1966 Atlantic Hurricane Database Reanalysis – Sandy Delgado and Chris Landsea

Green indicates wind changes of 15 kt or greater
Blue indicates lat/long changes greater than 1°
Red indicates a new entry
Yellow indicates a deletion

"Minor" intensity changes are less than 20 kt
"Minor" position changes are less than 2 degrees

Hurricane Alma [June 5-14, 1966] – AL011966

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44255 06/04/1966 M=11  1 SNBR= 951 ALMA        XING=1 SSS=2
44255 06/05/1966 M=10  1 SNBR= 951 ALMA        XING=1 SSS=2
         **        **

(June 4th has been removed from HURDAT)
44260 06/04*  0   0   0    0*127 840  25    0*133 843  25    0*140 845  25    0*

44265 06/05*148 847  25    0*155 848  25    0*163 848  30 1006*169 848  30    0*
44265 06/05*  0   0   0    0*  0   0   0    0*163 848  30 1006*168 847  30    0*
              *   *   *        *                              *** ***

44270 06/06*173 847  30    0*177 844  30    0*181 842  40  996*185 841  70  990*
44270 06/06*173 846  35    0*176 844  40 1000*180 842  50  996*185 841  65  990*
                ***  **      ***      ** **** ***      **                **

44275 06/07*189 840  80  990*192 839  80  986*194 838  85  983*197 837  85    0*
44275 06/07*188 840  65  990*190 839  65  986*193 839  70  983*196 838  75    0*
                     **      ***      **      *** ***  **      *** ***  **

44280 06/08*201 835  85  976*212 830  85  980*227 825  90    0*242 824 110  970*
44280 06/08*201 835  80  976*211 831  85    0*227 827  90    0*244 827 100    0*
                     **      *** ***        *     ***          *** *** ***    *

44285 06/09*257 826 100  974*273 833  90    0*288 844  85  970*297 846  80  981*
44285 06/09*260 828  90  974*275 834  90    0*288 843  90  970*296 845  75  981*
            *** ***  **      *** ***               ***  **      *** ***  **

44290 06/10*303 841  60  977*310 830  55    0*317 819  45    0*321 808  40    0*
44290 06/10*304 840  60    0*311 830  45    0*317 820  40  995*322 809  40  998*
            *** ***        * *** ***  **          ***  **  *** *** ***      ***

44295 06/11*325 796  40  997*331 782  40    0*337 767  40  990*337 754  65  993*
44295 06/11*326 796  50  997*331 781  55    0*337 767  65  990*339 754  75    0*
            ***      **          ***  **                **      ***      **    *

44300 06/12*337 742  70  998*343 735  70  997*349 733  60  994*356 733  60    0*
44300 06/12*338 742  75    0*343 735  70    0*349 733  65  994*356 733  60    0*
            ***      **    *                 *           **

44305 06/13*363 733  55  999*370 735  50    0*376 735  45 1002E382 729  45    0*
44305 06/13E363 734  55    0E370 735  50    0E376 735  45    0E382 729  45 1002*
            *    ***         **                 *                *             ****

44310 06/14E392 721  40    0E406 713  40    0E420 705  40    0*  0   0   0    0*
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44310 06/14E392 721 40   0E406 714 40   0E420 705 40   0* 0   0   0   0*
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44315 HRAFL2
44315 HRBFL3AFL1
****

Hurricane Landfall

June 8th 08Z 21.5N 82.9W 85 kt Isla de la Juventud, Cuba
June 8th 12Z 22.7N 82.7W 90 kt Havana Province, Cuba

U.S. Hurricane Impact

June 8th 19Z 24.6N 82.7W 100 kt Florida

U.S. Hurricane Landfall

June 09th – 21Z – 30.1N 84.2W – 75 kt – Category 1 – 982 mb – 1011 mb OCI – 225 nm ROCI – 30 nm RMW

Significant Revisions:

1. Genesis analyzed 30 hours later than originally shown in HURDAT based on coastal and ship observations.
2. Intensification to a tropical storm analyzed twelve hours earlier than originally shown in HURDAT based on synoptic data.
3. Significant decrease in intensity on June 7th based on aircraft reconnaissance data.
4. Significant increase in intensity on June 11th based on ship and reconnaissance aircraft observations.
5. Transition to an extratropical cyclone analyzed 18 hours earlier than originally shown in HURDAT based on ship and coastal observations.
6. Several central pressures added (mainly from station data) and several removed (no basis for them from available data).
7. Peak US hurricane impact increased from Category 2 to 3.

Daily Metadata:

June 3:

1. Maps and old HURDAT:
- HWM shows a trough over the western Caribbean Sea at 12Z.
- HURDAT does not list an organized system on this date.
- Microfilm shows a closed low pressure of at most 1012 mb at 12N, 82W at 12Z.

2. Discussion:
- MWR: "During the early days of June, a trough in the westerlies moved across the southeastern United States and extended deep into the Tropics. That portion from about Florida northward fractured from the southern extremity, leaving a closed Low near Cape Gracias on June 3."

June 4:

1. Maps and old HURDAT:
- HWM analyzes a spot low pressure at 13.8N, 84.5W at 12Z.

- HURDAT lists a 25 kt tropical depression at 13.3N, 84.3W at 12Z.
- Microfilm shows a tropical wave or trough extended from Central America to the Bahamas at 12Z. Ship highlights: No gales or low pressures.

2. Discussion:
- MWR: "The circulation developed downward from the middle troposphere to the surface over Nicaragua and Honduras on the morning of the 4th. At this point it was recognized that there was a definite threat of intensification, and air reconnaissance was scheduled for the following day." ATSR: "The first indication of Hurricane ALMA was a weak circulation over Nicaragua and Honduras 24 to 36 hours before a tropical depression warning was issued at 1200Z on 4 June."

June 5:

1. Maps and old HURDAT:
- HWM analyzes a closed low pressure of at most 1008 mb at 16.5N, 84.5W at 12Z.
- HURDAT lists a 30 kt tropical depression at 16.3N, 84.8W at 12Z.
- Microfilm shows a closed low pressure of at most 1008 mb at 16.4N, 84.8W at 12Z.

2. Aircraft highlights:
- Penetration center fix measured a central pressure of 1006 mb at 16.7N, 84.8W at 1445Z (WALLET/MWR).

3. Discussion:
- MWR: "On the morning of the 5th, the plane found a tropical depression of 1006 mb. (29.71 in) over the Gulf of Honduras."
- Reanalysis: Observations over the central Caribbean Sea indicate that a westerly-moving tropical wave showed signs of development during the first days of June. Satellite images showed a large area of convection over the area. The system was slow moving and took time to develop as it interacted with Central America.HURDAT originally indicated a tropical depression over Honduras and synoptic observations do not suggest it had a closed circulation while it was over land. Furthermore, it is not the current methodology to start a tropical cyclone over mountainous terrain on the 4th and early on the 5th. Coastal and ship observations around 12Z on the 5th suggested that an area of low pressure had developed and was organizing as it moved slowly northward away from the coast of Honduras. A reconnaissance aircraft investigated the disturbance at 1445Z on the 5th and made a center penetration measuring a central pressure of 1006 mb. Development of a tropical depression is analyzed at 12Z on the 5th, 36 hours later than originally shown in HURDAT. A central pressure of 1006 mb suggests maximum surface winds of 35 kt from the south of 25N Brown et al. pressure-wind relationship. Based on synoptic data, forward speed of about 5 kt and weak environmental pressures (1010 mb OCI), an intensity of 30 kt is analyzed at 12Z on the 5th, same as originally shown in HURDAT.

June 6:

1. Maps and old HURDAT:
- HWM analyzes a tropical storm of at most 1000 mb at 18.5N, 84.3W at 12Z.
- HURDAT lists a 40 kt tropical storm at 18.1N, 84.2W at 12Z.
- Microfilm shows a closed low pressure of at most 1008 mb at 17.7N, 84.2W at 12Z.

2. Ship highlights:

- 25 kt WSW and 1004 mb at 17.4N, 83.4W at 00Z (COADS).
- 35 kt N and 1008 mb at 17.5N, 86.2W at 06Z (micro).
- 40 kt E and 1015 mb at 19.6N, 81.2W at 12Z (COADS).
- 40 kt SE and 1009 mb at 17.9N, 81.3W at 18Z (COADS).
- 40 kt NE and 1010 mb at 20.8N, 82.3W at 21Z (COADS).

3. Land highlights:

- 25 kt SE and 1003 mb at Swan Island, Honduras at 06Z (micro).
- 35-40 kt SW and 999 mb at Swan Island, Honduras at 1230Z (WALLET).
- 15 kt W and 1004 mb at Swan Island, Honduras at 1830Z (WALLET).

4. Aircraft highlights:

- Penetration center fix measured a central pressure of 996 mb, estimated surface winds of 50 kt and an eye diameter of 25 nm at 17.8N, 84.2W at 12Z (WALLET).
- Penetration center fix measured a central pressure of 990 mb, estimated surface winds of 85 kt and an eye diameter of 39-47 nm at 18.8N, 83.9W at 1750Z (WALLET).
- Penetration center fix measured a central pressure of 990 mb, estimated surface winds of 65 kt and an eye diameter of 30-40 nm at 19.0N, 84.0W at 2350Z (WALLET).

5. Discussion:

- MWR: "By June 6, Alma had intensified to hurricane strength."
- ATSR: "Air Force reconnaissance aircraft observed intensification and a tropical storm warning was issued at 1300Z on 6 June. Moving slowly north ALMA intensified, rapidly reaching hurricane strength on 6 June some 300 miles south-southwest of Havana, Cuba."
- Reanalysis: The tropical cyclone rapidly intensified on this date as it moved northward. At 06Z on the 6th, Swan Islands reported 25 kt SE and 1003 mb, suggesting a central pressure of 1000 mb. A central pressure of 1000 mb suggest maximum surface winds of 47 kt from the south of 25N pressure-wind relationship. Due to a slow forward speed of about 4 kt, an intensity of 40 kt is analyzed at 06Z, up from 30 kt originally shown in HURDAT, a minor intensity change. Intensification to a tropical storm is analyzed at 00Z on the 6th, twelve hours earlier than originally shown in HURDAT. A reconnaissance aircraft investigated Alma at 12Z on the 6th measuring a central pressure of 996 mb, estimated surface winds of 50 kt and an eye diameter of 25 n mi. A central pressure of 996 mb suggests maximum surface winds of 54 kt from the south of 25N pressure-wind relationship. An eye diameter of 25 n mi suggests an RMW of about 19 n mi and the climatological value is 15 n mi. Based on a slow forward speed of about 4 kt and weak environmental pressures (1009 mb OCI), an intensity of 50 kt is analyzed at 12Z, up from 40 kt originally shown in HURDAT, a minor intensity change. The next penetration center fix measured a central pressure of 990 mb, estimated surface winds of 85 kt and an eye diameter of 39-47 n mi at 1750Z. A central pressure of 990 mb suggests maximum surface winds of 64 kt from the south of 25N pressure-wind relationship. An eye diameter of 39-47 n mi suggests an RMW of about 29-35 n mi and the climatological value is 16 n mi. Based on a slow forward speed of about 4 kt and large size, but slightly taking into some account the visual estimate from the reconnaissance aircraft, an intensity of 65 kt is analyzed at 18Z, down from 70 kt originally shown in HURDAT, a minor intensity change. Intensification to a hurricane is analyzed at 18Z on the 6th, same as originally shown in HURDAT. A satellite image at 1631Z showed a well-organized

tropical cyclone with an eye or eye-feature in the center of organized convection.

June 7:

1. Maps and old HURDAT:

- HWM analyzes a hurricane of at most 1000 mb at 19.8N, 83.5W at 12Z.
- HURDAT lists an 85 kt hurricane at 19.4N, 83.8W at 12Z.
- Microfilm shows a closed low pressure of at most 1008 mb at 19.2N, 83.5W at 12Z.

2. Ship highlights:

- 40 kt NE and 1007 mb at 20.6N, 83.0W at 00Z (COADS).
- 45 kt E and 1010 mb at 20.4N, 81.0W at 06Z (COADS).
- 40 kt E and 1007 mb at 20.2N, 80.5W at 09Z (COADS).
- 45 kt ESE and 1009 mb at 20.0N, 80.0W at 12Z (COADS).
- 40 kt NW and 1002 mb at 19.3N, 84.7W at 18Z (COADS).
- 40 kt SSE and 1008 mb at 19.3N, 79.0W at 21Z (COADS).

3. Land highlights:

- 20 kt SW and 1004 mb at Swan Island, Honduras at 06Z (micro).

4. Aircraft highlights:

- Penetration center fix measured a central pressure of 986 mb, estimated surface winds of 60 kt and an eye diameter of 35 nm at 19.0N, 83.8W at 0545Z (WALLET).
- Penetration center fix measured a central pressure of 983 mb, estimated surface winds of 70 kt and an eye diameter of 45 nm at 19.5N, 83.8W at 12Z (WALLET).
- Penetration center fix measured a central pressure of 976 mb, estimated surface winds of 75 kt and an eye diameter of 20-40 nm at 20.0N, 83.6W at 23Z (WALLET).

5. Satellite highlights:

- TIROS center fix at 20N, 80W at 1938Z (WALLET).

6. Discussion:

- MWR: "Alma moved slowly during June 7 …"
- Reanalysis: Alma continued to intensify on this date but at a slower pace. A reconnaissance aircraft measured a central pressure of 990 mb at 2350Z on the 6th and an intensity of 65 kt is analyzed at 00Z on the 7th, down from 80 kt originally shown in HURDAT, a minor intensity change. The next reconnaissance aircraft measured a central pressure of 986 mb, estimated surface winds of 60 kt and an eye diameter of 35 n mi at 0545Z. A central pressure of 986 mb suggests maximum surface winds of 70 kt from the south of 25N pressure-wind relationship. An eye diameter of 35 n mi suggests an RMW of about 26 n mi and the climatological value is 16 n mi. Since the system was almost stationary and had an RMW larger than normal, an intensity of 65 kt is analyzed at 06Z, down from 80 kt originally shown in HURDAT, a minor intensity change. A penetration center fix measured a central pressure of 983 mb, estimated surface winds of 70 kt and an eye diameter of 45 n mi at 12Z on the 7th. A central pressure of 983 mb suggests maximum surface winds of 74 kt from the south of 25N pressure-wind relationship. An eye diameter of 45 n mi suggests an RMW of about 34 n mi and the climatological value is 16 n mi. Based on a slow forward speed of about 3 kt and an RMW larger than average, an intensity of 70 kt is analyzed at 12Z on the 7th, down from 85 kt originally shown in HURDAT, a minor intensity change. A satellite image around 16Z showed a well-organized tropical cyclone with a

large rain band over the eastern quadrant wrapping into the center.

June 8:

1. Maps and old HURDAT:
- HWM analyzes a hurricane of at most 988 mb at 23.0N, 82.5W at 12Z.
- HURDAT lists a 90 kt hurricane at 22.7N, 82.5W at 12Z.
- Microfilm shows a closed low pressure of at most 1004 mb at 22.0N, 83.0W at 12Z.

2. Ship highlights:
- 40 kt ESE and 1011 mb at 24.5N, 83.0W at 00Z (COADS).
- 45 kt SE and 1011 mb at 24.5N, 80.9W at 06Z (COADS).
- 45 kt E and 1008 mb at 24.0N, 80.8W at 12Z (COADS).
- 50 kt SW and 999 mb at 23.5N, 82.7W at 18Z (COADS).

3. Land highlights:
- 55 kt NE and 995 mb at Isla de la Juventud, Cuba at 06Z (micro).
- Dead Calm at Nueva Gerona, Cuba at 09Z (WALLET).
- 50 kt ESE (gusts to 72 kt) and 1002 mb at Batabano, Cuba at 12Z (micro).
- 95 kt SE (maximum gust) at Havana, Cuba at 1215Z (WALLET).
- 80 kt SSE and 980 mb (minimum pressure) at Havana, Cuba at 1245Z (WALLET).
- 52 kt SE (maximum wind) at Key West, FL at 1717Z (WALLET).
- 970 mb (minimum pressure) at Dry Tortugas, FL at 1815Z (WALLET).
- 110 kt N (fastest mile) at Dry Tortugas, FL at 1822Z (WALLET).
- 50 kt ESE and 1010 mb at Port Everglades, FL at 2015Z (WALLET).

4. Aircraft highlights:
- Penetration center fix estimated an eye diameter of 20-37 nm at 21.2N, 82.9W at 06Z (WALLET).
- Penetration center fix estimated surface winds of 45 kt and an eye diameter of 36 nm at 22.6N, 82.6W at 1150Z (WALLET) (Only a small portion of the circulation was sampled as the system was close to landfall in Cuba).
- Penetration center fix measured a central pressure of 975 mb, estimated surface winds of 80 kt and an eye diameter of 20-60 nm at 24.1N, 82.6W at 1750Z (WALLET).

5. Radar highlights:
- Key West estimated an eye diameter of 30 nm at 22.9N, 82.7W at 1245Z (WALLET).
- Key West estimated an eye diameter of 30-40 nm at 24.3N, 82.6W at 1810Z (WALLET).

6. Discussion:
- MWR: "… but was accelerating and threatening western Cuba by early morning of the 8th. The hurricane passed over the Isle of Pines, and winds reached 110 mph at the Institute of Meteorology in Havana. The barometer fell to 979.7 mb. (28.93 in.) in Havana. The hurricane passed between Dry Tortugas and Key West, and damage to the lower Keys was estimated at one-third million dollars. The pressure was 970.2 mb. (28.65 in.) at Dry Tortugas. This was the lowest barometric reading at a land station during the hurricane's history. The highest wind speed, 125 mph, was also recorded at Dry Tortugas."
- ATSR: "ALMA continued to intensify as she gradually accelerated north across western Cuba and into the Gulf of Mexico…"

- Reanalysis: On this date, Alma increased in forward speed impacting western Cuba and the Florida Keys. A reconnaissance aircraft made a center penetration at 23Z on the 7th measuring a central pressure of 976 mb, estimating surface winds of 75 kt and an eye diameter of 20-40 n mi. A central pressure of 976 mb suggests maximum surface winds of 84 kt from the south of 25N pressure-wind relationship. An eye diameter of 20-40 n mi suggests an RMW of about 15-30 n mi and the climatological value is 16 n mi. Based on a slow forward speed of about 7 kt and an RMW possibly larger than average, an intensity of 80 kt is analyzed at 00Z on the 8th, down from 85 kt originally shown in HURDAT, a minor intensity change. Around 08Z on the 8th, the center of Alma moved over the Isle of Youth (Isla de la Juventud), Cuba with an analyzed intensity of 85 kt. At about 12Z, Alma made landfall near Guanimar, in the southern coast of the province of Havana, Cuba, with an analyzed intensity of 90 kt. Perez et al. analyzed Alma as a category 2 hurricane at landfall in Cuba. Unfortunately, neither landfalls in Cuba were accompanied by observations near the center.As the existing HURDAT values were consistent with the last reconnaissance and with Perez assessment, no changes were made to the 06Z and 12Z intensities and thus the Cuban landfalls. Havana, Cuba experienced a peak gust of 95 kt and a minimum pressure of 980 mb around 1245Z. The center of Alma passed about 20 n mi west of Havana and entered the southeastern Gulf of Mexico after 13Z. At 18Z on the 8th, the center of the hurricane passed between Dry Tortugas and Key West with an analyzed peak intensity of 100 kt, down from 110 kt officially in HURDAT, a minor intensity change. Intensification to a major hurricane is analyzed at 18Z on the 8th, same as originally shown in HURDAT. The intensity assessment at 18Z is complicated due to conflicting data from Dry Tortugas and a reconnaissance aircraft penetration center fix at 1750Z. Dry Tortugas reported a minimum pressure of 970 mb at 1815Z, which had originally been assessed as a central pressure in HURDAT, and peak sustained winds of 110 kt just a few minutes after the minimum pressure, which is also the original peak intensity in HURDAT. The weather station in the Dry Tortugas was located at 30 feet (~10 meters) above the ground. The aircraft reported a central pressure of 975 mb, estimated surface winds of 80 kt and an eye diameter of 20-60 n mi at 1750Z. Also around 18Z, the Key West radar estimated an eye diameter of 30-40 n mi. It is possible that Dry Tortugas experienced a mesocyclone while the eyewall of hurricane Alma moved over the location, leading to stronger winds and a lower pressure that were not representative of the entire circulation. The central pressure measured by the reconnaissance aircraft appears too high and was not added to HURDAT. Therefore, the assessed intensity of 100 kt is a blend between the observation in Dry Tortugas of 110 kt and the penetration center fix measurement of 975 mb, suggesting maximum surface winds of 84 kt from the south of 25N pressure-wind relationship.

June 9:

1. Maps and old HURDAT:

- HWM analyzes a hurricane of at most 992 mb at 29.5N, 84.3W at 12Z.
- HURDAT lists an 85 kt hurricane at 28.8N, 84.4W at 12Z.
- Microfilm shows a closed low pressure of at most 1004 mb at 29.0N, 84.0W at 12Z.

2. Ship highlights:

- 35 kt NNW and 1006 mb at 25N, 85W at 00Z (COADS).
- 35 kt S and 1009 mb at 25N, 80.3W at 06Z (COADS).
- 35 kt SE and 1002 mb at 30N, 79.6W at 12Z (COADS).

3. Land highlights:

- 40 kt SSW (maximum wind) and 1001 mb at Fort Myers, FL at 01Z (WALLET).
- 992 mb (minimum pressure) at Captiva Island, FL at 01Z (WALLET).
- 55 kt SE (maximum wind) (gusts to 80 kt) at St. Petersburg, FL at 0430Z (WALLET).
- 70 kt (fastest mile) at Treasure Island, FL at 0445Z (WALLET).
- 998 mb (minimum pressure) at Cedar key, FL at 11Z (WALLET).
- Dead Calm at Panacea, FL at 1910Z-2010Z (WALLET).
- 984 mb (minimum pressure) at Alligator Point, FL at 1925Z (WALLET).
- 982 mb (minimum pressure) at St. Marks, FL at 21Z (WALLET).
- Dead Calm at St. Marks, FL at 2105Z (WALLET).
- 987 mb (minimum pressure) at Tallahassee, FL at 2245Z (WALLET).

4. Aircraft highlights:

- Penetration center fix measured a central pressure of 974 mb, estimated surface winds of 95 kt and an eye diameter of 50 nm at 25.8N, 82.8W at 00Z (WALLET).
- Radar center fix at 27.4N, 83.2W at 0555Z (WALLET).
- Penetration center fix measured a central pressure of 970 mb and estimated surface winds of 85 kt at 28.8N, 84.3W at 12Z (WALLET).
- Penetration center fix measured a central pressure of 981 mb, estimated surface winds of 60 kt and an eye diameter of 40 nm at 29.5N, 84.5W at 18Z (WALLET).
- Penetration center fix measured a central pressure of 977 mb, estimated surface winds of 60 kt and an eye diameter of 30 nm at 29.8N, 84.2W at 20Z (WALLET).

5. Radar highlights:

- Key West, FL estimated a center fix at 26N, 82.7W at 0010Z (WALLET).
- Tampa, FL estimated an eye diameter of 53 nm at 27.4N, 83.2W at 0538Z (WALLET).
- Apalachicola, FL estimated a center fix at 28.8N, 84.3W at 1140Z (WALLET).
- Apalachicola, FL estimated a center fix at 29.8N, 84.3W at 1742Z (WALLET).

6. Discussion:

- MWR: "Air reconnaissance reported the same pressure over water in the northeastern Gulf of Mexico the next morning; however, some weakening occurred just before landfall in the Apalachee Bay area."
- ATSR: "…entering the US Coast 20 miles east-northeast of Apalachicola, Florida late on 9 June."
- "30.1N, 84.3W – 971 mb – 1015 mb Penv – RMW 23 nmi – speed 9 kt – 75 kt est max sustained 10m, 10-min wind" (Schwardt et al. (1979)) "Jun – FL, 2NW – Cat 2 – 982 mb" (Jarrell et al. (1992). (977 mb, Recon – RMW 20 nmi – 13 kt forward speed – landfall pt 30.1N, 84.2W" (Ho et al. (1987).
- Reanalysis: The first reconnaissance aircraft to investigate Alma on the 9th occurred at 00Z measuring a central pressure of 974 mb, estimating surface winds of 95 kt and an eye diameter of 50 n mi. A central pressure of 974 mb suggests maximum surface winds of 80 kt from the north of 25N pressure-wind relationship. An eye diameter of 50 n mi suggests an RMW of about 38 n mi and the climatological value is 20 n mi. Due to a forward speed of about 16 kt, an intensity of 90 kt is analyzed at 00Z on the 9th, down from 100 kt originally shown in HURDAT, a minor intensity change. Weakening below major hurricane intensity is analyzed at 00Z on the 9th, six hours earlier than originally shown in HURDAT. Another penetration center fix measured a central pressure of 970 mb and estimated surface winds of 85 kt at 12Z on the 9th. The Tampa radar estimated an eye diameter of 32 n mi at 1340Z. A central pressure of 970 mb suggests maximum surface winds of 84 kt north of 25N from the pressure-wind relationship. An eye diameter of 32 n mi suggests an RMW of about 24 n mi and the climatological value is 23 n mi. Due to a forward speed of about 16 kt, an

intensity of 90 kt is analyzed at 12Z on the 9th, up from 85 kt originally shown in HURDAT, a minor intensity change. The next reconnaissance aircraft measured a central pressure of 981 mb, estimated surface winds of 60 kt and an eye diameter of 40 n mi at 18Z. A central pressure of 981 mb suggests maximum surface winds of 76 kt from the north of 25N pressure-wind relationship. An eye diameter of 40 n mi suggests an RMW of about 30 n mi and a climatological value of 23 n mi. Due to a forward speed of 10 kt, an intensity of 75 kt is analyzed at 18Z, down from 85 kt originally shown in HURDAT, a minor intensity change. Landfall in the Florida panhandle occurred around 21Z on the 9th near St. Marks as a 75 kt hurricane. Satellite imaged showed a well-organized tropical cyclone with a large rain band over the western Atlantic wrapping into the center of the hurricane.

June 10:

1. Maps and old HURDAT:
- HWM analyzes a hurricane of at most 1000 mb at 32.0N, 82.3W with a cold front to the northwest at 12Z.
- HURDAT lists a 45 kt tropical storm at 31.7N, 81.9W at 12Z.
- Microfilm shows a closed low pressure of at most 1000 mb at 31.9N, 82.0W with a cold front to the northwest at 12Z.

2. Ship highlights:
- 25 kt SE and 1001 mb at 29.9N, 80.5W at 06Z (COADS).
- 35 kt SW and 1012 mb at 30.4N, 79.5W at 12Z (COADS).
- 35 kt SSE and 1011 mb at 31N, 77.3W at 18Z (COADS).
- 35 kt S and 1007 mb at 31.5N, 77.5W at 21Z (COADS).

3. Land highlights:
- 17 kt S and 1001 mb (minimum pressure) at Glynco, GA at 0758Z (SWO).
- 15 kt WNW and 998 mb (minimum pressure) at Alma, GA at 1055Z (SWO).
- 12 kt W and 1000 mb (minimum pressure) at Hunter AFB, GA at 1758Z (SWO).

4. Aircraft highlights:
- Penetration center fix at 31.8N, 81.6W (over land) at 14Z (WALLET).
- Penetration center fix at 32.4N, 80.9W (over land) at 1745Z (WALLET).
- Penetration center fix at 32.5N, 79.6W at 2340Z (WALLET).

5. Radar highlights:
- Apalachicola, FL estimated a center fix at 30.1N, 84.1W at 0013Z (WALLET).
- Charleston, SC estimated a center fix at 31.2N, 83.2W at 0540Z (WALLET).
- Charleston, SC estimated a center fix at 31.7N, 81.9W at 1142Z (WALLET).
- Savannah, GA estimated an eye diameter of 31 nm at 32.4N, 80.9W at 1745Z (WALLET).

6. Discussion:
- MWR: “Hurricane force winds decreased to gales over northern Florida and southern Georgia…”
- ATSR: “ALMA then turned northeastward crossing southern Georgia and diminished to a tropical storm.”
- Reanalysis: Alma weakened as it moved inland over southern Georgia. An approaching frontal boundary caused the storm to turn to the northeast. The Kaplan and DeMaria inland decay model was run for 00Z, 06Z, 12Z, and 18Z on the 10th. The model suggested 60 kt at 00Z, 42 kt at 06Z, 41 kt at 12Z and below

tropical storm intensity at 18Z. The highest winds observed within two hours of these times were 35 kt at 00Z, 12Z and 18Z, and below tropical storm intensity at 06Z. 60 kt was selected at 00Z, 45 kt at 06Z and 40 kt at 12Z and 18Z, while HURDAT originally had 60 kt, 55 kt, 45 kt and 40 kt, respectively. Central pressures of 995 mb and 998 mb were obtained at 12Z and 18Z, respectively, from 15 kt and 998 mb at Alma, GA and 12 kt and 1000 mb at Hunter AFB, GA. A central pressure of 995 mb suggests 52 kt and 998 mb suggests 47 kt, both from the north of 25N pressure-wind relationship. Taking into account that the system was overland, a 15% is subtracted and we obtain 44 kt at 12Z and 40 kt 18Z, supporting the intensity selection. Minor intensity changes to HURDAT were analyzed at 06Z and 12Z on the 10th. Thus, weakening to a tropical storm is analyzed at 00Z on the 10th, same as originally shown in HURDAT. Late on the 10th, the center of Alma moved over the Atlantic Ocean.

June 11:

1. Maps and old HURDAT:
- HWM analyzes a tropical storm of at most 1000 mb at 34.0N, 76.5W with a cold front just to the northwest at 12Z.
- HURDAT lists a 40 kt tropical storm at 33.7N, 76.7W at 12Z.
- Microfilm shows a closed low pressure of at most 1008 mb at 33.0N, 76.5W with a cold front just to the northwest at 12Z.

2. Ship highlights:
- 45 kt WSW and 1003 mb at 31.6N, 79.5W at 00Z (COADS).
- 35 kt S and 1005 mb at 30.8N, 77.8W at 03Z (COADS).
- 50 kt W and 1000 mb at 32.4N, 78.2W at 06Z (COADS).
- 40 kt NW and 1005 mb at 31.3N, 78.2W at 12Z (micro).
- 60 kt NE and 1010 mb at 35.5N, 74.7W at 15Z (COADS).
- 65 kt NW and 990 mb at 33.1N, 76.0W at 18Z (micro/WALLET).
- 75 kt E and 1000 mb at 34.3N, 75.9W at 18Z (COADS/MWL).
- 40 kt N and 1004 mb at 34.9N, 75.3W at 21Z (COADS).

3. Land highlights:
- 1001 mb (minimum pressure) at Wilmington, NC at 0645Z (WALLET).
- 37 kt NNE (minimum wind) (gusts to 50 kt) at Cape Hatteras, NC at 1519Z (WALLET).

4. Aircraft highlights:
- Penetration center fix measured a central pressure of 990 mb, estimated surface winds of 50 kt and an eye diameter of 60 nm at 33.8N, 76.6W at 12Z (WALLET).
- Penetration center fix at 34.1N, 75.8W at 1907Z (WALLET). Penetration center fix at 33.8N, 74.4W at 2250Z (WALLET).
- Radar highlights: Wilmington, NC estimated a center fix at 32.9N, 78.2W at 0456Z (WALLET).
- Wilmington, NC estimated a center fix at 33.7N, 76.8W at 1140Z (WALLET).

5. Discussion:
- MWR: "…but the storm regained hurricane status for about 18 hours off Cape Hatteras."
- ATSR: "As ALMA moved north of Savannah and east-northeast out into the Atlantic, she regained hurricane intensity on 11 and 12 June for about 18 hours before moving north and becoming extratropical south of Cape Cod."
- Reanalysis: Alma quickly reorganized over the warm waters of the Gulf Stream. A

reconnaissance aircraft investigated the tropical cyclone at 12Z measuring a central pressure of 990 mb, estimating surface winds of 50 kt and an eye diameter of 60 n mi at 12Z on the 11th. A central pressure of 990 mb suggests maximum surface winds of 59 kt from the north of 25N pressure-wind relationship and 63 kt from the north of 35N Landsea et al. pressure-wind relationship. An eye diameter of 60 n mi suggests an RMW of 45 n mi and the climatological value is 30 n mi. Due to a forward speed of 15 kt and ship data later on this date, an intensity of 65 kt is analyzed at 12Z on the 11th, up from 40 kt originally shown in HURDAT, a major intensity change. Intensification to a hurricane is analyzed at 12Z on the 11th, six hours earlier than originally shown in HURDAT. It is interesting to note that HURDAT originally showed an increase in intensity of 25 kt in six hours, from 40 kt at 12Z to 65 kt at 18Z, and the data available does not suggest such a rapid increase in intensity occurred. Two ships reported hurricane-force winds at 18Z, registering 65 kt and 75 kt. An intensity of 75 kt is analyzed at 18Z on the 10th, up from 65 kt originally shown in HURDAT. 75 kt is also the second peak in intensity of this hurricane, up from 70 kt originally shown in HURDAT. Satellite images showed a well-organized tropical cyclone with a ragged eye interacting with a frontal boundary to the northeast.

June 12:

1. Maps and old HURDAT:
- HWM analyzes a closed low pressure of at most 1004 mb at 35.8N, 72.9W with a warm front to the east and a cold front to the south at 12Z.
- HURDAT lists a 60 kt tropical storm at 34.9N, 73.3W at 12Z.
- Microfilm shows a closed low pressure of at most 1016 mb at 34.0N, 72.5W with a warm front to the east and a cold front to the south at 12Z.

2. Ship highlights:
- 55 kt N and 1008 mb at 34.9N, 75.4W at 00Z (COADS).
- 40 kt N and 1009 mb at 34.4N, 75.4W at 03Z (COADS).
- 50 kt E and 1009 mb at 35.3N, 74.8W at 06Z (COADS).
- 40 kt NW and 1003 mb at 34.5N, 74.3W at 09Z (COADS).
- 50 kt N and 1010 mb at 35.8N, 75W at 12Z (COADS).
- 50 kt N and 1012 mb at 36.7N, 74.9W at 18Z (COADS).
- 45 kt NW and 1008 mb at 36.2N, 74.9W at 22Z (COADS).

3. Aircraft highlights:
- Penetration center fix at 34.0N, 73.6W at 0545Z (WALLET).
- Penetration center fix at 36.2N, 73.2W at 2210Z (WALLET).

4. Discussion:
- Reanalysis: Alma gradually weakened as it moved slowly northward. Weakening to a tropical storm is analyzed at 18Z on the 12th, six hours later than originally shown in HURDAT. Ships near the center reported storm-force winds, up to 55 kt. Interaction with a stationary frontal boundary and possible entrainment of dry continental air caused Alma to begin to lose its tropical characteristics on this date. Satellite images showed that Alma remained well-organized with an eye or eye-like feature surrounded by convection.

June 13:

1. Maps and old HURDAT:
- HWM analyzes a tropical storm of at most 1004 mb at 37.7N, 72.9W with a warm

front to the northeast at 12Z.

- HURDAT lists a 45 kt tropical storm at 37.6N, 73.5W at 12Z.
- Microfilm shows a closed low pressure of at most 1016 mb at 38.0N, 73.0W with a frontal boundary to the northeast at 12Z.

2. Ship highlights:

- 50 kt N and 1012 mb at 37.6N, 74.6W at 00Z (COADS).
- 45 kt NW and 1001 mb at 35.8N, 74.5W at 00Z (micro).
- 45 kt N and 1011 mb at 37N, 75.4W at 06Z (COADS).
- 40 kt W and 1011 mb at 36.5N, 73.5W at 12Z (COADS).
- 40 kt NW and 1014 mb at 38.3N, 74.3W at 18Z (COADS).

3. Aircraft highlights:

- Penetration center fix at 37.5N, 73.6W at 1154Z (WALLET).
- Penetration center fix measured a central pressure of 1002 mb and estimated surface winds of 45 kt at 38.1N, 72.9W at 1745Z (WALLET).

4. Radar highlights:

- Cape Charles, VA estimated a center fix at 37.7N, 73.1W at 1130Z (WALLET).

5. Discussion:

- MWR: "Cold waters north of this area and colder and drier air from the mainland finally reduced Alma to an extratropical storm about midday on the 13th."
- Reanalysis: Transition to an extratropical cyclone is analyzed at 00Z on the 13th, eighteen hours earlier than originally shown in HURDAT. Synoptic observations indicated that a significant temperature gradient had developed across the circulation. The extratropical cyclone continued to gradually weaken. Ships registered a few gale-force winds throughout the day, except for 50 kt at 00Z. Despite the synoptic observations, satellite images showed that Alma remained a small system with organized convection.

June 14:

1. Maps and old HURDAT:

- HWM analyzes a closed low pressure of at most 1012 mb at 42.5N, 70.7W with a cold front to the west at 12Z.
- HURDAT lists a 40 kt extratropical cyclone at 42.0N, 70.5W at 12Z (last position).
- Microfilm shows a closed low pressure of at most 1012 mb at 42.0N, 69.0W at 12Z.

2. Ship highlights:

- 35 kt SW and 1016 mb at 40.2N, 67.7W at 12Z (COADS).

3. Discussion:

- Reanalysis: Synoptic observations late on the 14th indicated that Alma did not have a closed circulation and was becoming absorbed by a strong frontal boundary. The last position is analyzed at 12Z on the 14th, same as originally shown in HURDAT.

June 15:

4. Maps and old HURDAT:

- HWM indicates that Alma has been absorbed by a strong extratropical cyclone.

Date	Original HURDAT Central Pressure	Evidence	Changes
June 5 12Z	1006 mb	Penetration center fix: 1006 mb at 1445Z on June 5th	Retained
June 6 06Z		Land: 25 kt SE and 1003 mb at Swan Island, Honduras at 06Z on June 6th	1000 mb
June 6 12Z	996 mb	Penetration center fix: 996 mb at 12Z on June 6th	Retained
June 6 18Z	990 mb	Penetration center fix: 990 mb at 1750Z on June 6th	
June 7 00Z	990 mb	Penetration center fix: 990 mb at 2350Z on June 6th	
June 7 06Z	986 mb	Penetration center fix: 986 mb at 0545Z on June 7th	
June 7 12Z	983 mb	Penetration center fix: 983 mb at 12Z on June 7th	
June 8 00Z	976 mb	Penetration center fix: 976 mb at 23Z on June 7th	
June 8 06Z	980 mb	A minimum pressure of 980 mb was registered in Havana, Cuba at 1245Z on June 8th, no central pressures were recorded around 06Z	Removed
June 8 18Z	970 mb	A minimum pressure of 970 mb was recorded at Dry Tortugas at 1815Z and the center of the hurricane passed about 12 n mi to the east	
June 9 00Z	974 mb	Penetration center fix: 974 mb at 00Z on June 9th	Retained
June 9 12Z	970 mb	Penetration center fix: 970 mb at 12Z on June 9th	
June 9 18Z	981 mb	Penetration center fix: 981 mb at 18Z on June 9th	
June 10 00Z	977 mb	Penetration center fix: 977 mb at 20Z on June 9th	Removed
June 10 12Z		Land: 15 kt WNW and 998 mb at Alma, GA at 1055Z on June 10th	995 mb
June 10 18Z		Land: 15 kt WNW and 1000 mb at Hunter AFB, GA at 1758Z on June 10th	998 mb
June 11 00Z	997 mb	No central pressures were recorded at this time but synoptic observations indicate that it is reasonable, thus it was retained	Retained
June 11 12Z	990 mb	Penetration center fix: 990 mb at 12Z on June 10th	
June 11 18Z	993 mb	A ship near the center reported a pressure of 990 mb, suggesting a central pressure below 993 mb	Removed
June 12 00Z	998 mb	A ship near the center reported 25 kt N and a pressure of 999 mb, suggesting a central	

		pressure below 998 mb	
June 12 06Z	997 mb	No central pressures were recorded at this time and synoptic observations at earlier and later times indicate that it was likely below 997 mb	
June 12 12Z	994 mb	No central pressures reported around this time but synoptic data indicates that it is reasonable	Retained
June 13 00Z	999 mb	A ship near the center reported 45 kt NW and a pressure of 1001 mb, suggesting a central pressure below 999 mb	Removed
June 13 12Z	1002 mb	Penetration center fix: 1002 mb at 1745Z on June 13th	
June 13 18Z			1002 mb

Sources: NHC microfilm maps, the Historical Weather Maps series, the COADS ship database, Monthly Weather Review, Navy reconnaissance book, Mariners Weather Log, Satellite images from NCDC, Schwardt et al. (1979), Ho et al. (1987), Jarrell et al. (1992) and NHC Storm Wallets.

Hurricane Becky [June 30 – July 3, 1966] – AL021966

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44320 07/01/1966 M= 3  2 SNBR= 952 BECKY       XING=0 SSS=0
44320 06/30/1966 M= 4  2 SNBR= 952 BECKY       XING=0 SSS=0
         **         *

(June 30th is new to HURDAT)
44323 06/30E290 640  30    0E300 640  30    0S308 640  30    0S312 638  35    0*

44325 07/01*  0   0   0    0*  0   0   0    0*  0   0   0    0*324 578  25    0*
44325 07/01S315 630  35    0S318 618  35    0*323 603  40    0*330 585  45    0*
           **** ***  **     **** ***  **      *** ***  **      *** ***  **

44330 07/02*341 565  25    0*358 553  35    0*376 544  65  985*395 538  65  986*
44330 07/02*341 570  50    0*355 555  60    0*376 548  70    0*395 547  75  984*
                ***  **      *** ***  **          ***  **    *     ***  **  ***

44335 07/03*414 543  60    0*431 550  55    0E447 568  45    0E455 585  40    0*
44335 07/03E414 550  65    0E431 560  55    0E447 576  45    0E455 593  35    0*
           *    ***  **     *    ***               ***               ***  **

44340 HR
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Significant Revisions:

1. Genesis analyzed 42 hours earlier than originally shown in HURDAT based on ship observations.
2. Genesis is analyzed as an extratropical cyclone based on synoptic and satellite data.

3. Transition to a subtropical cyclone is analyzed on June 30th at 12Z based on synoptic and satellite data.

4. Significant changes in intensity analyzed on July 1st at 18Z and July 2nd at 00Z and 06Z based on surface observations.

5. Intensification to a tropical storm is analyzed 18 hours earlier than originally shown in HURDAT based on surface observations.

6. Transition to an extratropical cyclone is analyzed twelve hours earlier than originally shown in HURDAT based on surface observations.

June 27:

3. Maps and old HURDAT:
- HWM analyzes a tropical wave or trough north of Hispaniola and a stationary front over the western Atlantic at 12Z.
- HURDAT does not list an organized system on this date.
- Microfilm shows a spot low pressure near 25N, 68W with a trough extending to the southwest, and a stationary front to the northeast at 12Z.

4. Discussion:
a. Reanalysis: Hurricane Becky developed from a weakening frontal boundary and an upper level trough over the western Atlantic. A satellite image on June 27 showed a large flare up of convection between the Bahamas and Bermuda at the end of the frontal boundary. This frontal feature was also interacting with the northern portion of a westward-traveling tropical wave over the central Caribbean Sea.

June 28:

1. Maps and old HURDAT:
- HWM analyzes a weakening stationary front over the western Atlantic extending into the Bahamas as a trough at 12Z.
- HURDAT does not list an organized system on this date.
- Microfilm shows a closed low pressure of at most 1016 mb at 29N, 67W at 12Z.

June 29:

1. Maps and old HURDAT:
- HWM analyzes a closed low pressure of at most 1012 mb at 30N, 65W with a stationary front to the east at 12Z.
- HURDAT does not list an organized system on this date.
- Microfilm shows a closed low pressure of at most 1016 mb at 30N, 65W with a cold front to the east at 12Z.

June 30:

1. Maps and old HURDAT:
- HWM analyzes a closed low pressure of at most 1012 mb at 31.2N, 63.5W with a stationary front to the east at 12Z.
- HURDAT does not list an organized system on this date.
- Microfilm shows a closed low pressure of at most 1012 mb at 32N, 64W with a stationary front to the east at 12Z.

2. Ship highlights:
- 35 kt NW and 1011 mb at 30.4N, 64.5W at 18Z (COADS).

3. Discussion:

- TAC: "The low southeast of Bermuda has deepened and the ESSA II has shown a very good cyclonic pattern associated with it."
- Reanalysis: Genesis is analyzed at 00Z on June 30th as a 30 kt extratropical depression based on ship data. It is possible that a well-defined center may have developed on June 29th, but the data south of the system was sparse on this day. A satellite image on the 30th, likely around 18Z, showed a well-defined low-level circulation with most of the convection over the southwestern quadrant. Transition to a subtropical cyclone is analyzed at 12Z on the 30th, a stage not indicated previously in the old HURDAT, but the classification is consistent with the satellite appearance and synoptic observations that the frontal boundary had weakened to a trough. The subtropical cyclone attained gale-force winds at 18Z on the 30th based on two ship reports of 35 kt in the southwestern quadrant.

July 1:

1. Maps and old HURDAT:

- HWM analyzes a spot low pressure at 31N, 59.5W at 12Z.
- HURDAT lists a 25 kt tropical depression at 32.4N, 57.8W at 18Z (first position).
- Microfilm shows a closed low pressure of at most 1012 mb at 32.5N, 60W at 12Z.

2. Discussion:

- MWR: "Becky developed at an unusually high latitude. The initial depression appeared some 300 miles southeast of Bermuda on July 1. A cloud area photographed by the ESSA 2 satellite at 1200 GMT on that date showed evidence of a spiral structure near the incipient storm." ATSR: "Hurricane Becky, developing at an unusually high latitude, was discovered near mid-day on 1 July by the ESSA II and NIMBUS satellites as a weak depression some 300 miles southeast of Bermuda."
- Reanalysis: On June 1st, the cyclone turned to the northeast and increased in forward speed moving away from Bermuda. Transition to a tropical storm is analyzed at 12Z on July 1st based on a satellite image showing a very tight circulation with most of the convection near the center and over the eastern quadrant. Moreover, the synoptic maps indicated that the environment around the system was isotherm and the trough (former frontal boundary) plotted near the system on the previous days had dissipated.

July 2:

1. Maps and old HURDAT:

- HWM analyzes a hurricane of at most 1004 mb at 38N, 54.8W at 12Z.
- HURDAT lists a 65 kt hurricane at 37.6N, 54.4W at 12Z.
- Microfilm shows a closed low pressure of at most 1004 mb at 37.5N, 55W at 12Z.

2. Ship highlights:

- 20 kt S and 986 mb at 38.4N, 54.6W at 1545Z (micro).
- 65 kt WSW and 989 mb at 38.6N, 54.6W at 1605Z (micro).
- 40 kt SE and 1009 mb at 40.6N, 52.5W at 18Z (COADS).
- 65 kt W and 1000 mb at 40.8N, 55.2W at 22Z (micro).

3. Discussion:

- MWR: "The system moved northeastward under an upper-level trough and intensified to storm intensity by early the next day [July 2]. At 1545 GMT the M.S. *Johannes Russ* (log received later) passed through the center and observed a minimum pressure of 985 mb. (29.09 in). The ship experienced winds of hurricane force for about one-half hour." ATSR: "Moving northeastward, BECKY intensified rapidly, reaching tropical storm intensity on 2 July when the upper through fractured. Originally BECKY was classified as a tropical storm, but from post-analysis, it has been determined that BECKY reached hurricane strength on 2 July."
- Reanalysis: Surface observations on July 2nd indicated that Becky had rapidly intensified ahead of an approaching frontal boundary. A ship called Johannes Russ passed near the center of Becky estimating hurricane-force winds and a minimum pressure of 986 mb. The minimum pressure of 986 mb was measured at 1545Z, along with estimated surface winds near 20 kt, thus a central pressure of 984 mb is analyzed at this time and added to HURDAT in the time slot of 18Z on the 2nd. Central pressures of 985 mb and 986 mb were present in the original HURDAT at 12Z and 18Z, respectively, on the 2nd, and have been removed based on the ship data available. A central pressure of 984 mb suggests maximum surface winds of 69 kt from the north of 35N Landsea et al. pressure-wind relationship. Based on a forward speed of about 20 kt, an intensity of 75 kt is analyzed at 18Z on the 2nd, up from 65 kt originally in HURDAT, a minor intensity change. 75 kt is also the peak intensity of this hurricane, up from 65 kt originally in HURDAT. Intensification to a hurricane is analyzed at 12Z on the 2nd, same as originally shown in HURDAT. The old HURDAT also showed extreme strengthening on the 2nd, from 35 kt at 06Z to 65 kt at 12Z, which does not appear plausible and the reanalysis shows a more realistic though still rapid intensification.

July 3:

1. Maps and old HURDAT:

- HWM analyzes a tropical storm of at most 1000 mb at 44.8N, 58W with a cold front to the north at 12Z.
- HURDAT lists a 45 kt extratropical cyclone at 44.5N, 56.8W at 12Z.
- Microfilm shows a closed low pressure of at most 1004 mb at 45N, 57W at 12Z.

2. Ship highlights:

- 40 kt SE and 1016 mb at 40.2N, 46.5W at 12Z (micro).

3. Discussion:

- MWR: "On July 3 the hurricane began to move northwestward under the influence of a cold low which formed in the upper trough. As it moved over the colder waters south of Newfoundland it rapidly weakened and lost its tropical characteristics. Becky did not strike any land area and there were no reported casualties or loses to shipping." ATSR: "BECKY turned toward the northwest and weakened rapidly as she moved the cold waters south of Newfoundland. On 3 July, she became extratropical and by early the following day was absorbed by a low moving off the southern coast of Labrador."
- Reanalysis: Transition to an extratropical cyclone took place late on the 2nd and early on July 3rd based on surface observations. Becky moved over the far north Atlantic and under the influence of a stronger extratropical cyclone, and ship data suggests that it became an extratropical cyclone around 00Z on the 3rd. The system was still a powerful storm as a ship south of the center reported 65 kt at 22Z on the 2nd. Weakening below hurricane intensity is analyzed at 06Z on the 3rd, six hours later than originally shown in HURDAT. Dissipation occurred late on the 3rd as Becky was absorbed by the extratropical cyclone to the north. Surface observations showed that the circulation had

dissipated by 00Z on July 4th, thus the last position is analyzed at 18Z on the 3rd, just east of eastern Nova Scotia. Analogs to Becky are Tropical Storm Cindy (2011) and Hurricane Chris (2012).

July 4:

1. Maps and old HURDAT:

- HWM analyzes an extratropical cyclone of at most 988 mb at 52N, 60W at 12Z, Becky appears to have been absorbed.
- HURDAT does not list an organized system on this date.
- Microfilm shows a spot low at 42N, 58W at 12Z; Becky's remnants are to the north of the synoptic map.

Sources: NHC microfilm maps, the Historical Weather Maps series, the COADS ship database, Monthly Weather Review, Mariners Weather Log, Satellite images from NCDC and NSIDC, and NHC Storm Wallets.

Hurricane Celia [July 13-22, 1966] – AL031966

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44345 07/13/1966 M=10  3 SNBR= 953 CELIA       XING=0 SSS=0
44350 07/13*  0   0   0    0*  0   0   0    0*191 595  25    0*203 606  30 1012*
44350 07/13*170 575  30    0*180 585  35    0*191 597  35    0*203 610  40    0*
            *** ***  **      *** ***  **          ***  **          ***  **    *

44355 07/14*213 618  40    0*221 630  40    0*226 642  40 1012*227 658  40 1012*
44355 07/14D213 623  40    0D221 636  40    0D225 648  40    0D227 658  40 1012*
            *    ***        *    ***        **** ***        **

44360 07/15*227 674  35    0*229 686  35    0*230 694  30 1015*231 698  25    0*
44360 07/15D228 670  35    0D229 682  35    0D230 694  30 1015D231 710  25    0*
            **** ***        *    ***        *                  *    ***

44365 07/16*232 703  25    0*233 709  25    0*233 716  25    0*234 723  25    0*
44365 07/16D232 723  25    0D233 733  25    0D233 735  25    0D234 737  25    0*
            *    ***        *    ***        *    ***         *    ***

44370 07/17*236 730  25    0*237 737  25    0*237 744  25    0*238 751  25    0*
44370 07/17D235 739  25    0D236 742  25    0D237 750  25    0D238 759  25    0*
            **** ***        **** ***        *    ***         *    ***

44375 07/18*240 757  25    0*243 763  25    0*248 769  25    0*255 772  25    0*
44375 07/18D240 764  25    0D241 765  25    0D242 765  25    0*245 765  25    0*
            *    ***        **** ***        **** ***         **** ***

44380 07/19*262 773  25    0*266 772  25    0*270 764  25    0*278 748  30    0*
44380 07/19*254 765  25    0*262 763  25    0*270 757  30    0*278 748  30    0*
            *** ***          *** ***             ***  **

44385 07/20*289 732  30    0*303 716  50    0*319 699  60  997*336 679  70    0*
44385 07/20*289 737  40    0*303 724  50    0*319 707  60  997*336 685  65  994*
                ***  **          ***             ***              ***      ***

44390 07/21*361 657  70  995*395 632  70  998*429 620  65  998E463 599  65    0*
44390 07/21*361 657  65  995*395 632  60  998E429 612  60  997E463 597  55    0*
                                      **    *    ***      ***     ***  **
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44395 07/22E498 577  25    0E520 570  25    0*  0   0   0    0*  0   0   0    0*
44395 07/22E498 582  50    0E520 570  40    0*  0   0   0    0*  0   0   0    0*
                ***  **                **
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44400 HR

Significant Revisions:

1. Genesis analyzed twelve hours earlier than originally analyzed by HURDAT.
2. Intensification to a tropical storm analyzed eighteen hours earlier than originally shown in HURDAT.
3. Weakening to a tropical disturbance analyzed between July 14th at 00Z and 18th at 12Z based on synoptic observations.
4. Significant westward adjustment of positions (while as a wave) from late on July 15th through late on the 16th.
5. Transition to an extratropical cyclone analyzed six hours earlier than the original HURDAT.

Daily Metadata:

July 11:

1. Maps and old HURDAT:
- HWM and microfilm analyze a tropical wave over the Lesser Antilles at 12Z.
- HURDAT does not list an organized system on this date.

July 12:

1. Maps and old HURDAT:
- HWM and microfilm analyze a tropical wave over the Lesser Antilles at 12Z.
- HURDAT does not list an organized system on this date.

2. Aircraft highlights:
- 30 kt ENE and 1015 mb at 19.2N, 56.2W at 18Z (not a position fix) (micro).

3. Discussion:
- Reanalysis: Satellite images showed a large area of disorganized convection just east of the Lesser Antilles associated with a westerly-moving tropical wave.

July 13:

1. Maps and old HURDAT:
- HWM analyzes a spot low pressure at 19.5N, 59.5W at 12Z.
- HURDAT lists a 25 tropical depression at 19.1N, 59.5W at 12Z (first position).
- Microfilm shows a closed low pressure of at most 1012 mb at 18.5N, 59.5W at 12Z.

2. Ship highlights:
- 35 kt E and 1011 mb at 19.2N, 57.5W at 06Z (COADS).
- 35 kt E and 1018 mb at 21N, 59.5W at 12Z (micro).
- 40 kt E and 1013 mb at 21N, 60W at 18Z (micro).

3. Aircraft highlights:

- Center fix estimated an eye diameter of 40 nm and maximum surface winds of 40 kt (no time given but likely around 18Z) (MWR).

4. Discussion:

- MWR: "Celia formed some 200 mi northeast of the Leeward Islands on July 13. Ship reports indicated winds up to 40 mph and evidence of a circulation center near 19"N 59.5"W. at 1200 GMT. There had been earlier indications of disturbed weather in the area near and to the east and southeast of this point, but no history of a well-defined easterly wave or other synoptic feature. On the afternoon of the 13th, reconnaissance aircraft located a poorly defined cloud eye 40 mi. in diameter with maximum winds of 46 mph."
- WB Miami: First advisory at 22Z: "Air Force Reconnaissance and ship reports indicate that the disturbed area located east northeast of Puerto Rico has developed into Celia ... the third tropical storm of the season."
- Reanalysis: Synoptic observations indicated that the tropical wave had developed a closed-low level circulation at 00Z on this date and is analyzed to have become a 30 kt tropical depression at this time, twelve hours earlier than originally shown in HURDAT. The depression moved northwestward on this date and intensified to a tropical storm at 06Z based on a ship report of 35 kt about 60 nm to the north of the center. Intensification to a tropical storm is analyzed 18 hours earlier than originally shown in HURDAT. The Storm Wallet for Celia was not available and its location is unknown, thus it was not used for this reanalysis. Nonetheless, the MWR and the first WB advisory indicated that a reconnaissance aircraft investigated the system on this date, likely around 18Z, making a center fix and estimating surface winds of 40 kt. Satellite images showed a sheared system with most of the convection over the eastern quadrant. A central pressure of 1012 mb was present in the original HURDAT at 18Z and has been removed based on synoptic data.

July 14:

1. Maps and old HURDAT:

- HWM analyzes a tropical storm of at most 1012 mb at 22.8N, 64.2W at 12Z.
- HURDAT lists a 40 kt tropical storm at 22.6N, 64.2W at 12Z.
- Microfilm shows a tropical storm at 22.4N, 64.5W at 12Z.

2. Ship highlights:

- 40 kt ENE and 1015 mb at 23.2N, 62.2W at 03Z (micro).
- 35 kt E and 1014 mb at 23.5N, 62.8W at 06Z (COADS).
- 40 kt E and 1017 mb at 21.7N, 62.2W at 12Z (COADS).
- 35 kt E and 1015 mb at 24N, 65W at 17Z (micro).

3. Aircraft highlights:

- 30 kt ESE and 1013 mb at 22.8N, 64W at 12Z (not a position fix) (micro).

4. Discussion:

- WB Miami: Fifth advisory at 22Z: "Tropical Storm Celia remains poorly organized with the majority of the weather east of the center."
- Reanalysis: The circulation of Celia was poorly organized on the 13th and observations at 00Z on the 14th indicated that it had weakened into a trough or tropical wave. Thus, it is shown that Celia weakened from a tropical storm to a tropical wave at 00Z on this date. The original HURDAT did not show a tropical wave phase for Celia and actually intensified the system to a tropical storm at this time. (It is important to note that operationally Celia

was downgraded to a tropical wave at 16Z on the 15th.) Satellite images showed a weak swirl north of Puerto Rico with most of the poorly organized convective activity to the southeast. A central pressure of 1012 mb was present in the original HURDAT at 12Z and 18Z, while the 18Z has been retained based on the synoptic observations, reports from a reconnaissance aircraft indicated that the central pressure was likely near 1010 mb at 12Z, thus it is removed.

July 15:

1. Maps and old HURDAT:
- HWM analyzes a spot low pressure at 22.5N, 69.6W at 12Z.
- HURDAT lists a 30 kt tropical depression at 23N, 69.4W at 12Z.
- Microfilm shows a tropical wave extended from 14N-26N, 67W-73W at 12Z.

2. Aircraft highlights:
- 15 kt E at 23.5N, 70W at 1115Z (not a position fix) (micro).

3. Discussion:
- MWR: "The following morning [15], reconnaissance data indicated that Celia had degenerated into an area of showers with winds less than 35 mph."
- ATSR: "This area persisted, without evidence of a storm circulation, from 15 to 19 July, passing over the Bahama Islands."
- WB Miami: Eight advisory at 16Z: "Reports from Air Force reconnaissance aircraft during the morning indicate that Celia is losing her circulation and degenerating into an easterly wave north of Hispaniola."
- Reanalysis: The remnants of Celia moved westward on this date showing little signs of redevelopment on the satellite images. Maximum sustained winds decreasing below tropical storm intensity on this date around 12Z based upon ship, coastal and reconnaissance data.

July 16:

1. Maps and old HURDAT:
- HWM analyzes a spot low pressure at 23.6N, 71.9W at 12Z.
- HURDAT lists a 25 kt tropical depression at 23.3N, 71.6W at 12Z.
- Microfilm shows a tropical wave extended from 16N-26N, 71W-76W at 12Z.

2. Discussion:
- Reanalysis: Major track alterations are shown between 00Z and 12Z based on synoptic observations indicating that the tropical wave axis was farther west than shown in HURDAT.

July 17:

1. Maps and old HURDAT:
- HWM analyzes a spot low pressure at 23.9N, 74.5W at 12Z.
- HURDAT lists a 25 kt tropical depression at 23.7N, 74.4W at 12Z.
- Microfilm shows a tropical wave extended from 17N-26N, 75W-74W at 12Z.

July 18:

1. Maps and old HURDAT:
- HWM analyzes a spot low pressure at 24.8N, 76.6W at 12Z.
- HURDAT lists a 25 kt tropical depression at 24.8N, 76.9W at 12Z.

- Microfilm does not show an organized system at 12Z.

2. Discussion:
- Reanalysis: As the tropical wave approached the central Bahamas, it began to interact with a frontal boundary to the north and reorganized. Surface observations indicated that a closed low-level circulation developed at 18Z and at this time it is analyzed that Celia became a tropical depression. On this date, the system turned to the north.

July 19:

1. Maps and old HURDAT:
- HWM analyzes a closed low pressure of at most 1012 mb at 27.7N, 77.2W at 12Z.
- HURDAT lists a 25 kt tropical depression at 27N, 76.9W at 12Z.
- Microfilm shows a closed low pressure of at most 1010 mb at 27N, 76W at 12Z.

2. Discussion:
- Reanalysis: Satellite images showed a large area of sheared but organized convection associated with Celia while it turned to the northeast and began to gain in forward speed. Most of the convective activity was located over the eastern quadrant. No significant strengthening is analyzed on this date based on synoptic observations.

July 20:

1. Maps and old HURDAT:
- HWM analyzes a closed low pressure of at most 1000 mb at 32.5N, 69.6W with a cold front to the northwest at 12Z.
- HURDAT lists a 60 kt tropical storm at 31.9N, 69.9W at 12Z.
- Microfilm shows a closed low pressure of at most 1004 mb at 32N, 70W with a cold front to the northwest at 12Z.

2. Ship highlights:
- 35 kt S and 1007 mb at 28.4N, 72.4W at 00Z (COADS).
- 15 kt SSE and 998 mb at 32.9N, 70.1W at 12Z (COADS).
- 50 kt SW and 1002 mb at 31.5N, 75.8W at 13Z (micro).
- 40 kt SW and 1007 mb at 32.2N, 67.6W at 18Z (COADS/micro).

3. Aircraft highlights:
- Estimated maximum sustained winds of 70 kt and measured a central pressure of 997 mb (no time given but likely around 12Z) (MWR/WB).
- Measured a central pressure of 994 mb (no time given but likely around 18Z) (WB).

4. Discussion:
- MWR: "Five days later [20], Celia developed on the southwestern edge of a cloud mass some 3° in diameter as indicated by ESSA 2 and Nimbus satellite photographs. This cloud area had persisted although without evidence of a storm circulation, after Celia's dissipation on July 15. The area could be followed, along with a minor perturbation in the low-level flow, to the vicinity of the northwestern Bahamas and then northeastward on the 19th. At 0100 GMT, July 20, a ship located under the southwestern edge of this cloud mass reported squalls to 43 mph. Intensification proceeded rapidly, and when reconnaissance aircraft reached the area early on the morning of July 20,

winds of 80 mph and a central pressure of 997 mb (29.44 in) were observed. The hurricane maintained this intensity as it raced north-northeastward at forward speeds up to 45 mph in advance of a frontal trough moving off the eastern coast of the United States."

- WB Miami: Ninth advisory at 16Z: "Reports from ships and ESSA Research aircraft indicate that the remnants of former Tropical Storm Celia … which was showing indications yesterday of regeneration … intensified rapidly during the night and reached hurricane intensity this morning. Highest winds are 80 mph in squalls southeast of the center. Lowest pressure is 997 mb or 29.44 inches."
- Reanalysis: Surface and aircraft observations indicated that Celia rapidly intensified on this date. Intensification to a tropical storm is analyzed at 00Z based on a ship report of 35 kt S in the eastern quadrant. A reconnaissance aircraft investigated Celia around 12Z and measured a central pressure of 997 mb and estimated surface winds of 70 kt. A ship near the center of Celia at 12Z reported 15 kt SSE and 998 mb, which also suggests a central pressure of about 997 mb. A central pressure of 997 mb was present in the original HURDAT and it is retained. A central pressure of 997 mb suggests maximum surface winds of 49 kt from the north of 25N Brown et al. pressure-wind relationship. Based on the forward speed of about 22 kt and slightly weighting in the surface estimates, an intensity of 60 kt is analyzed at 12Z, same as originally shown in HURDAT. Another penetration center fix occurred around 18Z and measured a central pressure of 994 mb, which has been added to HURDAT at 18Z. A central pressure of 994 mb suggests maximum surface winds of 53 kt from the north of 25N pressure-wind relationship. Due to a forward speed of about 25 kt and small circulation, an intensity of 65 kt is analyzed at 18Z, slightly less than that originally shown in HURDAT. 65 kt is also the peak intensity of this tropical cyclone, again slightly less than originally shown in HURDAT (70 kt).

July 21:

1. Maps and old HURDAT:

- HWM analyzes a closed low pressure of at most 1004 mb at 43N, 61.5W with a cold front going through the center at 12Z.
- HURDAT lists a 65 kt hurricane at 42.9N, 62W at 12Z.
- Microfilm shows a hurricane of at most 1008 mb at 42.3N, 61.7W with a cold front to the southwest at 12Z.

2. Ship highlights:

- 35 kt S and 1016 mb at 36.3N, 62.2W at 00Z (COADS).
- 40 kt SSW and 1018 mb at 39.5N, 59.2W at 06Z (micro).
- 50 kt S and 1015 mb at 38.5N, 59.9W at 12Z (COADS).
- 35 kt SSE and 1022 mb at 44.2N, 55.4W at 18Z (COADS).

3. Aircraft highlights:

- Measured a central pressure of 995 mb (no time given but likely around 00Z) (WB).
- Measured a central pressure of 998 mb (no time given but likely around 06Z) (WB).
- Measured a central pressure of 997 mb (no time given but likely around 12Z) (WB).

4. Discussion:

- MWR: "Celia finally began to weaken and lose tropical characteristics just before reaching western Newfoundland where it moved inland on the afternoon of July 21, accompanied by squalls of 45 mph, then continued northward to merge with the frontal system over Labrador."
- WB Miami: 14th advisory at 22Z: "Celia is no longer a hurricane … during the past few hours Celia has moved inland over southwestern Newfoundland and highest winds have dropped to around 45 mph in gusts over central and eastern Newfoundland."
- Reanalysis: Celia became embedded within the frontal boundary that caused its northeastward acceleration and synoptic observations indicated that it became extratropical around 12Z, six hours earlier than originally shown in HURDAT. The Weather Bureau advisories on Celia showed that reconnaissance aircrafts investigated Celia around 00Z, 06Z and 12Z, and reported a central pressure of 995 mb at 00Z, 998 mb at 06Z and 997 mb at 12Z. The pressure values at 00Z and 06Z were already in HURDAT and have been retained. At 12Z, HURDAT originally had 998 mb and it has been replaced with 997 mb. Late on this day, Celia passed over easternmost Nova Scotia. Weakening below hurricane-force winds is analyzed at 06Z, 18 hours earlier than originally shown in HURDAT. HURDAT actually showed a weakening of 40 kt in six hours, from 65 kt at 18Z on this date to 25 kt at 00Z on the 22nd, which is unrealistic based on data available.

July 22:

1. Maps and old HURDAT:
- HWM analyzes a stationary front over the northwest Atlantic at 12Z.
- HURDAT lists a 25 kt extratropical depression at 52N, 57W at 06Z (last position).
- Microfilm shows that the system had moved north of surface analysis.

2. Ship highlights:
- 35 kt SE and 1020 mb at 52.2N, 55.7W at 06Z (COADS).

3. Discussion:
- Reanalysis: Celia gradually continued to lose strength and organization, and synoptic observations indicated that it had dissipated at 12Z, thus the last position is analyzed at 06Z, same as originally shown in HURDAT.

Sources: NHC microfilm maps, the Historical Weather Maps series, the COADS ship database, Monthly Weather Review, Navy reconnaissance book, Mariners Weather Log, Weather Bureau advisories and satellite images from NCDC and NSIDC.

Hurricane Dorothy [July 21-31, 1966] – AL041966

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44405 07/22/1966 M=10  4 SNBR= 954 DOROTHY     XING=0 SSS=0
44405 07/21/1966 M=11  4 SNBR= 954 DOROTHY     XING=0 SSS=0
         **        **

(July 21st is new to HURDAT)
44407 07/21*  0   0   0    0*315 440  25    0*315 435  25    0*317 431  25    0*
                             *** ***  **      *** ***  **      *** ***  **

44410 07/22*  0   0   0    0*  0   0   0    0*  0   0   0    0*310 410  25    0*
44410 07/22*316 427  25    0*314 423  25    0*312 420  25    0*310 417  25    0*
            *** ***  **      *** ***  **      *** ***  **            ***
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44415 07/23*315 415  25    0*317 417  25    0*318 419  40    0*320 420  40    0*
44415 07/23*312 415  30    0*315 417  35    0*320 420  45    0*325 423  55    0*
            ***      **      ***      **      *** ***  **      *** ***  **

44420 07/24*322 420  55    0*324 421  60    0*327 422  60  998*330 421  65    0*
44420 07/24*328 425  55    0*329 424  60    0*328 423  60    0*330 421  65  998*
            *** ***         *** ***         *** ***        *              ***

44425 07/25*333 418  65    0*338 411  65    0*345 405  65    0*353 405  65  997*
44425 07/25*333 417  65    0*338 411  65    0*345 406  65    0*353 405  65  997*
                ***

44430 07/26*359 408  65    0*361 414  65    0*362 419  65  989*364 422  65    0*
44430 07/26*358 408  65    0*361 414  70    0*362 419  75  989*364 422  75    0*
                                       **                **                **

44435 07/27*366 422  65    0*374 419  65    0*383 414  65  990*387 408  70    0*
44435 07/27*367 422  75    0*374 419  75  990*382 414  75    0*387 408  70    0*
            ***      **                **  *** ***      **    *

44440 07/28*392 401  75    0*401 392  70    0*409 385  70  993*416 382  70  996*
44440 07/28*393 401  70  994*401 392  70    0*409 385  70  993*416 382  65  996*
            ***      **  ***                                            **

44445 07/29*424 380  65    0*431 377  60    0*439 374  55  996*446 374  50  999*
44445 07/29*424 380  65    0*431 377  60    0*439 375  55  996*446 374  50 1000*
                                                  ***                      ****

44450 07/30*453 374  50    0*460 373  45    0*468 371  45    0E477 364  45    0*
44450 07/30*453 374  50    0*460 373  45    0E468 371  45    0E477 366  45 1009*
                                             *                     ***     ****

44455 07/31E490 360  40    0E505 365  40    0E520 370  35    0E535 385  35    0*
44455 07/31E490 360  40    0*  0   0   0    0*  0   0   0    0*  0   0   0    0*
                            *   *   *   *    *   *   *   *    *   *   *   *
44460 HR
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Significant Revisions:

1. Genesis analyzed 36 hours earlier than originally shown in HURDAT.
2. Intensification to a tropical storm analyzed six hours earlier than original shown in HURDAT.
3. Dissipation analyzed 18 hours earlier than originally shown in HURDAT.

Daily Metadata:

July 20:

1. Maps and old HURDAT:

- HWM does not show an organized system at 12Z.
- HURDAT does not list an organized system on this date.
- Microfilm shows a closed low pressure of at most 1024 mb at 36N, 41W at 12Z.

July 21:

1. Maps and old HURDAT:

- HWM and microfilm analyze trough along longitude 43W, extending from 28N-37N at 12Z.
- HURDAT does not list an organized system on this date.

2. Discussion:

- Reanalysis: A disturbance over the central Atlantic slowly became better organized and a well-defined circulation is analyzed to have developed at 06Z. The synoptic data suggests the winds at this time were weak and the system was embedded in an area of high environmental pressure. At 06Z, a 25 kt tropical depression is analyzed to have formed, 36 hours earlier than originally shown in HURDAT. The satellite images showed a large area of convection over the south and eastern quadrants, an increase in shower activity compared to the day before.

July 22:

1. Maps and old HURDAT:

- HWM analyzes a closed low pressure of at most 1020 mb at 30.5N, 44W at 12Z.
- HURDAT lists a 25 kt tropical depression at 31N, 41W at 18Z.
- Microfilm shows a closed low pressure of at most 1022 mb at 29N, 44.5W at 12Z.

2. Discussion:

- ATSR: "On July 22, the subtropical high was very well developed (1040 mb) with the center about 500 miles east of Newfoundland and this system covered the eastern two-thirds of the North Atlantic."
- Reanalysis: The depression remained weak while slowly moving southeastward. The convection remained displaced over the eastern quadrant according to the satellite images.

July 23:

1. Maps and old HURDAT:

- HWM analyzes a closed low pressure of at most 1020 mb at 32N, 41.5W at 12Z.
- HURDAT lists a 40 kt tropical storm at 31.8N, 41.9W at 12Z.
- Microfilm shows a closed low pressure of at most 1012 mb at 32.6N, 41.3W at 12Z.

2. Ship highlights:

- 40 kt ENE and 1025 mb at 36N, 43W at 12Z (MWL).
- 50 kt NE and 1015 mb at 34.5N, 43.4W at 15Z (micro).
- 50 kt NE and 1015 mb at 34.5N, 43.8W at 18Z (COADS).
- 50 kt NE and 1015 mb at 34.7N, 43.4W at 21Z (COADS).

3. Satellite highlights:

- 33N, 42.5W at 1606Z (WALLET)

4. Discussion:

- MWR: "Dorothy developed as a tropical storm near 32' N., 42' W. on July 23. Several ships in the area reported heavy rain and rough seas with winds as high as 58 mph. A photograph from the ESSA 1 satellite revealed a dramatic spiral cloud pattern on this date where only a small isolated area of clouds with no apparent circulation existed on the previous day"

- ATSR: "Surface charts on the 22 and early on 23 July indicated a strong trough or easterly wave with a possible circulation to the south of the high center, however, ship reports were sparse and no confirmation of this could be made. The 1200Z surface chart on 23 July containing more ships reports showed evidence of an organized circulation near 32 degrees north and 42 degrees west. A satellite photograph at 1626Z confirmed the circulation, revealing a dramatic spiral cloud pattern where only a small isolated area of clouds had existed on the previous day. The 1800Z surface chart contained a ship reporting winds of 50 knots and a tropical storm warning on DOROTHY was issued at 2200Z."
- Reanalysis: Synoptic and satellite observations indicated that the tropical depression became better organized and is analyzed to have intensified into a tropical storm at 06Z, six hours earlier than originally shown in HURDAT. A few ships reported tropical-storm-force winds, up to 50 kt.

July 24:

1. Maps and old HURDAT:
- HWM analyzes a tropical storm of at most 1012 mb at 33.2N, 42.3W at 12Z.
- HURDAT lists a 60 kt tropical storm at 32.7N, 42.2W at 12Z.
- Microfilm shows a tropical storm of at most 1016 mb at 33N, 43W at 12Z.

2. Ship highlights:
- 50 kt NE and 1014 mb at 34.8N, 43W at 00Z (COADS).
- 45 kt NE and 1014 mb at 34.9N, 42.9W at 03Z (COADS).
- 45 kt ENE and 1015 mb at 35N, 42.4W at 06Z (COADS).
- 40 kt SW and 1014 mb at 30.5N, 42W at 12Z (COADS).
- 45 kt S and 1008 mb at 32.8N, 41.2W at 18Z (COADS).

3. Aircraft highlights:
- Penetration center fix measured a central pressure of 998 mb and estimated surface winds of 65 kt at 32.9N, 42.2W at 2010Z (WALLET).

4. Satellite highlights:
- 32N, 42.5W at 1530Z (WALLET).

5. Discussion:
- MWR: "Dorothy remained quasi-stationary for the next two days and intensified to hurricane strength late on the 24th."
- Reanalysis: Surface observations on this date indicated that Dorothy had a large circulation but satellite images showed a very small, well-organized tropical cyclone inner core within a larger circulation, certainly a remnant of its non-tropical origin. This is similar to the development of Hurricane Karl in 1980 and the Perfect Storm in 1991. The first reconnaissance aircraft to investigate the tropical cyclone arrived at 2010Z measuring a central pressure of 998 mb and estimating surface winds of 65 kt. A central pressure of 998 mb suggests maximum surface winds of 47 kt from the north of 25N Brown et al. and 52 kt from the north of 35N and Landsea et al., pressure-wind relationships. An intensity of 65 kt is analyzed at 18Z due to the high environmental pressures (OCI 1022 mb) and small circulation. Same intensity as originally shown in HURDAT. Intensification to a hurricane is analyzed at 18Z on this date, same as originally shown in HURDAT.(Central pressures values for a few of the six hour periods were present in the original HURDAT between July 24th at 12Z and July 30th at 18Z. Based on the data available, some were

retained, others removed, and new central pressure values added. Detailed information on these changes can be found in the table at the end.)

July 25:

1. Maps and old HURDAT:
- HWM analyzes a hurricane of at most 1004 mb at 34.8N, 40.8W at 12Z.
- HURDAT lists a 65 kt hurricane at 34.5N, 40.5W at 12Z.
- Microfilm shows a hurricane of at most 1016 mb at 32.6N, 41.4W at 12Z.

2. Ship highlights:
- 35 kt NE and 1018 mb at 37.6N, 45.3W at 00Z (COADS).
- 35 kt E and 1020 mb at 36.9N, 40.4W at 03Z (COADS).
- 35 kt ENE and 1017 mb at 37N, 41.5W at 06Z (COADS).

3. Aircraft highlights:
- Penetration center fix measured a central pressure of 997 mb and estimated surface winds of 40 kt at 35.6N, 40.4W at 19Z (WALLET).

4. Discussion:
- MWR: "Finally the storm commenced a north-northeastward course on July 25."
- Reanalysis: The next reconnaissance aircraft measured a central pressure of 997 mb and estimated surface winds of 40 kt. Satellite images showed a very small tropical cyclone with organized convection over the center, including an eye-like feature. The hurricane remained at the center of the larger circulation. No changes in intensity are analyzed on this date, same as originally shown in HURDAT.

July 26:

1. Maps and old HURDAT:
- HWM analyzes a hurricane of at most 1008 mb at 36.8N, 42.2W at 12Z.
- HURDAT lists a 65 kt hurricane at 36.2N, 41.9W at 12Z.
- Microfilm shows a hurricane of at most 1016 mb at 36.3N, 42.2W at 12Z.

2. Ship highlights:
- 35 kt ESE and 1019 mb at 39.1N, 38.9W at 06Z (COADS).
- 45 kt E and 1004 mb at 36.7N, 42.6W at 13Z (COADS).
- 35 kt E and 1008 mb at 37.1N, 42.7W at 15Z (COADS).
- 35 kt NW and 1012 mb at 35.3N, 45.1W at 18Z (COADS).
- 45 kt S and 1008 mb at 36.1N, 40.3W at 21Z (COADS).

3. Aircraft highlights:
- Penetration center fix measured a central pressure of 989 mb, estimated surface winds of 65 kt and an eye diameter of 15 n mi at 36.2N, 42W at 1248Z (WALLET).
- Radar center fix at 36.6N, 42.1W at 2310Z (WALLET).

4. Satellite highlights:
- 35.5N, 41.5W at 1314Z (WALLET).

5. Discussion:

- MWR: "The lowest recorded pressure, 989 mb. (29.20 in.), was attained at 1200 GMT on July 26. Dorothy's course continued primarily northward with small east-west oscillations."
- Reanalysis: Satellite images indicated that Dorothy became better organized on this date with a larger area of organized convection over the center and an eye clearly discernable. A penetration center fix measured a central pressure of 989 mb, estimated surface winds of 65 kt and a 15 n mi eye diameter at 1248Z. A central pressure of 989 mb suggests maximum surface winds of 64 kt from the north of 35N pressure-wind relationship. An eye diameter of 15 n mi suggests an RMW of 12 nm and the climatological value is 31 nm. Based on the increased in organization, high environmental pressures (OCI 1017) and small RMW, an intensity of 75 kt is analyzed at 12Z, up from 65 kt originally in HURDAT, a minor intensity change. 75 kt is also the peak intensity of this tropical cyclone.

July 27:

1. Maps and old HURDAT:
- HWM analyzes a hurricane of at most 1000 mb at 38.5N, 41.1W at 12Z.
- HURDAT lists a 65 kt hurricane at 38.3N, 41.4W at 12Z.
- Microfilm shows a hurricane of at most 1012 mb at 38.4N, 41.3W at 12Z.

2. Ship highlights:
- 45 kt S and 1006 mb at 36N, 41W at 00Z (COADS).
- 35 kt SSE and 1014 mb at 38.5N, 37.7W at 12Z (COADS).
- 40 kt SW and 1012 mb at 37.4N, 39.2W at 18Z (COADS).

3. Aircraft highlights:
- Penetration center fix measured a central pressure of 990 mb, estimated surface winds of 65 kt and an eye diameter of 15 n mi at 38N, 41.3W at 0858Z (WALLET).
- Penetration center fix measured a central pressure of 998 mb [value appears to be too high], estimated surface winds of 60 kt and an eye diameter of 20 n mi at 38.4N, 41.4W at 1253Z (WALLET).
- Penetration center fix measured a central pressure of 994 mb, estimated surface winds of 85 kt and an eye diameter of 36 n mi at 38.9N, 40.5W at 2123Z (WALLET).

4. Discussion:
- MWR: "On the 27th the track became more northeastward as the storm attained its maximum forward speed, about 15 mph. As Dorothy progressed farther north and passed over progressively colder water its strength gradually diminished."
- Reanalysis: Dorothy continued northward with little change in intensity. A reconnaissance aircraft measured a central pressure of 990 mb, estimated surface winds of 65 kt and a 15 n mi eye diameter at 0858Z. An intensity of 75 kt is analyzed between 00Z and 12Z, up from 65 kt originally in HURDAT, a minor intensity change. Satellite images showed a well-organized tropical cyclone with banding to the northwest and south, and some dry air over the eastern quadrant restricting the convective activity in this sector. The next penetration center fix reported a central pressure of 998 mb but this value appears too high based on aircraft observations earlier and later on this date. Thus, it was not used for the reanalysis. The next aircraft measured a central pressure of 994 mb, estimated surface winds of 85 kt and a 36 n mi eye diameter at 2123Z. A central pressure of 994 mb suggests maximum surface winds of 58 kt from the north of 35N pressure-wind relationship. An eye diameter of

36 n mi suggests an RMW of 27 nm and the climatological value is 35 nm. An intensity of 70 kt is analyzed at 00Z on the 28th.

July 28:

1. Maps and old HURDAT:
- HWM analyzes a hurricane of at most 1008 mb at 41.5N, 38.5W with a cold front to the west at 12Z.
- HURDAT lists a 70 kt hurricane at 40.9N, 38.5W at 12Z.
- Microfilm shows a hurricane of at most 1008 mb at 41N, 37.9W at 12Z.

2. Ship highlights:
- 20 kt NNE and 1001 mb at 40.9N, 40.5W at 12Z (COADS).
- 20 kt NW and 1000 mb at 41.1N, 39W at 15Z (COADS).

3. Aircraft highlights:
- Penetration center fix measured a central pressure of 993 mb and estimated surface winds of 65 kt at 40.8N, 38.6W at 1155Z (WALLET).
- Penetration center fix measured a central pressure of 996 mb and estimated surface winds of 50 kt at 41.7N, 38.3W at 1910Z (WALLET).

4. Discussion:
- Reanalysis: A reconnaissance aircraft investigated Dorothy at 1155Z measuring a central pressure of 993 mb and estimating surface winds of 65 kt. An intensity of 70 kt is analyzed at 12Z, same as originally shown in HURDAT. The next penetration center fix measured a central pressure of 996 mb and estimated surface winds of 50 kt at 1910Z. A central pressure of 996 mb suggests maximum surface winds of 56 kt from the north of 35N pressure-wind relationship. An intensity of 65 kt is analyzed at 18Z on the 28th, down from 70 kt originally shown in HURDAT. Satellite images showed a small tropical cyclone with well-organized convection.

July 29:

1. Maps and old HURDAT:
- HWM analyzes a tropical storm of at most 1000 mb at 44.4N, 36.8W at 12Z.
- HURDAT lists a 55 kt tropical storm at 43.9N, 37.4W at 12Z.
- Microfilm shows a closed low pressure of at most 1000 mb at 44.2N, 37.2W at 12Z.

2. Ship highlights:
- 35 kt E and 1017 mb at 46.8N, 40.5W at 00Z (COADS).

3. Aircraft highlights:
- Penetration center fix measured a central pressure of 996 mb and estimated surface winds of 50 kt at 43.9N, 37.4W at 12Z (WALLET).
- Penetration center fix measured a central pressure of 1000 mb at 44.8N, 37.8W at 18Z (WALLET).

4. Discussion:
- MWR: "Finally, early on the 29th the hurricane decreased to tropical storm intensity. At this time its course was influenced by the circulation around 8 massive cyclone which was moving eastward off the northeastern coast of the United States."

- Reanalysis: A reconnaissance aircraft measured a central pressure of 996 mb and estimated surface winds of 55 kt at 12Z. Satellite images taken around 14Z indicated that the system retained a small circulation but the convection had significantly decreased from the day before. Therefore, an intensity of 55 kt is analyzed at 12Z, same as originally shown in HURDAT. Weakening to a tropical storm is analyzed at 06z, same as originally shown in HURDAT. Another penetration center fix measured a central pressure of 1000 mb at 18Z. A central pressure of 1000 mb suggests maximum surface winds of 49 kt north of 35N from the pressure-wind relationship. An intensity of 50 kt is analyzed at 18Z, same as originally shown in HURDAT.

July 30:

1. Maps and old HURDAT:
- HWM analyzes a tropical storm of at most 1012 mb at 47.3N, 36.3W with an extratropical cyclone to the northwest at 12Z.
- HURDAT lists a 45 kt tropical storm at 46.8N, 37.1W at 12Z.
- Microfilm shows that the system has moved north of the synoptic map.

2. Aircraft highlights:
- Penetration center fix measured a central pressure of 1009 mb and estimated surface winds of 50 kt at 47.2N, 36.9W at 1530Z (WALLET).

3. Discussion:
- MWR: "Thus, on the 30th, its northward speed increased."
- Reanalysis: Transition to an extratropical cyclone is analyzed to have occurred at 12Z based on the synoptic observations, six hours earlier than originally shown in HURDAT. Satellite images showed a small circulation with only some convection over the southeast quadrant. A reconnaissance aircraft measured a central pressure of 1009 mb and estimated surface winds of 50 kt at 1530Z. An intensity of 45 kt is analyzed at 18Z, same as originally shown in HURDAT.

July 31:

1. Maps and old HURDAT:
- HWM analyzes an occluded cyclone south of Greenland, Dorothy appears to have been absorbed at 12Z.

2. Discussion:
a. MWR: "…and on the 31st, as the storm turned toward the northwest, it lost its tropical characteristics. The closest point the storm track came to land was about 400 mi. west of the western Azores."
b. Reanalysis: The circulation of Dorothy weakened as it interacted with a strong extratropical cyclone to the west. Ship observations at 06Z indicated that the system did not have a closed circulation, thus the last position is analyzed at 00Z, eighteen hours earlier than originally shown in HURDAT.

Date	Original HURDAT Central Pressure	Evidence	Changes
July 24 12Z	998 mb	Penetration center fix: 998 mb at 2010Z on July 24th	Removed

July 24 18Z			998 mb
July 25 18Z	997 mb	Penetration center fix: 997 mb at 19Z on July 25th	Retained
July 26 12Z	989 mb	Penetration center fix: 989 mb at 1248Z on July 26th	
July 27 06Z		Penetration center fix: 990 mb at 0858Z on July 27th	990 mb
July 27 12Z	990 mb		Removed
July 28 00Z		Penetration center fix: 994 mb at 2123Z on July 27th	994 mb
July 28 12Z	993 mb	Penetration center fix: 993 mb at 1155Z on July 28th	Retained
July 28 18Z	996 mb	Penetration center fix: 996 mb at 1910Z on July 28th	
July 29 12Z	996 mb	Penetration center fix: 996 mb at 12Z on July 29th	
July 29 18Z	999 mb	Penetration center fix: 1000 mb at 18Z on July 29th	1000 mb
July 30 18Z		Penetration center fix: 1009 mb at 1530Z on July 30th	1009 mb

Sources: NHC microfilm maps, the Historical Weather Maps series, the COADS ship database, Monthly Weather Review, Navy reconnaissance book, Mariners Weather Log, Satellite images from NSIDC, Erickson (1967), and NHC Storm Wallets.

Tropical Storm Ella [July 22-28, 1966] – AL051966

```
44465 07/22/1966 M= 7  5 SNBR= 955 ELLA        XING=0 SSS=0
44470 07/22*  0   0   0    0*  0   0   0    0*100 350  25    0*108 368  25    0*
44470 07/22*  0   0   0    0*  0   0   0    0*100 350  25    0*104 368  25    0*
                                                                  ***

44475 07/23*117 387  25    0*125 407  25    0*134 427  30    0*142 446  30    0*
44475 07/23*109 387  25    0*115 407  25    0*122 427  30    0*131 446  30    0*
            ***              ***              ***              ***

44480 07/24*150 465  30    0*157 486  30    0*163 506  30    0*168 522  35 1009*
44480 07/24*140 466  35    0*147 486  35    0*154 504  35    0*159 521  35 1009*
            *** ***  **      ***      **      *** ***  **      *** ***

44485 07/25*172 535  40    0*175 546  45    0*178 558  45    0*181 570  45 1010*
44485 07/25*164 535  35    0*170 547  35    0*175 558  35 1010*180 570  35 1010*
            ***      **      *** ***  **      ***      ** **** ***      **

44490 07/26*184 582  45    0*188 593  45    0*193 603  45 1008*198 611  45 1008*
44490 07/26*184 582  35    0*188 593  35    0*193 603  35 1008*198 611  35 1008*
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                     **                **                **                **

44495 07/27*202 619  45    0*208 626  45    0*214 634  45 1012*219 642  45    0*
44495 07/27*203 619  35    0*208 626  35    0*214 634  35 1012*219 643  35 1012*
            ***      **                **                **          ***  ** ****

44500 07/28*225 651  45    0*231 662  45    0*237 673  40    0*243 684  30    0*
44500 07/28*225 652  35    0*231 662  30    0*  0   0   0    0*  0   0   0    0*
                ***  **                **        *   *   *        *   *   *

44505 TS
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Significant Revisions:

1. Intensification to a tropical storm is analyzed 18 hours earlier than originally shown in HURDAT based on synoptic data.
2. Weakening to a tropical depression is analyzed twelve hours earlier than originally shown in HURDAT based on synoptic and reconnaissance aircraft data.
3. A significant intensity change is analyzed on July 28th at 06Z based on synoptic and reconnaissance aircraft data.
4. Dissipation is analyzed twelve hours earlier than originally shown based on synoptic observations.

Daily Metadata:

July 21:

1. Maps and old HURDAT:

- HWM does not analyze an organized system at 12Z.
- HURDAT does not list an organized system on this date.
- Microfilm shows a spot low pressure at 13N, 39.5W at 12Z.

2. Satellite highlights:

- ESSA 2 estimated a center fix near 10N, 37W at 1111Z (WALLET).
- NIMBUS 2 estimated a center fix near 10.5N, 41W at 1402Z (WALLET).

3. Discussion:

- Reanalysis:

July 22:

1. Maps and old HURDAT:

- HWM analyzes a spot low pressure at 10.3N, 34.9W at 12Z.
- HURDAT lists a 25 kt tropical depression at 10N, 35W at 12Z (first position).
- Microfilm shows a closed low pressure of at most 1012 mb at 8.5N, 42W at 12Z.

2. Discussion:

- ATSR: "The first indication of the possible existence of ELLA was the formation of a cyclonic circulation on the ITCZ near 10 degrees north and 35 degrees west on 22 July."
- Reanalysis: Tropical Storm Ella developed from a tropical wave that left the African coast around July 20th. Satellite images show that the disturbance moved westward and became better organized. On July 22nd, the daily composite satellite image shows some rain bands extending from the ITCZ into the center

of the system, but because the center was located near the edge of the satellite images, it is difficult to assess the organizational state. The first position is analyzed at 12Z on the 22nd as a 25 kt tropical depression, same as originally shown in HURDAT. Time of genesis is uncertain due to the sparse data over the central Atlantic. The tropical depression moved west-northwest with a forward speed near 20 kt for the first three days after forming.

July 23:

1. Maps and old HURDAT:
- HWM analyzes a spot low pressure at 13.4N, 42.5W at 12Z.
- HURDAT lists a 30 kt tropical depression at 13.4N, 42.7W at 12Z.
- Microfilm shows a closed low pressure of at most 1012 mb at 12.5N, 43W at 12Z.

2. Satellite highlights:
- ESSA 2 estimated a center fix near 12.5N, 47W at 1151Z (WALLET).

3. Discussion:
- Reanalysis: On July 23rd, satellite images show a sheared tropical cyclone with most of the convection on the eastern quadrant.

July 24:

1. Maps and old HURDAT:
- HWM analyzes a closed low pressure of at most 1012 mb at 16.5N, 50.6W at 12Z.
- HURDAT lists a 30 kt tropical depression at 16.4N, 50.6W at 12Z.
- Microfilm shows a tropical wave along longitude 50W, extending from 10N-20W at 12Z.

2. Ship highlights:
- 35 kt SE and 1012 mb at 14.1N, 44.5W at 00Z (micro).

3. Aircraft highlights:
- Penetration center fix measured a central pressure of 1009 mb and estimated surface winds of 40 kt at 16N, 51.7W at 16Z (WALLET).

4. Satellite highlights:
- ESSA 2 estimated a center fix at 15N, 51.5W at 1230Z (WALLET).

5. Discussion:
- MWR: "Satellite pictures taken on July 22 and 23 appear to provide the best continuity prior to the discovery of a large calm area noted by aircraft reconnaissance on the 24th. Since data were sparse during these three days, one can only say that development was slow and not unusual." ATSR: "The initial circulation was discovered by ESSA II satellite pictures at 1215Z 24 July, and reconnaissance aircraft found a weak circulation later in the day. ELLA reached tropical storm intensity near 17 degrees north – 53 degrees west and a tropical storm warning was issued at 2200Z, 24 July."
- Reanalysis: A ship reported 35 kt SE and 1012 mb at 00Z on July 24th, thus intensification to a tropical storm is analyzed at this time. 35 kt is also the peak intensity of this tropical cyclone, down from 45 kt originally shown in HURDAT, a minor intensity change. Satellite images taken late on the 24th showed a large, sheared system with unorganized convection over the eastern quadrant. The first reconnaissance aircraft investigated Ella at 16Z on the 24th measuring a central pressure of 1009 mb and estimated surface winds of 40

kt. The highest central pressure available in the Brown et al. pressure-wind relationship is 1008 mb, which suggests maximum sustained winds of 30 kt south of 25N. Based on the poorly organized state of the tropical cyclone, an intensity of 35 kt is analyzed at 18Z on the 24th, same as originally shown in HURDAT. A central pressure of 1009 mb was present in the original HURDAT at 18Z on the 24th and has been retained.

July 25:

1. Maps and old HURDAT:
- HWM analyzes a tropical storm of at most 1008 mb at 18.1N, 55.7W at 12Z.
- HURDAT lists a 45 kt tropical storm at 17.8N, 55.8W at 12Z.
- Microfilm shows a tropical storm of at most 1012 mb at 17.8N, 56.5W at 12Z.

2. Ship highlights:
- 35 kt ESE and 1022 mb at 16.3N, 49.4W at 00Z (micro).

3. Aircraft highlights:
- Penetration center fix measured a central pressure of 1010 mb and estimated surface winds of 45 kt at 18.5N, 57.2W at 1416Z (WALLET).
- Penetration center fix measured a central pressure of 1010 mb, estimated surface winds of 45 kt and a wind center diameter of 60 nm at 18.1N, 56.9W at 18Z (WALLET).

4. Discussion:
- MWR: "Reconnaissance on the 25th and 26th indicated surface pressures no lower than 1008 mb. (29.77 in.). There was no visual cloud eye and organization was generally very poor. Indeed, at times, the system resembled a strong decelerating easterly wave. There were never any good low-level inflow or high-level outflow patterns, and temperatures and temperature trends never really favored intensification." ATSR: "ELLA continued to move west-northwest and subsequent reconnaissance flights on 25 and 26 July indicated the storm was developing slowly, with no visual cloud eye and very poor circulation."
- Reanalysis: On July 25th, Ella remained disorganized and a reconnaissance aircraft reported a central pressure of 1010 mb at 1416Z and 18Z, also estimating sustained winds of 45 kt and a diameter of 60 nm. Based on the synoptic data and measured central pressure, an intensity of 35 kt is analyzed at 12Z and 18Z on the 25th, down from 45 kt originally in HURDAT, minor intensity changes. A central pressure of 1010 mb has been added to the 12Z time slot on the 25th and retained at 18Z.

July 26:

1. Maps and old HURDAT:
- HWM analyzes a tropical storm of at most 1012 mb at 19.7N, 60.3W at 12Z.
- HURDAT lists a 45 kt tropical storm at 19.3N, 60.3W at 12Z.
- Microfilm shows a tropical storm of at most 1012 mb at 19.3N, 60.5W at 12Z.

2. Aircraft highlights:
- Penetration center fix measured a central pressure of 1008 mb and estimated surface winds of 25 kt at 19.2N, 60.3W at 1230Z (WALLET).
- Penetration center fix measured a central pressure of 1008 mb and estimated surface winds of 40 kt at 18.8N, 60.9W at 1750Z (WALLET).

3. Discussion:

- ATSR: "ELLA was weak and ill-defined throughout her life and show only a slight indication of intensifying on 26 July."
- Reanalysis: On July 26th, the weak tropical storm passed about 120 nm northeast of the Leeward Antilles. At 1230Z on the 26th, a reconnaissance aircraft measured a central pressure of 1008 mb and estimated surface winds of 25 kt. Based on a blend between the synoptic data and reconnaissance aircrafts estimates, an intensity of 35 kt is analyzed at 12Z on the 26th, down from 45 kt originally in HURDAT, a minor intensity change. The next reconnaissance aircraft measured a central pressure of 1008 mb and estimated surface winds of 40 kt at 1750Z on the 26th. An intensity of 35 kt is analyzed at 18Z on the 26th, down from 45 kt originally in HURDAT, a minor intensity change. Central pressures of 1008 mb were present in the original HURDAT in the time slots of 12Z and 18Z on the 26th, and have been retained. Satellite images on the 26th show a sheared tropical cyclone with most of the convective activity over the eastern quadrant.

July 27:

1. Maps and old HURDAT:
- HWM analyzes a tropical storm at 21.5N, 63.2W at 12Z.
- HURDAT lists a 45 kt tropical storm at 21.4N, 63.4W at 12Z.
- Microfilm shows a tropical storm at 21.3N, 63.7W at 12Z.

2. Ship highlights:
- 35 kt ESE and 1013 mb at 23.7N, 58.8W at 00Z (micro)

3. Aircraft highlights:
- Penetration center fix measured a central pressure of 1012 mb and estimated surface winds of 35 kt at 21.5N, 63.5W at 13Z (WALLET).
- Penetration center fix measured a central pressure of 1012 mb, estimated surface winds of 35-40 kt and a wind center diameter of 60 nm at 21.7N, 63.8W at 16Z (WALLET).

4. Discussion:
- Reanalysis: On July 27th, penetration center fixes measured a central pressure of 1012 mb at 13Z and 16Z, along with estimated surface winds of 35-40 kt. Based on a blend between the synoptic data and reconnaissance aircrafts estimates, an intensity of 35 kt is analyzed at 12Z and 18Z on the 27th, down from 45 kt at both times in the original HURDAT, minor intensity changes.

July 28:

1. Maps and old HURDAT:
- HWM analyzes a spot low pressure at 24.4N, 67.9W at 12Z.
- HURDAT lists a 40 kt tropical storm at 23.7N, 67.3W at 12Z.
- Microfilm shows a tropical storm of at most 1016 mb at 23.7N, 67.6W at 12Z.

2. Aircraft highlights:
- Radar center fix at 25.3N, 63.7W at 0405Z (WALLET).

3. Discussion:
- MWR: "Ella dissipated east of the Bahamas on the 28th. No loss of life or damage can be attributed to the storm." ATSR: "The storm gradually turned toward the northwest, with no significant change in size or intensity until mid-day on 28 July, when it weakened into an area of squalls near 24 degrees

north, 68 degrees west as it came under the influence of cold air from a polar trough."

- Reanalysis: On July 28th, Ella became less organized and is analyzed to have weakened to a tropical depression at 06Z, twelve hours before the original HURDAT. Synoptic observations at 12Z on the 28th indicate that Ella had weakened into a trough. A reconnaissance aircrafts investigated the system late on the 28th and was not able to close a center. Therefore, the last position is analyzed at 06Z on the 28th, twelve hours earlier than originally shown in HURDAT.

July 29:

1. Maps and old HURDAT:

- HWM and microfilm do not analyze an organized tropical system at 12Z.
- HURDAT does not list an organized system on this date.

2. Discussion:

- Reanalysis: Satellite images indicate that the remnants of Ella moved northward on July 29th and were absorbed by a frontal boundary over the north Atlantic the next day.

Sources: Historical Weather Maps series, the COADS ship database, Monthly Weather Review, Navy reconnaissance book, Mariners Weather Log, Satellite images from NCDC and NSIDC, and NHC Storm Wallets.

Hurricane Faith [August 21 – September 13, 1966] – AL061966

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44510 08/21/1966 M=18  6 SNBR= 956 FAITH       XING=0 SSS=0
44510 08/21/1966 M=24  6 SNBR= 956 FAITH       XING=0 SSS=0
                    **

44515 08/21*129 205  25    0*133 223  25    0*137 242  25    0*140 261  25 1006*
44515 08/21*129 205  25    0*133 223  25    0*137 241  25    0*140 259  30 1006*
                                                 ***              ***  **

44520 08/22*143 280  35    0*146 299  35    0*149 319  35    0*150 339  40    0*
44520 08/22*143 276  35    0*146 293  35    0*148 309  40    0*150 327  45    0*
                ***              ***          *** ***  **           ***  **

44525 08/23*151 358  50    0*152 378  50    0*152 398  65    0*153 418  65    0*
44525 08/23*151 348  50    0*152 372  60    0*152 396  65    0*153 418  65  992*
                ***              ***  **          ***                        ***

44530 08/24*153 438  80    0*153 457  80    0*153 477  80  992*156 498  85    0*
44530 08/24*153 438  65    0*153 457  65    0*153 477  65  992*155 498  65    0*
                     **                **                **      ***      **

44535 08/25*160 520  85  993*163 541  90  995*166 562  90  986*169 579  90  990*
44535 08/25*160 520  65  993*164 541  65  995*167 562  75  986*170 580  70  990*
                     **      ***      **      ***      **      *** ***  **

44540 08/26*173 594  90    0*177 608  85  997*183 622  80  995*190 637  75    0*
44540 08/26*174 596  60  994*179 610  55  997*184 623  55  995*190 637  60  994*
            *** ***  **  *** *** ***  **      *** ***  **                **  ***
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44545 08/27*197 651  75  987*204 663  75  993*210 675  75  989*216 687  75  983*
44545 08/27*197 651  70  987*204 663  65  993*210 675  65  989*217 689  70  983*
                     **                **                **      *** ***  **

44550 08/28*221 698  80  979*227 705  90  973*233 707 110  962*237 709 110  957*
44550 08/28*222 700  75  979*227 704  80  973*233 707  95  962*238 710 100  957*
            *** ***  **          ***  **                **      *** *** ***

44555 08/29*240 710 105  956*244 711 100  960*249 713 100  963*253 715 100  963*
44555 08/29*242 711 100  955*246 711  95  960*250 711  90  963*254 712  90  963*
            *** *** ***  *** ***      **      *** ***  **      *** ***  **

44560 08/30*258 718  95  963*263 721  95  970*269 724  95  966*274 727  90    0*
44560 08/30*258 715  90  963*263 719  80  970*269 723  85  966*274 729  85  967*
                ***  **          ***  **          ***  **          ***  **  ***

44565 08/31*280 730  90  967*285 733  90    0*293 736  90  988*305 733  90  963*
44565 08/31*280 732  85  967*287 734  80  973*294 735  85    0*305 733  90  963*
                ***  **      *** ***  **  *** *** ***  **    *

44570 09/01*317 724  90    0*329 714  95  963*340 703  95  963*350 692  95  957*
44570 09/01*317 725  90    0*329 714  90  963*340 703  90  963*350 692  95  957*
                ***                   **                **

44575 09/02*359 680  95  958*366 668  95    0*370 652  95    0*371 630  90    0*
44575 09/02*358 680  95  958*365 668  90  960*370 652  90    0*371 630  95    0*
            ***              ***      **  ***          **                **

44580 09/03*371 601  90    0*375 570  90  950*383 540  90    0*397 511  90    0*
44580 09/03*372 601 100    0*375 570 105  950*383 540 105    0*397 505 100    0*
            ***     ***                ***                ***          *** ***

44585 09/04*419 481  90    0*447 449  90    0*475 415  90  954*502 378  90    0*
44585 09/04*419 470  95    0E447 435  90    0E475 400  90  954E502 365  90    0*
                ***  **     *    ***         *    ***         *    ***

44590 09/05*528 338  90    0*552 294  90    0*573 245  90    0*587 194  90    0*
44590 09/05E528 330  90    0E552 294  85    0E573 245  80    0E587 194  75    0*
            *    ***         *          **     *          **     *          **

44595 09/06*604 120  90    0*611  60  65    0E625  30  55    0E6263575  55    0*
44595 09/06E602 127  70    0E615  70  65    0E625  20  60    0E6283570  60    0*
            **** ***  **     ****  **                **  **         ****  **

44600 09/07E6293530  40    0*  0   0   0    0*  0   0   0    0*  0   0   0    0*
44600 09/07E6303510  55    0E6343440  55    0E6403370  50    0E6473300  50    0*
            *******  **     ********  **     ********  **     ********  **
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(September 8th through 13th is new to HURDAT)

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44601 09/08E6573250  50    0E6683205  50    0E6803175  50    0E6953140  50    0*
44603 09/09E7103105  50    0E7253080  50    0E7403065  50    0E7503058  50    0*
44605 09/10E7603054  45    0E7703052  45    0E7803050  45    0E7903050  45    0*
44607 09/11E8003050  45    0E8103050  45    0E8203050  40    0E8253048  40    0*
44609 09/12E8273045  35    0E8293038  35    0E8303030  35    0E8303022  30    0*
44610 09/13E8303014  30    0E8303007  30    0E8303000  30    0E8302990  25    0*
44615 HR
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Significant Revisions:

1. Significant track changes made on August 22nd, September 4th and 6th based on synoptic observations.
2. Significant reductions in intensity on August 24th through the 26th, 28th and 30th based on data from reconnaissance aircrafts.
3. Significant increases in intensity on September 3rd and 7th based on reconnaissance and ship observations, respectively.
4. Intensity indicated to have temporarily dropped to a tropical storm on August 26th based on reconnaissance aircraft data.
5. Faith displayed a third peak in intensity on September 3rd reaching category 3 for a second time based on reconnaissance aircraft data.
6. Extratropical transition analyzed 54 hours earlier than originally shown.
7. Eight extra days are added to the track of Faith as an extratropical cyclone.

Daily Metadata:

August 20:

4. Maps and old HURDAT:

- HWM does not analyze an organized system at 12Z.
- HURDAT does not list an organized system on this date.
- Microfilm shows the monsoon trough over the eastern Atlantic extending to western Africa with a couple embedded centers of low pressures at 12Z.

5. Discussion:

- MWR: "With the advantages of hindsight, the system can be tracked in embryonic form from a position over Africa, near 8N, 5W, on August 18. At that time, there was only a poorly defined depression and a circular cloud mass as depicted by a TIROS IX photograph."
- ATSR: "Hurricane FAITH began as a poorly defined depression over the Ivory Coast of Africa on 18 August and moved westward at a forward speed of about 18 knots."
- Reanalysis: Satellite images indicated that a well-defined tropical wave was located off the western coast of Africa on this date.

August 21:

1. Maps and old HURDAT:

- HWM analyzes a closed low pressure of at most 1008 mb at 13.8N, 24.2W at 12Z.
- HURDAT lists a 25 kt tropical depression at 13.7N, 24.2W at 12Z.
- Microfilm shows a closed low pressure of at most 1008 mb at 13N, 25.5W at 12Z.

2. Ship highlights:

- 15 kt WNW and 1007 mb at 13.3N, 26.5W at 18Z (COADS).

3. Discussion:

- ATSR: "It was discovered as a weak circulation by ESSA II satellite photographs at 1009Z on 21 August near 14 degrees north and 24 degrees west."
- Reanalysis: The westerly-moving disturbance rapidly developed a closed circulation and a 25 kt tropical depression is analyzed to have formed at 00Z on this date, same as originally shown in HURDAT. Satellite images showed a well-organized tropical cyclone with a large rainding band extending from the

ITCZ to the center of the system and a large area of convection over the center. It is possible that this tropical cyclone could have reached tropical storm intensity on this date based on the satellite presentation but the synoptic data does not support an upgrade on this date. (Central pressures values for a many of the six-hour periods were present in the original HURDAT between August 21th at 18Z and September 4th at 12Z. Based on the data available, some were retained, others removed, and new central pressure values added. Detailed information on these changes can be found in the table at the end.)

August 22:

1. Maps and old HURDAT:
- HWM analyzes a tropical storm of at most 1008 mb at 15.2N, 31.9W at 12Z.
- HURDAT lists a 35 kt tropical storm at 14.9N, 31.9W at 12Z.
- Microfilm shows a tropical storm of at most 1012 mb at 15N, 32.1W at 12Z.

2. Discussion:
- ATSR: "The following day [22] at 1045Z, the ESSA II satellite revealed a well defined spiral cloud pattern and a tropical storm was warning was issued by FLEWEACEN ROTA."
- Reanalysis: Intensification to a tropical storm is analyzed at 00Z on this date, same as originally shown in HURDAT. Satellite images showed a well-organized tropical cyclone with circular convection over the center.

August 23:

1. Maps and old HURDAT:
- HWM analyzes a hurricane of at most 1008 mb at 15.8N, 39.7W at 12Z.
- HURDAT lists a 65 kt hurricane at 15.2N, 39.8W at 12Z.
- Microfilm shows a tropical storm of at most 1008 mb at 15.5N, 38.1W at 12Z.

2. Ship highlights:
- 35 kt E and 1009 mb at 17.2N, 37.5W at 14Z (micro/WALLET).

3. Aircraft highlights:
- Penetration center fix measured a central pressure of 992 mb, estimated surface winds of 75 kt and an eye diameter of 28 n mi at 15.3N, 42.6W at 2025Z (WALLET).

4. Discussion:
- ATSR: "Navy reconnaissance aircraft observed 75 knot winds in penetrating the storm at 2025Z, 23 July and the storm was upgraded to a hurricane at 2200Z."
- Reanalysis: Faith continued to intensify on this date as it moved generally westward at about 20 kt. A ship passed near the storm and reported gale-force winds at 14Z. The first reconnaissance aircraft reached the tropical cyclone at 2025Z measuring a central pressure of 992 mb, estimating surface winds of 75 kt and an eye diameter of 28 n mi. A central pressure of 992 mb suggests maximum surface winds of 61 kt from the south of 25N Brown et al. pressure-wind relationship. A 28 n mi eye diameter suggests an RMW of about 21 n mi and the climatological value is 14 n mi. Based on a forward speed of about 20 kt, an intensity of 65 kt is analyzed at 18Z, same as originally shown in HURDAT. Intensification to a hurricane is analyzed at 12Z, same as originally shown in HURDAT. Satellite images continued to show a well-organized tropical cyclone with circular convection over the center.

August 24:

1. Maps and old HURDAT:
- HWM analyzes a hurricane of at most 1000 mb at 15.9N, 47.7W at 12Z.
- HURDAT lists an 80 kt hurricane at 15.3N, 47.7W at 12Z.
- Microfilm shows a hurricane of at most 1004 mb at 15.4N, 47.2W at 12Z.

2. Aircraft highlights:
- Penetration center fix measured a central pressure of 992 mb and estimated surface winds of 55 kt at 15.2N, 47.9W at 14Z (WALLET).
- Penetration center fix measured a central pressure of 993 mb and an eye diameter of 28 n mi at 16.1N, 51.3W at 22Z (WALLET).

3. Discussion:
- Reanalysis: Another reconnaissance aircraft investigated Faith at 14Z measuring a central pressure of 992 mb and estimating surface winds of 55 kt. Based on a forward speed of about 20 kt, an intensity of 65 kt is analyzed at 12Z, down from 80 kt originally in HURDAT, a minor intensity change. An intensity of 65 kt is also analyzed at 18Z, down from 85 kt originally shown in HURDAT, a major intensity change. Satellite images suggests that the convective structure of Faith had become less organized compared to the days before.

August 25:

1. Maps and old HURDAT:
- HWM analyzes a hurricane of at most 1004 mb at 17.1N, 56W at 12Z.
- HURDAT lists a 90 kt hurricane at 16.6N, 56.2W at 12Z.
- Microfilm shows a hurricane of at most 1008 mb at 16.7N, 56W at 12Z.

2. Aircraft highlights:
- Penetration center fix measured a central pressure of 995 mb, estimated flight level winds of 60 kt and an eye diameter of 17 n mi at 16.3N, 54.4W at 0545Z (WALLET).
- Penetration center fix measured a central pressure of 986 mb, estimated surface winds of 80 kt and an eye diameter of 20 n mi at 16.7N, 56.2W at 12Z (WALLET).
- Penetration center fix measured a central pressure of 990 mb and estimated surface winds of 90 kt at 17N, 58W at 18Z (WALLET).

3. Discussion:
- Reanalysis: A penetration center fix measured a central pressure of 993 mb and estimated a 28 n mi eye diameter at 22Z on the 24th. An intensity of 65 kt is analyzed at 00Z on the 25th, down from 85 kt originally in HURDAT, a major intensity change. Another penetration center fix measured a central pressure of 995 mb and estimated an eye diameter of 17 n mi at 0545Z. A central pressure of 995 mb suggests maximum surface winds of 56 kt from the south of 25N pressure-wind relationship. Based on a forward speed of about 20 kt, an intensity of 65 kt is analyzed at 06Z, down from 90 kt originally in HURDAT, a major intensity change. The next reconnaissance aircraft measured a central pressure of 986 mb, estimated surface winds of 80 kt and an eye diameter of 20 n mi at 12Z. A central pressure of 986 mb suggests maximum surface winds of 70 kt from the south of 25N pressure-wind relationship. A 20 n mi eye diameter suggests an RMW of about 15 n mi and the climatological value is 14 n mi. Based on a forward speed of about 21 kt, an intensity of 75 kt is analyzed at 12Z, down from 90 kt originally in HURDAT, a minor intensity change. Another penetration center fix

measured a central pressure of 990 mb and estimated surface winds of 90 kt at 18Z. A central pressure of 990 mb suggests maximum surface winds of 64 kt from the south of 25N pressure-wind relationship. Based on a forward speed of about 17 kt, an intensity of 70 kt is analyzed at 18Z, down from 90 kt originally in HURDAT, a major intensity change. Satellite images indicated that Faith had become better organized since the 24th with an increase in banding and organized convection over the center.

August 26:

1. Maps and old HURDAT:
- HWM analyzes a hurricane of at most 1008 mb at 18.5N, 62.1W at 12Z.
- HURDAT lists an 80 kt hurricane at 18.3N, 62.2W at 12Z.
- Microfilm shows a hurricane of at most 1008 mb at 18N, 62.2W at 12Z.

2. Ship highlights:
- 35 kt ESE and 1014 mb at 18.7N, 58.7W at 12Z (COADS).
- 45 kt E and 1012 mb at 21.5N, 64.4W at 18Z (COADS).

3. Land highlights:
- 35 kt N and 1006 mb at Sint Maarten at 12Z (micro).

4. Aircraft highlights:
- Penetration center fix measured a central pressure of 994 mb, estimated flight level winds of 60 kt and an eye diameter of 30 n mi at 17.5N, 59.3W at 00Z (WALLET).
- Penetration center fix measured a central pressure of 997 mb and estimated an eye diameter of 20 n mi at 18N, 61.2W at 06Z (WALLET).
- Penetration center fix measured a central pressure of 995 mb, estimated surface winds of 50 kt and an eye diameter of 25 n mi at 18.2N, 62.2W at 1234Z (WALLET).
- Penetration center fix measured a central pressure of 994 mb and estimated surface winds of 50 kt at 19.5N, 64.5W at 21Z (WALLET).

5. Discussion:
- Reanalysis: Faith passed north of the Lesser Antilles producing gale-force winds on Sint Maarten. A reconnaissance aircraft measured a central pressure of 994 mb, estimated flight level winds of 60 kt and an eye diameter of 30 n mi at 00Z. A central pressure of 994 mb suggests maximum surface winds of 58 kt from the south of 25N pressure-wind relationship. A 30 n mi eye diameter suggests an RMW of about 23 n mi and the climatological value is 15 n mi. Based on a forward speed of about 16 kt but a large RMW, an intensity of 60 kt is analyzed at 00Z, down from 90 kt originally in HURDAT, a major intensity change. The original HURDAT did not show Faith weakening to a tropical storm on this date, but did show the system weakening from 90 kt at 0Z to 75 kt at 18Z. The next penetration center fix measured a central pressure of 997 mb and an eye diameter of 20 n mi at 06Z. A central pressure of 997 mb suggests maximum surface winds of 53 kt from the south of 25N pressure-wind relationship. A 20 n mi eye diameter suggests an RMW of about 15 n mi and the climatological value is 15 n mi. Based on a forward speed of about 14 kt, an intensity of 55 kt is analyzed at 06Z, down from 85 kt originally in HURDAT, a major intensity change. Another penetration center fix measured a central pressure of 995 mb, estimated surface winds of 50 kt and a 25 n mi eye diameter at 1234Z. An intensity of 55 kt is analyzed at 12Z, down from 80 kt originally in HURDAT, a major intensity change. The last reconnaissance aircraft measured a central pressure of 994 mb and estimated surface winds of

50 kt at 21Z. Based on a forward speed of about 15 kt, an intensity of 60 kt is analyzed at 18Z, down from 75 kt originally in HURDAT, a minor intensity change.

August 27:

1. Maps and old HURDAT:
- HWM analyzes a hurricane of at most 1000 mb at 21.2N, 67.3W at 12Z.
- HURDAT lists a 75 kt hurricane at 21N, 67.5W at 12Z.
- Microfilm shows a hurricane of at most 1004 mb at 21N, 67W at 12Z.

2. Ship highlights:
- 40 kt NE and 1011 mb at 21.4N, 66.2W at 00Z (COADS).
- 45 kt ESE and 1012 mb at 23.1N, 62.8W at 06Z (COADS).
- 45 kt N and 1002 mb at 20.7N, 68.3W at 12Z (COADS/micro).
- 45 kt SE and 1016 mb at 26N, 66.4W at 18Z (COADS)

3. Aircraft highlights:
- Radar center fix [or penetration center fix] estimated a central pressure of 987 mb at 19.9N, 65.2W at 00Z (WALLET).
- Penetration center fix measured a central pressure of 993 mb and estimated an eye diameter of 25 n mi at 20.4N, 66.4W at 0555Z (WALLET).
- Penetration center fix measured a central pressure of 989 mb and estimated surface winds of 65 kt at 20.7N, 67.1W at 1030Z (WALLET).
- Penetration center fix measured a central pressure of 983 mb, estimated surface winds of 80 kt and an eye diameter of 38 n mi at 21.7N, 69.2W at 1830Z (WALLET).
- Penetration center fix measured a central pressure of 979 mb and estimated surface winds of 80 kt at 22.1N, 70.1W at 2215Z (WALLET).

4. Discussion:
- Reanalysis: The first reconnaissance aircraft to reach Faith on this date measured a central pressure of 987 mb at 00Z. A central pressure of 987 mb suggests maximum sustained winds of 68 kt from the south of 25N pressure-wind relationship. Based on a forward speed of about 14 kt, an intensity of 70 kt is analyzed at 00Z, down from 75 kt originally in HURDAT, a minor intensity change. Re-intensification to a hurricane is analyzed at 00Z on this date. The next penetration center measured a central pressure of 993 mb and estimated an eye diameter of 25 n mi at 0555Z. A central pressure of 993 mb suggests maximum surface winds of 59 kt from the south of 25N pressure-wind relationship. A 25 n mi eye diameter suggests an RMW of about 19 n mi and the climatological value is 16 n mi. Based on a forward speed of about 14 kt, an intensity of 65 kt is analyzed at 06Z, down from 75 kt originally in HURDAT, a minor intensity change. A penetration center fix measured a central pressure of 989 mb and estimated surface winds of 65 kt at 1030Z. A central pressure of 989 mb suggests maximum surface winds of 65 kt from the south of 25N pressure-wind relationship. Based on a forward speed of about 13 kt, an intensity of 65 kt is analyzed at 12Z, down from 75 kt originally in HURDAT, a minor intensity change. The next reconnaissance aircraft measured a central pressure of 983 mb, estimated surface winds of 80 kt and an eye diameter of 38 n mi at 1830Z. A central pressure of 983 mb suggests maximum surface winds of 74 kt from the south of 25N pressure-wind relationship. A 38 n mi eye diameter suggests an RMW of about 29 n mi and the climatological value is 17 n mi. Based on a forward speed of about 11 kt but large RMW, an intensity of 70 kt is analyzed at 18Z, down from 75 kt originally in HURDAT, a minor intensity change.

Satellite images showed a well-organized tropical cyclone north of the central Greater Antilles.

August 28:

1. Maps and old HURDAT:
- HWM analyzes a hurricane of at most 1000 mb at 23.8N, 70.8W with a stationary front to the northwest at 12Z.
- HURDAT lists a 110 kt hurricane at 23.3N, 70.7W at 12Z.
- Microfilm shows a hurricane of at most 1000 mb at 23.6N, 70.8W with a cold front to the northwest at 12Z.

2. Ship highlights:
- 35 kt SSW and 1008 mb at 20.4N, 68.3W at 00Z (COADS).
- 35 kt SE and 1010 mb at 23.5N, 68.3W at 12Z (COADS).
- 35 kt SE and 1009 mb at 23.4N, 68.2W at 18Z (COADS).

3. Aircraft highlights:
- Penetration center fix measured a central pressure of 973 mb, estimated surface winds of 65 kt and an eye diameter of 25 n mi at 22.7N, 70.1W at 0545Z (WALLET).
- Penetration center fix measured a central pressure of 962 mb, estimated surface winds of 110 kt and an eye diameter of 30 n mi at 23.4N, 70.8W at 1212Z (WALLET).
- Penetration center fix measured a central pressure of 963 mb and estimated flight level winds of 106 kt at 23.6N, 71.1W at 1532Z (WALLET).
- Penetration center fix measured a central pressure of 957 mb, estimated flight level winds of 102 kt and an eye diameter of 30 n mi at 24N, 71.1W at 18Z (WALLET).
- Penetration center fix measured a central pressure of 956 mb and estimated surface winds of 95 kt at 24N, 71W at 20Z (WALLET).

4. Discussion:
- Reanalysis: Faith rapidly intensified on this day and satellite images showed a well-organized CDO and a clear eye. A reconnaissance aircraft measured a central pressure of 979 mb and estimated surface winds of 80 kt at 2215Z on the 27th. A central pressure of 979 mb suggests maximum surface winds of 79 kt from the south of 25N pressure-wind relationship. Based on a forward speed of about 13 kt, an intensity of 75 kt is analyzed at 00Z on this date, down from 80 kt originally in HURDAT, a minor intensity change. The next penetration center fix measured a central pressure of 973 mb, estimated surface winds of 65 kt and an eye diameter of 25 n mi at 0545Z. A central pressure of 973 mb suggests maximum surface winds of 87 kt from the south of 25N pressure-wind relationship intensifying subset. A 25 n mi eye diameter suggests an RMW of about 19 n mi and the climatological value is 17 n mi. Based on a forward speed of about 6 kt, an intensity of 80 kt is analyzed at 06Z, down from 90 kt originally in HURDAT, a minor intensity change. The next reconnaissance aircraft measured a central pressure of 962 mb, estimated surface winds of 110 kt and an eye diameter of 30 n mi at 1212Z. A central pressure of 962 mb suggests maximum surface winds of 100 kt from the south of 25N pressure-wind relationship intensifying subset. A 30 n mi eye diameter suggests an RMW of about 23 n mi and the climatological value is 18 n mi. Based on a forward speed of about 4 kt, an intensity of 95 kt is analyzed at 12Z, down from 110 kt originally in HURDAT, a minor intensity change. Another reconnaissance aircraft measured a central pressure of 957 mb and estimated an eye diameter of 30 n mi at 18Z. A

central pressure of 957 mb suggests maximum surface winds of 103 kt from the south of 25N pressure-wind relationship intensifying subset. Based on a forward speed of about 4 kt, an intensity of 100 kt is analyzed at 18Z, down from 110 kt originally in HURDAT, a minor intensity change. Intensification to a major hurricane is analyzed at 18Z, six hours later than originally shown in HURDAT.

August 29:

1. Maps and old HURDAT:
- HWM analyzes a hurricane of at most 1000 mb at 25.3N, 71.3W at 12Z.
- HURDAT lists a 100 kt hurricane at 24.9N, 71.3W at 12Z.
- Microfilm shows a hurricane of at most 1004 mb at 24.5N, 71.2W at 12Z.

2. Ship highlights:
- 35 kt S and 1008 mb at 23.1N, 69.8W at 00Z (COADS).
- 40 kt S and 1005 mb at 23.1N, 69.3W at 06Z (COADS).
- 50 kt S and 1007 mb at 23.9N, 68.8W at 12Z (COADS).
- 40 kt SSW and 1009 mb at 23.4N, 68.9W at 18Z (COADS).

3. Aircraft highlights:
- Penetration center fix measured a central pressure of 955 mb at 24.1N, 71.1W at 00Z (WALLET).
- Penetration center fix measured a central pressure of 960 mb at 24.7N, 70.9W at 0558Z (WALLET).
- Penetration center fix measured a central pressure of 963 mb, estimated surface winds of 90 kt and an eye diameter of 30 n mi at 24.9N, 71.1W at 1155Z (WALLET).
- Penetration center fix measured a central pressure of 963 mb and estimated surface winds of 70 kt at 25.5N, 71.1W at 18Z (WALLET).

4. Discussion:
- Reanalysis: Faith moved slowly northward while located just east of the central Bahamas as it interacted with a frontal boundary to the north. Satellite images showed that the eye visible on the 28th had disappeared and westerly shear had increased over the system displacing the convective activity. The first reconnaissance aircraft on this date measured a central pressure of 955 mb at 00Z. A central pressure of 955 mb suggests maximum surface winds of 106 kt from the south of 25N and 100 kt from the north of 25N pressure-wind relationships. Based on a forward speed of about 4 kt, an intensity of 100 kt is analyzed at 18Z, down from 110 kt originally in HURDAT, a minor intensity change. The next penetration center fix measured a central pressure of 960 mb at 0558Z. A central pressure of 960 mb suggests maximum surface winds of 101 kt from the south of 25N and 95 kt from the north of 25N pressure-wind relationships. Based on a slow forward speed of about 5 kt, an intensity of 95 kt is analyzed at 06Z, down from 100 kt originally shown in HURDAT, a minor intensity change. Weakening below major hurricane intensity is analyzed at 06Z, eighteen hours earlier than originally shown in HURDAT. Another penetration center fix measured a central pressure of 963 mb, estimated surface winds of 90 kt and an eye diameter of 30 n mi at 1155Z. A central pressure of 963 mb suggests maximum surface winds of 98 kt from the south of 25N and 92 kt from the north of 25N pressure-wind relationships. A 30 n mi eye diameter suggests an RMW of about 23 n mi and the climatological value is 18 n mi. Based on a forward speed of about 4 kt, an intensity of 90 kt is analyzed at 12Z, down from 100 kt originally in HURDAT, a minor intensity change. At 18Z, another reconnaissance aircraft measured a central

pressure of 963 mb and an intensity of 90 kt is analyzed at this time, down from 100 kt originally in HURDAT, a minor intensity change.

August 30:

1. Maps and old HURDAT:
- HWM analyzes a hurricane of at most 1000 mb at 27.5N, 72.5W at 12Z.
- HURDAT lists a 95 kt hurricane at 26.9N, 72.4W at 12Z.
- Microfilm shows a hurricane of at most 1004 mb at 26.9N, 72.3W at 12Z.

2. Ship highlights:
- 40 kt SE and 1012 mb at 24.7N, 67.5W at 00Z (COADS).
- 40 kt SE and 1011 mb at 24.3N, 67.9W at 06Z (MWL).
- 40 kt W and 1007 mb at 24.2N, 71.8W at 12Z (COADS).
- 40 kt SW and 1008 mb at 24.6N, 72.1W at 18Z (COADS).

3. Aircraft highlights:
- Penetration center fix measured a central pressure of 963 mb and estimated surface winds of 70 kt at 25.9N, 71.4W at 00Z (WALLET).
- Penetration center fix measured a central pressure of 970 mb, estimated flight level winds of 75 kt and an eye diameter of 45 n mi NE-SW at 26.2N, 71.9W at 06Z (WALLET).
- Penetration center fix measured a central pressure of 966 mb, estimated flight level winds of 90 kt and an eye diameter of 30 n mi at 26.9N, 72.2W at 1145Z (WALLET).
- Penetration center fix measured a central pressure of 967 mb at 27.7N, 73.3W at 2045Z (WALLET).
- Penetration center fix measured a central pressure of 967 mb and estimated flight level winds of 90 kt at 27.9N, 73.3W at 2350Z (WALLET).

4. Discussion:
- Reanalysis: Satellite images on this date indicated that Faith was being affected by westerly wind shear and the convection was mostly over the eastern quadrant. The first penetration center fix on this date measured a central pressure of 963 mb and estimated surface winds of 70 kt at 00Z. An intensity of 90 kt is analyzed at 00Z, down from 95 kt originally in HURDAT, a minor intensity change. The next penetration center fix measured a central pressure of 970 mb and estimated an eye diameter of 45 n mi at 06Z. A central pressure of 970 mb suggests maximum surface winds of 84 kt from the north of 25N and 81 kt from the north of 25N weakening subset of the pressure-wind relationships. A 45 n mi eye diameter suggests an RMW of about 34 n mi and the climatological value is 19 n mi. Based on a forward speed of about 6 kt, an intensity of 80 kt is analyzed at 06Z, down from 95 kt originally in HURDAT, a minor intensity change. Another penetration center fix measured a central pressure of 966 mb and estimated an eye diameter of 30 n mi at 1145Z. A central pressure of 966 mb suggests maximum surface winds of 89 kt from the north of 25N pressure-wind relationship. A 30 n mi eye diameter suggests an RMW of about 23 n mi and the climatological value is 19 n mi. Based on a forward speed of about 6 kt, an intensity of 85 kt is analyzed at 12Z, down from 95 kt originally in HURDAT, a minor intensity change. A reconnaissance aircraft measured a central pressure of 967 mb at 2045Z and an intensity of 85 kt is analyzed at 18Z, down from 90 kt originally shown in HURDAT, a minor intensity change.

August 31:

1. Maps and old HURDAT:

- HWM analyzes a hurricane of at most 996 mb at 29.5N, 73.8W at 12Z.
- HURDAT lists a 90 kt hurricane at 29.3N, 73.6W at 12Z.
- Microfilm shows a hurricane of at most 1000 mb at 29.5N, 73.6W at 12Z.

2. Ship highlights:

- 40 kt SSW and 1008 mb at 25.2N, 72.5W at 00Z (COADS).
- 40 kt S and 1007 mb at 25.8N, 72.9W at 06Z (COADS).
- 60 kt SE and 1002 mb at 29.4N, 71.3W at 12Z (COADS).
- 70 kt SE and 1003 mb at 30.3N, 71.3W at 18Z (COADS/MWL/micro).
- 984 mb (winds unknown) at 30.7N, 71.2W at 21Z (COADS).

3. Aircraft highlights:

- Penetration center fix measured a central pressure of 973 mb and estimated an eye diameter of 40 n mi at 28.9N, 73.4W at 0712Z (WALLET).
- Penetration center fix measured a central pressure of 963 mb and estimated surface winds of 60 kt at 30.4N, 73.4W at 1704Z (WALLET).
- Penetration center fix estimated surface winds of 80 kt at 31.7N, 72.7W at 2334Z (WALLET).

4. Discussion:

- Reanalysis: A penetration center fix at 2350Z on the 30th measured a central pressure of 967 mb and an intensity of 85 kt is analyzed at 00Z on the 31st, down from 90 kt originally shown in HURDAT, a minor intensity change. Another penetration center fix measured a central pressure of 973 mb and estimated an eye diameter of 40 n mi at 0712Z. A central pressure of 973 mb suggests maximum surface winds of 81 kt from the north of 25N and 77 kt from the north of 25N weakening subset of the pressure-wind relationships. A 40 n mi eye diameter suggests an RMW of about 30 n mi and the climatological value is 22 n mi. Based on a forward speed of about 8 kt, an intensity of 80 kt is analyzed at 06Z, down from 90 kt originally in HURDAT, a minor intensity change. At 1704Z, another penetration center fix measured a central pressure of 963 mb and estimated surface winds of 60 kt. A central pressure of 963 mb suggests maximum surface winds of 92 kt from the north of 25N pressure-wind relationship. An intensity of 90 kt is analyzed at 18Z, same as originally shown in HURDAT. A ship reported hurricane-force winds at 18Z.

September 1:

1. Maps and old HURDAT:

- HWM analyzes a hurricane of at most 984 mb at 34.5N, 70.2W with a stationary front to the north at 12Z.
- HURDAT lists a 95 kt hurricane at 34N, 70.3W at 12Z.
- Microfilm shows a hurricane of at most 996 mb at 34.4N, 70.4W with a stationary front to the north at 12Z.

2. Ship highlights:

- 80 kt SSE and 982 mb at 31.2N, 71.8W at 00Z (micro).
- 80 kt SSE and 968 mb at 32.7N, 70.8W at 06Z (COADS/MWL).
- 80 kt SSW and 985 mb at 32.5N, 69.5W at 12Z (COADS/MWL).
- 75 kt S and 984 mb at 33.9N, 68.2W at 18Z (COADS).

3. Aircraft highlights:

- Penetration center fix measured a central pressure of 963 mb, estimated flight level winds of 65 kt and an eye diameter of 75 n mi at 33N, 71.2W at 0630Z (WALLET).
- Penetration center fix measured a central pressure of 963 mb, estimated surface winds of 70 kt and an eye diameter of 50 n mi at 34.1N, 70.2W at 1215Z (WALLET).
- Penetration center fix measured a central pressure of 957 mb and estimated surface winds of 95 kt at 35.2N, 69.2W at 1850Z (WALLET).
- Penetration center fix measured a central pressure of 958 mb and estimated an eye diameter of 40 n mi at 35.5N, 68.1W at 23Z (WALLET).

4. Discussion:

- Reanalysis: The intensity of Faith remained generally steady on this date. The hurricane moved into an area of high ship traffic and a couple reported hurricane-force winds, up to 80 kt. Penetration center fixes measured 963 mb at 0630Z and 1215Z. An intensity of 90 kt is analyzed at 06Z and 12Z, down from 95 kt at both times originally shown in HURDAT, a minor intensity change. Another penetration center fix measured a central pressure of 957 mb and estimated surface winds of 95 kt at 1850Z. At 23Z, a reconnaissance aircraft estimated a 40 n mi eye diameter. A central pressure of 957 mb suggests maximum surface winds of 98 kt from the north of 25N pressure-wind relationship and 92 kt from the 35N Landsea et al. pressure-wind relationship. An eye diameter of 40 n mi suggests an RMW of 30 n mi and the climatological value is 27 n mi. Based on a forward speed of about 14 kt, an intensity of 95 kt is analyzed at 18Z, same as originally shown in HURDAT. Satellite images showed a well-organized tropical cyclone with a visible eye and interacting with a frontal boundary to the north.

September 2:

1. Maps and old HURDAT:

- HWM analyzes a hurricane of at most 980 mb at 37.3N, 65.1W with a stationary front to the north at 12Z.
- HURDAT lists a 95 kt hurricane at 37N, 65.2W at 12Z.
- Microfilm shows a hurricane of at most 1004 mb at 37N, 65.2W at 12Z.

2. Ship highlights:

- 75 kt SW and 982 mb at 33.7N, 69W at 00Z (COADS/micro).
- 50 kt N and 996 mb at 37.9N, 69.5W at 06Z (COADS).
- 50 kt NW and 995 mb at 36.6N, 67.9W at 12Z (COADS).
- 40 kt W and 975 mb at 37.8N, 62.1W at 18Z (COADS).

3. Aircraft highlights:

- Penetration center fix measured a central pressure of 960 mb, estimated flight level winds of 70 kt and an eye diameter of 20-50 n mi at 36.5N, 66.8W at 06Z (WALLET).
- Penetration center fix estimated surface winds of 60 kt and an eye diameter of 35 n mi at 37.1N, 65.2W at 1145Z (WALLET).
- Radar center fix estimated an eye diameter of 30 n mi at 37N, 63.2W at 1710Z (WALLET).

4. Discussion:

- Reanalysis: Faith turned to the east and increased in forward speed. A reconnaissance aircraft measured a central pressure of 958 mb and an eye diameter of 40 n mi at 23Z on the 1st. An intensity of 95 kt is analyzed at 00Z

on this date, same as originally shown in HURDAT. The next reconnaissance aircraft measured a central pressure of 960 mb and an eye diameter of 20-50 n mi at 06Z. A central pressure of 960 mb suggests maximum surface winds of 90 kt from the north of 35N pressure-wind relationship. An eye diameter of 20-50 n mi suggests an RMW of about 15-38 n mi and the climatological value of 27 n mi. Based on a forward speed of about 16 kt and an elliptical eye diameter, an intensity of 90 kt is analyzed at 06Z, down from 95 kt originally shown in HURDAT, a minor intensity change. A few ships reported winds over gale-force intensity, including 75 kt at 00Z.

September 3:

1. Maps and old HURDAT:
- HWM analyzes a hurricane of at most 980 mb at 38.7N, 54.3W with a cold front to the north at 12Z.
- HURDAT lists a 90 kt hurricane at 38.3N, 54W at 12Z.
- Microfilm shows a hurricane of at most 1004 mb at 37.9N, 53.9W with a stationary front to the north at 12Z.

2. Ship highlights:
- 60 kt SE and 971 mb at 37.4N, 59.8W at 00Z (COADS/micro).
- 65 kt NW and 980 mb at 37.2N, 60W at 06Z (COADS).
- 55 kt W and 992 mb at 35.7N, 55.7W at 12Z (COADS/MWL/micro).
- 60 kt SW and 987 mb at 36.8N, 51.5W at 15Z (MWL).
- 55 kt SW and 999 mb at 36.4N, 51.7W at 18Z (COADS).

3. Aircraft highlights:
- Penetration center fix measured a central pressure of 950 mb, estimated flight level winds of 95 kt and an eye diameter of 30 n mi at 37.5N, 57.5W at 0550Z (WALLET).
- Radar center fix estimated surface winds of 85 kt at 38.9N, 49.2W at 2027Z (WALLET).

4. Discussion:
- Reanalysis: Satellite images indicated that Faith had a well-defined eye with organized convection and banding features. A reconnaissance aircraft measured a central pressure of 950 mb and estimated an eye diameter of 30 n mi at 0550Z. An eye diameter of 30 n mi suggests an RMW of about 23 n mi and the climatological value is 28 n mi. A central pressure of 950 mb suggests maximum surface winds of 97 kt from the north of 35N pressure-wind relationship. Based on a forward speed of about 30 kt and RMW smaller than the climatological value, an intensity of 105 kt is analyzed at 06Z, up from 90 kt originally in HURDAT, a minor intensity change. 105 kt is also the peak intensity of this tropical cyclone, down from 110 kt originally in HURDAT. Intensification to a major hurricane is analyzed at 00Z on this date. The original HURDAT did not show Faith regaining major hurricane status.

September 4:

1. Maps and old HURDAT:
- HWM analyzes a hurricane of at most 964 mb at 48.1N, 39W at 12Z.
- HURDAT lists a 90 kt hurricane at 47.5N, 41.5W at 12Z.
- Microfilm shows that the system is north of the synoptic map at 12Z.

2. Ship highlights:

- 50 kt SSW and 1003 mb at 37.2N, 42.8W at 00Z (COADS).
- 35 kt SE and 965 mb at 45.1N, 41.6W at 06Z (COADS).
- 75 kt NNW and 973 mb at 45.1N, 43.9W at 09Z (COADS).
- 70 kt WNW and 987 mb at 45.5N, 42.5W at 13Z (WALLET).
- 60 kt SW and 981 mb at 47.8N, 31.4W at 18Z (COADS).

3. Aircraft higlights:
- Penetration center fix measured a central pressure of 954 mb at 48.4N, 40.4W at 14Z (WALLET).

4. Discussion:
- Reanalysis: Synoptic observations at 06Z indicated that cold, dry air had reached the center of Faith, creating a difference in temperatures across the circulation. Transition to an extratropical cyclone is analyzed at 06Z on this date, 54 hours earlier than originally shown in HURDAT. The last reconnaissance aircraft to investigate Faith reached the system at 14Z measuring a central pressure of 954 mb. A central pressure of 954 mb in a tropical cyclone suggests maximum surface winds of 94 kt from the north of 35N pressure-wind relationship. Since Faith is analyzed to have been extratropical at this time, an intensity of 90 kt is analyzed at 12Z, same as originally shown in HURDAT. Numerous ships reported gale-force and storm-force winds and a few experienced hurricane-force winds, up to 75 kt at 09Z. Significant changes in the track are introduced on this date based on synoptic observations that suggested that the center of Faith was farther east than originally shown in HURDAT.

September 5:

1. Maps and old HURDAT:
- HWM analyzes a hurricane of at most 960 mb at 57.6N, 23.8W with a stationary front to the east at 12Z.
- HURDAT lists a 90 kt hurricane at 57.3N, 24.5W at 12Z.

2. Ship highlights:
- 60 kt N and 972 mb at 52.5N, 36.1W at 00Z (COADS).
- 65 kt S and 974 mb at 53.1N, 25.4W at 06Z (COADS).
- 65 kt S and 985 mb at 53.2N, 25.4W at 12Z (COADS).
- 65 kt S and 979 mb at 56.5N, 24.7W at 18Z (COADS).

3. Discussion:
- Reanalysis: Faith continued northeastward as a strong extratropical cyclone. A few ships reported hurricane-force winds.

September 6:

1. Maps and old HURDAT:
- HWM analyzes an extratropical cyclone of at most 976 mb at 63N, 3W at 12Z.
- HURDAT lists a 55 kt extratropical cyclone at 62.5N, 3W at 12Z.

2. Ship highlights:
- 50 kt SW and 993 mb at 56N, 10.5W at 00Z (COADS).
- 60 kt W and 1000 mb at 56.1N, 12.2W at 06Z (COADS).
- 50 kt SW and 985 mb at 59.4N, 4.3W at 12Z (COADS).
- 55 kt WSW and 993 mb at 59.1N, 4.4W at 18Z (COADS).

3. Discussion:

- ATSR: "…becoming extratropical near the Faeroe Islands on 6 September"
- Reanalysis: Faith is analyzed to have weakened below hurricane-intensity at 12Z, six hours earlier than originally shown in HURDAT.

September 7:

1. Maps and old HURDAT:

- HWM analyzes an extratropical cyclone of at most 984 mb at 64N, 23E at 12Z.

2. Ship highlights:

- 45 kt W and 1003 mb at 57.7N, 7.0E at 00Z (COADS).
- 45 kt W and 993 mb at 61.1N, 4.1E at 06Z (COADS).
- 45 kt WNW and 1000 mb at 61.8N, 1E at 12Z (COADS).

3. Discussion:

- Reanalysis: Faith reached eastern Norway early on this date on its way over northern Europe. The last position in HURDAT is at 00Z but synoptic observations indicate that the extratropical cyclone continued eastward and lasted for six more days. A major track change is introduced at 00Z based on ship observations.

September 8:

1. Maps and old HURDAT:

- HWM analyzes an extratropical cyclone of at most 980 mb at 68N, 42.5E at 12Z.

2. Ship highlights:

- 35 kt N and 989 mb at 70N, 32E at 00Z (COADS).
- 40 kt N and 1005 mb at 68.4N, 10E at 06Z (COADS).

3. Discussion:

- Reanalysis: On this date, Faith entered the Arctic Ocean. Ships reported gale-force winds, up to 40 kt.

September 9:

1. Maps and old HURDAT:

- HWM analyzes an extratropical cyclone of at most 980 mb at 73N, 55E at 12Z.

2. Ship highlights:

- 50 kt N and 989 mb at 77.5N, 43E at 00Z (COADS).

3. Discussion:

- Reanalysis: Faith slowed its forward speed and a ship reported 50 kt at 00Z.

September 10:

1. Maps and old HURDAT:

- HWM analyzes an extratropical cyclone of at most 980 mb at 78N, 55E at 12Z.

September 11:

1. Maps and old HURDAT:

- HWM analyzes an extratropical cyclone of at most 984 mb at 85N, 55E at 12Z.

2. Ship highlights:
- 40 kt WNW and 999 mb at 76.5N, 43E at 00Z (COADS).
- 35 kt SW and 1007 mb at 69.6N, 34.1E at 12Z (COADS).

September 12:

1. Maps and old HURDAT:
- HWM analyzes an extratropical cyclone of at most 988 mb at 83N, 55E at 12Z.

2. Discussion:
- ATSR: "…by 12 September, became a stationary low of 980 mb over Franz Josef Land."
- Reanalysis: Weakening below gale-force intensity is analyzed at 18Z but this is uncertain due to the sparse data in the area.

September 13:

1. Maps and old HURDAT:
- HWM analyzes an extratropical cyclone of at most 996 mb at 83N, 55E at 12Z.

2. Discussion:
- Reanalysis: The ship observations over the far north Artic were very sparse but suggest that Faith continued to weaken. Last position is analyzed at 18Z.

September 14:

1. Maps and old HURDAT:
- HWM analyzes an extratropical cyclone of at most 992 mb at 86N, 80E at 12Z.

September 15:

1. Maps and old HURDAT:
- HWM analyzes an extratropical cyclone of at most 996 mb at 88N, 150E at 12Z.

September 16:

1. Maps and old HURDAT:
- HWM analyzes an extratropical cyclone of at most 980 mb at 80N, 130E, the remnant of Faith appears to have been absorbed at 12Z.

Date	Original HURDAT Central Pressure	Evidence	Changes
Aug 21 18Z	1006 mb	Ship: 15 kt WNW and 1007 mb at 18Z on Aug 21st	Retained
Aug 23 18Z		Penetration center fix: 992 mb at 2025Z on Aug 23th	992 mb
Aug 24 12Z	992 mb	Penetration center fix: 992 mb at 14Z on Aug 24th	Retained

Aug 25 00Z	993 mb	Penetration center fix: 993 mb at 22Z on Aug 24th	
Aug 25 06Z	995 mb	Penetration center fix: 995 mb at 0545Z on Aug 25th	
Aug 25 12Z	986 mb	Penetration center fix: 986 mb at 12Z on Aug 25th	
Aug 25 18Z	990 mb	Penetration center fix: 990 mb at 18Z on Aug 25th	
Aug 26 00Z		Penetration center fix: 994 mb at 00Z on Aug 26th	994 mb
Aug 26 06Z	997 mb	Penetration center fix: 997 mb at 06Z on Aug 26th	Retained
Aug 26 12Z	995 mb	Penetration center fix: 995 mb at 1234Z on Aug 26th	
Aug 26 18Z		Penetration center fix: 994 mb at 21Z on Aug 26th	994 mb
Aug 27 00Z	987 mb	Penetration center fix: 987 mb at 00Z on Aug 27th	Retained
Aug 27 06Z	993 mb	Penetration center fix: 993 mb at 0555Z on Aug 27th	
Aug 27 12Z	989 mb	Penetration center fix: 989 mb at 1030Z on Aug 27th	
Aug 27 18Z	983 mb	Penetration center fix: 983 mb at 1830Z on Aug 27th	
Aug 28 00Z	979 mb	Penetration center fix: 979 mb at 2215Z on Aug 27th	
Aug 28 06Z	973 mb	Penetration center fix: 973 mb at 0545Z on Aug 28th	
Aug 28 12Z	962 mb	Penetration center fix: 962 mb at 1212Z on Aug 28th	
Aug 28 18Z	957 mb	Penetration center fix: 957 mb at 18Z on Aug 28th	
Aug 29 00Z	956 mb	Penetration center fix: 955 mb at 00Z on Aug 29th	955 mb
Aug 29 06Z	960 mb	Penetration center fix: 960 mb at 05Z on Aug 29th	Retained
Aug 29 12Z	963 mb	Penetration center fix: 963 mb at 11Z on Aug 29th	
Aug 29 18Z	963 mb	Penetration center fix: 963 mb at 18Z on Aug 29th	
Aug 30 00Z	963 mb	Penetration center fix: 963 mb at 00Z on Aug 30th	
Aug 30 06Z	970 mb	Penetration center fix: 970 mb at 06Z on Aug 30th	
Aug 30 12Z	966 mb	Penetration center fix: 966 mb at 1145Z on Aug 30th	
Aug 30 18Z		Penetration center fix: 967 mb at 06Z on Aug 30th	967 mb
Aug 31	967 mb	Penetration center fix: 967 mb at 2350Z on Aug	Retained

00Z		30th	
Aug 31 06Z		Penetration center fix: 973 mb at 0712Z on Aug 31st	973 mb
Aug 31 12Z	988 mb	Central pressure measurements by the reconnaissance aircrafts earlier and later on this date suggest this pressure value is incorrect	Removed
Aug 31 18Z	963 mb	Penetration center fix: 963 mb at 1740Z on Aug 31st	Retained
Sep 01 06Z	963 mb	Penetration center fix: 963 mb at 0630Z on Sep 01st	
Sep 01 12Z	963 mb	Penetration center fix: 963 mb at 1215Z on Sep 01st	
Sep 01 18Z	957 mb	Penetration center fix: 957 mb at 1850Z on Sep 01st	
Sep 02 00Z	958 mb	Penetration center fix: 958 mb at 23Z on Sep 01st	
Sep 02 06Z		Penetration center fix: 960 mb at 06Z on Sep 02nd	960 mb
Sep 03 06Z	950 mb	Penetration center fix: 950 mb at 0550Z on Sep 03rd	Retained
Sep 04 12Z	954 mb	Penetration center fix: 954 mb at 14Z on Sep 04th	

Sources: NHC microfilm maps, the Historical Weather Maps series, the COADS ship database, Monthly Weather Review, Navy reconnaissance book, Mariners Weather Log, Satellite images from NCDC and NSIDC, and NHC Storm Wallets.

Tropical Storm Greta [September 1-6, 1966] – AL071966

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44610 09/01/1966 M= 7  7 SNBR= 957 GRETA       XING=0 SSS=0
44610 09/01/1966 M= 6  7 SNBR= 957 GRETA       XING=0 SSS=0
                     *

44615 09/01*  0   0   0    0*  0   0   0    0*137 484  25    0*143 496  25    0*

44620 09/02*149 508  25 1011*153 515  30    0*159 522  30    0*162 529  30    0*
44620 09/02*149 506  25 1011*155 515  30    0*160 522  30    0*162 529  30    0*
                ***          ***              ***

44625 09/03*164 537  30 1010*167 543  30    0*170 550  30 1013*174 558  30    0*
44625 09/03*164 537  30 1010*165 543  30    0*165 550  30 1013*168 558  30    0*
                             ***              ***              ***

44630 09/04*178 567  30    0*184 573  30    0*190 580  30 1009*198 590  50    0*
44630 09/04*173 567  30    0*180 573  35    0*188 580  40 1009*198 590  45 1004*
            ***              ***      **      ***      **                ** ****

44635 09/05*207 601  50 1004*210 609  45    0*213 617  40    0*218 626  35 1007*
44635 09/05*206 600  45    0*210 609  40    0*213 617  40    0*218 626  35 1007*
            *** ***  **    *          **
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44640 09/06*222 637  35 1009*230 651  35 1009*237 667  30 1011*246 682  30 1011*
44640 09/06*222 637  35 1007*229 651  30 1009*237 667  25 1011*246 682  25 1011*
                        **** ***      **                **                **
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(September 7th was removed from HURDAT)

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44645 09/07*256 697  30    0*261 706  30    0*267 715  30 1013*280 717  25    0*

44650 TS
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Significant Revisions:

1. Intensification to a tropical storm is analyzed twelve hours earlier than originally shown in HURDAT based on reconnaissance aircraft data.
2. Weakening to a tropical depression is analyzed six hours earlier than originally shown in HURDAT based on synoptic and reconnaissance aircraft data.
3. Dissipation is analyzed 24 hours earlier than originally shown in HURDAT based on surface observations.
4. Dissipation indicated to occur 6 hours earlier upon ship observations

Daily Metadata:

August 31:

1. Maps and old HURDAT:

- HWM and microfilm do not analyze an organized system at 12Z.
- HURDAT does not list an organized system on this date.

2. Satellite highlights:

- NIMBUS 2 estimated a center fix at 12.5N, 44.4W at 1455Z (WALLET).

3. Discussion:

- Reanalysis: Tropical Storm Greta developed from a tropical wave about 600 nm east of the Windward Islands. The timing of genesis is uncertain due to the sparse data available between the Lesser Antilles and Africa, but a NIMBUS satellite image on August 31st shows a disorganized disturbance.

September 1:

1. Maps and old HURDAT:

- HWM analyzes a closed low pressure of at most 1008 mb at 14N, 48.5W at 12Z.
- HURDAT lists a 25 kt tropical depression at 13.7N, 48.4W at 12Z (first position).
- Microfilm shows a tropical wave along longitude 50W at 12Z.

2. Aircraft highlights:

- Penetration center fix at 13.6N, 51.4W at 21Z (WALLET).

3. Satellite highlights:

- NIMBUS 2 estimated a center fix at 14N, 49.5W at 1421Z (WALLET).

4. Discussion:

- MWR: "The circulation which developed into Greta was first indicated by the weather report from the SS Sun Marcial and a cloud mass photographed by the Nimbus 2 satellite some 600 mi. east of Barbados on September 1. Air Force reconnaissance aircraft investigated the area the same day and found a

circulation and an area of showers but no strong winds. The depression remained weak with maximum winds of about 35 mph as it moved northwestward during the next two days." ATSR: "GRETA was first detected by the NIMBUS II satellite some 600 miles east of Barbados on 1 September." WBAS SAN JUAN Report in Tropical Storm Greta: "At 1200Z on September 1, the Dutch ship ATTIS (PCVY), at 10.7N 52.1W, reported a wind from 350 degrees at 39 knots.… By late afternoon of September 1, the ship corrected its wind from 350 degrees 39 knots to 070 degrees 7 knots."

- Reanalysis: The first position is analyzed at 12Z on September 1st as a 25 kt tropical depression, same as originally shown in HURDAT. A NIMBUS satellite image on the 1st indicates that the system had improved from the previous day with an increase in organized convection and even some banding features to the south and east.

September 2:

1. Maps and old HURDAT:

- HWM analyzes a closed low pressure of at most 1008 mb at 16.5N, 52.5W at 12Z.
- HURDAT lists a 30 kt tropical depression at 15.9N, 52.2W at 12Z.
- Microfilm shows a tropical wave extended from 10N-20N, 50W-58W at 12Z.

2. Aircraft highlights:

- Penetration center fix measured a central pressure of 1010 mb and estimated surface winds of 30 kt at 16.5N, 53.5W at 22Z (WALLET).

3. Satellite highlights:

- ESSA 2 estimated a center fix at 16N, 52W at 1141Z (WALLET).

4. Discussion:

- ATSR: "Navy reconnaissance aircraft confirmed a weak circulation, with maximum surface winds of 30 knots at 2200Z on 2 September …"
- Reanalysis: A reconnaissance aircraft investigated the tropical depression late on the 1st fixing a weak circulation at 13.6N, 51.4W at 21Z. A central pressure of 1011 mb is present in the original HURDAT at 00Z on September 2nd and appears to be related to the reconnaissance mission, thus it is retained. (Central pressures values for some 6 hour periods were present in the original HURDAT between September 2nd at 00Z and September 7th at 12Z. All observations appear to be consistent with reconnaissance data but in some cases, have been moved to appear in the correct time slot. Detailed information on these changes can be found in the table at the end.)

September 3:

1. Maps and old HURDAT:

- HWM analyzes a closed low pressure of at most 1012 mb at 17N, 55W at 12Z.
- HURDAT lists a 30 kt tropical depression at 17N, 55W at 12Z.
- Microfilm shows a closed low pressure of at most 1012 mb at 15N, 55W at 12Z.

2. Aircraft highlights:

- Penetration center fix measured a central pressure of 1013 mb and estimated surface winds of 30 kt at 16.2N, 55.2W at 12Z (WALLET).

3. Satellite highlights:

- ESSA 2 estimated a center fix at 16.5N, 55W at 1216Z (WALLET).

4. Discussion:

- ATSR: "and the first tropical depression warning was issued at 030000Z [Sep. 3]."
- Reanalysis: A reconnaissance aircraft reached the system at 22Z on the 2nd measuring a central pressure of 1010 mb and estimated surface winds of 30 kt. An intensity of 30 kt is analyzed at 00Z on September 3rd, same as originally shown in HURDAT. Another reconnaissance aircraft investigated the tropical depression at 12Z on the 3rd measuring a central pressure of 1013 mb and estimating surface winds of 30 kt. Satellite images on the 3rd show a very weak system with sheared convection over the eastern quadrant.

September 4:

1. Maps and old HURDAT:
- HWM analyzes a closed low pressure of at most 1012 mb at 19.5N, 58W at 12Z.
- HURDAT lists a 30 kt tropical depression at 19N, 58W at 12Z.
- Microfilm shows a tropical storm of at most 1012 mb at 18.9N, 57.9W at 12Z.

2. Ship highlights:
- 35 kt SE and 1013 mb at 17.1N, 58.6W at 18Z (COADS).

3. Aircraft highlights:
- Penetration center fix measured a central pressure of 1009 mb, estimated surface winds of 38 kt and a 40 nm eye diameter at 19.2N, 58.4W at 1450Z (WALLET).
- Penetration center fix measured a central pressure of 1004 mb, estimated surface winds of 50 kt and a 25 nm eye diameter at 20.1N, 59.4W at 2010Z (WALLET).

4. Discussion:
- MWR: "Moderate intensification occurred on September 4 and Navy reconnaissance aircraft reports indicated maximum surface winds of 58 mph and a central pressure of 1004 mb. (29.65 in.), the lowest reported during the life of the storm." ATSR: "The tropical depression remained weak as it continued to move northwest until 4 September when it moved under the southern edge of an upper level anticyclone and began to intensify. Navy reconnaissance aircraft observed maximum surface winds of 38 knots at 1450Z on 4 September and GRETA was upgraded to a tropical storm at 1600Z. GRETA reached her maximum intensity of 50 knots on 4 and 5 September, then began to weaken and become poorly organized."
- Reanalysis: Intensification to a tropical storm is analyzed at 06Z on September 4th, twelve hours earlier than originally shown in HURDAT, based on reconnaissance data later on the day. A reconnaissance aircraft measured a central pressure of 1004 mb and estimated surface winds of 50 kt at 2010Z on the 4th. A central pressure of 1004 mb suggests maximum surface winds of 39 kt from the south of 25N Brown et al. pressure-wind relationship. Based on a forward speed of about 14 kt, a ship report of 35 kt and weighting in some the surface estimate, an intensity of 45 kt is analyzed at 18Z on the 4th, down from 50 kt originally in HURDAT, a minor intensity change. 45 kt is also the peak intensity of this tropical cyclone, down from 50 kt originally in HURDAT. Satellite images on the 4th indicate that Greta remained a sheared tropical cyclone and generally poorly organized.

September 5:

1. Maps and old HURDAT:
- HWM analyzes a tropical storm of at most 1008 mb at 21.5N, 61.4W at 12Z.

- HURDAT lists a 40 kt tropical storm at 21.3N, 61.7W at 12Z.
- Microfilm shows a tropical storm at 21.5N, 61.7W at 12Z.

2. Aircraft highlights:
- Penetration center fix measured a central pressure of 1007 mb, estimated surface winds of 35 kt and a 30 nm eye diameter at 21.8N, 62.5W at 18Z (WALLET).
- Penetration center fix measured a central pressure of 1007 mb at 22.3N, 63.5W at 2308Z (WALLET).

3. Discussion:
- MWR: "However, by the next day, the trend had reversed and reconnaissance aircraft reported that Greta mas very poorly organized. Highest reported surface winds were only about 35 mph in a few squalls."
- Reanalysis: On the 5th, Greta began to weaken. A reconnaissance aircraft measured a central pressure of 1007 mb and estimated surface winds of 35 kt at 18Z on the 5th. An intensity of 35 kt is analyzed at 18Z on the 5th, same as originally shown in HURDAT.

September 6:

1. Maps and old HURDAT:
- HWM analyzes a closed low pressure of at most 1012 mb at 24.2N, 66.4W at 12Z.
- HURDAT lists a 30 kt tropical depression at 23.7N, 66.7W at 12Z.
- Microfilm shows a tropical storm at 23.7N, 66.6W at 12Z.

2. Aircraft highlights:
- Penetration center fix measured a central pressure of 1009 mb and estimated surface winds of 23 kt at 22.8N, 65.5W at 0615Z (WALLET).
- Penetration center fix measured a central pressure of 1011 mb at 23.8N, 66.4W at 1150Z (WALLET).
- Penetration center fix measured a central pressure of 1011 mb at 25N, 68.8W at 19Z (WALLET).

3. Discussion:
- Reanalysis: Based on data from reconnaissance center fixes, Greta weakened to a tropical depression at 06Z on September 6th, six hours earlier than originally shown in HURDAT. Synoptic observations early on September 7th indicate that the weak tropical cyclone had lost its closed circulation, thus the last position is analyzed at 18Z on the 6th, 24 hours earlier than originally shown in HURDAT.

September 7:

1. Maps and old HURDAT:
- HWM analyzes a spot low pressure of at 27N, 71W at 12Z.
- HURDAT lists a 30 kt tropical depression at 26.7N, 71.5W at 12Z.
- Microfilm shows a closed low pressure at 26.5N, 72W at 12Z.

2. Aircraft highlights:
- Penetration center fix measured a central pressure of 1013 mb and estimated surface winds of 15 kt at 26.6N, 71.6W at 1140Z (WALLET).
- Penetration center fix measured a central pressure of 1014 mb and estimated surface winds of 25 kt at 28N, 71.7W at 18Z (WALLET).

3. Discussion:

- MWR: "The system became even weaker as it continued northwestward to a point some 300 mi. northeast of the central Bahamas on September 7 and then turned northward." ATSR: "The system continued northwest, still weakening, then turned northward some 300 miles east of Nassau on 7 September. Coming under the influence of a polar trough, it dissipated."
- Reanalysis: Late on September 7th, reconnaissance aircraft investigating the weakened system made two penetration center fixes measuring central pressures of 1013 mb at 14Z and 1014 mb at 18Z with estimated surface winds below gale-force, but ship observations indicate that Greta was a trough at this time.

September 8:

1. Maps and old HURDAT:

- HWM analyzes a spot low pressure of at 31N, 74W with a frontal boundary to the north at 12Z.
- HURDAT does not list an organized system on this date.
- Microfilm shows a spot low pressure at 30.5N, 75.5W with a frontal boundary to the north at 12Z.

2. Discussion:

- MWR: "The cloud area associated with the dying surface circulation remained identifiable in satellite photographs through September 8 when it merged with a prefrontal cloud mass between the United States east coast and Bermuda."
- Reanalysis: The remnants of Greta moved northward on September 8th merging with a frontal boundary over the western Atlantic.

<table>
<tr><th>Date</th><th>Original HURDAT Central Pressure</th><th>Evidence</th><th>Changes</th></tr>
<tr><td>Sep 02 00Z</td><td>1011 mb</td><td>Penetration center fix: 1011 mb at 21Z on Sep 2nd</td><td rowspan="4">Retained</td></tr>
<tr><td>Sep 03 00Z</td><td>1010 mb</td><td>Penetration center fix: 1010 mb at 22Z on Sep 2nd</td></tr>
<tr><td>Sep 03 12Z</td><td>1013 mb</td><td>Penetration center fix: 1013 mb at 12Z on Sep 2nd</td></tr>
<tr><td>Sep 04 12Z</td><td>1009 mb</td><td>Penetration center fix: 1009 mb at 1450Z on Sep 04th</td></tr>
<tr><td>Sep 04 18Z</td><td></td><td rowspan="2">Penetration center fix: 1004 mb at 2010Z on Sep 04th</td><td>1004 mb</td></tr>
<tr><td>Sep 05 00Z</td><td>1004 mb</td><td>Removed</td></tr>
<tr><td>Sep 05 18Z</td><td>1007 mb</td><td>Penetration center fix: 1007 mb at 18Z on Sep 05th</td><td>Retained</td></tr>
<tr><td>Sep 06 00Z</td><td>1009 mb</td><td>Penetration center fix: 1007 mb at 2308Z on Sep 05th</td><td>1007 mb</td></tr>
</table>

Sep 06 06Z	1009 mb	Penetration center fix: 1009 mb at 0615Z on Sep 06th	Retained
Sep 06 12Z	1011 mb	Penetration center fix: 1011 mb at 14Z on Sep 06th	
Sep 06 18Z	1011 mb	Penetration center fix: 1011 mb at 19Z on Sep 06th	

Sources: NHC microfilm maps, the Historical Weather Maps series, the COADS ship database, Monthly Weather Review, Navy reconnaissance book, Mariners Weather Log, Satellite images from NCDC and NSIDC, and NHC Storm Wallets.

Tropical Storm Hallie [September 20-21, 1966] – AL081966

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44655 09/20/1966 M= 3  8 SNBR= 958 HALLIE      XING=0 SSS=0
44655 09/20/1966 M= 2  8 SNBR= 958 HALLIE      XING=0 SSS=0
                    *

44660 09/20*  0   0   0    0*  0   0   0    0*215 954  30    0*216 954  30    0*
44660 09/20*  0   0   0    0*  0   0   0    0*215 954  30    0*215 954  40    0*
                                                              ***      **

44665 09/21*215 954  45  997*212 955  45    0*208 958  45    0*204 962  35    0*
44665 09/21*215 954  50  997*212 955  50    0*208 958  40    0*204 962  30 1008*
                     **               **                **               **  ****

(September 22nd has been removed from HURDAT)
44670 09/22*200 967  15 1012*  0   0   0    0*  0   0   0    0*  0   0   0    0*
44670 09/22*  0   0   0    0*  0   0   0    0*  0   0   0    0*  0   0   0    0*
              *   *   *    *

44675 TS
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Significant Revisions:

1. Intensification to a tropical storm is analyzed six hours earlier than originally shown in HURDAT based on reconnaissance aircraft data.
2. Weakening to a tropical depression is analyzed six hours earlier than originally shown in HURDAT based on reconnaissance aircraft data.
3. Dissipation is analyzed six hours earlier based on synoptic and reconnaissance aircraft observations.

Daily Metadata:

September 18:

1. Maps and old HURDAT:

- HWM and microfilm show a stationary front over the northern Gulf of Mexico at 12Z.
- HURDAT does not list an organized system on this date.

2. Discussion:

- MWR: "On the previous two days [18 and 19], ESSA 2 satellite photographs indicated a large disorganized cloud mass in the southwestern Gulf merging into a frontal cloud band extending to the northeast."
- Reanalysis: Tropical Storm Hallie developed from the interaction between a tropical wave and a decaying frontal boundary over the Bay of Campeche. A NIMBUS satellite image on September 18 showed a large area of cloudiness over the Gulf of Mexico, and the HWM and microfilm surface analysis indicate a stationary frontal boundary present over the northern Gulf of Mexico and generally high environmental pressures (over 1012 mb) over the Bay of Campeche.

September 19:

1. Maps and old HURDAT:

- HWM analyzes a closed low pressure of at most 1008 mb at 21.1N, 96.4W with a stationary front to the northeast at 12Z.
- HURDAT does not list an organized system on this date.
- Microfilm shows a cold front over the northern Gulf of Mexico at 12Z.

2. Discussion:

- ATSR: "Tropical Storm HALLIE had begun as a disorganized cloud mass that merged with a frontal cloud band over the southwestern Gulf of Mexico. On 19 September, a polar front moved into the northwestern Gulf of Mexico and at 1405Z that day, ESSA II satellite photographs detected a suspicious area of cloudiness further south near 21N, 95W."
- Reanalysis: On September 19th, the NIMBUS satellite image showed an increase in convection and organization over the Bay of Campeche, and although the environmental pressures had begun to decrease, the sparse synoptic data do not indicate that a well-defined circulation had formed on this day.

September 20:

1. Maps and old HURDAT:

- HWM analyzes a spot low at 21.2N, 95.5W with a stationary front to the northeast at 12Z.
- HURDAT lists a 30 kt tropical depression at 21.5N, 95.4W at 12Z (first position).
- Microfilm shows a closed low pressure of at most 1008 mb at 20N, 96W with a cold front to the northeast at 12Z.

2. Aircraft highlights:

- Penetration center fix measured a central pressure of 997 mb, estimated surface winds of 45 kt and a 10 nm eye diameter at 21.5N, 95.4W at 2104Z (WALLET).

3. Discussion:

- MWR: "A tropical depression located just to the south of a weakening stationary front in the extreme southwestern Gulf of Mexico developed into tropical storm Hallie on September 20. Early on the 2Oth, shower activity along the Mexican coast from Tampico southward increased as a cut-off surface Low developed off the coast. At about the same time, satellite pictures revealed that the cloud pattern in the area was becoming dissociated from that of the front and showed evidence of a developing circulation. On the afternoon of the 20th, Navy reconnaissance reported that the central pressure had fallen to 997 mb. (29.44 in.) and that winds were 50 mph." ATSR: "By 1200Z on 20 September, the polar front had moved to the southwestern Gulf of Mexico and it appeared

that a weak cyclonic circulation had developed along the trailing edge of the front. The ESSA II satellite photographed the area at 1436Z and the circulation appeared more developed than the previous day. HALLIE had remained nearly stationary while intensifying, but began to drift southwest late on 20 September."

- Reanalysis: On September 20th, both the infrared and visible satellite images indicate that the disturbance had become better organized with some banding features on the eastern quadrant. The first position is analyzed at 12Z on the 20th as a 30 kt tropical depression, same as originally shown in HURDAT. The timing of Hallie's genesis is uncertain due to the sparse ship data over the Bay of Campeche. Genesis may have occurred late on the 19th or early on the 20th. Intensification to a tropical storm is analyzed at 18Z on the 20th based on aircraft reconnaissance data later on this day, six hours earlier than originally shown in HURDAT.

September 21:

1. Maps and old HURDAT:

- HWM analyzes a tropical storm of at most 1008 mb at 20.9N, 96.2W with a stationary front to the northeast at 12Z.
- HURDAT lists a 45 kt tropical storm at 20.8N, 95.8W at 12Z.
- Microfilm shows a closed low pressure of at most 1004 mb at 20.7N, 95.7W with a stationary front to the northeast at 12Z.

2. Aircraft highlights:

- Penetration center fix measured a central pressure of 1008 mb and estimated surface winds of 30 kt at 20.3N, 96W at 19Z (WALLET).

3. Land highlights:

- 30 kt NNE and 1003 mb art Nautla, Mexico at 12Z (micro).
- 25 kt WNW (gusts to 35 kt) and 1002 mb at Nautla, Mexico at 13Z (WALLET/MWR).

4. Discussion:

- MWR: "After remaining nearly stationary during this intensifying process, Hallie commenced a southwestward drift during the night. The Mexican coastal town of Nautla experienced gusts to 40 mph with heavy rain during the early morning hours and the pressure fell to 1002.4 mb. (29.60 in.) at 1300 GMT September 21. As the storm entered the coast, relatively cool, dry air was introduced, and this, together with the frictional effect of the coastal hills, caused the storm to weaken rapidly. By 1600 GMT the pressure at Nautla had risen to 1010.5 mb. (29.84 in.) and the wind and rain had subsided. Although the satellite photograph at 1522 GMT showed fairly good organization of the clouds, a reconnaissance flight could find little evidence of circulation. There were no reports of damage or loss of life from the storm." ATSR: "A Navy reconnaissance aircraft was immediately dispatched to the area and at 2104Z reported the circulation had a well defined eye with a warm center and surface winds of 45 kt. A tropical storm warning was issued at 2300Z. Early the following day, the storm made landfall a few miles south of Nautla, Mexico and once inland, weakened rapidly. By late in the day, there was little evidence of circulation. HALLIE was very short lived and traveled only 100 miles before dissipating near the Mexican Coast, 21 September." ESSA NEW ORLEANS WEATHER BUREAU ADVISORY NUMBER 5: "Cool dry air moving into Tropical Storm Hallie as it approached the Mexican coast near Nautla today caused the storm to weaken rapidly. The Navy and Air Force reconnaissance flights into the area reported that Hallie had become weak and disorganized

this afternoon. Highest winds are about 35 mph in showers along the Mexican coast from Tampico to Veracruz. This is the last advisory on Hallie."

- Reanalysis: The first reconnaissance aircraft to investigate Hallie occurred late on the 20th measuring a central pressure of 997 mb, estimating surface winds of 45 kt and a 10 nm eye diameter at 2104Z. A 10 nm eye diameter suggests an RMW of about 8 nm and the climatological value is 17 nm. A central pressure of 997 mb suggests maximum sustained winds of 53 kt from the south of 25N Brown et al. pressure-wind relationship. Based on the small RMW but almost stationary forward speed, an intensity of 50 kt is analyzed at 00Z on September 21st, up from 45 kt originally in HURDAT, a minor intensity change. 50 kt is also the peak intensity of this tropical cyclone, up from 45 kt originally in HURDAT. A central pressure of 997 mb was present in HURDAT and is retained. Early on the 21st, Hallie began to move southwestward toward the Mexican coast. At 13Z on the 21st, the city of Nautla, Mexico reported a minimum pressure of 1002 mb and gale-force gusts. Soon after, the pressure began to rise and by 18Z on this day it was 1012 mb. Data from Navy and Air Force reconnaissance aircrafts showed that Hallie had quickly weakened and was barely a tropical cyclone around 18Z on the 21st. The Air Force reconnaissance aircraft made a center fix at 19Z on the 21st measuring a central pressure of 1008 mb, which has been added to HURDAT in the 18Z time slot on this day, and estimated surface winds of 30 kt. Weakening to a tropical depression is analyzed at 18Z on the 21st, six hours earlier than originally shown in HURDAT. It is interesting to note that satellite images on the 21st show a compact system with well-organized convection. Dissipation is analyzed after 18Z on the 21st over the western Bay of Campeche, about 30 nm from the coast of Mexico. No landfall is analyzed to have occurred in Mexico, unlike the original HURDAT. However, this analysis is in agreement with the operational advisories on Hallie as reported in the last advisory. Tropical Storm Edouard in 1984 is an analog to Tropical Storm Hallie.

September 22:

1. Maps and old HURDAT:

- HWM and microfilm do not analyze an organized system at 12Z.
- HURDAT lists a 15 kt tropical depression at 20N, 96.7W at 00Z (last position).

Sources: NHC microfilm maps, the Historical Weather Maps series, the COADS ship database, Monthly Weather Review, Navy reconnaissance book, Mariners Weather Log, Mexican synoptic data, Satellite images from NCDC and NSIDC, and NHC Storm Wallets.

Hurricane Inez [September 21 – October 11, 1966] – AL091966

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44680 09/21/1966 M=21  9 SNBR= 959 INEZ        XING=1 SSS=1
44685 09/21*  0   0   0    0*  0   0   0    0* 99 351  25    0*104 360  25    0*
44685 09/21*  0   0   0    0*  0   0   0    0* 99 351  25    0*104 361  25    0*
                                                                     ***

44690 09/22*109 371  25    0*113 383  25    0*117 394  25    0*120 406  25    0*
44690 09/22*109 372  25    0*113 383  25    0*117 394  25    0*120 406  25    0*
                ***

44695 09/23*123 417  25    0*127 431  25    0*131 443  30    0*134 451  30    0*
44695 09/23*123 418  25    0*127 430  25    0*131 441  30    0*134 451  30    0*
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44700 09/24*137 460  30    0*140 469  30    0*144 477  30 1009*148 487  40 1008*
44700 09/24*137 460  30    0*140 469  30    0*144 479  35 1009*148 489  40 1008*
                                                 ***  **          ***

44705 09/25*151 497  45    0*154 506  50    0*156 515  55 1000*156 525  60 1000*
44705 09/25*151 498  45    0*153 507  50    0*155 516  50 1000*156 525  50 1000*
                ***          *** ***          ***      **                **

44710 09/26*156 536  60    0*157 548  60    0*158 560  70  995*158 570  75  982*
44710 09/26*156 536  55    0*157 548  60    0*158 560  65  995*159 570  80  982*
                     **                                **      ***      **

44715 09/27*159 580  80    0*160 592  95  965*161 604 105  961*162 617 110  962*
44715 09/27*159 580  90    0*160 591 100  965*161 603 105  961*162 617 110  958*
                     **          *** ***          ***                        ***
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Addendum on September 27th at 21Z

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44717 09/27*163 623  95  971*

44720 09/28*163 630 110    0*165 643 115  955*168 657 120    0*170 671 130  932*
44720 09/28*163 630 100  964*165 644 115  955*168 657 130    0*170 672 145  927*
                    ***  ***     ***                  ***          *** ***  ***

44725 09/29*171 685 130  929*173 697 125    0*175 709 120    0*181 723 100    0*
44725 09/29*171 685 145  928*172 697 145    0*175 710 145    0*181 723 100    0*
                    ***  ***     ***                  ***          *** ***

44730 09/30*188 736  80  987*193 745  90    0*198 754 100    0*202 763  65    0*
44730 09/30*187 735  80  987*192 745  90    0*198 754 100    0*202 763  80    0*
            *** ***          ***                                          **

44735 10/01*205 771  65    0*208 781  65    0*212 791  65    0*219 798  65    0*
44735 10/01*205 772  65    0*207 783  65    0*213 793  65    0*220 799  60    0*
                ***          *** ***          *** ***          *** ***  **

44740 10/02*226 801  65    0*230 801  65    0*233 799  55    0*240 795  55  999*
44740 10/02*226 801  50    0*231 801  50    0*235 799  50    0*241 796  55  999*
                     **       ***      **       ***      **       *** ***

44745 10/03*246 791  65  995*249 788  65  989*252 785  65  985*254 783  70  986*
44745 10/03*245 792  60  995*249 789  60  989*252 786  65  985*255 785  65  986*
            *** ***  **          ***  **          ***          *** ***  **


44750 10/04*256 784  75  985*255 790  75    0*253 797  75  987*250 805  75  984*
44750 10/04*255 785  65  985*255 790  65  988*252 796  75  987*250 805  85  984*
            *** ***  **                ** *** *** ***                     **

44755 10/05*247 813  75  988*246 822  80  985*245 830  80    0*243 836  85  980*
44755 10/05*246 814  85  988*245 823  85  985*245 830  85    0*243 837  85  980*
            *** ***  **       *** ***  **                **          ***

44760 10/06*240 843  90  970*237 850  95  983*233 856  95  974*228 863 100  974*
44760 10/06*240 843  90  977*237 850  95  974*233 857  95  974*228 864  95  974*
                         ***                ***     ***               ***  **
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44765 10/07*223 872 105  961*221 881 110    0*219 890 110    0*217 900 115  972*
44765 10/07*223 872 105  961*220 881 105    0*218 890 100    0*216 900  85  972*
                            ***     ***      ***     ***      ***      **

44770 10/08*215 910 115  972*215 921 115    0*218 931 120  953*221 939 120  956*
44770 10/08*215 910  95    0*215 921 105    0*218 931 115  953*220 939 115  956*
                      **    *         ***               ***      ***     ***

44775 10/09*223 946 120  948*226 952 120  951*228 957 120    0*230 960 120  953*
44775 10/09*222 947 115  948*226 952 115  951*227 956 110  951*229 960 100  961*
            *** *** ***              ***      *** *** ***  *** ***     ***  ***

44780 10/10*230 964 115  960*230 971 110  962*228 978 105  961*224 985  60    0*
44780 10/10*230 964 100  960*230 970 100  962*228 978 100  961*224 985  60    0*
            *** ***  **          ***  **          ***          *** ***  **

44785 10/11*221 992  30    0*218 999  30    0*2151006  30    0*  0   0   0    0*
44785 10/11*221 992  30    0*218 999  25    0*2151006  20    0*  0   0   0    0*
                                      **                **

44790 HRBFL1
44790 HRBFL2CFL2
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Hurricane Landfall

September 27th 17Z 16.2N 61.6W 110 kt 961 mb Guadeloupe
September 29th 14Z 17.7N 71.4W 145 kt Dominican Republic
September 29th 19Z 18.2N 72.6W 100 kt Haiti
September 30th 14Z 20.0N 75.7W 100 kt Cuba
October 1st 15Z 21.6N 79.5W 65 kt Cuba
October 10th 12Z 22.8N 97.8W 100 kt 961 mb Mexico

U.S. Hurricane Landfall

October 04th – 18Z – 25.0N 80.6W – 85 kt – Category 2 – 984 mb – 1009 mb OCI – 225 nm ROCI – 15 nm RMW
October 04th – 23Z – 24.7N 81.3W – 85 kt – Category 2 – 988 mb – 1009 mb OCI – 225 nm ROCI – 20 nm RMW
October 05th – 02Z – 24.6N 81.8W – 85 kt – Category 2 – 988 mb – 1009 mb OCI – 225 nm ROCI – 20 nm RMW

Significant Revisions:

1. Analyzed to have become a tropical storm six hours earlier than originally shown in HURDAT based on aircraft reconnaissance data.
2. Indicated to have become a major hurricane six hours earlier than originally shown in HURDAT based on aircraft reconnaissance data.
3. Significant increases in intensity between September 28th at 18Z and September 29th at 12Z based on aircraft reconnaissance data, indicating that the hurricane reached Category 5 intensity.
4. Analyzed to have made landfall as a Category 5 hurricane in the Dominican Republic based on aircraft reconnaissance data.
5. Weakening to a tropical storm on the 1st is analyzed eighteen hours earlier than originally shown in HURDAT based on aircraft reconnaissance and synoptic data.

6. Re-intensification to a hurricane on the 3rd is analyzed twelve hours later than originally shown in HURDAT based on aircraft reconnaissance and synoptic data.
7. Analyzed to have struck the Florida Keys as a Category 2 hurricane based on surface observations, up from Category 1 originally.
8. Indicated to have become a major hurricane again on the 7th six hours later than originally shown in HURDAT based on aircraft reconnaissance data.
9. Significant decreases in intensity at 18Z on the 7th, 0Z on the 8th, 18Z on the 9th and 00Z on the 10th based on aircraft reconnaissance data.

Daily Metadata:

September 19:

1. Maps and old HURDAT:

- HWM does not analyze any features of interest at 12Z.
- HURDAT does not list an organized system on this date.
- Microfilm shows a spot low pressure at 13N, 22.5W at 12Z.

2. Discussion:

- Reanalysis: Hurricane Inez developed from a tropical wave that can be traced back on satellite images to central Africa on September 15th. The easterly wave reached the west coast of Africa on the 18th.

September 20:

1. Maps and old HURDAT:

- HWM does not analyze any features of interest at 12Z.
- HURDAT does not list an organized system on this date.
- Microfilm shows a closed low pressure of at most 1012 mb at 12.5N, 22W at 12Z.

September 21:

1. Maps and old HURDAT:

- HWM analyzes a spot low pressure at 9.8N, 34.2W at 12Z.
- HURDAT lists a 25 kt tropical depression at 9.9N, 35.1W at 12Z.
- Microfilm shows a closed low pressure of at most 1008 mb at 10N, 35W at 12Z.

2. Discussion:

- MWR: "Inez originated as a weak tropical depression moving off the west coast of Africa on the morning of September 18. Genesis was determined on the basis of sparse land and ship reports and an ESSA 2 satellite photograph. For the next three days the associated cloud mass was tracked west-southwestward with the aid of satellite pictures until the morning of the 21st at which time the cloud mass was centered near 10N, 35W."
- ATSR: "On 21 September, a satellite photograph disclosed a tropical depression near 10N, 35W."
- Reanalysis: The tropical disturbance gradually became better organized and the first position is analyzed at 12Z on the 21st as a 25 tropical depression, same as originally shown in HURDAT. Genesis is uncertain due to the sparse data over the eastern and central Atlantic. Satellite images of the system over the eastern Atlantic are ambiguous but the tropical cyclone could have formed earlier than indicated.

September 22:

1. Maps and old HURDAT:

- HWM analyzes a spot low pressure at 11.8N, 39.2W at 12Z.
- HURDAT lists a 25 kt tropical depression at 11.7N, 39.4W at 12Z.
- Microfilm shows a tropical wave along longitude 38W at 12Z.

2. Discussion:

- Reanalysis: The tropical depression continued moving westward and satellite images showed no appreciable changes in the cloud pattern.

September 23:

1. Maps and old HURDAT:

- HWM analyzes a closed low pressure of at most 1012 mb at 13.3N, 44.2W at 12Z.
- HURDAT lists a 30 kt tropical depression at 13.1N, 44.3W at 12Z.
- Microfilm shows a tropical depression of at most 1012 mb at 13N, 44W at 12Z.

2. Discussion:

- MWR: "No satellite or ship information was received during the next 48 hours but on the morning of the 23d ESSA 2 and the Nimbus satellite pictures showed that the depression had moved westnorthwestward to approximately 13N, 45W."
- ATSR: "Another satellite photograph placed the disturbance near 13N, 44W on 23 September."
- Reanalysis: Satellite images showed that the tropical depression had become better organized with increased convection and some banding features. The first tropical depression bulletin issued by the Weather Bureau was at 16Z on the 23rd.

September 24:

1. Maps and old HURDAT:

- HWM analyzes a closed low pressure of at most 1012 mb at 14.6N, 47.7W at 12Z.
- HURDAT lists a 30 kt tropical depression at 14.4N, 47.7W at 12Z.
- Microfilm shows a tropical depression of at most 1012 mb at 14N, 48.3W at 12Z.

2. Aircraft highlights:

- Penetration center fix measured a central pressure of 1009 mb, estimated surface winds of 35 kt and a 40-100 n mi eye diameter at 14.5N, 48.1W at 1314Z (WALLET).
- Penetration center fix measured a central pressure of 1008 mb, estimated surface winds of 50 kt and a 20 n mi eye diameter at 15N, 49.4W at 20Z (WALLET).

3. Discussion:

- MWR: "A reconnaissance aircraft was able to reach the area on the morning of the 24th and found that only slight intensification had taken place during the six days. By afternoon, significant intensification appeared underway and the first advisory on tropical storm Inez, located about 800 mi. east of Martinique in the French West Indies, was issued."
- ATSR: "The following day [24] at 1314Z, a Navy reconnaissance aircraft confirmed a well defined circulation with surface winds of 35 knots and a tropical storm warning was issued at 2200Z on 24 September."

- Reanalysis: The first reconnaissance aircraft reached the tropical depression at 1314Z measuring a central pressure of 1009 mb and estimating surface winds of 35 kt. An intensity of 35 kt is analyzed at 12Z on the 24th, up from 30 kt originally shown in HURDAT, a minor intensity change. Intensification to a tropical storm is analyzed at 12Z on the 24th, six hours earlier than originally shown in HURDAT. The next penetration center fix measured a central pressure of 1008 mb, estimating surface winds of 50 kt and an eye diameter of 20 n mi at 20Z. A central pressure of 1008 mb suggests maximum surface winds of 30 kt from the south of 25N Brown et al. pressure-wind relationship. Based on a forward speed of about 11 kt and weighting a bit the surface estimate, an intensity of 40 kt is analyzed at 18Z, same as originally shown in HURDAT. The first tropical storm bulletin issued by the Weather Bureau was at 22Z on the 24th.

September 25:

1. Maps and old HURDAT:

- HWM analyzes a tropical storm of at most 1012 mb at 16.1N, 51.4W at 12Z.
- HURDAT lists a 55 kt tropical storm at 15.6N, 51.5W at 12Z.
- Microfilm shows a tropical storm of at most 1012 mb at 15.7N, 51.7W at 12Z.

2. Aircraft highlights:

- Penetration center fix measured a central pressure of 1000 mb, estimated surface winds of 55 kt and a 25 n mi eye diameter at 15.5N, 51.8W at 1202Z (WALLET).
- Penetration center fix measured a central pressure of 1000 mb and estimated surface winds of 60 kt at 15.6N, 53.7W at 20Z (WALLET).
- Penetration center fix estimated a 25 n mi eye diameter at 15.9N, 53.8W at 2140Z (WALLET).

3. Satellite highlights:
   - Estimated center fix near 16N, 58W at 0402Z (WALLET)

4. Discussion:

- Reanalysis: Inez continued on a westward track on the 25th while becoming better organized, as indicated by the satellite images showing a well-organized tropical cyclone with deep convection over its center and a large banding feature wrapping in from the east of the circulation. A reconnaissance aircraft investigated Inez at 1202Z measuring a central pressure of 1000 mb, estimating surface winds of 55 kt and an eye diameter of 25 n mi. A central pressure of 1000 mb suggests maximum surface winds of 47 kt from the south of 25N pressure-wind relationship. An eye diameter of 25 n mi suggests an RMW of about 19 n mi and the climatological value is 14 n mi. Based on a forward speed of about 9 kt and high environmental pressure (OCI 1015 mb), an intensity of 50 kt is analyzed at 12Z on the 25th, down from 55 kt originally shown in HURDAT, a minor intensity change. The next reconnaissance aircraft measured a central pressure of 1000 mb at 19Z and an intensity of 50 kt is selected for 18Z on the 25th, down from 60 kt originally in HURDAT, a minor intensity change. The location of the penetration and radar fixes reported late on the 25th suggests that the aircraft was about 60 n mi too far to the west than the hurricane actually was located based on previous and subsequent reconnaissance center fixes. Thus, the data obtained was used for the intensity reanalysis but the position of the hurricane was not adjusted due to the discrepancy.

September 26:

1. Maps and old HURDAT:

- HWM analyzes a hurricane of at most 1008 mb at 16.4N, 55.8W at 12Z.
- HURDAT lists a 70 kt hurricane at 15.8N, 56W at 12Z.
- Microfilm shows a hurricane of at most 1012 mb at 15.9N, 55.8W at 12Z.

2. Aircraft highlights:

- Penetration center fix measured a central pressure of 995 mb, estimated surface winds of 70 kt and a 10 n mi eye diameter at 15.8N, 55.8W at 1115Z (WALLET).
- Penetration center fix measured a central pressure of 990 mb, estimated surface winds of 70 kt and a 10 n mi eye diameter at 15.8N, 56.2W at 1346Z (WALLET).
- Penetration center fix measured a central pressure of 982 mb, estimated surface winds of 85 kt and an 11-16 n mi eye diameter at 16N, 56.6W at 1730Z (WALLET).
- Radar center fix estimated a 17 n mi eye diameter at 15.9N, 57.9W at 2330Z (WALLET).

3. Discussion:

- MWR: "After reaching tropical storm intensity Inez took a more westerly course at a somewhat slower forward speed and continued to intensify until the morning of the 26th when hurricane intensity was attained about 330 mi. east of Guadeloupe in the French West Indies. Inez continued on a west to west-northwestward course while intensifying rapidly."
- ATSR: "Inez spent the first five days of its existence in the development stage as it moved on a west-northwest track, finally reaching hurricane intensity on 26 September."
- Reanalysis: The tropical storm continued intensifying while approaching the Lesser Antilles. Satellite images showed a well-organized tropical cyclone with a CDO. A reconnaissance aircraft investigated Inez at 1115Z measuring a central pressure of 995 mb, estimating surface winds of 70 kt and an eye diameter of 10 n mi. A central pressure of 995 mb suggests maximum surface winds of 56 kt from the south of 25N pressure-wind relationship. An eye diameter of 10 n mi suggests an RMW of about 8 n mi and the climatological value is 14 n mi. Based on a forward speed of about 12 kt, small RMW and high environmental pressure (OCI 1015 mb), an intensity of 65 kt is analyzed at 12Z on the 26th, down from 70 kt originally shown in HURDAT, a minor intensity change. Intensification to a hurricane is analyzed at 12Z on the 26th, same as originally shown in HURDAT. The next penetration center fix occurred at 1730Z measuring a central pressure of 982 mb, estimating surface winds of 85 kt and an eye diameter of 11-16 n mi. A central pressure of 982 mb suggests maximum surface winds of 75 kt from the south of 25N pressure-wind relationship. An eye diameter of 11-16 n mi suggests an RMW of about 8-12 n mi and the climatological value is 14 n mi. Based on a forward speed of about 10 kt, small RMW and high environmental pressure (OCI 1015 mb), an intensity of 80 kt is analyzed at 18Z on the 26th, up from 75 kt originally shown in HURDAT, a minor intensity change.

September 27:

1. Maps and old HURDAT:

- HWM analyzes a hurricane of at most 1008 mb at 16.7N, 60W at 12Z.
- HURDAT lists a 105 kt hurricane at 16.1N, 60.4W at 12Z.
- Microfilm shows a hurricane of at most 1012 mb at 16.2N, 60.2W at 12Z.

2. Land highlights:

- 82 kt (peak sustained winds) at La Desirades, Guadeloupe around 1540Z (METEOFR).
- 97 kt (peak sustained winds) at Saint Francois, Guadeloupe at 1620Z (METEOFR).
- 80 kt (peak sustained winds before the pylon carrying the anemometer broke) at La Raizet airport, Guadeloupe at 17Z (METEOFR).
- 971 mb (minimum pressure) at La Raizet airport, Guadeloupe at 17Z (METEOFR).
- 958 mb (minimum pressure) at the harbor of Pointe-a-Pitre, Guadeloupe at 17Z (METEOFR).
- 110 kt (estimated sustained peak winds) and gusts to 120 kt at La Raizet airport, Guadeloupe at 19Z (METEOFR).

3. Aircraft highlights:

- Penetration center fix measured a central pressure of 965 mb, estimated flight winds of 90 kt and a 15 n mi eye diameter at 16N, 59W at 06Z (WALLET).
- Penetration center fix measured a central pressure of 961 mb, estimated surface winds of 110 kt and a 8 n mi eye diameter at 16.2N, 59.8W at 1050Z (WALLET).
- Penetration center fix measured a central pressure of 962 mb, estimated surface winds of 110 kt and a 10 n mi eye diameter at 16.1N, 61.6W at 1730Z (WALLET).
- Penetration center fix measured a central pressure of 971 mb, estimated surface winds of 90 kt and a 10 n mi eye diameter at 16.3N, 62.3W at 2054Z (WALLET)

4. Satellite highlights:

a. Estimated center fix near 16N, 58W at 0402Z (WALLET).

5. Discussion:

- MWR: "The center of the hurricane moved almost directly over Guadeloupe during the early afternoon of the 27th; winds of 80 mph were reported on the island before communications failed. Reconnaissance aircraft during the morning, however, had reported a central pressure of 961 mb (28.38 in.) and maximum winds of 120 mph. Inez was a small storm at this time with hurricane force winds extending outward only 50 mi from the center. The central pressure increased to 970 mb (28.64 in.) after the hurricane had passed over the Guadeloupe Islands where the contact between the circulation and the ocean surface was partially lost."
- ATSR: "She continued on a westward track trough the Caribbean, smashing the Leeward Islands, the southern coast of Dominican Republic, Haiti, and Cuba, with winds in excess of 130 kt as she crossed Dominican Republic and Haiti."
- Reanalysis: Inez kept strengthening on the 27th as indicated by the satellite images and reconnaissance aircraft data. The first penetration center fix on the 27th measured a central pressure of 965 mb and estimated an eye diameter of 15 n mi at 06Z. A central pressure of 965 mb suggests maximum surface winds of 97 kt from the south of 25N pressure-wind relationship intensifying subset. An eye diameter of 15 n mi suggests an RMW of about 11 n mi and the climatological value is 12 n mi. Based on a forward speed of about 12 kt, an intensity of 100 kt is selected at 06Z on the 27th, up from 95 kt originally shown in HURDAT, a minor intensity change. Intensification to a major hurricane is analyzed at 06Z on the 27th, six hours earlier than originally shown in HURDAT. The next penetration center fix measured a central pressure of 961 mb, estimating surface winds of 110 kt and an eye diameter of 8 n mi. A central pressure of 961 mb suggests maximum surface winds of 100 kt from the south of 25N pressure-wind relationship. An eye diameter of 8 n mi suggests an RMW of about 6 n mi and the climatological value is 12 n mi. Based on a forward speed of about 12 kt and small RMW, an intensity of 105 kt is analyzed

at 12Z on the 27th, same as originally shown in HURDAT. Inez made landfall in Guadeloupe around 17Z on the 27th as a category 3 hurricane. A pressure of 958 mb was measured in the harbor of Pointe-a-Pitre, Guadeloupe. It is uncertain if the measurement was recorded in calm conditions, but based on the track of Inez and location of the measurement, it is considered as a central pressure and added to HURDAT in the 18Z slot for the 27th. La Raizet airport, Guadeloupe measured 80 kt sustained winds before the pylon carrying the anemometer broke. Saint Francois, Guadeloupe, recorded 97 kt sustained winds. A central pressure of 958 mb suggests maximum surface winds of 105 kt from the south of 25N pressure-wind relationship intensifying subset. An eye diameter of 10 n mi was estimated by a reconnaissance aircraft at 1730Z on the 27th, suggesting an RMW of about 8 n mi and the climatological value is 12 n mi. Based on a small RMW and forward speed of 14 kt, an intensity of 110 kt is analyzed at 18Z on the 27th, same as originally shown in HURDAT. 110 kt is also the intensity of Inez at landfall in Guadeloupe. The passage of the small hurricane over the mountainous terrain of Guadeloupe, which has the highest peak in the Lesser Antilles reaching almost 5000 feet, caused the tropical cyclone to temporarily weaken as reported by the reconnaissance aircraft. A penetration center fix at 2054Z on the 27th measured a central pressure of 971 mb, estimated surface winds of 90 kt and an eye diameter of 10 n mi. A central pressure of 971 mb suggests maximum surface winds of 87 kt from the south of 25N pressure-wind relationship weakening subset. Although the eye diameter did not change in this penetration center fix, it had already increased to 15 n mi in the next fix at 0245Z on the 28th. Therefore, a best track point is added at 21Z on the 27th and it is analyzed that Inez weakened to 95 kt at this time, below major hurricane intensity.

September 28:

1. Maps and old HURDAT:

- HWM analyzes a hurricane of at most 1008 mb at 17.1N, 65.4W at 12Z.
- HURDAT lists a 120 kt hurricane at 16.8N, 65.7W at 12Z.
- Microfilm shows a hurricane of at most 1008 mb at 16.9N, 65.8W at 12Z.

2. Ship highlights:

- 35 kt S and 1007 mb at 16.1N, 66.5W at 19Z (COADS).

3. Land highlights:

- Gusts estimated to 70 kt at Mona Island, Puerto Rico at 2330Z (MWR).

4. Aircraft highlights:

- Penetration center fix measured a central pressure of 964 mb, estimated flight winds of 110 kt and a 15 n mi eye diameter at 16.3N, 63.5W at 0245Z (WALLET).
- Penetration center fix measured a central pressure of 955 mb, estimated surface winds of 85 kt and a 10 n mi eye diameter at 16.7N, 64.5W at 0545Z (WALLET).
- Penetration center fix measured a central pressure of 950 mb, estimated flight winds of 100 kt and a 8 n mi eye diameter at 16.7N, 64.8W at 0852Z (WALLET).
- Radar center fix estimated a 8 n mi eye diameter at 16.8N, 65.5W at 12Z (WALLET).
- Penetration center fix measured a central pressure of 932 mb, estimated surface winds of 120 kt and a 8 n mi eye diameter at 17N, 67.2W at 18Z (WALLET).
- Penetration center fix measured a central pressure of 927 mb and estimated a 10 n mi eye diameter at 16.9N, 67.4W at 1920Z (WALLET).
- Penetration center fix measured a central pressure of 928 mb, estimated surface winds of 150 kt and a 7.5 n mi RMW near 17N, 66W around 23Z (NHRP).

5. Radar highlights:

- San Juan estimated an eye diameter of 15 n mi at 16.5N, 63.2W at 0140Z (WALLET).
- San Juan estimated an eye diameter of 12 n mi at 16.6N, 64.4W at 0610Z (WALLET).
- San Juan estimated an eye diameter of 8 n mi at 16.8N, 65.7W at 1210Z (WALLET).
- San Juan estimated an eye diameter of 9 n mi at 17N, 67.3W at 1840Z (WALLET).

6. Discussion:

- MWR: "As the center moved westward into the eastern Caribbean Sea, Inez resumed intensification and by late afternoon on the 28th reached its lowest observed sea level pressure of 927 mb. (27.38 in.). Maximum surface winds were estimated to be 150 to 175 mph near the center. ESSA Research Flight Facility aircraft measured winds of 197 mph at 8,000 ft., the highest speed ever recorded by the research aircraft. At this time the center was located about 160 mi. southwest of San Juan, Puerto Rico and 170 mi. southeast of Santo Domingo, Dominican Republic moving west about 16 mph. The hurricane was under continuous surveillance by land-based radar in-Puerto Rico, with the eye visible for 23 hours from 9:45 am. AST on the 27th to 8:45 am. AST on the 28th."
- Reanalysis: The first reconnaissance aircraft to investigate Inez on the 28th occurred at 0245Z measuring a central pressure of 964 mb and estimated an eye diameter of 15 n mi. A central pressure of 964 mb suggests maximum surface winds of 97 kt from the south of 25N pressure-wind relationship. An eye diameter of 15 n mi suggests an RMW of about 11 n mi and the climatological value is 12 n mi. Based on a forward speed of about 14 kt, an intensity of 100 kt is analyzed at 00Z on the 28th, down from 110 kt originally shown in HURDAT, a minor intensity change. The next penetration center fix measured a central pressure of 955 mb, estimating surface winds of 85 kt and an eye diameter of 10 n mi at 0545Z on the 28th. A central pressure of 955 mb suggests maximum surface winds of 108 kt from the south of 25N pressure-wind relationship intensifying subset. An eye diameter of 10 n mi suggests an RMW of about 8 n mi and the climatological value is 13 n mi. Based on a forward speed of about 14 kt and small RMW, an intensity of 115 kt is analyzed at 06Z on the 28th, same as originally shown in HURDAT. Inez continued to rapidly intensify as it passed south of Puerto Rico. Another penetration center fix measured a central pressure of 927 mb, estimating surface winds of 120 kt and an eye diameter of 8 n mi at 1920Z on the 28th. A central pressure of 927 mb suggests maximum surface winds of 135 kt from the south of 25N pressure-wind relationship intensifying subset. An eye diameter of 8 n mi suggests an RMW of about 6 n mi and the climatological value is 11 n mi. Based on a forward speed of about 13 kt and small RMW, an intensity of 145 kt is analyzed at 18Z on the 28th, up from 130 kt originally shown in HURDAT, a minor intensity change. 145 kt is also the peak intensity of Inez, up from 130 kt originally shown in HURDAT, a major intensity change.

September 29:

1. Maps and old HURDAT:

- HWM analyzes a hurricane of at most 1004 mb at 17.5N, 70.8W at 12Z.
- HURDAT lists a 120 kt hurricane at 17.5N, 70.9W at 12Z.
- Microfilm shows a hurricane of at most 1008 mb at 17.2N, 71W at 12Z.

2. Ship highlights:

- 40 kt E and 1007 mb at 20.2N, 71.9W at 18Z (COADS).

3. Land highlights:

- 45-65 kt ENE and 999 mb at Port-au-Prince, Haiti at 17Z (WALLET).
- 80 kt E and 998 mb at Port-au-Prince, Haiti at 18Z (MICRO).

6. Aircraft highlights:

- Penetration center fix measured a central pressure of 928 mb, estimated flight level winds of 164 kt and a 12-16 n mi eye diameter at 17.1N, 69W at 0140Z (WALLET).
- Radar center fix estimated an outer eye diameter of 28 n mi and inner eye diameter of 11-14 n mi at 17.2N, 70W at 06Z (WALLET).
- Radar center fix estimated surface winds of 65 kt and a 14 n mi eye diameter at 17.6N, 71W at 1140Z (WALLET).
- Radar center fix at 18.6N, 72.7W at 20Z (WALLET).
- Penetration center fix measured a central pressure of 987 mb and estimated a 12 n mi eye diameter at 18.8N, 73.5W at 2355Z (WALLET).

4. Radar highlights:

- San Juan estimated an eye diameter of 14 n mi at 17.1N, 68.9W at 0040Z (WALLET).

5. Satellite highlights:

- Estimated a center fix at 17N, 68.5W at 0442Z (WALLET).

6. Discussion:

- MWR: "Inez struck the Barahona Peninsula of the Dominican Republic shortly before noon AST on the 29th and continued west-northwestward across the southwestern peninsula of Haiti between 2 pm and 4 pm AST. The eye entered at a point east of Jacmel on the southern coast of Haiti and emerged near Leogane on the northern coast. Reconnaissance aircraft found a central pressure of 987 mb (29.15 in.) just west of Port au Prince, Haiti on the evening of the 29th. This was a rise of 60 mb or 1.80 in. from the value reported just before the eye struck the Barahona Peninsula."
- Reanalysis: Satellite images early on the 29th showed a very small hurricane with a compact CDO and tiny eye. The tropical cyclone continued toward southern Hispaniola as a category 5 hurricane. A penetration center fix measured a central pressure of 928 mb, estimated flight level winds of 173 kt at 8000 feet and an eye diameter of 12-16 n mi at 0140Z on the 29th. An intensity of 145 kt is selected at 00Z on the 29th, up from 130 kt in the original HURDAT, a minor intensity change. No other penetration center fixes occurred before landfall in the Barahona Peninsula of the Dominican Republic around 14Z on the 29th. But radar center fixes were made by aircraft reconnaissance indicating that the eye diameter of Inez remained small, between 12-14 n mi, suggesting that the hurricane did not weaken. Thus, Inez is analyzed to have made landfall in the Dominican Republic at 14Z on the 29th as a category 5 hurricane with maximum sustained winds of 145 kt. The bulletins issued by the Weather Bureau also indicated that Inez made landfall in Hispaniola as a category 5 hurricane. Inez entered the Caribbean Sea about two hours later while moving toward Haiti. No data was obtained near the eye of Inez between landfall in the Dominican Republic and landfall in Haiti, thus the landfall intensity in Haiti is very uncertain. The hurricane should have weakened while crossing the Barahona Peninsula but wind damage observed at Jacmel, Haiti indicate that it was still a powerful hurricane. Therefore, landfall in Haiti is analyzed at 19Z on the 29th as a 100 kt hurricane, same as originally shown in HURDAT at 18Z on the 29th.

September 30:

1. Maps and old HURDAT:

- HWM analyzes a hurricane of at most 1004 mb at 20.3N, 75W at 12Z.
- HURDAT lists a 100 kt hurricane at 19.8N, 75.4W at 12Z.
- Microfilm shows a hurricane of at most 1004 mb at 19.3N, 75.2W at 12Z.

2. Ship highlights:

- 35 kt SSE and 1008 mb at 18.8N, 74.5W at 12Z (COADS).
- 35 kt SE and 1011 mb at 19.1N, 74.4W at 18Z (COADS).
- 120 kt (peak sustained winds) (time unknown) at Guantanamo Bay, Cuba (MWR).

3. Land highlights:

- 50 kt ENE and 1004 mb at Guantanamo Bay, Cuba at 12Z (micro).
- 75 kt SE and 1010 mb at Santiago de Cuba, Cuba at 18Z (micro).
- Analyzed as Cat. 1 by Perez et al. (2000)

4. Aircraft highlights:

- Radar center fix at 18.8N, 74.6W at 0610Z (WALLET).
- Radar center fix estimated a 10 n mi eye diameter at 19.8N, 75.1W at 1213Z (WALLET).
- Radar center fix at 20.9N, 75.6W at 2055Z (WALLET).

5. Radar highlights:

- Guantanamo Bay, Cuba estimated an eye diameter of 23 n mi at 19.1N, 74.6W at 0017Z (WALLET).
- Guantanamo Bay, Cuba estimated an eye diameter of 25 n mi at 19.2N, 74.7W at 0745Z (WALLET).
- Guantanamo Bay, Cuba estimated a center fix at 19.8N, 75.4W at 1215Z (WALLET).

6. Discussion:

- MWR: "After leaving Haiti, Inez continued northwestward toward eastern Cuba and struck Guantanamo City, a short distance west of Guantanamo Bay, on the morning of the 30th. Winds of 138 mph were reported as the center moved ashore. Therefore, rather rapid reintensification must have taken place over the Windward Passage."
- Reanalysis: The small hurricane crossed the Tiburon Peninsula of Haiti late on the 29th and early on the 30th it was located in the Windward Passage on its way to Cuba. A reconnaissance aircraft investigated Inez at 2355Z on the 29th measuring a central pressure of 987 mb and estimating an eye diameter of 12 n mi. A central pressure of 987 mb suggests maximum surface winds of 68 kt from the south of 25N pressure-wind relationship. An eye diameter of 12 n mi suggests an RMW of about 8 n mi and the climatological value is 16 n mi. Based on a forward speed of about 14 kt and small RMW, an intensity of 80 kt is selected at 00Z on the 29th, same as originally shown in HURDAT. Satellite images early on the 30th showed a well-organized tropical cyclone with a larger CDO compared to the day before and a hint of an eye. No other central pressures were measured on this date, likely due to the proximity of the hurricane to Cuba. Nonetheless, a radar center fix at 1213Z estimated an eye diameter of 10 n mi, suggesting that Inez still had a small RMW. The data available about the landfall in eastern Cuba is contradictory as Guantanamo Bay reported sustained winds of 120 kt but Perez et al. (2000) indicates that Inez was a category 1 hurricane at landfall. Based on the data reconnaissance

aircraft at 1213Z and taking into account the measurement in Guantanamo Bay, an intensity of 100 kt is selected at 12Z on the 30th, same as originally shown in HURDAT. Landfall is analyzed at 14Z on the 30th as a 100 kt hurricane just east of Santiago de Cuba. After landfall, Inez continued to move inland over the mountainous terrain of eastern Cuba and began to weaken.

October 1:

1. Maps and old HURDAT:

- HWM analyzes a hurricane of at most 1004 mb at 21.5N, 79.3W at 12Z.
- HURDAT lists a 65 kt hurricane at 21.2N, 79.1W at 12Z.
- Microfilm shows a hurricane of at most 1008 mb at 21N, 79.2W at 12Z.

2. Ship highlights:

- 35 kt E and 1009 mb at 23.2N, 79.7W at 18Z (COADS).
- 65 kt SE and 1007 mb at 21.6N, 79.2W at 18Z (micro).

3. Land highlights:

- 50 kt SE (likely high bias) and 1010 mb at Santiago de Cuba, Cuba at 12Z (micro).

3. Aircraft highlights:

- Radar center fix at 20.6N, 79.1W at 06Z (WALLET).
- Radar center fix estimated a 20 n mi eye diameter at 21.4N, 79.1W at 12Z (WALLET).
- Radar center fix at 22.2N, 80W at 18Z (WALLET).

4. Discussion:

- MWR: "The center of the storm became disorganized over the rugged terrain, however, and the weak steering currents were not sufficient to allow the eye to cross Cuba. Instead, it reorganized along the southern coast and moved slowly west-northwestward for about 36 hours, entering central Cuba just about due south of Miami."
- Reanalysis: The center of Inez moved back over the Caribbean Sea around 00Z on the 1st and remained close to the coastline of Cuba on this date. The proximity to Cuba limited the data that the reconnaissance aircrafts were able to collect on the 1st and only radar center fixes are available. Satellite images early on the 1st indicate that Inez had weakened with most of the convection over the eastern quadrant and elongated north-south. The intensity between 00Z and 12Z on the 1st is analyzed at 65 kt, same as originally shown in HURDAT, and 60 kt at 18Z, down from 65 kt originally shown in HURDAT, a minor intensity change. It is possible that Inez weakened to a tropical storm earlier than analyzed based on its appearance on satellite. Second landfall in Cuba is analyzed at 15Z on the 1st as a 65 kt hurricane, same as originally shown in HURDAT. Microfilm shows a ship or coastal station near the southern coast of Cuba that reported 65 kt at 18Z on the 1st but surrounding observations suggest it had a high wind bias.

October 2:

1. Maps and old HURDAT:

- HWM analyzes a hurricane of at most 1004 mb at 23.5N, 79.9W with a stationary front to the northwest at 12Z.
- HURDAT lists a 55 kt tropical storm at 23.3N, 79.9W at 12Z.
- Microfilm shows a tropical storm of at most 1004 mb at 23.5N, 79.4W at 12Z.

2. Ship highlights:

- 35 kt SE and 1007 mb at 23.2N, 79.9W at 00Z (COADS).
- 35 kt NE and 1011 mb at 25.9N, 79.9W at 12Z (COADS).
- 40 kt NE and 1007 mb at 24.7N, 80.6W at 17Z (COADS).

3. Aircraft highlights:

- Penetration center fix measured a central pressure of 996 mb and estimated surface winds of 60 kt at 23.7N, 79.7W at 1522Z (WALLET).
- Penetration center fix measured a central pressure of 999 mb and estimated surface winds of 65 kt at 24.1N, 79.6W at 1754Z (WALLET).
- Penetration center fix measured a central pressure of 995 mb, estimated surface winds of 50 kt and a 12-18 n mi eye diameter at 24.4N, 79.4W at 2220Z (WALLET).

4. Radar highlights:

- Miami, FL estimated an eye diameter of 12 n mi at 24.2N, 79.6W at 1840Z (WALLET).

5. Discussion:

- MWR: "A slow northward movement of about 5 mph brought the center across central Cuba where it briefly lost hurricane force."
- ATSR: "Inez turned north over Cuba and lost her hurricane intensity for about 18 hours as she crossed the mountains of Cuba."
- Reanalysis: Satellite images on the 2nd showed a sheared tropical cyclone with most of the convection over the eastern quadrant. The intensity is decreased to 50 kt between 00Z and 12Z on the 2nd corresponding to the system moving over central Cuba and aircraft reconnaissance data later on the date. Inez moved north of Cuba early on the 2nd and a penetration center fix at 1754Z measured a central pressure of 999 mb and estimated surface winds of 65 kt. An eye diameter of 12 n mi was estimated by the Key West radar at 1740Z on the 2nd. A central pressure of 999 mb suggests maximum surface winds of 49 kt from the south of 25N and 45 kt from the north of 25N pressure-wind relationships. An eye diameter of 12 n mi suggests an RMW of about 9 n mi and the climatological value is 20 n mi. Based on a forward speed of 7 kt and small RMW, an intensity of 55 kt is analyzed at 18Z on the 2nd, same as originally shown in HURDAT.

October 3:

1. Maps and old HURDAT:

- HWM analyzes a hurricane of at most 1000 mb at 25.9N, 78.5W with a stationary front to the northwest at 12Z.
- HURDAT lists a 65 kt hurricane at 25.2N, 78.5W at 12Z.
- Microfilm shows a tropical storm of at most 1000 mb at 25.8N, 78.3W with a stationary front to the northwest at 18Z.

2. Ship highlights:

- 35 kt NE and 1006 mb at 24.8N, 80.5W at 00Z (COADS).
- 40 kt NNE and 1009 mb at 27.1N, 79.6W at 12Z (micro).
- 50 kt N and 1002 mb at 25.5N, 80W at 18Z (COADS).

3. Land highlights:

- 35-45 kt NNE and 1007 mb at Key Biscayne, FL at 07Z (WALLET).
- 35 kt S and 1001 mb at Nassau, Bahamas at 12Z (micro).

- 35 kt S and 1001 mb at Nassau, Bahamas at 18Z (micro).
- 55 kt NNE (maximum wind) and 994 mb at Alice Town, Bahamas at 22Z (MWR).
- 56 kt ESE and 997 mb at Freeport, Bahamas (time unknown)(MWR).

4. Aircraft highlights:

- Penetration center fix measured a central pressure of 989 mb and estimated an eye diameter of 35-55 n mi at 25N, 78.9W at 0605Z (WALLET).
- Penetration center fix measured a central pressure of 985 mb, estimated surface winds of 60 kt and an eye diameter of 35 n mi at 25.1N, 78.5W at 1155Z (WALLET).
- Penetration center fix measured a central pressure of 986 mb and estimated surface winds of 75 kt at 25.7N, 78.6W at 18Z (WALLET).
- Penetration center fix measured a central pressure of 985 mb and estimated an eye diameter of 20-35 n mi at 25.5N, 78.4W at 2315Z (WALLET).

5. Radar highlights:

- Miami, FL estimated a center fix at 24.4N, 79.2W at 0010Z (WALLET).
- Miami, FL estimated an eye diameter of 35 n mi at 24.7N, 79W at 0640Z (WALLET).
- Miami, FL estimated an eye diameter of 35 n mi at 25.1N, 78.6W at 1240Z (WALLET).
  Miami, FL estimated a center fix at 25.7N, 78.7W at 1840Z (WALLET).

6. Discussion:

- MWR: "Slow intensification occurred as Inez moved north-northeastward into the western Bahamas on the night of October 2 and morning of the 3rd. Nassau had a peak gust of 64 mph and recorded nearly 15 inches of rain in the three-day period October 2-4. Although Nassau did not receive hurricane force winds as a part of the strong winds near the center of Inez, an anemometer in the vicinity of the tornado showed a rapid increase to over 100 mph in 10-15 sec. as the tornado approached. The highest wind reported in the Bahamas was 90 mph at West End, Grand Bahama."
- ATSR: "Moving into the Florida straits, the storm regenerated to hurricane strength some 95 miles south southeast of Miami."
- Reanalysis: Inez slowed its forward speed as it moved into the western Bahamas due to weak steering currents. A reconnaissance aircraft measured a central pressure of 995 mb, estimated surface winds of 50 kt and an eye diameter of 12-18 n mi at 2220Z on the 2nd. A central pressure of 995 mb suggests maximum surface winds of 56 kt from the south of 25N and 54 kt from the north of 25N pressure-wind relationships. An eye diameter of 12-18 n mi suggests an RMW of about 9-14 n mi and the climatological value is 20 n mi. Based on a forward speed of 6 kt and small RMW, an intensity of 60 kt is analyzed at 00Z on the 3rd, down from 65 kt originally shown in HURDAT, a minor intensity change. Satellite images showed an increase in convection and organization compared to the day before, while interacting with a frontal boundary to the north. The next penetration center fix measured a central pressure of 989 mb and estimated an eye diameter of 35-55 n mi at 0605Z on the 3rd. A central pressure of 989 mb suggests maximum surface winds of 65 kt from the south of 25N and 63 kt from the north of 25N pressure-wind relationships intensifying subsets. An eye diameter of 35-55 n mi suggests an RMW of about 26-41 n mi and the climatological value is 20 n mi. Based on a slow forward speed of about 3 kt and large RMW, an intensity of 60 kt is analyzed at 06Z on the 3rd, down from 65 kt originally shown in HURDAT, a minor intensity change. Another penetration center fix measured a central pressure of 985 mb, estimating surface winds of 60 kt and an eye diameter of 35 n mi at 1155Z on the 3rd. A

central pressure of 985 mb suggests maximum surface winds of 71 kt from the south of 25N and 66 kt from the north of 25N pressure-wind relationships. An eye diameter of 35 n mi suggests an RMW of about 26 n mi and the climatological value is 20 n mi. Based on a slow forward speed of about 3 kt and RMW larger than climatology, an intensity of 65 kt is analyzed at 12Z on the 3rd, same as originally shown in HURDAT. Another aircraft reconnaissance measured a central pressure of 986 mb at 18Z on the 3rd and an intensity of 65 kt is analyzed at this time, down from 70 kt originally shown in HURDAT, a minor intensity change. Late on the 3rd, Freeport and Alice Town in the Bahamas registered sustained winds reaching almost hurricane intensity.

October 4:

1. Maps and old HURDAT:

- HWM analyzes a hurricane of at most 996 mb at 26N, 79.8W with a stationary front to the northeast at 12Z.
- HURDAT lists a 75 kt hurricane at 25.3N, 79.7W at 12Z.
- Microfilm shows a hurricane of at most 1004 mb at 25.2N, 79.7W with a stationary front to the northeast at 18Z.

2. Ship highlights:

- 50 kt NE and 1007 mb at 27.7N, 79.7W at 00Z (COADS).
- 50 kt NW and 996 mb at 25N, 80W at 06Z (COADS).
- 60 kt NNW and 990 mb at 25.7N, 79.7W at 12Z (COADS).
- 85 kt E and 995 mb at 25.5N, 80W at 15Z (COADS).
- 60 kt W and 991 mb at 24.7N, 80.4W at 18Z (COADS).

3. Land highlights:

- 40 kt (gusts to 55 kt) and 1000 mb at Nassau, Bahamas at 00Z (MWR).
- 40 kt (gusts to 49 kt) and 1003 mb at Hillsboro Light, FL at 06Z (WALLET).
- 987 mb (minimim pressure) at Alice Town, Bahamas at 08Z (MWR).
- 63 kt (maximum sustained wind, likely elevated site) at Hillsboro Light, FL at 1015Z (MWR).
- Calm and 987 mb at North Key Largo, FL at 1430Z (WALLET).
- 65 kt ESE (maximum sustained wind) (gusts to 83 kt) at North Key Largo, FL at 1715Z (MWR).
- Calm and 984 mb at Islamorada, FL at 18Z (WALLET).
- 80 kt (SE at Tavernier, FL at 21Z (MWR).
- 85 kt ESE (maximum sustained winds) at Plantation Key, FL at 2145Z (WALLET).
- Calm and 988 mb at Big Pine Key, FL at 22Z (MWR).
- 75 kt SSE (maximum wind) at Grassy Key, FL at 2355Z (MWR).

4. Aircraft highlights:

- Penetration center fix at 25.5N, 78.5W at 0030Z (WALLET).
- Penetration center fix measured a central pressure of 988 mb at 25.5N, 79.3W at 0630Z (WALLET).
- Penetration center fix measured a central pressure of 987 mb, estimated flight level winds of 85 kt and an eye diameter of 2-10 n mi at 25.2N, 79.5W at 12Z (WALLET).
- Penetration center fix measured a central pressure of 984 mb, estimated surface winds of 100 kt and an eye diameter of 15 n mi at 25N, 80.4W at 1745Z (WALLET).

5. Radar highlights:

- Miami, FL estimated a center fix at 25.5N, 78.8W at 0042Z (WALLET).
- Miami, FL estimated an eye diameter of 38 n mi at 25.4N, 79.1W at 0640Z (WALLET).
- Key West, FL estimated an eye diameter of 28 n mi at 25.1N, 79.7W at 1208Z (WALLET).
- Miami, FL estimated a center fix at 25N, 80.7W at 1815Z (WALLET).

6. Discussion:

- MWR: "Late on October 3, a trend toward the west-southwest was indicated by radar and aircraft reconnaissance and this was fairly well established during the early morning hours of the 4th. Once this course was established it was maintained with only minor fluctuations until late on the 7th. The eye of Inez moved directly over all of the Keys from Key Largo to Key West and the US Navy Weather Office at Boca Chica was able to obtain a rather rare hurricane eye sounding which is shown in figure 2. The highest wind reported on the Florida mainland was a gust to 92 mph at Flamingo. All of the Keys reported winds of hurricane force."
- ATSR: "The intensifying surface ridge and strong upper level anticyclone over the Eastern Gulf of Mexico forced Inez to turn southwestward through the Florida Keys."
- Reanalysis: After being about 12 hours stationary over the western Bahamas, the hurricane began to move westward toward Florida. Satellite images early on the 4th showed that Inez had continued to become better organized with a circular CDO and a hint of an eye. A reconnaissance aircraft investigated Inez at 2315Z on the 3rd measuring a central pressure of 985 mb. An intensity of 65 kt is analyzed at 00Z on the 4th, down from 75 kt originally shown in HURDAT, a minor intensity change. The next penetration center fix measured a central pressure of 988 mb at 0630Z on the 4th and an intensity of 65 kt is analyzed at 06Z on the 4th, down from 75 kt originally shown in HURDAT, a minor intensity change. Another penetration center fix measured a central pressure of 987 mb and an eye diameter of 2-10 n mi at 12Z on the 4th. A central pressure of 987 mb suggests maximum surface winds of 68 kt from the south of 25N and 64 kt from the north of 25N pressure-wind relationships. An eye diameter of 2-10 n mi suggests an RMW of about 2-8 n mi and the climatological value is 20 n mi. Based on the small RMW and forward speed of about 7 kt, an intensity of 75 kt is analyzed at 12Z on the 4th, same as originally shown in HURDAT. The center of Inez approached the upper Florida Keys late on the 4th. A reconnaissance aircraft measured a central pressure of 984 mb, estimated surface winds of 100 kt and an eye diameter of 15 n mi at 1745Z. A central pressure of 984 mb suggests maximum surface winds of 72 kt from the south of 25N and 68 kt from the north of 25N pressure-wind relationships. An eye diameter of 15 n mi suggests an RMW of about 12 n mi and the climatological value is 20 n mi. Based on a ship report of 85 kt at 15Z and 85 kt at Plantation Key at 2145Z, an intensity of 85 kt is analyzed at 18Z on the 4th, up from 75 kt originally shown in HURDAT, a minor intensity change. The first landfall in the Florida Keys is analyzed at 18Z on the 4th as the hurricane moved over Plantation Key with maximum sustained winds of 85 kt. The center of the hurricane later on the 4th passed over Windley Key and Islamorada, but the RMW passed over most of the keys. The original HURDAT indicated that Inez struck the Florida Keys as a category 1 hurricane but the data suggests it was a category 2 at landfall. The original HURDAT also only showed southwest Florida as being struck by the hurricane but the reanalysis assesses both southeast and southwest Florida as being impacted by Category 2 winds.

October 5:

1. Maps and old HURDAT:

- HWM analyzes a hurricane of at most 996 mb at 24.8N, 83.2W with a cold front to the northeast at 12Z.
- HURDAT lists an 80 kt hurricane at 24.5N, 83W at 12Z.
- Microfilm shows a hurricane of at most 1004 mb at 24.1N, 83W with a cold front to the northeast at 12Z.

2. Ship highlights:

- 90 kt SSE and 991 mb at 24.6N, 80.7W at 00Z (COADS).
- 70 kt S and 993 mb at 24.6N, 80.6W at 00Z (COADS).
- 45 kt NW and 1000 mb at 23.3N, 83.2W at 06Z (COADS).
- 45 kt SE and 1006 mb at 23.8N, 81.5W at 12Z (COADS).
- 55 kt SSE and 1002 mb at 24.3N, 81.6W at 15Z (COADS).
- 55 kt SSE and 1001 mb at 24.2N, 82.2W at 18Z (COADS).
- 55 kt SSE and 1001 mb at 24.2N, 82.6W at 21Z (COADS).

3. Land highlights:

- 65 kt SE (maximum sustained winds) (gusts to 83 kt) at Boca Chica, FL at 0442Z (MWR/WALLET).
- 75 kt SSE (maximum sustained winds) (gusts to 80 kt) at Key West, FL at 0506Z (MWR).
- Gusts to 105 kt at Dry Tortugas, FL at 15Z (MWR).
- 60 kt ESE and 1000 mb at Dry Tortugas, FL at 17Z (WALLET).

4. Aircraft higlights:

- Penetration center fix measured a central pressure of 988 mb and estimated surface winds of 85 kt at 24.6N, 81.4W at 00Z (WALLET).
- Penetration center fix measured a central pressure of 985 mb and an eye diameter of 40 n mi at 24.5N, 82.3W at 0610Z (WALLET).
- Radar center fix at 24.5N, 83.1W at 1155Z (WALLET).
- Penetration center fix measured a central pressure of 980 mb and estimated surface winds of 90 kt at 24.2N, 83.8W at 18Z (WALLET).
- Penetration center fix measured a central pressure of 977 mb and estimated an eye diameter of 10 n mi at 24.1N, 84.1W at 2345Z (WALLET).

5. Radar highlights:

- Key West, FL estimated an eye diameter of 28 n mi at 24.7N, 81.3W at 0010Z (WALLET).
- Miami, FL estimated a center fix at 24.5N, 82.7W at 0614Z (WALLET).
- Key West, FL estimated an eye diameter of 27 n mi at 24.4N, 83.1W at 1240Z (WALLET).
  Key West, FL estimated an eye diameter of 44 n mi at 24.3N, 83.7W at 1839Z (WALLET).

6. Discussion:

- ATSR: "Northwest Cuba and northern Yucatan were battered with hurricane winds, torrential rains and high tides as Inez continued southwestward, intensifying slowly."
- Reanalysis: Inez continued to move through the Florida Keys early on the 5th with maximum sustained winds of 85 kt and maintained a southwestward track over the southeastern Gulf of Mexico during the 5th. A reconnaissance aircraft measured a central pressure of 988 mb and estimated surface winds of 85 kt at

00Z on the 5th. Based on a ship report of 90 kt and synoptic observations in the Florida Keys around 00Z, an intensity of 85 kt is analyzed at 00Z on the 5th, up from 75 kt originally shown in HURDAT, a minor intensity change. Key West reported sustained winds of 75 kt at 0506Z on the 5th. Another penetration center fix measured a central pressure of 985 mb and an eye diameter of 40 n mi at 0610Z on the 5th. On microfilm it is shown that Dry Tortugas reported 100 kt at 12Z and 18Z on the 5th. MWR only shows Dry Tortugas reporting gusts to 105 kt at 15Z on the 5th, thus the values in microfilm likely were incorrect. An intensity of 85 kt is analyzed at 06Z on the 5th, up from 80 kt originally shown in HURDAT, a minor intensity change. Another reconnaissance aircraft measured a central pressure of 980 mb, estimated surface winds of 90 kt and an eye diameter of 20-30 n mi at 1650Z. A central pressure of 980 mb suggests maximum surface winds of 78 kt from the south of 25N pressure-wind relationship. An eye diameter of 20-30 n mi suggests an RMW of about 15-23 n mi and the climatological value is 20 n mi. Based on a forward speed of about 7 kt, an intensity of 85 kt is analyzed at 18Z on the 5th, up from 80 kt originally show in HURDAT, a minor intensity change.

October 6:

1. Maps and old HURDAT:

- HWM analyzes a hurricane of at most 996 mb at 23.8N, 86.2W with a stationary front to the north at 12Z.
- HURDAT lists a 95 kt hurricane at 23.3N, 85.6W at 12Z.
- Microfilm shows a hurricane of at most 1004 mb at 23.5N, 85.7W with a cold front to the north at 12Z.

2. Ship highlights:

- 50 kt SSE and 1002 mb at 23.6N, 82.7W at 00Z (COADS).
- 80 kt NW and 994 mb at 23.3N, 84.9W at 03Z (COADS).
- 35 kt SE and 1010 mb at 24.2N, 81.5W at 06Z (COADS).
- 50 kt SW and 1005 mb at 21.3N, 85.1W at 12Z (COADS).
- 40 kt SW and 999 mb at 21.9N, 86W at 18Z (COADS).
- 50 kt SW and 997 mb at 22.3N, 86W at 21Z (COADS).

3. Land highlights:

a. 35 kt SW and 1004 mb at Cabo de San Antonio, Cuba at 06Z (micro).
b. 35 kt SW and 1002 mb at Cabo de San Antonio, Cuba at 12Z (micro).

4. Aircraft highlights:

a. Penetration center fix measured a central pressure of 974 mb at 23.6N, 85.4W at 0850Z (WALLET).
b. Penetration center fix measured a central pressure of 974 mb and estimated surface winds of 125 kt at 23.6N, 85.8W at 1310Z (WALLET).
c. Penetration center fix measured a central pressure of 974 mb, estimated surface winds of 70 kt and an eye diameter of 20 n mi at 22.6N, 86.7W at 1919Z (WALLET).

5. Radar highlights:

a. Key West, FL estimated an eye diameter of 25 n mi at 24N, 84.4W at 0038Z (WALLET).
b. Key West, FL estimated an eye diameter of 44 n mi at 23.4N, 84.7W at 0542Z (WALLET).
c. Key West, FL estimated a center fix at 23.6N, 85.1W at 0945Z (WALLET).

6. Discussion:

- Reanalysis: Inez continued to move southwestward producing tropical-storm-force winds along the northwest coast of Cuba. A reconnaissance aircraft measured a central pressure of 977 mb and estimated an eye diameter of 10 n mi at 2345Z on the 5th. A central pressure of 977 mb suggests maximum surface winds of 81 kt from the south of 25N pressure-wind relationship. An eye diameter of 10 n mi suggests an RMW of about 8 n mi and the climatological value is 18 n mi. Based on a forward speed of about 8 kt and RMW smaller than the climatological value, an intensity of 90 kt is analyzed at 00Z on the 6th, same as originally shown in HURDAT. The next penetration center fix measured central pressure of 974 mb at 0850Z on the 6th. A central pressure of 974 mb suggests maximum surface winds of 85 kt from the south of 25N pressure-wind relationship. Based on a forward speed of about 7 kt and small RMW, an intensity of 95 kt is analyzed at 06Z on the 6th, same as originally shown in HURDAT. The next penetration center fixes measured a central pressure of 974 mb at 1310Z and 1919Z on the 6th. An intensity of 95 kt is analyzed at 12Z and 18Z on the 6th, same as originally shown in HURDAT at 12Z and down from 100 kt at 18Z, a minor intensity change.

October 7:

1. Maps and old HURDAT:

- HWM analyzes a hurricane of at most 996 mb at 22.5N, 89.7W with a stationary front to the north at 12Z.
- HURDAT lists a 110 kt hurricane at 21.9N, 89W at 12Z.
- Microfilm shows a hurricane of at most 1004 mb at 22.1N, 88.9W with a stationary front to the north at 12Z.

2. Ship highlights:

- 40 kt N and 1006 mb at 24.3N, 88.9W at 00Z (COADS).
- 40 kt NNE and 1009 mb at 24.1N, 89.2W at 06Z (micro).
- 35 kt NNW and 1006 mb at 23.2N, 90.7W at 12Z (COADS).
- 50 kt N and 1005 mb at 23.2N, 91.2W at 18Z (COADS).

3. Land highlights:

a. 60 kt (maximum winds)(gusts to 70 kt) at Merida, Mexico (time unknown)(MWR).
b. 35 kt W and 1004 mb at Merida, Mexico at 12Z (micro/MEXICO).
c. 30 kt W and 993 mb at Merida, Mexico at 18Z (micro).

4. Aircraft highlights:

a. Penetration center fix measured a central pressure of 961 mb and estimated an eye diameter of 10 n mi at 22.3N, 87.2W at 0015Z (WALLET).
b. Radar center fix estimated an eye diameter of 30 n mi at 22.3N, 88.1W at 0605Z (WALLET).
c. Radar center fix at 22N, 89.1W at 1145Z (WALLET).
d. Penetration center fix measured a central pressure of 972 mb, estimated surface winds of 65 kt and an eye diameter of 35 n mi at 21.5N, 90W at 1825Z (WALLET).

5. Satellite highlights:

- Estimated center fix near 22.5N, 89.5W at 1545Z (WALLET)

6. Discussion:

- MWR: "Inez continued west-southwestward just south of Dry Tortugas and brushed the northern coast of Yucatan, Mexico, with hurricane conditions on October 7."
- Reanalysis: The first reconnaissance aircraft to make a penetration center fix on the 7th measured a central pressure of 961 mb and estimated an eye diameter of 10 n mi at 0015Z. A central pressure of 961 mb suggests maximum surface winds of 100 kt from the south of 25N pressure-wind relationship. An eye diameter of 10 n mi suggests an RMW of about 8 n mi and the climatological value is 16 n mi. Based on a small RMW and forward speed of about 10 kt, an intensity of 105 kt is analyzed at 00Z on the 7th, same as originally shown in HURDAT. Inez continued on a southwestward track passing just north of the Yucatan Peninsula and hurricane-force winds likely affected the northern coast. Merida, Mexico, registered sustained winds of 60 kt on the 7th. The next reconnaissance aircraft measured a central pressure of 972 mb, estimated surface winds of 65 kt and an eye diameter of 35 n mi at 1825Z. it is possible that the larger size eye diameter and higher pressure indicated a concentric eyewall cycle. A central pressure of 972 mb suggests maximum surface winds of 86 kt from the south of 25N pressure-wind relationship weakening subset. An eye diameter of 35 n mi suggests an RMW of about 26 n mi and the climatological value is 17 n mi. Based on a forward speed of about 10 kt, an intensity of 85 kt is analyzed at 18Z on the 7th, down from 115 kt originally shown in HURDAT, a major intensity change.

October 8:

1. Maps and old HURDAT:

- HWM analyzes a hurricane of at most 996 mb at 22.1N, 93.5W with a weakening front to the northeast at 12Z.
- HURDAT lists a 120 kt hurricane at 21.8N, 93.1W at 12Z.
- Microfilm shows a hurricane of at most 996 mb at 21.7N, 93.2W with a weakening front to the northeast at 12Z.

2. Ship highlights:

- 55 kt ENE and 1001 mb at 23.3N, 90.5W at 00Z (COADS).
- 35 kt SE and 1013 mb at 25.8N, 86.3W at 06Z (COADS).
- 40 kt E and 1007 mb at 23.2N, 90.5W at 12Z (COADS).

3. Aircraft highlights:

- Radar center fix estimated an eye diameter of 27 n mi at 21.6N, 90.9W at 0045Z (WALLET).
- Penetration center fix measured a central pressure of 953 mb, estimated flight level winds of 90 kt and an eye diameter of 8 n mi at 21.7N, 92.6W at 0915Z (WALLET).
- Penetration center fix measured a central pressure of 956 mb, estimated surface winds of 100 kt and an eye diameter of 12 n mi at 22N, 93.9W at 1730Z (WALLET).

4. Discussion:

- Reanalysis: Based upon the reconnaissance late on the 8th, a major intensity change is also analyzed at 00Z on the 9th as the selected intensity is 95 kt and 115 kt was originally shown in HURDAT. The next penetration center fix measured a central pressure of 953 mb and estimated an eye diameter of 8 n mi at 0915Z on the 8th. A central pressure of 953 mb suggests maximum surface winds of 110 kt from the south of 25N pressure-wind relationship intensifying subset. An eye diameter of 8 n mi suggests an RMW of about 6 n mi and the

climatological value is 15 n mi. Based on a small RMW and forward speed of about 9 kt, an intensity of 115 kt is analyzed at 12Z on the 8th, down from 120 kt originally shown in HURDAT, a minor intensity change. Another penetration center fix measured a central pressure of 956 mb, estimated surface winds of 100 kt and an eye diameter of 12 n mi at 1730Z on the 8th. An intensity of 115 kt is analyzed at 18Z on the 8th, down from 120 kt originally shown in HURDAT, a minor intensity change.

October 9:

1. Maps and old HURDAT:

- HWM analyzes a hurricane of at most 1000 mb at 23.2N, 95.8W at 12Z.
- HURDAT lists a 120 kt hurricane at 22.8N, 95.7W at 12Z.
- Microfilm shows a hurricane of at most 1000 mb at 21.7N, 95.5W at 12Z.

2. Aircraft highlights:

- Penetration center fix measured a central pressure of 948 mb, estimated flight level winds of 103 kt and an eye diameter of 30 n mi at 21.9N, 95W at 00Z (WALLET).
- Penetration center fix measured a central pressure of 951 mb, estimated flight level winds of 85 kt and an eye diameter of 10 n mi at 22.6N, 95.1W at 0620Z (WALLET).
- Penetration center fix measured a central pressure of 951 mb and estimated an eye diameter of 42-52 n mi at 22.7N, 95.5W at 12Z (WALLET).
- Penetration center fix measured a central pressure of 961 mb, estimated surface winds of 90 kt and an eye diameter of 45-50 n mi at 22.8N, 96.2W at 18Z (WALLET).

3. Radar highlights:

- Brownsville, TX estimated a center fix at 22.4N, 95.5W at 0543Z (WALLET).
- Brownsville, TX estimated a center fix at 22.7N, 95.7W at 1444Z (WALLET).
- Brownsville, TX estimated an eye diameter of 55 n mi at 23N, 96.1W at 1842Z (WALLET).

4. Discussion:

- MWR: "The hurricane also reached its maximum intensity in the Gulf of Mexico at this time with a pressure of 948 mb (28.00 in) reported by reconnaissance aircraft at 0000 GMT on the 9th."
- Reanalysis: Inez moved on a westward track and slowed its forward speed on the 9th. A penetration center fix measured a central pressure of 948 mb and estimated an eye diameter of 30 n mi at 00Z on the 9th. A central pressure of 948 mb suggests maximum surface winds of 115 kt from the south of 25N pressure-wind relationship intensifying subset. An eye diameter of 30 n mi suggests an RMW of about 23 n mi and the climatological value is 15 n mi. Based on an RMW larger than the climatological value and forward speed of about 9 kt, an intensity of 115 kt is analyzed at 00Z on the 10th, down from 120 kt originally shown in HURDAT, a minor intensity change. Another penetration center fix measured a central pressure of 951 mb and an eye diameter of 10 n mi at 0620Z on the 9th. A central pressure of 951 mb suggests maximum surface winds of 110 kt from the south of 25N pressure-wind relationship. An intensity of 115 kt is analyzed at 06Z on the 9th, down from 120 kt originally shown in HURDAT, a minor intensity change. The next reconnaissance aircraft measured a central pressure of 951 mb and estimated an eye diameter of 45-52 n mi at 12Z on the 9th. An eye diameter of 42-52 n mi suggests an RMW of about 32-39 n mi and the climatological value is 15 n mi.

Due to an RMW larger than the climatological value, an intensity of 110 kt is analyzed at 12Z on the 9th, down from 120 kt originally shown in HURDAT, a minor intensity change. The next penetration center fix measured a central pressure of 961 mb, estimated surface winds of 90 kt and an eye diameter of 45-50 n mi at 18Z on the 9th. A central pressure of 961 mb suggests maximum surface winds of 100 kt from the south of 25N pressure-wind relationship. An eye diameter of 45-50 n mi suggests an RMW of about 34-38 n mi and the climatological value is 17 n mi. Based on synoptic observations at the time of landfall on the 10th, an intensity of 100 kt is analyzed at 18Z on the 9th, down from 120 kt originally shown in HURDAT, a major intensity change. Satellite images showed a well-organized tropical cyclone with a large eye.

October 10:

1. Maps and old HURDAT:

- HWM analyzes a hurricane of at most 992 mb at 23.5N, 97.9W at 12Z.
- HURDAT lists a 105 kt hurricane at 22.8N, 97.8W at 12Z.
- Microfilm shows a hurricane of at most 1000 mb at 22.8N, 97.8W at 12Z.

2. Ship highlights:

- 35 kt SE and 1006 mb at 20.1N, 96W at 18Z (micro).

3. Land highlights:

- 50 kt NW and 1009 mb at Tampico, Mexico at 06Z (micro).
- 100 kt (maximum wind)(gusts to 110 kt) at Tampico, Mexico (time unknown, likely around 12Z) (MWR).

4. Aircraft highlights:

- Penetration center fix measured a central pressure of 960 mb, estimated surface winds of 90 kt and an eye diameter of 30 n mi at 23.2N, 96.3W at 00Z (WALLET).
- Penetration center fix measured a central pressure of 962 mb, estimated flight level winds of 90 kt and an eye diameter of 30 n mi at 23N, 96.5W at 03Z (WALLET).
- Radar center fix measured an eye diameter of 30 n mi at 23.2N, 97.2W at 0741Z (WALLET).
- Penetration center fix measured a central pressure of 961 mb and estimated an eye diameter of 35 n mi at 22.5N, 97.7W at 1213Z (WALLET).
- Radar center fix measured an eye diameter of 20 n mi at 22.6N, 98.3W at 15Z (WALLET).

5. Radar highlights:

- Brownsville, TX estimated an eye diameter of 40 n mi at 23.1N, 96.5W at 0041Z (WALLET).
- Brownsville, TX estimated an eye diameter of 31 n mi at 22.9N, 97W at 0641Z (WALLET).
- Brownsville, TX estimated an eye diameter of 20 n mi at 22.8N, 97.7W at 1215Z (WALLET).
- Brownsville, TX estimated an eye diameter of 20 n mi at 22.6N, 98.5W at 1641Z (WALLET).

6. Discussion:

- MWR: "Rising surface pressures to the north in Texas beginning late on the 9th finally forced Inez west-southwestward into Mexico just north of Tampico on

the morning of the 10th. Tampico reported gusts to 127 mph before communications were lost as the center was moving inland."

- Reanalysis: Penetration center fixes measured a central pressure of 960 mb at 00Z, 962 mb at 03Z and 961 mb at 1213Z on the 10th. Thus, an intensity of 100 kt was analyzed at 00Z, 06Z and 12Z on the 10th, down from 115 kt at 00Z, 110 kt at 06Z, and 105 kt at 12Z on the 10th originally shown in HURDAT, a minor intensity change. Landfall is analyzed at 12Z on the 10th just north of Tampico, Mexico, as a 100 kt hurricane. Maximum surface winds of 100 kt were measured at Tampico, Mexico. After landfall, Inez quickly weakened over the mountainous terrain of the Sierra Madre Occidental. Weakening to a tropical storm is analyzed at 18Z on the 10th, same as originally shown in HURDAT.

October 11:

1. Maps and old HURDAT:

- HWM analyzes a no features of interest at 12Z.
- HURDAT lists a 30 kt tropical depression at 21.5N, 100.6W at 12Z (last position).
- Microfilm shows a closed low pressure of at most 1008 mb at 21.8N, 101.2W at 12Z.

2. Discussion:

- Reanalysis: Weakening to a tropical depression is analyzed at 00Z on the 11th, same as originally shown in HURDAT. Based on synoptic observations, the last position is analyzed at 12Z on the 11th, same as originally shown in HURDAT.

Date	Original HURDAT Central Pressure	Evidence	Changes
Sep 24 12Z	1009 mb	Penetration center fix: 1009 mb at 1314Z on Sep 24th	Retained
Sep 24 18Z	1008 mb	Penetration center fix: 1008 mb at 20Z on Sep 24th	
Sep 25 12Z	1000 mb	Penetration center fix: 1000 mb at 1202Z on Sep 25th	
Sep 25 18Z	1000 mb	Penetration center fix: 1000 mb at 19Z on Sep 25th	
Sep 26 12Z	995 mb	Penetration center fix: 995 mb at 1115Z on Sep 26th	
Sep 26 18Z	982 mb	Penetration center fix: 982 mb at 1730Z on Sep 26th	
Sep 27 06Z	965 mb	Penetration center fix: 965 mb at 06Z on Sep 27th	
Sep 27 12Z	961 mb	Penetration center fix: 961 mb at 1050Z on Sep 27th	
Sep 27 18Z	962 mb	Land: Pointe-a-Pitre, Guadeloupe measured 958 mb at 17Z on Sept 27th	958 mb
Sep 28 00Z		Penetration center fix: 964 mb at 0245Z on Sep 28th	964 mb
Sep 28	955 mb	Penetration center fix: 955 mb at 0545Z on Sep	Retained

06Z		28th	
Sep 28 18Z	932 mb	Penetration center fix: 927 mb at 1920Z on Sep 28th	927 mb
Sep 29 00Z	929 mb	Penetration center fix: 928 mb at 0140Z on Sep 29th	928 mb
Sep 30 00Z	987 mb	Penetration center fix: 987 mb at 2355Z on Sep 29th	Retained
Oct 02 18Z	999 mb	Penetration center fix: 999 mb at 1815Z on Oct 02nd	
Oct 03 00Z	995 mb	Penetration center fix: 995 mb at 220Z on Oct 02nd	
Oct 03 06Z	989 mb	Penetration center fix: 989 mb at 0605Z on Oct 03rd	
Oct 03 12Z	985 mb	Penetration center fix: 985 mb at 1155Z on Oct 03rd	
Oct 03 18Z	986 mb	Penetration center fix: 986 mb at 18Z on Oct 03rd	
Oct 04 00Z	985 mb	Penetration center fix: 985 mb at 2315Z on Oct 03rd	
Oct 04 06Z		Penetration center fix: 988 mb at 0630Z on Oct 04th	988 mb
Oct 04 12Z	987 mb	Penetration center fix: 987 mb at 12Z on Oct 04th	Retained
Oct 04 18Z	984 mb	Penetration center fix: 984 mb at 1745Z on Oct 04th	
Oct 05 00Z	988 mb	Penetration center fix: 988 mb at 00Z on Oct 05th	
Oct 05 06Z	985 mb	Penetration center fix: 985 mb at 0610Z on Oct 05th	
Oct 05 18Z	980 mb	Penetration center fix: 980 mb at 18Z on Oct 05th	
Oct 06 00Z	970 mb	Penetration center fix: 977 mb at 2345Z on Oct 05th	977 mb
Oct 06 06Z	983 mb	Penetration center fix: 974 mb at 0850Z on Oct 06th	974 mb
Oct 06 12Z	974 mb	Penetration center fix: 974 mb at 1310Z on Oct 06th	Retained
Oct 06 18Z	974 mb	Penetration center fix: 974 mb at 1919Z on Oct 06th	
Oct 07 00Z	961 mb	Penetration center fix: 961 mb at 0015Z on Oct 07th	
Oct 07 18Z	972 mb	Penetration center fix: 972 mb at 1825Z on Oct 07th	
Oct 08 00Z	972 mb		Removed
Oct 08 12Z	953 mb	Penetration center fix: 953 mb at 0915Z on Oct 08th	Retained
Oct 08 18Z	956 mb	Penetration center fix: 956 mb at 1730Z on Oct 08th	

Oct 09 00Z	948 mb	Penetration center fix: 948 mb at 00Z on Oct 09th	
Oct 09 06Z	951 mb	Penetration center fix: 951 mb at 0620Z on Oct 09th	
Oct 09 12Z		Penetration center fix: 951 mb at 12Z on Oct 09th	951 mb
Oct 09 18Z	953 mb	Penetration center fix: 961 mb at 18Z on Oct 09th	961 mb
Oct 10 00Z	960 mb	Penetration center fix: 961 mb at 00Z on Oct 10th	Retained
Oct 10 06Z	962 mb	Penetration center fix: 962 mb at 03Z on Oct 10th	
Oct 10 12Z	961 mb	Penetration center fix: 961 mb at 1213Z on Oct 10th	

Sources: NHC microfilm maps, the Historical Weather Maps series, the COADS ship database, Monthly Weather Review, Navy reconnaissance book, Mariners Weather Log, Satellite images from NCDC, NSIDC and Allison (1972), and NHC Storm Wallets.

Tropical Storm Judith [September 27-30, 1966] – AL101966

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44795 09/27/1966 M= 4 10 SNBR= 960 JUDITH      XING=0 SSS=0
44800 09/27*108 432  25    0*110 445  25    0*112 458  25    0*114 471  25    0*
44800 09/27*108 432  25    0*110 445  25    0*112 458  30    0*114 471  30    0*
                                                         **                **

44805 09/28*116 484  30    0*119 498  30    0*122 512  40    0*125 527  40    0*
44805 09/28*116 484  30    0*119 498  30    0*122 512  35    0*125 527  35    0*
                                                         **                **

44810 09/29*128 542  40 1013*131 561  40    0*134 580  45    0*136 597  45 1007*
44810 09/29*128 542  35    0*131 561  35    0*134 580  40 1009*136 597  40 1007*
                     **    *          **                ** ****          **

44815 09/30*138 612  30    0*138 624  30    0*138 634  30    0*  0   0   0    0*
44815 09/30*138 614  35    0*138 631  30    0*  0   0   0    0*  0   0   0    0*
                ***  **          ***            *   *   *
44820 TS
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Tropical Storm Landfall

09/29 22Z 13.8N 60.9W 40 kt St. Lucia

Significant Revisions:

1. Weakening to a tropical depression delayed 6 hours based on observations in the Lesser Antilles.

2. Dissipation indicated to occur 6 hours earlier upon ship observations.

Daily Metadata:

September 26:

1. Maps and old HURDAT:

- HWM analyzes a spot low pressure at 11.2N, 40.4W at 12Z.
- HURDAT does not list an organized system on this date.
- Microfilm does not show an organized system at 12Z.

2. Ship highlights:
- No gales or low pressures.

3. Satellite highlights:
- NIMBUS 2 estimated a center fix near 12N, 44W at 1441Z (WALLET).

4. Discussion:
- MWR: "Ship reports and satellite photographs on the 26th and 27th of September gave some indications of circulation in the south-central North Atlantic."
- Reanalysis: A tropical disturbance was located about 900 miles to the east of the Lesser Antilles based on surface observations and a satellite image.

September 27:

1. Maps and old HURDAT:
- HWM does not show an organized system at 12Z.
- HURDAT lists a 25 kt tropical depression at 11.2N, 45.8W at 12Z.
- Microfilm shows a tropical wave from 5N-17N, 43W-50W at 12Z.

2. Ship highlights:
- 30 kt SE and 1013 mb at 16.8N, 45.6W at 15Z.

3. Satellite highlights:
- ESSA 2 estimated a center fix near 11.5N, 46.5W at 1440Z (WALLET).

4. Discussion:
- Reanalysis: The first position is analyzed at 00Z as a 25 kt tropical depression, same as originally shown in HURDAT. The time of genesis is uncertain due to the sparse data available between the Lesser Antilles and Africa. The satellite image does show an increase in convection and organization compared to 24 hours before.

September 28:

1. Maps and old HURDAT:
- HWM analyzes a tropical storm at 12.5N, 51W at 12Z.
- HURDAT lists a 40 kt tropical storm at 12.2N, 51.3W at 12Z.
- Microfilm shows a tropical storm of at most 1008 mb at 11.9N, 50.5W at 12Z.

2. Ship highlights:
- No gales or low pressures.

3. Satellite highlights:
- ESSA 2 estimated a center fix near 11.8N, 50.5W at 1203Z (WALLET).

4. Discussion:
- MWR: "On the 28th the ESSA 2 photograph showed an area of cloudiness larger than that associated with hurricane Inez, but with only slight indications of circulation."

- Advisory: “Pictures received from the weather satellite ESSA 2 show that tropical storm Judith has developed in the Atlantic about 650 miles east of the Windward Islands. … Highest winds are estimated on the basis of the satellite photograph to be at least 45 mph near the center.”
- Reanalysis: Intensification to a tropical storm is analyzed at 12Z, same as originally shown in HURDAT. This is also uncertain due to the sparse data. The satellite image shows a large area of convection but no organized banding.

September 29:

1. Maps and old HURDAT:

- HWM analyzes a tropical storm of at most 1008 mb at 13.6N, 55.9W at 12Z.
- HURDAT lists a 45 kt tropical storm at 13.4N, 58W at 12Z.
- Microfilm shows a tropical storm of at most 1008 mb at 13N, 57.2W at 12Z.

2. Ship highlights:

- No gales or low pressures.

3. Aircraft highlights:

- Penetration center fix measured a central pressure of 1013 mb and estimated an eye diameter of 30 nm at 12.8N, 54.4W at 0110Z (WALLET).
- Penetration center fix measured a central pressure of 1009 mb and estimated surface winds of 40 kt at 13.5N, 59W at 14Z (WALLET).
- Penetration center fix measured a central pressure of 1007 mb, estimated surface winds of 25 kt and flight level winds of 45 kt at 13.8N, 59.8W at 18Z (WALLET).
- Radar center fix at 13.2N, 60.1W at 23Z (WALLET).

4. Discussion:

- MWR: “The following day [29] reconnaissance aircraft reported the central pressure as 1007 mb (29.74 in) and the maximum flight-level wind speed 50 mph. Judith was centered a short distance north of Barbados and was apparently decreasing in intensity at that time.”
- Reanalysis: The first reconnaissance aircraft investigated Judith early on this day making a center fix at 0110Z. A central pressure of 1013 mb appears in HURDAT at 00Z, obtained by the reconnaissance aircraft during the nighttime flight, but appears to have been a peripheral pressure based on ship reports suggesting a lower central pressure. Thus, it has been removed from HURDAT. A satellite image captured at 1240Z showed a sheared tropical cyclones with an exposed center and most of the deep convection over the southeast quadrant. Another penetration center fix occurred at 14Z measuring a central pressure of 1009 mb and estimating surface winds of 40 kt. A central pressure of 1009 mb has been added to HURDAT and an intensity of 40 kt is analyzed, both at 12Z. 40 kt is the peak intensity of this tropical storm, down from 45 kt originally in HURDAT. The last penetration center fix occurred at 18Z measuring a central pressure of 1007 mb. A central pressure of 1007 mb suggests maximum surface winds of 32 kt from the south of 25N Brown et al. pressure-wind relationship. Due to the forward speed of about 17 kt, an intensity of 40 is analyzed at 18Z, down from 45 kt originally in HURDAT, a minor intensity change. Around 22Z, the center of Judith crossed the island of St. Lucia with an estimated intensity of 40 kt.

September 30:

1. Maps and old HURDAT:

- HWM analyzes a closed low pressure of at most 1008 mb at 13.8N, 64W at 12Z.
- HURDAT lists a 30 kt tropical depression at 13.8N, 63.4W at 12Z (last position).
- Microfilm shows a tropical wave from 10N-16N, 61W-65W at 12Z.

2. Ship highlights:
- 35 kt near the west coast of Marie Galante (time unknown, but likely early on the 30th) (MWR).

3. Land highlights:
- 32 kt at Martinique (time unknown, but likely early on the 30th.) (MWR)

4. Discussion:
- MWR: "After passing through the island chain Judith was no longer of storm intensity. It continued to weaken and was downgraded to easterly wave status on the 30th. The strongest surface winds reported in the island chain during the passage of Judith were 37 mph at Martinique and 40 mph on a ship near the west coast of Marie Galante."
- Reanalysis: Judith quickly weakened over the eastern Caribbean. Based on the MWR report of a ship experiencing gale-force winds on this day (possibly very early on this day), weakening to a tropical depression is delayed until 06Z, six hours later than originally shown in HURDAT. Ship and aircraft reconnaissance observations at 12Z suggest that Judith had weakened to a tropical wave, thus the last position is analyzed at 06Z, six hours earlier than originally shown in HURDAT. The satellite image shows a disorganized area of convection and an upper-level trough or low is visibly north of the remnants of Judith, likely responsible for the strong wind shear affecting the system.

October 1:

1. Maps and old HURDAT:
- HWM does not show an organized system on this date.
- Microfilm shows a tropical wave from 13N-18N, 60W-71W at 12Z.

2. Discussion:
   a. Reanalysis: The remnants of Judith did not show signs of redevelopment after dissipation.

3. Ship highlights:
- No gales or low pressures.

Sources: NHC microfilm maps, the Historical Weather Maps series, the COADS ship database, Monthly Weather Review, Navy reconnaissance book, Mariners Weather Log, Satellite images from NCDC and NSIDC, and NHC Storm Wallets.

Hurricane Lois [November 4-14, 1966] – AL111966

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44825 11/04/1966 M=11 11 SNBR= 961 LOIS        XING=0 SSS=0
44830 11/04*  0   0   0    0*  0   0   0    0*265 500  25    0*265 522  25    0*
44830 11/04*  0   0   0    0*  0   0   0    0S255 505  30    0S255 512  30    0*
                                             **** ***  **     **** ***  **

44835 11/05*262 540  25    0*256 554  25    0*250 560  25    0*248 557  25  998*
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44835 11/05S254 521  35    0S253 533  35    0S252 548  35    0S249 557  40  998*
           **** ***  **     **** ***  **     **** ***  **     ****       **

44840 11/06*245 552  25  998*243 546  30    0*240 540  30    0*239 535  50  995*
44840 11/06*245 552  40  998*242 547  40    0*240 542  45    0*239 537  50  995*
                     **     **** ***  **          ***  **          ***

44845 11/07*239 530  50    0*238 526  50    0*237 523  55    0*240 514  60  986*
44845 11/07*239 532  50    0*238 526  55    0*239 520  60    0*242 510  65  986*
                ***                   **     *** ***  **      *** ***  **

44850 11/08*248 498  70  986*258 477  70    0*274 456  70    0*301 434  70    0*
44850 11/08*246 498  70    0*258 477  70    0*275 456  70    0*300 434  75    0*
           ***            *                  ***              ***       **

44855 11/09*326 413  70    0*342 398  70    0*358 384  70  989*373 368  70  989*
44855 11/09*326 413  75    0*343 399  75    0*358 386  75  983*373 370  70  989*
                     **      *** ***  **          ***  **  ***     ***

44860 11/10*388 352  70    0*400 337  70    0*412 322  65  988*426 305  65    0*
44860 11/10*388 352  70    0*402 337  70    0*416 321  65  988E427 306  60    0*
                             ***              *** ***         **** ***  **

44865 11/11*439 288  65    0*450 272  65    0*458 257  65    0*464 239  65    0*
44865 11/11E436 290  60    0E445 275  55    0E449 260  55    0E450 245  50    0*
           **** ***  **     **** ***  **     **** ***  **     **** ***  **

44870 11/12E468 221  65    0E470 210  60    0E467 200  55    0E459 186  45    0*
44870 11/12E450 233  50    0E450 220  50    0E450 203  45    0E449 186  45    0*
           *** ***  **      *** ***  **      *** ***  **      ***

44875 11/13E450 172  45    0E443 163  45    0E435 155  45 1016E425 148  45    0*
44875 11/13E445 172  45    0E440 163  45    0E432 160  40    0E420 165  35    0*
           ***              ***              *** ***  **    * *** ***  **

44880 11/14E412 143  45    0*  0   0   0    0*  0   0   0    0*  0   0   0    0*
44880 11/14E411 169  30    0E405 175  30    0*  0   0   0    0*  0   0   0    0*
           *** ***  **     **** ***  **
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44885 HR

Significant Revisions:

1. Analyzed as a subtropical cyclone between genesis on November 4th at 12Z and 5th at 18Z based on synoptic and satellite data.
2. Significant track changes on November 5th between 00Z and 12Z, 11th at 18Z through the 12th at 18Z and 13th at 18Z through the 14th at 00Z based on synoptic observations.
1. Significant increase in intensity on November 5th and 6th based on synoptic and reconnaissance aircraft data.
2. Significant reduction in intensity on November 11th and 12th based on ship observations.
3. Transition to an extratropical cyclone is analyzed 30 hours earlier than originally shown in HURDAT.

4. Dissipation indicated to occur six hours later upon ship observations.

Daily Metadata:

November 1:

1. Maps and old HURDAT:

- HWM analyzes an extratropical cyclone near 35N, 30W at 12Z.
- HURDAT does not list an organized system on this date.
- Microfilm shows an extratropical cyclone near 34N, 27W at 12Z.

2. Ship highlights:

- 45 kt NE and 1012 mb at 39.9N, 29.4W at 12Z (COADS).
- 45 kt E and 1014 mb at 40.6N, 28.6W at 18Z (COADS).

November 2:

1. Maps and old HURDAT:

- HWM analyzes an extratropical cyclone near 31.5N, 34W at 12Z.
- HURDAT does not list an organized system on this date.
- Microfilm shows an extratropical cyclone near 31N, 33W at 12Z.

2. Ship highlights:

- 45 kt E and 1018 mb at 41.5N, 27.6W at 00Z (COADS).
- 40 kt E and 1012 mb at 38.9N, 31.5W at 06Z (COADS).
- 45 kt E and 1018 mb at 39.8N, 33.5W at 12Z (COADS).
- 45 kt NE and 1010 mb at 36.1N, 39.1W at 18Z (COADS).

November 3:

1. Maps and old HURDAT:

- HWM analyzes a closed low pressure of at most 1008 mb at 29.6N, 39.7W at 12Z.
- HURDAT does not list an organized system on this date.
- Microfilm shows a closed low pressure of at most 1004 mb at 26.5N, 31.5W at 12Z.

2. Ship highlights:

- 45 kt NE and 1015 mb at 36.8N, 37.2W at 00Z (COADS).
- 45 kt NE and 1019 mb at 37.3N, 36.5W at 06Z (COADS).
- 50 kt NE and 1018 mb at 34.6N, 44.6W at 12Z (COADS).
- 45 kt NE and 1018 mb at 34.9N, 43.7W at 18Z (COADS).

3. Discussion:

- Reanalysis: A non-tropical area of low pressure developed in the tail-end of a weakening frontal boundary over the central Atlantic. Surface observations indicate that another low pressure formed to the west and became better organized as the former weakened.

November 4:

1. Maps and old HURDAT:

- HWM analyzes a closed low pressure of at most 1000 mb at 26.6N, 49.9W at 12Z.

- HURDAT lists a 25 kt tropical depression at 26.5N, 50W at 12Z.
- Microfilm shows a closed low pressure of at most 1004 mb at 25.1N, 50.5W at 12Z.

2. Ship highlights:
- 40 kt NE and 1028 mb at 38.8N, 42.6W at 00Z (COADS).
- 40 kt ENE and 1023 mb at 38N, 45.8W at 06Z (COADS).
- 30 kt NNE and 995 mb [likely 10 mb too low] at 25.4N, 51.9W at 12Z (COADS).
- 5 kt W and 1001 mb at 23.9N, 51.3W at 18Z (COADS).

3. Satellite highlights:
- Center fix at 26.5N, 50W at 1116Z (WALLET).

4. Discussion:
- MWR: "Lois first revealed itself as a small cloud vortex on the ESSA 2 satellite photograph on the morning of November 4. Weather charts showed a low pressure area in the region extending from the surface up through the middle levels of the atmosphere. However, because of the rather cold temperatures near the center, the circulation at that time did not appear to be tropical in nature."
- Reanalysis: Based on synoptic observations, a subtropical depression is analyzed to have developed at 12Z. The time of genesis is the same as originally shown in HURDAT but the original classification was as a tropical cyclone. Satellite images suggest that the system still retained some extratropical characteristics although the surface observations showed that the circulation was generally isothermal.

November 5:

1. Maps and old HURDAT:
- HWM analyzes a closed low pressure of at most 1004 mb at 25.2N, 55.6W at 12Z.
- HURDAT lists a 25 kt tropical depression at 25N, 56W at 12Z.
- Microfilm shows a closed low pressure of at most 1004 mb at 24.7N, 55.3W at 12Z.

2. Ship highlights:
- 35 kt N and 1005 mb at 24.9N, 52.5W at 00Z (COADS).
- 15 kt SE and 1005 mb at 27.5N, 51.9W at 06Z (COADS).
- 20 kt NE and 1003 mb at 26.2N, 55.4W at 12Z (COADS).
- 35 kt N and 1006 mb at 25.1N, 61.4W at 18Z (COADS).

3. Aircraft highlights:
- Penetration center fix measured a central pressure of 998 mb, estimated surface winds of 35 kt and a 5 nm eye diameter at 24.8N, 55.9W at 1620Z (WALLET).

4. Discussion:
- Reanalysis: The subtropical depression initially moved slowly westward and turned to the south on this date. Intensification to a subtropical storm is analyzed at 00Z based on a ship observation of 35 kt N at this time. Also at this time, a ship reported a 95 kt N wind but this observation appears to be erroneous and has been discounted. A reconnaissance aircraft investigated the system at 1620Z measuring a central pressure of 998 mb and estimating surface winds of 35 kt. A central pressure of 998 mb suggests maximum surface winds of

51 kt south of 25N and 47 kt north of 25N according to the Brown et al. pressure-wind relationship. Based on a forward speed of about 7 kt and broad circulation, an intensity of 40 kt is analyzed at 18Z, up from 25 kt originally shown in HURDAT, a minor intensity change. A central pressure of 998 mb was present in the original HURDAT and it is retained.

November 6:

1. Maps and old HURDAT:

- HWM analyzes a closed low pressure of at most 1008 mb at 24.2N, 53.8W at 12Z.
- HURDAT lists a 30 kt tropical depression at 24N, 54W at 12Z.
- Microfilm shows a closed low pressure of at most 1008 mb at 24N, 54W at 12Z.

2. Ship highlights:

- 20 kt NE and 1005 mb at 24.8N, 56W at 00Z (COADS).
- 40 kt N and 1007 mb at 24.8N, 56W at 18Z (COADS).

3. Aircraft highlights:

- Penetration center fix measured a central pressure of 995 mb, estimated surface winds of 50 kt and a 10 n mi eye diameter at 24N, 53.8W at 1755Z (WALLET).

4. Discussion:

- MWR: "During the next two days the system showed little movement while a gradual warming was noted at all levels. The satellite revealed a progressive enlargement and degree of organization of the associated cloud spiral and on November 6 a US. Air Force reconnaissance flight found that an eye had formed with surrounding winds of 55 mph."
- Reanalysis: Lois turned to the east and gradually intensified. Based on satellite images and surface observations, it is analyzed to have become a tropical storm at 00Z. A central pressure of 998 mb was present in the original HURDAT at 00Z and although there are no reports of a reconnaissance aircraft investigation and nearby ships, it appears reasonable and it is retained. Another reconnaissance aircraft investigated Lois at 1755Z measuring a central pressure of 995 mb, estimated surface winds of 50 kt and a 10 n mi eye diameter. A central pressure of 995 mb suggests maximum surface winds of 56 kt north of 25N and 52 kt from the south of 25N pressure-wind relationship. A 10 n mi eye diameter suggests an RMW of 8 n mi and the climatological value is 19 n mi. Based on a forward speed of 4 kt and small RMW, an intensity of 50 kt is analyzed at 18Z, same as originally shown in HURDAT. A central pressure of 995 mb was present in the original HURDAT and has been retained.

November 7:

1. Maps and old HURDAT:

- HWM analyzes a tropical storm of at most 1004 mb at 24.3N, 51.7W at 12Z.
- HURDAT lists a 55 kt tropical storm at 23.7N, 52.3W at 12Z.
- Microfilm shows a tropical storm of at most 1008 mb at 24N, 51W at 12Z.

2. Ship highlights:

- 15 kt ENE and 1003 mb at 24.5N, 51.5W at 12Z (COADS).
- 45 kt S and 1002 mb at 22.8N, 50.5W at 18Z (COADS).

3. Aircraft highlights:

- Penetration center fix measured a central pressure of 986 mb, estimated surface winds of 65 kt and a 20 n mi eye diameter at 24.5N, 50.8W at 1910Z (WALLET).
- Penetration center fix measured a central pressure of 984 mb, estimated surface winds of 70 kt and a 20 n mi eye diameter at 25.1N, 50.5W at 2050Z (WALLET).

4. Satellite highlights:
- Center fix at 23.8N, 51.2W at 1120Z (WALLET).

5. Discussion:
- Reanalysis: Satellite images showed a small system with most of the convection over the northern and eastern quadrant. A reconnaissance aircraft investigated Lois at 1910Z measuring a central pressure of 986 mb, estimating surface winds of 65 kt and a 20 n mi eye diameter. A central pressure of 986 mb suggests maximum surface winds of 70 kt north of 25N and 65 kt from the south of 25N pressure-wind relationship. A 20 n mi eye diameter suggests an RMW of 15 n mi and the climatological value is 20 n mi. Based on a forward speed of 12 kt and small RMW, an intensity of 65 kt is analyzed at 18Z, up from 60 kt originally shown in HURDAT. Intensification to a hurricane is analyzed six hours earlier than originally shown in HURDAT. A central pressure of 986 mb was present in the original HURDAT and has been retained.

November 8:

1. Maps and old HURDAT:
- HWM analyzes a hurricane of at most 1004 mb at 27.8N, 44.5W at 12Z.
- HURDAT lists a 70 kt hurricane at 27.4N, 45.6W at 12Z.
- Microfilm shows a hurricane of at most 1008 mb at 28.5N, 45.3W at 12Z.

2. Ship highlights:
- 60 kt N and 999 mb at 26N, 48W at 03Z (micro/WALLET).
- 20 kt SE and 1005 mb at 27.9N, 45W at 12Z (COADS).
- 35 kt N and 1001 mb at 28.4N, 45W at 15Z (COADS).

3. Satellite highlights:
- Center fix at 30N, 44.4W at 1635Z (WALLET).

4. Aircraft highlights:
- Radar center fix estimated surface winds of 55 kt at 28.1N, 45W at 1048Z (WALLET).

5. Discussion:
- Reanalysis: Satellite images indicated that Lois had become much better organized with the center embedded in the CDO. A central pressure of 986 mb was present in the original HURDAT at 00Z but it has been removed since the reconnaissance aircraft at 2050Z on the 8th measured 984 mb, suggesting a lower central pressure at 00Z on this date. Lois turned to the northeast and accelerated over the central Atlantic.

November 9:

1. Maps and old HURDAT:

- HWM analyzes a hurricane of at most 1000 mb at 36.4N, 38.3W with a cold front to the northwest at 12Z.
- HURDAT lists a 70 kt hurricane at 35.8N, 38.4W at 12Z.
- Microfilm shows a hurricane of at most 1004 mb at 36.3N, 38.6W with a cold front to the northwest at 12Z.

2. Ship highlights:
- 35 kt SE and 1002 mb at 30.9N, 40.4W at 00Z (COADS).
- 35 kt SE and 1003 mb at 35.7N, 38.9W at 06Z (COADS).
- 55 kt SW and 1000 mb at 33.9N, 38.7W at 09Z (COADS).
- 40 kt S and 1004 mb at 34.5N, 37.1W at 12Z (micro).
- 40 kt SE and 1016 mb at 40.1N, 33.1W at 18Z (COADS).

3. Aircraft highlights:
- Penetration center fix measured a central pressure of 983 mb at 35.8N, 38.9W at 1116Z (WALLET).
- Penetration center fix measured a central pressure of 989 mb, estimated surface winds of 65 kt and a 40 nm eye diameter at 36.6N, 36.8W at 1930Z (WALLET).

4. Satellite highlights:
- Center fix at 34.5N, 39W at 1030Z (WALLET).

5. Discussion:
- Reanalysis: A reconnaissance aircraft investigated Lois at 1116Z measuring a central pressure of 983 mb. A central pressure of 983 mb suggests maximum surface winds of 69 kt north of 25N and 70 kt from the north of 35N from the Landsea et al. pressure-wind relationship. Based on a forward speed of 20 kt, an intensity of 75 kt is analyzed at 12Z, up from 70 kt originally shown in HURDAT. A central pressure of 989 mb was present in the original HURDAT at 12Z and has been replaced with 983 mb. 75 kt is also the peak intensity of this tropical cyclone, up from 70 kt originally in HURDAT. Another penetration center fix measured a central pressure of 989 mb, estimated surface winds of 65 kt and a 40 n mi eye diameter at 1930Z. A central pressure of 989 mb suggests maximum surface winds of 64 kt from the 35N pressure-wind relationship. Due to a forward speed of about 22 kt, an intensity of 70 kt is analyzed at 18Z, same as originally shown in HURDAT.

November 10:

1. Maps and old HURDAT:
- HWM analyzes a hurricane of at most 1004 mb at 42.3N, 31.7W with a cold front to the north at 12Z.
- HURDAT lists a 65 kt hurricane at 41.2N, 32.2W at 12Z.
- Microfilm shows a hurricane of at most 1008 mb at 42N, 32.5W at 12Z.

2. Ship highlights:
- 45 kt SW and 1014 mb at 37.1N, 33.4W at 00Z (COADS).
- 40 kt SE and 1017 mb at 39.7N, 29.3W at 06Z (COADS).
- 35 kt S and 1023 mb at 39.3N, 31W at 12Z (COADS).
- 45 kt SSE and 1010 mb at 43.1N, 27.1W at 18Z (COADS).

3. Aircraft highlights:

- Penetration center fix measured a central pressure of 988 mb and estimated surface winds of 65 kt at 42.6N, 32.1W at 1352Z (WALLET).

4. Satellite highlights:
- Center fix at 42N, 32.5W at 1130Z (WALLET).

5. Discussion:
- MWR: "On the 10th, gale force winds of 50 mph occurred at Corvo in the Azores."
- Reanalysis: A reconnaissance aircraft investigated Lois at 1352Z measuring a central pressure of 988 mb and estimating surface winds of 65 kt. A central pressure of 988 mb suggests maximum surface winds of 65 kt north 35N pressure-wind relationship. Based on a forward speed of 12 kt and small RMW, an intensity of 65 kt is analyzed at 12Z, same as originally shown in HURDAT. A central pressure of 988 mb was present in the original HURDAT at this time and has been retained. Synoptic observations and satellite images early on the 11th indicated that transition to an extratropical cyclone occurred late on this date as Lois interacted with a frontal boundary. Extratropical transition is analyzed at 18Z, 30 hours earlier than originally shown in HURDAT. Weakening below hurricane intensity is analyzed at 18Z, six hours earlier than originally shown in HURDAT.

November 11:

1. Maps and old HURDAT:
- HWM analyzes a hurricane of at most 1000 mb at 46.3N, 25.5W with a cold front to the northeast at 12Z.
- HURDAT lists a 65 kt hurricane at 45.8N, 25.7W at 12Z.
- Microfilm shows that the hurricane has moved north of the surface analysis map.

2. Ship highlights:
- 35 kt N and 1007 mb at 45.8N, 31.2W at 00Z (COADS).
- 50 kt N and 1001 mb at 46N, 29.5W at 06Z (COADS).
- 50 kt NNW and 999 mb at 45.8N, 28.8W at 09Z (COADS).
- 50 kt NW and 1000 mb at 45.7N, 28.2W at 12Z (COADS).
- 35 kt N and 998 mb at 45.9N, 26.4W at 18Z (COADS).

3. Discussion:
- Reanalysis: Lois gradually lost strength on this date while turning to the east over the northeastern Atlantic. A few ships near the center reported gale and storm-force winds, up to 50 kt.

November 12:

1. Maps and old HURDAT:
- HWM analyzes an extratropical cyclone of at most 1000 mb at 46.8N, 19.9W at 12Z.
- HURDAT lists a 55 kt extratropical cyclone at 46.7N, 20W at 12Z.
- Microfilm shows that the hurricane has moved north of the surface analysis map.

2. Ship highlights:
- 40 kt N and 999 mb at 46.1N, 24.4W at 00Z (COADS).
- 40 kt S and 992 mb at 44N, 21.2W at 06Z (COADS).

- 40 kt NW and 996 mb at 43.8N, 21.4W at 12Z (COADS).
- 40 kt NNW and 1006 mb at 43.5N, 22.1W at 18Z (COADS).

3. Discussion:
- MWR: "By the 12th the storm had lost most of its tropical characteristics and began a slow turn to the east and southeast as a weakened low pressure area."
- Reanalysis: Lois continued on an eastward track and slowly weakened. A few ships reported gale-force winds. Large track alterations are introduced at 06Z and 12Z on the 12th based on synoptic observations suggesting the center of the cyclone was farther south than originally shown in HURDAT.

November 13:

1. Maps and old HURDAT:
- HWM analyzes an extratropical cyclone of at most 1008 mb at 43.3N, 16W at 12Z.
- HURDAT lists a 45 kt extratropical cyclone at 43.5N, 15.5W at 12Z.
- Microfilm shows that the hurricane has moved north of the surface analysis map.

2. Ship highlights:
- 35 kt NNE and 1019 mb at 47.3N, 21.8W at 00Z (COADS).
- 40 kt NW and 1004 mb at 43.6N, 17.7W at 06Z (COADS).

3. Discussion:
- MWR: "On the 13th, the remnants of Lois finally became unidentifiable in a region about 300 mi. west of Portugal."
- Reanalysis: On this date, Lois turned to the south and continued to weaken. A central pressure of 1016 mb was present in the original HURDAT at 12Z and has been removed based on synoptic observations. Major track changes are introduced at 18Z on this date and 00Z on the 14th based on surface observations.

November 14:

1. Maps and old HURDAT:
- HWM does not show an organized system at 12Z.
- HURDAT lists a 45 kt extratropical cyclone at 41.2N, 14.3W at 00Z (last position).
- Microfilm shows that the hurricane has moved north of the surface analysis map.

2. Discussion:
- Reanalysis: Weakening to an extratropical depression is analyzed at 00Z based on the synoptic observations. Ship data at 12Z indicated that the surface circulation had dissipated, thus the last position is analyzed at 06Z, six hours later than originally shown in HURDAT.

Sources: NHC microfilm maps, the Historical Weather Maps series, the COADS ship database, Monthly Weather Review, Navy reconnaissance book, Mariners Weather Log, Satellite images from NCDC and NSIDC, and NHC Storm Wallets.

New Tropical Storm [June 28 – July 2, 1966] – AL121966

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45285 06/28/1966 M= 5  2 SNBR= 968 UNNAMED     XING=0 SSS=0
45290 06/28*  0   0   0    0*  0   0   0    0*197 825  25    0*203 825  25    0*
45295 06/29*210 825  30    0*218 825  35    0*225 825  35 1008*232 825  40 1007*
45300 06/30*239 825  40 1004*246 825  40 1005*252 825  40    0*258 826  40    0*
45305 07/01*263 827  40 1004*269 828  40    0*276 830  40 1006*286 831  40    0*
45310 07/02*298 831  35    0*309 829  30    0*315 827  25    0*318 824  20    0*
45315 TS
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Tropical Storm Landfall

06/29 14Z 22.7N 82.5W 35 kt Havana Province, Cuba

U.S. Tropical Storm Landfall

07/01 22Z 29.3N 83.1W 40 kt FL

Significant Revisions:

1. A new tropical storm has been added to HURDAT, not previously shown in McAdie et al. (2009).

Daily Metadata:

June 27:

1. Maps and old HURDAT:
- HWM analyzes a trough or tropical wave from 16N-27N, 64W-82W at 12Z.
- Microfilm shows a tropical wave from 15N-22N, along 81W at 12.

2. Discussion:
- Reanalysis: A strong tropical wave over the western Caribbean Sea was producing a large area of convection based on satellite images. The disturbance was likely interacting with a weakening frontal boundary to the north. Surface observations indicate that the disturbance did not have a well-defined center on this date.

June 28:

1. Maps and old HURDAT:
- HWM analyzes a closed low pressure of at most 1008 mb at 20N, 85W with a trough extending to the northeast at 12Z.
- Microfilm shows a closed low pressure of at most 1008 mb at 20.6N, 82W at 12Z.
- MWL shows a center of low pressure at 19.5N, 82.9W at 12Z.
- Miami WB advisory lists a tropical depression at 20.5N, 82W at 16Z (first advisory).

2. Discussion:
- MWR: “A weak tropical depression formed over the northwestern Caribbean Sea on June 28.”
- Reanalysis: The active tropical wave is analyzed to have developed a well-defined center based on synoptic observations and a 25 kt tropical depression formed at 12Z. This is consistent with the first official Weather Bureau advisory issued at 16Z. Satellite images showed a large area of convection. The center appears to be near the western edge of the convection, an indication of westerly wind shear affecting the system.

June 29:

1. Maps and old HURDAT:
- HWM analyzes a closed low pressure of at most 1008 mb at 21N, 84W at 12Z.
- Microfilm shows a tropical wave over the western Caribbean Sea at 12Z.
- MWL shows a center of low pressure at 22.6N, 82.1W at 12Z.
- Miami WB advisory lists a tropical depression at 22N, 82.5W at 10Z.

2. Ship highlights:
- 35 kt SE and 1011 mb at 23.4N, 79.2W at 09Z (COADS).
- 5 kt SW and 1009 mb at Nueva Gerona, Cuba at 12Z (micro).
- 5 kt NW and 1008 mb at Havana, Cuba at 18Z (micro).
- 45 kt SE and 1010 mb at 23.5N, 80.2W at 18Z (COADS).
- 35 kt SE and 1010 mb at 23.4N, 80.3W at 18Z (COADS).

3. Discussion:
- MWR: "During the succeeding four days it moved slowly northward, crossed Cuba …"
- Miami WB Advisory: "NAVY reconnaissance of the tropical depression shows a broad low pressure area off the north coast of extreme western Cuba. There are two or more minor wind circulation centers. One is in the vicinity of latitude 23.5N longitude 82.5W or about 80 miles south southwest of Key West and 200 miles southwest of Miami."
- Reanalysis: The tropical depression moved slowly northward toward western Cuba and intensified. A ship reported SE 35 kt just north of Cuba at 09Z. The tropical cyclone is analyzed to have become a 35 kt tropical storm at 06Z. Two other ships reported gale-force winds at 18Z. Ship "2837" reported SE 35 kt and ship "4414" reported 45 kt at nearly the same location. Wind and pressure reports from these ships were compared to nearby ships at earlier and later times and the observations were considered reasonable. Thus, at 18Z, an intensity of 40 kt is selected to compromise between the ships' observations. 40 kt is also the peak intensity of this tropical storm. The tropical cyclone remained sheared on this date and the strongest winds were not near the center but at about 120 n mi in the northeast quadrant. The center of the tropical storm made landfall in the southern coast of the Havana province of Cuba around 14Z. The landfall intensity is analyzed at 35 kt but these winds were likely occurring over the Florida Straits in the northeast quadrant. A central pressure of 1008 mb has been added at 12Z based on the observation near the center of 5 kt SW and 1009 mb at Nueva Gerona, Cuba. At 18Z, Havana, Cuba reported 5 kt NW and 1008 mb, suggesting a central pressure of 1007 mb, which has been added to HURDAT. NAVY reconnaissance investigated the tropical cyclone but the data collected is not available for this reanalysis.

June 30:

1. Maps and old HURDAT:
- HWM analyzes a closed low pressure of at most 1008 mb at 25.3N, 82.7W at 12Z.
- Microfilm shows a closed low pressure of at most 1008 mb at 26N, 82.5W at 12Z.
- MWL shows a center of low pressure at 26N, 82.2W at 12Z.
- Miami WB advisory lists a tropical depression at 25.5N, 82.5W at 10Z.

2. Ship highlights:
- 30 kt SE and 1009 mb at 23.5N, 80.5W at 00Z (COADS).
- 15 kt SE and 1006 mb at Key West, FL at 00Z (micro).

- 20 kt S and 1007 mb at Key West, FL at 06Z (micro).
- 30 kt SE and 1009 mb at 24.4N, 81.5W at 12Z (COADS).

3. Discussion:
- MWR: "…passed along the west coast of Florida."
- Miami WB Advisory: "Air Force Reconnaissance … ship and land station reports indicate that the depression is poorly defined and has not intensified."
- Reanalysis: The tropical storm continued northward into the southeastern Gulf of Mexico and passed between Dry Tortugas and Key West around 06Z. Key West reported 15 kt SE and 1006 mb at 00Z and 20 kt S and 1007 mb at 06Z, suggesting a central pressure of 1004 mb at 00Z and 1005 mb at 06Z, which have been added to HURDAT. Satellite images show a large area of organized convection over Florida and Cuba with an exposed center of circulation over the eastern Gulf of Mexico, suggesting strong westerly wind shear.

July 1:

1. Maps and old HURDAT:
- HWM analyzes a closed low pressure of at most 1008 mb at 28.5N, 83W at 12Z.
- Microfilm shows a closed low pressure of at most 1006 mb at 27.5N, 83W at 12Z.
- MWL shows a center of low pressure at 27.1N, 83.1W at 12Z.
- Miami WB advisory lists a tropical depression at 27.7N, 83W at 10Z.

2. Ship highlights:
- 15 kt SSW and 1006 mb at Fort Myers, FL at 00Z (SWO).
- 40 kt SE and 1008 mb at 27.5N, 79.3W at 06Z (COADS).
- 5 kt ESE and 1007 mb at Tampa, FL at 12Z (SWO).
- 40 kt SE and 1012 mb at 29N, 78.9W at 18Z (COADS).

3. Discussion:
- Reanalysis: The tropical storm remained shared on this day and passed just west of Tampa before making landfall near Cedar Key at 22Z with maximum sustained winds of 40 kt. Those winds were likely occurring over the waters of the Atlantic, east of Florida, and not near the center. Two ships reported 40 kt winds at 06Z and 18Z. Fort Myers reported 15 kt SSW and 1006 mb at 00Z, suggesting a central pressure of 1004 mb, which has been added to HURDAT. Similarly, Tampa reported 5 kt ESE and 1007 mb at 12Z, suggesting a central pressure of 1006 mb, which has been added to HURDAT.

July 2:

1. Maps and old HURDAT:
- HWM analyzes a spot low pressure at 31N, 84W at 12Z.
- Microfilm a spot low pressure at 31N, 83W at 12Z.
- MWL shows a center of low pressure at 31N, 82.4W at 12Z.
- Miami WB advisory lists a tropical depression over northern Florida at 03Z (last advisory).

2. Discussion:
- MWR: "and moved inland near Cross City, then turned northeastward and finally dissipated over southeastern Georgia late on July 2."
- Reanalysis: The tropical storm is analyzed to have weakened to a tropical depression at 06Z as it moved into southern Georgia. Surface observations

indicate that it quickly lost organization and dissipated after 18Z. The last position is analyzed at 18Z.

July 3:

1. Maps and old HURDAT:
- HWM and microfilm show that the system had dissipated at 12Z.

Sources: NHC microfilm maps, the Historical Weather Maps series, the COADS ship database, Mariners Weather Log, Monthly Weather Review, EV2 (Surface Weather Observations) from NCDC and Satellite images from NCDC and NSIDC. This disturbance was in Jack Beven and David Roth's List of Suspects.

Tropical Depression [July 26-27, 1966] – AL131966

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44345 07/26/1966 M= 2  7 SNBR= 953 UNNAMED      XING=0 SSS=0
44350 07/26*  0   0   0    0*288 900  25 1007*290 907  25    0*293 912  25    0*
44355 07/27*297 917  25    0*302 921  25    0*308 925  20    0*  0   0   0    0*
44360 TD
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Significant Revisions:

1. A new tropical depression has been added to HURDAT, not previously shown in McAdie et al. (2009).

Daily Metadata:

July 23:

1. Maps and old HURDAT:
- HWM analyzes a warm front over the western Atlantic at 12Z.
- Microfilm shows a stationary front over the western Atlantic and a trough over the western Caribbean Sea at 12Z.

July 24:

1. Maps and old HURDAT:
- HWM analyzes a stationary front over the western Atlantic and a trough over the eastern Gulf of Mexico at 12Z.
- Microfilm shows a closed low pressure of at most 1012 mb at 27.5N, 80W with a stationary front over the western Atlantic at 12Z.

2. Discussion:
- MWR: "A weak tropical low moved west-northwestward across the Florida Peninsula and into the extreme northeastern Gulf of Mexico on July 24."

July 25:

1. Maps and old HURDAT:
- HWM analyzes a closed low pressure of at most 1014 mb at 28.5N, 88.5W at 12Z.
- Microfilm shows a closed low pressure of at most 1014 mb at 28N, 86.5W at 12Z.

2. Discussion:

- MWR: "By noon of the 25th, the rain pattern on coastal radars indicated a fairly well organized circulation."
- Reanalysis: A trough of low pressure moved westward into the Gulf of Mexico and slowly became better organized on the 25th. Satellite images showed that the convection was disorganized.

July 26:

1. Maps and old HURDAT:

- HWM analyzes a closed low pressure of at most 1012 mb at 29.5N, 90.5W at 12Z.
- Microfilm shows a closed low pressure of at most 1012 mb at 29.5N, 89.5W at 12Z.
- MWL lists a center of low pressure at 29.1N, 90.1W at 12Z.

2. Land highlights:

- 10 kt SSE and 1008 mb at Boothville, LA at 0658Z (SWO).

3. Discussion:

- MWR: "The Low crossed southeastern Louisiana coast near Boothville about 0600Z on the 26th and continued very slowly westward…. Satellite and radar pictures, taken while the center was near New Orleans, showed good similarity in the weather bands associated with it."
- Reanalysis: A low pressure developed over the northern Gulf of Mexico as the trough continued westward. Satellite images and surface observations indicate that a tropical depression formed just south of Louisiana at 06Z. A well-defined circulation is evident in the visible satellite image with most of the convection over the southern quadrant. Boothville, LA, located near the center of the tropical depression, reported 10 kt SSE and 1008 mb at 0658Z, suggesting a central pressure of 1007 mb at 06Z. A central pressure of 1007 mb suggests maximum sustained winds of 30 kt from the north of 25N Brown et al. pressure-wind relationship. Based on the slow forward speed of 7 kt and synoptic observations, an intensity of 25 kt is analyzed at 06Z. 25 kt is also the peak intensity of this tropical depression.

July 27:

1. Maps and old HURDAT:

- HWM analyzes a closed low pressure of at most 1012 mb at 30N, 92.5W at 12Z.
- Microfilm shows a closed low pressure of at most 1012 mb at 31.2N, 86.5W at at 12Z.
- MWL lists a center of low pressure at 29.8N, 92.4W at 12Z.

2. Aircraft highlights:

- 20 kt SW and 1012 mb at 28N, 91.8W at 06Z (COADS).

3. Discussion:

- MWR: "…losing its intensity in south-central Louisiana during the morning of the 27th."
- Reanalysis: The tropical depression moved inland in the morning taking a more northward track. The visible satellite image showed a large area of convection over the center of the tropical cyclone. Surface observations over Louisiana at 18Z indicated that the surface circulation had dissipated, thus 12Z is the last position.

July 28:

3. Maps and old HURDAT:
- HWM and microfilm indicate no features of interest at 12Z.

Sources: NHC microfilm maps, the Historical Weather Maps series, the COADS ship database, Mariners Weather Log, Monthly Weather Review, EV2 (Surface Weather Observations) from NCDC. Satellite images from NCDC and NSIDC. This disturbance was in Jack Beven's List of Suspects.

Tropical Depression [September 27-30, 1966] – AL141966

```
44345 09/27/1966 M= 4 13 SNBR= 953 UNNAMED      XING=0 SSS=0
44350 09/27*  0   0   0    0*  0   0   0    0*  0   0   0    0*180 290  30    0*
44355 09/28*180 300  30    0*178 310  30    0*175 320  30    0*170 330  25    0*
44360 09/29*165 338  25    0*162 346  25    0*161 355  25    0*162 365  25    0*
44365 09/30*165 375  25    0*172 385  25    0*180 395  25    0*190 405  25    0*
44370 TD
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Significant Revisions:

1. A new tropical depression has been added to HURDAT, not previously shown in McAdie et al. (2009).

Daily Metadata:

September 27:

1. Maps and old HURDAT:
- HWM and microfilm do not show any features of interest at 12Z.

2. Discussion:
Reanalysis: Satellite images showed a tropical wave west of the Cape Verde Islands with disorganized convection.

September 28:

1. Maps and old HURDAT:
- HWM analyzes a spot low pressure at 17.6N, 32.5W at 12Z.
- Microfilm shows a spot low pressure at 18.5N, 31.5W at 12Z.

2. Discussion:
- Reanalysis: Satellite images at 0137Z on this date indicated that the tropical wave had become much better organized. The system had a large area of organized convection and banding features. It is analyzed that a 30 kt tropical depression formed at 18Z on the 27th. The ship data in this part of the Atlantic is sparse, thus the time of genesis and intensity is uncertain. 30 kt is the peak intensity of this tropical cyclone, but it may have reached tropical storm intensity on this date.

September 29:

1. Maps and old HURDAT:
- HWM analyzes a spot low pressure at 18.7N, 33.7W at 12Z.

- Microfilm shows a closed low pressure of at most 1012 mb at 16.8N, 34.9W at 12Z.

2. Discussion:

- Reanalysis: Satellite images indicated that the convective activity associated with the tropical depression had become sheared by strong southwesterly wind shear, limiting the convection to the northeast quadrant. Thus the intensity is decreased to 25 kt on this date.

September 30:

1. Maps and old HURDAT:

- HWM analyzes a spot low pressure at 18.3N, 38.3W at 12Z.
- Microfilm shows a closed low pressure of at most 1012 mb at 18.5N, 38.5W at 12Z.

2. Discussion:

- Reanalysis: The tropical depression continued westward and satellite images showed that southwesterly shear was still impinging the circulation, causing the convection to be located over the northeastern quadrant.

October 1:

1. Maps and old HURDAT:

- HWM analyzes no features of interest at 12Z.
- Microfilm shows a closed low pressure of at most 1016 mb at 20N, 43W at 12Z.

2. Discussion:

- Reanalysis: Satellite images showed no changes in the organization of the tropical system on this date. Surface observations indicated that the circulation was not closed on this date, thus the last position is analyzed at 18Z on the 30th. The tropical wave continued westward over the next couple of days showing no signs of redevelopment.

October 2:

1. Maps and old HURDAT:

- HWM analyzes a tropical wave extending from 12N-22N, along 54W at 12Z.
- Microfilm shows a tropical wave extending from 11N-23N and 44W-51W at 12Z.

Sources: NHC microfilm maps, the Historical Weather Maps series, the COADS ship database and satellite images from NCDC and NSIDC.

Tropical Storm Kendra [October 3-11, 1966] – AL151966

```
44345 10/03/1966 M= 9 14 SNBR= 953 KENDRA      XING=0 SSS=0
44350 10/03*  0   0   0    0*  0   0   0    0*135 220  25    0*136 220  25    0*
44355 10/04*137 220  25    0*138 220  25    0*140 220  25    0*142 220  25    0*
44355 10/05*144 219  30    0*147 217  30    0*150 214  30    0*153 211  30    0*
44360 10/06*156 207  30    0*160 204  30    0*163 202  30    0*167 201  30    0*
44365 10/07*171 201  30    0*174 202  35    0*177 203  35    0*180 204  35    0*
44370 10/08*182 205  35    0*183 206  30    0*183 208  30    0*183 214  30    0*
44375 10/09*182 222  30    0*180 235  30    0*177 250  25    0*174 265  25    0*
44380 10/10L171 280  25    0L168 295  25    0L165 308  25    0L160 319  25    0*
44385 10/11L155 330  25    0L148 340  20    0L140 350  20    0L133 360  20    0*
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44390 TS

Significant Revisions:

1. A new tropical storm has been added to HURDAT, not previously shown in McAdie et al. (2009).

Daily Metadata:

October 2:

5. Maps and old HURDAT:

- HWM does not analyze an organized system at 12Z.
- Microfilm shows a closed low pressure of at most 1012 mb at 12N, 20W at 12Z.

6. Discussion:

- MWR: "The name Kendra was given to a low pressure system in the extreme eastern Atlantic. Post analysis indicates that Kendra was not a tropical storm."

October 3:

1. Maps and old HURDAT:

- HWM analyzes a spot low pressure at 12.8N, 22.4W at 12Z.
- Microfilm shows a closed low pressure of at most 1012 mb at 11N, 22W at 12Z.
- ATSR lists a best track position at 12N, 22W at 10Z (first position).

2. Discussion:

- ATSR: "KENDRA was first detected as a tropical depression near 12N 22W by ESSA II satellite photographs at 0922Z on 3 October. The photographs showed a well defined circulation, but the depression never really developed and remained a weak circulation for the next 5 days as it moved slowly northward."
- Reanalysis: A tropical wave that likely left the west coast of Africa on the 2nd, became better organized and is analyzed to have become a 25 kt tropical depression at 12Z based on surface observations and a visible satellite image available on the 1966 Annual Tropical Storm Report (ATSR) book.

October 4:

1. Maps and old HURDAT:

- HWM analyzes a closed low pressure of at most 1012 mb at 15.1N, 22.8W at 12Z.
- Microfilm shows a closed low pressure of at most 1012 mb at 14N, 22W at 12Z.
- ATSR lists a best track position at 14.7N, 22.8W at 10Z.

2. Discussion:

- Reanalysis: The tropical depression slowly moved northward between Africa and the Cape Verde Islands due to weak steering currents.

October 5:

1. Maps and old HURDAT:

- HWM analyzes a closed low pressure of at most 1012 mb at 15.1N, 21.7W at 12Z.
- Microfilm does not show an organized system at 12Z.
- ATSR lists a best track position at 15.8N, 21.8W at 10Z.

2. Ship highlights:

- 30 kt N and 1007 mb at 14.9N, 21.5W at 06Z (COADS).

3. Discussion:

- Reanalysis: A ship near the center of the tropical depression reported 30 kt N and 1007 mb at 00Z, thus the intensity is increased to 30 kt at 00Z.

October 6:

1. Maps and old HURDAT:

- HWM analyzes a closed low pressure of at most 1012 mb at 17N, 19.9W at 12Z.
- Microfilm does not show an organized system at 12Z.
- ATSR lists a best track position at 16.5N, 20W at 10Z.

October 7:

1. Maps and old HURDAT:

- HWM analyzes a closed low pressure of at most 1012 mb at 18.7N, 19.5W at 12Z.
- Microfilm does not show an organized system at 12Z.
- ATSR lists a best track position at 18.2N, 19.4W at 10Z.

2. Ship highlights:

- 30 kt NE and 1011 mb at 18.2N, 20.8W at 00Z (COADS).
- 30 kt N and 1009 mb at 17.5N, 21.1W at 03Z (COADS).
- 35 kt WNW and 1003 mb at 17.4N, 20.5W at 18Z (COADS).

3. Discussion:

- Reanalysis: Intensification to a tropical storm is analyzed at 06Z based on ship reports of 30 kt at 00Z and 03Z, and 35 kt and 1003 mb at 18Z, the only observation of tropical-storm-force winds. The 1003 mb report appears to be about 5 mb too low based on comparisons of this ship's reports at earlier and later times to nearby ships. 35 kt is also the peak intensity of Kendra. The exact time that Kendra became a tropical storm and its peak intensity remains uncertain. Kendra may have been a tropical storm since the 4th based on the organization of the convection on the satellite images, but the data in this part of the Atlantic is very sparse. The system looks better organized on satellite images between the 4th and 7th. Kendra turned to the west on this date while located northeast of the Cape Verde Islands.

October 8:

1. Maps and old HURDAT:

- HWM analyzes a closed low pressure of at most 1012 mb at 20.5N, 21.6W at 12Z.
- Microfilm shows a spot low pressure at 18.5N, 21W at 12Z.
- ATSR lists a best track position at 19.8N, 21.2W at 10Z.

2. Discussion:

- ATSR: "On 8 October, the depression was named and upgraded to a tropical storm [22Z on the 8th]. However, from post-analysis, it was decided that KENDRA did not meet the minimum requirements for a tropical storm. KENDRA reached her most northern point on 8 October near 20N 23W, then began to move slowly southwest."

- Reanalysis: Weakening to a tropical depression is analyzed at 06Z as Kendra accelerated to the west. The satellite image indicated that the convection associated with the system had diminished. Kendra may have been upgraded to a tropical storm operationally on this date based on the ship report of tropical-storm-force winds late on the 7th.

October 9:

1. Maps and old HURDAT:
- HWM analyzes a closed low pressure of at most 1012 mb at 19N, 24.7W at 12Z.
- Microfilm shows a tropical storm of at most 1012 mb at 19N, 24.4W at 12Z.
- ATSR lists a best track position at 19N, 24.5W at 10Z.

2. Discussion:
- Reanalysis: The tropical depression continued to weaken as it moved westward north of the Cape Verde Islands. Satellite images showed that the system remained mostly devoid of convection except for a few thunderstorms.

October 10:

1. Maps and old HURDAT:
- HWM analyzes a spot low pressure at 16.8N, 28.8W at 12Z.
- Microfilm shows a tropical storm of at most 1012 mb at 16.5N, 29.1W at 12Z.
- ATSR lists a best track position at 16.3N, 28.2W at 10Z.

2. Discussion:
- ATSR: "The ESSA II satellite photograph at 0946Z on 10 October showed an organized circulation as the system continued southwest."
- Reanalysis: Kendra moved away from the Cape Verde Islands on this date into a region almost devoid of ship traffic, which makes it difficult to keep track of its center. Nonetheless, satellite images showed that the system continued on a southwest track as a remnant low pressure devoid of convection. Thus it is analyzed that Kendra became a remnant low pressure at 00Z.

October 11:

1. Maps and old HURDAT:
- HWM analyzes a spot low pressure at 14.5N, 33.4W at 12Z.
- Microfilm shows a tropical wave along longitude 33W at 12Z.
- ATSR lists a best track position at 14.2N, 32.8W at 10Z.

2. Discussion:
- ATSR: "KENDRA degenerated on 11 October near 13N 35W."
- Reanalysis: The weakened system was still discernable in the satellite images on this date. On the 12th, Kendra dissipated or weakened into a trough over the central Atlantic based on the satellite images, thus the last position is analyzed at 18Z on the 11th.

October 12:

1. Maps and old HURDAT:
- HWM does not analyze an organized system at 12Z.

Sources: NHC microfilm maps, the Historical Weather Maps series, the COADS ship database, Mariners Weather Log, Monthly Weather Review, Navy reconnaissance book, and satellite images from NCDC and NSIDC. This disturbance was in Jack Beven's List of Suspects.

New Tropical Storm [November 13-19, 1966] – AL161966

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44170 11/13/1966 M= 7 16 SNBR= 913 NOT NAMED   XING=0 SSS=0
44175 11/13*  0   0   0    0*  0   0   0    0*  0   0   0    0S309 267  35    0*
44180 11/14S301 272  35    0S295 279  35    0*290 286  35    0*291 290  40    0*
44185 11/15*293 293  45    0*297 296  50  997*303 301  50    0*315 309  55  994*
44190 11/16*327 317  55    0*340 325  55    0*352 333  55    0*365 339  55    0*
44195 11/17*380 344  55    0*397 348  55    0*420 353  55    0E443 354  55    0*
44200 11/18E474 350  55    0E504 335  55    0E525 310  55    0E540 280  55    0*
44205 11/19E556 245  55    0E580 210  55    0E620 173  55    0E665 135  50    0*
44210 TS
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Significant Revisions:

1. A new tropical storm has been added to HURDAT, not previously shown in McAdie et al. (2009).

Daily Metadata:

November 12:

1. Maps and old HURDAT:

- HWM and microfilm analyze cold front over the eastern Atlantic extending from an extratropical cyclone, former Hurricane Lois, located near 47N, 20W at 12Z.

November 13:

1. Maps and old HURDAT:

- HWM shows a closed low pressure system with a cold front going through the center at 33N, 43W at 12Z.
- Microfilm shows a frontal boundary over the eastern Atlantic extending from an extratropical cyclone, former Hurricane Lois, located near 43N, 15W at 12Z.
- MWL shows a center of low pressure at 33N, 23W at 12Z.

2. Ship observations:

- 30 kt NNW and 1006 mb at 29.6N, 27.5W at 18Z (COADS).

3. Discussion:

- Reanalysis: The genesis of this tropical cyclone was associated with the frontal boundary extending from an extratropical cyclone, the former Hurricane Lois. As the extratropical cyclone moved eastward toward the Iberian Peninsula, the frontal boundary moved into the eastern Atlantic and a low pressure developed on this date in the tail-end of the front. A satellite image early on the 14th showed a well-defined circulation with banding features, thus the first point is analyzed at 18Z on the 13th. Synoptic observations near the center and the satellite image indicate that the system had subtropical characteristics, so the first position is analyzed as a 35-kt subtropical storm on the 13th at 18Z. The initial intensity is based on a ship

report of 30 kt at 18Z in the southwest quadrant. Due to the sparse data in this region of the Atlantic, time of genesis and intensity are uncertain.

November 14:

1. Maps and old HURDAT:
- HWM analyzes a closed low pressure of at most 1008 mb at 29N, 27W at 12Z.
- Microfilm shows a closed low pressure of at most 1008 mb at 28N, 29.5W at 12Z.
- MWL shows a center of low pressure at 29.5N, 28W at 12Z.

2. Ship highlights:
- 30 kt NNE and 1001 mb at 30.5N, 29.7W at 18Z (COADS).

3. Discussion:
- Reanalysis: HWM and microfilm indicate that the frontal boundaries near the system had dissipated by 12Z and surface observations showed that it had become more symmetric at this time, thus it is analyzed to have become a tropical storm at 12Z. The tropical cyclone slowly moved westward on this date.

November 15:

1. Maps and old HURDAT:
- HWM analyzes a closed low pressure of at most 1000 mb at 30.8N, 30.2W at 12Z.
- Microfilm shows a closed low pressure of at most 1008 mb at 30N, 29W at 12Z.
- MWL shows a center of low pressure at 29.5N, 28W at 12Z.

2. Ship highlights:
- 35 kt NE and 1000 mb at 30.7N, 29.5W at 00Z (COADS).
- 35 kt ENE and 1007 mb at 33N, 27.4W at 03Z (COADS).
- 10 kt E and 998 mb at 31.4N, 28.7W at 06Z (COADS).
- 35 kt N and 1003 mb at 31.3N, 31W at 12Z (COADS).
- 10 kt SSW and 995 mb at 31.5N, 30.3W at 18Z (COADS).

3. Discussion:
- Reanalysis: A satellite image at 0129Z showed a small tropical cyclone with banding features and convection organized around the center. The small tropical storm turned to the northwest and increased in forward speed. A few ships reported gale-force winds. A ship reported 10 kt E and 998 mb at 06Z, suggesting a central pressure of 997 mb, which has been added to HURDAT. A central pressure of 997 mb suggests maximum surface winds of 53 kt from the north of 35N Landsea et al. pressure-wind relationship. Due to the slow forward speed of about 5 kt, an intensity of 50 kt is analyzed at 06Z. Another ship reported 10 kt SSW and 995 mb at 18Z, suggesting a central pressure of 994 mb, which has been added to HURDAT. A central pressure of 994 mb suggests maximum surface winds of 58 kt from the north of 35N pressure-wind relationship. Based on a forward speed of about 13 kt, an intensity of 55 kt is analyzed at 18Z. 55 kt is also the peak intensity of this tropical cyclone. The peak intensity is uncertain due to the sparse data and it is possible it may have reached hurricane intensity.

November 16:

1. Maps and old HURDAT:
- HWM analyzes a closed low pressure of at most 1004 mb at 34.8N, 33W at 12Z.

- Microfilm shows a closed low pressure of at most 1000 mb at 35.5N, 34.5W at 12Z.
- MWL shows a center of low pressure at 33.5N, 33.5W at 12Z.

2. Ship highlights:

- 35 kt SE and 1014 mb at 33.5N, 26.2W at 00Z (COADS).
- 45 kt W and 993 mb at 33N, 32W at 06Z (MWL).
- 40 kt S and 1006 mb at 34.8N, 31.1W at 12Z (COADS).
- 50 kt SE and 1017 mb at 37N, 29.5W at 18Z (MWL).

3. Discussion:

- MWL: "Gales were also being generated out to 200 mi. in its eastern semicircle by a small low near 34°N, 33°W on the 16th."
- Reanalysis: The tropical storm continued northwestward with no appreciable changes in intensity. A couple of ships reported gale-force and storm-force winds, up to 50 kt. Microfilm maps at 12Z and 18Z on the 16th indicate that a reconnaissance aircraft investigated the cyclone around 14Z but additional summerized data is not available for this reanalysis.

November 17:

1. Maps and old HURDAT:

- HWM analyzes a closed low pressure of at most 1012 mb at 42N, 35.5W with a cold front just to the west at 12Z.
- Microfilm shows a closed low pressure of at most 1012 mb at 42.8N, 34.1W with a cold front to the west at 12Z.
- MWL shows a center of low pressure at 41.8N, 36W at 12Z.

2. Ship highlights:

- 55 kt SE and 1007 mb at 39.6N, 33.1W at 00Z (COADS).
- 40 kt SE and 1013 mb at 39.3N, 32.5W at 06Z (COADS).
- 35 kt SE and 1020 mb at 40N, 31.1W at 12Z (COADS).

3. Discussion:

- Reanalysis: The tropical storm passed west of the Azores early on this date on a more northward track. A few ships reported tropical storm force winds, including 55 kt at 00Z. As a frontal boundary approached from the west, the tropical cyclone began to acquire extratropical characteristics. Synoptic observations at 18Z indicated that cold, dry air had reached the center of the system, thus transition to an extratropical cyclone is analyzed at this time.

November 18:

1. Maps and old HURDAT:

- HWM analyzes an extratropical cyclone of at most 1012 mb at 52N, 28.5W at 12Z.
- MWL shows a center of low pressure at 52.6N, 31.5W at 12Z.

2. Ship highlights:

- 40 kt SSE and 1018 mb at 46.1N, 31.5W at 00Z (COADS).
- 45 kt S and 1019 mb at 56.4N, 24.1W at 06Z (COADS).
- 35 kt SSE and 1016 mb at 51.5N, 26.5W at 12Z (COADS).
- 45 kt S and 1008 mb at 51.4W, 26.1W at 18Z (COADS).

3. Discussion:

- Reanalysis: The extratropical cyclone turned to the northeast and accelerated. A few ships registered gale-force winds up to 45 kt.

November 19:

1. Maps and old HURDAT:

- HWM analyzes an extratropical cyclone of at most 1004 mb at 63N, 18W at 12Z.
- MWL shows a center of low pressure at 62.5N, 19W at 12Z.

2. Ship highlights:

- 35 kt NE and 1007 mb at 56.3N, 25.4W at 00Z (COADS).
- 45 kt S and 1018 mb at 56.2N, 15W at 06Z (COADS).
- 55 kt S and 1015 mb at 60.3N, 13.5W at 12Z (COADS).
- 45 kt S and 1002 mb at 64.9N, 11.7W at 18Z (COADS).

3. Discussion:

- Reanalysis: The extratropical cyclone began to interact with another system that was located near southeastern Greenland. Observations on the 20th indicated that the systems had merged, thus the last position is analyzed at 18Z on the 19th. The extratropical cyclone was still strong on this date based on the synoptic data, ships reported winds up to 55 kt. An analog to this tropical cyclone is Hurricane Nicole, 1998.

November 20:

1. Maps and old HURDAT:

- HWM analyzes an extratropical cyclone of at most 992 mb at 74N, 1E at 12Z.
- MWL shows a center of low pressure at 74N, 0.5W at 12Z.

Sources: NHC microfilm maps, the Historical Weather Maps series, the COADS ship database, Mariners Weather Log, and Satellite images from NCDC and NSIDC. This disturbance was in Jack Beven and David Roth's List of Suspects.

New Tropical Storm [November 19-26, 1966] – AL171966

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44175 11/19/1966 M= 8 17 SNBR= 913 NOT NAMED   XING=0 SSS=00                  L
44180 11/19*  0   0   0    0*  0   0   0    0*  0   0   0    0E230 520  25    0*
44185 11/20E240 510  25    0E247 496  30    0E254 480  30    0E260 465  35    0*
44190 11/21E263 450  35    0E265 440  35    0E266 434  35    0E268 428  35    0*
44195 11/22*271 422  35 1004*275 415  35 1002*280 405  35    0*285 397  40    0*
44200 11/23*291 392  40    0*300 395  40    0*315 402  45    0*327 409  50  997*
44205 11/24*333 415  50    0*337 418  50    0*337 418  55    0*335 414  55    0*
44210 11/25*335 410  55    0*336 413  50    0*339 420  45    0*345 430  40    0*
44215 11/26*350 442  30    0*  0   0   0    0*  0   0   0    0*  0   0   0    0*
44220 TS
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Significant Revisions:

1. A new tropical storm has been added to HURDAT, not previously shown in McAdie et al. (2009).

Daily Metadata:

November 18:

1. Maps and old HURDAT:

- HWM and microfilm analyze a stationary front over the central Atlantic at 12Z.

November 19:

1. Maps and old HURDAT:

- HWM analyzes an extratropical cyclone of at most 1012 mb at 26N, 48W at 12Z.
- Microfilm shows a stationary front over the central Atlantic at 12Z.
- MWL shows a center of low pressure at 24.8N, 47.9W at 12Z.

2. Discussion:

- Reanalysis: Surface observations indicate that a non-tropical area of low pressure developed in the tail-end of a weakening frontal boundary late on this date over the central Atlantic. The first position is analyzed at 18Z as a 25 kt extratropical depression. A ship located 350 nm to the north of the system reported gale-force winds but appears to have a high bias compared to surrounding ships and it is outside the outermost closed isobar (OCI), responding more to the pressure-gradient due to a strong high pressure over the north Atlantic.

November 20:

3. Maps and old HURDAT:

- HWM analyzes an extratropical cyclone of at most 1008 mb at 24.5N, 47.5W at 12Z.
- Microfilm shows an extratropical cyclone of at most 1010 mb at 25N, 46.2W at 12Z.
- MWL shows a center of low pressure at 24.8N, 47.9W at 12Z.

4. Ship highlights:

- 35 kt SW and 1006 mb at 23.5N, 46.5W at 18Z (COADS).

5. Discussion:

- Reanalysis: The extratropical cyclone moved northeastward and intensified. A ship reported 35 kt SW and 1006 mb at 18Z and at this time, it is analyzed that the depression intensified into an extratropical storm.

November 21:

1. Maps and old HURDAT:

- HWM analyzes an extratropical cyclone of at most 1012 mb at 25N, 44W at 12Z.
- Microfilm shows an occluded cyclone of at most of 1008 mb at 25.7N, 44W at 12Z.
- MWL shows a center of low pressure at 26N, 44.4W at 12Z.

2. Ship highlights:

- 35 kt ENE and 1014 mb at 30.1N, 46.1W at 06Z (COADS).

November 22:

1. Maps and old HURDAT:

- HWM analyzes a closed low pressure of at most 1008 mb at 28N, 41W at 12Z.
- Microfilm shows a closed low pressure of at most 1008 mb at 28N, 41W at 12Z.
- MWL shows a center of low pressure at 27.9N, 41.4W at 12Z.

2. Ship highlights:

- 10 kt NW and 1005 mb at 26.4N, 42.5W at 00Z (micro).
- 15 kt NE and 1004 mb at 27.9N, 42.2W at 06Z (COADS).

3. Discussion:

- Reanalysis: Synoptic observations near the center indicate that the extratropical cyclone began to occlude on the 21st and it is analyzed to have become a tropical storm at 00Z on the 22nd. The circulation was still elongated northeast-southwest and the system may have been a subtropical storm at this time. Nonetheless, the frontal boundaries had dissipated and the system was isothermal. A ship near the center of this tropical storm reported 10 kt NW and 1005 mb, suggesting a central pressure of 1004 mb, which has been added to HURDAT. A central pressure of 1004 mb suggests maximum sustained winds of 36 kt from the north of 25N Brown et al. pressure-wind relationship. An intensity of 35 kt is analyzed at 00Z. Another ship observation at 06Z, could be the same ship as in 00Z but it does not have a marker in COADS, reported 15 kt NE and 1004 mb, suggesting a central pressure of 1002 mb, which has been added to HURDAT. A central pressure of 1002 mb suggests maximum surface winds of 40 kt from the north of 25N pressure-wind relationship. Based on the slow forward speed of 10 kt, the intensity is analyzed at 35 kt at 06Z.

November 23:

1. Maps and old HURDAT:

- HWM analyzes a closed low pressure of at most 1008 mb at 31N, 41W at 12Z.
- Microfilm shows a closed low pressure of at most 1008 mb at 31N, 41W at 12Z.
- MWL shows a center of low pressure at 30N, 40.3W at 12Z.

2. Ship highlights:

- 45 kt ENE and 1009 mb at 31.4N, 38.5W at 00Z (COADS).
- 10 kt N and 1004 mb at 30.5N, 41.8W at 06Z (COADS).
- 35 kt N and 1009 mb at 32N, 43.2W at 09Z (COADS).
- 45 kt NE and 1012 mb at 33.1N, 42.7W at 12Z (COADS).
- 60 kt NE and 1001 mb at 33.8N, 41.6W at 18Z (COADS).
- 30 kt E and 1000 mb at 33.1N, 40.8W at 18z (COADS).

3. Discusssion:

- Tropical Analysis: “Third deep surface low with center near 32N 40W has deepened in past 24 hrs and ship close to center at 1800Z reported a surface wind of 60 kt. Probable movement of this low center is slowly northward then recurving to the northwest.”
- Reanalysis: The tropical storm changed course on this date as it began to move to the northwest over the central Atlantic and intensified. A couple of ships reported tropical-storm-force winds at 18Z, including the ship “GQCP” which registered 60 kt. Comparisons of this ship’s reports at earlier and later times to other nearby ships indicate that it had a high bias, likely around 10 kt. The ship “PICJ” reported 30 kt E and 1000 mb, suggesting a central pressure of 997 mb, which has been added to HURDAT. The observations of this ship at earlier and later times were also carefully analyzed and found to be consistent with nearby synoptic observations. A central pressure of 997 mb suggests maximum surface winds of 49 kt from the north of 25N pressure-wind

relationship. Based these ship reports, an intensity of 50 kt is analyzed at 18Z.

November 24:

1. Maps and old HURDAT:
- HWM analyzes a closed low pressure of at most 1004 mb at 34N, 40W at 12Z.
- Microfilm shows a closed low pressure of at most 1004 mb at 34N, 42W at 12Z.
- MWL shows a center of low pressure at 33.3N, 40.9W at 12Z.

2. Ship highlights:
- 45 kt W and 1001 mb at 32.2N, 42W at 00Z (COADS).
- 40 kt E and 1004 mb at 34.8N, 40W at 06Z (COADS).
- 55 kt E and 1017 mb at 37.2N, 39W at 12Z (MWL).
- 50 kt ESE and 1001 mb at 34.3N, 40.2W at 18Z (COADS).

3. Discussion:
- Reanalysis: On this date, the tropical storm slowed and became almost stationary. A couple of ships reported tropical-storm-force winds, including 55 kt at 12Z and 50 kt at 18Z. An intensity of 55 kt is analyzed at 12Z, also the peak intensity of this tropical cyclone.

November 25:

1. Maps and old HURDAT:
- HWM analyzes a closed low pressure of at most 1004 mb at 34N, 40W at 12Z.
- Microfilm shows a closed low pressure of at most 1004 mb at 34N, 42W at 12Z.
- MWL shows a center of low pressure at 33.3N, 40.9W at 12Z.

2. Ship highlights:
- 40 kt SW and 1006 mb at 33.6N, 38.7W at 00Z (micro).
- 35 kt E and 1021 mb 38.4N, 40W at 03Z (COADS).
- 50 kt E and 1018 mb at 38.5N, 37.8W at 06Z (COADS).
- 35 kt W and 1002 mb at 32N, 42.2W at 12Z (COADS).
- 35 kt ESE and 1015 mb at 38.4N, 41.6W at 18Z (COADS).

3. Discussion:
- Reanalysis: An extratropical cyclone was intensifying over the western Atlantic on this date and likely caused an increase in vertical wind shear over the tropical storm leading to its weakening. Intensity indicated to drop steadily from 55 kt at 00Z to 40 kt at 18Z based upon ship reports.

November 26:

1. Maps and old HURDAT:
- HWM and microfilm analyze a closed low pressure of at most 988 mb at 32N, 62W (original low pressure appears to have dissipated) at 12Z.

2. Discussion:
- Reanalysis: The tropical cyclone continued to rapidly lose strength and is analyzed to have weakened to a tropical depression at 00Z. Ship reports at 06Z indicated that it did not have a closed circulation and had degenerated into a trough of low pressure, thus the last position is analyzed at 00Z.

Sources: NHC microfilm maps, the Historical Weather Maps series, the COADS ship database, and Mariners Weather Log. This disturbance was in Jack Beven and David Roth's List of Suspects.

1966 Additional Notes

1. March 3-9: Historical Weather Maps indicate that a trough of low pressure was present northeast of the Leeward Islands on March 3rd. The disturbance moved eastward over the next couple of days ahead of a frontal boundary. On March 7th, gale-force winds developed over the northern portion of the trough due to the strong ridge of high pressure to the north. Synoptic observations on the 7th show that a low pressure system developed but the tropical-storm-force winds remained about 450 n mi from the center. The next day, the disturbance weakened and dissipated on the 9th. Therefore, because the gale-force winds were not directly produced by the disturbance and associated with the pressure-gradient, and the data available is inconclusive whether or not it had a well-defined center, it is not added to HURDAT. This disturbance was in Jack Beven's and David Roth's Lists of Suspects.

Day	Latitude	Longitude	Status
March 3	10-20N	60W	Trough
March 4	11-24N	56W	Trough
March 5	11-24N	44W	Trough
March 6	15-29N	41W	Trough
March 7	23N	46W	Subtropical storm?
March 8	20N	44W	Trough
March 9			Dissipated

2. May 3-10: Historical Weather Maps show that a frontal boundary entered the Gulf of Mexico on May 3rd and an extratropical cyclone developed in the tail-end of the weakening cold front the next day. The system produced a large area of showers and thunderstorms according to the nephanalysis on the Microfilm maps over the next couple of days. The COADS were obtained and gale-force winds were reported on the 5th and 6th about 300 n mi to the northeast of the center. On the 8th, the system accelerated to the northeast and made landfall in northern Florida around 12Z on the 9th. The next day, it was absorbed by a frontal boundary while over the eastern United States. Therefore, because the disturbance did not acquire tropical characteristics, it not added to HURDAT. This disturbance was in Jack Beven's and David Roth's Lists of Suspects.

Day	Latitude	Longitude	Status
May 3	North Gulf of Mexico		Cold front
May 4	25N	95W	Extratropical
May 5	24N	95W	Extratropical
May 6	27N	93W	Extratropical
May 7	27N	89W	Extratropical
May 8	20N	90W	Extratropical
May 9	30N	84W	Extratropical
May 10			Absorbed

3. June 22-25: Historical Weather Maps indicate that a weakening cold front over the western Atlantic led to the formation of an extratropical cyclone on June 23th. The cyclone moved northeastward and was absorbed by a strong cold front on June 25th. The COADS were obtained and no gales were reported. Therefore, because the data shows that the system remained an extratropical cyclone and did not produce tropical storm force winds, it is not added to HURDAT. This disturbance was in David Roth's Lists of Suspects.

Day	Latitude	Longitude	Status
June 22	Western Atlantic		Weakening cold front
June 23	31N	69W	Extratropical
June 24	35N	66W	Extratropical
June 25			Absorbed

4. September 21-24: Microfilm maps show that a tropical wave was present over the central Atlantic on September 21st. Satellite images available on the Storm Wallet of this system show that it had a well-defined circulation on the 22nd but only a small, poorly organized area of convection under strong vertical wind shear. A reconnaissance aircraft investigated the disturbance around 18Z on the 22nd finding measuring a central pressure of 1011 mb and estimating surface winds of 35 kt. The system was operationally a tropical depression on the 22nd and 23rd. Another reconnaissance aircraft investigated the disturbance on the 23rd and reported that it had degenerated into a trough or tropical wave. The system entered the Caribbean Sea on the 23rd and continued westward dissipating the next day. The COADS were obtained and no gales were reported in association this disturbance. Therefore, because the coverage of the convection associated with this disturbance was small and the convection appears to have been transient and disorganized, it is not added to HURDAT. This disturbance was in Jack Beven's Lists of Suspects.

Day	Latitude	Longitude	Status
September 21	14N	45W	Tropical Wave
September 22	14N	53W	Tropical Depression? / Tropical Storm?
September 23	14N	60W	Tropical Wave
September 24			Dissipated

5. September 24-29: Historical Weather Maps, microfilm and satellite images show that a weakening cold front was located over the central and eastern Gulf of Mexico on September 23th. The disturbance remained generally stationary and poorly organized between the 24th and 26th, while generating a large area of showers and thunderstorms. On the 27th, satellite images suggest the system became better organized as it began to move northward. Nonetheless, synoptic observations showed that it remained poorly organized at the surface. On the 28th, as it approached the northern coast of the Gulf of Mexico, a weak surface circulation developed according to microfilm. Shortly after, it made landfall and weakened, and was absorbed by a frontal boundary on the 29th over the eastern seaboard. COADS were obtained and no gales were reported in association with this disturbance. Therefore, because the system did not produce tropical storm force winds and the circulation was not well defined, it is not added to HURDAT.

Day	Latitude	Longitude	Status
September 23	Gulf of Mexico		Weakening cold front
September 24	22N	93W	Tropical Disturbance
September 25	22N	93W	Tropical Disturbance

September 26	22N	93W	Tropical Disturbance
September 27	24N	92W	Tropical Disturbance
September 28	27N	89W	Tropical Depression?
September 29			Absorbed

6. October 14-19: Historical Weather Maps, microfilm and satellite images indicate that a stationary frontal boundary was located over the central Atlantic on October 14th. An area of low pressure developed the next day between Puerto Rico and Bermuda. The system moved northward and satellite images showed a large area of convection on the 15th with no banding or organization. On the 16th, the low had acquired a more extratropical appearance on the satellite images. The system accelerated to the northeast on the 17th ahead of an approaching frontal boundary and was absorbed by a larger extratropical cyclone on the 19th. COADS were obtained and no gales were reported in association with this system before it became extratropical. Therefore, because the data suggests it did not acquire tropical characteristics, it is not added to HURDAT. This disturbance was in Jack Beven's and David Roth's Lists of Suspects.

Day	Latitude	Longitude	Status
October 14	Central Atlantic		Stationary frontal boundary
October 15	26N	65W	Low?
October 16	32N	62W	Extratropical
October 17	44N	54W	Extratropical
October 18	49N	41W	Extratropical
October 19			Absorbed

7. November 6-13: Historical Weather Maps, microfilm and satellite images show that a low pressure system developed north of Lois and ahead of an approaching frontal boundary on November 6th. The low rapidly moved northeast ahead of an extratropical cyclone on the 7th and it was fully extratropical by the next day. The system continued into the north Atlantic and was absorbed on the 13th. The COADS were acquired and it showed some gale-force winds on the 6th and 7th about 300 n mi north of the center primarily due to the synoptic scale pressure gradient. Therefore, because the system did not acquire tropical characteristics, it is not added to HURDAT.

Day	Latitude	Longitude	Status
November 6	33N	53W	Low?
November 7	37N	50W	Low?
November 8	47N	48W	Extratropical
November 9	54N	39W	Extratropical
November 10	59N	31W	Extratropical
November 11	65N	23W	Extratropical
November 12	68N	8W	Extratropical
November 13	71N	8E	Absorbed

8. November 10-18: Historical Weather Maps, microfilm and satellite images indicate that a trough of low pressure was located over the central Atlantic on November 10th. An area of low pressure developed on the 11th to the north of the

Leeward Islands and satellite images showed a large area of cloudiness. The low moved slowly westward on the 12th and was investigated by a reconnaissance aircraft, which found a broad center and winds below tropical storm intensity. Satellite images indicated that the showers and thunderstorms were located to the north and east of the circulation, with a large band extending from the eastern Caribbean to the center. The western and southwestern quadrants were generally rain-free. Surface observations on the 13th showed that the system had moved northeastward and was north-south elongated with possible centers in the north and south portions of the circulation. The northern circulation became better organized on the 14th and may have briefly developed into a tropical or subtropical storm before becoming embedded within a frontal boundary. A ship reported 40 kt about 120 n mi west of the center and another ship reported 35 kt to the east at 12Z on the 14th. The disturbance became extratropical late on the 14th and was absorbed in the north Atlantic on the 18th. Therefore, because the disturbance remained disorganized during most of its lifetime, except for briefly on the 14th, it is not added to HURDAT. This disturbance was in Jack Beven's and David Roth's Lists of Suspects.

Day	Latitude	Longitude	Status
November 10	19N-26N	47W-56W	Trough
November 11	25N	56W	Subtropical Depression?
November 12	25N	60W	Subtropical Depression?
November 13	29N	57W	Subtropical Storm?
November 14	36N	56W	Subtropical Storm?
November 15	47N	53W	Extratropical
November 16	57N	48W	Extratropical
November 17	66N	52W	Extratropical
November 18			Absorbed

9. November 23-30: Historical Weather Maps and microfilm show a weakening frontal boundary over the western Atlantic on November 23rd. An extratropical cyclone formed near Bermuda on the 24th and slowly moved northward. The extratropical cyclone became occluded on the 25th and gale-force winds were present about 200 n mi to the north of center. The frontal boundaries dissipated on the 26th and a few ships about 200 n mi to the west and south of the center reported winds up to 40 kt, suggesting that it was not a tropical cyclone. It is possible it may have been a subtropical cyclone on the 26th and 27th. The disturbance became extratropical on the 28th and was absorbed over the north Atlantic on the 30th. Therefore, because the system did not acquire tropical characteristic, it is not added to HURDAT. This disturbance was in Jack Beven's and David Roth's Lists of Suspects.

Day	Latitude	Longitude	Status
November 23	Western Atlantic Ocean		Weakening stationary front
November 24	31N	63W	Extratropical
November 25	32N	62W	Occluded
November 26	33N	62W	Subtropical Storm?
November 27	36N	61W	Subtropical Storm?
November 28	38N	61W	Extratropical
November 29	45N	61W	Extratropical

November 30	Absorbed

10. December 12-17: Historical Weather Maps and microfilm indicate that a trough of low pressure was located over the central Atlantic on December 12th. An area of low pressure developed on the 13th and a ship about 150 n mi northwest of the circulation reported gale-force winds, but the disturbance remained poorly organized with a trough extending to the south. The system moved south over the next couple of days, and the ships in the area registered no more gales. Observations on the 17th indicated that it had dissipated. Therefore, because the circulation was not well defined, especially when it was producing tropical storm force winds, it is not added to HURDAT. This disturbance was in Jack Beven's and David Roth's Lists of Suspects.

Day	Latitude	Longitude	Status
December 12	15N-30N	50W	Trough
December 13	30N	48W	Trough
December 14	28N	49W	Subtropical Depression?
December 15	24N	49W	Subtropical Depression?
December 16	20N	44W	Subtropical Depression?
December 17			Dissipated

1967 Reanalysis – Chris Landsea, Sandy Delgado, and Brenden Moses – Revised April 2020

Notes:

1967 marks the first year that non-developing tropical depressions were included into HURDAT2. This greatly increased the number of systems to be examined. Also note that many of these systems in HURDAT2 do not meet the current criteria to be called tropical cyclones and are being removed from HURDAT2.

Based upon the Committee's recommendation, we will now add in new tropical storms/subtropical storms based upon at least one ship/station report (wind/pressure) along with satellite imagery. Previously, two observationally-based pieces of evidence were required.

Green indicates wind changes of 15 kt or greater
Blue indicates lat/long changes greater than 1°
Red indicates a new entry
Yellow indicates a deletion

Tropical Depression [June 10-12, 1967] – AL011967

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55555 06/10/1967 M= 3  1 SNBR=   4 UNNAMED

55560 06/10*  0   0   0    0*  0   0   0    0*180 850   0    0*180 853   0    0*
55560 06/10*  0   0   0    0*  0   0   0    0*170 850  25 1006*173 850  25    0*
                                              ***      ** **** *** ***  **
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55565 06/11*180 855   0    0*180 858   0    0*179 860   0    0*181 862   0    0*
55565 06/11*176 850  25 1004*179 851  25    0*181 853  25 1004*183 857  25    0*
            *** ***  ** **** *** ***  **      *** ***  ** **** *** ***  **

55570 06/12*183 865   0    0*185 868   0    0*190 870   0    0*  0   0   0    0*
55570 06/12*184 862  25    0*185 867  25    0*185 873  25    0*  0   0   0    0*
            *** ***  **          ***  **      *** ***  **
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55575 TD

Significant Revisions:

4. The original HURDAT did not have intensities for the positions of this non-developing tropical depression.

Daily Metadata:

June 7:

3. Maps and old HURDAT:

- HWM and microfilm show a tropical wave over the western Caribbean Sea at 12Z.

4. Discussion:

- Reanalysis: Satellite imagery and synoptic observations showed disorganized convection associated with a trough extending from the Bahamas to the southern Caribbean Sea.

June 8:

1. Maps and old HURDAT:

- HWM analyzes a tropical wave over the western Caribbean Sea at 12Z.
- Microfilm shows a spot low at 15.7N, 83.5W at 12Z.

2. Discussion:

- Reanalysis: The disturbance remained disorganized as it slowly moved northward.

June 9:

6. Maps and old HURDAT:

- HWM analyzes a spot low at 18N, 82W at 12Z.
- Microfilm does not feature any feature of interest at 12Z.

7. Discussion:

a. Reanalysis: The disturbance continued to produce a large area of convection but at the surface it remained disorganized.

June 10:

1. Maps and old HURDAT:

- HWM analyzes a closed low pressure of at most 1008 mb at 16.7N, 85.5W at 12Z.
- HURDAT lists a tropical depression at 18N, 85W at 12Z (first position).
- Microfilm shows a closed low pressure of at most 1008 mb at 15.5N, 86.5W at 12Z.

2. Land highlights:

- 15 kt S and 1008 mb at Swan Islands, Honduras at 12Z (micro).

3. Discussion:

- Reanalysis: The disturbance entered the Gulf of Honduras and a 25 kt tropical depression is analyzed to have developed at 12Z on June 10th, same as originally shown in HURDAT. Operationally, it was also upgraded to a tropical depression at 12Z on the 10th. It is interesting to mention that the pressure at Swan Island at 12Z on this date was 4 mb lower than at the same time 24 hours before. Satellite imagery showed that the tropical depression was being affected by shear displacing most of the convection away from the center.

June 11:

1. Maps and old HURDAT:

- HWM analyzes a spot low at 18.2N, 85.8W at 12Z.
- HURDAT lists a tropical depression at 17.9N, 86W at 12Z
- Microfilm shows a tropical disturbance of at most 1004 mb at 18.3N, 85.2W at 12Z.

2. Land highlights:

- 5 kt NW and 1005 mb at Guanaja Island, Honduras at 00Z (micro).
- 15 kt SE and 1006 mb at Swan Islands, Honduras at 12Z (micro)

3. Discussion:

- Reanalysis: The weak tropical depression moved slowly northward. Satellite imagery showed that convection was sheared to the northeast of the center.

June 12:

1. Maps and old HURDAT:

- HWM analyzes a spot low at 17.5N, 87W at 12Z.
- HURDAT lists a tropical depression at 19N, 87W at 12Z (last position).
- Microfilm shows a closed low pressure of at most 1008 mb at 19N, 88W at 12Z.

2. Discussion:

- Reanalysis: The weak tropical depression moved northwestward and is analyzed to have dissipated after 12Z on the 12th, same as originally shown in HURDAT. It is important to mention that the evidence, satellite and synoptic, that this system was a tropical depression is sparse and it is possible that it was not a tropical depression as it was always poorly-organized and embedded in a large area of low environmental pressures.

June 13:

1. Maps and old HURDAT:

- HWM and microfilm show a trough over the eastern Gulf of Mexico at 12Z.

Sources: NHC microfilm maps, the Historical Weather Maps series, the COADS ship database, Monthly Weather Review and satellite images from NCDC.

Tropical Depression, June 10-13 – AL021967:

Historical Weather Maps, microfilm and satellite images analyzed a trough between the Greater Antilles and Bermuda on June 9th. Synoptic observations suggested that a weak low pressure developed on the 10th but was poorly organized and

convection was displaced to the east and south of the center. In HURDAT, the system was listed as Tropical Depression #2 and the first position was analyzed at 12Z on the 10th (see below). The disturbance moved to the northwest and remained disorganized. Over the next few days, the convection was very sparse and the low-level circulation remained poorly defined. The last position in HURDAT was analyzed at 12Z on the 13th as a tropical depression. By the 14th, the system had been absorbed by a frontal boundary. No gales were observed in relation to this disturbance. Because the system did not have a well-defined circulation and the convective activity was poorly organized, it is not a tropical cyclone and is thus removed from HURDAT. This disturbance was in Jack Beven's Lists of Suspects.

Unnamed Tropical Storm [June 15-22, 1967] – AL031967

```
12345 06/14/1967 M= 5  3 SNBR=   4 UNNAMED
12345 06/15/1967 M= 8  3 SNBR=   4 UNNAMED
         **         *

(June 14th has been removed from HURDAT)
12345 06/14*  0   0   0    0*  0   0   0    0*270 760   0    0*272 757   0    0*

12350 06/15*280 752   0    0*283 750   0    0*290 750   0    0*297 752   0    0*
12350 06/15*  0   0   0    0*  0   0   0    0*  0   0   0    0S290 740  30    0*
              *   *            *   *            *   *         **** ***  **

12355 06/16*301 756   0    0*305 758   0    0*311 759   0    0*316 768   0    0*
12355 06/16S292 748  30    0S294 756  30    0S296 763  35    0S299 769  35    0*
           **** ***  **     **** ***  **     **** ***  **     **** ***  **

12360 06/17*320 771   0    0*322 780   0    0*328 785   0    0*331 789   0    0*
12360 06/17*304 775  35 1006*313 782  35 1006*323 786  35 1006*331 785  35 1009*
            *** ***  ** **** *** ***  ** **** *** ***  ** ****     ***  ** ****

12365 06/18*335 780   0    0*341 780   0    0*  0   0   0    0*  0   0   0    0*
12365 06/18*337 784  35    0*343 782  30    0*349 780  30    0*355 778  30    0*
            *** ***  **      *** ***  **      *** ***  **      *** ***  **

(June 19th to the 22nd are new to HURDAT)
12370 06/19*360 773  25    0*365 764  25    0E369 754  25    0E373 743  30    0*
12375 06/20E379 730  35    0E387 717  40    0E398 706  45    0E405 701  45    0*
12380 06/21E407 703  40    0E405 705  35    0E407 701  30    0E412 696  30    0*
12385 06/22E420 690  25    0*  0   0   0    0*  0   0   0    0*  0   0   0    0*

12390 TS

U.S. Tropical Storm Landfall
----------------------------
06/18 02Z 33.9N 78.3W 35 kt NC
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Significant Revisions:

8. Genesis is analyzed 42 hours later than originally shown in HURDAT based on synoptic observations.
9. A subtropical cyclone stage is added from 18Z June 15th through 18Z June 16th.

10. Major position changes analyzed at 18Z on June 15th, 06Z-18Z on June 16th and 00Z on June 17th.

11. System is analyzed to have reached tropical storm intensity, compared with tropical depression peak originally.

12. Dissipation is analyzed four days later than originally shown in HURDAT based on synoptic observations.

June 13:

5. Maps and old HURDAT:

- HWM and microfilm show a trough over the eastern Gulf of Mexico at 12Z.

June 14:

5. Maps and old HURDAT:

- HWM and microfilm show a trough extending from the Bahamas to the Yucatan peninsula at 12Z.
- HURDAT lists a tropical depression at 27N, 76W at 12Z (first position).

6. Ship highlights:

a. 35 kt NNE (likely high bias) and 1014 mb at 30N, 80.8W at 18Z (COADS).

7. Discussion:

- MWR: "Satellite pictures and ship data were sufficient to observe and track the weak tropical depression which formed northeast of the Bahamas on June 14."
- Reanalysis: A trough over the Bahamas was producing a large area of convection. Synoptic observations showed that the disturbance did not have a closed low-level circulation.

June 15:

5. Maps and old HURDAT:

- HWM analyzes a trough extending from the western Atlantic to the Yucatan peninsula at 12Z.
- HURDAT lists a tropical depression at 29N, 75W at 12Z.
- Microfilm shows a spot low at 28.5N, 74.5W with a trough extending to the southwest at 12Z.

6. Ship highlights:

a. 30 kt NE and 1002 mb (low bias) at 30.1N, 74.6W at 18Z (COADS).

7. Discussion:

- Reanalysis: The disturbance became better organized and a closed low-level circulation developed at 18Z on the 15th based on synoptic observations. Satellite images showed a large area of convection to the north and east of the center. Upper-level analyses show a trough superimposed over the top of the surface center. Therefore a 30 kt subtropical depression is analyzed to have formed at this time. (The original HURDAT did not have intensities for the positions of this tropical cyclone.)

June 16:

5. Maps and old HURDAT:

- HWM analyzes a trough extending from the western Atlantic to the central Gulf of Mexico at 12Z.
- HURDAT lists a tropical depression at 31.1N, 75.9W at 12Z.
- Microfilm shows a spot low at 30.5N, 76W at 12Z.
- MWL tracks of centers of cyclones estimates a center position at 30.4N, 75.6W at 12Z.

6. Ship highlights:
a. 35 kt NE and 1015 mb at 31.9N. 78.4W at 12Z (COADS/MWL).
b. 35 kt NE and 1013 mb at 32.7N, 77.3W at 18Z (COADS).

7. Land radar highlights:
- Wilmington, NC made a center fix at 31N, 76W at 12Z (WALLET). (The system is too far from the radar to obtain a meaningful center fix.)

8. Discussion:
- Climatological Data: "On the 16th, a small surface cyclone formed beneath an upper level trough which lay across northern peninsular Florida and extended northeastward off the Atlantic coast. The cyclone developed gradually and moved generally northwestward toward the South Carolina coast."
- Reanalysis: The subtropical depression moved slowly to the northwest and is analyzed to have intensified into a 35 kt subtropical storm at 12Z on the 16th based on ship observations. 35 kt is also the peak intensity of this system. Satellite images showed a small circulation with convection over or near the center.

June 17:

5. Maps and old HURDAT:
- HWM analyzes a closed low pressure of at most 1010 mb at 32N, 78.5W at 12Z.
- HURDAT lists a tropical depression at 32.8N, 78.5W at 12Z.
- Microfilm shows a closed low pressure of at most 1012 mb at 32N, 78.5W at 12Z. Microfilm indicated "T.D. #3" on the maps, indicating it was carried operationally as a tropical depression.
- MWL tracks of centers of cyclones estimates a center position at 31.2N, 78.8W at 12Z.

6. Ship highlights:
a. 35 kt E and 1015 mb at 34.5N, 76.4W at 00Z (COADS).
b. 20 kt NE and 1008 mb at 31.7N, 78.3W at 00Z (COADS).
c. 30 kt SE and 1013 mb at 32.3N, 76.1W at 06Z (COADS).
d. 20 kt NE and 1008 mb at 31.6N, 79.3W at 06Z (COADS).
e. 25 kt S and 1009 mb at 32.2N, 78.1W at 12Z (COADS).
f. 35 kt SE and 1013 mb at 32.9N, 77.1W at 18Z (COADS).
g. 35 kt SE and 1014 mb at 33.3N, 76.6W at 21Z (COADS/WALLET).

7. Aircraft highlights:
a. Penetration center fix measured a central pressure of 1009 mb and estimated surface winds of 30 kt at 33.4N, 78.5W at 2032Z (WALLET).

8. Land radar highlights:
a. Charleston, SC made a center fix at 32.2N, 78.5W at 09Z (WALLET).
b. Charleston, SC made a center fix at 32.9N, 78.9W at 1245Z (WALLET).

c. Charleston, SC made a center fix at 33.5N, 80W at 1715Z (WALLET).

9. Discussion:

a. MWR: "By the 17th, it was possible to track the center on the WSR-57 radar at Charleston, SC, and later that day, a Navy reconnaissance plane located the center of circulation."
b. Storm Data: "Tropical depression skirted the coastlines of Georgetown and Horry counties making landfall at the North Carolina border. Highest winds were 36 mph [gusts]."
c. Climatological Data: "By noon of the 17th, it had assumed a northerly course and later moved north-northeasterly along the coast. The center passed about 10 miles east of Myrtle Beach and made a landfall at the extreme eastern tip of the State. The highest winds measured were 36 mph [gusts] at Myrtle Beach. The cyclone maintained its intensity, but the intensity of its circulation decreased as it moved inland."
d. MWL: "A weak tropical depression appeared off the South Carolina coast on the 17th. It caused winds up to 30 kt with some gusts to 35 kt."
e. Reanalysis: The system turned to the north and approached the Carolinas. Satellite images showed a small area of organized convection associated with the tropical cyclone. Based upon the smaller area of more symmetric deep convection from satellite pictures on the 16th and 17th, the system is estimated to have transitioned to a tropical storm around 00Z on the 17th. A few ships reported gale-force winds. A ship reported 20 kt NE and 1008 mb at 00Z on the 17th, suggesting a central pressure of 1006 mb, which has been added to HURDAT at this time. Another ship reported 20 kt NE and 1008 mb at 06Z on the 17th, suggesting a central pressure of 1006 mb, which has been added to HURDAT at this time. A ship reported 25 kt S and 1009 mb at 12Z on the 17th, suggesting a central pressure of 1006 mb, which has been added to HURDAT at this time. A penetration center fix measured a central pressure of 1009 mb and estimated surface winds of 30 kt at 2032Z on the 17th. A central pressure of 1009 mb has been added to HURDAT at 18Z on the 17th.

June 18:

4. Maps and old HURDAT:

- HWM analyzes a closed low pressure of at most 1016 mb with a frontal boundary to the north at 34.4N, 78.5W at 12Z.
- HURDAT lists a tropical depression at 34.1N, 78W at 06Z (last position).
- Microfilm show a closed low pressure of at most 1016 mb with a frontal boundary to the north at 35N, 78W at 12Z.
- MWL tracks of centers of cyclones estimates a center position at 34.8N, 78.4W at 12Z.

5. Land radar highlights:

- Wilmington, NC made a center fix at 34.2N, 78.2W at 0545Z (WALLET).

6. Discussion:

a. MWR: "The depression entered the North Carolina coast southwest of Wilmington during the evening of the 17th, drifted northward during the 18th, and was overtaken by a cold front later the same day. From the remnants, there developed a frontal wave which moved east-northeastward into the Atlantic."

b. MWL: "Dumped 6 to 7 inches of rain on the Myrtle Beach area before moving into North Carolina the following day [18]."

c. Reanalysis: The small tropical storm moved northward and made landfall near the North and South Carolina border around 02Z on the 18th. Weakening to a tropical depression is analyzed at 06Z on the 18th.

June 19:

4. Maps and old HURDAT:

- HWM and microfilm analyze a closed low pressure of at most 1012 mb with a frontal boundary just to the north at 37N, 76W at 12Z.
- MWL tracks of centers of cyclones estimates a center position at 36.9N, 75.9W at 12Z.

5. Discussion:

a. Reanalysis: An approaching frontal boundary caused the tropical depression to turn to the northeast and based on synoptic observations, transition into an extratropical cyclone is analyzed at 12Z on the 19th. Around this time, the extratropical cyclone moved back over the Atlantic Ocean.

June 20:

1. Maps and old HURDAT:

- HWM analyzes an extratropical cyclone at 40N, 70W at 12Z.
- Microfilm shows an extratropical cyclone at 40N, 70.5W at 12Z.
- MWL tracks of centers of cyclones estimates a center position at 39.4N, 71.2W at 12Z.

2. Ship highlights:

- 35 kt NNE and 1015 mb at 39.2N, 73.9W at 00Z (COADS).
- 40 kt NE and 1014 mb at 42.3N, 68.4W at 06Z (COADS).
- 35 kt E and 1016 mb at 43N, 67.7W at 12Z (COADS).
- 45 kt S and 1014 mb at 35.9N, 66.4W at 18Z (COADS).

3. Discussion:

- Reanalysis: A couple of ships reported gale-force winds and intensification into an extratropical storm is analyzed at 00Z on the 20th while moving to the northeast. The extratropical cyclone is analyzed to have reached a peak intensity of 45 kt late on the 20th.

June 21:

1. Maps and old HURDAT:

- HWM analyzes an occluded cyclone of at most 1008 mb at 42N, 70W at 12Z.
- Microfilm shows an occluded cyclone of at most 1012 mb at 40.5N, 70.5W at 12Z.
- MWL tracks of centers of cyclones estimates a center position at 41.2N, 70W at 12Z.

2. Ship highlights:

- 30 kt SE and 1013 mb at 39.3N, 66.3W at 00Z (COADS).

- 30 kt S and 1008 mb at 39.9N, 69.8W at 06Z (COADS).

3. Discussion:

- Reanalysis: The extratropical cyclone remained almost stationary south of Nantucket and is analyzed to have weakened below gale intensity at 12Z on the 21st.

June 22:

1. Maps and old HURDAT:

- HWM analyzes a weakening frontal boundary over the northwest Atlantic, suggesting that the cyclone had dissipated, at 12Z.

2. Discussion:

- Reanalysis: Synoptic observations at 06Z on the 22nd indicated that the circulation had dissipated, thus the last position is analyzed at 00Z.

Sources: NHC microfilm maps, the Historical Weather Maps series, the COADS ship database, Monthly Weather Review, Atlantic Tropical Disturbances 1967 (MWR), Navy reconnaissance book, Mariners Weather Log, Satellite images from NCDC, and NHC Storm Wallets.

Tropical Depression, June 18-20, AL041967:
Historical Weather Maps, microfilm and satellite images indicated that a disturbance developed at the tail-end of a weakening cold front on June 17th while north of the Leeward Islands. A weak low pressure developed on the 18th and moved northward. Synoptic observations suggested that it was not well-defined at the surface. In HURDAT, the system was listed as Tropical Depression #4 and the first position was analyzed at 12Z on the 18th. The system remained poorly organized over the next couple of days and weakened as a frontal system approached from the west. The last position in HURDAT was analyzed at 12Z on the 20th as a tropical depression. Microfilm suggests that the weak low pressure system dissipated on the 21st. No gales were observed in relation to this disturbance. Because the disturbance did not have a well-defined center and the convective activity was poorly organized, it is not a tropical cyclone and is removed from HURDAT. This disturbance was in Jack Beven's Lists of Suspects.

Tropical Depression, July 5-9, AL051967:
Historical Weather Maps, microfilm and satellite images showed a tropical wave exiting the coast of Africa on July 6th. The system was listed in HURDAT as Tropical Depression #5 and the first position was analyzed at 12Z on the 5th over western Africa. Synoptic observations suggested that the tropical wave moved westward without showing signs of organization. By the 10th, the convection associated with the disturbance had dissipated. No gales were observed in relation to this disturbance. Because the disturbance did not have a well-defined center, it is not a tropical cyclone and is removed from HURDAT. This disturbance was in Jack Beven's Lists of Suspects.

Tropical Depression, July 21-22, AL061967:
Historical Weather Maps, microfilm and satellite images indicated that a tropical wave left the west coast of Africa on July 20th. The system was listed in HURDAT as Tropical Depression #6 with the first position listed at 12Z on the 21st. The tropical wave moved westward and showed no signs of organization based on synoptic observations and satellite images. No gales were observed in relation to this disturbance. Because the disturbance

did not have a well-defined center, it is not a tropical cyclone and is removed from HURDAT. This disturbance was in Jack Beven's and David Roth's Lists of Suspects.

Tropical Depression, August 3-6, AL071967:
Historical Weather Maps, microfilm and satellite images showed a tropical wave exiting the west coast of Africa on August 3rd. The system is listed as Tropical Depression #7 in HURDAT with the first position shown at 12Z on the 3rd. Synoptic data and satellite images suggested that the tropical wave did not become any better organized as it moved westward and did not develop a well-defined surface circulation. No gales were observed in relation to this disturbance. Because the disturbance did not have a well-defined center, it is not a tropical cyclone and is removed from HURDAT. This disturbance was in Jack Beven's Lists of Suspects.

Tropical Depression, August 10-16, AL081967:
Historical Weather Maps, microfilm and satellite images suggested that a tropical wave left the west coast of Africa around August 11th. The system is listed as Tropical Depression #8 in HURDAT with the first position at 12Z on the 10th while the system was still over western Africa. The tropical disturbance moved westward and showed no signs of organization based on satellite images and synoptic data. The last position in HURDAT was analyzed at 12Z on the 16th while over the central Atlantic. No gales were observed in relation to this disturbance. Because the disturbance did not have a closed circulation, it is not a tropical cyclone and is removed from HURDAT. This disturbance was in Jack Beven's Lists of Suspects.

Tropical Depression, August 16-19, AL091967:
Historical Weather Maps, microfilm and satellite images indicated that a tropical wave left the west coast of Africa around August 17th. The system is listed as Tropical Depression #9 in HURDAT with the first position at 12Z on the 16th while the system was still over western Africa. The tropical disturbance moved westward and showed no signs of organization based on satellite images and synoptic data. The last position in HURDAT was analyzed at 12Z on the 19th while over the eastern Atlantic. No gales were observed in relation to this disturbance. Because the disturbance did not have a closed circulation, it is not a tropical cyclone and is removed from HURDAT. This disturbance was in Jack Beven's Lists of Suspects.

Tropical Depression, August 20-24, AL101967:
Historical Weather Maps, microfilm and satellite images showed that a tropical wave left the west coast of Africa around August 21st. The system is listed as Tropical Depression #10 in HURDAT with the first position at 12Z on the 20th while the system was still over western Africa. The tropical disturbance moved westward and showed no signs of organization based on satellite images and synoptic data. The last position in HURDAT was analyzed at 12Z on the 24th while over the central Atlantic. No gales were observed in relation to this disturbance. Because the disturbance did not have a closed circulation, it is not a tropical cyclone and is removed from HURDAT. This disturbance was in Jack Beven's Lists of Suspects.

Hurricane Arlene [August 28 – September 5, 1967] – AL111967

```
43805 08/28/1967 M= 8 11 SNBR= 945 ARLENE      XING=0 SSS=0
43805 08/28/1967 M= 9 11 SNBR= 945 ARLENE      XING=0 SSS=0
                     *

43810 08/28*  0   0   0    0*  0   0   0    0*  0   0   0    0*158 358  30    0*
```

```
43815 08/29*164 369  30    0*171 378  30    0*178 390  30    0*185 401  30    0*
43815 08/29*164 368  30    0*171 379  30    0*178 390  30    0*185 402  35    0*
                ***              ***                              ***  **

43820 08/30*192 415  30    0*198 428  30    0*209 448  35    0*220 462  35 1001*
43820 08/30*193 416  40    0*200 430  40    0*206 443  45 1001*211 455  45 1001*
            *** ***  **      *** ***  **      *** ***  ** **** *** ***  **

43825 08/31*232 476  35    0*243 490  40    0*253 497  40    0*263 510  45 1008*
43825 08/31*218 469  45    0*228 483  40    0*243 497  40    0*258 510  40 1008*
            *** ***  **      *** ***  **      ***              ***      **

43830 09/01*275 518  45    0*287 527  45    0*299 538  50 1009*308 551  50    0*
43830 09/01*271 521  40    0*284 529  40    0*297 538  45 1009*308 551  50    0*
            *** ***  **      *** ***  **      ***      **

43835 09/02*319 563  55 1007*332 568  55    0*345 569  60  999*361 567  60    0*
43835 09/02*319 563  50 1007*332 568  55    0*346 569  60  999*361 566  65    0*
                     **                       ***                  ***  **

43840 09/03*376 558  65  994*392 549  70    0*407 538  70  998*433 520  75    0*
43840 09/03*376 558  70  990*392 548  70    0*408 538  75    0*426 525  80    0*
                     **  ***     ***          ***      **    * *** ***  **

43845 09/04*446 512  60  982*458 486  60    0E466 460  60    0E467 457  60    0*
43845 09/04*445 510  80  982*456 493  70    0E460 474  60    0E462 453  50    0*
            *** ***  **      *** ***  **      *** ***          *** ***  **

(September 5th is new to HURDAT)
43850 09/05E463 432  45    0E463 415  40    0E465 400  35    0E470 390  30    0*

43855 HR
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Significant Revisions:

1. Intensification into a tropical storm is assessed 18 hours earlier based on synoptic observations.
2. Major track changes analyzed at 00Z and 06Z on August 31st and 12Z on September 4th.
3. Major intensity increased at 00Z on September 4th based on reconnaissance aircraft data.
4. Dissipation analyzed 24 hours later based on ship data.

Daily Metadata:

August 25:

1. Maps and old HURDAT:

- HWM depicts a spot low pressure center at 16N, 23W at 12Z.
- Microfilm analyzes low pressure embedded along an equatorial trough at 14N, 24W at 12Z.

2. Discussion:

- MWR: "During the latter part of August, satellite photographs revealed that the Intertropical Convergence Zone (ITC) had become more active after remaining quiescent and somewhat farther south than normal until that time. During the

period from August 24 to September 3, a series of four rather well-defined cloud masses were observed to move westward off the African coast along the ITC. The first of these later formed Arlene…. As the first disturbance moved westward off the African coast on August 24, the upper air sounding at Dakar, Senegal, showed a windshift from the northeast to southeast late on the 24th in the lower levels of the troposphere. During the following 24 to 36 hr, 3- to 4-mb 24-hr pressure falls were observed in the Cape Verde Islands. Around 1800 GMT on the 25th a Pan American Airways flight reported 'cyclonic circulation apparent with falling pressures between lat. 10N to 14N and long 20W to 25W.' At the same time the British ship *Ripon* reported a west-southwest wind of 29 mph and heavy intermittent rain to the southwest of this area."

- Reanalysis: A tropical wave left the west coast of Africa on August 24th and soon after began to show signs of intensification. Synoptic observations suggests that a broad and elongated area of low pressure developed near the Cape Verde Islands on the 25th, and satellite images indicated that the convective activity was poorly organized. Thus, it is not analyzed to have been a tropical depression at this time.

August 26:

1. Maps and old HURDAT:

- HWM depicts a spot low pressure center at 13.5N, 26.5W at 12Z.
- Microfilm analyzes low pressure embedded along an equatorial trough at 11N, 31W at 12Z.

2. Satellite highlights:

- ESSA V estimated a center fix at 13N, 29W at 1710Z (WALLET).

3. Discussion:

- MWR: "ESSA 5 Digitized Mosaics on the 25th, 26th, and 27th showed the disturbance continuing generally westward about 10 to 15 mph. Little additional information was received in the vicinity of the disturbance during these days."
- ATSR: "ARLENE was first detected as a tropical disturbance near 13N, 29W by a satellite photo at 1714Z on 26 August."
- Reanalysis: The disturbance continued westward and remained disorganized.

August 27:

1. Maps and old HURDAT:

- HWM depicts a closed low pressure of at most 1012 mb at 13.2N, 31.8W at 12Z.
- Microfilm analyzes a tropical cyclone of at most 1008 mb at 12N, 31W at 12Z.

2. Satellite highlights:

- ESSA V estimated a center fix at 12.5N, 34W at 1752Z (WALLET).

3. Discussion:

- 12Z Satellite bulletin (micro): "Tropical depression in eastern Atlantic placed at 12N 31W on basis of ESSA 2 satellite pictures and continuity but large cloud area in vicinity of low does not show definite organization and is not separated from ITC cloudiness extending to the southwest or from extensive cloudiness to the north of the low."
- ATSR: "The following day [27], it was also photographed by satellite at 1753Z and appeared less organized than the previous day."

- Reanalysis: Satellite images indicated that the tropical disturbance was becoming better organized but synoptic observations showed that it did not yet have a closed circulation. Operationally, it was upgraded to a tropical depression at 06Z on the 27th.

August 28:

1. Maps and old HURDAT:

- HURDAT lists a 30 kt tropical depression at 15.8N, 35.8W at 18Z
- HWM depicts a closed low pressure of at most 1012 mb at 15N, 36W at 12Z.
- Microfilm analyzes a tropical cyclone of at most 1010 mb at 11N, 37W at 12Z.

2. Satellite highlights:

- ESSA V estimated a center fix at 16N, 36W at 1924Z (WALLET).

3. Discussion:

- MWR: "On August 28 around 1800 GMT the ESSA 3 and ESSA 5 satellites showed a well-organized area of clouds and weather near lat 16N, long 36W. This was chosen as the starting point for the official track of Arlene. On this day the disturbance was first classified a strong tropical depression under the Satellite Classification System of the National Environmental Satellite Center. Once the strong tropical depression had formed, it moved northwestward about 17 mph."
- 00Z Aug 29 Satellite bulletin (micro): "The ESSA 5 digitized mosaic for 28 Aug shows the tropical depression in the central Atlantic to be centered near 16N 36W at 28/1924Z. This represents a considerable departure from the previous continuity of movement. This system appears to have a much better cloud organization with the low level circulation fairly well defined and with an extensive cirrus overcast and high level outflow to the east."
- Reanalysis: Satellite images indicated that the system had become better organized, showing an exposed low-level circulation with most of the convection to the east and south of the center. The first position is analyzed at 18Z on the 28th as a 30 kt tropical depression, same as originally shown in HURDAT. This is partly corroborated by the sparse synoptic observations over the central Atlantic.

August 29:

1. Maps and old HURDAT:

- HURDAT lists a 30 kt tropical depression at 17.8N, 39.0W at 12Z
- HWM depicts a closed low pressure of at most 1012 mb at 18.5N, 39.5W at 12Z.
- Microfilm analyzes a tropical cyclone of at most 1012 mb at 16N, 39W at 12Z.

2. Satellite highlights:

- ESSA V estimated a center fix at 18N, 40W at 1716Z (WALLET).

3. Discussion:

- 12Z Satellite bulletin (micro): "Tropical depression in eastern Atlantic located at 16N 39W on continuity from ESSA 5 pictures of yesterday. No apt picture for today. Depression has apparently moved on a more northwesterly course than expected, and latest pictures show larger cloud mass and better organized."
- 00Z Aug 30 Satellite bulletin (micro): "The developing tropical depression was located near 18.5N 40W at 29/1716Z from the ESSA 5 satellite picture. It is

moving generally northwestward at 12 knots. The center is well defined by a spiral cloud band."

- Reanalysis: The tropical depression moved northwestward over the central Atlantic on the 29th. Satellite images showed a sheared system with most of the convection over the northern semicircle. Intensification to a tropical storm is analyzed at 18Z on the 29th based on ship observations early on the 30th.

August 30:

1. Maps and old HURDAT:

- HURDAT lists a 35 kt tropical storm at 20.9N, 44.8W at 12Z
- HWM depicts a tropical storm of at most 1008 mb at 21N, 45W at 12Z.
- Microfilm analyzes a tropical cyclone of at most 1008 mb at 20.7N, 44.5W at 12Z.

2. Ship highlights:

- 40 kt E and 1012 mb at 21.5N, 40W at 00Z (COADS).
- 35 kt E and 1014 mb at 20.2N, 38.7W at 06Z (COADS).
- 40 kt ENE and 1014 mb at 22.9N, 43.9W at 09Z (COADS).
- 30 kt NNE and 1004 mb at 21N, 44.7W at 12Z (COADS).
- 35 kt NE and 1015 mb at 23.1N, 43.1W at 12Z (micro).

3. Satellite highlights:

- NIMBUS II estimated a center fix at 21N, 45W at 1430Z (WALLET).
- ESSA III estimated a center fix at 21N, 45.5W at 1555Z (WALLET).
- ESSA V estimated a center fix at 22N, 46.5W at 1752Z (WALLET).

4. Aircraft highlights:

- Penetration center fix measured a central pressure of 1001 mb and estimated surface winds of 35 kt at 21N, 45.5W at 1746Z (WALLET).

5. Discussion:

- MWR: "Late on the 29th [~00Z on the 30th], the Norwegian ship *Thorsriver* reported an east wind of 46 mph near lat. 21N and long. 20W. [likely to be 40W]…Navy reconnaissance aircraft reached Arlene on the afternoon of the 30th and found maximum winds of 70 m.p.h. near the center."
- 12Z Satellite bulletin (micro): "Tropical Depression No. 5 has been named Tropical Storm Arlene on the basis of ship reports and the ESSA 2 apt picture this morning. A late ship reports from ICDS and a later and superior NIMBUS apt picture allow a better positioning of storm near 21N44W."
- ATSR: "It finally reached tropical storm intensity near 21N, 45W and a tropical storm warning naming the storm was issued by FLEWEAFAC JAX at 1300Z on 30 August."
- Reanalysis: Arlene maintained a northwestward track on the 30th and a few ships reported gale-force winds. A ship at 12Z reported 30 kt and 1004 mb, suggesting a central pressure of 1001 mb, which has been added to HURDAT. A central pressure of 1001 mb suggests maximum surface winds of 45 kt from the south of 25N Brown et al. pressure-wind relationship. Based on a forward speed of about 14 kt, an intensity of 45 kt is analyzed at 12Z on the 30th, up from 35 kt originally shown in HURDAT, a minor intensity change. A penetration center fix at 1746Z on the 30th measured a central pressure of 1001 mb and estimated surface winds of 35 kt. (It is of note that the MWR account indicates 70 m.p.h

winds [60 kt], which is not consistent with the vortex message in the storm wallet. The reanalysis is not sure which is correct, though more weight is placed on the pressure, rather than either peak wind estimate.) An intensity of 45 kt is analyzed at 18Z on the 30th, up from 35 kt originally shown in HURDAT, a minor intensity change. Satellite images showed a well-defined circulation with most of the convection north of the center.

August 31:

1. Maps and old HURDAT:

- HURDAT lists a 40 kt tropical storm at 25.3N, 49.7W at 12Z.
- HWM depicts a tropical storm of at most 1008 mb at 24.7N, 49.5W at 12Z.
- Microfilm analyzes a tropical storm of at most 1016 mb at 24.6N, 48.8W at 12Z.

2. Ship highlights:

- 40 kt E and 1023 mb at 26.8N, 42.3W at 00Z (COADS).
- 40 kt ESE and 1021 mb at 26.4N, 46.6W at 09Z (COADS).
- 40 kt ESE and 1023 mb at 26.1N, 46.3W at 12Z (COADS).

3. Satellite highlights:

- ESSA II estimated a center fix at 25.5N, 49W at 1055Z (WALLET).
- ESSA III estimated a center fix at 25.5N, 50.5W at 1646Z (WALLET).
- ESSA V estimated a center fix at 27.5N, 51W at 1858Z (WALLET).

4. Aircraft highlights:

- Penetration center fix measured a central pressure of 1008 mb and estimated surface winds of 45 kt at 26.2N, 50.9W at 1707Z (WALLET).

5. Discussion:

- ATSR: "ARLENE began to fill slightly on 31 August, but was still well defined."
- Reanalysis: On the 31st, Arlene became less organized and slightly weakened. A penetration center fix measured a central pressure of 1008 mb and estimated surface winds of 45 kt at 1707Z on the 31st. A central pressure of 1008 mb suggests maximum surface winds of 28 kt from the north of 25N pressure-wind relationship. Based on ship reports of 40 kt earlier on the 31st, a forward speed of about 20 kt and high environmental pressure (1017 mb OCI), an intensity of 40 kt is analyzed at 18Z on the 31st, down from 45 kt originally shown in HURDAT, a minor intensity change. Satellite images indicated that the center was exposed with most of the convection displaced to the north.

September 1:

1. Maps and old HURDAT:

- HURDAT lists a 50 kt tropical storm at 29.9N, 53.8W at 12Z.
- HWM depicts a tropical storm of at most 1016 mb at 30.5N, 54W with a cold front far to the west at 12Z.
- Microfilm analyzes a tropical storm of at most 1016 mb at 29.9N, 53.7W at 12Z.

2. Shi highlights:

- 35 kt SE and 1023 mb at 30.2N, 52.2W at 12Z (COADS).
- 40 kt SE and 1020 mb at 31.2N, 53.5W at 18Z (COADS).

3. Satellite highlights:

- NIMBUS II estimated a center fix at 30.5N, 54.5W at 1515Z (WALLET).
- ESSA V estimated a center fix at 31.5N, 56W at 1850Z (WALLET).

4. Aircraft highlights:
- Penetration center fix measured a central pressure of 1009 mb and estimated surface winds of 65 kt at 29.9N, 53.7W at 1153Z (WALLET).
- Penetration center fix measured a central pressure of 1007 mb and estimated surface winds of 45 kt at 31.5N, 56W at 22Z (WALLET).

5. Discussion:
- ATSR: "She was not as well defined the following day [1]."
- Reanalysis: Satellite images showed that Arlene had become better organized with deep convection over the northeastern semicircle, but the center was still exposed. Synoptic observations, on the other hand, indicated that the tropical storm was poorly organized. A penetration center fix measured a central pressure of 1009 mb and estimated surface winds of 65 kt at 1153Z on the 1st. Based on a forward speed of about 16 kt, high environmental pressure (1018 mb OCI) and weighing some the visual estimate, an intensity of 45 kt is analyzed at 12Z on the 1st, down from 50 kt originally shown in HURDAT, a minor intensity change. A couple of ships reported gale-force winds of the 1st.

September 2:
1. Maps and old HURDAT:
- HURDAT lists a 60 kt tropical storm at 34.5N, 56.9W at 12Z.
- HWM depicts a hurricane of at most 1008 mb at 35.5N, 57.5W with a cold front to the west at 12Z.
- Microfilm analyzes a tropical storm of at most 1016 mb at 34.3N, 57.3W at 12Z.

2. Aircraft highlights:
- Penetration center fix measured a central pressure of 999 mb and estimated surface winds of 60 kt at 33.7N, 56.7W at 0902Z (WALLET).
- Penetration center fix measured a central pressure of 994 mb and estimated surface winds of 70 kt at 36.8N, 56.8W at 2103Z (WALLET).

3. Discussion:
- ATSR: "However, as ARLENE moved northward over the warm water of the Gulf Stream and obtained more favorable outflow aloft, she deepened and reached hurricane intensity near 37N, 56W."
- Reanalysis: Satellite images showed that Arlene had continued to become better organized with organized convection over the center as a frontal boundary approached from the west and wind shear decreased. Late on the 1st, a penetration center fix measured a central pressure of 1007 mb and estimated surface winds of 45 kt at 22Z. Based on a forward speed of about 16 kt and high environmental pressure (1022 mb OCI), an intensity of 50 kt is analyzed at 00Z on the 2nd, down from 55 kt originally in HURDAT, a minor intensity change. The next penetration center fix measured a central pressure of 999 mb and estimated surface winds of 60 kt at 0902Z on the 2nd. A central pressure of 999 mb suggests maximum surface winds of 45 kt from the north of 25N and 50 kt from the north of 35N Landsea et al. pressure-wind relationships. Based on a forward speed of about 14 kt and high environmental pressure (1017 mb OCI), an intensity of 60 kt is analyzed at 12Z on the 2nd, same as originally shown in HURDAT. Intensification to a hurricane is analyzed at 18Z on the 2nd, six hours

earlier than originally shown in HURDAT, based on synoptic observations early on the 3rd and aircraft reconnaissance data late on the 2nd.

September 3:

1. Maps and old HURDAT:

- HURDAT lists a 70 kt hurricane at 40.7N, 53.8W at 12Z.
- HWM depicts a hurricane of at most 1004 mb at 41.3N, 53.7W with a cold front just to the west at 12Z.
- Microfilm analyzes a hurricane of at most 1008 mb at 41N, 53.5W with a cold front just to the west at 12Z.

2. Ship highlights:

- 60 kt S and 996 mb at 36.9N, 55.5W at 00Z (COADS).
- 45 kt S and 1015 mb at 37.1N, 53.9W at 03Z (MWL).
- 45 kt S and 1015 mb at 36.7N, 52.8W at 06Z (COADS).
- 35 kt SW and 1019 mb at 41.2N, 49.3W at 18Z (COADS).

3. Satellite highlights:

- ESSA III estimated a center fix at 42N, 53W at 1530Z (WALLET).

4. Aircraft highlights:

- Penetration center fix measured a central pressure of 998 mb and estimated surface winds of 50 kt at 40.1N, 54.2W at 0946Z (WALLET).
- Penetration center fix measured a central pressure of 982 mb and estimated surface winds of 75 kt at 44.3N, 51.4W at 22Z (WALLET).

5. Discussion:

- Reanalysis: A penetration center fix measured a central pressure of 994 mb and estimated surface winds of 70 kt at 2103Z on the 2nd. A ship reported 60 kt and 996 mb at 00Z on the 3rd, suggesting a central pressure of 990 mb or lower, which is in agreement with the penetration center fix three hours earlier. A central pressure of 990 mb suggests maximum surface winds of 63 kt from the north of 35N pressure-wind relationship. Based on a forward speed of about 16 kt, small circulation and ship report of 60 kt, an intensity of 70 kt is analyzed at 00Z on the 3rd, up from 65 kt originally shown in HURDAT, a minor intensity change. Another penetration center fix reported a central pressure of 998 mb at 0946Z but it appears to have missed the center based on central pressure reports late on the 2nd and late on the 3rd, and since there are no indications that Arlene had weakened. A satellite image at 1530Z on the 3rd showed that Arlene had continued to become better organized with convection surrounding a well-defined eye, and a banding feature over the eastern semicircle.

September 4:

1. Maps and old HURDAT:

- HURDAT lists a 60 kt extratropical storm at 46.6N, 46W at 12Z.
- HWM depicts a hurricane of at most 1008 mb at 47.5N, 46W with a cold front just to the northwest at 12Z.

2. Ship highlights:

- 40 kt SSW and 1011 mb at 43.6N, 50.8W at 00Z (COADS).

3. Satellite highlights:

- ESSA II estimated a center fix at 47N, 46W at 1111Z (WALLET).
- ESSA III estimated a center fix at 46.4N, 46W at 1410Z (WALLET).

4. Discussion:

- ATSR: "As ARLENE moved north, then northeast over the colder water and was overtaken by a polar front, she rapidly decreased in intensity and became extratropical about 200 miles east-southeast of Newfoundland. She had retained hurricane intensity for only 24 hours."
- Reanalysis: A penetration center fix measured a central pressure of 982 mb and estimated surface winds of 75 kt at 22Z on the 3rd. A central pressure of 982 mb suggests maximum surface winds of 71 kt from the north of 35N pressure-wind relationship. Based on a forward speed of about 27 kt, an intensity of 80 kt is analyzed at 00Z on the 4th, up from 60 kt originally shown in HURDAT, a major intensity change. 80 kt is also the peak intensity of this hurricane, up from 75 kt originally shown in HURDAT at 18Z on the 3rd, a minor intensity change. After reaching its peak intensity, Arlene began to weaken quickly as it accelerated over the north Atlantic. Transition to an extratropical cyclone is analyzed at 12Z on the 4th, same as originally shown in HURDAT. Satellite images showed a small and sheared tropical cyclone with convection near the center at the end of a frontal boundary.

September 5:

1. Maps and old HURDAT:

- HWM depicts a broad extratropical cyclone at 45N, 45W at 12Z.

2. Ship highlights:

- 35 kt E and 1013 mb at 46.7N, 38W at 06Z (COADS).

3. Discussion:

- Reanalysis: The last position in the original HURDAT was at 18Z on the 4th but synoptic observations suggests that Arlene retained a closed circulation on the 5th. The weak extratropical cyclone gradually lost strength and organization and observations early on the 6th indicated that the low-level circulation had opened up into a trough, thus the last position is analyzed at 18Z on the 5th, 24 hours later than originally shown in HURDAT.

Date	Original HURDAT Central Pressure	Evidence	Changes
Aug 30 12Z		Ship: 30 kt NNE and 1004 mb at 21N, 44.7W at 12Z	1001 mb
Aug 30 18Z	1001 mb	Penetration center fix: 1001 mb at 1746Z	Retained
Aug 31 18Z	1008 mb	Penetration center fix: 1008 mb at 1707Z	
Sep 01 12Z	1009 mb	Penetration center fix: 1009 mb at 1153Z	
Sep 02 00Z	1007 mb	Penetration center fix: 1007 mb at 22Z on Sep 1st	
Sep 02 12Z	999 mb	Penetration center fix: 999 mb at 0902Z	
Sep 03 00Z	994 mb	Ship: 60 kt S and 996 mb at 36.9N, 55.5W at 00Z	990 mb
Sep 03 12Z	998 mb	Observations early and late on Sep 3rd suggest that this penetration fix missed the center, thus it is removed	Removed

		from HURDAT	
Sep 04 00Z	982 mb	Penetration center fix: 982 mb at 22Z on Sep 3rd	Retained

Sources: NHC microfilm maps, the Historical Weather Maps series, the COADS ship database, Monthly Weather Review, Mariners Weather Log, Satellite images from NCDC, and NHC Storm Wallets.

Hurricane Chloe (September 4-21, 1967) - AL121967

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45040 09/05/1967 M=17 12 SNBR= 964 CHLOE       XING=0 SSS=0
45040 09/04/1967 M=18 12 SNBR= 964 CHLOE       XING=0 SSS=0
         **        **

(September 4th is new to HURDAT)
45045 09/04*  0   0   0    0*  0   0   0    0*  0   0   0    0*150 190  25    0*
                                                              *** ***  **

45045 09/05*154 203  30    0*157 217  30    0*159 231  30 1008*161 245  30 1008*
45045 09/05*154 203  30    0*157 217  30    0*159 231  30 1008*161 245  30 1007*
                                                                            ****

45050 09/06*164 260  30    0*168 275  30    0*171 290  30    0*175 307  30    0*
45050 09/06*164 260  30    0*168 275  35    0*171 290  35    0*175 307  35    0*
                                      **                **                **

45055 09/07*180 321  30    0*186 335  30    0*193 347  30    0*200 358  30    0*
45055 09/07*180 321  35    0*186 335  35    0*193 347  35    0*200 358  35    0*
                     **                **                **                **

45060 09/08*207 368  30    0*217 376  30    0*227 380  35    0*237 383  40    0*
45060 09/08*207 368  35    0*217 376  35    0*227 380  40    0*237 383  40    0*
                     **                **                **

45065 09/09*248 388  45    0*258 391  60    0*263 394  65    0*267 396  75  997*
45065 09/09*248 388  45    0*258 391  50    0*263 394  55    0*265 398  55  997*
                                      **                **      *** ***  **

45070 09/10*266 404  65    0*265 414  70    0*264 427  70    0*263 439  70  998*
45070 09/10*266 404  55    0*265 414  55    0*264 427  55    0*263 439  55  998*
                     **                **                **                **

45075 09/11*262 450  70    0*261 462  75    0*260 473  80    0*262 487  85  987*
45075 09/11*262 450  60    0*261 462  60    0*260 474  65    0*262 486  65  987*
                     **                **          ***  **          ***  **

45080 09/12*265 493  85    0*268 497  85    0*273 502  90    0*277 507  90  964*
45080 09/12*265 495  70    0*268 498  75    0*272 501  85    0*276 505  90  964*
                ***  **          ***  **      *** ***  **      *** ***

45085 09/13*279 509  95    0*282 512  95    0*284 515  95    0*288 519  95  958*
45085 09/13*279 509  95    0*282 512  95    0*284 515  95    0*287 518  95  958*
                                                              *** ***

45090 09/14*290 522  95    0*294 526  95    0*300 533  90    0*308 541  90  962*
45090 09/14*290 522  95    0*294 526  95    0*300 533  95    0*308 541  95  958*
                                                      **                **  ***

45095 09/15*317 549  85    0*326 558  80    0*335 566  80    0*345 572  80  973*
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45095 09/15*317 549  90    0*326 558  85    0*335 566  80    0*345 572  80  973*
                     **                **
45100 09/16*356 576  80    0*367 578  80    0*378 578  80    0*389 578  80  970*
45100 09/16*356 576  85    0*367 578  85    0*378 578  85    0*389 578  85  970*
                     **                **                **                **
45105 09/17*400 569  80    0*408 551  80    0*414 530  80    0*419 507  80  967*
45105 09/17*400 569  85    0*408 551  85    0*414 530  90    0*419 507  90  967*
                     **                **                **                **
45110 09/18*423 478  80    0*427 448  75    0*430 418  75    0*434 385  75  969*
45110 09/18*423 478  85    0*427 448  85    0*430 418  85    0*434 385  85  969*
                     **                **                **                **
45115 09/19*440 350  75    0*445 315  75    0*449 280  75    0*448 248  75    0*
45115 09/19*440 350  85    0*445 315  85    0*449 280  80    0*448 248  75    0*
                     **                **                **
45120 09/20*446 215  70    0*443 181  70    0*440 150  60    0*442 118  55    0*
45120 09/20*446 220  70    0*445 191  65    0*445 155  60    0*447 118  55    0*
                ***          *** ***  **      *** ***          ***
45125 09/21*443  85  45  992*446  51  40    0E448  18  40    0E4513585  35  996*
45125 09/21*450  85  50    0*453  51  45    0E457  18  40    0E4603585  35    0*
            ***      **    * ***      **      ***              ***            *
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45130 HR

Significant Revisions:

1. Intensification to a tropical storm is analyzed 54 hours earlier based on synoptic observations and satellite images.
2. Major intensity decreases analyzed at 18Z on September 9th, 06Z-18Z on September 10th and 11th and 00Z on September 12th.
3. Intensification to a hurricane is analyzed 48 hours later based on aircraft reconnaissance data.
4. A couple of the central pressure values in original HURDAT were added or removed based on synoptic and aircraft reconnaissance data. The additions and removals are documented in a table at the end.

Daily Metadata:

September 4:

1. Maps and old HURDAT:

- HWM analyzes a closed low pressure of at most 14.2N, 18.5W at 12Z.
- HURDAT does not list an organized system on this date.
- Microfilm shows a tropical wave along the west coast of Africa at 12Z.

2. Satellite highlights:

- ESSA V estimated a center fix at 15N, 18W at 15Z (WALLET).

3. Discussion:

- MWR: "As the fourth in the series of disturbances moved off the African Coast on September 4, Dakar reported winds shifting from northeast to southeast in the layer extending from the surface to 700 mb."

- Reanalysis: A tropical wave left the west coast of Africa on September 3rd and satellite images and synoptic observations indicated that it quickly became better organized. A closed low-level circulation is analyzed to have formed at 18Z on the 4th, and this is the first analyzed position, six hours earlier than originally shown in HURDAT. Satellite images showed that on the 4th the tropical depression already presented some banding features, especially over the southern semicircle.

September 5:

1. Maps and old HURDAT:

- HWM analyzes a closed low pressure of at most 1012 mb at 16.5N, 23.5W at 12Z.
- HURDAT lists a 30 kt tropical depression at 15.9N, 23.1W at 12Z.
- Microfilm shows a tropical cyclone of at most 1008 mb at 15.5N, 24W at 12Z.

2. Ship highlights:

- 5 kt W and 1009 mb at 14.9N, 23.9W at 12Z (micro).
- 10 kt N and 1008 mb at 16.9N, 25.5W at 18Z (COADS).

3. Satellite highlights:

- ESSA V estimated a center fix at 16.2N, 25W at 1739Z (WALLET).

4. Discussion:

- MWR: "The next day [5], the Low passed through the Cape Verde Islands with a minimum pressure of 1008 mb. (29.76 in.) and 25- to 30-mph winds."
- ATSR: "Hurricane CHLOE, the season's third tropical cyclone, evolved from a weak depression originating just east of the Cape Verde Islands. By 5 September, there was evidence of a weak circulation centered near 16N, 23W."
- Reanalysis: The tropical depression moved westward and passed over the Cape Verde Islands.

September 6:

1. Maps and old HURDAT:

- HWM analyzes a closed low pressure of at most 1012 mb at 18.5N, 29.5W at 12Z.
- HURDAT lists a 30 kt tropical depression at 17.1N, 29W at 12Z.
- Microfilm shows a tropical cyclone of at most 1012 mb at 16.5N, 28W at 12Z.

2. Ship highlights:

a. 35 kt NE and 1013 mb at 17.3N, 30.5W at 06Z (COADS).

3. Satellite highlights:

- ESSA III estimated a center fix at 17N, 30W at 14Z (WALLET).
- ESSA V estimated a center fix at 17.3N, 30.3W at 1630Z (WALLET).

4. Discussion:

- Reanalysis: On the 6th, satellite images indicated that the tropical depression was well-organized with convection over the center and banding features to the north and south. A ship reported 35 kt at 06Z on the 6th and intensification to a tropical storm is analyzed at this time, also taking into account the satellite presentation.

September 7:

1. Maps and old HURDAT:

- HWM analyzes a closed low pressure of at most 1012 mb at 19N, 34.8W at 12Z.
- HURDAT lists a 30 kt tropical depression at 19.3N, 34.7W at 12Z.
- Microfilm shows a tropical cyclone of at most 1012 mb at 19.5N, 35.5W at 12Z.

2. Satellite highlights:

- ESSA III estimated a center fix at 20N, 35.5W at 1446Z (WALLET).
- ESSA V estimated a center fix at 20N, 35.8W at 1730Z (WALLET).

3. Discussion:

- MWR: "On the 7th, the depression turned northwestward under the influence of a rather vigorous middle-latitude trough. However, the trough filled and moved eastward without picking up Chloe."
- Reanalysis: Chloe continued on a northwestward track over the central Atlantic and no changes in intensity are analyzed on this date. Satellite images showed a large system with sprawling banding features to the north and south of a small area of convection near or over the center.

September 8:

4. Maps and old HURDAT:

- HWM analyzes a tropical storm of at most 1012 mb at 23.3N, 38.5W at 12Z.
- HURDAT lists a 35 kt tropical storm at 22.7N, 38W at 12Z.
- Microfilm shows a tropical storm of 1005 mb at 22.5N, 38W at 12Z.

5. Ship highlights:

b. 35 kt ENE and 1009 mb at 23.1N, 37.9W at 06Z (COADS).
c. 40 kt ENE and 1013 mb at 23.3N, 37W at 12Z (COADS).

6. Satellite highlights:

a. ESSA V estimated a center fix at 25N, 37.5W at 1728Z (WALLET).

7. Aircraft highlights:

a. Penetration center fix reported a pressure minimum of 1007 mb and estimated surface winds of 35 kt at 22.1N, 38.5W at 1740Z (WALLET).

8. Discussion:

- MWR: "Slowly intensifying during the northward motion, Chloe attained tropical storm strength on the 8th."
- ATSR: "This depression moved west-northwest, then curved more to the northwest, reaching tropical storm intensity on the 8th, near 23N, 38W."
- Reanalysis: A reconnaissance aircraft investigated Chloe late on the 8th but was not able to reach the center, thus the pressure minimum reported is not used as a central pressure. Satellite images showed that southwesterly shear had increased causing the center to be exposed and most of the convection to be displaced to the northeast. A couple of ships reported gale-force winds on this date, up to 40 kt.

September 9:

1. Maps and old HURDAT:

- HWM analyzes a hurricane of at most 1012 mb at 27.4N, 39.3W at 12Z.
- HURDAT lists a 65 kt hurricane at 26.3N, 39.4W at 12Z.
- Microfilm shows a tropical storm of at most 1008 mb at 26.2N, 38.7W at 12Z.

2. Ship highlights:

d. 40 kt E and 1013 mb at 27.4N, 40.1W at 06Z (COADS).
e. 35 kt N and 1014 mb at 26.4N, 40.7W at 12Z (COADS).
f. 35 kt SE and 1014 mb at 27.2N, 36.4W at 15Z (COADS).
g. 35 kt SE and 1012 mb at 26.5N, 36.4W at 18Z (COADS).

3. Satellite highlights:

- ESSA II estimated a center fix at 26.3N, 39W at 1024Z (WALLET).
- ESSA III estimated a center fix at 26N, 39.5W at 1445Z (WALLET).

4. Aircraft highlights:

- Penetration center fix measured a central pressure of 997 mb, estimated surface winds of 75 kt and an eye diameter of 20 n mi at 26.9N, 39.6W at 18Z (WALLET).

5. Discussion:

- MWR: "The next day [9], an Air Force reconnaissance plane reported 86-m.p.h. winds and a central pressure of 997 mb. (29.44 in.). Failing to make contact with the trough, hurricane Chloe turned sharply westward."
- ATSR: "CHLOE continued to intensify as she moved north-northwest and reached hurricane intensity on 9 September. CHLOE was stalled by an intensifying anticyclone to the northwest, both at the surface and aloft. This forced her to seek an abrupt change in course to the west on the 9th and 10th of September."
- Reanalysis: Chloe continued to intensify as the track changed to the west late on the 9th. A penetration center fix measured a central pressure of 997 mb, estimated surface winds of 75 kt and an eye diameter of 20 n mi at 18Z on the 9th. A central pressure of 997 mb suggests maximum surface winds of 49 kt from the north of 25N Brown et al. pressure-wind relationship. An eye diameter of 20 n mi suggests an RMW of about 15 n mi and the climatological value is 22 n mi. Due to a slow forward speed of 4 kt, but small RMW and weighing some the visual estimate, an intensity of 55 kt is analyzed at 18Z on the 9th, down from 75 kt originally shown in HURDAT, a major intensity change. The circulation remained exposed on satellite images on the 9th with most of the convection displaced to the northeast due to strong southwesterly shear. A few ships reported gale-force winds on this date.

September 10:

1. Maps and old HURDAT:

- HWM analyzes a hurricane of at most 1008 mb at 27.2N, 42.5W at 12Z.
- HURDAT lists a 70 kt hurricane at 26.4N, 42.7W at 12Z.
- Microfilm shows a hurricane of at most 1012 mb at 27.2N, 42.7W at 12Z.

2. Ship highlights:

h. 35 kt ENE and 1015 mb at 29.1N, 35.9W at 06Z (COADS).
i. 30 kt N (35 kt in microfilm) and 1007 mb at 26.9N, 45.6W at 18Z (COADS).

3. Satellite highlights:

- ESSA II estimated a center fix at 27N, 42.5W at 11Z (WALLET).
- ESSA III estimated a center fix at 26N, 44W at 1536Z (WALLET).

4. Aircraft highlights:

- Penetration center fix measured a central pressure of 998 mb, estimated surface winds of 70 kt and an eye diameter of 50 n mi at 26.2N, 44.1W at 19Z (WALLET).

5. Discussion:

- Reanalysis: The next penetration center fix occurred at 19Z on the 10th measuring a central pressure of 998 mb and estimating surface winds of 70 kt. An intensity of 55 kt is analyzed at 18Z on the 10th, down from 70 kt originally in HURDAT, a minor intensity change. Satellite images indicated that the shear had decreased with organized convection covering the center of the tropical storm.

September 11:

1. Maps and old HURDAT:

- HWM analyzes a hurricane of at most 1000 mb at 27N, 47.5W at 12Z.
- HURDAT lists an 80 kt hurricane at 26N, 47.3W at 12Z.
- Microfilm shows a hurricane of at most 1004 mb at 26.6N, 47.4W at 12Z.

2. Ship highlights:

j. 50 kt S and 1006 mb at 26N, 44.6W at 00Z (micro).
k. 65 kt NE and 1012 mb at 27.3N, 49.8W at 09Z (COADS).
l. 35 kt SW and 1007 mb at 24.3N, 47.6W at 12Z (COADS).
m. 35 kt SE and 1012 mb at 26.1N, 46W at 18Z (COADS).

3. Satellite highlights:

- ESSA II estimated a center fix at 26N, 47.5W at 1140Z (WALLET).
- ESSA II estimated a center fix at 26N, 49W at 1622Z (WALLET).

4. Aircraft highlights:

- Penetration center fix measured a central pressure of 987 mb and estimated surface winds of 80 kt at 26.4N, 49W at 1930Z (WALLET).

5. Discussion:

- Reanalysis: Satellite images on the 11th showed that Chloe had become much better organized with convection surrounding a ragged eye. A penetration center fix measured a central pressure of 987 mb and estimated surface winds of 80 kt at 1930Z on the 11th. A central pressure of 987 mb suggests maximum surface winds of 64 kt from the north of 25N pressure-wind relationship. Based on a forward speed of about 12 kt, an intensity of 65 kt is analyzed at 18Z on the 11th, down from 85 kt originally shown in HURDAT, a major intensity change. Intensification to a hurricane is analyzed at 12Z on the 11th, in part due to the reconnaissance aircraft data and a ship report of 65 kt at 09Z, which appears to have a high bias. Intensification to a hurricane is analyzed at 48 hours later than originally shown in HURDAT.

September 12:

1. Maps and old HURDAT:

- HWM analyzes a hurricane of at most 1000 mb at 28N, 50.5W at 12Z.
- HURDAT lists a 70 kt hurricane at 27.3N, 50.2W at 12Z.
- Microfilm shows a hurricane of at most 1004 mb at 27.1N, 50.9W at 12Z.

2. Ship highlights:

- 35 kt SSW and 1006 mb at 26.4N, 47.7W at 09Z (COADS).
- 40 kt ENE and 1012 mb at 29.8N, 49.9W at 12Z (COADS).
- 45 kt NE and 1007 mb at 28.8N, 52.7W at 18Z (COADS).
- 45 kt E and 1009 mb at 29.4N, 50.1W at 21Z (COADS).

3. Satellite highlights:

- ESSA II estimated a center fix at 27.3N, 50.7W at 1030Z (WALLET).

4. Aircraft highlights:

- Penetration center fix measured a central pressure of 964 mb, estimated surface winds of 95 kt and an eye diameter of 23-28 n mi at 27.7N, 50.6W at 1740Z (WALLET).

5. Discussion:

- ATSR: "By 12 September, CHLOE was back on a northwest course, moving slowly across the central North Atlantic. She reached her maximum intensity of 95 knot winds on the 12th and 13th."
- Reanalysis: Chloe continued to intensify on the 12th and satellite images showed a well-defined eye with organized convection surrounding it. A penetration center fix measured a central pressure of 964 mb, estimated surface winds of 95 kt and an eye diameter of 23-28 n mi at 1740Z on the 12th. A central pressure of 964 mb suggests maximum surface winds of 95 kt from the north of 25N intensifying subset of the pressure-wind relationship. An eye diameter of 23-28 n mi suggests an RMW of about 17-21 n mi and the climatological value is 19 n mi. Due to a slow forward speed of about 6 kt, an intensity of 90 kt is analyzed at 18Z on the 12th, same as originally shown in HURDAT. A few ships reported gale-force winds in the periphery of the hurricane.

September 13:

1. Maps and old HURDAT:

- HWM analyzes a hurricane of at most 992 mb at 29.3N, 51.5W at 12Z.
- HURDAT lists a 95 kt hurricane at 28.4N, 51.5W at 12Z.
- Microfilm shows a hurricane of at most 996 mb at 28.7N, 51.2W at 12Z.

2. Ship highlights:

- 40 kt ENE and 1010 mb at 30N, 50.6W at 00Z (micro).
- 60 kt W and 992 mb at 27.1N, 50W at 06Z (COADS).
- 35 kt SSW and 1006 mb at 26.5N, 49.2W at 12Z (COADS).
- 35 kt E and 1009 mb at 28.9N, 47.8W at 18Z (COADS).

3. Satellite highlights:

- ESSA II estimated a center fix at 28N, 51W at 1055Z (WALLET).

4. Aircraft highlights:
- Penetration center fix measured a central pressure of 958 mb, estimated surface winds of 80 kt and an eye diameter of 20 n mi at 28.7N, 51.8W at 1745Z (WALLET).

5. Discussion:
- MWR: "The hurricane deepened again as it took on a northward component of motion. The minimum central pressure reported in Chloe was 958 mb. (28.29 in.) on September 13."
- Reanalysis: Chloe continued to slowly gain strength over the central Atlantic. Satellite images depicted a well-organized tropical cyclone with a well-defined eye and deep convection surrounding it. A penetration center fix measured a central pressure of 958 mb, estimated surface winds of 80 kt and an eye diameter of 20 n mi at 1745Z on the 13th. A central pressure of 958 mb suggests maximum surface winds of 102 kt from the north of 25N intensifying subset of the pressure-wind relationship. An eye diameter of 20 n mi suggests an RMW of about 15 n mi and the climatological value is 17 n mi. Due to a slow forward speed of about 5 kt, an intensity of 95 kt is analyzed at 18Z on the 13th, same as originally shown in HURDAT. A couple of ships reported gale-force winds in the periphery of the hurricane, except for a ship at 06Z that got close to the RMW reporting 60 kt and 992 mb.

September 14:

1. Maps and old HURDAT:
- HWM analyzes a hurricane of at most 996 mb at 30.7N, 53.2W at 12Z.
- HURDAT lists a 90 kt hurricane at 30N, 53.3W at 12Z.
- Microfilm shows a hurricane of at most 1006 mb at 29.5N, 53W at 12Z.

2. Ship highlights:
- 35 kt S and 1008 mb at 27.2N, 48.8W at 00Z (COADS).
- 70 kt SW and 1005 mb at 29.5N, 55.5W at 18Z (micro).

3. Satellite highlights:
- ESSA II estimated a center fix at 29.6N, 52.9W at 1130Z (WALLET).
- NIMBUS estimated a center fix at 30.3N, 53.9W at 15Z (WALLET).
- ESSA V estimated a center fix at 31N, 55W at 1733Z (WALLET).

4. Aircraft highlights:
- Penetration center fix measured a central pressure of 958 mb and estimated an eye diameter of 35-40 n mi at 31.1N, 54.1W at 18Z (WALLET).

5. Discussion:
- Reanalysis: Chloe continued very well-organized in the satellite images on the 14th as it slowly moved northwestward over the central Atlantic. A penetration center fix reported a central pressure of 958 mb at 18Z on the 14th and an intensity of 95 kt is analyzed at this time, up from 90 kt in HURDAT, a minor intensity change. It is possible that Chloe may have been a major hurricane early on this date but the data is not conclusive to make this assertion. A ship reported 70 kt at 18Z as it approached the RMW of the hurricane.

September 15:

1. Maps and old HURDAT:
- HWM analyzes a hurricane of at most 996 mb at 34.1N, 56.9W at 12Z.
- HURDAT lists an 80 kt hurricane at 33.5N, 56.6W at 12Z.
- Microfilm shows a hurricane of at most 992 mb at 32.9N, 55.5W at 12Z.

2. Ship highlights:
- 35 kt ENE and 1007 mb at 36.3N, 58.7W at 09Z (COADS).
- 35 kt ENE and 1008 mb at 36.6N, 58W at 12Z (COADS).
- 40 kt E and 1008 mb at 36.9N, 57.3W at 15Z (COADS).
- 40 kt SSE and 1013 mb at 35.4N, 52.2W at 18Z (COADS).
- 45 kt E and 1009 mb at 37.7N, 56W at 21Z (COADS).

3. Satellite highlights:
- ESSA II estimated a center fix at 33N, 55.5W at 12Z (WALLET).
- ESSA V estimated a center fix at 34.7N, 57.5W at ~18Z (WALLET).

4. Aircraft highlights:
- Penetration center fix measured a central pressure of 973 mb, estimated surface winds of 75 kt and an eye diameter of 25 n mi at 34.6N, 57.2W at 18Z (WALLET).

5. Discussion:
- MWR: "Approaching Doria on the 15th, Chloe turned northward."
- Reanalysis: Chloe weakened on the 15th as it interacted with Doria, passing just 650 n mi from the hurricane. Satellite images showed that the convection remained organized over the center but the well-defined eye previously visible had become ragged. A penetration center fix measured a central pressure of 973 mb, estimated surface winds of 75 kt and an eye diameter of 25 n mi at 18Z on the 15th. A central pressure of 973 mb suggests maximum surface winds of 77 kt from the north of 25N weakening subset and 80 kt from the north of 35N Landsea et al. pressure-wind relationships. An eye diameter of 25 n mi suggests an RMW of about 20 n mi and the climatological value is 28 n mi. Based on a forward speed of about 13 kt and small RMW, an intensity of 80 kt is analyzed at 18Z on the 15th, same as originally shown in HURDAT. Ships remained in the periphery on this date reporting only gale-force winds.

September 16:

1. Maps and old HURDAT:
- HWM analyzes a hurricane of at most 996 mb at 38.5N, 57.5W at 12Z.
- HURDAT lists an 80 kt hurricane at 37.8N, 57.8W at 12Z.
- Microfilm shows a hurricane of at most 992 mb at 37.7N, 57.7W at 12Z.

2. Ship highlights:
- 35 kt ESE and 1010 mb at 37.9N, 55.3W at 00Z (COADS).
- 35 kt SE and 1013 mb at 38.2N, 54.6W at 03Z (COADS).
- 35 kt S and 1013 mb at 34.3N, 54W at 06Z (COADS).
- 65 kt SE and 1004 mb at 39.4N, 56.6W at 12Z (COADS).

- 50 kt SE and 1004 mb at 39.1N, 55.8W at 15Z (COADS).
- 50 kt S and 1003 mb at 38.8N, 55.8W at 18Z (COADS).
- 50 kt S and 1004 mb at 38.4N, 55.4W at 21Z (COADS).

3. Satellite highlights:
- ESSA II estimated a center fix at 37.5N, 57.5W at 1236Z (WALLET).
- NIMBUS estimated a center fix at 38N, 58W at 1640Z (WALLET).
- ESSA V estimated a center fix at 38.6N, 58W at ~18Z (WALLET).

4. Aircraft highlights:
- Penetration center fix measured a central pressure of 970 mb, estimated surface winds of 100 kt and an eye diameter of 17 n mi at 38.9N, 57.8W at 1804Z (WALLET).

5. Discussion:
- ATSR: "CHLOE reached her extreme western position near 38N, 58W…"
- Reanalysis: Chloe continued on a slow pace northward entering the shipping lane. Many more ships registered gale and storm-force winds on the 16th compared to previous days and even a report of hurricane-force winds at 12Z. A penetration center fix measured a central pressure of 970 mb, estimated surface winds of 100 kt and an eye diameter of 17 n mi at 1804Z on the 16th. A central pressure of 970 mb suggests maximum surface winds of 82 kt from the north of 35N pressure-wind relationship. An eye diameter of 17 n mi suggests an RMW of about 13 n mi and the climatological value is 32 n mi. Due to a forward speed of about 11 kt and small RMW, an intensity of 85 kt is analyzed at 18Z on the 16th, up from 80 kt originally shown in HURDAT, a minor intensity change.

September 17:

1. Maps and old HURDAT:
- HWM analyzes a hurricane of at most 996 mb at 42N, 52.7W at 12Z.
- HURDAT lists an 80 kt hurricane at 41.4N, 53W at 12Z.
- Microfilm shows a hurricane of at most 1000 mb at 40.9N, 52.7W at 12Z.

2. Ship highlights:
- 50 kt SSW and 1006 mb at 38N, 54.7W at 00Z (COADS).
- 45 kt SW and 1008 mb at 37.5N, 55W at 03Z (COADS).
- 35 kt NE and 1001 mb at 44.3N, 50.1W at 12Z (COADS).
- 50 kt NNE and 998 mb at 43.4N, 52.3W at 18Z (COADS).

3. Satellite highlights:
- ESSA II estimated a center fix at 41.2N, 53.5W at 1030Z (WALLET).
- ESSA III estimated a center fix at 41.5N, 51.5W at 1548Z (WALLET).

4. Aircraft highlights:
- Penetration center fix measured a central pressure of 967 mb, estimated surface winds of 90 kt and an eye diameter of 10 n mi at 41.9N, 50.4W at 1830Z (WALLET).

5. Discussion:

- MWR: "Westerlies steered the storm eastward, away from Doria, on September 17. Satellite pictures suggest that Chloe remained rather intense and probably retained tropical character while crossing the North Atlantic."
- ATSR: "and then curved northeast and accelerated rapidly to the east on 17 September."
- Reanalysis: Chloe turned to the northeast and accelerated as it passed a few hundred miles southeast of Newfoundland. Satellite images indicated that the hurricane remained compact and organized. A penetration center fix measured a central pressure of 967 mb, estimated surface winds of 90 kt and an eye diameter of 10 n mi at 1830Z on the 17th. A central pressure of 967 mb suggests maximum surface winds of 85 kt from the north of 35N pressure-wind relationship. An eye diameter of 10 n mi suggests an RMW of about 8 n mi and the climatological value is 34 n mi. Based on a forward speed of about 23 kt and small RMW, an intensity of 90 kt is analyzed at 18Z on the 17th, up from 80 kt originally shown in HURDAT, a minor intensity change.

September 18:

1. Maps and old HURDAT:
- HWM analyzes a closed low pressure of at most 996 mb at 45N, 40.5W with a stationary front going through the center at 12Z.
- HURDAT lists a 75 kt hurricane at 43N, 41.8W at 12Z.
- Microfilm shows a hurricane of at most 1000 mb at 43N, 41W at 12Z.

2. Ship highlights:
- 60 kt NE and 994 mb at 43.7N, 47.5W at 00Z (COADS).
- 50 kt S and 985 mb at 45.5N, 42.6W at 06Z (COADS).
- 60 kt SW and 983 mb at 41.7N, 42.3W at 09Z (COADS).
- 65 kt WSW and 999 mb at 41.4N, 42.6W at 12Z (COADS).
- 40 kt WSW and 1011 mb at 38.5N, 40.5W at 15Z (COADS).
- 35 kt NE and 1000 mb at 45.5N, 42.5W at 18Z (micro).

3. Satellite highlights:
- ESSA II estimated a center fix at 43N, 40.5W at 12Z (WALLET).
- ESSA V estimated a center fix at 43.5N, 39W at 1448Z (WALLET).

4. Aircraft highlights:
- Penetration center fix measured a central pressure of 969 mb, estimated surface winds of 70 kt and an eye diameter of 10 n mi at 43.4N, 38.6W at 1745Z (WALLET).

5. Discussion:
- MWR: "The last good data regarding intensity were received on September 18 from an Air Force plane that found a central pressure of 969 mb. (28.61 in.)."
- Reanalysis: Chloe moved eastward over the north Atlantic and remained a strong hurricane. Satellite images showed a compact system but with some decrease in central core organization. The last penetration center fix measured a central pressure of 969 mb at 1745Z on the 18th and an intensity of 85 kt is analyzed at 18Z on this date, up from 75 kt originally in HURDAT, a major intensity change. Many ships reported sustained winds of 35 to 60 kt with one report of hurricane-force on the 18th.

September 19:

1. Maps and old HURDAT:
- HWM analyzes a hurricane of at most 992 mb at 45.5N, 27.9W at 12Z.
- HURDAT lists a 75 kt hurricane at 44.9N, 28W at 12Z.

2. Ship highlights:
- 35 kt E and 998 mb at 46.3N, 32W at 00Z (COADS).
- 35 kt WSW and 1012 mb at 40.3N, 28.4W at 06Z (COADS).
- 35 kt NE and 997 mb at 47.2N, 29W at 09Z (COADS).
- 45 kt NE and 998 mb at 47.5N, 28.1W at 12Z (COADS).
- 45 kt NE and 1000 mb at 47.8N, 27.2W at 15Z (COADS).
- 45 kt WSW and 1003 mb at 41.6N, 25.6W at 18Z (COADS).

3. Satellite highlights:
- ESSA III estimated a center fix at 44.9N, 28W at ~12Z (WALLET).

4. Discussion:
- Reanalysis: Chloe continued eastward and retained its tropical characteristics as it passed north of the Azores Islands. Satellite images showed that it remained compact with organized convection near or over the center.

September 20:

1. Maps and old HURDAT:
- HWM analyzes a hurricane of at most 1000 mb at 44.6N, 15W at 12Z.
- HURDAT lists a 60 kt tropical storm at 44N, 15W at 12Z.

2. Ship highlights:
- 50 kt WNW and 1001 mb at 42.7N, 24.2W at 00Z (COADS).
- 45 kt NW and 1002 mb at 43.4N, 22.7W at 06Z (COADS).
- 50 kt WNW and 994 mb at 42.8N, 18.2W at 12Z (COADS).
- 45 kt N and 1005 mb at 47N, 16.5W at 18Z (COADS).
- 35 kt NE and 1000 mb at 47.3N, 11.3W at 21Z (COADS).

3. Satellite highlights:
- ESSA III estimated a center fix at 44N, 15W at 1143Z (WALLET).

4. Discussion:
- Reanalysis: Chloe approached the Iberian Peninsula on the 20th and satellite images suggested that it had begun to transition into an extratropical cyclone. Synoptic observations, on the other hand, indicated that the cyclone retained a warm core. Weakening to a tropical storm is analyzed at 12Z on the 20th, same as originally shown in HURDAT.

September 21:

1. Maps and old HURDAT:
- HWM analyzes an extratropical cyclone of at most 996 mb at 47N, 0W at 12Z.

- HURDAT lists a 40 kt extratropical storm at 44.8N, 1.8W at 12Z.

2. Ship highlights:
- 45 kt SSE and 990 mb at 44.9N, 8.2W at 00Z (COADS).
- 40 kt NW and 1003 mb at 46.4N, 10W at 06Z (COADS).
- 35 kt N and 1004 mb at 47.4N, 6.2W at 12Z (COADS).

3. Discussion:
- MWR: "No additional information concerning the thermodynamic nature of the storm was collected until its remnant reached Europe. When the baroclinic effects became dominant is not known. The extratropical stage may have occurred 12 to 24 hr. earlier than indicated in figure 2 (track). The only casualties attributed to Chloe resulted from the sinking of the Fiete Sehulze in the Bay of Biscay on September 21. Three crewmen drowned and 11 were reported missing."
- Reanalysis: The center of Chloe passed north of the Iberian Peninsula and made landfall in France after 12Z on the 21st. Synoptic observations indicated that it had become an extratropical cyclone before landfall, thus transition to an extratropical cyclone is analyzed at 12Z on the 21st, same as originally shown in HURDAT. Satellite images indicated that the circulation quickly lost definition after landfall. Last position is analyzed at 18Z on the 21st, same as originally shown in HURDAT.

September 22:

1. Maps and old HURDAT:
- HWM analyzes an extratropical cyclone of at most 1008 mb at 45N, 13E at 12Z.

2. Discussion:
- Reanalysis: HWM showed a weak low pressure over NE Italy on the 22nd that may have been the remnants of Chloe as a large extratropical cyclone intensified to the north. Satellite images showed disorganized convection over southeastern Europe.

September 23:

1. Maps and old HURDAT:
- HWM indicates that the remnants of Chloe had dissipated over southeastern Europe at 12Z.

2. Discussion:
- Reanalysis: On the 23rd, the disorganized convection observed on satellite images on the 22nd had become part of the frontal boundary associated with a strong extratropical cyclone to the north.

Date	Original HURDAT Central Pressure	Evidence	Changes
Sep 05 12Z	1008 mb	Ship: 5 kt W and 1009 mb at 14.9N, 23.9W	Retained
Sep 05 18Z	1008 mb	Ship: 10 kt N and 1008 mb at 16.9N, 25.5W	1007 mb

Sep 09 18Z	997 mb	Penetration center fix: 997 mb at 18Z	Retained
Sep 10 18Z	998 mb	Penetration center fix: 998 mb at 19Z	
Sep 11 18Z	987 mb	Penetration center fix: 987 mb at 1930Z	
Sep 12 18Z	964 mb	Penetration center fix: 964 mb at 1740Z	
Sep 13 18Z	958 mb	Penetration center fix: 958 mb at 1745Z	
Sep 14 18Z	962 mb	Penetration center fix: 958 mb at 18Z	958 mb
Sep 15 18Z	973 mb	Penetration center fix: 973 mb at 18Z	Retained
Sep 16 18Z	970 mb	Penetration center fix: 970 mb at 1804Z	
Sep 17 18Z	967 mb	Penetration center fix: 967 mb at 1830Z	
Sep 18 18Z	969 mb	Penetration center fix: 969 mb at 1830Z	
Sep 21 00Z	992 mb	Synoptic observations indicated that the central pressure was lower, a ship reported 45 kt SSE and 990 mb at 00Z on the 21st	Removed
Sep 21 18Z	996 mb	Synoptic observations in HWM at 12Z over France suggested that the central pressure at 18Z was likely lower	

Sources: NHC microfilm maps, the Historical Weather Maps series, the COADS ship database, Monthly Weather Review, Mariners Weather Log, Satellite images from NCDC, and NHC Storm Wallets.

Hurricane Beulah [September 6–24, 1967] – AL131067

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42675 09/05/1967 M=18 13 SNBR= 922 BEULAH      XING=1 SSS=3

42680 09/05*  0   0   0    0*  0   0   0    0*140 570  30    0*139 578  30 1010*
42680 09/05*  0   0   0    0*  0   0   0    0*134 570  25    0*134 576  25 1010*
                                              ***      **      ***  ***  **

42685 09/06*138 585  30    0*137 593  30    0*136 600  30    0*136 602  30    0*
42685 09/06*134 582  25    0*134 588  25    0*134 594  25    0*134 599  30    0*
            *** ***  **      *** ***  **      *** ***  **      *** ***

42690 09/07*137 605  30    0*138 607  30    0*139 608  40 1006*140 611  45    0*
42690 09/07*135 602  30 1006*136 605  30    0*139 608  35 1006*143 611  40    0*
            *** ***     **** *** ***                   **      ***      **

42695 09/08*142 615  50 1005*144 619  55    0*145 622  60  996*147 629  75  989*
42695 09/08*145 615  45    0*146 619  50    0*146 622  60  996*148 629  75  989*
            ***      ** **** ***      **      ***              ***

42700 09/09*150 637  80    0*153 644  90    0*158 651 100    0*163 661 115  950*
42700 09/09*152 636  80    0*155 643  90    0*158 652 100    0*163 661 110  950*
            *** ***          *** ***               ***                  ***

42705 09/10*168 667 120    0*173 676 125    0*175 682 130  947*176 690 120  951*
42705 09/10*167 668 125  940*172 676 120    0*175 683 110  947*177 690 105  951*
            *** *** ***  *** ***     ***          *** ***      ***     ***

42710 09/11*177 699 110  967*177 708  80    0*177 715  75    0*176 726  80  978*
42710 09/11*178 699  95  967*177 707  85    0*175 716  80    0*175 725  75  978*
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            ***     ***          ***  **      *** ***  **      *** ***  **
42715 09/12*176 733  65 1006*175 741  65  997*173 751  60 1000*165 762  50  998*
42715 09/12*175 733  65    0*175 742  55  997*174 751  45 1000*165 762  45  998*
            ***         ****     ***  **      ***      **                **

42720 09/13*162 768  50 1004*160 773  50    0*158 778  50  996*158 781  50  997*
42720 09/13*162 768  35 1004*159 773  40 1002*158 778  45  997*158 782  45  997*
                     **      ***      ** ****          **  ***     ***  **

42725 09/14*159 785  55  996*160 790  60  998*163 795  75  991*168 801  90  989*
42725 09/14*159 786  45  996*160 791  45  998*164 795  60  991*168 801  65  989*
                ***  **          ***  **      ***      **                **

42730 09/15*173 810 100  985*176 816 100    0*180 824 100  980*185 833 100  978*
42730 09/15*172 810  70  985*176 818  70    0*180 825  75  980*184 832  80  978*
            ***     ***          *** ***          *** ***      *** *** ***

42735 09/16*187 837 100  975*192 844 100  970*196 851 100  964*199 856 100  967*
42735 09/16*187 838  85  975*191 845  90  970*195 851  95  964*198 857  95  967*
                *** ***      *** *** ***      ***     ***      *** *** ***

42740 09/17*202 862  95    0*206 872  90    0*210 885  85    0*212 894  85    0*
42740 09/17*202 863 105    0*206 874 110    0*210 885  70    0*213 896  65    0*
                *** ***          *** ***                **      *** ***  **

42745 09/18*215 906  90  977*216 918  95  978*218 927  95  970*221 937 100  967*
42745 09/18*215 907  75  978*217 917  80  978*219 927  85  970*221 936  90  967*
                ***  **  *** *** ***  **      ***      **          *** ***

42750 09/19*224 942 105    0*228 948 110  949*235 957 125  961*239 960 135  923*
42750 09/19*224 943  95  963*229 949 110  949*233 956 125    0*237 960 135  923*
                *** ***  *** *** ***          *** ***      *** ***

42755 09/20*242 962 140  923*251 968 140  931*259 972 140    0*264 977  90    0*
42755 09/20*243 963 140  923*251 966 125  931*259 972 110  940*265 978  85  952*
            *** ***              *** ***               ***  *** *** ***  **  ***

42760 09/21*273 981  70    0*277 984  65    0*277 987  45    0*272 992  35    0*
42760 09/21*271 982  75    0*274 985  60    0*275 987  45    0*273 990  35    0*
            *** ***  **      *** ***  **      ***              *** ***

42765 09/22*267 995  35    0*265 997  35    0*2611000  30    0*2581003  30    0*
42765 09/22*270 993  30    0*265 996  30    0*258 999  30    0*2501000  30    0*
            *** ***  **      *** ***  **      *******          *******

(The 23rd and 24th are new to HURDAT)
00000 09/23*2421000  25    0*234 997  20    0*227 991  20    0*220 983  25    0*
00000 09/24*215 975  30 1001*210 967  25    0*  0   0   0    0*  0   0   0    0*
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42770 HRATX3

Tropical Storm Landfall

9/07 14Z 14.0N 60.9W 35 kt St. Lucia

Hurricane Landfalls

9/17 0300Z 20.5N 86.8W 110 kt, 954 mb, Cozumel, Mexico
9/17 0500Z 20.5N 87.3W 110 kt Puerto Aventuras, Mexico
9/20 1200Z 25.9N 97.2W 110 kt, 940 mb, 10 nmi RMW, E of Matamoros, Mexico

U.S. Hurricane Impact

September 20 – Category 3, South Texas

Significant Revisions:

1. Several central pressures have been added or removed – details in table at end of writeup
2. Landfall in Hispaniola removed
3. Major reductions to intensity on September 10-18, and 20
4. Major increase to intensity on September 17
5. Yucatan Peninsula landfall upgraded from Category 2 to Category 3
6. Erroneous Category 5 landfall in Mexico reduced to Category 3
7. Track extended by 36 hours

Daily Metadata:

August 22 – September 2:

1. Maps and old HURDAT:
    a. Microfilm and HWM depict nothing of interest
2. Discussion
    a. Carlson 1969: "Wave W-3 (later to become Hurricane Beulah) appears first on the 22d near the eastern edge of the analysis network. A widespread area of enhanced rainfall and convection east of the Cameroon Mountains (15E long) accompanied the wave's passage westward across the mountains. After its arrival over their west slopes on August 24 the rainfall became more coherent, while convection itself was confined to a relatively narrow zone between 10 and 18N lat. Cyclonic circulation and confluence in the 2,000-ft streamlines became more noticeable after the 27th, and a closed vortex formed beneath the wave axis at 12N on the 29th. Pressure falls associated with the depression amounted to 2mb at Dakar and the Cape Verde Islands. It remained quiescent, however, for some time, and it was not until September 8 at long 60W that the depression became a tropical storm."
    b. MWR: "The disturbance from which Beulah developed emerged from the African coast on August 28, and moved westward as a "humping up" of the ITC... with minor fluctuations this westward progression continued until September 4 when a Navy reconnaissance aircraft found a weak circulation."

    c. Reanalysis: The origins of Hurricane Beulah can, with some degree of uncertainty, be traced back to a tropical wave over the African Continent on August 22. Tracked via ESSA satellite imagery, the disturbance was part of a series of well-defined waves that evolved into an outbreak of tropical cyclones during the end of August through early September across the Atlantic basin. Although research by Carlson (1969) indicates Beulah to explicitly originate from one of these waves, surface observations and microfilm data show that the

system followed in his paper was a separate, antecedent depression not mentioned within HURDAT. Beulah itself appears to have coalesced in relation to this depression as well as enhancement of the Intertropical Convergence Zone (labeled as an equatorial trough in microfilm) across the main development region. Accordingly, no analyses are made for this time period in relation to Beulah.

September 3:

1. Maps and old HURDAT:
    a. HWM analyzes an elongated trough extending from 12N 62W to 16N 37W at 12Z
    b. Microfilm analyzes a tropical disturbance embedded within an equatorial trough centered at either 14N 51W (TD marker) or 14.5N 48.5W (low marker) at 12Z.
    c. WFO San Juan lists a tropical depression at 14.0N 50.4W at 12Z.
2. Discussion:
    a. Reanalysis: The first concrete evidence of the precursor disturbance to Beulah comes from ship observations on September 3, which indicates the presence of a trough along 15N, with a possible vortex center around 50W.

September 4:

1. Maps and old HURDAT:
    a. HWM analyzes an area of low pressure embedded within a trough at 13.5N 57W at 12Z.
    b. Microfilm analyzes a tropical disturbance embedded within a trough at 13N 52.5W at 12Z
    c. WFO San Juan lists a tropical depression at 14.5N 54.3W at 12Z.
2. Aircraft highlights:
    a. Low-level investigation into disturbance found an elongated trough with a large area of light winds and no evidence of a defined circulation (SW).
3. Discussion:
    a. Reanalysis: The antecedent trough moved sluggishly west in response to a subtropical ridge to its north. Ship observations continued to show an absense of a defined circulation on September 4, which was later confirmed during a reconnaissance mission between 13 and 18Z.

September 5:

1. Maps and old HURDAT:
    a. HURDAT lists a 30 kt tropical depression at 14.0N 57.0W at 12Z.
    b. HWM analyzes a low of at most 1012 mb near 14.5N 56.5W at 12Z.
    c. Microfilm analyzes a tropical cyclone, embedded within a trough, of at most 1012 mb at 14.0N 57.0W at 12Z.
2. Discussion:
    a. MWR: "Early on September 5, ship reports verified that a weak depression had formed, with lowest pressure about 1010 mb. (29.83 in.), located near lat. 14.0N., long. 57.0W., at 0700 EST."

    b. Reanalysis: On September 5, the disturbance became somewhat better defined, and the system was initiated originally in HURDAT as a

tropical depression at 12Z. Observations are sparse near the center of the system, so the original genesis is retained.

September 6:

1. Maps and old HURDAT:
    a. HURDAT lists a 30 kt tropical depression at 13.6N 60.0W at 12Z.
    b. HWM analyzes an area of low pressure at 14.5N 59.5W at 12Z.
    c. Microfilm analyzes a tropical cyclone, embedded within a trough, of at most 1012 mb at 13.6N 60.0W at 12Z.
2. Aircraft highlights:
    a. Radar center fix at 15.0N 60.3W at 13Z; "no cyclonic circulation" (SW)
3. Discussion:
    a. MWR: "On September 6 the depression passed just north of Barbados and satellite photographs indicated that the circulation was becoming better organized."
    b. Reanalysis: Observations from Barbados, Martinique, and nearby ships indicated a weak, possibly closed circulation through much of September 6. Reconnaissance failed to find a closed circulation during a 13Z mission. By 18Z, data from Barbados and Martinique show signs of a well-defined closed circulation

September 7:

1. Maps and old HURDAT:
    a. HURDAT lists a 40 kt tropical storm with 1006 mb at 13.9N 60.8W at 12Z.
    b. HWM analyzes an area of low pressure at 14N 61W at 12Z.
    c. Microfilm analyzes a tropical cyclone, embedded within a trough, of at most 1008 mb at 14N 61W at 12Z.
2. Ship highlights:
    a. 25 kt SSW and 1008 mb at 14.0N 59.4W at 03Z (Micro).
3. Aircraft highlights:
    a. Penetration center fix with estimated surface winds of 35 kt and a central pressure of 1006 mb at 13.8N 60.8W at 1358Z (SW).
    b. Circumnavigation center fix with estimated surface winds of 45 kt and a pressure (not central) of 1005 mb at 14.6N 61.4W at 2150Z (SW).
4. Discussion:
    a. MWR: "On September 7, a Navy reconnaissance aircraft obtained a cloud eye and a pressure center of 1006 mb (29.70 in) near 13.8N 60.5W at 0900 EST with maximum winds of 40 mph. On that day the circulation moved into the eastern Caribbean near the southern tip of Martinique. The same afternoon an investigating aircraft measured 58 mph and 1005 mb (29.68 in) with the center 20 mi off the west coast of Martinique."

    b. Reanalysis: A 25 kt SSW and 1008 mb at 03z ship observation yields an estimated central pressure of 1006 mb. A pressure of 1006 mb suggests maximum winds of 35 kt from the south of 25N Brown et al. pressure-wind relationship. This value was adjusted downward to 30 kt, accounting for the storm's slow movement and slightly below-average environmental pressures. Some intensification took place later on September 7 as the storm turned northwest near the Lesser Antilles. A reconnaissance center fix at 1358Z provided a central pressure of 1006 mb and 35 kt surface winds. Based on their measurements and average environmental pressures, Beulah is upgraded to a 35 kt tropical storm

at 12Z, consistent with the original timing of HURDAT but 5 kt weaker. Roughly two hours later, the center of Beulah made landfall over the northern edge of St. Lucia before the storm entered the Caribbean Sea. Small adjustments to the storm's track are made on this day to better agree with a recon fix at 2150Z that placed the center farther north than the original HURDAT track.

September 8:

1. Maps and old HURDAT:
   a. HURDAT lists a 60 kt tropical storm with 996 mb at 14.5N 62.2W at 12Z.
   b. HWM analyzes a tropical storm of at most 1008 mb at 15N 62.5W at 12Z.
   c. Microfilm analyzes a tropical storm with 996 mb at 14.5N 62.2W at 12Z.
2. Aircraft highlights
   a. Penetration center fix with estimated surface winds of 60 kt, a 15 nmi circular eye, and a central pressure of 996 mb at 14.5N 62.2W at 1204Z (SW).
   b. Penetration center fix with estimated surface winds of 75 kt, a 5 nmi oval eye, and a central pressure of 989 mb at 14.6N 62.8W at 1749Z (SW).
3. Station highlights
   a. 40 kt SE and 1008 mb at Martinique at 08Z (SW).
4. Discussion:
   a. MWR: "Beulah rapidly strengthened and attained hurricane intensity by midday on September 8. Thus Beulah became only the third September storm of this century to gain hurricane force in the eastern Caribbean. Deepening continued as Beulah moved on a northwestward track and came under surveillance of land-based radar at San Juan."

   b. Reanalysis: Upon entering the Caribbean Sea, Beulah underwent marked intensification. Recon observations showed steadily falling pressures and a contracting eye throughout the day. A 1204Z fix yielded a central pressure of 996 mb with a 15 nmi eye and a 1749Z fix found 989 mb and a miniscule 5 nmi eye. A pressure of 996 mb suggests 54 kt and a pressure of 989 mb suggests 65 kt, both from the south of 25N Brown et al. pressure-wind relationship. The former fix depicted a near-average size storm (RMW of about 13 nmi) while the latter showed Beulah to be considerable smaller than average with an RMW less than 5 nmi. Intensities at 12Z and 18Z are assessed at 60 kt and 75 kt, respectively, based on these data. Intensification to hurricane status remains unchanged from the original HURDAT, though the 18Z value is reduced by 5 kt.

September 9:

1. Maps and old HURDAT:
   a. HURDAT lists a 100 kt hurricane at 15.8N 65.1W at 12Z.
   b. HWM analyzes hurricane of at most 1004 mb at 16N 65W at 12Z.
   c. Microfilm analyzes a hurricane of at most 1004 mb at 15.9N 65.4W at 12Z.
2. Aircraft highlights:
   a. Penetration center fix with flight-level winds of 85 kt at 15.3N 63.7W at 00Z (SW).
   b. Penetration center fix with flight-level winds of 90 kt and a 14 nmi oval eye at 15.5N 64.3W at 06Z (SW).

c. Radar center fix with estimated surface winds of 75 kt and a 9 nmi eye at 15.8N 65.1W at 12Z (SW).
d. Penetration center fix with estimated surface winds of 100 kt, a central pressure of 950 mb, and a 10 nmi eye at 16.1N 66.3W at 18Z (SW).

3. San Juan radar fixes (SW)
   a. 15.4N 64.4W at 06Z
   b. 15.7N 65.1W at 12Z
   c. 16.4N 66.0W at 18Z
4. Discussion:
   a. Reanalysis: Rapid intensification took place on September 9 as Beulah's central pressure fell to 950 mb by 18Z, as measured by reconnaissance—this observation is also the only reported central pressure for the day. A pressure of 950 mb suggests maximum winds of 113 kt from the intensifying subset of the south of 25N Brown et al. pressure-wind relationship. A concurrent 10 nmi eye yields a slightly smaller-than-average RMW of about 8 nmi. The storm also accelerated to 10 kt by this time but the environmental pressure remained below average. Accounting for these factors, an intensity of 110 kt is assessed at 18Z.

September 10:

1. Maps and old HURDAT:
   a. HURDAT lists a 130 kt hurricane with 947 mb at 17.5N 68.2W at 12Z.
   b. HWM analyzes a hurricane of at most 1008 mb at 18.0N 68.5W at 12Z.
   c. Microfilm analyzes a hurricane of at most 1008 mb at 17.5N 68.4W at 12Z.
2. Ship highlights:
   a. 70 kt E and 1012 mb at 18.0N 67.9W at 12Z (Micro).
   b. 40 kt SE and 1015 mb at 18.6N 68.4W at 18Z (Micro).
3. Aircraft highlights:
   a. Penetration center fix with a central pressure of 940 mb, a 6 nmi inner eye, and 25 nmi outer eye at 16.7N 66.7W at 2352Z on September 9th (SW).
   b. Radar center fix at 17.2N 67.7W at 0605Z (SW).
   c. Penetration center fix with estimated surface winds of 130 kt, a central pressure of 947 mb, and a 10 nmi eye at 17.5N 68.3W at 1145Z (SW).
   d. Penetration center fix with estimated surface winds of 130 kt, a central pressure of 951 mb, and a 10 nmi eye at 17.7N 69.0W at 18Z (SW).
4. San Juan radar fixes (SW)
   a. 16.5N 66.4W at 00Z.
   b. 17.2N 67.4W at 06Z.
   c. 17.4N 68.2W at 12Z.
   d. 17.3N 69.1W at 1830Z.
5. Discussion:
   a. MWR: "Air Force reconnaissance measured a central pressure of 940 mb (27.75 in) on September 9 [~00z September 10] when the hurricane was about 100 mi south of Puerto Rico. This was the lowest pressure found during her trek through the Caribbean."

"On September 10 radar reports indicated a more westward track as the hurricane crossed to the west of a weak trough and came under the influence of an upper anticyclone located to the northwest, over the Bahamas."

b. Reanalysis: Beulah reached its first peak on September 10 as it moved south of Puerto Rico and turned west. A recon fix at 2352Z on September 9 yielded a central pressure of 940 mb just as an eyewall replacement cycle (EWRC) began; a 6 nmi eye was observed within a developing 25 nmi outer eyewall. A pressure of 940 mb suggests maximum winds of 123 kt from the intensifying subset of the south of 25N Brown et al. pressure-wind relationship. Accounting for a smaller-than-average core RMW, slow speed of 8 kt, and near-average environmental pressures, an intensity of 125 kt is assessed at 00Z, slightly higher than originally in HURDAT. As beautifully documented by San Juan's radar, Beulah's inner core soon disintegrated as the EWRC continued. Winds at 06Z are estimated at 115 kt, 10 kt lower than originally in HURDAT, based on the onset of EWRC-induced weakening. Subsequent recon fixes confirmed the weakening with rising pressures: 947 mb at 1145Z and 951 mb at 18Z. A pressure of 947 mb suggests maximum winds of 110 kt and a pressure of 951 mb suggests maximum winds of 107 kt, both from the weakening subset of the south of 25N Brown et al. pressure-wind relationship. During both periods, the storm had a smaller-than average eye, was moving somewhat slow, and was located within near-average environmental pressures. Based on these factors, intensities of 110 kt and 105 kt are chosen for 12Z and 18Z, respectively. Both values are major reductions from 130 kt and 120 kt originally in HURDAT.

September 11:

1. Maps and old HURDAT:
   a. HURDAT lists a 75 kt hurricane at 17.7N 71.5W at 12Z.
   b. HWM analyzes a hurricane of at most 1008 mb at 18.5N 71.5W at 12Z.
   c. Microfilm analyzes a hurricane of at most 1008 mb at 17.9N 71.8W at 12Z.
2. Ship highlights:
   a. 5 kt SSW and 1004 mb at 16.1N 73.3W at 18Z (COADS).
3. Station highlights:
   a. 30 kt NE and 1005 mb at Santo Domingo, Dominican Republic, at 00Z (Micro).
4. Aircraft highlights:
   a. Penetration center fix with flight-level winds of 102 kt, a central pressure of 967 mb, and a 15 nmi eye at 17.7N 69.9W at 0031Z (SW).
   b. Penetration center fix with flight-level winds of 80 kt at 17.7N 70.7W at 06Z (SW).
   c. Radar center fix with a 10 nmi eye at 17.5N 71.6W at 12Z; "Island Beata [Dominican Republic] inside eye" (SW).
   d. Penetration center fix with estimated surface winds of 80 kt, a central pressure of 978 mb, a 20 nmi "half-moon shape" eye at 17.4N 72.6W at 1745Z (SW).
5. Discussion
   a. MWR: "After skirting the Barahona Peninsula on September 11, Beulah continued westward, moving parallel to, and about 50 mi south of the Tiburon Peninsula of Haiti, sparing the beleaguered area from the full force of her winds and inflicting relatively minor water damage."

b. Reanalysis: Hurricane Beulah wobbled just south of the Dominican Republic on September 11, though it passed directly over the small island of Beata around 12z. Minor adjustments to track are made to better match recon fixes. This is, however, a major change such that landfall in the Dominican Republic is no longer shown. A major reduction to intensity is made at 00Z from 110 kt to 95 kt. This is based on a central pressure fix at 0031Z of 967 mb which yields maximum sustained winds of 91 kt from the weakening subset of the south of 25N Brown et al. pressure-wind relationship. Steady weakening is depicted throughout the day to 75 kt based on a central pressure of 978 mb at 1745Z. This yields maximum sustained winds of 79 kt from the weakening subset of the south of 25N Brown et al. pressure-wind relationship. The 18Z wind speed is assessed slightly below the relationship due to Beulah's somewhat slow forward speed, average RMW, and below-average environmental pressures.

September 12:

1. Maps and old HURDAT:
   a. HURDAT lists a 60 kt tropical storm with 1000 mb at 17.3N 75.1W at 12Z.
   b. HWM analyzes a tropical storm of at most 1004 mb at 18.0N 75.3W at 12Z.
   c. Microfilm analyzes a hurricane of at most 1008 mb at 17.3N 75.0W at 12Z.
2. Ship highlights:
   a. 5 kt S and 1004 mb at 16.7N 72.4W at 00Z (COADS).
   b. 40 kt SSE and 1008 mb at 15.3N 76.0W at 18Z (Micro).
   c. 10 kt NW and 1005 mb at 16.3N 76.6W at 21Z (COADS).
3. Aircraft highlights:
   a. Radar center fix with flight-level winds of 37 kt and a 7 nmi eye at 17.6N 73.3W at 0005Z (SW).
   b. Penetration center fix with flight-level winds of 35 kt, a central pressure of 997 mb, and a 10-15 nmi eye at 17.5N 74.2W at 0558Z (SW).
   c. Penetration center fix with estimated surface winds of 65 kt and a central pressure of 1000 mb at 17.4N 75.1W at 1130Z (SW).
   d. Penetration center fix with estimated surface winds of 65 kt and a central pressure of 998 mb at 16.5N 76.1W at 1733Z (SW).
   e. Penetration center fix with 1004 mb central pressure at 2345Z (SW).
4. Discussion:
   a. MWR: "During the period from the 10th to the 13th a remarkable weakening occurred. In this interval, the central pressure rose approximately 55 mb (1.63 in) and maximum winds decreased from 150 mph to only 40 mph. The hurricane was downgraded to a tropical storm early on the 12th. Thus Beulah, after having initially intensified in an area usually considered unfavorable, proceeded to weaken in a region generally regarded as conducive to intensification. Beulah's brush with Hispaniola probably contributed, at least initially, to her decay but it is felt that the major factor was the environmental changes in the upper troposphere. A strongly confluent jet stream to the rear of a 200-mb trough penetrated from the mid-Atlantic southwestward over the storm, greatly impeding its outflow. This northeasterly current also served to deflect the storm from its westward course, thus eliminating any serious threat to Jamaica."

b. Reanalysis: Beulah succumbed to strong wind shear and its close bypass of mountainous Hispaniola on September 12 as it passed south of Haiti. The hurricane weakened to tropical storm status by 06Z, 6 hours earlier than originally in HURDAT. Its center relocated nearly a degree south of its previous course—sparing Jamaica from a direct hit. This relocation is verified by two recon fixes at 1130Z and 1733Z. The revised track is nearly identical to what was originally shown in HURDAT. The reduction in intensity stems from a 997 mb central pressure at 0558Z; this value yields maximum winds of 53 kt from the south of 25N Brown et al. pressure-wind relationship. Maximum winds fell to 45 kt by 12Z and briefly leveled out there.

September 13:

1. Maps and old HURDAT:
   a. HURDAT lists a 50 kt tropical storm with 996 mb at 15.8N 77.8W at 12Z.
   b. HWM analyzes a tropical storm of at most 1004 mb at 16.5N 78.0W at 12Z.
   c. Microfilm analyzes a tropical storm of at most 1004 mb at 15.8N 77.8W at 12Z.
2. Ship highlights:
   a. 10 kt NW and 1005 mb at 15.7N 76.7W at 00Z (COADS).
   b. 20 kt SE and 1004 mb at 16.1N 76.6W at 06Z (COADS).
   c. 20 kt SW and 1002 mb at 15.2N 77.5W at 12Z (COADS).
3. Aircraft highlights:
   a. Penetration center fix with flight-level winds of 28 kt at 16.2N 76.7W at 2345Z on September 12th (SW).
   b. Penetration center fix with estimated surface winds of 38 kt and a central pressure of 997 mb at 15.8N 77.8W at 1150Z (SW).
   c. Penetration center fix with estimated surface winds of 35 kt and a central pressure of 997 mb at 15.8N 78.1W at 18Z (SW).
4. Discussion:
   a. Reanalysis: Tropical Storm Beulah continued its unusually slow movement south of Jamaica on September 13. A central pressure of 1004 mb was measured by recon at 2345Z on September 12 alongside 28 kt maximum flight-level winds, and a ship near the storm's center measured 1005 mb with NW 10 kt at 00Z. A central pressure of 1004 mb suggests maximum sustained winds of 39 kt south of 25N from the Brown et al. pressure-wind relationship. Based on the storm's slow movement, lack of significant winds from nearby ships, and low environmental pressures, an intensity of 35 kt is assessed at 00Z. This is a major reduction from the 50 kt originally in HURDAT. It is possible that Beulah degraded to a tropical depression around this time. Thereafter, Beulah's central pressure began to fall. A ship observation of 20 kt SE and 1004 mb at 06Z yields a central pressure of 1002 mb. This value suggests maximum sustained winds of 43 kt south of 25N from the Brown et al. pressure-wind relationship. Winds at 06Z are assessed at 40 kt, down from 50 kt originally in HURDAT. Winds are estimated to have reached 45 kt by 12Z based on a central pressure of 997 mb at 1150Z. A central pressure of 997 mb suggests maximum winds of 53 kt south of 25N from the Brown et al. pressure-wind relationship. These values are retained at 18Z based on another fix of 997 mb at that time.

September 14:

1. Maps and old HURDAT:
    a. HURDAT lists a 75 kt hurricane with 991 mb at 16.3N 79.5W at 12Z.
    b. HWM analyzes a hurricane of at most 1000 mb at 17N 80W at 12Z.
    c. Microfilm analyzes a hurricane of at most 1004 mb at 16.1N 79.5W at 12Z.
2. Aircraft highlights:
    a. Penetration center fix with flight-level winds of 45 kt and a central pressure of 996 mb at 15.9N 78.6W at 0015Z (SW).
    b. Penetration center fix with flight-level winds of 45 kt and a central pressure of 998 mb at 15.8N 79.1W at 0530Z (SW).
    c. Penetration center fix with estimated surface winds of 65 kt, a central pressure of 991 mb, and a 15 nmi eye at 16.4N 79.5W at 1145Z (SW).
    d. Penetration center fix with estimated surface winds of 115 kt, a central pressure of 989 mb, and a 10x20 nmi elliptical eye at 16.7N 80.1W at 1745Z; "Due to a large amount of cloud cover in the eye, we released the drop based on flight level winds and might have missed the surface center by 2 or 3 miles" (SW).
3. Discussion:
    a. MWR: “As the confluent zone aloft moved eastward and was replaced by a ridge, Beulah once again became a hurricane and turned toward the northwest.”
    b. Reanalysis: Conditions over the western Caribbean Sea became more favorable for development on September 14 and Beulah continued to reorganize. During the latter half of the day, reconnaissance found steadily decreasing central pressures. The first two times are assessed at 45 kt based on central pressures of 996 mb and 998 mb, similar to the preceding 12 hours. A central pressure of 991 mb at 1145Z suggests maximum sustained winds of 62 kt south of 25N from the Brown et al. pressure-wind relationship. An eye redeveloped by this time, reported to be 15 nmi by recon; based on the slightly smaller-than-average RMW (about 10 nmi), slow forward speed, and low environmental pressures, an intensity of 60 kt is assessed at 12Z, a major decrease from the 75 kt originally in HURDAT. Reconnaissance fixed a pressure of 989 mb at 1745Z and reported surface winds of 115 kt. It is possible that this may not be a central pressure and the value was lower, but based on a 985 mb fix at 0117Z on September 15, it is unlikely that the central pressure was significantly off. A central pressure of 989 mb suggests maximum sustained winds of 65 kt south of 25N from the Brown et al. pressure-wind relationship. Although environmental pressures remained low and the storm was still only moving at about 7 kt, some weight is given to the exceptionally high surface wind estimate and the 18Z intensity is assessed at 65 kt. This is a major reduction from the 90 kt originally in HURDAT. Major reductions to intensity are made at 06Z, 12Z, 18Z, with Beulah assessed as regaining hurricane status at 18Z—6 hours later than originally in HURDAT.

September 15:

1. Maps and old HURDAT:
    a. HURDAT lists a 100 kt hurricane with 980 mb at 18.0N 82.4W at 12Z.
    b. HWM analyzes a hurricane of at most 1004 mb at 18.5N 82.5W at 12Z.

c. Microfilm analyzes a hurricane of at most 1004 mb at 18.0N 82.4W at 12Z.

2. Ship highlights:
   a. 25 kt ENE and 1004 mb at 17.9N 81.3W at 00Z (COADS).
   b. 25 kt E and 1005 mb at 18.9N 81.3W at 00Z (COADS).
   c. 35 kt E and 995 mb at 18.3N 82.2W at 18Z (Micro); pressure appears too low
3. Station highlights:
   a. 5 kt N and 1005 mb at Swan Island (Micro).
   b. 20 kt W and 1004 mb at Swan Island (Micro).
4. Aircraft highlights:
   a. Penetration center fix with flight-level winds of 72 kt, a central pressure of 985 mb, and a 15x25 nmi elliptical eye at 17.6N 81.0W at 0117Z (SW).
   b. Radar center fix at 17.5N 81.8W at 06Z (SW).
   c. Penetration center fix with estimated surface winds of 110 kt, flight-level winds of 105 kt, a central pressure of 980 mb, and a 12 nmi oval eye at 18.1N 82.6W at 1331Z (SW).
   d. Penetration center fix with estimated surface winds of 105 kt, a central pressure of 978 mb, and a 16 nmi circulation at 18.5N 83.2W at 1755Z (SW).
5. Discussion:
   a. Reanalysis: Steady intensification continued throughout September 15 as Beulah maintained its northwest course toward the Yucatan Peninsula. Reconnaissance fixed steadily decreasing pressures throughout the day: 985 mb at 0117Z, 980 mb at 1331Z, and 978 mb at 1755Z. Major reductions to intensity are made at all synoptic positions for September 15, with the original HURDAT having 100 kt for all times. The hurricane maintained a smaller-than-average RMW, relatively slow forward speed of 8-10 kt, and remained within low environmental pressures throughout the day. A central pressure of 985 mb suggests maximum sustained winds of 71 kt from the south of 25N Brown et al. pressure-wind relationship; sustained winds are assessed at 70 kt for 00Z and 06Z based on this. A central pressure of 980 mb suggests maximum sustained winds of 78 kt from south of 25N Brown et al. pressure-wind relationship; sustained winds are assessed at 75 kt for 12Z based on this. A central pressure of 978 mb suggests maximum winds of 81 kt from the intensifying subset from the south of 25N Brown et al. pressure-wind relationship. Accounting for the continued pressure drop and surface wind estimates of 105-110 kt, an intensity of 80 kt is assessed at 18Z. Minor adjustments are made to the track, with smoothing applied to the hurricane’s wobbling path.

September 16:

1. Maps and old HURDAT:
   a. HURDAT lists a 100 kt hurricane with 964 mb at 19.6N 85.1W at 12Z.
   b. HWM analyzes a hurricane of at most 1000 mb at 20N 85.5W at 12Z.
   c. Microfilm analyzes a hurricane of at most 996 mb at 19.7N 85.2W at 12Z.
2. Ship highlights:
   a. 25 kt W and 1004 mb at 16.7N 83.9W at 00Z (COADS).
   b. 30 kt SE and 996 mb at 19.0N 83.4W at 00Z (COADS); pressure appears too low.

c. 20 kt W and 1005 mb at 17.6N 84.7W at 06Z (COADS).
d. 30 kt E and 999 mb at 21.4N 84.7W at 12Z (COADS); pressure appears too low.
e. 45 kt SE and 1008 mb at 20.5N 83.5W at 12Z (COADS).
f. 40 kt S and 1007 mb at 19.3N 84.5W at 18Z (COADS).
g. 45 kt S and 1004 mb at 19.7N 84.6W at 21Z (COADS).

3. Station highlights:
   a. 20 kt W and 1004 mb at Swan Island (Micro).
   b. 10 kt NE and 1005 mb at Cozumel, Mexico (Micro).
4. Aircraft highlights:
   a. Penetration center fix with flight-level winds of 86 kt, a central pressure of 975 mb, and a 17 nmi eye at 18.5N 83.8W at 00Z (SW).
   b. Penetration center fix with flight-level winds of 100 kt, a central pressure of 970 mb, and a 11 nmi eye at 19.1N 84.6W at 0545Z (SW).
   c. Penetration center fix with estimated surface winds of 90 kt and a central pressure of 964 mb at 19.7N 85.1W at 1207Z (SW).
   d. Penetration center fix with flight-level winds of 100 kt and a central pressure of 967 mb at 19.6N 85.7W at 1732Z (SW).
5. Discussion:
   a. MWR: "As the northwestward course became more firmly established, the threat to Cozumel Island and northeastern Yucatan increased."
   b. Reanalysis: Intensification continued for most of September 16. Sustained winds for all synoptic times are reduced from the original HURDAT. A central pressure of 975 mb, fixed at 0117Z, suggests maximum sustained winds of 85 kt from the intensifying subset of the south of 25N Brown et al. pressure-wind relationship. Winds are assessed at 85 kt at 00Z based on this, a major decrease from the 100 kt originally in HURDAT. A central pressure of 970 mb, fixed at 0545Z, suggests maximum sustained winds of 91 kt from the intensifying subset of the south of 25N Brown et al. pressure-wind relationship. Winds are assessed at 90 kt at 06Z based on this, down from 100 kt originally in HURDAT. A central pressure of 964 mb, fixed at 1207Z, suggests maximum sustained winds of 98 kt from the intensifying subset of the south of 25N Brown et al. pressure-wind relationship. Winds are assessed at 95 kt at 12Z based on this, down from 100 kt originally in HURDAT.

September 17:

1. Maps and old HURDAT:
   a. HURDAT lists an 85 kt hurricane at 21.0N 88.5W at 12Z.
   b. HWM analyzes a hurricane of at most 996 mb at 21N 88.5W at 12Z.
   c. Microfilm analyzes a hurricane of at most 996 mb at 20.8N 88.1W at 12Z.
2. Ship highlights:
   a. 40 kt SE and 1016 mb at 19.9N 84.7W at 00Z (COADS).
   b. 45 kt SE and 1007 mb at 20.5N 85.2W at 03Z (Micro).
   c. 45 kt ENE and 1008 mb at 23.6N 89.1W at 12Z (COADS).
   d. 35 kt SE and 1007 mb at 21.9N 86.3W at 12Z (COADS).
   e. 50 kt ESE and 1009 mb at 23.3N 88.2W at 18Z (COADS).
3. Station highlights:
   a. 954.5 mb minimum pressure, peak winds of 104-113 kt N at Cozumel, Mexico; exact time unknown but likely around 3-4Z (SWO from Mexican Meteorological Service).
   b. 20 kt NW and 1000 mb at Merida, Mexico, at 12Z (Micro).

c. 20 kt SW and 995 mb at Merida, Mexico, at 18Z (Micro).

4. Aircraft highlights:
   a. Radar center fix with a 12 nmi eye at 20.2N 86.3W at 00Z (SW).
   b. Radar center fix with a 12 nmi eye at 20.5N 87.3W at 06Z (SW).
   c. Radar center fix at 21.1N 88.5W at 1216Z (SW).
   d. Radar center fix at 21.3N 89.6W at 18Z (SW).
5. Discussion:
   a. MWR: "Landfall on Cozumel occurred during the evening of September 16 [local time, September 17 UTC] with maximum winds about 100 mph. Forty percent of the houses on the Island, virtually all of light construction, were totally destroyed, and several hotels were severely damaged. Beulah entered the southwestern Gulf of Mexico on the afternoon of September 17, weakened only slightly from her traverse of the Yucatan coastal lowlands. The pressure only rose 10 mb (967 to 977 mb) or 0.3 in between reconnaissance measurements preceding and following the land crossing."
   b. Reanalysis: After pausing late on September 16, Beulah deepened significantly before making landfall in Cozumel and the Yucatan Peninsula proper. No center fixes are available around this time due to its proximity to land; however, a weather station in Cozumel registered a minimum pressure of 954 mb and maximum winds of 104-113 kt, presumably around 03-04Z. There is no indication whether or not this was a central pressure, but given the hurricane's track it was presumably close. Using it as a baseline, a pressure of at most 954 mb suggests maximum sustained winds of at least 108 kt from the intensifying subset of the south of 25N Brown et al. pressure wind relationship. Although no eye diameter, and consequently RMW, measurements are available at the time of landfall, preceding values from recon indicate the RMW to be around 10 nmi, which is slightly smaller than the average of 13 nmi. These values indicate that Beulah regained major hurricane status before moving ashore. Based on the aforementioned data, winds at 00Z are assessed at 105 kt, up from 95 kt originally in HURDAT, and winds at 06Z are assessed at 110 kt. Consequently, Beulah's landfalls in Cozumel (03Z) and Puerto Aventuras (05Z) are both assessed at 110 kt. This is a major increase from the 90 kt landfalls originally in HURDAT. Landfall positions are based on multiple aircraft radar fixes. The Kaplan and DeMaria inland decay model was run for two periods starting at 05Z with 110 kt, yielding 67 kt for 12Z and 63 kt for 18Z. Intensities for 12Z and 18Z are assessed at 70 kt and 65 kt accordingly. Beulah may have briefly weakened to a tropical storm around 18Z; however, given that the center of Beulah was beginning to move offshore by this point and its large circulation, hurricane-force winds likely redeveloped offshore. The 18Z assessment is a major reduction from the 85 kt originally in HURDAT.

September 18:

1. Maps and old HURDAT:
   a. HURDAT lists a 95 kt hurricane with 970 mb at 21.8N 92.7W at 12Z.
   b. HWM analyzes a hurricane of at most 992 mb at 22N 92.5W at 12Z.
   c. Microfilm analyzes a hurricane of at most 992 mb at 22.1N 92.9W at 12Z.
2. Ship highlights:

a. 45 kt SE and 998 mb at 22.2N 89.8W at 00Z (COADS).
b. 40 kt SE and 1010 mb at 22.0N 87.5W at 00Z (COADS).
c. 60 kt SE and 995 mb at 21.9N 90.5W at 03Z (Micro).
d. 75 kt ESE at 21.7N 90.9W at 06Z (COADS).
e. 60 kt SE and 994 mb at 21.5N 92.0W at 12Z (COADS).
f. 80 kt ESE and 1000 mb at 21.4N 92.2W at 18Z (COADS).

3. Station highlights:
   a. 35 kt S and 1000 mb at Merida, Mexico, at 00Z (Micro).
   b. 15 kt W and 1001 mb at Campeche, Mexico, at 00Z (Micro).
   c. 20 kt ESE and 1005 mb at Merida, Mexico, at 06Z (Micro).
4. Aircraft highlights:
   a. Penetration center fix with flight-level winds of 56 kt, a central pressure of 978 mb, and a 20 nmi eye at 21.6N 90.7W at 0027Z (SW).
   b. Penetration center fix with flight-level winds of 42 kt and a central pressure of 978 mb at 21.6N 91.8W at 0546Z (SW).
   c. Penetration center fix with estimated surface winds of 90 kt, a central pressure of 970 mb, and a 22 nmi eye at 22.0N 92.7W at 1202Z (SW).
   d. Penetration center fix with estimated surface winds of 85 kt, a central pressure of 967 mb, and a 22 nmi eye at 22.0N 93.5W at 1701Z (SW).
   e. Penetration center fix with estimated surface winds of 75 kt, a central pressure of 963 mb, and a 20x30 nmi oval eye at 22.2N 94.1W at 2136Z (SW).
5. Discussion:
   a. MWR: “Expectations of further intensification soon materialized as Beulah attained a lower central pressure with each succeeding measurement... Early on September 18 Beulah, continuing on a northwestward course, came under surveillance of the Weather Bureau radar at Brownsville. Radar reports indicated that Beulah’s motion was somewhat erratic, reminiscent of the cycloidal path that hurricane Carla followed through the western Gulf of Mexico in 1961.”
   b. Reanalysis: Once over the Gulf of Mexico, Beulah soon began reorganizing. Recon fixes around 0027Z and 0546Z revealed the central pressure to be steady at 978 mb before deepening ensued. A central pressure of 978 mb suggests maximum sustained winds of 80 kt from the south of 25N Brown et al. pressure-wind relationship. Given Beulah’s average forward speed, average RMW of 15 nmi, and low-environmental pressures, intensity at 00Z is assessed at 75 kt and at 06Z 80 kt. These are major reductions from the 90 kt and 95 kt, respectively, originally in HURDAT. A subsequent fix at 1202Z found a central pressure of 970 mb. A central pressure of 970 mb suggests maximum surface winds of 91 kt from the intensifying subset of the south of 25N Brown et al. pressure-wind relationship. Given the same factors as earlier in the day, winds at 12Z are assessed at 85 kt, down from 95 kt originally in HURDAT. A central pressure of 967 mb was fixed at 1701Z and 1925Z, with the latter accompanied by 100 kt estimated surface winds. A central pressure of 967 mb suggests maximum sustained winds of 95 kt from the intensifying subset of the south of 25N Brown et al. pressure-wind relationship. Winds are assessed at 90 kt at 18Z, a decrease from 100 kt originally in HURDAT.

September 19:

1. Maps and old HURDAT:
    a. HURDAT lists a 125 kt hurricane with 961 mb at 23.5N 95.7W at 12Z.
    b. HWM analyzes a hurricane of at most 992 mb at 24N 95.5W at 12Z.
    c. Microfilm analyzes a hurricane of at most 996 mb at 23.5N 96.0W at 12Z.
2. Ship highlights:
    a. 60 kt NW and 1003 mb at 20.8N 96.6W at 00Z (COADS).
    b. 50 kt SSW and 1000 mb at 21.1N 92.1W at 00Z (Micro).
    c. 35 kt E and 1007 mb at 26.5N 94.2W at 12Z (COADS).
    d. 35 kt E and 1008 mb at 26.8N 94.8W at 18Z (COADS).
    e. 30 kt SSE and 1001 mb at 22.1N 92.5W at 18Z (Micro).
3. Aircraft highlights:
    a. Penetration center fix with 75 kt flight-level winds, an extrapolated pressure of 948 mb, and a 20 nmi oval eye at 22.5N 94.2W at 0128Z (SW).
    b. Penetration center fix with 90 kt flight-level winds, a central pressure of 963 mb, and a 23 nmi oval eye at 23.0N 94.4W at 0301Z (SW).
    c. Radar center fix at 22.8N 94.6W at 0540Z (SW).
    d. 949 mb measurement from dropsonde around 6Z—fix report missing (SW).
    e. Recon radar fix with a 13 nmi eye, 110 kt estimated surface winds, a pressure of 963 mb observed 16 miles from the center, with a fix at 23.4N 95.8W at 1247Z (SW).
    f. Penetration center fix with 125 kt estimated surface winds, 140 kt flight-level winds, a central pressure of 923 mb, and a 15 nmi eye at 23.9N 96.2W at 2031Z (SW).
4. Brownsville radar fixes (SW)
    a. 22.9N 94.9W with a 29 nmi eye at 0547Z.
    b. 23.5N 95.7W with an 18 nmi eye at 1145Z.
    c. 23.6N 96.0W at 1816Z.
    d. 23.7N 96.0W with a 9x14 nmi elliptical eye at 1840Z.
5. Discussion:
    a. Reanalysis: Rapid intensification took place on September 19 as Hurricane Beulah turned to the northwest and headed toward the Rio Grande Valley. Throughout the day, the storm’s movement was unsteady, with multiple wobbles and periods of acceleration and deceleration. The revised track represents a smoothed version of the actual track. Two recon fixes, one at 2136Z on September 18 and the other at 0301Z on September 19, yielded a central pressure of 963 mb. A third fix came with an extrapolated pressure of 948 mb at 0128Z. Given the outlying nature of the 948 mb report, this value is discounted and a central pressure of 963 mb is added to HURDAT. A central pressure of 963 mb suggests maximum sustained winds of 99 kt from the intensifying subset of the south of 25N Brown et al. pressure-wind relationship. Winds of 95 kt are assessed at 00Z, down from 105 kt originally in HURDAT, given the slightly-above average RMW of 18 nmi, and low environmental pressures. A pressure of 949 mb is provided in HURDAT for the 06Z position; however, the recon fix specifically for this observation was not found in Beulah’s storm wallets archive. A brief mention of it was found and the value is considered reliable. A central pressure of 949 mb suggests maximum sustained winds of 114 kt from the intensifying subset of the south of 25N Brown et al. pressure-wind relationship. Winds of 110 kt are assessed for 06Z, the

same as originally in HURDAT. A later fix at 2031Z revealed a central pressure of 923 mb along with an eye diameter of 15 nmi. A central pressure of 923 mb suggests maximum sustained winds of 139 kt from the intensifying subset of the south of 25N Brown et al. pressure-wind relationship. Accounting for the hurricane's slow movement, near-average eye diameter, and low environmental pressures, winds for 18Z are assessed at 135 kt, unchanged from the original HURDAT. Due to no recon fixes at 12Z, winds of 125 kt are estimated based on the 110 kt at 06Z and 135 kt at 18Z; this is the same as originally in HURDAT.

September 20:

1. Maps and old HURDAT:
    a. HURDAT lists a 140 kt hurricane at 25.9N 97.2W at 12Z.
    b. HWM analyzes a hurricane of at most 988 mb at 25.9N 97.2W at 12Z.
    c. Microfilm analyzes a 945 mb hurricane at 26.0N 96.9W at 12Z.
2. Ship highlights:
    a. 40 kt E and 1005 mb at 26.6N 94.2W at 00Z (COADS).
    b. 25 kt S and 1003 mb at 21.4N 93.5W at 00Z (COADS).
    c. 45 kt E and 1005 mb at 26.4N 94.1W at 06Z (COADS).
    d. Gust to 118 kt in Port Brownsville; time unknown (MWR).
    e. 45 kt SE and 1006 mb at 26.2N 94.0W at 12Z (COADS).
    f. 35 kt SE and 1011 mb at 27.9N 91.9W at 12Z (COADS).
    g. 45 kt SE and 1009 mb at 26.6N 94.0W at 18Z (COADS).
3. Station highlights:
    a. 950 mb lowest pressure (winds not calm) at Brownsville, Texas, at 13Z (SWO).
        i. 60 kt peak sustained at 0830Z (SWO).
        ii. Station's anemometer was tilted 30 degrees during the storm
    b. 45 kt E and 998 mb at Corpus Christi Intl., Texas, at 1755Z (SWO).
    c. 952 mb lowest pressure at Raymondville, Texas, at 1850Z (MWR)
    d. 980 mb lowest pressure at Bishop, Texas; time unknown (MWR)
    e. 991 mb at Corpus Christi, Texas, at 2305Z (SWO)
4. Aircraft highlights:
    a. Penetration center fix with 95 kt flight-level winds, a central pressure of 923 mb, and a 10 nmi eye at 24.7N 96.3W at 0320Z (SW).
    b. Penetration center fix with 95 kt flight-level winds, a central pressure of 931 mb, and a 12 nmi eye at 25.1N 96.5W at 0557Z (SW).
        i. “"Accuracy of fix in doubt due to navigational instruments variance."
    c. Penetration center fix with 75 kt flight-level winds, a central pressure of 936 mb, and a 15 nmi eye at 25.5N 97.1W at 09Z (SW).
    d. Radar center fix with a 10 nmi eye at 26.5N 97.8W at 18Z (SW).
5. Brownsville radar fixes (SW)
    a. 24.3N 96.3W at 0015Z.
    b. 25.0N 96.7W at 0541Z.
    c. 26.0N 97.2W at 1205Z with a 10 nmi eye.
    d. 25.9N 97.2W at 1221Z.
    e. 26.3N 97.7W at 1744Z.
6. Additional:
    a. Ho et al.: Landfall at 25.8N 97.2W with 939 mb and 9 nmi RMW
    b. Jarrell et al.: Category 3 landfall with 950 mb.
7. Discussion:

a. MWR: “Beulah made landfall between Brownsville and the mouth of the Rio Grande about daybreak on September 20. Before the hurricane eye struck land the central pressure rose gradually and was probably a little less than 950 mb (28.05 in) at the time of landfall. At 0800 EST (13z), the pressure at Brownsville fell to 951 mb (28.07 in), which was the lowest land station reading. The SS Shirley Lykes, at anchor in Port Brownsville, reported winds of 136 mph. The Brownsville Weather Bureau Office recorded a peak gust of 109 mph but the anemometer shaft tilted 30 degrees, so the actual wind was probably higher. The center remained over land as it moved north-northwestward parallel to the lower Texas coast during the day. The storm gradually weakened but hurricane force winds occurred as far north as the Corpus Christi-Alice area during the evening of September 20.”
b. Reanalysis: Hurricane Beulah’s rapid intensification culminated early on September 20 with it achieving Category 5 status. Frustratingly, no recon fixes are available around the time of peak intensity and the hurricane may have achieved a pressure in mid- to upper- 910 mb range. The closest fix to the 00Z synoptic time is 923 mb at 0320Z, which would yield an intensity of 135 kt based on the same reasoning as 18Z on September 19. Given the lack of data immediately before and after 00Z, the 140 kt peak originally in HURDAT is kept, making Beulah a Category 5 hurricane. The hurricane may have began an eyewall replacement cycle soon thereafter; steady weakening ensued. A center fix made at 0557Z revealed a central pressure of 931 mb with a 12 nmi eye. A central pressure of 931 mb suggests maximum sustained winds of 124 kt and 117 kt from the weakening subsets of the south of 25N and north of 25N Brown et al. pressure-wind relationships, respectively. Given slight acceleration of the storm to 10 kt, a smaller-than-average RMW, and below-average environmental pressures, a blend of these values is used to obtain an intensity of 120 kt for 06Z. This is a major decrease from the erroneous 140 kt (which has no basis as far as can be determined) originally in HURDAT. Around 12Z, Beulah made landfall in extreme northeastern Tamaulipas state, Mexico, just south of the Rio Grande. No direct observations of the central pressure are available at this time so there is modest uncertainty in the intensity of Beulah at landfall. However, based on observations from Brownsville, Texas, which appears to have entered the RMW around 13Z, we can estimate the landfall intensity. Around 13Z, the Brownsville station observed a minimum pressure of 950 mb with sustained winds around 40 kt. It is known that the station’s anemometer tilted at some point during the storm, so the winds are somewhat suspect. However, assuming these winds are accurate, the Schloemer equation was run using an RMW range of 8 to 12 nmi and distance from center range of 12 to 18 nmi. Central pressure values of 891 to 943 mb were obtained using this equation. Given the steady weakening prior to landfall, it can safely be surmised that the central pressure was not below 936 mb at the time of landfall. Assuming filling of a few more millibars took place between 09Z and 12Z, and using the 937 to 943 mb range from the Schloemer equation, a central pressure of 940 mb was obtained. This value is accordingly introduced to HURDAT at 12Z. This estimate is in-line with the 939 mb value listed by Ho et al. for Beulah’s landfall. The 950 mb from Jarrell et al.—likely based directly from Brownsville’s minimum pressure—is considered too high. A central

pressure of 940 mb suggests maximum winds of 110 kt from the weakening subset of the north of 25N Brown et al. pressure-wind relationship. Radar imagery at the time of landfall depicted a 10 nmi eye, indicating an RMW of approximately 8 nmi—this is significantly smaller than the climatological RMW size of 15 nmi for a 940 mb storm. With other factors unchanged, landfall intensity is assessed at 110 kt, making Beulah a Category 3 landfall for Mexico. This is a major decrease from the erroneous 140 kt value originally in HURDAT. Additionally, as the eye crossed into Texas soon after landfall, Beulah is also considered a Category 3 impact for South Texas. Beulah's large size and northwesterly track through Southern Texas enabled it to maintain its intensity for longer than would be expected. The Kaplan and DeMaria inland decay model was run for four periods starting at 12Z; however, all outputs were below observed winds and not factored into intensity assessments. The eye passed directly over Raymondville at 1850Z, where a pressure of 952 mb was observed. With radar fixes corroborating Beulah's position over Raymondville, the 952 mb is added as a central pressure at 18Z. A central pressure of 952 mb suggests maximum winds of 99 kt from the weakening subset of the north of 25N Brown et al. pressure-wind relationship. Applying a 15% reduction for the storm being over land provides an intensity of about 85 kt; this value is used as the 18Z intensity. (Note that running the Ho et al. inland pressure-decay model from the 952 mb central pressure at 1850Z backwards to the 12Z landfall gives 938 mb +/- 5 mb. This further collaborates the 940 mb analysis of the central pressure at landfall.)

September 21:

1. Maps and old HURDAT
    a. HURDAT lists a 45 kt tropical storm at 27.7N 98.7W at 12Z.
    b. HWM analyzes a hurricane of at most 1000 mb near 28N 99W at 12Z.
    c. Microfilm analyzes a 993 mb tropical storm at 27.2N 98.9W at 12Z.
2. Ship highlights:
    a. 35 kt SE and 1010 mb at 26.1N 92.5W at 00Z (COADS).
    b. 30 kt SE and 1009 mb at 26.1N 96.4W at 18Z (COADS).
3. Station highlights:
    a. 72 kt SSE at Kingsville NAS, Texas, at 0040Z (SWO).
    b. 55 kt ENE (peak sustained) at Alice, Texas, at 01Z (SWO).
    c. 976 mb and 74 kt S (estimated) at Premont, Texas, at 01Z (MWR).
    d. 979 mb w/ hurricane-force at Kingsville NAS, Texas, ~01Z (MWR/SWO).
    e. 59 kt fastest mile at Aransas Pass, Texas, at 0120Z (MWR)
    f. 54 kt ESE at Corpus Christi, Texas, at 0140Z (SWO).
    g. 987 mb and 40 kt ESE at Alice, Texas, at 07Z (SWO).
    h. 996 mb and 25 kt N at Laredo AFB, Texas, at 0955Z (SWO).
    i. 996 mb at Laredo, Texas, at 15Z (MWR).
4. Discussion:
    a. MWR: "The storm stalled near Alice during the night and then arced slowly southwestward."
    b. Reanalysis: Hurricane-force winds battered Southern Texas throughout the overnight of September 20-21. Premont and the Kingsville NAS observed hurricane-force winds around 00Z, with the latter measuring sustained winds of 72 kt SSE at 0040Z. This observation is used as the basis for the 75 kt intensity at 00Z, a slight increase from the 70 kt

originally in HURDAT. Observations from Alice, Texas, indicate the center of Beulah remained to the southwest, with winds consistently blowing from the southeast to east-southeast. Accordingly, the track of Beulah is adjusted south of the original HURDAT. Weakening to tropical storm status is now shown at 06Z, six hours earlier than originally in HURDAT, based on a steady weakening trend. Observations over south-central Texas are sparse, and the exact state of Beulah's core is somewhat uncertain. However, a wind shift from north to northeast in Laredo around 20Z indicates the center moving southeast of the city.

September 22:

1. Maps and old HURDAT:
    a. HURDAT lists a 30 kt tropical depression 26.1N 100.0W at 12Z.
    b. HWM depicts nothing of interest
    c. Microfilm analyzes a low pressure of at most 1004 mb at 26.0N 100.0W at 12Z.
2. Ship highlights:
    a. 30 kt SE and 1009 mb at 26.1N 96.9W at 00Z (COADS).
    b. 30 kt ESE and 1012 mb at 26.0N 96.4W at 12Z (COADS).
3. Station highlights:
    a. 15 kt NE and 1004 mb at Monterrey, Mexico, at 18Z (Micro).
4. Discussion:
    a. MWR: "On September 22 the circulation finally broke up in the mountainous terrain near Monterrey, Mexico."
    b. Reanalysis: Moving over the mountainous terrain along the Texas-Mexico border, Beulah is believed to have weakened to a tropical depression by 00Z on September 22, 12 hours earlier than originally in HURDAT. Although observations are sparse, the disheveled core of Beulah appears to have turned south-southwest on September 22 as it traversed Nuevo Leon state.

September 23:

1. Maps and old HURDAT:
    a. HWM depicts nothing of interest
    b. Microfilm analyzes a low pressure of at most 1006 mb at 21.5N 99.3W at 12Z.
2. Ship highlights:
    a. 25 kt E and 1011 mb at 26.2N 96.9W at 00Z (COADS).
3. Station highlights:
    a. 15 kt NW and 1003 mb at San Luis Potosi, Mexico, at 00Z (Micro).
    b. E wind and 1005 mb at 23.7N 98.0W at 00Z (Micro).
    c. 10 ke SE and 1005 mb at Tuxpan, Mexico, at 18Z (Micro).
4. Discussion:
    a. Reanalysis: Coastal observations on September 23 and 24 in Mexico reveal a slight pressure drop as Beulah approached. In particular, observations at Tampico and Tuxpan depict a closed circulation emerging over the Gulf of Mexico at 00Z on September 24. Measurements from the latter provide evidence of a 1001 mb central pressure. Based on these data, Beulah is assessed as surviving its landfall and re-emerged over the Gulf of Mexico as a 30 kt tropical depression around 00Z. Thereafter, a lack of data prevents further assessment of how long the system persisted. One additional position is provided at 06Z based on continuity. This is a two-day extension to Beulah's original

track. Regardless of how long Beulah may have remained a tropical depression over the Gulf of Mexico, it eventually degraded into a trough and became entangled with the monsoon trough. Interestingly, this monsoon trough later led to the development of Hurricane Fern in early October in the same region.

September 24:

1. Maps and old HURDAT:
   a. HWM depicts nothing of interest
   b. Microfilm analyzes a low pressure of at most 1008 mb at 20.5N 96.5W at 12Z.
2. Station highlights:
   a. 25 kt E and 1008 mb at Tampico, Mexico, at 00Z (Micro).
   b. 10 kt W and 1003 mb at Tuxpan, Mexico, at 00Z (Micro).
3. Discussion:
   a. Reanalysis: See September 23

Date	Original HURDAT Central Pressure	Evidence	Changes
Sep 5 18Z	1010 mb	Penetration center fix: 1003 mb around 1835Z	Retained
Sep 7 00Z		COADS: 25 kt SSW and 1008 mb at 03Z	1006 mb
Sep 7 12Z	1006 mb	Penetration center fix: 1006 mb around 1358Z	Retained
Sep 8 00Z	1005 mb	1005 mb ob from 2150z Sep 7 recon not measured at center; fix was obtained by surface winds rather than penetration.	Removed
Sep 8 12Z	996 mb	Penetration center fix: 996 mb around 1204Z	Retained
Sep 8 18Z	989 mb	Penetration center fix: 989 mb around 1749Z	Retained
Sep 9 18Z	950 mb	Penetration center fix: 950 mb around 1800Z	Retained
Sep 10 00Z		Penetration center fix: 940 mb around 2352Z	940 mb
Sep 10 12Z	947 mb	Penetration center fix: 947 mb around 1145Z	Retained
Sep 10 18Z	951 mb	Penetration center fix: 951 mb around 1800Z	Retained
Sep 11 00Z	967 mb	Penetration center fix: 967 mb around 0031Z	Retained
Sep 11 18Z	978 mb	Penetration center fix: 978 mb around 1745Z	Retained

Sep 12 00Z	1006 mb	No penetration made during 0005Z fix; 1006 mb ob was not near the center.	Removed
Sep 12 06Z	997 mb	Penetration center fix: 997 mb around 0558Z	Retained
Sep 12 12Z	1000 mb	Penetration center fix: 1000 mb around 1130Z	Retained
Sep 12 18Z	998 mb	Penetration center fix: 998 mb around 1733Z	Retained
Sep 13 00Z	1004 mb	Penetration center fix: 1004 mb around 2345Z on Sep 12th	Retained
Sep 13 06Z		COADS: 20 kt SE and 1004 mb at 06Z	1002 mb
Sep 13 12Z	996 mb	Penetration center fix: 997 mb around 1150Z	997 mb
Sep 13 18Z	997 mb	Penetration center fix: 997 mb around 1800Z	Retained
Sep 14 00Z	996 mb	Penetration center fix: 996 mb around 0015Z	Retained
Sep 14 06Z	998 mb	Penetration center fix: 998 mb around 0530Z	Retained
Sep 14 12Z	991 mb	Penetration center fix: 991 mb around 1145Z	Retained
Sep 14 18Z	989 mb	Penetration center fix: 989 mb around 1745Z	Retained
Sep 15 00Z	985 mb	Penetration center fix: 985 mb around 0117Z	Retained
Sep 15 12Z	980 mb	Penetration center fix: 980 mb around 1331Z	Retained
Sep 15 18Z	978 mb	Penetration center fix: 978 mb around 1755Z	Retained
Sep 16 00Z	975 mb	Penetration center fix: 975 mb around 0000Z	Retained
Sep 16 06Z	970 mb	Penetration center fix: 970 mb around 0545Z	Retained
Sep 16 12Z	964 mb	Penetration center fix: 964 mb around 1207Z	Retained
Sep 16 18Z	967 mb	Penetration center fix: 967 mb around 1732Z	Retained
Sep 18 00Z	977 mb	Penetration fix: 977.5 mb at 0027z; rounded to nearest even yields 978 mb.	978 mb
Sep 18 06Z	978 mb	Penetration center fix: 978 mb around 0540Z	Retained

Sep 18 12Z	970 mb	Penetration center fix: 970 mb around 1202Z	Retained
Sep 18 18Z	967 mb	Penetration center fix: 967 mb around 1701Z	Retained
Sep 19 00Z		Penetration center fix: 963 mb around 2146Z on Sep 18th Penetration center fix: 963 mb around 0301Z on Sep 19th	963 mb
Sep 19 06Z	949 mb	Dropsonde measurement of 949 mb verifies HURDAT value but fix report not available within storm wallets	Retained
Sep 19 12Z	961 mb	1247Z fix was not a penetration; 961 mb was measured 16 miles from the center	Removed
Sep 19 18Z	923 mb	Penetration center fix: 923 mb around 2031Z	Retained
Sep 20 00Z	923 mb	Penetration center fix: 923 mb around 0320Z	Retained
Sep 20 06Z	931 mb	Penetration center fix: 931 mb around 0557Z	Retained
Sep 20 12Z		Estimated landfall pressure of 940 mb obtained through the Schloemer equation and assumed continuation of gradual filling from the 936 mb observed three hours prior to landfall.	940 mb
Sep 20 18Z		Raymondville, Texas: 952 mb at 1850z Radar center fix over city at 18Z to verify center passage	952 mb
Sep 24 00Z		Tuxpan: 10 kt W and 1003 mb at 00Z (Micro)	1001 mb

Sources: the NHC microfilm maps, the Historical Weather Maps series, the COADS ship database, Monthly Weather Review, Navy reconnaissance book, Mariners Weather Log, National Hurricane Research Project (NHRP), North Atlantic Tropical Cyclones, Local Climatological Data, Surface Weather Observations, Schwerdt et al. (1979), Ho et al. (1987), Carlson (1969), Jarrell et al. (1992) and NHC Storm Wallets.

Hurricane Doria [September 4-21, 1967] – AL141967

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45115 09/07/1967 M=14 14 SNBR= 924 DORIA       XING=1
45115 09/04/1967 M=17 14 SNBR= 924 DORIA       XING=1
         **        **

(September 4th through 7th are new to HURDAT)
45120 09/04*  0   0   0    0*  0   0   0    0*  0   0   0    0E310 780  35    0*
45125 09/05E310 780  35    0E310 779  35    0E310 776  35    0E310 771  40    0*
45130 09/06S310 767  40    0S309 765  40    0S307 764  35    0S305 764  35    0*
45135 09/07S302 764  35    0S299 764  35    0S294 766  30    0S288 770  30    0*
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45140 09/08*285 775  25 1010*280 781  25    0*277 786  25 1007*277 789  25    0*
45140 09/08*283 775  30 1007*279 780  30    0*278 785  30 1007*277 789  30    0*
            ***      ** **** *** ***  **      *** ***  **                 **

45145 09/09*277 791  30    0*278 792  35    0*279 791  35 1004*282 787  35    0*
45145 09/09*276 791  30 1007*277 792  35    0*279 791  35 1004*282 787  40    0*
            ***         **** ***                                         **

45150 09/10*291 780  40  997*305 770  65    0*318 761  65    0*332 751  65  984*
45150 09/10*290 781  50  997*302 772  60    0*318 761  65    0*332 751  70  984*
            *** ***  **      *** ***  **                                 **

45155 09/11*342 736  65    0*351 721  60    0*359 706  60  999*362 692  50  998*
45155 09/11*342 736  70  987*351 721  60    0*359 707  55  999*362 692  55  998*
                     **  ***                       ***  **

45160 09/12*363 678  65    0*365 666  65    0*366 657  70    0*367 649  70    0*
45160 09/12*363 678  55    0*365 666  55    0*366 657  60    0*367 651  65    0*
                     **               **               **          ***  **

45165 09/13*368 647  70  989*369 645  70    0*370 647  70    0*371 649  75  983*
45165 09/13*368 649  70  989*369 648  70    0*370 648  75    0*371 649  75  983*
                ***              ***              ***  **

45170 09/14*373 653  75    0*375 656  75    0*377 660  75    0*380 665  70  973*
45170 09/14*373 652  80    0*376 656  80    0*378 660  80    0*380 665  85  973*
                ***  **      ***      **      ***      **                 **

45175 09/15*380 671  65  980*380 678  65    0*380 689  70    0*379 705  70  975*
45175 09/15*380 671  85    0*380 678  85    0*380 689  80    0*379 705  80  975*
                     **    *           **               **                 **

45180 09/16*379 719  70  981*378 733  70  986*377 745  60    0*373 753  55  990*
45180 09/16*379 719  75  981*379 733  70  986*377 745  65    0*373 753  60  990*
                     **      ***                      **                 **

45185 09/17*365 759  45    0*356 762  35    0*347 763  30 1006*338 762  30    0*
45185 09/17*365 759  50    0*356 762  40    0*347 763  30 1006*338 762  30    0*
                     **               **

45190 09/18*331 760  30 1006*324 756  30    0*319 750  25 1006*315 745  25 1006*
45190 09/18*331 760  30 1006*324 756  30    0*319 750  30 1006*315 745  30 1006*
                                                       **                 **

45195 09/19*310 740  25    0*305 734  25    0*300 730  25    0*296 723  25    0*
45195 09/19L310 740  25    0L305 735  25    0L300 730  25    0L297 723  25    0*
            *                 *    ***         *                 ****

45200 09/20*295 715  25 1010*295 708  25    0*295 700  25    0*295 693  25    0*
45200 09/20L295 715  25 1010L295 708  25    0L295 700  25    0L295 695  25    0*
            *                 *                 *                 *

45205 09/21*295 685  25    0*295 679  25    0*295 675  25    0*  0   0   0    0*
45205 09/21L295 690  25    0L295 685  25    0L295 680  25    0*  0   0   0    0*
            *    ***         *    ***         *    ***
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45210 HR

U.S. Tropical Storm Landfall

09/17 00Z 36.5N 75.9W 50 kt NC

Significant Revisions:

1. Genesis is analyzed 4 days earlier based on synoptic observation and satellite images.
2. System now indicated to have an extratropical phase on the 4th and 5th, transitioning to a subtropical cyclone phase on the 6th and 7th.
3. Major intensity increase shown from 18Z 14th through 06Z 15th based on aircraft reconnaissance data.
4. Assessed to have been a low between September 19th and 21st based on synoptic data and satellite images.
5. Some central pressures previously in HURDAT have been removed, other retained and new values added based on aircraft reconnaissance data.

Daily Metadata:

September 4:
1. Maps and old HURDAT:
- HWM and microfilm showed a stationary frontal boundary over the western Atlantic 12Z.

2. Ship highlights:
- 35 kt N and 1015 mb at 30.5N, 79.7W at 18Z (COADS).

3. Discussion:
- MWR: "Circulation was first observed around a cold frontal low pressure system off the northeast Florida coast on September 4. This Low drifted aimlessly for 3 days in a small area (radius 100 mi.) centered 250 mi. east of Jacksonville."
- ATSR: "A cold front moved south over northern Florida on 1 September and became nearly stationary over central and southern Florida for the next few days. On September 4, a weak wave developed on the front about 200 miles east-southeast of Jacksonville and remained nearly stationary as it slowly developed into a weak circulation during the next three days."
- Reanalysis: A frontal boundary reached the western Atlantic in early September and an area of low pressure formed off the southeast coast of the United States. Synoptic observations showed that the disturbance developed a well-defined circulation around 18Z on the 4th with a weak a warm front extending to the northeast and a cold front extending to the southwest. Thus the first position is analyzed at 18Z on the 4th as a 35 kt extratropical storm based on a ship report of 35 kt. Also, satellite images showed a large area of convection with some signs of banding, mostly over the northeast semicircle due to strong southwesterly wind shear associated with a large extratropical cyclone over the central United States. The first position in HURDAT was originally at 00Z on the 8th, 42 hours later than analyzed.

September 5:
1. Maps and old HURDAT:
- HWM showed a stationary frontal boundary over the western Atlantic 12Z.

- Microfilm analyzes a closed low pressure of at most 1016 mb at 31N, 77W with a stationary frontal boundary going through the center at 12Z.

2. Ship highlights:
- 35 kt NE and 1019 mb at 31.6N, 79.8W at 00Z (COADS).

3. Discussion:
- Reanalysis: Doria drifted eastward with little change in intensity, while still displaying some frontal characteristics. Satellite images showed that it was still under strong southwesterly shear with most of the convection displaced north of the center.

September 6:
1. Maps and old HURDAT:
- HWM and microfilm depict a closed low pressure of at most 1016 mb at 31N, 77W with a stationary frontal boundary going through the center at 12Z.

2. Ship highlights:
- 40 kt NE and 1017 mb at 32N, 76.9W at 00Z (COADS).
- 35 kt NE and 1020 mb at 32.6N, 76.1W at 06Z (COADS).

3. Discussion:
- Reanalysis: Satellite images showed a well-defined circulation with most of the convection displaced over the eastern semicircle. The system no longer displayed any significant front characteristics. Based upon the satellite imagery and upper-level maps, the system is considered a subtropical storm beginning at 00Z on the 6th. A ship about 60 n mi from the assessed position at 00Z on the 6th reported 40 kt and this is the basis for an analyzed intensity of 40 kt between 18Z on the 6th and 06Z on the 7th. This is also the first peak in intensity during the lifetime of this system.

September 7:
1. Maps and old HURDAT:
- HWM depicts a closed low pressure of at most 1014 mb at 29.5N, 78W with a warm front to the east at 12Z.
- Microfilm analyzes a closed low pressure of at most 1014 mb at 28.5N, 76.5W at 12Z.

2. Discussion:
- MWR: "On September 7, the lowest pressure was 1010 mb (29.82 in.)…."
- Reanalysis: Doria remained poorly organized due to the strong shear affecting the system. The circulation was well-defined on satellite images with most of the convection over the eastern semicircle as the cyclone slowly moved southward. No gales were reported on this date and weakening to a subtropical depression is analyzed at 12Z on the 7th.

September 8:
1. Maps and old HURDAT:
- HURDAT lists a 25 kt tropical depression at 27.7N, 78.6W at 12Z
- HWM depicts a closed low pressure of at most 1012 mb at 28.4N, 78.7W with a stationary frontal boundary to the northeast at 12Z.
- Microfilm analyzes a tropical cyclone of at most 1012 mb at 28N, 78.5W at 12Z.

2. Ship highlights:

- 20 kt NE and 1009 mb at 28.4N, 78.8W at 00Z.

3. Aircraft highlights:

- Penetration center fix measured a central pressure of 1007 mb at 27.7N, 78.6W at 1320Z (WALLET).
- Penetration center fix at 28N, 78.7W at 1840Z (WALLET).
- Penetration center fix measured a central pressure of 1007 mb and estimated surface winds of 25 kt at 28N, 78.8W at 22Z (WALLET).

4. Discussion:

- MWR: "…and on the 8th 1007 mb. (29.74 in.). The center at that time was about 50 mi. north of Grand Bahama Island."
- Reanalysis: As the upper-level trough that was interacting with the system had pushed eastward replaced by an upper-level ridge, the system is indicated to have become a tropical cyclone around 00Z on the 8th. A ship at 00Z with 20 kt and 1009 mb pressure suggests a central pressure of 1007 mb, which has been added to HURDAT replacing the existing 1010 mb. A reconnaissance aircraft investigated the tropical depression at 1320Z on the 8th measuring a central pressure of 1007 mb. A central pressure of 1007 mb suggests maximum surface winds of 32 kt from the north of 25N Brown et al. pressure-wind relationship. Due to the slow motion of the cyclone, about 4 kt, but high environmental pressure (1015 mb OCI), an intensity of 30 kt is analyzed at 00Z and 12Z on the 8th, 5 kt higher than originally shown in HURDAT, a minor intensity change. Strong southwesterly shear continued to impact the system on this date, displacing most of the convection to the northeast of the center.

September 9:

1. Maps and old HURDAT:

- HURDAT lists a 35 kt tropical storm at 27.9N, 79.1W at 12Z
- HWM depicts a closed low pressure of at most 1012 mb at 28N, 79.8W at 12Z.
- Microfilm analyzes a tropical cyclone of at most 1008 mb at 28.2N, 79W at 12Z.

2. Aircraft highlights:

- Radar center fix at 27.8N, 79.1W at 0307Z (WALLET).
- Penetration center fix measured a central pressure of 1004 mb and estimated surface winds of 45 kt at 27.8N, 79.2W at 1332Z (WALLET).
- Radar center fix at 28.1N, 78.6W at 17Z (WALLET).
- Penetration center fix measured a central pressure of 997 mb, estimated surface winds of 35 kt and an eye diameter of 15 n mi at 28.5N, 78.4W at 2130Z (WALLET).
- Radar center fix at 29N, 78.1W at 2352Z (WALLET).

3. Discussion:

- MWR: "Doria reached tropical storm intensity the following day [9] about 100 mi. east of Cape Kennedy and began moving more rapidly northeastward. A gradual warming of over 3°C had occurred since the first circulation was observed. The upper air soundings from Cape Kennedy, Fla., show a warming of about 3°C between 10,000 and 20,000 ft. during this period."

- ATSR: "A fix by Navy reconnaissance aircraft at 1332Z on 9 September determined that the circulation had become tropical, and a depression warning was issued by FLEWEAFAC JAX at 091600Z. Subsequent reconnaissance information indicated that the tropical depression was more intense than originally suspected and was rapidly becoming a tropical storm. The first warning on tropical storm DORIA was issued by FLEWEAFAC JMX at 091700Z."
- Reanalysis: The environment became more favorable for intensification on the 9th as the extratropical cyclone to the west lifted northeastward, causing a decrease in the shear and leading to an increase in convection and organization, as shown by the satellite images. A penetration center fix measured a central pressure of 1007 mb at 22Z on the 8th and an intensity of 30 kt is assessed at 00Z on the 9th, same as originally shown in HURDAT. Another penetration center fix measured a central pressure of 1004 mb and estimated surface winds of 45 kt at 1332Z on the 9th. A central pressure of 1004 mb suggests maximum surface winds of 36 kt from the north of 25N pressure-wind relationship. Due to the slow forward speed of about 7 kt, but weighing some the visual estimate, an intensity of 35 kt is analyzed at 12Z on the 9th, same as originally shown in HURDAT. Re-intensification to a tropical storm is analyzed at 06Z on the 9th, same as originally shown in HURDAT.

September 10:

1. Maps and old HURDAT:

- HURDAT lists a 65 kt hurricane at 31.8N, 76.1W at 12Z.
- HWM depicts a hurricane of at most 1004 mb at 32N, 76W at 12Z.
- Microfilm analyzes a tropical storm of at most 1004 mb at 31.8N, 76W at 12Z.

2. Ship highlights:

- 45 kt NE and 996 mb at 31.7N, 76.3W at 12Z (COADS).
- 35 kt SE and 1004 mb at 33.3N, 74.1W at 18Z (COADS).
- 60 kt S and 1011 mb at 33.1N, 73.3W at 21Z (COADS).

3. Aircraft highlights:

- Radar center fix at 32N, 75.5W at 1314Z (WALLET).
- Penetration center fix measured a central pressure of 984 mb, estimated surface winds of 70 kt and an eye diameter of 30 n mi at 33.1N, 75.2W at 1739Z (WALLET).
- Penetration center fix measured a central pressure of 987 mb, estimated surface winds of 65 kt and an eye diameter of 30 n mi at 33.2N, 74.2W at 2130Z (WALLET).

4. Discussion:

- MWR: "Doria reached hurricane intensity and passed about 100 mi southeast of the North Carolina capes on the 10th."
- ATSR: "With the approach of a polar front from the northwest, DORIA began to move more rapidly to the northeast and, by 10 September, had attained hurricane intensity and was centered about 300 miles east-northeast of Jacksonville. As DORIA moved northeast she decreased to tropical storm intensity and regained hurricane strength again within the space of 24 hours."
- Reanalysis: The last penetration center fix on the 9th indicated that Doria had continued to deepen, measuring a central pressure of 997 mb, estimating surface winds of 35 kt and an eye diameter of 15 n mi at 2130Z. A central pressure of 997 mb suggests maximum surface winds of 49 kt from the north of 25N pressure-

wind relationship. An eye diameter of 15 n mi suggests an RMW of about 12 n mi and the climatological value is 23 n mi. Based on a forward speed of 9 kt and small RMW, an intensity of 50 kt is analyzed at 00Z on the 10th, up from 40 kt originally in HURDAT, a minor intensity change. Satellite images showed that Doria had become better organized as it accelerated northeastward ahead of a frontal boundary. A reconnaissance aircraft measured a central pressure of 984 mb, estimated surface winds of 70 kt and an eye diameter of 30 n mi at 1739Z on the 10th. A central pressure of 984 mb suggests a maximum surface winds of 68 kt from the north of 25N pressure-wind relationship. An eye diameter of 30 n mi suggests an RMW of about 23 n mi and the climatological value is 27 n mi. Based on a forward speed of 16 kt and RMW slightly smaller than average, an intensity of 70 kt is analyzed at 18Z on the 10th, up from 65 kt originally shown in HURDAT, a minor intensity change. Intensification to a hurricane is analyzed at 12Z on the 10th, six hours later than originally shown in HURDAT. HURDAT showed Doria intensifying from 40 kt to 65 kt between 06Z and 12Z on the 10th, but this appears erroneous based on the data available. 70 kt is also the second peak intensity of Doria.

September 11:

1. Maps and old HURDAT:

- HURDAT lists a 60 kt tropical storm at 35.9N, 70.6W at 12Z.
- HWM depicts a tropical storm of at most 1004 mb at 36.5N, 70.7W with a cold front just to the west at 12Z.
- Microfilm analyzes a tropical storm of at most 1004 mb at 35.9N, 70.6W with a cold front just to the west at 12Z.

2. Ship highlights:

- 35 kt NNE and 1011 mb at 34.3N, 75.6W at 00Z (COADS).
- 40 kt N and 1019 mb at 37.3N, 74.8W at 06Z (COADS).
- 40 kt W and 1009 mb at 35.2N, 69W at 12Z (COADS).
- 40 kt N and 1018 mb at 34.6N, 75.6W at 15Z (COADS).
- 40 kt NNW and 1010 mb at 35.3N, 70.9W at 18Z (COADS).
- 35 kt NW and 1011 mb at 35.2N, 69.5W at 21Z (COADS).

3. Aircraft highlights:

- Penetration center fix measured a central pressure of 999 mb, estimated surface winds of 50 kt and an eye diameter of 25 n mi at 35.9N, 70.6W at 1205Z (WALLET).
- Penetration center fix measured a central pressure of 998 mb, estimated surface winds of 60 kt and an eye diameter of 23 n mi at 36.3N, 69.2W at 18Z (WALLET).

4. Discussion:

- MWR: “The following day [11] cold air entering Doria's circulation weakened it to less than hurricane force as the center moved almost due east.”
- Reanalysis: Doria initially moved northeastward at quick pace on the 11th, but began to slow later in the day as the trough to the north started to lose its influence on the system. A reconnaissance aircraft investigated the hurricane at 2130Z on the 10th measuring a central pressure of 987 mb, estimating surface winds of 65 kt and an eye diameter of 30 n mi. A central pressure of 987 mb suggests maximum surface winds of 64 kt from the north of 25N pressure-wind relationship and 66 kt from the north of 35N Landsea et al. pressure-wind relationship. An eye diameter of 30 n mi suggests an RMW of about 23 n mi and

the climatological value is 30 n mi. Based on a forward speed of 16 kt and rather high (1016 mb) environmental pressures, an intensity of 70 kt is analyzed at 00Z on the 11th, slightly higher than originally shown in HURDAT. The next penetration center fix found that Doria had continued to weaken, measuring a central pressure of 999 mb, estimating surface winds of 50 kt and an eye diameter of 25 n mi at 1205Z on the 11th. A central pressure of 999 mb suggests maximum surface winds of 50 kt from the north of 35N and 45 kt from the north of 25N pressure-wind relationships. An eye diameter of 25 n mi suggests an RMW of about 20 n mi and the climatological value is 30 n mi. Based on a forward speed of 13 kt but small RMW and high OCI, an intensity of 55 kt is analyzed at 12Z on the 11th, down from 60 kt originally shown in HURDAT, a minor intensity change. The last penetration center fix on the 11th measured a central pressure of 998 mb at 18Z. An intensity of 55 kt is analyzed at 18Z on the 11th, slightly higher than originally shown in HURDAT. Satellite images indicated that southwesterly shear had increased again over the circulation displacing most of the convection over the northeastern semicircle.

September 12:

1. Maps and old HURDAT:

- HURDAT lists a 70 kt hurricane at 36.6N, 65.7W at 12Z.
- HWM depicts a hurricane of at most 1004 mb at 37N, 66W with a warm front to the northeast at 12Z.
- Microfilm analyzes a tropical storm of at most 1008 mb at 36N, 65.4W with a cold front to the northeast at 12Z.

2. Ship highlights:

- 40 kt N and 1013 mb at 35.5N, 71.2W at 00Z (COADS).
- 35 kt NE and 1019 mb at 39.8N, 63.5W at 03Z (COADS).
- 45 kt ENE and 1014 mb at 39N, 62.5W at 06Z (COADS).
- 35 kt NE and 1020 mb at 39.3N, 66.6W at 12Z (COADS).

3. Aircraft highlights:

- Penetration center fix measured a central pressure of 989 mb, estimated surface winds of 55 kt and an eye diameter of 3-28 n mi at 36.9N, 64.7W at 23Z (WALLET).

4. Discussion:

- MWR: "Doria warmed again on the 12th as its movement slowed markedly and its winds reached hurricane force once more."
- Reanalysis: On the 12th, Doria turned to the east and continued to lose forward speed. The tropical storm gradually re-intensified as indicated by a penetration center fix late on this date. Satellite images showed that it was still under the influence of strong shear, displacing most of the convective activity over the northern quadrant. A few ships reported gale-force winds, up to 45 kt.

September 13:

1. Maps and old HURDAT:

- HURDAT lists a 70 kt hurricane at 37N, 64.7W at 12Z.
- HWM depicts a hurricane of at most 1004 mb at 37.7N, 64.9W with a stationary front to the northeast at 12Z.

- Microfilm analyzes a tropical storm of at most 1008 mb at 36.5N, 64W with a stationary front to the northeast at 12Z.

2. Ship highlights:
- 55 kt NE (high bias) and 1014 mb at 38.3N, 67.7W at 06Z (COADS).
- 55 kt NE (high bias) and 1014 mb at 38.7N, 66.5W at 12Z (COADS).
- 35 kt NE and 1022 mb at 41.2N, 62.5W at 15Z (COADS).
- 45 kt E and 1010 mb at 39.1N, 65.4W at 18Z (COADS).
- 35 kt NE and 1020 mb at 40.8N, 66.3W at 21Z (COADS).

3. Aircraft highlights:
- Penetration center fix measured a central pressure of 983 mb, estimated surface winds of 75 kt and an eye diameter of 15 n mi at 36.9N, 64.9W at 1721Z (WALLET).

4. Discussion:
- ATSR: "DORIA stalled on 13 September as the polar front and the trough aloft weakened, leaving her under very weak steering currents aloft."
- Reanalysis: Doria remained almost stationary on this date as it gradually intensified. A penetration center fix measured a central pressure of 989 mb, estimated surface winds of 55 kt and an elongated eye with a minor axis of 3 n mi and a major axis of 28 n mi at 23Z on the 12th. A central pressure of 989 mb suggests maximum surface winds of 64 kt from the north of 35N pressure-wind relationships. An eye diameter of 3-28 n mi suggests an RMW of about 2-21 n mi and the climatological value is 32 n mi. Since the cyclone was almost stationary but had a small RMW and high (1015 mb) environmental pressure, an intensity of 70 kt is retained. Re-intensification to a hurricane is analyzed at 18Z on the 12th, 18 hours later than originally shown in HURDAT. The next penetration center fix measured a central pressure of 983 mb, estimated surface winds of 75 kt and an eye diameter of 15 n mi at 1721Z. A central pressure of 983 mb suggests maximum surface winds of 70 kt from the north of 35N pressure-wind relationship. An eye diameter of 15 n mi suggests an RMW of about 12 n mi and the climatological value is 30 n mi. Since the cyclone was almost stationary but had a small RMW and higher (1014 mb) environmental pressure, an intensity of 75 kt is retained. The satellite images showed that Doria had become better organized with convection surrounding a well-defined eye.

September 14:
1. Maps and old HURDAT:
- HURDAT lists a 75 kt hurricane at 37.7N, 66W at 12Z.
- HWM depicts a hurricane of at most 996 mb at 38.5N, 66W with a stationary front to the northeast at 12Z.
- Microfilm analyzes a hurricane of at most 1008 mb at 37.5N, 65.7W with a stationary front to the northeast at 12Z.

2. Ship highlights:
- 50 kt NE and 1012 mb at 39.6N, 64.5W at 00Z (COADS).
- 40 kt NW and 999 mb at 37.3N, 66.5W at 06Z (COADS).
- 50 kt NW and 990 mb at 37.6N, 66.5W at 09Z (COADS).
- 65 kt NW and 982 mb at 37.5N, 67W at 12Z (COADS).
- 65 kt E at 38.3N, 66.2W at 15Z (COADS).

- 55 kt SE and 996 mb at 38.5N, 65.5W at 18Z (COADS).
- 40 kt SE and 1003 mb at 38.5N, 64.9W at 21Z (COADS).

3. Aircraft highlights:
- Penetration center fix measured a central pressure of 973 mb, estimated surface winds of 65 kt and an eye diameter of 28 n mi at 38.1N, 66.5W at 1741Z (WALLET).
- Penetration center fix measured a central pressure of 980 mb and estimated an eye diameter of 26 n mi at 38N, 66.1W at 2141Z (WALLET).

4. Discussion:
- MWR: "Doria attained her lowest central pressure, 973 mb. (28. 73 in.), well at sea, about midway between Nantucket and Bermuda, on September 14."
- Reanalysis: Doria turned to the west and continued to intensify. A penetration center fix measured a central pressure of 973 mb, estimated surface winds of 65 kt and an eye diameter of 28 n mi at 1741Z on the 14th. A central pressure of 973 mb suggests maximum surface winds of 80 kt from the north of 35N pressure-wind relationship. An eye diameter of 28 n mi suggests an RMW of about 20 n mi and the climatological value is 31 n mi. Based on a forward speed of about 5 kt but small RMW and high (1015 mb) environmental pressure, an intensity of 85 kt is analyzed at 18Z on the 14th, up from 70 kt originally shown in HURDAT, a large intensity change. 85 kt is also the peak intensity, and third overall peak in intensity during the lifetime of this tropical cyclone. Many ships were in the path of Doria on this date and reported winds up to hurricane-force. Satellite images showed a well-organized tropical cyclone.

September 15:
1. Maps and old HURDAT:
- HURDAT lists a 70 kt hurricane at 38N, 68.7W at 12Z.
- HWM depicts a hurricane of at most 1000 mb at 38.5N, 69W at 12Z.
- Microfilm analyzes a tropical storm of at most 992 mb at 38.4N, 68W at 12Z.

2. Ship highlights:
- 45 kt NNW and 979 mb at 38N, 67.5W at 00Z (COADS/micro).
- 75 kt NE and 1004 mb at 39.2N, 68.2W at 06Z (micro).
- 50 kt W and 986 mb at 39.6N, 69.7W at 12Z (COADS).
- 40 kt N (90 kt MWL, micro) and 995 mb at 38.4N, 71.4W at 18Z (COADS).
- 60 kt NNW and 1011 mb at 37.3N, 71.1W at 21Z (micro).

3. Aircraft highlights:
- Penetration center fix measured a central pressure of 975 mb, estimated surface winds of 65 kt and an eye diameter of 22-35 n mi at 37.8N, 69.9W at 16Z (WALLET).
- Penetration center fix estimated surface winds of 65 kt and an eye diameter of 25 n mi at 37.9N, 70.5W at 1806Z (WALLET).

4. Radar highlights:
- Atlantic City, NJ center fix at 37.8N, 71.3W at 2211Z (WALLET).
- New York City, NY center fix at 38.1N, 71.8W at 2314Z (WALLET).

5. Discussion:

- ATSR: "She reversed her direction and slowly turned westward as the anti-cyclone aloft over the northwest United States intensified and, by 15 September, was steering her toward the Virginia coast."
- Reanalysis: Early on the 15th, Hurricane Chloe over the central Atlantic came within 650 n mi of Hurricane Doria. The Fujiwara interaction between the two circulations caused Chloe to move northward, while Doria took a more southwesterly track, missing the approaching trough to the north. A penetration center fix reported a central pressure of 980 mb at 2141Z on the 14th but it appears that it missed the central pressure given it being several millibars higher than immediately preceding and subsequent fixes, thus it has been removed from HURDAT. The next penetration center fix at 16Z on the 15th measured a central pressure of 975 mb, estimated surface winds of 65 kt and elongated eye with a minor axis of 22 n mi and a major axis of 35 n mi. A central pressure of 975 mb suggests maximum surface winds of 78 kt from the north of 35N pressure-wind relationship. An eye diameter of 22-35 n mi suggests an RMW of about 17-26 n mi and the climatological value is 30 n mi. Based on a forward speed of about 14 kt and RMW smaller than average, an intensity of 80 kt is analyzed at 18Z on the 15th, up from 70 kt originally shown in HURDAT, a minor intensity change. 80 kt is thus maintained as its intensity from 12Z on the 14th to 18Z on the 15th. This results in major increases in intensity at 00Z and 06Z on the 15th, up from 65 kt. Satellite images showed that Doria displayed convection that was still organized around the center, but there were no signs of an eye or banding features.

September 16:

1. Maps and old HURDAT:

- HURDAT lists a 60 kt tropical storm at 37.7N, 74.5W at 12Z.
- HWM depicts a hurricane of at most 1000 mb at 38.5N, 69.8W at 12Z.
- Microfilm analyzes a tropical storm of at most 992 mb at 37.8N, 69.4W at 12Z.

2. Ship highlights:

- 99 kt NE and 993 mb at 38.6N, 71.6W at 00Z (COADS/MWL).
- 35 kt WNW and 1004 mb at 36.9N, 73.6W at 06Z (COADS).
- 40 kt WSW and 1008 mb at 36.3N, 74.5W at 12Z (COADS).
- 35 kt SW and 1009 mb at 36.1N, 74.5W at 15Z (COADS).
- 35 kt S and 1004 mb at 37N, 74.5W at 18Z (COADS).

3. Land highlights:

- 45 kt (gusts to 72 kt) at Indian River Inlet, DE at 1030Z (MWR/WALLET).
- 48 kt (gusts to 50 kt) at Ocean City, MD at 11Z (MWR/WALLET).
- 45 kt (gusts to 50 kt) and 1003 mb at Wallops Island, VA at 1631Z (MWR).
- 1000 mb (minimum pressure) at Cape Henry at 2015Z (WALLET).
- 35 kt NE (gusts to 50 kt) and 1002 mb at Norfolk, VA at 2119Z (MWR).

4. Aircraft highlights:

- Penetration center fix measured a central pressure of 986 mb at 37.8N, 73.3W at 0615Z (WALLET).
- Radar center fix measured a central pressure of 986 mb and estimated surface winds of 60 kt at 37.8N, 73.9W at 0907Z (WALLET).

- Penetration center fix measured a central pressure of 990 mb, estimated surface winds of 45 kt and an eye diameter of 50 n mi at 37.2N, 75.3W at 1803Z (WALLET).

5. Radar highlights:

- New York City, NY center fix at 38N, 72.5W at 0045Z (WALLET).
- Atlantic City, NJ center fix at 37.9N, 72W at 0135Z (WALLET).
- New York City, NY center fix at 38N, 73.2W at 0514Z (WALLET).
- Atlantic City, NJ center fix at 37.9N, 73.3W and estimated an eye diameter of 40 n mi at 0535Z (WALLET).
- Cape Charles, VA center fix at 37.8N, 74.5W at 1215Z (WALLET).
- Cape Charles, VA center fix at 36.6N, 75.8W and estimated an eye diameter of 25 n mi at 2138Z (WALLET).

6. Discussion:

- MWR: "High pressure at the surface and aloft over the New England area turned Doria westward and it continued as a hurricane to within a few miles of the Virginia capes on September 16. Then Doria again encountered cold and drier air and moved over colder water. The highest measured wind, 114 mph, was recorded by the ship, Esso New Orleans, at midnight on the 15th. The highest wind reported by a land station near the center was 50 mph with gusts to 83 mph at Indian River Inlet, Del."
- Reanalysis: Doria turned to the southwest while moving towards the United States and began to weaken. A central pressure of 981 mb was present in the original HURDAT at 00Z on the 16th and seems reasonable based on antecedent and subsequent penetration center fixes. A central pressure of 981 mb suggests maximum surface winds of 72 kt from the north of 35N pressure-wind relationship. Based on a forward speed of about 14 kt, an intensity of 75 kt is analyzed at 00Z on the 16th, up from 70 kt originally shown in HURDAT, a minor intensity change. (The 99 kt ship report at 00Z appears to be unrealistic, given the aircraft reconnaissance observations. Thus this is not weighted in the intensity assessment.) The next penetration center fix measured a central pressure of 986 mb and estimated surface winds of 60 kt at 0615Z on the 16th. A central pressure of 986 mb suggests maximum surface winds of 67 kt from the north of 35N pressure-wind relationship. Based on a forward speed of about 14 kt, an intensity of 70 kt is analyzed at 06Z on the 16th, same as originally shown in HURDAT. The last penetration center fix on the 16th measured a central pressure of 990 mb, estimated surface winds of 45 kt and an eye diameter of 45 n mi at 1803Z on the 16th. A central pressure of 990 mb suggests maximum surface winds of 63 kt from the north of 35N pressure-wind relationship. An eye diameter of 50 n mi suggests an RMW of about 40 n mi and the climatological value is 32 n mi. Based on a forward speed of about 8 kt and a large size, an intensity of 60 kt is analyzed at 18Z on the 16th, up from 55 kt originally shown in HURDAT, a minor intensity change. The center of Doria passed close to the Mid-Atlantic States producing sustained tropical storm-force winds along the coasts of Delaware, Maryland, Virginia, and North Carolina.

September 17:

1. Maps and old HURDAT:

- HURDAT lists a 30 kt tropical depression at 34.7N, 76.3W at 12Z.
- HWM depicts a closed low pressure of at most 1012 mb at 34.5N, 76.5W at 12Z.

- Microfilm analyzes a tropical cyclone of at most 1012 mb at 34.7N, 76.5W at 12Z.

2. Ship highlights:
- 35 kt NE and 1013 mb at 35.9N, 73.8W at 06Z (COADS).

3. Aircraft highlights:
- Penetration center fix measured a central pressure of 1006 mb, estimated surface winds of 32 kt and an eye diameter of 25 n mi at 34.7N, 76.2W at 1138Z (WALLET).
- Penetration center fix measured a central pressure of 1006 mb, estimated surface winds of 35 kt and an eye diameter of 35 n mi at 33.3N, 76.1W at 2230Z (WALLET).

4. Radar highlights:
- Cape Charles, VA center fix at 36.3N, 76W at 0003Z (WALLET).
- Cape Charles, VA center fix at 35.7N, 75.3W at 0610Z (WALLET).

5. Discussion:
- MWR: "The weakened center reached land near the Virginia-North Carolina border and continued southward across the North Carolina capes and back to sea on September 17. Doria continued southward and then eastward as a weak depression but was still recognizable 4 days later south of Bermuda."
- ATSR: "DORIA dropped to tropical storm intensity late on the 16th before making landfall near the Virginia-North Carolina border. She moved south over the extreme eastern edge of North Carolina and weakened to a depression."
- Reanalysis: The center of Doria crossed the North Carolina coastline around 00Z on the 17th with maximum sustained winds of 50 kt. Doria is only the 3rd known tropical cyclone to hit North Carolina on a south or southwest track. The tropical storm continued to weaken over eastern North Carolina, reaching the southern coast around 12Z on the 17th. A penetration center fix at 1138Z on this date measured a central pressure of 1006 mb and estimated surface winds of 32 kt. A central pressure of 1006 mb suggests maximum surface winds of 32 kt from the north of 25N and 37 kt from the north of 35N pressure-wind relationships. Based on a forward speed of about 9 kt, an intensity of 30 kt is analyzed at 12Z on the 17th, same as originally shown in HURDAT.

September 18:
1. Maps and old HURDAT:
- HURDAT lists a 25 kt tropical depression at 31.9N, 75W at 12Z.
- HWM depicts a closed low pressure of at most 1012 mb at 32N, 75W at 12Z.
- Microfilm analyzes a tropical cyclone of at most 1008 mb at 31.9N, 75W at 12Z.

2. Aircraft highlights:
- Penetration center fix measured a central pressure of 1006 mb and estimated surface winds of 15 kt at 31.8N, 74.7W at 1231Z (WALLET).
- Penetration center fix measured a central pressure of 1006 mb and estimated surface winds of 14 kt at 31.5N, 74.5W at 1740Z (WALLET).

3. Discussion:
- Reanalysis: Doria turned to the southeast on the 18th with no appreciable changes in intensity. Two penetration center fixes occurred around 12Z and 18Z

on the 18th measuring a central pressure of 1006 mb and an intensity of 30 kt has been analyzed at both times, up from 25 kt originally in HURDAT, minor intensity changes. Satellite images showed that Doria lost most of its convection.

September 19:
1. Maps and old HURDAT:
- HURDAT lists a 25 kt tropical depression at 30N, 73W at 12Z.
- HWM depicts a closed low pressure of at most 1012 mb at 30.2N, 72.2W at 12Z.
- Microfilm analyzes a tropical cyclone of at most 1012 mb at 30N, 72W at 12Z.

2. Discussion:
- ATSR: "She dissipated on the 19th as she moved southeast, then east over the waters of the North Atlantic, southwest of Bermuda."
- Reanalysis: On the 19th, Doria continued southeastward over the western Atlantic. Satellite images indicated that the system had lost its organized, deep convection, becoming a remnant low around 00Z.

September 20:
1. Maps and old HURDAT:
- HURDAT lists a 25 kt tropical depression at 29.5N, 70W at 12Z.
- HWM depicts a closed low pressure of at most 1012 mb at 30.2N, 70.5W at 12Z.
- Microfilm analyzes a tropical cyclone of at most 1012 mb at 29.5N, 70W at 12Z.

September 21:
1. Maps and old HURDAT:
- HURDAT lists a 25 kt tropical depression at 29.5N, 67.5W at 12Z (last position).
- HWM depicts a spot low pressure at 32N, 62.7W at 12Z.
- Microfilm analyzes a tropical cyclone of at most 1012 mb at 29.5N, 67.5W at 12Z.

2. Discussion:
- Reanalysis: The weakened circulation interacted with a trough over the western Atlantic and Doria is analyzed to have merged with this disturbance after 12Z on the 21st. Thus, the last position is analyzed at 12Z on the 21st, same as originally in HURDAT.

September 22:
1. Maps and old HURDAT:
- HWM depicts a spot low pressure at 28N, 69W at 12Z.
- Microfilm analyzes a tropical cyclone of at most 1012 mb at 29N, 67W at 12Z.

September 23:
1. Maps and old HURDAT:
- HWM and microfilm analyze that the trough that Doria had merged with had dissipated at 12Z.

Date	Original HURDAT Central Pressure	Evidence	Changes

Sep 08 00Z	1010 mb	Ship: 20 kt NE and 1009 mb at 28.4N, 78.8W at 00Z	1007 mb
Sep 08 12Z	1007 mb	Penetration center fix: 1007 mb at 1320Z	Retained
Sep 09 00Z		Penetration center fix: 1007 mb at 22Z on Sep 8th	1007 mb
Sep 09 12Z	1004 mb	Penetration center fix: 1004 mb at 1332Z	Retained
Sep 10 00Z	997 mb	Penetration center fix: 997 mb at 2324Z on Sep 9th	
Sep 10 18Z	984 mb	Penetration center fix: 984 mb at 1739Z	
Sep 11 00Z		Penetration center fix: 987 mb at 2130Z on Sep 10th	987 mb
Sep 11 12Z	999 mb	Penetration center fix: 999 mb at 1205Z	Retained
Sep 11 18Z	998 mb	Penetration center fix: 998 mb at 18Z	
Sep 13 00Z	989 mb	Penetration center fix: 989 mb at 23Z on Sep 12th	
Sep 13 18Z	983 mb	Penetration center fix: 983 mb at 1721Z	
Sep 14 18Z	973 mb	Penetration center fix: 973 mb at 1741Z	
Sep 15 00Z	980 mb	Penetration center fix reported a central pressure of 980 mb at 2141Z on Sep 14th, four hours after measuring 973 mb, and later on the 15th, a penetration center fix measured 975 mb. Thus, this measurement appears erroneous and has been removed.	Removed
Sep 15 18Z	975 mb	Penetration center fix: 975 mb at 16Z	Retained
Sep 16 00Z	981 mb	No penetration center fix reported but a reconnaissance aircraft was investigating the cyclone at this time and the central pressure appears reasonable	
Sep 16 06Z	986 mb	Penetration center fix: 986 mb at 0615Z	
Sep 17 12Z	1006 mb	Penetration center fix: 1006 mb at 1138Z	
Sep 18 00Z	1006 mb	Penetration center fix: 1006 mb at 23Z on Sep 17th	
Sep 18 12Z	1006 mb	Penetration center fix: 1006 mb at 1231Z	
Sep 18 18Z	1006 mb	Penetration center fix: 1006 mb at 1740Z	
Sep 20 00Z	1010 mb	No ships or reconnaissance aircraft near the cyclone around this time	Removed

Sources: NHC microfilm maps, the Historical Weather Maps series, the COADS ship database, Monthly Weather Review, Mariners Weather Log, Satellite images from NCDC, and NHC Storm Wallets.

Tropical Depression [September 19-27, 1967] – AL151967

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55555 09/18/1967 M= 9 15 SNBR=   4 UNNAMED
55555 09/19/1967 M= 9 15 SNBR=   4 UNNAMED
         **

(September 18th has been removed)
55560 09/18*  0   0   0    0*  0   0   0    0*140 145   0    0*141 152   0    0*

55565 09/19*141 162   0    0*142 172   0    0*143 185   0    0*145 200   0    0*
55565 09/19*  0   0   0    0*  0   0   0    0*130 190  25    0*133 200  25    0*
              *   *             *   *          ***  ***  **      ***       **

55570 09/20*145 212   0    0*146 229   0    0*146 241   0    0*146 251   0    0*
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55570 09/20*136 212  25    0*139 225  25    0*142 238  25    0*144 251  25    0*
            ***      **      ***  ***  **      ***  ***  **      ***      **

55575 09/21*148 269   0    0*149 282   0    0*150 300   0    0*151 311   0    0*
55575 09/21*146 266  25    0*148 282  25    0*150 297  25    0*151 312  25    0*
            *** ***  **      ***      **          ***  **          ***  **

55580 09/22*153 329   0    0*154 345   0    0*156 360   0    0*156 371   0    0*
55580 09/22*153 327  25    0*154 343  25    0*156 358  25    0*157 371  25    0*
                ***  **          ***  **          ***  **      ***      **

55585 09/23*158 382   0    0*159 397   0    0*160 410   0    0*161 421   0    0*
55585 09/23L158 384  25    0L159 397  25    0L160 409  25    0L161 421  25    0*
            *    ***  **     *         **     *    ***  **     *         **

55590 09/24*161 436   0    0*162 450   0    0*163 464   0    0*164 474   0    0*
55590 09/24L161 434  25    0L162 448  25    0L163 462  25    0L163 475  25    0*
            *    ***  **     *    ***  **     *    ***  **     ****  ***  **

55595 09/25*165 489   0    0*165 500   0    0*165 514   0    0*165 527   0    0*
55595 09/25*163 487  25    0*163 500  25    0*163 514  25 1012*162 527  30    0*
            *** ***  **      ***      **      ***      ** **** ***      **

55600 09/26*163 541   0    0*160 557   0    0*158 570   0    0*  0   0   0    0*
55600 09/26*160 541  30    0*157 555  30    0*153 569  30    0*149 583  30    0*
            ***      **      *** ***  **      *** ***  **      *** ***  **

(September 27th has been added to HURDAT)
55605 09/27*145 596  25    0*140 610  25    0*  0   0   0    0*  0   0   0    0*

55610 TD
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Significant Revisions:

1. The original HURDAT did not have intensities for the positions of this tropical cyclone.
2. First position analyzed 24 hours later than originally shown in HURDAT.
3. Major position changes analyzed at 12Z and 18Z on September 19th.
4. Dissipation analyzed 18 hours later than originally shown in HURDAT.

Daily Metadata:

September 17:

1. Maps and old HURDAT:

- HWM analyzes no features of interest at 12Z.

September 18:

1. Maps and old HURDAT:

- HWM and microfilm analyze no features of interest at 12Z.
- HURDAT lists a tropical depression at 14N, 14.5W at 12Z (first position).

2. Discussion:

- Reanalysis: The original HURDAT showed a tropical depression forming over western Africa at 12Z on this date. Synoptic observations show a tropical wave

moving across the area and satellite images only depict a few showers and thunderstorms, not resembling a tropical cyclone.

September 19:

1. Maps and old HURDAT:

- HWM analyzes no features of interest at 12Z.
- HURDAT lists a tropical depression at 14.3N, 18.5W at 12Z.
- Microfilm shows a closed low pressure of at most 1014 mb at 13N, 19W at 12Z.

2. Discussion:

- Reanalysis: Satellite images showed a small but organized area of convection off the coast of Africa. Synoptic observations suggested that a closed low-level circulation developed around 12Z on the 19th and a 25 kt tropical depression is analyzed to have formed at this time.

September 20:

1. Maps and old HURDAT:

- HWM analyzes no features of interest at 12Z.
- HURDAT lists a tropical depression at 14.6N, 24.1W at 12Z.
- Microfilm shows a tropical cyclone of at most 1014 mb at 13N, 24.5W at 12Z.

2. Discussion:

- Reanalysis: The tropical depression continued west-northwest at about 13 kt, passing south of the Cabo Verde Islands. Satellite images showed a small area of convection associated with the tropical cyclone.

September 21:

1. Maps and old HURDAT:

- HWM analyzes no features of interest at 12Z.
- HURDAT lists a tropical depression at 15N, 30W at 12Z.
- Microfilm shows a tropical cyclone of at most 1014 mb at 14.5N, 29W at 12Z.

2. Discussion:

- Reanalysis: The tropical depression moved into the central Atlantic where the data is sparse.

September 22:

1. Maps and old HURDAT:

- HWM HWM analyzes a tropical wave along 36W, extending from 12N-20N at 12Z.
- HURDAT lists a tropical depression at 15.6N, 36W at 12Z.
- Microfilm shows a tropical cyclone of at most 1014 mb at 15N, 34W at 12Z.

2. Discussion:

- Reanalysis: The tropical depression continued westward and satellite images showed a small area of convection near the center.

September 23:

1. Maps and old HURDAT:

- HWM analyzes a tropical wave along 41W, extending from 12N-22N at 12Z.
- HURDAT lists a tropical depression at 16N, 41W at 12Z.
- Microfilm shows a tropical cyclone at 18N, 41W at 12Z.

2. Discussion:

- Microfilm Tropical Analysis 231800Z: "ESSA 3 TODAY SHOWS VERY LITTLE CLOUDINESS IN THE AREA OF TROPICAL DEPRESSION XX1003 AND THERE HAVE BEEN NO SUPPORTING CONVENTIONAL DATA SO IT IS DROPPED."
- Reanalysis: On September 23rd and 24th, the tropical depression lost all the convective activity and is analyzed to have weakened into a post-tropical cyclone.

September 24:

1. Maps and old HURDAT:

- HWM analyzes a tropical wave along 48W, extending from 14N-24N at 12Z.
- HURDAT lists a tropical depression at 16.3N, 46.4W at 12Z.
- Microfilm shows a tropical cyclone of at most 1012 mb at 17.5N, 46.5W at 12Z.

September 25:

1. Maps and old HURDAT:

- HWM analyzes a tropical wave along 53W, extending from 14N-24N at 12Z.
- HURDAT lists a tropical depression at 16.5N, 51.4W at 12Z.
- Microfilm shows a tropical cyclone of at most 1014 mb at 16N, 51.5W at 12Z.

2. Ship highlights:

- 15 kt E and 1014 mb at 17.7N, 51.5W at 12Z (COADS).

3. Discussion:

- Reanalysis: A reconnaissance aircraft investigated the system around 12Z on the 25th indicating that it had a closed low-level circulation. Satellite images showed a redevelopment of deep convection and it is analyzed to have become a tropical depression again at 00Z on this date. Synoptic and aircraft data suggested that the tropical depression had a central pressure of about 1012 mb at 12Z on the 25th, and this value has been added to HURDAT.

September 26:

1. Maps and old HURDAT:

- HWM analyzes a tropical wave along 58W, extending from 10N-22N at 12Z.
- HURDAT lists a tropical depression at 15.8N, 57W at 12Z (last position).
- Microfilm shows a tropical cyclone of at most 1012 mb at 14.3N, 57.3W at 12Z.

2. Ship highlights:

- 30 kt SE and 1013 mb at 16.1N, 55.7W at 09Z (COADS).

3. Discussion:

- Reanalysis: The tropical depression remained poorly organized as it approached the Lesser Antilles. A couple of ships reported 30 kt and this is the peak intensity of this tropical cyclone.

September 27:

1. Maps and old HURDAT:

- HWM analyzes a tropical wave along 63W, extending from 10N-22N at 12Z.
- Microfilm shows a tropical disturbance at 14N, 63W at 12Z.

2. Discussion:

- Reanalysis: The tropical depression moved into the eastern Caribbean Sea and is analyzed to have dissipated after 06Z on the 27th based on synoptic observations.

September 28:

1. Maps and old HURDAT:

- HWM analyzes no features of interest at 12Z.
- Microfilm shows a tropical disturbance at 14.5N, 70.5W at 12Z.

Sources: NHC microfilm maps, the Historical Weather Maps series, the COADS ship database, Monthly Weather Review, Mariners Weather Log and satellite images from NCDC.

Tropical Storm [September 25 – October 1, 1967] – AL161967

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55555 09/22/1967 M= 9 16 SNBR=   4 UNNAMED
55555 09/25/1967 M= 7 16 SNBR=   4 UNNAMED
         **         *

(September 22th through 24th have been removed)
55560 09/22*  0   0   0    0*  0   0   0    0*108 150   0    0*109 162   0    0*
55565 09/23*109 175   0    0*110 189   0    0*110 203   0    0*111 203   0    0*
55570 09/24*113 229   0    0*116 240   0    0*116 250   0    0*117 262   0    0*

55575 09/25*117 275   0    0*118 290   0    0*120 300   0    0*121 316   0    0*
55575 09/25*120 270  25    0*120 285  25    0*120 300  30    0*120 315  30    0*
            *** ***  **      *** ***  **                **      *** ***  **

55580 09/26*121 330   0    0*120 345   0    0*120 360   0    0*119 365   0    0*
55580 09/26*120 330  30    0*120 345  30    0*120 357  30    0*120 365  30    0*
            ***      **                **          ***  **      ***      **

55585 09/27*119 370   0    0*119 375   0    0*119 380   0    0*120 387   0    0*
55585 09/27*120 370  35    0*120 375  35    0*120 380  35    0*120 386  35    0*
            ***      **      ***      **      ***      **          ***  **

55590 09/28*121 392   0    0*125 398   0    0*130 400   0    0*133 403   0    0*
55590 09/28*122 392  40    0*124 397  40    0*127 400  40    0*130 402  40    0*
            ***      **      *** ***  **      ***      **      *** ***  **

55595 09/29*136 403   0    0*141 404   0    0*146 406   0    0*151 410   0    0*
55595 09/29*133 403  35    0*137 405  35    0*141 407  35    0*145 410  35 1004*
            ***      **      *** ***  **      *** ***  **      ***      **  ****

55600 09/30*155 413   0    0*156 418   0    0*160 421   0    0*  0   0   0    0*
55600 09/30*149 414  30    0*154 418  30    0*158 421  25    0*161 425  25    0*
            *** ***  **      ***      **      ***      **      *** ***  **

(October 1st is new to HURDAT)
55605 10/01*163 430  25    0*164 435  25    0*165 440  25    0*  0   0   0    0*

55610 TD
55610 TS
      **
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Significant Revisions:

1. System upgraded to a tropical storm based upon satellite and aircraft reconnaissance data.
2. The original HURDAT did not have intensities for the positions of this tropical cyclone.
3. First position analyzed 60 hours later than originally shown in HURDAT.
4. Dissipation analyzed 24 hours later than originally shown in HURDAT.

Daily Metadata:

September 21:

1. Maps and old HURDAT:

- HWM analyzes no features of interest at 12Z.

September 22:

1. Maps and old HURDAT:

- HWM and microfilm analyze no features of interest at 12Z.
- HURDAT lists a tropical depression at 10.8N, 15W at 12Z (first position).

2. Discussion:

- Reanalysis: Satellite imagery showed an active tropical wave over the west coast of Africa. Synoptic observations did not suggest it had a closed low-level circulation.

September 23:

1. Maps and old HURDAT:

- HWM and microfilm analyze no features of interest at 12Z.
- HURDAT lists a tropical depression at 11N, 20.3W at 12Z.

September 24:

1. Maps and old HURDAT:

- HWM analyzes no features of interest at 12Z.
- HURDAT lists a tropical depression at 11.6N, 25W at 12Z.
- Microfilm shows a spot low at 11.7N, 24.7W at 12Z.

September 25:

1. Maps and old HURDAT:

- HWM and microfilm analyze no features of interest at 12Z.
- HURDAT lists a tropical depression at 12N, 30W at 12Z.

2. Ship highlights:

- 30 kt ENE and 1015 mb at 15.4N, 36W at 18Z (COADS).

3. Discussion:

- Reanalysis: The tropical wave moved westward and remained poorly organized until September 25th. Satellite imagery on the 25th showed a small system but some organized convection, including some banding over the northern semicircle. Synoptic observations over the eastern Atlantic were sparse, thus

the time of genesis is uncertain. Based on the data available, the first position is analyzed at 00Z on the 25th as a 25 kt tropical depression. An intensity of 30 kt is analyzed at 12Z on the 25th, based on a 30 kt observation at 18Z.

September 26:

1. Maps and old HURDAT:

- HWM and microfilm analyze no features of interest at 12Z.
- HURDAT lists a tropical depression at 12N, 36W at 12Z.

2. Ship highlights:

- 30 kt NE and 1009 mb at 14N, 33.3W at 18Z (COADS).

3. Discussion:

- Reanalysis: The tropical depression continued westward over the central Atlantic. Satellite imagery showed a small tropical system with organized convection near or over the center.

September 27:

1. Maps and old HURDAT:

- HWM analyzes no features of interest at 12Z.
- HURDAT lists a tropical depression at 11.9N, 38W at 12Z.
- Microfilm shows a tropical cyclone of at most 1010 mb at 12N, 38W at 12Z.

2. Discussion:

- Reanalysis: Operationally, the 13th tropical depression of the season was declared at 06Z on the 27th. Satellite imagery indicated that the convection remained small in coverage but well organized. Based upon the satellite imagery, the system is upgraded to a minimal (35 kt) tropical storm.

September 28:

1. Maps and old HURDAT:

- HWM analyzes a closed low pressure of at most 1008 mb at 13.5N, 38.5W at 12Z.
- HURDAT lists a tropical depression at 13N, 40W at 12Z.
- Microfilm shows a tropical cyclone of at most 1008 mb at 12.5N, 39.5W at 12Z.

2. Discussion:

- Reanalysis: Based upon satellite imagery, the system's intensity is assessed at 40 kt on the 28th, which is the peak intensity of the system.

September 29:

1. Maps and old HURDAT:

- HWM analyzes a closed low pressure of at most 1008 mb at 13N, 40.8W at 12Z.
- HURDAT lists a tropical depression at 14.6N, 40.6W at 12Z.
- Microfilm shows a tropical cyclone of at most 1010 mb at 14N, 42W at 12Z.

2. Aircraft highlights:

- Dropsonde: 1005 mb and estimated surface winds of 10 kt S at 14.5N, 40W at 1954Z (micro).

3. Discussion:

- Reanalysis: The tropical depression was almost stationary on this date. Microfilm showed that a reconnaissance aircraft investigated the tropical cyclone late on the 29th. A minimum pressure of 1005 mb and visually estimated surface winds of 10 kt suggests a central pressure of 1004 mb, which has been added to the 18Z time slot. A central pressure of 1004 mb suggests maximum surface winds of 39 kt from the south of 25N Brown et al. pressure-wind relationship. Due to the slow movement and sparse data, an intensity of 35 kt is analyzed at 18Z on the 29th.

September 30:

1. Maps and old HURDAT:

- HWM analyzes no features of interest at 12Z.
- HURDAT lists a tropical depression at 16N, 42.1W at 12Z (last position).
- Microfilm shows a tropical cyclone of at most 1010 mb at 16.6N, 44W at 12Z.

2. Discussion:

- Reanalysis: The tropical cyclone became less organized on this date based on the satellite imagery and weakening back to a tropical depression is shown at 00Z. A reconnaissance aircraft investigated the system late on this date but only a couple of the observations were recorded in the microfilm. Nonetheless, a ship reported a weak (5 kt) west wind, suggesting that a closed low-level circulation was still present.

October 1:

1. Maps and old HURDAT:

- HWM and microfilm analyze no features of interest at 12Z.

2. Discussion:

- Reanalysis: The tropical depression continued to weaken on October 1st and the last position is analyzed at 12Z on this date. Operationally, the last position is analyzed at 18Z on the 1st.

October 2:

1. Maps and old HURDAT:

- HWM and microfilm analyze no features of interest at 12Z.

October 3:

1. Maps and old HURDAT:

- HWM and microfilm analyze no features of interest at 12Z

Sources: NHC microfilm maps, the Historical Weather Maps series, the COADS ship database, Monthly Weather Review, Mariners Weather Log and satellite images from NCDC.

Tropical Depression [September 25-28, 1967] – AL171967

```
55555 09/25/1967 M= 4 17 SNBR=   4 UNNAMED
55555 09/26/1967 M= 3 17 SNBR=   4 UNNAMED
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(September 25th has been removed)

55560	09/25*	0	0	0	0*	0	0	0	0*151	187	0	0*152	195	0	0*
55565	09/26*	153	202	0	0*	153	208	0	0*154	215	0	0*155	225	0	0*
55565	09/26*	0	0	0	0*	0	0	0	0*154	215	25	0*155	222	25	0*
		*	*	*		*	*	*			**		***	**	
55570	09/27*	157	231	0	0*	160	239	0	0*162	242	0	0*169	250	0	0*
55570	09/27*	157	229	30	0*	159	236	30	0*162	242	30	0*166	248	30	0*
			***	**		***	***	**			**	***	***	**	
55575	09/28*	174	255	0	0*	179	261	0	0*181	264	0	0* 0	0	0	0*
55575	09/28*	172	253	25	0*	176	258	25	0*180	264	25	0* 0	0	0	0*
		***	***	**		***	***	**	***		**				

55580 TD

Significant Revisions:

1. The original HURDAT did not have intensities for the positions of this tropical cyclone.

2. First position analyzed 24 hours later than originally shown in HURDAT.

Daily Metadata:

September 24:

1. Maps and old HURDAT:

- HWM analyzes no features of interest at 12Z.

September 25:

1. Maps and old HURDAT:

- HWM analyzes no features of interest at 12Z.
- HURDAT lists a tropical depression at 15.1N, 18.7W at 12Z (first position).
- Microfilm shows a tropical cyclone of at most 1012 mb at 16N, 19.5W at 12Z.

2. Discussion:

- Reanalysis: A tropical wave entered the eastern Atlantic on September 25th. Satellite images showed a large area of disorganized convection.

September 26:

1. Maps and old HURDAT:

- HWM analyzes no features of interest at 12Z.
- HURDAT lists a tropical depression at 15.4N, 21.5W at 12Z.
- Microfilm shows a tropical cyclone of at most 1012 mb at 14.8N, 22.3W at 12Z.

2. Land highlights:

- 40 kt (likely gusts) at Sal Island, Cabo Verde Islands (time unknown)(micro).

3. Discussion:

- Reanalysis: The tropical disturbance became better organized and it is analyzed to have become a tropical depression at 12Z on September 26th based on ship and coastal data. Satellite images showed a large area of convection with

some signs of banding. Microfilm at 12Z on the 26th indicates that 40 kt were measured at Sal Island in the Cabo Verde archipelago, the time is unknown, but it likely occurred earlier on the 26th. Based on synoptic observations, it is likely these winds were gusts and the elevation of the anemometer is unknown.

September 27:

1. Maps and old HURDAT:

- HWM analyzes a closed low pressure of at most 1012 mb at 16.5N, 23.9W at 12Z.
- HURDAT lists a tropical depression at 16.2N, 24.2W at 12Z.
- Microfilm shows a tropical cyclone of at most 1010 mb at 15.8N, 24.7W at 12Z.

2. Ship highlights:

- 35 kt SE and 1013 mb at 18N, 21.5W at 12Z (COADS).
- 30 kt E and 1009 mb at 19N, 23.8W at 18Z (COADS).

3. Discussion:

- Reanalysis: The tropical depression moved northwestward and a peak of 30 kt is analyzed on this date. A ship reported 35 kt at 12Z on the 27th and coupled with another report of 30 kt at 18Z on this date suggests that the tropical cyclone may have achieved tropical storm intensity. But since there is only one report of gale-force winds and nearby ship and coastal data is below gale-force intensity, the tropical cyclone is retained as a tropical depression. Satellite images showed a large band of convection extending from the ITCZ to the eastern semicircle of the circulation with some convection over the center.

September 28:

1. Maps and old HURDAT:

- HWM analyzes a spot low pressure at 17.4N, 27.2W at 12Z.
- HURDAT lists a tropical depression at 18.1N, 26.4W at 12Z (last position).
- Microfilm shows a tropical cyclone of at most 1008 mb at 18.4N, 27.5W at 12Z.

2. Discussion:

- Reanalysis: On this date, the tropical cyclone weakened as shown in the satellite images, possibly due to moving into cooler waters and into a drier air mass. The last position is analyzed at 12Z on the 28th, same as originally shown in HURDAT.

September 29:

1. Maps and old HURDAT:

- HWM analyzes no features of interest at 12Z.
- Microfilm shows a tropical disturbance at 20N, 29.5W at 12Z.

2. Discussion:

- Reanalysis: The remnants continued northwestward and remained poorly organized.

September 30:

1. Maps and old HURDAT:

- HWM and microfilm analyze no features of interest at 12Z.

2. Discussion:

- Reanalysis: An increase in convection was noticed on September 30th as the remnants of the tropical depression interacted with a trough over the eastern Atlantic. The disturbance became embedded within the trough as an extratropical cyclone developed near 35N, 40W over the next few days.

Sources: NHC microfilm maps, the Historical Weather Maps series, the COADS ship database, Monthly Weather Review, Mariners Weather Log and satellite images from NCDC.

Tropical Storm Edith (September 26 - October 1, 1967) – AL181967

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45215 09/26/1967 M= 6 18 SNBR= 966 EDITH       XING=0 SSS=0

45220 09/26*  0   0   0    0*  0   0   0    0*125 470  30    0*126 484  30 1005*

45225 09/27*128 498  30    0*130 505  30    0*132 512  30 1008*135 521  30 1008*
45225 09/27*127 496  30    0*128 505  30    0*131 513  30 1010*135 521  30 1008*
            *** ***         ***              *** ***     ****

45230 09/28*139 530  30 1005*142 540  30    0*144 551  40 1002*145 560  45 1000*
45230 09/28*139 530  35 1005*142 540  40 1001*144 550  40 1002*145 560  45 1000*
                     **                ** ****     ***

45235 09/29*146 570  50    0*146 576  40    0*147 582  35 1007*149 587  35 1005*
45235 09/29*146 568  45    0*146 576  40    0*147 582  35 1007*148 589  35 1005*
                ***  **                                        *** ***

45240 09/30*148 598  35    0*146 609  30    0*145 620  30 1010*145 630  30 1008*
45240 09/30*148 598  35    0*146 608  30    0*145 619  30 1010*145 630  30    0*
                                ***              ***                         *

45245 10/01*145 640  30    0*145 647  30    0*145 655  30    0*  0   0   0    0*
45245 10/01*145 641  30    0*  0   0   0    0*  0   0   0    0*  0   0   0    0*
                ***            *   *   *        *   *   *

45250 TS
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Significant Revisions:

1. Intensification to a tropical storm is analyzed twelve hours earlier based on aircraft reconnaissance data.
2. Dissipation is analyzed twelve hours earlier based on synoptic and aircraft reconnaissance data.
3. A couple of the central pressure values in original HURDAT were modified or removed based on synoptic and aircraft reconnaissance data. A central pressure was added at 06Z on September 28th.

Daily Metadata:

September 23:

1. Maps and old HURDAT:

- HWM analyzes a tropical wave along 42W at 12Z.
- HURDAT does not list an organized system on this date.

2. Satellite highlights:

- ESSA II estimated a center fix at 11.5N, 32W at 15Z (WALLET).

3. Discussion:

- MWR: "Tropical storm Edith originated on the intertropical convergence zone. The disturbance was initially noted very near the African Coast on the satellite pictures of September 20. Successive pictures showed that this disturbance moved westward 5 to 6 degrees of longitude per day."
- Reanalysis: Satellite images showed a broad disturbance along the ITCZ.

September 24:

1. Maps and old HURDAT:

- HWM analyzes a closed low pressure of at most 1012 mb at 12.2N, 43W at 12Z.
- HURDAT does not list an organized system on this date.

2. Satellite highlights:

- ESSA II estimated a center fix at 12N, 37.5W at 15Z (WALLET).

3. Discussion:

- ATSR: "Tropical storm EDITH was first detected by satellite on 24 September as a weak disturbance near 12N, 43W."
- Reanalysis: The disturbance continued to move westward and satellite images showed disorganized convection along the ITCZ.

September 25:

1. Maps and old HURDAT:

- HWM analyzes a closed low pressure of at most 1012 mb at 12.2N, 45.3W at 12Z.
- HURDAT does not list an organized system on this date.
- Microfilm does not show any feature of interest at 12Z.

2. Satellite highlights:

- ESSA II estimated a center fix at 12N, 43W at 1030Z (WALLET).

3. Discussion:

- Reanalysis: The tropical disturbance was better organized on this date based on satellite images and synoptic observations indicate that a closed low-level circulation could have already developed, but the data is sparse near the system.

September 26:

1. Maps and old HURDAT:

- HWM analyzes a closed low pressure of 1012 mb at 13N, 48.5W at 12Z.
- HURDAT lists a 30 kt tropical depression at 12.5N, 47W at 12Z (first position).
- Microfilm shows a tropical cyclone of at most 1012 mb at 11.5N, 48W at 12Z.

2. Satellite highlights:

- ESSA II estimated a center fix at 12.5N, 47W at 11Z (WALLET).

3. Aircraft highlights:

- Penetration center fix measured a central pressure of 1005 mb, estimated surface winds of 45 kt and an eye diameter of 25 n mi at 12.7N, 49.2W at 2030Z (WALLET).

4. Discussion:

- MWR: "But it was not until September 26 that sufficient circulation features, established by ships and by satellite and aircraft reconnaissance, justified the upgrading of the disturbance to a tropical depression."
- ATSR: "This disturbance moved slowly west-northwest and developed into a circulation near 12.5N, 48W when discovered by satellite at 1112Z on the 26th. This was confirmed by aircraft reconnaissance reports later in the day. The first warning naming tropical storm EDITH was issued by FLEHEAFAC JAX at 262200Z."
- Reanalysis: The first position is analyzed at 12Z on September 26th as a 30 kt tropical depression, same as originally shown in HURDAT. A reconnaissance aircraft investigated the tropical cyclone at 2030Z on the 26th measuring a central pressure of 1005 mb, estimating surface winds of 45 kt and an eye diameter of 25 n mi. A central pressure of 1005 mb suggests maximum surface winds of 37 kt from the south of 25N Brown et al. pressure-wind relationship. An eye diameter of 25 n mi suggests an RMW of about 19 n mi and the climatological value is 12 n mi. Based on the large RMW and average forward speed of about 12 kt, an intensity of 30 kt is analyzed at 18Z on the 26th, same as originally shown in HURDAT. Satellite images suggest that the tropical cyclone had continued to become better organized with convection near the center and some banding over the northern semicircle.

September 27:

1. Maps and old HURDAT:

- HWM analyzes a closed low pressure of 1008 mb at 13.2N, 51W at 12Z.
- HURDAT lists a 30 kt tropical depression at 13.2N, 51.2W at 12Z.
- Microfilm shows a tropical storm of at most 1008 mb at 12.7N, 51.1W at 12Z.

2. Aircraft highlights:

- Penetration center fix measured a central pressure of 1010 mb and estimated surface winds of 25 kt at 13N, 51.3W at 1325Z (WALLET).
- Penetration center fix measured a central pressure of 1008 mb and estimated surface winds of 25 kt at 13N, 51.5W at 17Z (WALLET).

3. Discussion:

- Reanalysis: The tropical depression continued westward and penetration center fixes at 1325Z and 17Z on September 27th indicated that the central pressure was at 1010 mb and 1008 mb, respectively. An intensity of 30 kt is analyzed on this date, same as originally shown in HURDAT. Satellite images showed organized convection near or over the center.

September 28:

1. Maps and old HURDAT:

- HWM analyzes a tropical storm of at most 1008 mb at 15N, 54.2W at 12Z.

- HURDAT lists a 40 kt tropical storm at 14.4N, 55.1W at 12Z.
- Microfilm shows a tropical storm of at most 1004 mb at 14.4N, 55.1W at 12Z.

2. Ship highlights:
- 15 kt SW and 1005 mb at 12.5N, 56.3W at 18Z (COADS).

3. Aircraft highlights:
- Penetration center fix measured a central pressure of 1005 mb at 14.2N, 53.1W at 0030Z (WALLET).
- Penetration center fix measured a central pressure of 1001 mb at 14.2N, 53.8W at 0445Z (WALLET).
- Penetration center fix measured a central pressure of 1002 mb, estimated surface winds of 45 kt and an eye diameter of 20 n mi at 14.4N, 55.1W at 12Z (WALLET).
- Penetration center fix measured a central pressure of 1000 mb at 14.6N, 55.9W at 1745Z (WALLET).

4. Discussion:
- MWR: "Possibly Edith vacillated between depression and storm intensity during the next 2 days [27th & 28th], but the track was not drawn for storm intensity until the 28th. This decision was based mainly upon the lowest pressure, 1000 mb. (29.53 in.), and highest winds, 55 mph, measured during Edith's life history."
- ATSR: "However, from past analysis, it was decided EDITH did not reach tropical storm intensity until early On 28 September. She rapidly gained her maximum intensity later that same day as she moved west-northwest."
- Reanalysis: A penetration center fix measured a central pressure of 1005 mb at 0030Z on September 28th. A central pressure of 1005 mb suggests maximum surface winds of 37 kt from the south of 25N pressure-wind relationship. An intensity of 35 kt is analyzed at 00Z on the 28th, up from 30 kt originally in HURDAT, a minor intensity change. The next penetration center fix measured a central pressure of 1001 mb at 0445Z on the 28th. A central pressure of 1001 mb suggests maximum surface winds of 45 kt from the south of 25N pressure-wind relationship. Based on a forward speed of about 10 kt, an intensity of 40 kt is analyzed at 06Z on the 28th, up from 30 kt originally shown in HURDAT, a minor intensity change. The next penetration center fixes measured central pressures of 1002 mb at 12Z and 1000 mb at 1745Z on the 28th. An intensity of 40 kt is analyzed at 12Z and 45 kt at 18Z on the 28th, same originally in HURDAT. 45 kt is also the peak intensity of Edith, down from 50 kt originally shown in HURDAT at 00Z on the 29th, a minor intensity change. Satellite images showed that Edith had continued to become better organized although it was under strong southwesterly shear, displacing most of the convection to the eastern semicircle.

September 29:

1. Maps and old HURDAT:
- HWM analyzes a tropical storm of at most 1008 mb at 15.2N, 57.5W at 12Z.
- HURDAT lists a 35 kt tropical storm at 14.7N, 58.2W at 12Z.
- Microfilm shows a tropical storm of at most 1008 mb at 14.7N, 58W at 12Z.

2. Aircraft highlights:

- Penetration center fix estimated an eye diameter of 18 n mi at 14.5N, 56.6W at 0555Z (WALLET).
- Penetration center fix measured a central pressure of 1007 mb, estimated surface winds of 35 kt and an eye diameter of 20 n mi at 14.8N, 58.3W at 1205Z (WALLET).
- Penetration center fix measured a central pressure of 1005 mb, estimated surface winds of 40 kt and an eye diameter of 21 n mi at 14.9N, 58.6W at 18Z (WALLET).

3. Discussion:

- ATSR: "She decreased in intensity as she came under the influence of a trough aloft and cyclonic circulation at the 200 mb level."
- Reanalysis: Edith continued westward, approaching the Lesser Antilles. A penetration center fix measured a central pressure of 1007 mb and estimated surface winds of 35 kt at 1205Z on September 29th. A central pressure of 1007 mb suggests maximum surface winds of 37 kt from the south of 25N pressure-wind relationship. An intensity of 35 kt is analyzed at 12Z on the 29th, same as originally shown in HURDAT. The next penetration center fix measured a central pressure of 1005 mb at 18Z on the 29th and an intensity of 35 kt is analyzed at this time, same as originally shown in HURDAT. Satellite images showed that Edith was still being affected by strong shear.

September 30

1. Maps and old HURDAT:

- HWM analyzes a spot low pressure at 13.8N, 62.2W at 12Z.
- HURDAT lists a 30 kt tropical depression at 14.5N, 62W at 12Z.
- Microfilm shows a tropical storm of at most 1012 mb at 15.1N, 60.6W at 12Z.

2. Aircraft highlights:

- Penetration center fix measured a central pressure of 1010 mb and estimated surface winds of 35 kt at 14.5N, 62.1W at 1225Z (WALLET).

3. Discussion:

- MWR: "Edith moved through the Northern Windward Islands during the morning of the 30th; the center had become enlarged and elongated. There were no sustained strong winds reported in the Island Chain, although gustiness was noted, especially around Martinique and Guadeloupe. Some local flooding might have occurred, but damage should be considered minor. No deaths were reported."
- ATSR: "She then moved slowly westward, passing over Martinique on the 30th…"
- Reanalysis: The tropical storm weakened as it moved across the Lesser Antilles. A penetration center fix at 1225Z on the 30th indicated that the center was extremely diffuse with a central pressure of 1010 mb. Weakening to a tropical depression is analyzed at 06Z on the 30th, same as originally shown in HURDAT. Satellite images showed that the convection associated with Edith had become disorganized.

October 1:

1. Maps and old HURDAT:

- HWM analyzes a spot low pressure at 14.2N, 64.9W at 12Z.

- HURDAT lists a 30 kt tropical depression at 14.5N, 65.5W at 12Z (last position).
- Microfilm shows a spot low pressure at 15N, 66W at 12Z.

2. Discussion:

- ATSR: "…and degenerated into an area of disturbed weather over the eastern Caribbean on 1 October."
- Reanalysis: Synoptic observations at 06Z on October 1st indicated that the circulation of Edith had dissipated, thus the last position is analyzed at 00Z, twelve hours earlier than originally shown in HURDAT.

October 2:

1. Maps and old HURDAT:

- HWM and microfilm do not analyze any feature of interest over the eastern Caribbean Sea at 12Z.

2. Discussion:

- Reanalysis: Satellite images indicated that the convection associated with the remnants of Edith had mostly dissipated.

Date	Original HURDAT Central Pressure	Evidence	Changes
Sep 26 18Z	1005 mb	Penetration center fix: 1005 mb at 2030Z	Retained
Sep 27 12Z	1008 mb	Penetration center fix: 1010 mb at 1325Z	1010 mb
Sep 27 18Z	1008 mb	Penetration center fix: 1008 mb at 17Z	Retained
Sep 28 00Z	1005 mb	Penetration center fix: 1005 mb at 0030Z	
Sep 28 06Z		Penetration center fix: 1001 mb at 0445Z	1001 mb
Sep 28 12Z	1002 mb	Penetration center fix: 1002 mb at 12Z	Retained
Sep 28 18Z	1000 mb	Penetration center fix: 1000 mb at 1745Z	
Sep 29 12Z	1007 mb	Penetration center fix: 1007 mb at 1205Z	
Sep 29 18Z	1005 mb	Penetration center fix: 1005 mb at 18Z	
Sep 30 12Z	1010 mb	Penetration center fix: 1010 mb at 1225Z	
Sep 30 18Z	1008 mb	No synoptic observations near the center	Removed

Sources: NHC microfilm maps, the Historical Weather Maps series, the COADS ship database, Monthly Weather Review, Mariners Weather Log, Satellite images from NCDC, and NHC Storm Wallets.

Hurricane Fern (October 1-4, 1967) – AL191967

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45255 10/01/1967 M= 4 19 SNBR= 967 FERN        XING=0 SSS=0

45260 10/01*  0   0   0    0*  0   0   0    0*  0   0   0    0*203 930  25 1005*
45260 10/01*  0   0   0    0*  0   0   0    0*  0   0   0    0*203 930  30    0*
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                                                                                                  **     *

45265 10/02*207 930  30 1005*215 930  35    0*221 931  50    0*224 934  60    0*
45265 10/02*209 930  40    0*215 930  55    0*221 931  65    0*224 934  65  987*
            ***      **    *          **                 **                **  ***

45270 10/03*226 937  75  987*227 946  65  999*228 955  65  993*228 962  65  996*
45270 10/03*226 939  60    0*227 946  60    0*228 954  55  993*228 962  50  996*
                ***  **    *          **    *     ***  **                **

45275 10/04*228 972  65    0*226 978  65    0*224 983  35    0*222 988  30    0*
45275 10/04*228 970  50  997*226 977  50    0*224 983  30    0*  0    0   0    0*
                ***  **  ***     ***  **                **        *    *   *
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45280 HR

Tropical Storm Landfall

10/04 08Z 22.6N 97.9W 50 kt Mexico

Significant Revisions:

1. Major intensity increases analyzed at 06Z and 12Z on October 2nd and major intensity decreases at 00Z and 18Z on October 3rd and 00Z and 06Z on October 4th based on reconnaissance aircraft data.
2. A few central pressures originally in HURDAT were removed and others were added based on reconnaissance aircraft data.
3. Weakening below hurricane intensity is analyzed 42 hours earlier than originally shown in HURDAT based on reconnaissance aircraft data.

Daily Metadata:

September 29:

1. Maps and old HURDAT:

- HWM analyzes a closed low pressure of at most 1004 mb at 18N, 91W with a stationary front extending to the northeast at 12Z.

2. Discussion:

- Reanalysis: Satellite images showed a large disturbance over southern Yucatan with convection extending from the eastern Gulf of Mexico to the eastern Gulf of Mexico along a trough.

September 30:

1. Maps and old HURDAT:

- HWM analyzes a closed low pressure of at most 1008 mb at 19N, 91.5W with a stationary front extending to the northeast at 12Z.
- HURDAT does not list an organized system on this date.
- Microfilm shows a stationary frontal boundary over the southeast Gulf of Mexico extending into eastern Mexico at 12Z.

2. Ship observations:

- 40 kt NNW and 1024 mb at 22.2N, 93.4W at 12Z (micro).
- 35 kt N and 1015 mb at 13.6N, 95.5W (eastern Pacific) at 18Z (micro).

3. Discussion:

- MWR: "During the latter part of September, a cold front swept through the southwestern Gulf of Mexico and Bay of Campeche. On September 29 Carmen, Mexico, reported northwesterly gusts over 60 mph as the front passed. By the 30th, pressures were falling in the Bay of Campeche."
- Reanalysis: The tropical disturbance moved slowly northwestward and entered the Bay of Campeche late on September 30th. Satellite images continued to show a large area of convection.

October 1:

1. Maps and old HURDAT:

- HWM analyzes a spot low pressure at 20.7N, 92.3W with a stationary frontal boundary to the northeast at 12Z.
- HURDAT lists a 30 kt tropical depression at 20.3N, 93W at 18Z (first position).
- Microfilm shows a tropical disturbance of at most 1012 mb at 20N, 93W with a stationary frontal boundary to the northeast at 12Z.

2. Discussion:

- MWR: "…satellite pictures on the morning of October 1 indicated a large circulatory cloud mass centered near 20"N., 93"W."
- ATSR: "Hurricane FERN began as a well organized cloud mass that formed on the southern end of a cold front in the Bay of Campeche on 1 October near 20.5N, 93W."
- Reanalysis: The time of genesis is uncertain due to the sparse data over the southern Gulf of Mexico. Satellite images showed that the tropical disturbance had continued to become better organized and the first position is analyzed at 18Z on October 1st, same as originally shown in HURDAT.

October 2:

1. Maps and old HURDAT:

- HWM analyzes a tropical storm of at most 1008 mb at 23.3N, 93.2W with a stationary frontal boundary to the northeast at 12Z.
- HURDAT lists a 50 kt tropical storm at 22.1N, 93.1W at 12Z.
- Microfilm shows a hurricane of at most 1008 mb at 22N, 93W at 12Z.

2. Ship highlights:

- 50 kt SW and 1004 mb at 22N, 93W at around 11Z (MWR/WALLET).
- 45 kt N and 1012 mb (S in WALLET) at 21.9N, 92.4W at 18Z (COADS/WALLET).

3. Aircraft highlights:

- Penetration center fix measured a central pressure of 987 mb, estimated surface winds of 70 kt and an eye diameter of 27 n mi at 22.3N, 93.3W at 1520Z (WALLET).

4. Discussion:

- MWR: "The satellite pictures on the morning of October 2 showed that the system had become better organized. Navy reconnaissance aircraft that afternoon located Fern's center about 300 mi. east of Tampico, Mexico. On the

same day the British ship Plainsman encountered storm force winds, 1004-mb. (29.65 in.) pressure, and a pressure drop of 10 mb. (0.30 in.) in 16 hr. After rapidly attaining hurricane intensity, with peak winds about 85 mph, and central pressure of 987 mb. (29.15 in.), the storm moved slowly westward to west-northwestward about 7 mph and turned westsouthwestward as it neared the coast."

- ATSR: "A Navy reconnaissance aircraft was dispatched to the area early on 2 October and reported the circulation had a well defined eye with a warm center and hurricane force winds. FLEWEAFAC JAX issued warning number 1 on Hurricane FERN at 021730Z. Initial intensification allowed FERN to make some headway to the north, but a large high pressure system both at the surface and aloft near the northern Gulf of Mexico and southern United States caused FERN to assume a westward track on 2 October."
- Reanalysis: A reconnaissance aircraft investigated the tropical cyclone at 1520Z on October 2nd measuring a central pressure of 987 mb, estimating surface winds of 70 kt and an eye diameter of 27 n mi. A central pressure of 987 mb suggests maximum surface winds of 68 kt from the south of 25N Brown et al. pressure-wind relationship. An eye diameter of 27 n mi suggests an RMW of about 20 n mi and the climatological value is 17 n mi. Based on a slow forward speed of about 3 kt but high environmental pressures (1015 mb OCI) and a visual estimate of 70 kt, an intensity of 65 kt is analyzed at 12Z and 18Z on the 2nd. Thus, based on the data from the reconnaissance aircraft, intensification to a tropical storm is analyzed at 00Z on the 2nd, six hours earlier than originally shown in HURDAT. 65 kt is also the peak intensity of Fern, down from 75 kt originally in HURDAT, a minor intensity change. Satellite images showed that Fern had become much better organized with a CDO and banding features over the northern and eastern quadrants.

October 3:

1. Maps and old HURDAT:

- HWM analyzes a hurricane of at most 1004 mb at 23.2N, 95.8W at 12Z.
- HURDAT lists a 65 kt hurricane at 22.8N, 95.5W at 12Z.
- Microfilm shows a hurricane of at most 1008 mb at 22.6N, 95.7W at 12Z.

2. Aircraft highlights:

- Penetration center fix measured a central pressure of 999 mb and estimated an eye diameter of 15 n mi at 22.7N, 93.9W at 0244Z (WALLET).
- Penetration center fix measured a central pressure of 999 mb and estimated an eye diameter of 15 n mi at 22.6N, 95.1W at 0935Z (WALLET).
- Penetration center fix measured a central pressure of 993 mb and estimated surface winds of 50 kt at 22.7N, 95.8W at 1249Z (WALLET).
- Penetration center fix measured a central pressure of 996 mb and estimated surface winds of 40 kt at 22.7N, 95.8W at 18Z (WALLET).
- Penetration center fix measured a central pressure of 997 mb, estimated surface winds of 60 kt and an eye diameter of 30 n mi at 22.8N, 96.8W at 2136Z (WALLET).

3. Discussion:

- Reanalysis: The next reconnaissance aircraft reached Fern at 0244Z on October 3rd measuring a central pressure of 999 mb and estimating an eye diameter of 15 n mi. Analyzing the height and temperature at 850 mb and 700 mb, it suggests

extrapolated central pressure values of 999 mb and 994 mb, accordingly. Due to this discrepancy and rapid increase in central pressure from the previous report (987 mb at 1520Z on the 2nd), it is possible that the drop landed outside, the reported central pressure of 999 mb is not utilized in this reanalysis and a gradual weakening is shown early on the 2nd. Likewise, the 999 mb reported at 0935Z for a small eye is not consistent with the 993 mb value observed three hours later. Thus this 999 mb is also considered not to be a central pressure. A reconnaissance aircraft reported a central pressure of 993 mb and estimated surface winds of 50 kt at 1249Z on the 3rd. A central pressure of 993 mb suggests maximum surface winds of 59 kt from the south of 25N pressure-wind relationship. At 0935Z on the 3rd, a penetration fix reported an eye diameter of 15 n mi, suggesting an RMW of about 12 n mi and the climatological value is 13 n mi. Based on an average RMW and forward speed of about 7 kt, an intensity of 55 kt is analyzed at 12Z on the 3rd, down from 65 kt originally shown in HURDAT, a minor intensity change. The next penetration fix measured a central pressure of 996 mb and estimated surface winds of 40 kt at 18Z on the 3rd. A central pressure of 996 mb suggests maximum surface winds of 54 kt from the south of 25N pressure-wind relationship. An intensity of 50 kt is analyzed at 18Z on the 3rd, down from 65 kt in the original HURDAT, a major intensity change, due to a slow forward speed of about 8 kt. Satellite images showed that Fern had lost organization compared to the previous day, with most of the convection over the southern semi-circle.

October 4:

2. Maps and old HURDAT:

- HWM analyzes a tropical storm of at most 1008 mb at 22.5N, 98.8W at 12Z.
- HURDAT lists a 35 kt tropical storm at 22.4N, 98.3W at 12Z.
- Microfilm shows a tropical cyclone of at most 1008 mb at 22.5N, 98.3W at 12Z.

3. Land highlights:

a. 30 kt NW and 1005 mb at Tampico, Mexico at 06Z (micro/WALLET).

4. Discussion:

a. MWR: "The center moved inland about 30 mi. north of Tampico early on the 4th. This storm dissipated rapidly over land. Fern was of maximum intensity at the time it was first located but weakened slowly and remained a very small storm as it moved through the southwestern Gulf of Mexico. When the center crossed the coast the highest winds were probably slightly less than hurricane force."
b. ATSR: "FERN made landfall just north of Tampico, Mexico early on 4 October and dissipated rapidly over the mountains of northern Mexico."
c. Reanalysis: The last penetration center fix measured a central pressure of 997 mb, estimated surface winds of 60 kt and an eye diameter of 30 n mi at 2136Z on the 3rd. An intensity of 50 kt is analyzed at 00Z on the 4th, down from 65 kt originally shown in HURDAT, a major intensity change. The small tropical storm continued westward and made landfall north of Tampico, Mexico around 08Z with maximum sustained winds of 50 kt. The mountainous terrain quickly caused the circulation to weaken and synoptic observations at 18Z on the 4th indicated that it had dissipated, thus the last position is analyzed at 12Z on the 4th, six hours earlier than originally shown in HURDAT.

October 5:

1. Maps and old HURDAT:

- HWM does not analyze any feature of interest at 12Z.
- HURDAT does not list an organized system on this date.
- Microfilm shows a tropical cyclone of at most 1012 mb at 20.5N, 106.5W (just west of Mexico) at 12Z.

2. Discussion:

- Microfilm Tropical Analysis: "REMAINS OF HURRICANE FERN HAVE PASSED JUST TO WEST OF MEXICAN COAST NEAR 20N ACCORDING TO SATELLITE."
- Reanalysis: The remnants of Fern continued westward crossing into the eastern Pacific. The disturbance produced some showers and thunderstorms west of Manzanillo, Mexico, but synoptic observations suggested that it did not have a well-defined circulation.

October 6:

1. Maps and old HURDAT:

- HWM does not analyze any feature of interest at 12Z.
- HURDAT does not list an organized system on this date.
- Microfilm shows a spot low pressure at 21.3N, 110W at 12Z.

2. Discussion:

- Microfilm Tropical Analysis: "THE LOW NEAR 21N 107W AND ASSOCIATED CLOUD MASS CONTINUED AS THE REMAINS OF FERN."
- Reanalysis: The disturbance continued producing some convection as it passed south of Baja California.

October 7:

1. Maps and old HURDAT:

- HWM and microfilm do not analyze any feature of interest at 12Z.
- HURDAT does not list an organized system on this date.

2. Discussion:

- Reanalysis: Satellite images showed that the convective activity decreased as it moved over colder waters and the disturbance dissipated.

Date	Original HURDAT Central Pressure	Evidence	Changes
Oct 01 18Z	1005 mb	No synoptic observations near the center	Removed
Oct 02 00Z	1005 mb		
Oct 02 18Z		Penetration center fix: 987 mb at 1520Z	987 mb
Oct 03 00Z	987 mb	No synoptic observations near the center	Removed
Oct 03 06Z	999 mb	Different values obtained from the extrapolation of 850 mb and 700 mb	
Oct 03 12Z	993 mb	Penetration center fix: 993 mb at 1249Z	Retained
Oct 03 18Z	996 mb	Penetration center fix: 996 mb at 18Z	

Oct 04 00Z		Penetration center fix: 997 mb at 2136Z on Oct 03	997 mb

Sources: NHC microfilm maps, the Historical Weather Maps series, the COADS ship database, Monthly Weather Review, Mariners Weather Log, Satellite images from NCDC, and NHC Storm Wallets.

Tropical Depression, October 3-5, AL201967:

Historical Weather Maps, microfilm and satellite suggested that a tropical wave left the west coast of Africa around October 3rd. The system is listed as Tropical Depression #20 in HURDAT with the first position at 12Z on the 3rd. The disturbance moved westward and there was an increase in convection over the far eastern Atlantic on the 4th. A stronger disturbance began to organize to the northeast, becoming Tropical Storm Ginger a few days later, and absorbing this disturbance. The last position was analyzed in HURDAT at 12Z on the 5th. No gales were observed in relation to this disturbance. Because the disturbance did not have a closed circulation, it is not a tropical cyclone and is removed from HURDAT. This disturbance was in Jack Beven's Lists of Suspects.

Tropical Storm Ginger (October 5-8, 1967) – AL211967

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45285 10/05/1967 M= 4 21 SNBR= 968 GINGER      XING=0 SSS=0

45290 10/05*  0   0   0    0*  0   0   0    0*170 183  30    0*175 182  30    0*
45290 10/05*  0   0   0    0*  0   0   0    0*165 183  30    0*170 182  35    0*
                                             ***              ***      **

45295 10/06*180 181  35    0*185 182  40    0*190 185  40    0*195 189  45 1002*
45295 10/06*175 181  40    0*180 181  45    0*185 182  45    0*190 184  45    0*
            ***      **      *** ***  **      *** ***  **      *** ***        *

45300 10/07*200 193  40    0*204 198  30    0*205 205  30 1012*204 212  30    0*
45300 10/07*194 187  40    0*198 191  35    0*200 197  30 1011*202 204  30    0*
            *** ***         *** ***  **      *** ***     **** *** ***

45305 10/08*203 220  30    0*202 228  30    0*200 236  30    0*197 243  25    0*
45305 10/08L202 212  30    0L201 220  30    0L200 228  30    0L197 237  25    0*
           **** ***         **** ***         *    ***         *    ***

45310 TS
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Significant Revisions:

1. The central pressures in the original HURDAT have been removed or replaced based on synoptic observations.

2. Analyzed to have been a remnant low on October 8th based on satellite images.

Daily Metadata:

October 3:

1. Maps and old HURDAT:

- HWM and microfilm do not analyze any features of interest at 12Z.
- HURDAT does not list an organized system on this date.

2. Discussion:

- MWR: "Ginger formed in the wake of a tropical depression that moved off the African Coast on October 3. Although data are limited, it appears that the storm developed within an area of convection 200 to 300 mi northeast of the depression center."
- Storm Wallets: "GINGER WAS A TROPICAL STORM WHICH ORIGINATED IN THE FAR EASTERN ATLANTIC AND NEVER ENTERED THE NATIONAL WEATHER SERVICE'S FORECAST ZONE (WEST OF 35) THERE WERE NO FORMAL ADVISORIES ISSUED ON GINGER BY THE NATIONAL HURRICANE CENTER. … NORTH ATLANTIC GALE [were] ISSUED BY THE NAVY FLEET WEATHER FACILITY AT ROTA SPAIN FOR MILITARY AND MARITIME INTEREST."
- Reanalysis: Satellite images showed a large area of convection near the coast of Africa associated with the monsoon trough.

October 4:

1. Maps and old HURDAT:

- HWM does not analyze any features of interest at 12Z.
- HURDAT does not list an organized system on this date.
- Microfilm shows a tropical cyclone of at most 1012 mb at 14N, 22W at 12Z.

2. Discussion:

- Reanalysis: The tropical disturbance was almost stationary. Microfilm analyzes a tropical depression south of the Cape Verde Islands on this date but it does not appear to have a closed circulation. In fact, it looks to be part of the ITCZ or the monsoon trough extending from the eastern Atlantic into western Africa. Satellite images continued to show a large area of disorganized showers and thunderstorms.

October 5:

1. Maps and old HURDAT:

- HWM analyzes a closed low pressure of 1012 mb at 17.2N, 18.5W at 12Z.
- HURDAT lists a 30 kt tropical depression at 17N, 18.3W at 12Z (first position).
- Microfilm shows a tropical cyclone of at most 1008 mb at 17N, 18W at 12Z.

2. Ship highlights:

- 35 kt NE (high bias) and 1014 mb at 18.8N, 17.9W at 12Z (COADS).
- 35 kt S and 1007 mb at 16.4N, 18.1W at 18Z (COADS).

3. Discussion:

- MWR: "Satellite pictures on October 5 and 6 showed a well marked vertical cloud character suggesting tropical storm intensity. This was confirmed early on the 6th when three different ships reported 40- to 45-mph. winds. Based on this information, Ginger was named."
- ATSR: "Tropical Storm GINGER formed east of the Cape Verde Islands near 17N, 18W. Satellite photographs on 5 October indicated a possible tropical storm circulation."

- Reanalysis: Satellite images showed that the large disturbance had become better organized and smaller in scale, with most of the convection concentrated near the center. Synoptic observations indicated that a closed low-level circulation had developed by 12Z on the 5th, same as originally shown in HURDAT. The first position is analyzed as a 30 kt tropical depression, same as originally in HURDAT. Time of genesis is uncertain and based on the sparse data available, the tropical cyclone may have formed earlier on the 5th. The tropical depression moved slowly northward between Africa and the Cape Verde Islands, and intensification to a tropical storm is analyzed at 18Z on the 5th based on a ship report of 35 kt over the eastern semicircle. Another ship reported 35 kt at 12Z on the 5th but nearby synoptic observations suggested it had a high bias.

October 6:

1. Maps and old HURDAT:

- HWM analyzes a tropical storm of at most 1012 mb at 19.8N, 18.7W at 12Z.
- HURDAT lists a 40 kt tropical storm at 19N, 18.5W at 12Z.
- Microfilm shows a closed low pressure of at most 1008 mb at 19N, 18.8W at 12Z.

2. Ship highlights:

- 35 kt S and 1012 mb at 14.7N, 18.2W at 00Z (COADS).
- 35 kt SE and 1008 mb at 18.5N, 17.5W at 06Z (COADS).
- 40 kt ESE and 1012 mb at 19.5N, 17.5W at 12Z (COADS).
- 40 kt ESE and 1011 mb at 17.4N, 17.5W at 18Z (COADS).

3. Discussion:

- ATSR: "…this was confirmed by satellite, land station and ship reports on 6 October. GINGER initially moved northward, but her movement was blocked by an anticyclone both on the surface and aloft centered near the Azores."
- Reanalysis: Ginger moved to the northwest and intensified. A couple of ships reported 40 kt winds at 12Z and 18Z on the 6th and a peak intensity of 45 kt is analyzed at 06Z to 18Z on the 6th, same as originally shown in HURDAT. Satellite images showed that most of the convection was located over the northern semicircle, an indication of southerly shear. A central pressure of 1002 mb was present in the original HURDAT at 18Z on the 6th and it has been removed since there is no ship or reconnaissance aircraft data near the center around this time to justify the central pressure.

October 7:

1. Maps and old HURDAT:

- HWM analyzes a closed low pressure of 1012 mb at 21N, 21W at 12Z.
- HURDAT lists a 30 kt tropical depression at 20.5N, 20.5W at 12Z.
- Microfilm shows a tropical storm of at most 1012 mb at 20N, 22W at 12Z.

2. Ship highlights:

- 30 kt NE and 1013 mb at 20.8N, 17.7W at 00Z (COADS).

3. Discussion:

- MWR: "The storm turned to a more westward track and rapidly weakened on the 7th. One ship near the center at 1200 GMT reported a pressure of only 1012 mb.

(29.88 in.) and 10-mph. winds. Satellite pictures on this same day verified the weakening trend."

- ATSR: "The storm then turned westward early on 7 October, weakened to a depression."
- Reanalysis: Ginger weakened to a tropical depression around 12Z on the 7th, six hours later than originally shown in HURDAT, as it moved into cooler sea-surface temperatures northwest of the Cape Verde Islands. MWR suggests that a ship near the center at 12Z on the 7th reported 10 kt and 1012 mb, suggesting a central pressure of 1011 mb, which has been added to HURDAT replacing the existing 1012 mb. Satellite images showed that the convection was weak and small in coverage.

October 8:

1. Maps and old HURDAT:

- HWM analyzes a closed low pressure of 1012 mb at 20.2N, 24W at 12Z.
- HURDAT lists a 30 kt tropical depression at 20N, 23.6W at 12Z.
- Microfilm shows a tropical cyclone of at most 1012 mb at 20N, 22.5W at 12Z.

2. Ship highlights:

- 30 kt NNE and 1012 mb at 20N, 23.7W at 06Z (COADS).
- 30 kt NE and 1014 mb at 21.2N, 23.1W at 12Z (COADS).

3. Discussion:

- MWR: "The remains of Ginger could still be detected on satellite pictures on the 8th."
- ATSR: "…dissipated on the 8th."
- Reanalysis: Satellite images indicated that the tropical depression had lost most of its convection and a remnant well-defined low-level circulation was still visible. Thus, weakening to a remnant low is analyzed at 00Z on the 8th. Synoptic observations after 18Z on the 8th showed that the surface circulation had dissipated, thus the last position is analyzed at this time, same as originally shown in HURDAT.

October 9:

1. Maps and old HURDAT:

- HWM analyzes a spot low pressure at 20N, 27.2W at 12Z.
- HURDAT does not list an organized system on this date.
- Microfilm shows a tropical wave or trough along 29W at 12Z.

2. Discussion:

- MWR: "However, 24 hr. later all evidence of circulation had disappeared."
- Reanalysis: Synoptic and satellite data suggests that the circulation dissipated and no regeneration occurred.

October 10:

1. Maps and old HURDAT:

- HWM analyzes a tropical wave or trough along 34W at 12Z.

Sources: NHC microfilm maps, the Historical Weather Maps series, the COADS ship database, Monthly Weather Review, Mariners Weather Log, Satellite images from NCDC, and NHC Storm Wallets.

Tropical Depression [October 7-10, 1967] – AL221967

```
55555 10/08/1967 M= 2 22 SNBR=   4 UNNAMED
55555 10/07/1967 M= 7 22 SNBR=   4 UNNAMED
         **         *

(October 7th is new to HURDAT)
55560 10/07*  0   0   0    0*264 794  25    0*273 786  25    0*280 778  25    0*

55565 10/08*  0   0   0    0*  0   0   0    0*250 752   0    0*256 742   0    0*
55565 10/08*285 770  25    0*290 760  25    0*295 750  25    0*299 741  25    0*
            *** ***  **      *** ***  **      *** ***  **      *** ***  **

55570 10/09*262 735   0    0*270 729   0    0*279 725   0    0*  0   0   0    0*
55570 10/09*304 736  25    0*310 733  25    0*317 733  25    0*330 730  25    0*
            *** ***  **      *** ***  **      *** ***  **      *** ***  **

(October 10th to 13th is new to HURDAT)
55575 10/10*350 725  25    0*370 720  25    0*390 710  25    0E410 690  25    0*
55575 10/11E435 675  25    0E465 665  25    0E490 640  30    0E515 620  30    0*
55575 10/12E535 590  30    0E545 550  35    0E555 510  35    0E560 480  35    0*
55575 10/13E565 450  35    0*  0   0   0    0*  0   0   0    0*  0   0   0    0*

55580 TD
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Significant Revisions:

1. The original HURDAT did not have intensities for the positions of this tropical cyclone.
2. First position is analyzed 30 hours earlier than originally shown in HURDAT.
3. Major southward position changes identified during the track of this tropical cyclone.
4. Four days are added to the end of the life cycle of this system, including a new extratropical phase.

Daily Metadata:

October 6:

1. Maps and old HURDAT:

- HWM analyze a trough extending from the western Atlantic to the western Caribbean Sea.
- Microfilm shows a trough over the western Bahamas.

2. Discussion:

- Reanalysis: Satellite images and synoptic observations showed a trough over the Bahamas and western Caribbean Sea.

October 7:

1. Maps and old HURDAT:

- Microfilm and HURDAT show a spot low at 27.7N, 78W at 12Z.

- MWL tracks of centers of cyclones estimates a center position at 25.8N, 78.8W at 12Z.

2. Discussion:

- Reanalysis: An area of low pressure became better organized over the western Bahamas and a 25 kt tropical depression is analyzed to have formed at 06Z on the 7th based on synoptic observations. The tropical depression moved to the northeast and satellite imagery showed that most of the convection was displaced to the north of the center.

October 8:

1. Maps and old HURDAT:

- HWM analyzes a closed low pressure of at most 1014 mb at 30N, 75W at 12Z.
- HURDAT lists a tropical depression at 25N, 75.2W at 12Z (first position).
- Microfilm shows a tropical cyclone of at most 1012 mb at 30N, 75W at 12Z.
- MWL tracks of centers of cyclones estimates a center position at 28.5N, 76W at 12Z.

2. Discussion:

- Reanalysis: The tropical depression continued on a northeast track and satellite imagery showed that most of the convection was away from the center, over the eastern and northern semicircles. Operationally, it was upgraded to the 18th tropical depression of the season at 12Z on the 7th. The positions in HURDAT appear to be about five degrees south of where the center of the tropical depression was located based on synoptic observations.

October 9:

1. Maps and old HURDAT:

- HWM analyzes a closed low pressure of at most 1012 mb at 32N, 75.5W at 12Z.
- HURDAT lists a tropical depression at 27.9N, 72.5W at 12Z (last position).
- Microfilm shows a tropical cyclone of at most 1010 mb at 32N, 72.7W at 12Z.
- MWL tracks of centers of cyclones estimates a center position at 30.4N, 75.6W at 12Z.

2. Discussion:

- Reanalysis: The weak tropical depression turned to the north as a front approached from the west. Satellite imagery showed some convection over the eastern semicircle.

October 10:

1. Maps and old HURDAT:

- HWM analyzes a strong front over the eastern United States at 12Z.
- Microfilm shows a tropical cyclone of at most 1010 mb at 38.5N, 71W at 12Z.

2. Discussion:

- Reanalysis: The circulation became diffused early on October 10th and it became difficult to track after 00Z on this date. The system is analyzed to have become extratropical after it merged with a frontal boundary around 18Z.

October 11-13:

1. Maps and old HURDAT:

- HWM analyzes a front over the western Atlantic at 12Z on the 11th.

2. Discussion:

- The extratropical low accelerated toward the northeast over the next couple of days. On the 12th, it intensified some and became an extratropical gale. After 00Z on the 13th, the system was absorbed into a larger extratropical low.

Sources: NHC microfilm maps, the Historical Weather Maps series, the COADS ship database, Monthly Weather Review, Mariners Weather Log and satellite images from NCDC.

Unnamed Tropical Storm [October 14-19, 1967] – AL231967

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12340 10/12/1967 M= 3 23 SNBR=   4 UNNAMED
12340 10/14/1967 M= 6 23 SNBR=   4 UNNAMED
         **         *

(October 12th and 13th were removed from HURDAT)
12345 10/12*  0   0   0    0*  0   0   0    0*210 710   0    0*215 712  0    0*
12350 10/13*220 721   0    0*223 729   0    0*230 738   0    0*239 731  0    0*

12355 10/14*249 728   0    0*260 725   0    0*270 725   0    0*  0   0   0    0*
12355 10/14*  0   0   0    0S270 715  40 1002S285 712  40    0S295 705  40    0*
              *   *         **** ***  ** ******** ***  **     **** ***  **

(October 15th through the 19th are new to HURDAT)
12360 10/15S303 697  40    0S293 705  40    0S286 713  40    0S287 717  45    0*
12365 10/16S288 718  45    0S291 719  45    0S294 721  45    0S298 725  40    0*
12370 10/17S306 730  35    0S320 735  35    0S335 736  35    0*350 730  40    0*
12375 10/18*365 720  50    0*385 705  50    0E418 680  45    0E455 655  40    0*
12380 10/19E470 645  40    0E480 640  35    0*  0   0   0    0*  0   0   0    0*
12385 TS
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Significant Revisions:

1. The first position is analyzed 54 hours later than originally shown in HURDAT based on synoptic observations.
2. Analyzed to have begun as a subtropical cyclone. It was originally initiated as a tropical cyclone in HURDAT.
3. Major position change analyzed at 12Z on October 14th based on synoptic data.
4. The track is extended for five days based on synoptic observations.

October 12:

1. Maps and old HURDAT:

- HWM analyzes a tropical wave over the central Caribbean Sea at 12Z.
- Microfilm shows a tropical wave over the eastern Bahamas at 12Z.

2. Discussion:

- Reanalysis: Convection increased north of the northeastern Caribbean Sea on October 10th as a tropical wave moved across the area. At this time, a frontal boundary was over the western Atlantic and moving eastward. By the 12th, the tropical wave was located north of Hispaniola, producing a disorganized area of convection. Synoptic observations indicated that it lacked a closed low-level circulation. Originally, it was upgraded to a tropical depression at 12Z on this date in HURDAT. No intensities were present in the original HURDAT in relation to this system.

October 13:

1. Maps and old HURDAT:

- HWM analyzes a spot low pressure at 23.5N, 73.5W with a stationary frontal boundary to the northwest at 12Z.
- Microfilm shows a tropical cyclone of at most 1012 mb at 23.8N, 73.8W with a frontal boundary to the north at 12Z.

2. Ship highlights:

- 40 kt N and 1012 mb at 28.2N, 72.7W at 18Z (COADS).

3. Discussion:

- Reanalysis: On this date, the tropical disturbance turned to the north over the eastern Bahamas and became better organized. Synoptic observations suggested that a broad low-level circulation had developed by late on the 13th, but it remained elongated northeast-southwest. A ship reported 40 kt late on the 13th but nearby ship data suggested that it likely had a high bias. Satellite images showed a large area of convection as the tropical disturbance interacted with a stationary frontal boundary.

October 14:

1. Maps and old HURDAT:

- HWM analyzes a closed low pressure of at most 1008 mb at 28N, 72W with a stationary frontal boundary just to the northwest at 12Z. The boundary also extends to the northeast as a stationary front.
- Microfilm shows a closed low pressure of at most 1006 mb at 29N, 72W at 12Z.
- MWL tracks of centers of cyclones estimates a center position at 27.8N, 71W at 12Z.

2. Ship highlights:

- 30 kt S and 1005 mb at 26.4N, 70.4W at 06Z (micro).
- 35 kt NNW and 1011 mb at 31.1N, 72.8W at 12Z (micro).
- 35 kt SW and 1010 mb at 28.5N, 67.6W at 15Z (COADS).
- 35 kt SW and 1012 mb at 28N, 67.8W at 18Z (COADS).

3. Aircraft highlights:

- Observation: 1005 mb at 28.5N, 72.7W at 1625Z (micro).

4. Discussion:

- Reanalysis: Early on the 14th, synoptic observations indicated that the low-level circulation was becoming better defined and at 06Z, it is analyzed that a closed low-level circulation had developed. Operationally, it was upgraded

to the 19th tropical depression of the season at 00Z on the 14th. Satellite images on the 14th showed two large areas of convection and the HWM 500 mb maps indicated that a mid-upper level trough was located near the cyclone. A ship at 06Z on the 14th reported 30 kt S and 1005 mb, suggesting a central pressure of 1002 mb. A central pressure of 1002 mb suggests maximum surface winds of 43 kt from the north of 25N Brown et al. pressure-wind relationship. Based on a forward speed of about 15 kt, subtropical characteristics and synoptic observations, an intensity of 40 kt is analyzed at 06Z on the 14th. Thus, the first position is analyzed at 06Z on the 14th as a 40 kt subtropical cyclone. In the original HURDAT, the last position was analyzed at 12Z on this date. The second area of convection, roughly extending from 30N-35N and 63W-68W, is associated with a separate system forming along the stationary frontal boundary.

October 15:

1. Maps and old HURDAT:

- HWM analyzes a weakening frontal boundary over the western Atlantic at 12Z. Farther northeast, an extratropical low was centered near 35N 60W.
- Microfilm shows a closed low pressure of at most 1014 mb at 28N, 71.5W with a frontal boundary just to the north at 12Z.

2. Ship highlights:

- 35 kt NE and 1017 mb at 31.1N, 71.4W at 12Z (COADS).
- 40 kt NE and 1017 mb at 30.5N, 73.9W at 18Z (COADS).

3. Discussion:

- Reanalysis: The subtropical cyclone had a complex evolution on October the 15th. Synoptic observations showed that on the 14th and early on the 15th, the cyclone moved northeastward. Later on the 15th, the system became quite elongated northeast-southwest and another low pressure appears to have formed about 350 n mi to the northeast near 35N 60W, associated with a large area of disorganized convection. MWL suggests that it was actually the subtropical cyclone that raced to the northeast, but such a scenario is implausible for a system to have moved at over 50 kt in a 6-hr period near 30N. On the other hand, MWR showed that the subtropical cyclone actually turned to the west, which is in agreement with this reanalysis. A couple of ships reported gale-force winds over the northern semicircle. Satellite images showed a small circulation with sheared convection over the northern semicircle.

October 16:

1. Maps and old HURDAT:

- HWM analyzes a closed low pressure of at most 1016 mb at 30.5N, 71.5WW with a weakening frontal boundary to the east at 12Z. The second system was an extratropical cyclone near 36N 43W.
- Microfilm shows a tropical cyclone of at most 1012 mb at 29N, 72W at 12Z.
- MWL tracks of centers of cyclones estimates a center position at 29.7N, 73.2W at 12Z.

2. Ship highlights:

- 35 kt NE and 1017 mb at 30.8N, 72.5W at 00Z (COADS).
- 40 kt NE and 1018 mb at 31.7N, 71.7W at 06Z (COADS).

- 35 kt ENE and 1017 mb at 31.8N, 72.1W at 12Z (COADS).
- 30 kt SE and 1023 mb at 33N, 68.1W at 18Z (COADS).

3. Discussion:

- Reanalysis: The subtropical storm moved slowly northwestward. Satellite images showed a small cyclone with most of the convection over the northern semicircle. A few ships reported gale-force winds, up to 40 kt.

October 17:

1. Maps and old HURDAT:

- HWM analyzes a closed low pressure of at most 1016 mb at 33N, 73.5W with a weakening frontal boundary to the southeast and another frontal boundary approaching from the west at 12Z.
- Microfilm shows a tropical disturbance of at most 1016 mb at 33.5N, 74W at 12Z.
- MWL tracks of centers of cyclones estimates a center position at 33N, 74W at 12Z.

2. Ship highlights:

- 30 kt ESE and 1019 mb at 33.3N, 71.3W at 00Z (COADS).
- 35 kt E and 1017 mb at 36.9N, 72.2W at 18Z (COADS).

3. Discussion:

- Reanalysis: The subtropical storm moved northward and increased in forward speed due to an approaching frontal boundary. Synoptic observations suggested that from late on the 16th to around midday on the 17th, the subtropical storm had weakened, thus the intensity is decreased to 35 kt at this time. The convection increased over the center and the circulation became better defined late on the 17th and the cyclone began to re-intensify, thus it is analyzed that it became a tropical storm at 18Z.

October 18:

1. Maps and old HURDAT:

- HWM analyzes an extratropical cyclone at 43N, 69.8W at 12Z.
- Microfilm shows an extratropical cyclone at 42.6N, 70W at 12Z.
- MWL tracks of centers of cyclones estimates a center position at 42N, 68.5W at 12Z.

2. Ship highlights:

- 45 kt S and 1011 mb at 36.1N, 70.7W at 00Z (COADS).
- 40 kt SSW and 1013 mb at 35.3N, 70.5W at 06Z (COADS).
- 40 kt SW and 1013 mb at 37.3N, 69.5W at 12Z (micro).
- 30 kt SW and 1004 mb at 43.8N, 64.7W at 18Z (COADS).

3. Discussion:

- Reanalysis: Early on the 18th, a ship about 65 n mi from the center, reported 45 kt S while the small tropical storm was moving at about 18 kt. A peak in intensity of 50 kt is analyzed at 00Z on the 18th. An approaching frontal boundary interacted with the tropical cyclone and transition into an extratropical cyclone is analyzed at 12Z on the 18th based on synoptic

observations. Late on the 18th, the extratropical cyclone moved over the Atlantic provinces of Canada. Satellite images showed a small system with most of the convection over the northern and eastern semicircles, ahead of a large extratropical cyclone.

October 19:

1. Maps and old HURDAT:

- HWM analyzes a large extratropical cyclone at 47.5N, 73W at 12Z.

2. Ship highlights:

- 40 kt SSW and 1015 mb at 41.8N, 62.6W at 00Z (COADS).
- 30 kt SSW and 1013 mb at 49.4N, 54.3W at 06Z (COADS).

3. Discussion:

- Reanalysis: The weakening extratropical cyclone became embedded within the frontal boundary over the north Atlantic associated with a strong extratropical cyclone over southeastern Canada. The last position is analyzed at 06Z on the 19th.

Sources: NHC microfilm maps, the Historical Weather Maps series, the COADS ship database, Monthly Weather Review, Atlantic Tropical Disturbances 1967 (MWR), Mariners Weather Log, and Satellite images from NCDC.

Tropical Depression [October 15-17, 1967] – AL241967

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55555 10/15/1967 M= 3 24 SNBR=   4 UNNAMED

55560 10/15*  0   0   0    0*  0   0   0    0*155 425   0    0*152 436   0    0*
55560 10/15*  0   0   0    0*  0   0   0    0*155 425  25    0*152 437  25    0*
                                                        **          ***  **

55565 10/16*149 450   0    0*147 463   0    0*146 475   0    0*141 482   0    0*
55565 10/16*149 450  25    0*146 463  25    0*143 475  30    0*141 485  30 1006*
                     **      ***      **      ***      **          ***  ** ****

55570 10/17*140 495   0    0*140 505   0    0*141 514   0    0*  0   0   0    0*
55570 10/17*140 495  30    0*140 505  25    0*141 514  25    0*  0   0   0    0*
                     **                **                **

55575 TD
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Significant Revisions:

1. The original HURDAT did not have intensities for the positions of this tropical cyclone.

Daily Metadata:

October 14:

1. Maps and old HURDAT:

- HWM and microfilm do not analyze any features of interest at 12Z.

2. Discussion:

- Reanalysis: Satellite imagery showed a large and disorganized disturbance in the central Atlantic.

October 15:

1. Maps and old HURDAT:

- HWM and microfilm do not analyze any features of interest at 12Z.
- HURDAT lists a tropical depression at 15.5N, 42.5W at 12Z (first position).

2. Discussion:

- Reanalysis: Synoptic observations were sparse over the central Atlantic but satellite imagery showed some organization association with the convection associated with the disturbance, thus a tropical depression is analyzed to have formed at 12Z on the 15th, same as originally shown in HURDAT.

October 16:

1. Maps and old HURDAT:

- HWM analyzes a tropical wave along 45W, extending from 12N-22N at 12Z.
- HURDAT lists a tropical depression at 14.6N, 47.5W at 12Z.
- Microfilm shows a tropical disturbance at 14.5N, 48.5W at 12Z.

2. Aircraft highlights:

- Dropsonde: 1007 mb and estimated surface winds of 10 kt at 18Z (micro).

3. Discussion:

- Reanalysis: Satellite imagery showed that the tropical depression was still poorly organized but a reconnaissance aircraft investigated the system late on the 16th finding a closed low-level circulation. A drop measured a pressure of 1007 mb and surface winds of 10 kt were visually estimated at 18Z, thus a central pressure of 1006 mb is added to HURDAT at 18Z on this date. A central pressure of 1006 mb suggests maximum surface winds of 35 kt from the south of 25N Brown et al. pressure-wind relationship. An intensity of 30 kt is analyzed at 18Z on the 16th due to its slow forward speed of about 10 kt. 30 kt is also the peak intensity of this tropical depression. Operationally, it was upgraded to the 21st tropical depression of the season at 18Z on the 16th.

October 17:

1. Maps and old HURDAT:

- HWM analyzes a tropical wave along 49W, extending from 8N-18N at 12Z.
- HURDAT lists a tropical depression at 14.1N, 51.4W at 12Z (last position).
- Microfilm shows a tropical disturbance of at most 1012 mb at 14.3N, 50W at 12Z.

2. Discussion:

- Reanalysis: The weak tropical depression continued westward and based on synoptic observations, it weakened into a trough after 12Z on the 17th. The last position is analyzed at 12Z on the 17th, same as originally shown in HURDAT. Satellite imagery showed a small area of convection near the center.

October 18:

1. Maps and old HURDAT:

- HWM does not analyze any features of interest at 12Z.
- Microfilm shows a tropical disturbance of at most 1008 mb at 15N, 52.5W at 12Z.

2. Discussion:

- Reanalysis: The remnants of the tropical depression continued westward showing no signs of regeneration. It is important to mention that based on the synoptic observations and satellite data available, this system may have not been a tropical depression, but it is retained because the data is not conclusive.

October 19:

1. Maps and old HURDAT:

- HWM analyzes a tropical wave along 51W, extending from 8N-18N at 12Z.
- Microfilm shows a closed low pressure of at most 1012 mb at 12.5N, 51W at 12Z.

October 20:

1. Maps and old HURDAT:

- HWM and microfilm do not analyze any features of interest at 12Z.

Sources: NHC microfilm maps, the Historical Weather Maps series, the COADS ship database, Monthly Weather Review, Mariners Weather Log and satellite images from NCDC.

Hurricane Heidi [October 19 – November 2, 1967] – AL251967

```
45315 10/19/1967 M=14 25 SNBR= 969 HEIDI       XING=0 SSS=0                    L
45315 10/19/1967 M=15 25 SNBR= 969 HEIDI       XING=0 SSS=0                    L
                    **

45320 10/19*  0   0   0    0*  0   0   0    0*205 540  25    0*207 555  25    0*
45320 10/19*  0   0   0    0*  0   0   0    0*205 540  25    0*207 555  30    0*
                                                                         **

45325 10/20*209 570  30    0*210 585  30    0*211 600  30    0*214 615  35 1008*
45325 10/20*209 570  35    0*210 585  40    0*211 600  45    0*214 615  50    0*
                     **               **               **               **    *

45330 10/21*219 629  40    0*224 641  40    0*232 652  40    0*245 661  40 1005*
45330 10/21*219 629  50    0*224 641  50    0*232 652  50    0*245 661  50 1005*
                     **               **               **               **

45335 10/22*258 668  45    0*269 670  50    0*281 665  55 1006*294 656  60    0*
45335 10/22*258 668  55    0*269 670  55    0*281 668  55 1006*294 656  55 1006*
                     **               **          ***                  ** ****

45340 10/23*308 643  65  995*321 627  65    0*328 609  75    0*330 585  75    0*
45340 10/23*307 640  65  995*319 620  65    0*327 600  65  994*329 580  70  992*
            *** ***          *** ***          *** ***  **  *** *** ***  **  ***
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45345 10/24*330 562  75    0*330 545  70    0*330 529  70  999*331 513  70    0*
45345 10/24*330 562  70    0*330 545  65    0*330 529  65  999*330 513  65  995*
                     **                **                **      ***      **  ***

45350 10/25*334 501  75    0*339 493  75    0*345 485  75  989*349 477  75    0*
45350 10/25*333 501  70    0*338 493  70    0*345 485  75  988*350 476  75  986*
            ***      **      ***      **                    *** *** ***      ***

45355 10/26*353 469  80    0*356 463  80    0*359 461  80    0*362 461  80  981*
45355 10/26*353 467  75    0*356 463  75    0*359 461  75  985*362 462  75  981*
                ***  **                **                **  ***     ***  **

45360 10/27*365 462  80    0*367 462  75    0*370 460  75  991*375 456  70    0*
45360 10/27*365 463  75    0*367 464  70    0*370 463  65  991*375 460  65    0*
                ***  **          ***  **          ***  **          ***  **

45365 10/28*380 451  70    0*384 446  70    0*387 441  70  994*390 439  70    0*
45365 10/28*380 453  65    0*384 446  65    0*388 442  65  994*391 440  65    0*
                ***  **                **      *** ***  **      *** ***  **

45370 10/29*392 439  65    0*393 439  65    0*393 441  60    0*391 446  55    0*
45370 10/29*393 440  65    0*394 441  65    0*395 444  60  999*392 448  60  998*
            *** ***          *** ***          *** ***      *** *** ***  **  ***


45375 10/30*388 451  50    0*387 456  55    0*389 461  60    0*395 465  60    0*
45375 10/30*389 452  60    0*387 456  60    0*389 461  60    0*393 467  60  996*
            *** ***  **                **                      *** ***      ***

45380 10/31*403 467  60    0*412 462  55    0*421 450  55    0*427 436  50    0*
45380 10/31*403 469  60    0*414 464  55    0*423 452  55    0*430 436  50 1005*
                ***          *** ***          *** ***          ***         ****

45385 11/01E430 420  45    0E430 403  40    0E430 385  40    0E430 368  40    0*
45385 11/01*435 420  50    0*438 403  50    0E435 390  45    0E431 380  40    0*
           ****      **     ****      **      *** ***  **      *** ***

   (November 2nd is new to HURDAT)
45390 11/02E425 370  40    0E415 360  40    0E395 353  40    0E370 350  40    0*

   45395 HR
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Significant Revisions:

1. Intensification to a tropical storm is analyzed to have occurred 18 hours earlier.
2. Major intensity increase analyzed at 12Z and 18Z on October 20th based on synoptic observations.
3. Transition to an extratropical cyclone analyzed 12 hours later based on synoptic data.
4. Major position changes are analyzed at 12Z and 18Z on November 1st based on synoptic observations.
5. Track extended an extra day as an extratropical cyclone based on synoptic observations.

6. Many central pressures were added from October 20th at 18Z and October 31th at 18Z based on synoptic observations and aircraft data.

Daily Metadata:

October 15:

1. Maps and old HURDAT:

- HWM and microfilm do not analyze any features of interest at 12Z.
- HURDAT does not list an organized system on this date.

2. Discussion:

- MWR: "Heidi appeared, in embryonic form, as a cloud mass revealed by satellite photographs in the tropical central Atlantic in mid-October."

October 16:

1. Maps and old HURDAT:

- HWM does not analyze any features of interest at 12Z.
- Microfilm shows a tropical wave extending from 11N-22N, 41W-49W at 12Z.

October 17:

1. Maps and old HURDAT:

- HWM analyzes a closed low pressure of at most 1012 mb at 18N, 43.5W at 12Z.
- Microfilm shows a broad low pressure of at most 1012 mb with centers at 17N, 44.5W and 14.3N, 50W at 12Z.

October 18:

1. Maps and old HURDAT:

- HWM analyzes a closed low pressure of at most 1012 mb at 19N, 47.5W at 12Z.
- Microfilm shows a broad disturbance with two centers, 19.5N, 48W and 10N, 52.5W of at most 1008 mb at 12Z.

2. Satellite highlights:

- ESSA V estimated a center fix at 19.5N, 49W (time unknown) (WALLET).

3. Discussion:

- Reanalysis: A broad disturbance over the central Atlantic moved northwestward and gradually became better organized. To the southwest of this disturbance, there was another system that operationally was upgraded to a tropical depression.

October 19:

1. Maps and old HURDAT:

- HWM analyzes a closed low pressure of at most 1012 mb at 21N, 54W at 12Z.
- HURDAT lists a 25 kt tropical depression at 20.5N, 54W at 12Z (first position).
- Microfilm shows a tropical disturbance at 20.5N, 54.5W at 12Z.

2. Satellite highlights:

- ESSA V estimated a center fix at 21N, 55W at 1551Z (WALLET).

3. Discussion:

- MWR: "From this area of convective activity a depression formed about 500 mi. northeast of the Lesser Antilles on October 19, and it is at this point that the official track of Heidi began."
- ATSR: "The existence of a tropical depression near 20.5N, 54W on 19 October was suspected from aircraft reconnaissance reports that same day along an easterly wave that had been moving slowly westward east of the Lesser Antilles."
- Reanalysis: Satellite images showed a large area of organized convection. Synoptic observations were sparse and the first position is analyzed at 12Z on the 19th as a 25 kt tropical depression, same as originally shown in HURDAT. It was investigated whether the remains of Tropical Depression AL241967 played any role in the genesis of Heidi. However, this is unlikely given that 48 hour elapsed after the dissipation of TD AL24 and the genesis of Heidi. Satellite imagery and the microfilm analyses show a separate tropical wave moving in from the east was associated with Heidi's formation.

October 20:

1. Maps and old HURDAT:

- HWM analyzes a closed low pressure of at most 1012 mb at 21.5N, 60W at 12Z.
- HURDAT lists a 30 kt tropical depression at 21.1N, 60W at 12Z.
- Microfilm shows a tropical disturbance of at most 1012 mb at 21.7N, 59.7W at 12Z.

2. Ship highlights:

- 35 kt NE and 1016 mb at 24.2N, 52.4W at 00Z (COADS).
- 50 kt and 1008 mb at 22.1N, 61.1W at 16Z (MWR/micro).

3. Satellite highlights:

- ESSA V estimated a center fix at 21N, 61.5W at 1642Z (WALLET).

4. Discussion:

- MWR: "The SS *Sunrana* passed through the depression on October 20 and found winds of 58 mph in squalls and lowest pressure of 1008 mb. (29.76 in.). Although the winds were of tropical storm intensity, the system did not appear to have a warm core, and its designation as a named storm was withheld pending receipt of additional data."
- ATSR: "From post analysis and ship reports, it was seen that HEIDI actually attained tropical storm intensity at 1800Z on the 20th about 300 miles northeast of Puerto Rico."
- Reanalysis: Intensification into a tropical storm is analyzed at 00Z on the 20th based on synoptic observations, including the ship that reported 50 kt at 18Z on this date. Satellite images showed an area of convection oriented north-south.

October 21:

1. Maps and old HURDAT:

- HWM analyzes a tropical storm of at most 1012 mb at 24N, 65.2W with a frontal boundary to the northwest at 12Z.

- HURDAT lists a 40 kt tropical storm at 23.2N, 65.2W at 12Z.
- Microfilm shows a tropical cyclone of at most 1012 mb at 23.7N, 65.3W with a frontal boundary to the northwest at 12Z.

2. Ship highlights:
- 40 kt SE and 1015 mb at 25.2N, 64.4W at 15Z (COADS).
- 40 kt E and 1007 mb at 24.8N, 65.8W at 18Z (COADS).

3. Satellite highlights:
- ESSA V estimated a center fix at 21N, 66.5W at 1732Z (WALLET).

4. Aircraft highlights:
- Penetration center fix measured a central pressure of 1005 mb and estimated surface winds of 30 kt (40 kt in microfilm at 1418Z) (MWR/micro).

5. Discussion:
- MWR: "A Navy investigative flight was dispatched on October 21, and maximum winds of only 35 mph and minimum pressure of 1005 mb (29.68 in) were measured. A weak wind circulation was found but no eye was visible on radar."
- Reanalysis: Heidi moved northwestward and the intensity remained generally steady on this date. A penetration center fix measured a central pressure of 1005 mb and estimated surface winds of 30 kt around 18Z on the 21st. A central pressure of 1005 mb suggests maximum surface winds of 34 kt from the south of 25N Brown et al. pressure-wind relationship. Based on a forward speed of about 15 kt and two 40 kt ships around 18Z, an intensity of 50 kt is analyzed at 18Z on the 21st.

October 22:

1. Maps and old HURDAT:
- HWM analyzes a hurricane of at most 1012 mb at 28.7N, 66.3W with a frontal boundary to the north at 12Z.
- HURDAT lists a 55 kt tropical storm at 28.1N, 66.5W at 12Z.
- Microfilm shows a tropical cyclone of at most 1012 mb at 28.5N, 66.5W with a frontal boundary to the north at 12Z.

2. Ship highlights:
- 40 kt E and 1012 mb at 26.4N, 66.3W at 00Z (COADS).
- 60 kt ESE and 1013 mb at 26.5N, 65.8W at 02Z (WALLET/MWR).
- 35 kt SSW and 1013 mb at 25.6N, 65.3W at 06Z (COADS).
- 35 kt S and 1006 mb at 29.8N, 63.9W at 21Z (COADS)

3. Aircraft highlights:
- Penetration center fix measured a central pressure of 1006 mb, estimated surface winds of 75 kt and an eye diameter of 45 n mi at 28.5N, 66.5W at 1417Z (WALLET).
- Penetration center fix measured a central pressure of 1006 mb, estimated surface winds of 55 kt and an eye diameter of 45 n mi at 29.2N, 65.9W at 1752Z (WALLET).

- Penetration center fix measured a central pressure of 995 mb, estimated surface winds of 65 kt and an eye diameter of 9 n mi at 30.3N, 64.3W at 22Z (WALLET).

4. Discussion:

- MWR: "The system was located on the edge of a strong baroclinic zone to the northeast, with very little surface pressure gradient on the west side. The SS Homeric, passing a short distance east of the center early on October 22, found winds of 70 mph in squalls, but on the west side no wind of over 25 mph was reported. The thermal character of the system remained in doubt until an Air Force reconnaissance flight later in the day found that the center had warmed 2°C through the middle levels. A short time later a Navy aircraft reported that rapid deepening had occurred, with the central pressure falling to 995 mb. (29.38 in.)."
- ATSR: "HEIDI was named and upgraded to a tropical storm on 22 October at 1200Z, with maximum winds of 60 knots."
- Reanalysis: Heidi turned to the north as a frontal boundary approached from the northwest. A penetration center fix measured a central pressure of 1006 mb and estimated surface winds of 75 kt at 1417Z on the 22nd. A central pressure of 1006 mb suggests maximum surface winds of 32 kt from the north of 25N pressure-wind relationship. Based on a forward speed of about 16 kt, high environmental pressure (1015 OCI), and putting some weight on the visual estimate of 75 kt, an intensity of 55 kt is analyzed at 12Z on the 22nd, same as originally shown in HURDAT. (We are interpreting that 60 kt report to not be representative of the circulation of the tropical storm and instead a transient occurrence (i.e., squall line, outflow boundary).) Satellite images showed a large area of convection associated with Heidi with some indication of southwesterly wind shear.

October 23:

1. Maps and old HURDAT:

- HWM analyzes a hurricane of at most 1004 mb at 33.5N, 59W with a frontal boundary to the northeast at 12Z.
- HURDAT lists a 75 kt hurricane at 32.8N, 60.9W at 12Z.
- Microfilm shows a hurricane of at most 1008 mb at 33.2N, 59.5W with a frontal boundary to the northeast and trough extending to the southwest at 12Z.

2. Ship highlights:

- 40 kt S and 1010 mb at 29.6N, 63.6W at 00Z (COADS).
- 35 kt NE and 1016 mb at 33.2N, 66.2W at 06Z (COADS).
- 40 kt NNE and 1023 mb at 37N, 65.1W at 12Z (COADS).
- 35 kt N and 1016 mb at 37.3N, 56.3W at 18Z (COADS).

3. Aircraft highlights:

- Penetration center fix measured a central pressure of 994 mb and estimated surface winds of 75 kt at 33.1N, 59.8W at 1150Z (WALLET).
- Penetration center fix measured a central pressure of 992 mb, estimated surface winds of 80 kt and an eye diameter of 15 n mi at 33N, 57.3W at 1842Z (WALLET).
- Penetration center fix measured a central pressure of 1002 mb and estimated surface winds of 70 kt at 33N, 56.6W at 2124Z (WALLET).

4. Discussion:

- MWR: "Heidi was upgraded to hurricane status in the midnight advisory issued by the Miami Weather Bureau. At this time Heidi was recurving into a trough in the westerlies, and the hurricane proceeded on an east-northeastward course about 20 mph for the next 2 days, while maintaining minimal hurricane intensity."
- ATSR: "HEIDI moved west-northwest, then curved northward toward Bermuda just as she had increased to hurricane intensity and a polar front was approaching from the west. HEIDI accelerated eastward on 23 October as the polar front overtook her about 200 miles east of Bermuda."
- Reanalysis: Heidi accelerated to the northeast and intensified. Late on the 22nd, a penetration center fix measured a central pressure of 995 mb, estimated surface winds of 65 kt and an eye diameter of 9 n mi at 22Z. A central pressure of 995 mb suggests maximum surface winds of 52 kt from the north of 25N pressure-wind relationship. An eye diameter of 9 n mi suggests an RMW of about 7 n mi and the climatological value is 24 n mi. Based on a forward speed of about 17 kt, high environmental pressures (1015 OCI) and small RMW, an intensity of 65 kt is analyzed at 00Z on the 23rd, same as originally shown in HURDAT. The next penetration center fix measured a central pressure of 994 mb at 1150Z on the 23rd and an intensity of 65 kt is analyzed at 12Z on this date, same as originally shown in HURDAT. Another penetration center fix measured a central pressure of 992 mb, estimated surface winds of 80 kt and an eye diameter of 15 n mi at 1842Z on the 23rd. A central pressure of 992 mb suggests maximum surface winds of 56 kt from the north of 25N pressure-wind relationship. An eye diameter of 15 n mi suggests an RMW of about 12 n mi and the climatological value is 28 n mi. Based on a forward speed of about 24 kt and small RMW, an intensity of 70 kt is analyzed at 18Z on the 23rd, down from 75 kt originally shown in HURDAT, a minor intensity change.

October 24:

1. Maps and old HURDAT:

- HWM analyzes a hurricane of at most 1004 mb at 33.5N, 53W with a frontal boundary to the northeast at 12Z.
- HURDAT lists a 70 kt hurricane at 33N, 52.9W at 12Z.
- Microfilm shows a hurricane of at most 1004 mb at 33N, 52.5W with a frontal boundary to the northeast and trough extending to the southwest at 12Z.

2. Ship highlights:

- 35 kt NNE and 1025 mb at 37.4N, 61.9W at 00Z (COADS).
- 55 kt NW and 995 mb at 32.5N, 53.1W at 13Z (COADS).
- 50 kt N and 1001 mb at 33.1N, 52.5W at 18Z (COADS).
- 45 kt NE and 1015 mb at 35.1N, 48W at 21Z (COADS).

3. Aircraft highlights:

- Penetration center fix measured a central pressure of 999 mb, estimated surface winds of 80 kt and an eye diameter of 15 n mi at 33.1N, 53.1W at 1145Z (WALLET).
- Penetration center fix measured a central pressure of 995 mb and estimated surface winds of 50 kt at 32.8N, 51.2W at 1750Z (WALLET).

4. Discussion:

- Reanalysis: Heidi turned to the east and had no appreciable changes in intensity. A penetration center fix measured a central pressure of 999 mb, estimated surface winds of 80 kt and an eye diameter of 15 n mi at 1145Z on the 24th. A central pressure of 999 mb suggests maximum surface winds of 45 kt from the north of 25N pressure-wind relationship. An eye diameter of 15 n mi suggests an RMW of about 12 n mi and the climatological value is 28 n mi. Based on a forward speed of about 16 kt, small RMW and some weighting of the visual estimate, an intensity of 65 kt is analyzed at 12Z on the 24th, down from 70 kt originally shown in HURDAT, a minor intensity change. Another penetration center fix measured a central pressure of 995 mb and estimated surface winds of 50 kt at 1750Z on the 24th. A central pressure of 995 mb suggests maximum surface winds of 52 kt from the north of 25N pressure-wind relationship. Based on a forward speed of about 16 kt, an intensity of 65 kt is analyzed at 18Z on the 24th, down from 70 kt originally shown in HURDAT, a minor intensity change. A couple of ships reports storm-force winds, up to 55 kt. Satellite images indicated that Heidi was under strong southerly shear with most of the convection over the northern semicircle.

October 25:

1. Maps and old HURDAT:

- HWM analyzes a hurricane of at most 1008 mb at 35N, 48W with a frontal boundary to the northeast at 12Z.
- HURDAT lists a 75 kt hurricane at 34.5N, 48.5W at 12Z.
- Microfilm shows a hurricane of at most 1008 mb at 34.5N, 48.5W with a frontal boundary to the northeast and trough extending to the southwest at 12Z.

2. Ship highlights:

- 40 kt NE and 1010 mb at 35.2N, 48.3W at 00Z (COADS).
- 40 kt NE and 1015 mb at 35.4N, 48.5W at 03Z (COADS).
- 40 kt NE and 1010 mb at 35.8N, 47.5W at 06Z (COADS).
- 40 kt NE and 1011 mb at 35.4N, 49.6W at 09Z (COADS).
- 50 kt NE and 1008 mb at 35.7N, 47.5W at 12Z (micro).
- 55 kt NE and 1002 mb at 36N, 47.3W at 18Z (micro).
- 65 kt NE and 998 mb at 36N, 47.8W at 21Z (WALLET).

3. Aircraft highlights:

- Penetration center fix measured a central pressure of 988 mb, estimated surface winds of 85 kt and an eye diameter of 20-30 n mi at 34.5N, 48.5W at 1140Z (WALLET).
- Penetration center fix measured a central pressure of 986 mb and estimated surface winds of 100 kt at 35.2N, 47W at 1945Z (WALLET).

4. Discussion:

- MWR: "On October 25 the westerlies weakened and retreated northward as a strong upper ridge built from Nova Scotia to Bermuda. The hurricane was thus embedded in an environment of light and variable winds at upper levels, while at the surface, high pressure, extending from the east around through the north and northwest, impeded appreciable northward movement. The hurricane's path thus became essentially blocked, and for the next 5 days, from October 25 to 30, Heidi wandered mainly northward about 5 mph… while maximum surface winds of 115 mph were found on the previous day [25]."

- ATSR: "On 25 October, HEIDI curved toward the northeast and decreased her forward speed."
- Reanalysis: Heidi moved eastward while losing forward speed. A penetration center fix measured a central pressure of 988 mb, estimated surface winds of 85 kt and an eye diameter of 20-30 n mi at 1140Z on the 25th. A central pressure of 988 mb suggests maximum surface winds of 62 kt from the north of 25N and 65 kt from the north of 35N Landsea et al. pressure-wind relationships. An eye diameter of 20-30 n mi suggests an RMW of about 15-23 n mi and the climatological value is 30 n mi. Based on a forward speed of about 9 kt and small RMW, an intensity of 75 kt is analyzed at 12Z on the 25th, same as originally shown in HURDAT. 75 kt is also the peak intensity of this tropical cyclone, down from 80 kt originally shown in HURDAT, a minor intensity change. The next penetration center fix measured a central pressure of 986 mb at 1945Z on the 25th and an intensity of 75 kt is analyzed at 18Z on this date, same as originally shown in HURDAT. A few ships reported gale and storm-force winds, and one registered 65 kt.

October 26:

1. Maps and old HURDAT:

- HWM analyzes a hurricane of at most 1004 mb at 36.5N, 46W with a frontal boundary to the east at 12Z.
- HURDAT lists an 80 kt hurricane at 35.9N, 46.1W at 12Z.
- Microfilm shows a tropical storm of at most 1008 mb at 36N, 45.5W with a trough extending to the southwest at 12Z.

2. Ship highlights:

- 50 kt (NE?) and 1008 mb at 36N, 47.8W at 00Z (WALLET).
- 40 kt E and 1010 mb at 38.3N, 43.4W at 06Z (COADS).
- 40 kt E and 1019 mb at 38.8N, 42.6W at 09Z (COADS).
- 50 kt NE and 1011 mb at 37.6N, 44.5W at 12Z (COADS).
- 45 kt ENE and 1014 mb at 39N, 45W at 18Z (COADS).
- 50 kt NE and 1008 mb at 37.8N, 47.8W at 21Z (COADS).

3. Aircraft highlights:

- Penetration center fix measured a central pressure of 985 mb and estimated surface winds of 80 kt at 35.8N, 45.9W at 1131Z (WALLET).
- Penetration center fix measured a central pressure of 981 mb, estimated surface winds of 70 kt and an eye diameter of 40 n mi at 36.5N, 46.6W at 19Z (WALLET).

4. Discussion:

- MWR: "Minimum pressure of 981 mb. (29.00 in.) was attained on October 26…"
- ATSR: "By 26 October, HEIDI stalled in the middle of the North Atlantic as the polar front and upper level trough moved east, leaving her in a cut-off circulation aloft. High pressure at the surface and aloft to the east near the Azores and to the northwest near Newfoundland blocked the movement of HEIDI for the next four days before she was able to make any appreciable progress."
- Reanalysis: Heidi was almost stationary on this date with no appreciable changes in intensity. A penetration center fix measured a central pressure of 985 mb at 1131Z on the 25th and an intensity of 75 kt is analyzed at 12Z on this date, down from 80 kt originally shown in HURDAT, a minor intensity

change. The next penetration center fix measured a central pressure of 981 mb, estimated surface winds of 70 kt and an eye diameter of 40 n mi at 19Z on the 26th. A central pressure of 981 mb suggests maximum surface winds of 72 kt from the north of 35N pressure-wind relationship. An eye diameter of 40 n mi suggests an RMW of about 30 n mi and the climatological value is 30 n mi. Due to high environmental pressures (1017 mb OCI) but almost stationary, an intensity of 75 kt is analyzed at 18Z on the 26th, down from 80 kt originally shown in HURDAT, a minor intensity change. Satellite images showed a small but well-organized tropical cyclone embedded within a large envelope.

October 27:

1. Maps and old HURDAT:

- HWM analyzes a hurricane of at most 1004 mb at 37.5N, 46W with a frontal boundary to the east and another one approaching from the west at 12Z.
- HURDAT lists a 75 kt hurricane at 37N, 46W at 12Z.
- Microfilm shows a hurricane of at most 1000 mb at 37N, 46.3W at 12Z.

2. Ship highlights:

- 70 kt N (high bias) and 1009 mb at 37.8N, 48.2W at 00Z (micro).
- 35 kt NE and 1012 mb at 38.6N, 47.4W at 03Z (COADS).
- 35 kt NNW and 1018 mb at 38N, 52.1W at 12Z (COADS).

3. Aircraft highlights:

- Penetration center fix measured a central pressure of 991 mb and estimated surface winds of 65 kt at 37N, 46.3W at 1140Z (WALLET).
- Radar center fix at 37.4N, 45.4W at 19Z (WALLET).

4. Discussion:

- Reanalysis: Heidi moved slowly to the north and weakened. A penetration center fix measured a central pressure of 999 mb and estimated surface winds of 65 kt at 1140Z on the 27th. A central pressure of 999 mb suggests maximum surface winds of 61 kt from the north of 35N pressure-wind relationship. Based on high environmental pressures (1017 mb OCI) but slow forward speed of about 3 kt, an intensity of 65 kt is analyzed at 12Z on the 27th, down from 75 kt originally shown in HURDAT, a minor intensity change. Satellite images showed that Heidi was still a small tropical cyclone with an eye or eye-like feature.

October 28:

1. Maps and old HURDAT:

- HWM analyzes a hurricane of at most 1000 mb at 40N, 44W with a frontal boundary to the northwest at 12Z.
- HURDAT lists a 70 kt hurricane at 38.7N, 44.1W at 12Z.
- Microfilm shows a hurricane of at most 1004 mb at 39N, 44W at 12Z.

2. Ship highlights:

- 40 kt SW and 1013 mb at 36.7N, 42.2W at 00Z (COADS).
- 35 kt SE and 1018 mb at 38.9N, 38.7W at 12Z (COADS).
- 40 kt SW and 1011 mb at 37.7N, 43.2W at 15Z (micro).
- 35 kt SE and 1012 mb at 40.8N, 40.8W at 18Z (COADS).

3. Aircraft highlights:

- Penetration center fix measured a central pressure of 994 mb at 39N, 44W at 1343Z (WALLET).

4. Discussion:

- Reanalysis: Heidi moved slowly to the northeast with no appreciable changes in intensity. A penetration center fix measured a central pressure of 994 mb at 1343Z on the 28th. A central pressure of 994 mb suggests maximum surface winds of 58 kt from the north of 35N pressure-wind relationship. Due to high environmental pressures (1019 mb OCI) and slow forward speed of about 4 kt, an intensity of 65 kt is analyzed at 12Z on the 28th, down from 70 kt originally shown in HURDAT, a minor intensity change. Satellite images showed a small tropical cyclone with organized convection near or over the center.

October 29:

1. Maps and old HURDAT:

- HWM analyzes a tropical storm of at most 1008 mb at 40.2N, 44.2W with a frontal boundary to the northwest at 12Z.
- HURDAT lists a 60 kt tropical storm at 39.3N, 44.1W at 12Z.
- Microfilm shows a tropical storm of at most 1008 mb at 39.6N, 44.2W at 12Z.

2. Ship highlights:

- 45 kt NE and 1039 mb at 39.7N, 40.3W at 06Z (COADS).
- 10 kt S and 1003 mb at 38.3N, 44.6W at 18Z (COADS).

3. Aircraft highlights:

- Penetration center fix measured a central pressure of 999 mb and estimated surface winds of 65 kt at 39.6N, 44.3W at 1115Z (WALLET).
- Penetration center fix measured a central pressure of 998 mb, estimated surface winds of 48 kt and an eye diameter of 70 n mi at 39N, 45.1W at 1807Z (WALLET).

4. Discussion:

- MWR: "This slow northward movement permitted progressively cooler air and water to weaken Heidi to tropical storm intensity on October 29."
- Reanalysis: Heidi turned to the northwest and moved slowly. A penetration center fix measured a central pressure of 999 mb and estimated surface winds of 65 kt at 1115Z on the 29th. A central pressure of 999 mb suggests maximum surface winds of 50 kt from the north of 35N pressure-wind relationship. Due to high environmental pressures (1021 mb OCI) but a slow forward speed of about 4 kt, an intensity of 60 kt is analyzed at 12Z on the 29th, same as originally shown in HURDAT. Weakening to a tropical storm is analyzed at 12Z on the 29th, same as originally shown in HURDAT.

October 30:

1. Maps and old HURDAT:

- HWM analyzes a tropical storm of at most 1008 mb at 39.5N, 46.5W with a frontal boundary to the west at 12Z.
- HURDAT lists a 60 kt tropical storm at 38.9N, 46.1W at 12Z.
- Microfilm shows a tropical storm of at most 1004 mb at 39.8N, 46W at 12Z.

2. Ship highlights:

- 60 kt NE and 1007 mb at 39.2N, 46W at 00Z (COADS).
- 40 kt W and 1012 mb at 36.8N, 47.1W at 06Z (COADS).
- 15 kt NW and 1005 mb at 39.3N, 48.8W at 18Z (COADS).

3. Aircraft highlights:

- Penetration center fix measured a central pressure of 996 mb and estimated surface winds of 70 kt at 39.5N, 46.8W at 2010Z (WALLET).

4. Discussion:

- MWR: "By the 30th the storm had lost its tropical characteristics and turned eastward as a low pressure area."
- Reanalysis: Heidi continued northwestward with no appreciable changes in intensity. The tropical storm was investigated by a reconnaissance aircraft at 2010Z on the 30th measuring a central pressure of 996 mb and estimated surface winds of 70 kt. A central pressure of 996 mb suggests maximum surface winds of 55 kt from the north of 35N pressure-wind relationship. Based on a forward speed of about 8 kt, an intensity of 60 kt is analyzed at 18Z on the 30th, same as originally shown in HURDAT. Satellite images showed a tropical cyclone with a small area of convection over the eastern semicircle.

October 31:

1. Maps and old HURDAT:

- HWM analyzes a tropical storm of at most 1008 mb at 43N, 45W with a frontal boundary to the north at 12Z.
- HURDAT lists a 55 kt tropical storm at 42.1N, 45W at 12Z.
- Microfilm shows a tropical storm of at most 1008 mb at 42N, 45.9W at 12Z.

2. Ship highlights:

- 35 kt SW and 1010 mb at 40.6N, 45.7W at 06Z (COADS).
- 10 kt ENE (80 kt in micro) and 1014 mb at 43N, 47.4W at 12Z (COADS).
- 35 kt S and 1011 mb at 41.5N, 44.3W at 12Z (COADS).
- 35 kt S and 1011 mb at 42.3N, 43.2W at 18Z (COADS).

3. Aircraft highlights:

- Penetration center fix measured a central pressure of 1005 mb and estimated surface winds of 45 kt at 42.5N, 45W at 1540Z (WALLET).

4. Discussion:

- ATSR: "HEIDI began to lose her tropical characteristics on the 31st…"
- Reanalysis: An approaching cold front caused Heidi to turn to the northeast and accelerate while weakening. A penetration center fix measured a central pressure of 1005 mb and estimated surface winds of 45 kt at 1540Z on the 31st. A central pressure of 1005 mb suggests maximum surface winds of 40 kt from the north of the 35N pressure-wind relationship. Based on a forward speed of about 13 kt, an intensity of 50 kt is analyzed at 18Z on the 31st. Satellite images showed a sheared tropical cyclone with most of the convection over the eastern semicircle. A few ships reported gale-force winds on this date.

November 1:

1. Maps and old HURDAT:

- HWM analyzes a closed low pressure of at most 1016 mb at 44N, 37W with a frontal boundary going through the center at 12Z.
- HURDAT lists a 40 kt extratropical storm at 43N, 38.5W at 12Z.
- Microfilm shows a closed low pressure of at most 1016 mb at 43.5N, 37.5W with a frontal boundary going through the center at 12Z.

2. Ship highlights:

- 50 kt NE and 1009 mb at 44N, 40.6W at 03Z (COADS).
- 40 kt NNE and 1012 mb at 44.1N, 40.5W at 06Z (COADS).
- 45 kt NNE and 1017 mb at 44.2N, 40.4W at 09Z (COADS).
- 45 kt N and 1019 mb at 47.9N, 41.7W at 12Z (COADS).
- 35 kt ENE and 1017 mb at 44.5N, 35.8W at 15Z (COADS).
- 40 kt ENE and 1020 mb at 44.7N, 36.7W at 18Z (COADS).

3. Discussion:

- MWR: "Finally, on November 1, ship and satellite data indicated that the remnants of Heidi had become absorbed into the broad-scale features of the North Atlantic."
- ATSR: "…and by 1 November, had become extratropical over the cold waters of the North Atlantic, northwest of the Azores."
- Reanalysis: Heidi turned to the east and continued to weaken. Transition to an extratropical cyclone is analyzed at 12Z on the 1st based on synoptic observations twelve hours later than shown in HURDAT. Many ships reported gale-force winds on this date and one ship registered 50 kt.

November 2:

1. Maps and old HURDAT:

- HWM analyzes a closed low pressure of at most 1016 mb at 39.5N, 35W with a frontal boundary going through the center at 12Z.
- Microfilm shows a frontal boundary over the northeast Atlantic at 12Z.

2. Ship highlights:

- 40 kt ENE and 1023 mb at 44.9N, 34.8W at 00Z (COADS).
- 40 kt N and 1017 mb at 39.8N, 40.1W at 18Z (COADS).

3. Discussion:

- Reanalysis: The last position in the original HURDAT is on November 1st at 18Z but synoptic observations suggested that Heidi retained a closed low-level circulation on the 2nd. The intensity is assessed at 40 kt on this date based on synoptic data. Ship observations early on the 3rd suggested that Heidi did not have a closed circulation anymore, thus the last position is analyzed at 18Z on the 2nd, 24 hours later than originally shown in HURDAT.

November 3:

1. Maps and old HURDAT:

- HWM analyzes a closed low pressure of at most 1012 mb at 41.5N, 22W with a frontal boundary going through the center at 12Z.
- Microfilm shows an extratropical cyclone at 40.6N, 23.3W at 12Z.

November 4:

1. Maps and old HURDAT:

- HWM analyzes an extratropical cyclone over the central Atlantic and a frontal boundary extending to Europe, the remnants of Heidi appear to have been absorbed, at 12Z.
- Microfilm shows a frontal boundary over the northeast Atlantic at 12Z.

Date	Original HURDAT Central Pressure	Evidence	Changes
Oct 20 18Z	1008 mb	No penetration center fixes or ship reports near the center around this time	Removed
Oct 21 18Z	1005 mb	Penetration center fix: 1005 mb around 18Z	Retained
Oct 22 12Z	1006 mb	Penetration center fix: 1006 mb at 1417Z	
Oct 22 18Z		Penetration center fix: 1006 mb at 1752Z	1006 mb
Oct 23 00Z	995 mb	Penetration center fix: 995 mb 22Z on Oct 22nd	Retained
Oct 23 12Z		Penetration center fix: 994 mb at 1150Z	994 mb
Oct 23 18Z		Penetration center fix: 992 mb at 1842Z	992 mb
Oct 24 12Z	999 mb	Penetration center fix: 999 mb at 1145Z	Retained
Oct 24 18Z		Penetration center fix: 995 mb at 1750Z	995 mb
Oct 25 12Z	989 mb	Penetration center fix: 988 mb at 1140Z	988 mb
Oct 25 18Z		Penetration center fix: 986 mb at 1945Z	986 mb
Oct 26 12Z		Penetration center fix: 985 mb at 1131Z	985 mb
Oct 26 18Z	981 mb	Penetration center fix: 981 mb at 19Z	Retained
Oct 27 12Z	991 mb	Penetration center fix: 991 mb at 1140Z	
Oct 28 12Z	994 mb	Penetration center fix: 994 mb at 1343Z	
Oct 29 12Z		Penetration center fix: 999 mb at 1115Z	999 mb
Oct 29 18Z		Penetration center fix: 998 mb at 1807Z	998 mb
Oct 30 18Z		Penetration center fix: 996 mb at 2010Z	996 mb
Oct 31 18Z		Penetration center fix: 1005 mb at 1540Z	1005 mb

Sources: NHC microfilm maps, the Historical Weather Maps series, the COADS ship database, Monthly Weather Review, Mariners Weather Log, Satellite images from NCDC, and NHC Storm Wallets.

Tropical Depression, October 26-29, AL261967:
Historical Weather Maps, microfilm and satellite showed a disturbance over the Bahamas and eastern Cuba on October 25th, possibly associated with a tropical wave. The system was listed in HURDAT as Tropical Depression #26 with the first position at 12Z on the 26th as the system moved northeastward ahead of an

approaching frontal boundary. Synoptic observations indicated that the disturbance did not have a well-defined closed circulation. The system weakened over the next few days and was absorbed by the frontal boundary early on the 30th. The last position in HURDAT was analyzed at 12Z on the 29th. No gales were observed in relation to this disturbance. Because the disturbance did not have a closed circulation, it is not a tropical cyclone and is removed from HURDAT. This disturbance was in Jack Beven's Lists of Suspects.

Unnamed Tropical Storm [June 20-23, 1967] – AL271967

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12345 06/20/1967 M= 4 27 SNBR=   4 UNNAMED

12350 06/20*300 780  25    0*300 775  25    0*300 770  25    0*300 764  30    0*
12355 06/21*300 757  30    0*301 749  35    0*303 741  40 1006*306 732  45    0*
12360 06/22*309 724  45    0*313 719  40    0*318 715  35    0*324 712  30 1013*
12365 06/23*332 708  25    0*342 703  25    0*355 695  25    0*  0   0   0    0*
12370 TS
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Significant Revisions:

1. A new tropical storm has been added to HURDAT, not previously shown in McAdie et al. (2009).

June 19:

1. Maps and old HURDAT:
- HWM and microfilm do not show any features of interest over the western Atlantic at 12Z.

2. Discussion:
- Reanalysis: Disorganized convection increased over the eastern Gulf of Mexico and western Atlantic around mid-June due to a trough of low pressure. Synoptic observations indicate that gradually a low pressure developed east of northeast Florida.

June 20:

1. Maps and old HURDAT:
- HWM do not show any features of interest over the western Atlantic at 12Z.
- Microfilm analyzes a spot low at 29.5N, 76W at 12Z.

2. Discussion:
- Reanalysis: The low-level circulation became better organized on June 20th and synoptic observations at 00Z on this date indicated that a well-defined center had formed, thus genesis is analyzed at this time as a 25 kt tropical depression. The system moved slowly southeastward and satellite images showed that it was being affected by strong westerly shear.

June 21:

1. Maps and old HURDAT:
- HWM shows a weakening frontal boundary over the western Atlantic at 12Z.
- Microfilm analyzes a tropical disturbance at 28.5N, 73.5W with a weakening frontal boundary to the north at 12Z.
- MWL tracks of centers of cyclones estimates a center position at 28.7N, 74.3W at 12Z.

2. Ship highlights:

- 25 kt NE and 1009 mb at 30.1N, 74.1W at 12Z (COADS).

3. Discussion:

- Reanalysis: The tropical depression turned to the east as it slowly intensified. Intensification into a tropical storm is analyzed at 06Z on the 21st based on synoptic observations early on the 22nd and also satellite images. Satellite images on the 21st showed a small tropical cyclone with convection near the center.

June 22:

1. Maps and old HURDAT:

- HWM shows a closed low pressure of at most 1016 mb at 32.5N, 71.5W with a weakening frontal boundary to the northeast at 12Z.
- Microfilm analyzes a closed low pressure of at most 1016 mb at 32.5N, 71.5W at 12Z.
- MWL tracks of centers of cyclones estimates a center position at 32N, 71.2W at 12Z.

2. Ship highlights:

- 40 kt SE and 1011 mb at 31N, 70.8W at 00Z (COADS).
- 55 kt SSE (likely high bias) and 1020 mb at 31.6N, 69.7W at 00Z (COADS).
- 30 kt S and 1013 mb at 32N, 70.6W at 12Z (COADS/micro).

3. Penetration center fix:

- Penetration center fix measured a central pressure of 1013 mb and estimated surface winds of 25 kt at 32.4N, 71.2W at 1830Z (WALLET).

4. Discussion:

- Reanalysis: A ship reported 40 kt at 00Z on the 22nd and another reported 55 kt, which likely has a high bias. A satellite image early on the 22nd showed a small but well-organized tropical cyclone with a CDO over the center. Based on the synoptic data, a peak intensity of 45 kt is analyzed at 18Z on the 21st and 00Z on the 22nd. Satellite images later on the 22nd showed that the small tropical storm had lost most of the convection. A penetration center fix measured a central pressure of 1013 mb and estimated surface winds of 25 kt at 1830Z on the 22nd. Weakening to a tropical depression is analyzed at 18Z on the 22nd.

June 23:

1. Maps and old HURDAT:

- HWM shows a spot low of at most 1016 mb at 35.8N, 70W with a frontal boundary to the northwest at 12Z.
- Microfilm analyzes a spot low at 35.5N, 70W with a frontal boundary to the northwest at 12Z.
- MWL tracks of centers of cyclones estimates a center position at 34.8N, 70W at 12Z.

2. Discussion:

- Reanalysis: The small tropical depression continued to weaken on the 23rd and dissipation is analyzed after 12Z based on synoptic observations.

June 24:

1. Maps and old HURDAT:
- HWM does not show any features of interest over the northwest Atlantic, the system appears to have dissipated.

Sources: NHC microfilm maps, the Historical Weather Maps series, the COADS ship database, Monthly Weather Review, Mariners Weather Log, Satellite images from NCDC, and NHC Storm Wallets.

Unnamed Tropical Storm [September 1-5, 1967] – Al281967

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55555 09/01/1967 M= 5 28 SNBR=   4 UNNAMED
55560 09/01*  0   0   0    0*  0   0   0    0*145 250  25    0*146 255  25    0*
55565 09/02*147 260  25    0*149 265  25    0*152 270  30    0*156 276  30    0*
55570 09/03*159 282  30    0*162 287  30    0*166 293  35    0*170 298  35 1004*
55575 09/04*173 303  35    0*175 309  35    0*176 315  30    0*176 322  30    0*
55580 09/05*176 330  30    0*176 340  30    0*176 352  25    0*176 365  25    0*
55585 TS
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Significant Revisions:

1. New tropical storm, not previously in HURDAT. However, it was considered a tropical depression operationally.

Daily Metadata:

August 28:

1. Maps and old HURDAT:
- HWM and microfilm do not show any features of interest at 12Z.

2. Discussion:
- Reanalysis: A tropical wave entered the eastern Atlantic late on August 28th.

August 29:

1. Maps and old HURDAT:
- HWM does not analyze any features of interest at 12Z.
- Microfilm shows a tropical disturbance at 13N, 24W at 12Z.

2. Discussion:
- Reanalysis: The tropical disturbance moved slowly westward and remained disorganized.

August 30:

1. Maps and old HURDAT:
- HWM analyzes a spot low at 15N, 21W at 12Z.
- Microfilm shows a spot low at 10N, 23W at 12Z.

2. Discussion:

- Reanalysis: Satellite imagery showed a large area of convection over the eastern Atlantic but synoptic observations indicated that the circulation was still disorganized.

August 31:

1. Maps and old HURDAT:
- HWM analyzes a closed low pressure of at most 1012 mb at 16N, 20W at 12Z.
- Microfilm shows a spot low of at most 1008 mb at 12N, 24W at 12Z.

2. Discussion:
- Reanalysis: The tropical disturbance remained disorganized as shown in the satellite imagery and synoptic observations.

September 1:

1. Maps and old HURDAT:
- HWM analyzes a closed low pressure of at most 1012 mb at 16N, 21W at 12Z.
- Microfilm shows a tropical cyclone of at most 1012 mb at 14N, 29W at 12Z.

2. Discussion:
- Reanalysis: Satellite imagery showed that the tropical disturbance had become much better organized. Synoptic observations were sparse but the first position is analyzed at 12Z on the 1st as a 25 kt tropical depression. Operationally, it was also upgraded to a tropical depression at this time.

September 2:

1. Maps and old HURDAT:
- HWM analyzes a closed low pressure of at most 1012 mb at 14.7N, 26.5W at 12Z.
- Microfilm shows a tropical cyclone of at most 1012 mb at 15N, 27W at 12Z.

2. Discussion:
- Reanalysis: The tropical depression moved slowly westward and gained strength. Satellite images suggested a small but well-defined circulation, with convection near the center, though the system was still connected to the ITCZ.

September 3:

1. Maps and old HURDAT:
- HWM analyzes a closed low pressure of at most 1012 mb at 17.5N, 29W at 12Z.
- Microfilm shows a tropical cyclone of at most 1012 mb at 16.7N, 29.5W at 12Z.

2. Ship highlights:
- 30 kt NE and 1013 mb at 18.7N, 28.1W at 18Z (COADS).
- 20 kt SSW and 1006 mb at 16.4N, 29.6W at 18Z (COADS).

3. Discussion:
- Reanalysis: Satellite images showed a small but organized tropical cyclone with convection over or near the center. Intensification to a tropical storm is analyzed at 12Z on the 3rd, but this is uncertain due to the sparse data

available. A ship reported 20 kt SSW and 1006 mb, suggesting a central pressure of 1004 mb, which has been added to HURDAT. A central pressure of 1004 mb suggests maximum surface winds of 39 kt from the south of 25N Brown et al. pressure-wind relationship. Due to the slow forward speed of the tropical cyclone, an intensity of 35 kt is analyzed at 18Z on the 3rd. Another ship reported 30 kt NE, which is also consistent with a 35-kt intensity.

September 4:

1. Maps and old HURDAT:

- HWM analyzes a closed low pressure of at most 1012 mb at 15.5N, 30.7W at 12Z.
- Microfilm shows a tropical cyclone of at most 1012 mb at 16.4N, 31.4W at 12Z.

2. Discussion:

- Reanalysis: Weakening to a tropical depression is analyzed at 12Z on the 4th. Satellite images showed a small circulation with some convection over and to the north of the center.

September 5:

1. Maps and old HURDAT:

- HWM analyzes a tropical wave along 40W, extending from 10N-25N at 12Z.
- Microfilm shows a tropical cyclone at 14.5N, 33.5W at 12Z.

2. Discussion:

- Reanalysis: Over the central Atlantic, the tropical depression continued to weaken and is analyzed to have dissipated after 18Z on the 5th. Satellite imagery showed a weak circulation devoid of convection.

September 6:

1. Maps and old HURDAT:

- HWM does not analyze any features of interest at 12Z.
- Microfilm shows a tropical disturbance near 14N, 39W at 12Z.

2. Discussion:

- Reanalysis: Satellite images indicated that the remnants of the tropical cyclone had either dissipated or become embedded within the large circulation of Chloe to the east.

Sources: NHC microfilm maps, the Historical Weather Maps series, the COADS ship database, Monthly Weather Review, Mariners Weather Log and satellite images from NCDC.

1967 Additional Notes

1. June 10-13: Historical Weather Maps, microfilm and satellite images analyzed a trough between the Greater Antilles and Bermuda on June 9th. Synoptic observations suggested that a weak low pressure developed on the 10th but was

poorly organized and convection was displaced to the east and south of the center. In HURDAT, the system was listed as Tropical Depression #2 and the first position was analyzed at 12Z on the 10th (see below). The disturbance moved to the northwest and remained disorganized. Over the next few days, the convection was very sparse and the low-level circulation remained poorly defined. The last position in HURDAT was analyzed at 12Z on the 13th as a tropical depression. By the 14th, the system had been absorbed by a frontal boundary. No gales were observed in relation to this disturbance. Because the system did not have a well-defined circulation and the convective activity was poorly organized, it is not a tropical cyclone and is thus removed from HURDAT. This disturbance was in Jack Beven's Lists of Suspects.

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AL021967,            UNNAMED,     13,
19670610, 1200,  , TD, 28.0N,  63.0W, -99,
19670610, 1800,  , TD, 28.5N,  63.0W, -99,
19670611, 0000,  , TD, 29.2N,  63.2W, -99,
19670611, 0600,  , TD, 29.9N,  63.3W, -99,
19670611, 1200,  , TD, 31.1N,  63.8W, -99,
19670611, 1800,  , TD, 32.3N,  64.5W, -99,
19670612, 0000,  , TD, 33.1N,  65.2W, -99,
19670612, 0600,  , TD, 34.0N,  65.9W, -99,
19670612, 1200,  , TD, 34.1N,  65.8W, -99,
19670612, 1800,  , TD, 34.2N,  65.7W, -99,
19670613, 0000,  , TD, 34.5N,  65.3W, -99,
19670613, 0600,  , TD, 34.8N,  65.0W, -99,
19670613, 1200,  , TD, 35.1N,  64.8W, -99,
```

2. June 18-20: Historical Weather Maps, microfilm and satellite images indicated that a disturbance developed at the tail-end of a weakening cold front on June 17th while north of the Leeward Islands. A weak low pressure developed on the 18th and moved northward. Synoptic observations suggested that it was not well-defined at the surface. In HURDAT, the system was listed as Tropical Depression #4 and the first position was analyzed at 12Z on the 18th. The system remained poorly organized over the next couple of days and weakened as a frontal system approached from the west. The last position in HURDAT was analyzed at 12Z on the 20th as a tropical depression. Microfilm suggests that the weak low pressure system dissipated on the 21st. No gales were observed in relation to this disturbance. Because the disturbance did not have a well-defined center and the convective activity was poorly organized, it is not a tropical cyclone and is removed from HURDAT. This disturbance was in Jack Beven's Lists of Suspects.

```
AL041967,            UNNAMED,      9,
19670618, 1200,  , TD, 23.0N,  59.0W, -99,
19670618, 1800,  , TD, 23.8N,  59.9W, -99,
19670619, 0000,  , TD, 25.0N,  60.0W, -99,
19670619, 0600,  , TD, 26.0N,  60.0W, -99,
19670619, 1200,  , TD, 27.0N,  60.0W, -99,
19670619, 1800,  , TD, 28.5N,  60.7W, -99,
19670620, 0000,  , TD, 30.0N,  61.0W, -99,
19670620, 0600,  , TD, 31.5N,  61.2W, -99,
19670620, 1200,  , TD, 33.0N,  62.1W, -99,
```

3. July 5-9: Historical Weather Maps, microfilm and satellite images showed a tropical wave exiting the coast of Africa on July 6th. The system was listed in HURDAT as Tropical Depression #5 and the first position was analyzed at 12Z on the 5th over western Africa. Synoptic observations suggested that the tropical wave moved westward without showing signs of organization. By the 10th, the convection associated with the disturbance had dissipated. No gales were observed in relation to this disturbance. Because the disturbance did not have a well-defined center, it is not a tropical cyclone and is removed from HURDAT. This disturbance was in Jack Beven's Lists of Suspects.

```
AL051967,            UNNAMED,     17,
19670705, 1200,  , TD, 11.0N,  15.1W, -99,
19670705, 1800,  , TD, 11.1N,  16.1W, -99,
19670706, 0000,  , TD, 11.2N,  17.1W, -99,
19670706, 0600,  , TD, 11.4N,  18.1W, -99,
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19670706, 1200,  , TD, 11.6N,  19.5W, -99,
19670706, 1800,  , TD, 11.8N,  20.7W, -99,
19670707, 0000,  , TD, 12.0N,  22.0W, -99,
19670707, 0600,  , TD, 12.0N,  23.3W, -99,
19670707, 1200,  , TD, 12.0N,  24.5W, -99,
19670707, 1800,  , TD, 12.0N,  25.5W, -99,
19670708, 0000,  , TD, 12.0N,  26.9W, -99,
19670708, 0600,  , TD, 12.0N,  28.1W, -99,
19670708, 1200,  , TD, 12.0N,  29.3W, -99,
19670708, 1800,  , TD, 12.0N,  30.1W, -99,
19670709, 0000,  , TD, 12.0N,  31.2W, -99,
19670709, 0600,  , TD, 12.0N,  32.8W, -99,
19670709, 1200,  , TD, 12.0N,  33.9W, -99,
```

4. July 21-22: Historical Weather Maps, microfilm and satellite images indicated that a tropical wave left the west coast of Africa on July 20th. The system was listed in HURDAT as Tropical Depression #6 with the first position listed at 12Z on the 21st. The tropical wave moved westward and showed no signs of organization based on synoptic observations and satellite images. No gales were observed in relation to this disturbance. Because the disturbance did not have a well-defined center, it is not a tropical cyclone and is removed from HURDAT. This disturbance was in Jack Beven's and David Roth's Lists of Suspects.

```
AL061967,            UNNAMED,      5,
19670721, 1200,  , TD, 14.9N,  17.0W, -99,
19670721, 1800,  , TD, 14.3N,  18.9W, -99,
19670722, 0000,  , TD, 14.1N,  20.5W, -99,
19670722, 0600,  , TD, 14.0N,  22.7W, -99,
19670722, 1200,  , TD, 14.0N,  24.5W, -99,
```

5. August 3-6: Historical Weather Maps, microfilm and satellite images showed a tropical wave exiting the west coast of Africa on August 3rd. The system is listed as Tropical Depression #7 in HURDAT with the first position shown at 12Z on the 3rd. Synoptic data and satellite images suggested that the tropical wave did not become any better organized as it moved westward and did not develop a well-defined surface circulation. No gales were observed in relation to this disturbance. Because the disturbance did not have a well-defined center, it is not a tropical cyclone and is removed from HURDAT. This disturbance was in Jack Beven's Lists of Suspects.

```
AL071967,            UNNAMED,     13,
19670803, 1200,  , TD, 19.5N,  17.1W, -99,
19670803, 1800,  , TD, 19.0N,  18.2W, -99,
19670804, 0000,  , TD, 18.1N,  19.8W, -99,
19670804, 0600,  , TD, 17.5N,  21.0W, -99,
19670804, 1200,  , TD, 16.5N,  22.3W, -99,
19670804, 1800,  , TD, 15.1N,  23.9W, -99,
19670805, 0000,  , TD, 14.0N,  25.0W, -99,
19670805, 0600,  , TD, 12.9N,  26.6W, -99,
19670805, 1200,  , TD, 12.0N,  27.9W, -99,
19670805, 1800,  , TD, 11.5N,  28.9W, -99,
19670806, 0000,  , TD, 11.0N,  30.0W, -99,
19670806, 0600,  , TD, 11.3N,  31.1W, -99,
19670806, 1200,  , TD, 10.0N,  32.0W, -99,
```

6. August 10-16: Historical Weather Maps, microfilm and satellite images suggested that a tropical wave left the west coast of Africa around August 11th. The system is listed as Tropical Depression #8 in HURDAT with the first position at 12Z on the 10th while the system was still over western Africa. The tropical disturbance moved westward and showed no signs of organization based on satellite images and synoptic data. The last position in HURDAT was analyzed at 12Z on the 16th while over the central Atlantic. No gales were observed in relation to this disturbance.

Because the disturbance did not have a closed circulation, it is not a tropical cyclone and is removed from HURDAT. This disturbance was in Jack Beven's Lists of Suspects.

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AL081967,            UNNAMED,     25,
19670810, 1200,  , TD, 12.9N,  13.0W, -99,
19670810, 1800,  , TD, 13.0N,  14.0W, -99,
19670811, 0000,  , TD, 13.1N,  15.6W, -99,
19670811, 0600,  , TD, 13.1N,  17.1W, -99,
19670811, 1200,  , TD, 13.0N,  18.9W, -99,
19670811, 1800,  , TD, 13.0N,  19.9W, -99,
19670812, 0000,  , TD, 13.0N,  20.8W, -99,
19670812, 0600,  , TD, 13.0N,  21.5W, -99,
19670812, 1200,  , TD, 13.0N,  22.4W, -99,
19670812, 1800,  , TD, 13.0N,  23.4W, -99,
19670813, 0000,  , TD, 13.1N,  24.8W, -99,
19670813, 0600,  , TD, 13.2N,  25.9W, -99,
19670813, 1200,  , TD, 13.4N,  26.8W, -99,
19670813, 1800,  , TD, 13.6N,  27.8W, -99,
19670814, 0000,  , TD, 13.8N,  28.8W, -99,
19670814, 0600,  , TD, 13.8N,  30.0W, -99,
19670814, 1200,  , TD, 13.8N,  31.0W, -99,
19670814, 1800,  , TD, 13.8N,  32.0W, -99,
19670815, 0000,  , TD, 13.9N,  33.1W, -99,
19670815, 0600,  , TD, 14.0N,  34.0W, -99,
19670815, 1200,  , TD, 14.0N,  35.0W, -99,
19670815, 1800,  , TD, 14.0N,  36.0W, -99,
19670816, 0000,  , TD, 14.0N,  37.0W, -99,
19670816, 0600,  , TD, 14.0N,  38.0W, -99,
19670816, 1200,  , TD, 14.0N,  39.0W, -99,
```

7. August 16-19: Historical Weather Maps, microfilm and satellite images indicated that a tropical wave left the west coast of Africa around August 17th. The system is listed as Tropical Depression #9 in HURDAT with the first position at 12Z on the 16th while the system was still over western Africa. The tropical disturbance moved westward and showed no signs of organization based on satellite images and synoptic data. The last position in HURDAT was analyzed at 12Z on the 19th while over the eastern Atlantic. No gales were observed in relation to this disturbance. Because the disturbance did not have a closed circulation, it is not a tropical cyclone and is removed from HURDAT. This disturbance was in Jack Beven's Lists of Suspects.

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AL091967,            UNNAMED,     13,
19670816, 1200,  , TD, 18.0N,  16.1W, -99,
19670816, 1800,  , TD, 18.0N,  17.0W, -99,
19670817, 0000,  , TD, 17.9N,  17.9W, -99,
19670817, 0600,  , TD, 17.7N,  18.8W, -99,
19670817, 1200,  , TD, 17.4N,  19.7W, -99,
19670817, 1800,  , TD, 17.0N,  20.8W, -99,
19670818, 0000,  , TD, 17.0N,  22.0W, -99,
19670818, 0600,  , TD, 17.0N,  23.1W, -99,
19670818, 1200,  , TD, 16.9N,  24.1W, -99,
19670818, 1800,  , TD, 16.9N,  25.2W, -99,
19670819, 0000,  , TD, 17.0N,  26.7W, -99,
19670819, 0600,  , TD, 17.0N,  27.9W, -99,
19670819, 1200,  , TD, 17.0N,  29.1W, -99,
```

8. August 20-24: Historical Weather Maps, microfilm and satellite images showed that a tropical wave left the west coast of Africa around August 21st. The system is listed as Tropical Depression #10 in HURDAT with the first position at 12Z on the 20th while the system was still over western Africa. The tropical disturbance moved westward and showed no signs of organization based on satellite images and synoptic data. The last position in HURDAT was analyzed at 12Z

on the 24th while over the central Atlantic. No gales were observed in relation to this disturbance. Because the disturbance did not have a closed circulation, it is not a tropical cyclone and is removed from HURDAT. This disturbance was in Jack Beven's Lists of Suspects.

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AL101967,            UNNAMED,     17,
19670820, 1200,  , TD, 21.1N,  17.0W, -99,
19670820, 1800,  , TD, 20.9N,  17.8W, -99,
19670821, 0000,  , TD, 20.1N,  18.1W, -99,
19670821, 0600,  , TD, 19.4N,  19.2W, -99,
19670821, 1200,  , TD, 18.6N,  20.0W, -99,
19670821, 1800,  , TD, 18.0N,  21.0W, -99,
19670822, 0000,  , TD, 17.0N,  22.1W, -99,
19670822, 0600,  , TD, 16.1N,  23.1W, -99,
19670822, 1200,  , TD, 15.6N,  24.1W, -99,
19670822, 1800,  , TD, 15.2N,  25.1W, -99,
19670823, 0000,  , TD, 14.9N,  26.2W, -99,
19670823, 0600,  , TD, 14.5N,  27.5W, -99,
19670823, 1200,  , TD, 13.9N,  28.9W, -99,
19670823, 1800,  , TD, 13.0N,  30.3W, -99,
19670824, 0000,  , TD, 12.8N,  31.9W, -99,
19670824, 0600,  , TD, 12.2N,  33.9W, -99,
19670824, 1200,  , TD, 12.0N,  35.0W, -99,
```

9. September 20-25: Historical Weather Maps, microfilm and satellite images showed a frontal boundary over the central and western Atlantic, interacting with the remnants of Hurricane Doria, on September 20th. A weak low pressure developed on the 21st and moved northeastward. Satellite images and synoptic observations suggested that the system intensified on the 22nd and 23rd, and gale-force winds were reported north of the center on the 23rd. The next day, the disturbance moved southeastward and weakened below gale force, and dissipation occurred on the 25th. Therefore, because the low did not acquire tropical or subtropical characteristics, it is not added to HURDAT.

Day	Latitude	Longitude	Status
Sep 20	Western and Central Atlantic		Cold front
Sep 21	33N	63W	Extratropical
Sep 22	38N	56W	Extratropical
Sep 23	42N	49W	Extratropical
Sep 24	38N	44W	Extratropical
Sep 25			Dissipated

10. October 2-6: Historical Weather Maps, microfilm and satellite images indicated that a tropical wave moved into the eastern Caribbean Sea on September 30th. Convection increased north of the islands as the tropical wave interacted with an upper level low on October 1st. A weak low pressure developed on the 2nd and slowly moved northward. Satellite images suggested that the convective pattern became better organized on the 3rd but synoptic observations suggested that the system did not have a well-defined circulation. Over the next few days, the disturbance weakened and dissipated on the 6th. Because the disturbance did not have a well-defined center, it is not added to HURDAT. This disturbance was in Jack Beven's Lists of Suspects.

Day	Latitude	Longitude	Status
Oct 1	Leeward Islands		Tropical Wave

Oct 2	20N	63W	Tropical Wave
Oct 3	26N	57W	Tropical Wave
Oct 4	28N	57W	Tropical Wave
Oct 5	30N	59W	Tropical Wave
Oct 6			Dissipated

11. October 3-5: Historical Weather Maps, microfilm and satellite suggested that a tropical wave left the west coast of Africa around October 3rd. The system is listed as Tropical Depression #20 in HURDAT with the first position at 12Z on the 3rd. The disturbance moved westward and there was an increase in convection over the far eastern Atlantic on the 4th. A stronger disturbance began to organize to the northeast, becoming Tropical Storm Ginger a few days later, and absorbing this disturbance. The last position was analyzed in HURDAT at 12Z on the 5th. No gales were observed in relation to this disturbance. Because the disturbance did not have a closed circulation, it is not a tropical cyclone and is removed from HURDAT. This disturbance was in Jack Beven's Lists of Suspects.

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AL201967,            UNNAMED,      9,
19671003, 1200,  , TD, 13.0N,  17.1W, -99,
19671003, 1800,  , TD, 13.0N,  18.2W, -99,
19671004, 0000,  , TD, 13.0N,  19.6W, -99,
19671004, 0600,  , TD, 13.0N,  20.9W, -99,
19671004, 1200,  , TD, 13.0N,  22.0W, -99,
19671004, 1800,  , TD, 13.0N,  23.1W, -99,
19671005, 0000,  , TD, 13.0N,  24.5W, -99,
19671005, 0600,  , TD, 13.0N,  25.7W, -99,
19671005, 1200,  , TD, 13.0N,  27.0W, -99,
```

12. October 26-29: Historical Weather Maps, microfilm and satellite showed a disturbance over the Bahamas and eastern Cuba on October 25th, possibly associated with a tropical wave. The system was listed in HURDAT as Tropical Depression #26 with the first position at 12Z on the 26th as the system moved northeastward ahead of an approaching frontal boundary. Synoptic observations indicated that the disturbance did not have a well-defined closed circulation. The system weakened over the next few days and was absorbed by the frontal boundary early on the 30th. The last position in HURDAT was analyzed at 12Z on the 29th. No gales were observed in relation to this disturbance. Because the disturbance did not have a closed circulation, it is not a tropical cyclone and is removed from HURDAT. This disturbance was in Jack Beven's Lists of Suspects.

```
AL261967,            UNNAMED,     13,
19671026, 1200,  , TD, 25.9N,  70.9W, -99,
19671026, 1800,  , TD, 26.1N,  69.9W, -99,
19671027, 0000,  , TD, 26.0N,  68.7W, -99,
19671027, 0600,  , TD, 25.5N,  67.5W, -99,
19671027, 1200,  , TD, 25.4N,  66.1W, -99,
19671027, 1800,  , TD, 25.7N,  65.0W, -99,
19671028, 0000,  , TD, 26.3N,  64.8W, -99,
19671028, 0600,  , TD, 26.8N,  62.8W, -99,
19671028, 1200,  , TD, 26.9N,  61.2W, -99,
19671028, 1800,  , TD, 25.0N,  62.8W, -99,
19671029, 0000,  , TD, 26.2N,  64.8W, -99,
19671029, 0600,  , TD, 28.8N,  65.8W, -99,
19671029, 1200,  , TD, 31.0N,  66.2W, -99,
```

13. October 29 – November 4: Historical Weather Maps, microfilm and satellite images a frontal boundary over the western Atlantic on October 29th. The next day, an extratropical cyclone developed along the frontal boundary and it became occluded on the 31st. Gales were reported by nearby ships on the 30th and 31st. As the occluded cyclone

moved southward, it weakened. On November 1st, microfilm shows a gale near the center but the circulation was elongated and poorly defined, and the satellite image only showed a small area of convection southeast of the center. On the 2nd, winds near the system had decreased below gale force. The next day, the system turned northward and dissipated on the 4th. Because disturbance did not acquire tropical or subtropical characteristics, it is not added to HURDAT. This disturbance was in Jack Beven's Lists of Suspects.

Day	Latitude	Longitude	Status
Oct 29	Western Atlantic		Cold front
Oct 30	42N	62W	Extratropical
Oct 31	39N	64W	Occluded
Nov 1	30N	66W	Occluded
Nov 2	26N	69W	Occluded
Nov 3	30N	68W	Occluded
Nov 4			Dissipated

14. November 11-16: Historical Weather Maps, microfilm and satellite images indicated that a trough interacted with the tail-end of a frontal boundary over the central Atlantic starting around November 10th. Microfilm suggests that a weak low pressure developed on the 12th and moved northward ahead of a cold front. The extratropical cyclone intensified and was absorbed by a cold front a few days later. Because disturbance did not acquire tropical or subtropical characteristics, it is not added to HURDAT. This disturbance was in David Roth's Lists of Suspects.

Day	Latitude	Longitude	Status
Nov 11	Central Atlantic		Trough
Nov 12	22N	55W	Extratropical
Nov 13	30N	53W	Extratropical
Nov 14	30N	49W	Extratropical
Nov 15	33N	51W	Extratropical
Nov 16			Absorbed

1968 Atlantic Hurricane Season Reanalysis by Sandy Delgado, Stacy Stewart, Andrew Hagen, and Chris Landsea – August 2020

Red indicates wind changes of 15 kt or greater
Yellow indicates lat/long changes greater than 1°
Green indicates a new entry
Blue indicates a deletion

Hurricane Abby [June 1-13, 1968] – AL011968

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45395 06/01/1968 M=13  1 SNBR= 970 ABBY        XING=1 SSS=0
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45400 06/01*  0   0   0    0*172 855  30    0*175 855  30    0*182 857  30
0*
45400 06/01*  0   0   0    0*170 855  25    0*172 855  25    0*178 857  25
0*
                             ***      **      ***      **      ***      **

45405 06/02*188 858  30 1005*197 857  30    0*205 853  30    0*214 848  40
1002*
45405 06/02*185 858  30 1005*195 857  30    0*205 853  35    0*214 848  40
1002*
            ***              ***                      **

45410 06/03*223 842  45  997*233 839  60  999*245 836  65  999*248 835  65
0*
45410 06/03*221 844  45  997*230 840  45  999*240 837  45  999*245 836  45
997*
            *** ***          *** ***  **      *** ***  **      *** ***  **
***

45415 06/04*251 833  65  994*258 829  60  993*269 821  55  992*276 817  55
0*
45415 06/04*250 834  50  994*258 829  55  993*267 823  55  992*274 818  45
0*
            *** ***  **               **      *** ***          *** ***  **

45420 06/05*280 813  50    0*281 809  50  994*280 805  50    0*278 802  50
965*
45420 06/05*280 811  45    0*282 808  45    0*282 805  55    0*282 802  65
994*
                ***  **      *** ***  **  *** ***      **      ***      **
***

45425 06/06*280 800  50  997*286 804  50    0*291 809  50    0*299 812  50
0*
45425 06/06*283 801  65    0*286 804  65    0*292 808  60  992*299 812  55
0*
            *** ***  **  ***          **      *** ***  **  ***          **

45430 06/07*306 815  50  999*314 818  50    0*320 820  45    0*326 820  30
0*
45430 06/07*306 815  50  997*314 818  40  999*320 820  35 1002*326 821  30
1003*
                         ***          **  ***          ** ****     ***
****

45435 06/08*330 822  30    0*335 822  30    0*340 823  25    0*344 823  25
0*
45435 06/08*330 822  30    0*335 822  30    0*341 823  25    0*348 823  25
0*
                                             ***              ***

45440 06/09*350 820  25    0*353 818  25    0*357 811  25    0*359 803  25
0*
45440 06/09*356 821  25    0*363 818  25    0*364 811  25    0*362 803  25
0*
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            *** ***          ***              ***              ***

45445 06/10*359 795  25    0*356 789  25    0*349 787  25    0*342 790  25
0*
45445 06/10L359 795  25    0L356 789  25    0L349 787  25    0L342 787  25
0*
           *                *                *                *    ***

45450 06/11*333 792  25    0*332 790  25    0*333 787  25    0*334 785  25
0*
45450 06/11L335 787  25    0L332 787  25    0*333 787  25    0*334 785  25
0*
           **** ***         *    ***

45455 06/12*336 782  25    0*338 780  25    0*340 778  25    0*347 771  25
0*
45455 06/12*336 782  30    0*338 780  30    0*340 778  30    0*345 773  30
0*
                     **              **              **      *** ***  **

45460 06/13*354 766  25    0*361 759  25    0*368 750  25    0*372 745  25
0*
45460 06/13*352 766  30    0*359 757  30    0*365 748  30    0*  0   0   0
0*
            ***      **      *** ***  **      *** ***  **      *** ***  **

45465 HR
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Landfalls:

June 2nd/23Z – 21.9N 84.5W – 45 kt – 997 mb – Cuba
June 4th/12Z – 26.7N 82.3W – 55 kt – 992 mb – Florida
June 6th/22Z – 30.4N 81.4W – 55 kt - Florida

Significant Revisions:

13. Intensity significantly reduced on the 3rd and 4th based upon aircraft reconnaissance observations. Abby no longer considered a hurricane over the Gulf of Mexico;
14. Several central pressures were removed (if not observed or reasonable) and added (if observed);
15. Intensity significantly boosted on the 5th and 6th based on station and aircraft observations and satellite imagery. Abby now considered a hurricane over the Atlantic Ocean;
16. A remnant low stage is indicated from 00Z on the 10th through 06Z on the 11th.

Daily Metadata:

May 28:

6. Maps and old HURDAT:

- HWM does not analyze any features of interest at 12Z.
- HURDAT does not list an organized system on this date.
- Microfilm shows a tropical disturbance near 19.5N, 85.5W at 12Z.

7. Discussion:

- b. Reanalysis: Disorganized deep convection was observed over the northwestern Caribbean Sea.

May 29:

1. Maps and old HURDAT:
- HWM does not analyze any features of interest at 12Z.
- HURDAT does not list an organized system on this date.
- Microfilm shows a tropical disturbance at 18.8N, 83.1W at 12Z.

2. Discussion:
a. MWR: "A midtropospheric trough had persisted over the extreme northwestern Caribbean Sea during the latter part of May. A short-wave trough moving eastward through the semipermanent Caribbean trough pushed a weak cold front southward into the Florida Straits near the end of the month. The low-level convergence field gradually increased, and satellite pictures showed the merging of the cloud systems associated with the frontal zone and upper trough."
b. Reanalysis: A weak surface trough developed in association with the disorganized deep convection over the northwestern Caribbean Sea, which then persisted through the 31st.

May 30:

1. Maps and old HURDAT:
- HWM does not analyze any features of interest at 12Z.
- HURDAT does not list an organized system on this date.
- Microfilm shows a tropical disturbance of at most 1012 mb at 18N, 83W at 12Z.

May 31:

1. Maps and old HURDAT:
- HWM does not analyze any features of interest at 12Z.
- HURDAT does not list an organized system on this date.
- Microfilm shows a tropical disturbance near 20.5N, 83W along a trough extending from south Florida to an area of low pressure near Belize at 12Z.

June 1:

1. Maps and old HURDAT:
- HWM analyzes a tropical wave over the western Caribbean Sea at 12Z.
- HURDAT lists a 30 kt tropical depression at 17.5N, 85.5W at 12Z.
- Microfilm shows a tropical cyclone of at most 1008 mb near 17N, 86W at 12Z.

2. Discussion:
- MWR: "The extensive and prolonged rains produced by these systems, together with another minor midtropospheric trough that moved into the mean trough on the 1st, caused general pressure falls throughout the extreme western Caribbean Sea. The trough probably also helped start Abby on her northward trek. As the pressure fell, deep southwesterly flow began through Central America and over the adjoining Pacific Ocean (a temporale) advecting very warm and moist tropical air into the area of maximum pressure falls. A warm-core tropical cyclone gradually organized on June 1."
- ATSR: "Abby, the first hurricane of the season … formed as a tropical depression north of Honduras early on 1 June."

- Reanalysis: Genesis of this system as a tropical depression is retained at 06Z. While definitive evidence of a closed low do not exist until around 12Z, the pressure at Swan Island dropped by 4 mb in 24 hours (from 1013 mb at 06Z on the 31st to 1009 mb at 06Z on the 1st). Deep convection appeared to diminish some late in the day.

June 2:

1. Maps and old HURDAT:
- HWM analyzes a closed low pressure of at most 1004 mb at 20.1N, 85.5W at 12Z.
- HURDAT lists a 30 kt tropical depression at 20.5N, 85.3W at 12Z.
- Microfilm shows a tropical cyclone of at most 1004 mb near 20.5N, 80.3W at 12Z.

2. Ship highlights:
- 30 kt SE and 1002 mb at 21.4N, 84.8W at 12Z (micro).
- 25 kt ENE and 1004 mb at 21.4N, 84.9W at 12Z (COADS).
- 35 kt E and 1010 mb at 23.6N, 83W at 15Z (COADS).
- 35 kt E and 1010 mb at 24.1N, 82.1W at 18Z (COADS).

3. Aircraft highlights:
- Penetration center fix measured a central pressure of 1002 mb and estimated surface winds of 40 kt at 21.5N, 84.5W at 19Z (WALLET).
- Penetration center fix measured a central pressure of 997 mb and estimated surface winds of 30 kt at 21.8N, 84.8W at 21Z (WALLET).

4. Discussion:
- MWR: "…and reached tropical storm intensity on June 2. A general warming of the upper troposphere over the Gulf of Mexico and western Caribbean Sea during this time, and a strong west-southwesterly jet stream persisted from southern Mexico to southern Florida; conditions were quite similar to the predevelopment stage of hurricane Alma in 1966."
- ATSR: "Moving northward, ABBY attained tropical storm intensity on the second of June, just before passing over the western tip of Cuba."
- Reanalysis: The system gradually developed on the 2nd. Intensification to a tropical storm at 12Z (six hours earlier) is based upon 35 kt winds from a ship at 15Z. Deep convection over a large area redeveloped mainly in the eastern semicircle of Abby. Aircraft reconnaissance recorded a 997 mb central pressure at 21Z. This pressure suggests maximum winds of 53 kt from the Brown et al. south of 25N pressure-wind relationship. The tropical storm made landfall in western Cuba a couple hours later around 23Z. Due to low environmental pressure and a slow forward speed, the intensity at landfall (and at 00Z on the 3rd) is 45 kt, unchanged from that in HURDAT previously.

June 3:

1. Maps and old HURDAT:
- HWM analyzes a tropical storm of at most 1000 mb at 24.9N, 83.5W at 12Z.
- HURDAT lists a 65 kt hurricane at 24.5N, 83.6W at 12Z.
- Microfilm shows a tropical storm of at most 1000 mb at 23.5N, 83.7W at 12Z.

2. Ship highlights:
- 35 kt SE and 1001 mb (low bias) at 24.2N, 81.9W at 00Z (COADS).
- 15 kt W and 999 mb at 21.7N 84.4W at 00Z (COADS).
- 35 kt E and 1009 mb at 24.3N, 82.4W at 06Z (COADS).

- 35 kt SE and 1003 mb at 24.4N, 82.7W at 12Z (COADS).
- 35 kt NE and 1002 mb at 24.8N, 85.5W at 18Z (COADS).
- 15 kt E and 999 mb at 24.8N, 84.2W at 18Z (COADS).

3. Land highlights:
- 37 kt SE (maximum sustained winds) at Key West, FL at 1048Z and 1417Z (MWR).
- 40 kt E and 1009 mb at Dry Tortugas, FL at 12Z (micro).

4. Aircraft highlights:
- Penetration center fix measured a central pressure of 999 mb and estimated flight level winds of 50 kt at 24.4N, 84.7W at 1046Z (WALLET).
- Penetration center fix measured a central pressure of 997 mb and estimated flight level winds of 50 kt at 25.3N, 82.8W at 1540Z (WALLET).

5. Radar highlights:
- Key West, FL estimated an eye diameter of 35 n mi at 25.3N, 83.5W at 1412Z (WALLET).
- Tampa, FL estimated a center fix at 25.3N, 83.5W at 1510Z (WALLET).

6. Discussion:
- MWR: "Tropical storm Abby crossed extreme western Cuba on the evening of June 2, moving on a north-northeast course around 10 mi/hr with a minimum pressure slightly below 1000 mb. Abby slowed her forward progress upon reaching the area just northwest of Dry Tortugas on the morning of June 3, and for the next 12 to 18 hr moved less than 5 mi/hr while showing signs of developing a wall cloud and eye. The radars at Key West and Tampa during this period showed a number of transient eye formations, and it is quite likely that hurricane force winds occurred in heavier squalls near these organizing wall clouds."
- ATSR: "The following day [3], ABBY briefly attained hurricane strength as she passed west of Dry Tortugas."
- Advisories (WALLET): 10Z – "HIGHEST WINDS ARE ESTIMATED 50 MPH…INDICATIONS ARE FOR SLOW INTENSIFICATION WITH ABBY POSSIBLY REACHING HURRICANE FORCE LATE TODAY OR TONIGHT." 13Z – "ABBY WILL REACH HURRICANE FORCE TODAY…LATEST REPORTS FROM AIRFORCE RECONNAISSANCE AND LAND BASED RADAR INDICATE THAT ABBY HAS BEGUN TO INTENSIFY AND INDICATIONS THAT IT WILL REACH HURRICANE FORCE TODAY." 16Z – "DURING THE LAST FEW HOURS REPORTS FROM AIRFORCE RECON AND FROM BOTH MIAMI AND KEY WEST RADARS INDICATE THAT ABBY HAS NOW FORMED AN EYE AND INTENSIFIED TO NEAR HURRICANE STRENGTH…ABBY IS A MINIMAL HURRICANE AT THIS TIME."
- Reanalysis: Abby remained relatively steady state during the 3rd with the central pressure remaining around 997-999 mb. The intensity is kept at a steady 45 kt for the day, which is a major change downward at 06 to 18Z. Operationally, Abby was brought to hurricane intensity on this day over the Gulf of Mexico, based primarily upon interpretation of the Miami and Key West radars. However, radar data did not show a closed eye, and the banding eye that did appear in radar reports was intermittent and at altitudes above 10,000 based on the range from the radars, which suggests that it was likely a mid-level eye only. The system had a sheared appearance in satellite imagery on this date, with the center at least partly exposed. This suggests that the short-lived eye formations in radar data may well have been related to transient convective bursts. Note that the track on the 3rd had numerous conflicting reports from aircraft, ships, and radar. The moderate southwestward shift of the position on this date is based upon a compromise among the various observations.

June 4:

1. Maps and old HURDAT:

- HWM analyzes a hurricane of at most 996 mb at 27.2N, 82.5W at 12Z.
- HURDAT lists a 55 kt tropical storm at 26.9N, 82.1W at 12Z.
- Microfilm shows a closed low pressure of at most 996 mb at 27N, 82W at 12Z.

2. Ship highlights:

- 35 kt NE and 1007 mb at 25.9N, 85.7W at 00Z (COADS).
- 30 kt S and 999 mb at 24.7N, 83.3W at 00Z (COADS).
- 35 kt N and 1007 mb at 25.1N, 85.3W at 06Z (COADS).
- 30 kt NW and 998 mb at 24.8N, 83.6W at 06Z (COADS).
- 40 kt SSE and 1007 mb at 25.8N, 79.6W at 12Z (COADS).
- 20 kt S and 1000 mb at 27.4N, 80.0W at 18Z (COADS).
- 40 kt S and 1009 mb at 29.4N, 77.2W at 18Z (COADS).

3. Land highlights:

- 45 kt (maximum sustained winds) at Plantation Key, FL at 0755Z (MWR).
- 994 mb (min pressure, corrected) at Punta Gorda, FL at 0930Z (MWR).
- 40 kt (maximum sustained winds) at North Key Largo, FL at 1030Z (MWR).
- 10 kt SSE and 993 mb (in the eye, uncorrected pressure) at Punta Gorda, FL at 13Z (WALLET).
- 40 kt SW (maximum sustained winds) at Miami NHC, FL at 17Z (MWR).
- 992 kt (minimum pressure) at Avon Park, FL at 19Z (WALLET, considered unreliable and not used in MWR report).

4. Aircraft highlights:

- Penetration center fix at 25.6N, 83.1W at 0150Z (WALLET).
- Penetration center fix measured a central pressure of 993 mb and estimated flight level winds of 50 kt at 25.3N, 82.8W at 0515Z (WALLET).

5. Radar highlights:

- Daytona Beach, FL estimated a center fix at 27.6N, 80.9W at 1511Z (WALLET).

6. Discussion:

- MWR: "Abby resumed a northeasterly course at 10 mi/hr by the evening of June 3 and moved inland on the morning of June 4 near Punta Gorda, Fla. (about halfway between Fort Myers and Sarasota). The storm's lowest pressure was reported at this time with stations near the center indicating barometric readings near 992 mb. Abby's general northeasterly course from the Caribbean to landfall in Florida agreed quite well with the steering implied in the tropospheric (1000-100 mb) mean flow with minor variations in track also correlating well with weak shortwave midtropospheric features. Intensification during this time, which continued to be favored by the high-level circulation (200 mb). The trough that had persisted over the eastern United States during this time moved off the coast late on the 3rd; it was followed on the 4th by ridging to the north, which resulted first in a more nearly eastward course across the peninsula and then blocked further northeastward movement after the morning of the 5th."
- ATSR: "She continued on a north-northeast track toward the Florida Coast and moved inland near Punta Gorda, Florida as a tropical storm early on the fourth of June."
- Reanalysis: Aircraft observations and surface reports from Florida indicate that Abby deepened some before landfall. Based upon the last aircraft

reconnaissance and observations from Punta Gorda, a central pressure of 992 mb is analyzed at landfall. Abby made landfall on the southwest Florida coast just southwest of Punta Gorda around 12Z. 992 mb central pressure suggests an intensity of 56 kt from the north of 25N Brown et al. pressure-wind relationship. Peak observed sustained winds were 45 kt at Plantation Key, though winds stronger than that likely occurred southeast of the landfall location. 55 kt intensity is selected at 12Z, same as originally shown. Thus Abby is indicated to now have intensified slowly until landfall with a peak intensity in the Gulf of 55 kt (at 06 and 12Z on the 4th), while the original HURDAT had a peak of 65 kt over the open Gulf (from 12Z on the 3rd to 06Z on the 4th).

June 5:

1. Maps and old HURDAT:

- HWM analyzes a tropical storm of at most 1000 mb at 28.5N, 80.5W with a stationary front to the northeast at 12Z.
- HURDAT lists a 50 kt tropical storm at 28N, 80.5W at 12Z.
- Microfilm shows a closed low pressure of at most 996 mb at 28N, 80W at 12Z.

2. Ship highlights:

- 35 kt S and 1009 mb at 26.3N, 78.6W at 00Z (COADS).
- 35 kt ENE and 1005 mb at 30.5N, 79.8W at 06Z (COADS).
- 45 kt NE and 1006 mb at 30.3N, 79.3W at 12Z (COADS).
- 45 kt E and 1012 mb at 31.5N, 78.5W at 18Z (COADS).
- 50 kt NE and 1004 mb at 28.9N, 80.4W at 22Z (COADS).

3. Aircraft highlights:

- Penetration center fix measured a central pressure of 994 mb, estimated surface winds of 65 kt and an eye diameter of 20 n mi at 28.4N, 80.3W at 18Z (WALLET).

4. Land highlights:

- 60 kt (5-min, maximum sustained winds) and gusts to 76 kt at a NASA 60-ft Tower, FL (no time given) (MWR).
- 15 kt SE and 996 mb at Melbourne Beach, FL at 00Z (WALLET).
- 40 kt SE (maximum sustained winds) at Jupiter Light, FL at 01Z (MWR).
- 998 mb (min pressure) at Cocoa, FL at 05Z (MWR).
- 995 mb (min pressure) at Fort Pierce, FL at 1030Z (MWR).
- 35 kt NNE (maximum sustained winds) and gusts to 48 kt at Titusville, FL at 1721Z (MWR).
- 35 kt NE (maximum sustained winds) and 1008 mb at Ponte Vedra, FL at 2225Z (WALLET).

5. Discussion:

- MWR: "During the following 24 hr, the storm remained in the general area of Cape Kennedy awaiting eastward movement of the blocking high-pressure system. The 994-mb central pressure measured by Navy reconnaissance aircraft on the morning of the 5th was essentially the same as that measured by the ESSA reconnaissance aircraft (993 mb) just prior to landfall on the west coast about 24 hr earlier. The highest winds over water were estimated by Navy reconnaissance at 75 mi/hr just off the Florida east coast on the morning of June 5."
- ATSR: "ABBY, in a weakened condition, moved slowly across the Florida Peninsula and eventually offshore near Cape Kennedy on the fifth of June where

she stalled for several hours. ABBY then began to move northward and intensify."

- Reanalysis: Abby slowly moved eastward over land on the 5th reaching the Atlantic coast of Florida just before 12Z. The tropical cyclone quickly regained strength upon reaching the Atlantic waters. A 5-minute-average 60 kt wind report at the NASA Pad 39A site (right on the coast) with an 18 m anemometer height above ground was reported. This converts roughly to a 10-meter 1-minute wind speed of 57 kt. The time for this measurement was not mentioned, but it likely was at 12-18Z. At 18Z, aircraft reconnaissance reached Abby and estimated surface winds of 65 kt and observed a central pressure of 994 mb in a 20 nm diameter eye. This pressure suggests maximum winds of 53 kt from the Brown et al. pressure-wind relationship. Abby was only moving about 3 kt at the time, but had a small inner core with an RMW of about 15 nm compared with 23 nm from climatology for this latitude and central pressure. It is also of note that Abby displayed a ragged eye in the middle of a symmetric central dense overcast in satellite imagery at this time. Based upon a blend of these factors, Abby is analyzed to have reached 65 kt – Category 1 hurricane – intensity at 18Z (major upward revision from 50 kt) and 55 kt at 12Z. 65 kt is the peak intensity for Abby (from 18Z on the 5th to 06Z on the 6th), same as previously in HURDAT (but on the 3rd and 4th instead while over the Gulf of Mexico). Note that previously Abby did not have a hurricane intensity stage while over the Atlantic Ocean. However, given the uncertainty in indicating a new 65-kt minimal hurricane intensity, that it is possible that Abby did not reach hurricane intensity in the Atlantic.

June 6:

1. Maps and old HURDAT:

- HWM analyzes a tropical storm of at most 1000 mb at 29.8N, 81W with a cold front to the northeast at 12Z.
- HURDAT lists a 50 kt tropical storm at 29.1N, 80.9W at 12Z.
- Microfilm shows a closed low pressure of at most 1004 mb at 29.5N, 80.6W at 12Z.

2. Ship highlights:

- 40 kt S and 999 mb at 27.8N, 78.9W at 00Z (COADS).
- 45 kt NE and 1005 mb at 29.5N, 80.1W at 06Z (COADS).
- 50 kt E and 1006 mb at 30.4N, 80.2W at 12Z (COADS).
- 50 kt E and 1005 mb at 30.9N, 79.5W at 15Z (COADS).
- 45 kt E and 1009 mb at 31.7N, 79.7W at 18Z (COADS).

3. Land highlights:

- 20 kt N and 997 mb at Melbourne Beach, FL at 00Z (WALLET).
- 998 mb (minimum pressure) at Daytona Beach WBO, FL at 09Z (MWR).
- 45 kt N (max wind) at Jacksonville WBO, FL at 1354Z (MWR).
- 10 kt W and 999 mb (minimum pressure) at Jacksonville WBO, FL at 2316Z (MWR).

4. Aircraft highlights:

- Penetration center fix measured a central pressure of 997 mb and estimated flight level winds of 40 kt at 28.4N, 80W at 06Z (WALLET).
- Penetration center fix measured a central pressure of 992 mb, estimated surface winds of 50 kt and an eye diameter of 30 n mi at 29.1N, 80.7W at 1128Z (WALLET).

5. Radar highlights:

- Jacksonville, FL estimated an eye diameter of 25 n mi at 29.4N, 81.7W at 0840Z (WALLET).
- Jacksonville, FL estimated an eye diameter of 30 n mi at 29.9N, 81.3W at 1625Z (WALLET).

6. Discussion:
- MWR: "On June 6, Abby began moving north northwestward just off the upper east coast of Florida and moved inland north of Jacksonville at nightfall. Jacksonville measured the highest land observed winds with a sustained velocity of 52 mi/hr and gusts of 67 mi/hr on June 6."
- ATSR: "She skirted the northern Florida coast and moved inland near the Florida-Georgia border late on 6 June. The highest wind measured at this time was 45 knots and a gust to 57 knots as the storm passed just east of Jacksonville."
- Reanalysis: Abby accelerated toward the northwest and was just offshore, but paralleling, the northeast Florida coast. A 997 mb minimum pressure was reported for the 06Z night fix, but given earlier and subsequently lower pressures, it appears that the 997 mb was not a central pressure. A 992 mb central pressure measured at 1128Z suggests an intensity of 56 kt from the north of 25N pressure-wind relationship. Abby's 30 nm eye corresponds with an RMW of about 22 nm, which is about the same as climatology. Ships reported up to 50 kt on this date. First-light ATS visible imagery indicates the convection was not symmetric around the eye, suggesting the system may have been weakening by that time. An intensity of 60 kt is assessed at 12Z, up some from the 50 kt shown originally. While no further aircraft reconnaissance observations were available before landfall, the eye diameter estimated from the Jacksonville radar became larger by 18Z (30 nm from 25 nm earlier) and the intensity for Abby is estimated to have dropped more at that time. Abby made landfall near 30.4N 81.4W around 22Z, just south of Fernandina Beach with an intensity of about 55 kt. This assumes a continued gradual weakening until landfall and is 5 kt higher than that implied by the original HURDAT.

June 7:

1. Maps and old HURDAT:
- HWM analyzes a hurricane of at most 1004 mb at 33N, 82W at 12Z.
- HURDAT lists a 45 kt tropical storm at 32N, 82W at 12Z.
- Microfilm shows a closed low pressure of at most 1004 mb at 31.8N, 82.1W at 12Z.

2. Ship highlights:
- 40 kt S and 1004 mb at 30.3N, 80.7W at 00Z (COADS).
- 30 kt SSW and 1010 mb at 30.4N, 79.3W at 06Z (COADS).
- 30 kt SSW and 1013 mb at 31.7N, 78.4W at 12Z (COADS).
- 30 kt SSE and 1013 mb at 32N, 78.3W at 18Z (COADS).

3. Station highlights:
   - 20 kt S and 1001 mb at 06Z at Brunswick (Micro).
   - 5 kt NW and 1003 mb at 12Z at Alma (Micro).
   - 10 kt NE and 1005 mb at 18Z at Augusta (micro).

4. Discussion:
- MWR: "The gradually weakening circulation of Abby moved through extreme eastern Georgia and northwest South Carolina during the next several days,

reaching central North Carolina on June 9. Thereafter, a very weak and diffuse circulation center could be followed on a hairpin-shaped track through eastern North Carolina until it was finally absorbed in a cold frontal trough off the Virginia capes on June 13."

- ATSR: "Abby rapidly lost her intensity and moved slowly northward through eastern Georgia and South Carolina as a weak tropical depression, reaching North Carolina on the ninth of June and dissipating on the tenth."
- Reanalysis: Around 00Z on the 7th, Jacksonville reported 999 mb with 10 kt W wind, suggesting a central pressure of 997 mb with overland exposure. This central pressure suggests an intensity of 49 kt from the Brown et al. north of 25N pressure-wind relationship. A 50 kt intensity is maintained at 00Z. At 06Z, Savannah observed 1001 mb with 20 kt S at 06Z, suggesting 999 mb central pressure with overwater exposure. 999 mb suggests 45 kt from the pressure-wind relationship. As the system is now overland, an intensity of 40 kt is assessed at 06Z. At 18Z, August's 1005 mb and 10 kt NE wind indicates a central pressure of 1003 mb. This central pressure suggests 38 kt intensity. Due to it being overland and slow moving, 30 kt is assessed, weakening it to a tropical depression around 18Z, same as originally shown in HURDAT. Satellite imagery continues to show a symmetric central dense overcast, but no longer indicates an eye.

June 8:

1. Maps and old HURDAT:
- HWM analyzes a closed low pressure of at most 1008 mb at 35N, 82.5W at 12Z.
- HURDAT lists a 25 kt tropical depression at 34N, 82W at 12Z.
- Microfilm shows a closed low pressure of at most 1008 mb at 34.5N, 82W at 12Z.

2. Station highlights:
   - 5 kt ESE and 1004 mb at Augusta at 00Z (micro).
3. Discussion:
   - Reanalysis: Symmetric, deep convection continued on this day for Abby as it moved across Georgia and South Carolina as a tropical depression.

June 9:

1. Maps and old HURDAT:
- HWM analyzes a closed low pressure of at most 1012 mb at 36.5N, 81.5W at 12Z.
- HURDAT lists a 25 kt tropical depression at 35.7N, 81.1W at 12Z.
- Microfilm shows a closed low pressure of at most 1012 mb at 35.5N, 81W at 12Z.

2. Discussion:
   - Reanalysis: Deep convection diminished some from the satellite images available, but likely still enough to consider it a tropical cyclone. The system is retained as a tropical depression as it moved slowly eastward.

June 10:

1. Maps and old HURDAT:
- HWM analyzes a closed low pressure of at most 1012 mb at 36N, 80W with a stationary frontal boundary to the north at 12Z.
- HURDAT lists a 25 kt tropical depression at 34.9N, 78.7W at 12Z.
- Microfilm shows a closed low pressure of at most 1012 mb at 34.5N, 78.8W at 12Z.

2. Discussion:

- Reanalysis: Abby's center became somewhat ill-defined on this date and the deep convection lost much of its organization. Because of this, the system is indicated to be a remnant low starting at 00Z.

June 11:

1. Maps and old HURDAT:
- HWM analyzes a closed low pressure of at most 1012 mb at 33N, 80W with a stationary frontal boundary to the north at 12Z.
- HURDAT lists a 25 kt tropical depression at 33.7N, 78.7W at 12Z.
- Microfilm shows a closed low pressure of at most 1010 mb at 33.5N, 78.5W with a warm front to the northeast at 12Z.

2. Discussion:
   - Reanalysis: Abby reached the Atlantic coast again early on the 11th. At the same time the center became more well-defined and some loosely organized deep convection redeveloped. Because of this, the system is reclassified as a tropical depressions once again beginning at 12z.

June 12:

1. Maps and old HURDAT:
- HWM analyzes a closed low pressure of at most 1012 mb at 33N, 80W with a frontal boundary to the northwest at 12Z.
- HURDAT lists a 25 kt tropical depression at 34N, 77.8W at 12Z.
- Microfilm shows a closed low pressure of at most 1010 mb at 33.5N, 78.7W at 12Z.

2. Discussion:
   - Reanalysis: Abby moved slowly northeastward closely paralleling the North Carolina coast with no significant change in organization or intensity.

June 13:

1. Maps and old HURDAT:
- HWM analyzes a trough of low pressure off the eastern seaboard ahead of a frontal boundary at 12Z.
- HURDAT lists a 25 kt tropical depression at 36.8N, 75W at 12Z.
- Microfilm shows a closed low pressure of at most 1006 mb at 36N, 74W with a trough extended to the southwest and an approaching cold front just to the west at 12Z.

2. Ship highlights:
   - 40 kt S (likely high wind bias) and 1008 mb at 35.2N, 75.2W at 00Z (COADS).
   - 35 kt S and 1007 mb at 34.7N, 71.8W at 12Z (COADS).

3. Discussion:
   - Reanalysis: Abby continued toward the northwest and became absorbed by a developing extratropical cyclone after 12Z. Dissipation is now indicted after 12Z, which is six hours earlier. (Note that the 35 kt S ship report at 12Z appears to be legitimate, but is likely more due to the synoptic scale pressure gradient from the extratropical cyclone, and not from Abby.)

June 14:

1. Maps and old HURDAT:

- HWM analyzes an extratropical cyclone over Atlantic Canada, Abby has been absorbed, at 12Z.
- HURDAT does not list an organized storm on this date.
- Microfilm shows an extratropical cyclone, Abby has been absorbed, at 00Z.

Date	Original HURDAT Central Pressure	Evidence	Changes
Jun 2 00Z	1005 mb	No actual observations, but value appears reasonable	Retained
Jun 2 18Z	1002 mb	Penetration center fix: 1002 mb at 19Z	Retained
Jun 3 00Z	997 mb	Penetration center fix: 997 mb at 21Z on the 2nd	Retained
Jun 3 06Z	999 mb	No actual observations, but value appears reasonable	Retained
Jun 3 12Z	999 mb	Penetration center fix: 999 mb at 1046Z	Retained
Jun 3 18Z	997 mb	Penetration center fix: 997 mb at 1540Z	Retained
Jun 4 00Z	994 mb	No actual observations, but value appears reasonable	Retained
Jun 4 06Z	993 mb	Penetration center fix: 993 mb at 0515Z	Retained
Jun 4 12Z	992 mb	994 mb minimum pressure at Punta Gorda at 0930Z	Retained
Jun 5 06Z	994 mb	No actual observations and value is unreasonably low	Removed
Jun 5 18Z	965 mb	Penetration center fix: 994 mb at 18Z	994 mb
Jun 6 00Z	997 mb	No actual observations and value is unreasonably high	Removed
Jun 6 12Z	---	Penetration center fix: 992 mb at 1128Z	992 mb
Jun 7 00Z	999 mb	Jacksonville observed their lowest pressure of 999 mb at 2316Z on the 6th with 10 kt W wind. 997 mb is analyzed central pressure assuming overland exposure.	997 mb
Jun 7 06Z	---	Brunswick observed 1001 mb with 20 kt S at 06Z, suggesting 999 mb central pressure with overwater exposure.	999 mb
Jun 7 12Z	---	Alma observed 1003 mb with 5 kt NW, suggesting 1002 mb central pressure.	1002 mb
Jun 7 18Z	---	Augusta observed 1005 mb with 10 kt NE, suggesting 1003 mb central pressure.	1003 mb
Jun 8 00Z	---	Augusta observe 1004 mb with 5 kt ESE, suggesting 1003 mb central pressure.	1003 mb

Sources: NHC microfilm maps, the Historical Weather Maps series, the COADS ship database, Monthly Weather Review, Mariners Weather Log, Satellite images from NCDC, and NHC Storm Wallets.

Hurricane Brenda [June 18-26, 1968] – AL021968

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45470 06/17/1968 M=10  2 SNBR= 971 BRENDA      XING=0 SSS=0
45470 06/18/1968 M= 9  2 SNBR= 971 BRENDA      XING=0 SSS=0
         **         *
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(June 17th has been removed from HURDAT)

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45475 06/17*  0   0   0    0*  0   0   0    0*240 805  25    0*245 808  25 1012*

45480 06/18*250 810  25    0*255 811  25    0*260 812  25    0*265 813  25    0*
45480 06/18*250 813  25    0*253 813  25    0*257 813  25    0*262 813  25    0*
                ***          *** ***          *** ***          *** ***

45485 06/19*270 813  25    0*275 813  25    0*280 812  25    0*287 811  25 1012*
45485 06/19*266 813  25    0*271 813  25    0*277 812  30    0*285 811  35 1012*
            *** ***          ***              ***      **      ***      **

45490 06/20*295 811  25    0*301 806  25    0*306 796  25    0*309 785  25    0*
45490 06/20*295 810  35    0*303 807  35    0*308 798  35    0*309 787  35 1008*
                ***  **      *** ***  **      *** ***  **          ***  ** ****

45495 06/21*310 774  30    0*309 763  45    0*309 752  50 1005*308 742  55  995*
45495 06/21*310 777  35    0*310 765  40    0*310 752  40 1005*310 743  55  995*
                ***  **      *** ***  **      ***      **      *** ***

45500 06/22*308 734  55  993*311 729  60    0*315 725  60  998*321 718  60  997*
45500 06/22*310 737  55    0*311 731  55    0*315 725  55  998*321 719  60  997*
            *** ***        *     ***  **               **          ***

45505 06/23*327 712  60  997*337 701  60  995*347 684  65  992*351 666  65    0*
45505 06/23*327 712  60  997*337 701  60  995*346 685  65  992*351 666  65    0*
                                              *** ***

45510 06/24*355 643  65  991*355 618  65  990*356 593  65  990*357 566  65    0*
45510 06/24*354 643  70  991*354 618  70  990*355 593  70  990*357 566  65    0*
            ***      **      ***      **      ***      **

45515 06/25*358 540  60  997*362 515  60    0*368 490  60  994*373 463  50    0*
45515 06/25*358 540  60  997*362 515  60    0*367 489  60  994E372 462  55    0*
                                              *** ***         **** ***  **

45520 06/26*378 435  45    0*384 407  30    0*390 380  30    0*  0   0   0    0*
45520 06/26E378 435  40    0E384 407  30    0E390 380  30    0*  0   0   0    0*
            *          **     *                 *
45525 HR
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Significant Revisions:

5. Intensification to a tropical storm is analyzed 36 hours earlier than originally shown in HURDAT based on ship data.
6. Transition to an extratropical cyclone is analyzed at 18Z on June 25th. The original HURDAT did not show an extratropical phase.

Daily Metadata:

June 16:

8. Maps and old HURDAT:

- HWM and microfilm show a trough of low pressure over the western Bahamas at 12Z.
- HURDAT does not list an organized system on this date.

9. Discussion:

- Reanalysis: Satellite images showed a weak frontal boundary over the western Atlantic causing showers and thunderstorms over the western Bahamas on June 14th. Over the next few days, a disturbance develops east of Florida and becomes better organized.

June 17:

5. Maps and old HURDAT:

- HWM and microfilm show a trough of low pressure from the western Bahamas to the western Atlantic at 12Z.
- HURDAT lists a 25 kt tropical depression at 24N, 80.5W at 12Z (first position).

6. Discussion:

- MWR: "Brenda began as a tropical depression over the Florida Straits on June 17, forming under the persistent mean June trough in which the closed Low was embedded. This depression then drifted up the Florida peninsula for 2½ days with little change in intensity. While the depression was over Florida, the heaviest showers and a few squalls with wind gusts occasionally 40 mi/hr or better were well east of the depression."
- Reanalysis: Satellite images and synoptic observations suggest that the disturbance remained a trough at the surface on the 17th as it slowly moved westward.

June 18:

9. Maps and old HURDAT:

- HWM analyzes a closed low pressure of at most 1014 mb at 26N, 82W at 12Z.
- HURDAT lists a 25 kt tropical depression at 26N, 81.2W at 12Z.
- Microfilm shows a tropical cyclone of at most 1012 mb at 25.5N, 81.5W at 12Z.

10. Ship highlights:

- 35 kt SEE and 1004 mb (high wind and low pressure bias) at 24.9N, 80.1W at 00Z (COADS).

11. Discussion:

- ATSR: "BRENDA began as a weak circulation just off the southeast coast of Florida near 25.5N, 82.5W on 18 June."
- Reanalysis: Synoptic observations indicate that a closed low-level circulation developed near southwest Florida on the 18th at 00Z, thus genesis is shown 12 hours later than originally in HURDAT as a 25 kt tropical depression. A ship reported 35 kt SSE and 1004 mb at 00Z on the 18th but the synoptic data suggests that the winds have a high bias and the pressure a low bias. Satellite images show that most of the thunderstorm activity was located to the east of the center, an indication of westerly wind shear.

June 19:

5. Maps and old HURDAT:

- HWM analyzes a closed low pressure of 1012 mb at 28N, 82W at 12Z.
- HURDAT lists a 25 kt tropical depression at 28N, 81.2W at 12Z.
- Microfilm shows a closed low pressure of at most 1014 mb at 27N, 81.5W at 12Z.

6. Ship highlights:

- 35 kt SE and 1016 mb at 28.8N, 78.5W at 18Z (COADS).

7. Land highlights:

- 10 kt SW and 1013 mb at Orlando, FL at 18Z (micro).

8. Discussion:

- Reanalysis: Satellite images indicate that the tropical depression had become better organized on the 19th even though it had been moving northward over Florida for the past day or so. A ship about 100 nmi to the east of the center reported 35 kt SE at 18Z and the observation appears reasonable based on the structure of the tropical cyclone with most of the convection over the eastern quadrant. Intensification to a tropical storm is analyzed at 18Z on the 19th, 36 hours earlier than originally shown in HURDAT.

June 20:

5. Maps and old HURDAT:

- HWM analyzes a closed low pressure of 1008 mb at 31N, 80W with a weakening frontal boundary to the north at 12Z.
- HURDAT lists a 25 kt tropical depression at 30.6N, 79.6W at 12Z.
- Microfilm shows a closed low pressure of at most 1010 mb at 30.7N, 79.5W at 12Z.

6. Ship highlights:

- 35 kt SSW and 1014 mb at 28N, 79W at 12Z (COADS).

7. Aircraft highlights:

a. Penetration center fix measured a central pressure of 1008 mb and estimated surface winds of 30 kt at 31N, 79W at 1645Z (WALLET).

8. Discussion:

a. MWR: "The depression left northeastern Florida early on the 20th and turned toward the east over the open Atlantic as it was picked up by a weak trough in the westerlies."
b. ATSR: "Unable to develop over land, the circulation remained a tropical depression as it moved slowly northward over central Florida and then, finally, moved offshore near St. Augustine early on 20 June where it began to intensify."
c. Reanalysis: Around 00Z on the 20th, the center of Brenda moved over the Atlantic Ocean between Daytona Beach and St. Augustine. The tropical storm turned to the northeast ahead of an approaching frontal boundary and gained in forward speed. A reconnaissance aircraft investigated the tropical cyclone at 1645Z on the 20th measuring a central pressure of 1008 mb and estimated surface winds of 30 kt. Satellite images continued to show a tropical cyclone with most of the convective activity displaced to the east of the center and the system appears to be tangled up with a front. Brenda interacted with the frontal boundary just northeast of it and gained some hybrid characteristics on the 20th and 21st. While the system did become elongated NE-SW with its wind field, no cooler, drier air reached near the center of Brenda. The changes do not appear to be significant enough to indicate a formal subtropical or extratropical stage.

June 21:

6. Maps and old HURDAT:

- HWM analyzes a tropical storm of at most 1008 mb at 31.3N, 75W with a stationary frontal boundary to the northeast at 12Z.

- HURDAT lists a 50 kt tropical storm at 30.9N, 75.2W at 12Z.
- Microfilm shows a tropical storm of at most 1004 mb at 30.9N, 75.3W at 12Z.

7. Ship highlights:
- 35 kt E and 1005 mb at 31.4N, 75.7W at 06Z (COADS).
- 35 kt N and 1009 mb at 30.4N, 77.4W at 12Z (COADS).
- 50 kt S and 1010 mb at 29.5N, 72.6W at 18Z (micro).

8. Aircraft highlights:
- Penetration center fix measured a central pressure of 1005 mb, estimated surface winds of 55 kt and an eye diameter of 25 nmi at 30.9N, 75.2W at 1205Z (WALLET).
- Penetration center fix measured a central pressure of 995 mb and estimated surface winds of 60 kt at 30.4N, 74.3W at 1848Z (WALLET).
- Penetration center fix measured a central pressure of 993 mb and estimated surface winds of 50 kt at 30.4N, 74.2W at 2054Z (WALLET).

9. Discussion:
- MWR: "Brenda reached storm intensity on June 21 as the favorable weak shear field continued."
- ATSR: "By the following day [21], BRENDA had attained tropical storm intensity as she moved on an easterly track to a point about 275 miles east of Jacksonville."
- Reanalysis: Brenda turned to the east and slowed its forward speed. A reconnaissance aircraft investigated the tropical storm at 1205Z on the 21st measuring a central pressure of 1005 mb and estimated surface winds of 55 kt. A central pressure of 1005 mb suggests maximum surface winds of 34 kt from the north of 25N Brown et al. pressure-wind relationship. Based on a forward speed of about 9 kt and synoptic observations, an intensity of 40 kt is analyzed at 12Z on the 21st, down from 50 kt originally shown in HURDAT, a minor intensity change. The next penetration center fix measured a central pressure of 995 mb and estimated surface winds of 60 kt at 1848Z on the 21st. A central pressure of 995 mb suggests maximum surface winds of 52 kt from the south of 25N pressure-wind relationship. An intensity of 55 kt is retained. Satellite images indicated that westerly wind shear continued to impact the tropical cyclone with most of the convection over the eastern quadrant.

June 22:

6. Maps and old HURDAT:
- HWM analyzes a tropical storm of at most 1008 mb at 32N, 72W with a stationary frontal boundary to the northeast at 12Z.
- HURDAT lists a 60 kt tropical storm at 31.5N, 72.5W at 12Z.
- Microfilm shows a tropical storm of at most 1004 mb at 31.5N, 72.2W at 12Z.

7. Ship highlights:
- 40 kt S and 1013 mb at 29N, 72.8W at 00Z (COADS).
- 30 kt SSW and 1001 mb at 30.8N, 71.6W at 12Z (micro).
- 35 kt N and 1014 mb at 31.2N, 74.5W at 15Z (COADS).
- 20 kt SW and 1002 mb at 32N, 72W at 18Z (COADS).

8. Aircraft highlights:

- Penetration center fix measured a central pressure of 998 mb, estimated surface winds of 50 kt and an eye diameter of 30-50 nmi at 31.8N, 72.3W at 1407Z (WALLET).
- Penetration center fix measured a central pressure of 995 mb, estimated surface winds of 45 kt and an eye diameter of 30 nmi at 32.2N, 72W at 1815Z (WALLET).
- Penetration center fix measured a central pressure of 997 mb and estimated surface winds of 65 kt at 32.7N, 71.2W at 2353Z (WALLET).

9. Satellite highlights:

- ESSA II (Bermuda) made a center at 31.8N, 73.5W at 1130Z (WALLET).
- ESSA II (NESC) made a center at 31.5N, 72.5W at 1130Z (WALLET).
- ESSA V made a center at 32N, 72W at 1955Z (WALLET).
- ESSA VI made a center at 32N, 72.5W (no time given) (WALLET).

10. Discussion:

- ATSR: "She then moved on a track slightly south of east for about 24 hours before coming back to the northeast track and accelerating in forward speed."
- Reanalysis: Satellite images showed that the westerly shear had diminished on the 22nd and the tropical cyclone had become better organized with an eye visible. Despite the improvement in appearance, penetration center fixes by reconnaissance aircrafts indicated that the central pressure had not decreased nor did they report an increase in the estimated surface winds. A central pressure of 998 mb was measured at 1407Z and 997 mb at 1815Z on the 22nd. The original 60 kt HURDAT intensity is retained at 18Z as a compromise between the aircraft data and the hurricane-like appearance in satellite imagery.

June 23:

6. Maps and old HURDAT:

- HWM analyzes a tropical storm of at most 1008 mb at 35.2N, 68.2W with a stationary frontal boundary to the northeast at 12Z.
- HURDAT lists a 65 kt hurricane at 34.7N, 68.4W at 12Z.
- Microfilm shows a hurricane of at most 1004 mb at 34.8N, 68.5W at 12Z.

7. Ship highlights:

- 50 kt E and 1004 mb at 33N, 71.5W at 00Z (COADS).

8. Aircraft highlights:

- Penetration center fix measured a central pressure of 995 mb at 33.8N, 71W at 06Z (WALLET).
- Penetration center fix measured a central pressure of 992 mb, estimated surface winds of 60 kt and an eye diameter of 25 nmi at 34.8N, 68.4W at 1215Z (WALLET).
- Penetration center fix measured a central pressure of 991 mb, estimated surface winds of 70 kt and an eye diameter of 30 nmi at 35.5N, 64.5W at 2330Z (WALLET).

9. Satellite highlights

- ESSA II made a center at 35N, 68.5W at 12Z (WALLET).
- ESSA VI made a center at 35N, 68W at 1440Z (WALLET).
- ESSA V made a center at 35.5N, 66W at 2230Z (WALLET).

10. Discussion:

- MWR: "Brenda encountered the midlatitude westerlies on the 23rd near latitude 35.0°N, reaching minimal hurricane force for a little over a day in the Atlantic, during which time it passed about 200 mi north of Bermuda. Highest wind was estimated to be 80 mi/hr by Air Force reconnaissance on the 23rd."
- ATSR: "BRENDA intensified to hurricane intensity on 23 June some 200 miles northwest of Bermuda. She maintained hurricane intensity for little more than a day as she moved north of Bermuda at about 20 knots and headed for the Azores."
- Reanalysis: Penetration center fixes at 2353Z on the 22nd and 06Z on the 23rd measured a central pressure of 997 mb and 995 mb, respectively. Due to the increasing forward speed and stronger estimated surface winds, intensities of 55 kt and 60 kt, are analyzed at 00Z and 06Z on the 23rd, respectively. Down from 60 kt at 00Z, a minor intensity change, and same at 06Z from the original HURDAT. A reconnaissance aircraft investigated Brenda at 1215Z on the 23rd measuring a central pressure of 992 mb, estimating surface winds of 60 kt and an eye diameter of 25 nmi. A central pressure of 992 mb suggests maximum surface winds of 56 kt from the north of 25N and 60 kt from the north of 35N Landsea et al. pressure-wind relationships. An eye diameter of 25 nmi suggests an RMW of about 19 nmi and the climatological value is 30 nmi. Based on a forward speed of about 16 kt and small RMW, an intensity of 65 kt is analyzed at 12Z on the 23rd, same as originally shown in HURDAT. Brenda is analyzed to have become a hurricane at 12Z on the 23rd, same as originally shown in HURDAT. Satellite images showed a compact tropical cyclone with a well-organized CDO and a hint of an eye.

June 24:

5. Maps and old HURDAT:

- HWM analyzes a hurricane of at most 1008 mb at 36.2N, 59W with a frontal boundary to the north at 12Z.
- HURDAT lists a 65 kt hurricane at 35.6N, 59.3W at 12Z.
- Microfilm shows a hurricane of at most 1008 mb at 35.5N, 59W with a frontal boundary to the north at 12Z.

6. Ship highlights:

- 45 kt SE and 1012 mb at 36N, 61.5W at 00Z (COADS).
- 40 kt SE and 1003 mb at 36N, 61.5W at 06Z (COADS).
- 45 kt NW and 1008 mb at 35N, 60W at 12Z (micro).
- 45 kt SW at 34.2N, 55W at 34.2N, 55W at 22Z (micro).

7. Aircraft highlights:

- Penetration center fix measured a central pressure of 990 mb and estimated an eye diameter of 20 nmi at 35.3N, 62.1W at 0545Z (WALLET).
- Penetration center fix measured a central pressure of 990 mb, estimated surface winds of 60 kt and an eye diameter of 14 nmi at 35.5N, 59.4W at 1143Z (WALLET).
- Penetration center fix measured a central pressure of 1000 mb, estimated surface winds of 55 kt and an eye diameter of 30 nmi at 35.6N, 54.6W at 2240Z (WALLET).
- Penetration center fix measured a central pressure of 997 mb at 35.6N, 5W at 2329Z (WALLET).

8. Satellite highlights:

- ESSA V made a center at 35N, 55.5W at 1919Z (WALLET).

9. Discussion:

- MWR: "…the lowest pressure measured was 990 mb early on the 24th."
- ATSR: "BRENDA was downgraded to a tropical storm on 24 June as she moved over colder water and was cut off from the very moist tropical air by an extension of high pressure to the south."
- Reanalysis: Brenda continued to increase in forward speed on the 24th. A penetration center fix measured a central pressure of 991 mb, estimated surface winds of 70 kt and an eye diameter of 30 nmi at 2330Z on the 23rd. 991 mb suggests an intensity of 58 kt from the north of 25N and 61 kt from the north of 35N pressure-wind relationships. Based on a fast forward speed of about 24 kt, an intensity of 70 kt is analyzed at 00Z on the 24th, up from 65 kt originally shown in HURDAT, a minor intensity change. 70 kt is also the peak intensity of this tropical cyclone, up from 65 kt originally shown in HURDAT, a minor intensity change. 70 kt is also analyzed at 06Z and 12Z, up from 65 kt originally shown in HURDAT, minor intensity changes. Satellite images showed a tightly curved circulation just ahead of an approaching frontal boundary displacing most of the convection to the south.

June 25:

5. Maps and old HURDAT:

- HWM analyzes a tropical storm of at most 1000 mb at 37.5N, 49.5W with a frontal boundary just to the west at 12Z.
- HURDAT lists a 60 kt tropical storm at 36.8N, 49W at 12Z.
- Microfilm shows a tropical storm of at most 1004 mb at 36.1N, 49W with a frontal boundary to the north at 12Z.

6. Ship highlights:

- 35 kt W and 1010 mb at 34.9N, 46.5W at 18Z (COADS).

7. Ship highlights:

- Penetration center fix measured a central pressure of 994 mb, estimated surface winds of 48 kt and an eye diameter of 25 nmi at 37.1N, 49.6W at 1135Z (WALLET).

8. Discussion:

- Reanalysis: The next penetration center fix measured a central pressure of 997 mb at 2329Z on the 24th. This pressure suggests an intensity of 49 kt from the north of 25N and 53 kt from the north of 35N pressure-wind relationships. Based on a forward speed of about 26 kt, an intensity of 60 kt is retained at 00Z on the 25th. The next center fix measured a central pressure of 994 mb at 1135Z on the 25th, and an intensity of 60 kt is also selected at 12Z on the 25th. Synoptic observations late on the 25th indicated that Brenda had become embedded within the nearby frontal boundary and a temperature gradient is evident at 18Z. Based on synoptic and satellite data, transition to an extratropical cyclone is analyzed at 18Z on the 25th. The original HURDAT retained Brenda as a tropical cyclone until dissipation on the 26th.

June 26:

5. Maps and old HURDAT:

- HWM analyzes an extratropical cyclone at 40N, 38W at 12Z.
- HURDAT lists a 30 kt tropical depression at 39N, 38W at 12Z (last position).
- Microfilm shows a closed low pressure of at most 1012 mb at 39N, 38W with a frontal boundary just to the north at 12Z.

6. Discussion:

- MWR: "After a day and a half the storm was cut off from the very moist tropical air by a ridge of high pressure to the south extending across most of the Atlantic. Brenda lost intensity on the 26th when it was engulfed by a strong extratropical system."
- ATSR: "BRENDA lost her tropical characteristics and became extratropical about 500 miles west of the Azores on 26 June."
- GULL POST FLIGHT SUMMARY 260210Z: "Search area in vicinity 38.5N 43.5W at 700 mb. Flight level winds indicate no closed circulation at FL. Lowest FL height 305 meters along a trough between 37.5N 44W and 39N 43.9W. Wind westerly to southwesterly across trough, lowest SLP 1006 mb by dropsonde. No organized visual or radar pattern observed. Broken CB activity 100 NM east of the storm area. No def. pattern noted."
- Reanalysis: The weakening extratropical cyclone is analyzed to have weakened below gale intensity at 06Z on the 26th, same as originally shown in HURDAT. Synoptic observations at 18Z on the 26th indicated that Brenda had lost its closed circulation and the last position is analyzed at 12Z on the 26th, same as originally shown in HURDAT. Satellite images showed that the system may have weakened into a trough earlier on the 26th and dissipation may have taken place sooner than shown.

June 27:

1. Maps and old HURDAT:

- HWM analyzes an extratropical cyclone at 49N, 44W at 12Z.

Date	Original HURDAT Central Pressure	Evidence	Changes
June 19 18Z	1012 mb	Land: 10 kt SW and 1013 mb at Orlando, FL	Retained
June 20 18Z		Penetration center fix: 1008 mb at 1645Z on June 20th	1008 mb
June 21 12Z	1005 mb	Penetration center fix: 1005 mb at 1205Z on June 21st	Retained
June 21 18Z	995 mb	Penetration center fix: 995 mb at 1848Z on June 21st	
June 22 00Z	993 mb	Penetration center fix: 993 mb at 2054Z on June 21st	Removed
June 22 12Z	998 mb	Penetration center fix: 998 mb at 1407Z on June 22nd	Retained
June 22 18Z	997 mb	Penetration center fix: 997 mb at 1815Z on June 22nd	
June 23 00Z	997 mb	Penetration center fix: 997 mb at 2353Z on June 22nd	
June 23 06Z	995 mb	Penetration center fix: 995 mb at 06Z on June 23rd	
June 23 12Z	992 mb	Penetration center fix: 992 mb at 1215Z on June 23rd	
June 24 00Z	991 mb	Penetration center fix: 991 mb at 2330Z on June 23rd	
June 24 06Z	990 mb	Penetration center fix: 990 mb at 06Z on June 24th	
June 24 12Z	990 mb	Penetration center fix: 990 mb at 0545Z on June 24th	
June 25 00Z	997 mb	Penetration center fix: 997 mb at 2329Z on June 24th	
June 25 12Z	994 mb	Penetration center fix: 994 mb at 1135Z on June 25th	

Sources: NHC microfilm maps, the Historical Weather Maps series, the COADS ship database, Monthly Weather Review, Navy reconnaissance book, Climatological Data Center, Mariners Weather Log, Satellite images from NCDC, and NHC Storm Wallets.

Tropical Storm Candy [June 22-26, 1968] – AL031968

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45530 06/22/1968 M= 5  3 SNBR= 972 CANDY       XING=1 SSS=0

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45535 06/22*  0   0   0    0*200 950  25    0*205 950  25    0*210 950  25    0*
                             *** ***  **      *** ***  **      *** ***

45540 06/23*215 960  30    0*231 960  30    0*248 961  30    0*264 966  45 1001*
45540 06/23*217 952  30    0*231 956  35    0*246 961  40    0*264 966  50 1001*
            *** ***              ***  **      ***      **               **

45545 06/24*283 972  60  999*301 978  30    0*321 978  25    0*341 969  25    0*
45545 06/24*283 972  60  995*300 976  40    0*318 978  30    0*337 969  25    0*
                         *** *** ***  **      ***      **      ***

45550 06/25*359 955  25    0*382 930  25    0*400 900  25    0*410 868  25    0*
45550 06/25*357 955  25    0*382 930  25    0*397 900  25    0*410 868  25    0*
            ***                              ***

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45555 06/26E417 828  25    0E420 790  25    0E413 760  25    0E402 745  25    0*
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U.S. Tropical Storm Landfall

06/23 2230Z 27.8N 97.1W 60 kt TX - 995 mb

Significant Revisions:

1. First position analyzed twelve hours earlier than originally shown in HURDAT based on ship observations.
2. Intensification to a tropical storm analyzed twelve hours earlier than originally shown in HURDAT based on ship and reconnaissance data.
3. Weakening to a tropical depression is analyzed six hours later than originally shown in HURDAT.
4. Dissipation analyzed twelve hours later than originally shown in HURDAT based on synoptic observations.

Daily Metadata:

June 21:

1. Maps and old HURDAT:

- HWM and microfilm does not analyze any features of interest at 12Z.
- HURDAT does not list an organized system on this date.

2. Discussion:

- MWR: "A 500-mb cutoff Low over east Texas on the 17th gradually filled. A weak trough persisted in the area until the 21st when another cutoff Low developed with the trough continuing well southward into Mexico."
- Reanalysis: Satellite images showed an area of disorganized convection over the southwestern Gulf of Mexico on the 21st.

June 22:

1. Maps and old HURDAT:

- HWM analyzes a tropical wave or trough along the western coast of the Gulf of Mexico at 12Z.
- HURDAT lists a 25 kt tropical depression at 20N, 96W at 18Z (first position).
- Microfilm shows a tropical disturbance of at most 1008 mb at 21.8N, 94.2W at 12Z.

2. Ship highlights:

- 15 kt S and 1005 mb at 20.1N, 94W at 06Z (COADS).

3. Discussion:

- MWR: "A weak shear field existed over the southwestern Gulf of Mexico and satellite pictures showed above-normal cloudiness and shower activity for several days prior to the formation of a depression off the Mexican coast on June 22."
- ATSR: "Satellite pictures showed above-normal cloudiness over the southwest Gulf of Mexico for several days prior to the formation of a tropical depression off the Mexican Coast on 22 June."
- Reanalysis: Synoptic observations indicated that a broad low-level circulation had formed early on the 22nd. The disturbance became better organized and the first position is analyzed at 06Z on the 22nd. Genesis is uncertain due to the sparse data in the Bay of Campeche. Satellite images also indicated that the system had become better organized in the last 24 hours with a large area of convection and some banding features to the north and south of the apparent center of circulation. The tropical depression was elongated north-south based on synoptic and satellite data. Observations from Tuxpan, Mexico were 4-5 mb too low based on nearby synoptic observations.

June 23:

1. Maps and old HURDAT:

- HWM analyzes a tropical depression of 1003 mb at 26N, 96.5W at 12Z.
- HURDAT lists a 30 kt tropical depression at 24.8N, 96.1W at 12Z.
- Microfilm shows a tropical cyclone of at most 1004 mb at 25.5N, 96W at 12Z.

2. Ship highlights:

- 50 kt SSE and 1000 mb at 26.7N, 96.4W at 18Z (WALLET).
- 35 kt SSE and 1004 mb at 26.3N, 95.7W at 18Z (COADS).
- 35 kt SE and 1006 mb at 27.3N, 95.4W at 22Z (COADS).

3. Land highlights:

- 40 kt SSE (maximum sustained winds) at Port Lavaca, TX at 22Z (MWR).
- 997 mb (minimum pressure) at Aransas Pass, TX at 2245Z. Winds calm and 999 mb at 2230Z (WALLET).
- 50 kt SE (maximum sustained winds) and gusts to 60 kt at Austwell, TX at 23Z-00Z (MWR).
- 37 kt ESE (maximum sustained winds) and gusts to 49 kt and 1000 mb at Victoria, TX at 2359Z (SWO).
- 50 kt (maximum sustained winds) at Long Mott, TX (time unknown) (MWR).

4. Aircraft highlights:

- Penetration center fix measured a central pressure of 1001 mb and estimated surface winds of 45 kt at 25.7N, 96.3W at 1630Z (ATSR).

5. Radar highlights:

- Brownsville, TX estimated a center fix at 25.5N, 96.3W at 15Z (WALLET).
- Brownsville, TX estimated a center fix at 26.9N, 96.7W at 1830Z (WALLET).

6. Discussion:

- MWR: "A Navy reconnaissance aircraft was dispatched on June 23 and found tropical storm Candy. The plane indicated a central pressure of 1001 mb and 52 mi/hr winds. Before the arrival of the plane, three separate and distinct circulation centers appeared on the Brownsville radar: one 40 mi north-northwest, another 125 mi south-southeast, and a third 70 mi east-southeast. The latter intensified and became Candy while the other two dissipated. The storm moved towards the north-northwest about 20 mi/hr on the 23rd and crossed the Texas coast near Port Aransas during the late afternoon. The lowest pressure reported was 997 mb at Aransas Pass, on the mainland, about 25 mi north-northeast of Corpus Christi. Winds were in excess of 60 mi/hr for nearly an hour at Austwell, just north of Port Aransas, where the peak gust recorded in the storm was 71 mi/hr. Gale force winds occurred in squalls along the coast from Corpus Christi to Galveston."
- ATSR: "During the early morning hours of 23 June, the radar at Brownsville, Texas indicated possible spiral bands northwest and southeast of their station. Pressures began to fall steadily along the southeast Texas Coast, accompanied by increasing northeasterly winds and steady rain. A Navy reconnaissance aircraft was diverted from a scheduled ALFA track soon after takeoff and preceded to investigate the depression. At 231615Z, this aircraft discovered a circulation at 25.7N, 96.3W with maximum winds of 45 knots. This depression was upgraded and Warning No. 1 was issued on tropical Storm CANDY at 231700Z. Following initial intensification, CANDY moved north-northwest at about 15 knots; however, a large high pressure system both at the surface and aloft over the southern United States caused the storm to make landfall near Port Aransas, Texas late in the day on 23 June. CANDY then weakened rapidly as she moved northward through East Texas."
- Reanalysis: Intensification to a tropical storm is analyzed at 06Z on the 23rd based on ship and aircraft reconnaissance observations later in the date. A reconnaissance aircraft investigated Candy at 1630Z on the 23rd measuring a central pressure of 1001 mb and estimated surface winds of 45 kt. A central pressure of 1001 mb suggests maximum surface winds of 42 kt from the south of 25N Brown et al. pressure-wind relationship. Based on a forward speed of 18 kt and a ship report of 50 kt at 18Z on the 23rd, an intensity of 50 kt is analyzed at 18Z on the 23rd, up from 45 kt originally shown in HURDAT, a minor intensity change. A central pressure of 1001 mb was present in the original HURDAT at 18Z on the 23rd and it is retained. Satellite images showed a large area of convection with banding features, but still elongated north-south. The fast-moving tropical storm made landfall in southern Texas around 2230Z. A central pressure of 995 mb is analyzed at landfall based in part on the report of 37 kt ESE and 1000 mb at 2359Z on the 23th in Victoria, Texas. Aransas Pass, Texas, reported a minimum pressure of 997 mb at 2245Z likely inside the radius of maximum wind (calm winds and 999 mb at 2230Z were also reported) and Austwell, Texas registered maximum sustained winds of 50 kt at 23Z. A central pressure of 995 mb suggests maximum surface winds of 56 kt from the north of 25N pressure-wind relationship. Based on a forward speed of about 20 kt, an intensity of 60 kt is analyzed at 2230Z on the 23rd and 00Z on the 24th, same as originally shown in HURDAT. 60 kt is also the peak intensity of this tropical storm, same as originally shown in HURDAT. Candy may have reached

hurricane intensity before landfall but the data is insufficient to support an upgrade.

June 24:

1. Maps and old HURDAT:
- HWM analyzes a closed low pressure of at most 1004 mb near 32N, 98W at 12Z.
- HURDAT lists a 25 kt tropical depression at 32.1N, 97.8W at 12Z.
- Microfilm shows a closed low pressure of at most 1004 mb at 31.5N, 97.8W at 12Z.

2. Ship highlights:
- 40 kt S and 1010 mb at 28.1N, 94.6W at 00Z (COADS).
- 30 kt SE and 1014 mb at 28.7N, 92.1W at 06Z (micro).

3. Land highlights:
- 25 kt SE and 1005 mb (minimum pressure) at Palacios, TX at 0059Z (MWR/SWO).
- 10 kt E and 1004 mb at Austin, TX at 06Z (micro).
- 15 kt S and 1004 mb at Waco, TX at 12Z (micro).

4. Discussion:
- MWR: "Over land, Candy weakened slowly and passed over Fort Worth early on the 24th."
- Reanalysis: A central pressure of 995 mb is added to HURDAT at 00Z on the 24th replacing the existing value of 999 mb. The tropical storm rapidly weakened over Texas but the weakening assessed in this reanalysis is more gradual than previously shown in HURDAT based on synoptic and satellite data. A satellite image taken by ESSA likely around 12Z showed a well-defined circulation over northeast Texas with convection mostly to the northeast of the center and some banding features. Weakening to a tropical depression is analyzed at 12Z on the 24th.

June 25:

1. Maps and old HURDAT:
- HWM analyzes a closed low pressure of at most 1000 mb near 40N, 91W with a warm front just to the north at 12Z.
- HURDAT lists a 25 kt tropical depression at 40N, 90W at 12Z.
- Microfilm shows a closed low pressure of at most 1000 mb at 40N, 89.5W with a frontal boundary just to the north and west at 12Z.

2. Land highlights:
a. 7 kt NW and 1001 mb at Columbia, MO at 0755Z (SWO).
b. 25 kt NW and gusts to 35 kt at Quincy, IL at 1125Z (SWO).
c. 10 kt SE and 999 mb at Springfield, IL at 1158Z (SWO).
d. 14 kt SW and 999 mb at Lafayette, IN at 1757Z (SWO).

3. Discussion:
- MWR: "The remnants accelerated towards the northeast on the 25th ahead of an approaching cold front."
- ATSR: "."
- Reanalysis: Candy continued to move rapidly to the northeast as it interacted with a frontal boundary. Synoptic observations indicated that the tropical depression remained in the warm sector of an extratropical cyclone, thus retaining its tropical characteristics. Satellite images showed a large area of convection over the Midwest of the United States.

June 26:

1. Maps and old HURDAT:

- HWM analyzes an extratropical cyclone of at most 1000 mb at 42N, 77W at 12Z.
- HURDAT lists a 25 kt extratropical depression at 42N, 80W at 06Z (last position).
- Microfilm shows an extratropical cyclone of at most 1000 mb at 41N, 76W at 12Z.

2. Land highlights:

- 14 kt SSW and 998 mb at Cleveland, OH at 00Z (SWO).
- 10 kt NNW and 997 mb at Erie, PA at 06Z (SWO).
- 15 kt SSW and 1000 mb at Harrisburg, PA at 1158Z (SWO).

3. Discussion:

- MWR: "…encountered cold air on the 26th, and lost tropical characteristics."
- Reanalysis: Transition to an extratropical cyclone occurred at 00Z on the 26th (same as originally in HURDAT) based on synoptic observations showing a pronounced temperature gradient across the circulation and east to west elongation of the circulation along the frontal boundary. The system continued to move rapidly eastward during the 26th and by early the next day, it had weakened into a trough of low pressure, thus the last position is analyzed at 18Z on the 26th, twelve hours later than originally shown in HURDAT.

June 27:

1. Maps and old HURDAT:

- HWM analyzes a stationary front over the north Atlantic extending to an extratropical cyclone over the Great Lakes and a couple of embedded low pressures at 12Z.
- Microfilm shows an extratropical cyclone of at most 1008 mb at 37.5N, 74W at 12Z.

Sources: NHC microfilm maps, the Historical Weather Maps series, the COADS ship database, Monthly Weather Review, Navy reconnaissance book, Mariners Weather Log, EV2 Surface Weather Observations, Satellite images from NCDC, and NHC Storm Wallets.

AL041968:

July 3-5: Microfilm maps show a trough or tropical wave over the central Gulf of Mexico and a frontal boundary to the north on July 3rd. HURDAT indicated that the disturbance became a tropical depression at 00Z on July 4th. Synoptic and satellite data showed that it remained disorganized, environmental pressures were high, and it did not have a closed circulation. The last position in HURDAT is at 00Z on July 5th. Satellite images on the 5th showed that the system had become absorbed by the stationary frontal boundary. Therefore, because the system did not have a closed circulation, it is removed from HURDAT. This disturbance was in Jack Beven's Lists of Suspects.

Hurricane Dolly [August 10-17, 1968] – AL051968

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45565 08/10/1968 M= 8  5 SNBR= 973 DOLLY       XING=0 SSS=0

45570 08/10*250 790  25 1013*259 800  25    0*270 805  25 1012*282 806  25    0*
45570 08/10*  0   0   0    0*259 800  30    0*270 804  30 1012*282 806  35    0*
              *   *   *    *          **          ***  **                **

45575 08/11*294 804  25 1011*306 799  25    0*318 788  30    0*329 771  30    0*
45575 08/11*295 804  35 1011*309 799  35    0*319 788  40 1004*329 773  45    0*
            ***      **      ***      **      ***      ** ****     ***  **

45580 08/12*338 752  30 1005*344 733  30    0*350 713  45  994*357 690  50    0*
45580 08/12*338 756  50    0*344 735  55    0*350 713  65  994*357 690  75    0*
                ***  **    *     ***  **                **                **

45585 08/13*364 666  65  985*370 641  65    0*376 620  65 1001*382 599  45    0*
45585 08/13*364 666  75  985*370 642  70    0*376 620  60  995*382 599  60  996*
                     **          ***  **                ** ****          **  ***

45590 08/14*388 575  55  999*393 544  60    0*398 513  70  992*402 488  65    0*
45590 08/14*388 575  60  999*393 544  70    0*398 513  75  986*402 487  75    0*
                     **               **                **  ***     ***  **

45595 08/15*406 460  65    0*407 438  65    0*408 412  65  999*409 389  65    0*
45595 08/15*405 463  75    0*407 440  70    0*408 415  65    0*409 389  60    0*
            *** ***  **          ***  **          ***      ***          **

45600 08/16*413 363  65 1006*420 340  65    0*426 316  30    0*428 295  30 1011*
45600 08/16*413 365  50    0*420 340  40    0E425 319  30    0E428 295  30 1010*
                ***  **    *          **     **** ***         *            ****

45605 08/17*428 265  30    0*  0   0   0    0*  0   0   0    0*  0   0   0    0*
45605 08/17E428 270  30    0*  0   0   0    0*  0   0   0    0*  0   0   0    0*
            *    ***
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Significant Revisions:

1. First position analyzed six hours later than originally shown in HURDAT based on synoptic observations.
2. Intensification to a tropical storm is analyzed 42 hours earlier than originally shown in HURDAT based on ship and aircraft reconnaissance observations.
3. Intensification to a hurricane is analyzed twelve hours earlier than originally shown in HURDAT based on aircraft reconnaissance observations.
4. Major changes in intensity for a stronger system analyzed on the 11th to the 13th based on aircraft reconnaissance data.
5. Weakening to a tropical storm is analyzed six hours earlier than originally shown in HURDAT based on aircraft reconnaissance data.
6. Re-intensification to a hurricane analyzed twelve hours earlier than originally shown in HURDAT based on aircraft reconnaissance data.
7. Weakening below hurricane intensity is analyzed 18 hours earlier than originally shown in HURDAT based on aircraft reconnaissance data.

8. Transition to an extratropical cyclone is analyzed on August 16th at 12Z based on synoptic observations. HURDAT originally did not show an extratropical phase.

Daily Metadata:

August 8:

1. Maps and old HURDAT:

- HWM does not analyze any features of interest at 12Z.
- HURDAT does not list an organized system on this date.
- Microfilm shows a tropical wave extended from latitude 14N-25N and longitude 69W-74W at 12Z.

2. Discussion:

- MWR: "A tropical wave that emerged from the African coast on July 31 provided the initial impulse from which Dolly eventually developed."
- Reanalysis: A sharp tropical wave reached the eastern Bahamas on the 8th and satellite images showed a large area of disorganized convection.

August 9:

1. Maps and old HURDAT:

- HWM analyzes a tropical wave over the central Bahamas at 12Z.
- HURDAT does not list an organized system on this date.
- Microfilm shows a tropical wave along longitude 77W, extended from latitude 16N-25N at 12Z.

2. Discussion:

- MWR: "This wave traversed the tropical Atlantic in rather typical fashion, reaching the Florida Straits on August 9. An upper cold Low, which had formed north of Hispaniola on the 6th, moved west-northwestward through the 10th, about 5° lat. ahead of the wave, with an anticyclone southeast or over the wave. A strong anticyclone over the Middle Atlantic States caused subsidence and gradual warming over the Southeastern States during this time, with warming over south Florida by the 9th. The upper Low moved into the warming environment with the tropospheric wind shear gradually becoming weak anticyclonic from the weak cyclonic shear of the previous 2 days."
- ATSR: "The eastern wave that spawned DOLLY was tracked by satellite from Africa across the Atlantic over Cuba and through the Bahamas during the first part of August. On 9 August, as it approached Florida, the wave intensified, forming a tropical depression which moved northward across eastern Florida, then turned northeastward out to sea."
- Reanalysis: Satellite images showed that the disturbance continued becoming better organized on the 9th as it reached the western Bahamas. Synoptic observations indicated that it did not have a closed circulation.

August 10:

1. Maps and old HURDAT:

- HWM analyzes a closed low pressure of at most 1014 mb at 27N, 81W at 12Z.
- HURDAT lists a 25 kt tropical depression at 27N, 80.5W at 12Z.
- Microfilm shows a tropical disturbance of at most 1014 mb at 26.5N, 80.7W at 12Z.

2. Ship highlights:

- 35 kt SSE and 1015 mb at 28N, 78.8W at 18Z (COADS).

3. Discussion:

- MWR: "A depression formed just off the southeast Florida coast late on the 9th. The depression moved inland just north of Fort Lauderdale during the night and back out to sea during the afternoon of August 10, ahead of a trough in the westerlies approaching the eastern United States. Squalls with gusts to 30 mi/hr accompanied the depression as it hugged the coast."
- Reanalysis: Genesis is analyzed at 06Z on the 10th as a 30 kt tropical depression, six hours later than originally shown in HURDAT based on surface observations. Soon after forming, it made landfall in southeast Florida and continued to move northward. A central pressure of 1012 mb was present in the old HURDAT at 12Z on the 10th and has been retained based on synoptic observations. Intensification to a tropical storm is analyzed at 18Z on the 10th based on a ship report of 35 kt about 120 n mi east of the center. A review of the ship's reports indicated that they were consistent with the reports of nearby ships. Furthermore, satellite images showed that the system had become much better organized from the day before with convection more concentrated and some banding features, especially over the eastern quadrant. Late on the 10th, the center of Dolly moved back over the Atlantic Ocean.

August 11:

1. Maps and old HURDAT:

- HWM analyzes a closed low pressure of at most 1012 mb at 32N, 79W with a cold front to the north at 12Z.
- HURDAT lists a 30 kt tropical depression at 31.8N, 78.8W at 12Z.
- Microfilm shows a tropical cyclone of at most 1008 mb at 31.7N, 79W at 12Z.

2. Ship highlights:

- 35 kt SW and 1012 mb at 31.1N, 77.1W at 18Z (COADS).

3. Aircraft highlights:

a. Penetration center fix measured a central pressure of 1004 mb and estimated surface winds of 30 kt at 31.9N, 78.9W at 1216Z (WALLET).

4. Radar highlights:

a. Daytona Beach, FL estimated a center fix at 29.8N, 80.2W at 0145Z (WALLET).
b. Charleston, SC estimated a center fix at 30.6N, 79.8W at 0545Z (WALLET).
c. Charleston, SC estimated an eye diameter of 40 n mi at 31.6N, 78.8W at 1140Z (WALLET).

5. Discussion:

- MWR: "The depression moved northeastward, moving parallel to and about 125 mi off the Georgia and Carolina coasts. Weather Bureau radars at Daytona Beach, Charleston, and Hatteras had the depression under surveillance during this time. At this stage, the future of the depression depended on whether or not it could avoid absorption by a cold front approaching from the northwest. It was still moving through a zone of anticyclonic low tropospheric wind shear and over warm waters, making the prospect for intensification favorable if the circulation remained detached from the frontal zone."
- Reanalysis: On the 11th, Dolly accelerated to the northeast ahead of an approaching frontal boundary. A central pressure of 1011 mb was present in the old HURDAT at 00Z on the 11th and has been retained based on synoptic observations. The first reconnaissance aircraft investigated the tropical

storm at 1216Z measuring a central pressure of 1004 mb and estimating surface winds of 30 kt. A central pressure of 1004 mb suggests maximum surface winds of 36 kt from the north of 25N Brown et al. pressure-wind relationship. An intensity of 40 kt is selected at 12Z on the 11th, up from 30 kt originally shown in HURDAT, a minor intensity change. This assessment is based in part on a forward speed of about 14 kt and the system's small size. A central pressure of 1004 mb was added to HURDAT at 12Z on the 11th.

August 12:

1. Maps and old HURDAT:

- HWM analyzes a tropical storm of at most 1000 mb at 35.9N, 70.5W with a cold front just to the northwest at 12Z.
- HURDAT lists a 45 kt tropical storm at 35N, 71.3W at 12Z.
- Microfilm shows a tropical cyclone of at most 1008 mb at 34.7N, 71.2W with a frontal boundary just to the northwest at 12Z.

2. Ship highlights:

- 35 kt WSW and 1011 mb at 32.3N, 77.1W at 00Z (COADS).
- 35 kt SW and 1014 mb at 32.2N, 73.8W at 03Z (COADS).
- 35 kt SW and 1014 mb at 31.7N, 73.8W at 06Z (COADS).
- 40 kt SW and 1011 mb at 33.3N, 71.4W at 12Z (COADS).

3. Aircraft highlights:

- Penetration center fix measured a central pressure of 994 mb, estimated surface winds of 45 kt and an eye diameter of 25 n mi at 35N, 71.1W at 1240Z (WALLET).
- Penetration center fix measured a central pressure of 985 mb, estimated surface winds of 65 kt and an eye diameter of 15 n mi at 36.3N, 67.2W at 2225Z (WALLET).

4. Radar highlights:

- Hatteras, NC estimated an eye diameter of 50 n mi at 33.9N, 73.4W at 0540Z (WALLET).

5. Discussion:

- MWR: "Satellite photographs and Navy reconnaissance reports on August 12 revealed that this was the case, and tropical storm Dolly was christened during the morning of that day. Low-level inflow had been generated again late on the 11th as environmental pressures rose behind the passing upper trough. The storm was embedded in a well-established zonal flow pattern, moving east-northeastward about 20 mi/hr. This course and speed were to continue with only minor fluctuations throughout the life history of the storm, carrying it some 2,600 mi along a remarkably uniform track. Rapid deepening occurred on August 12 with the central pressure falling to 994 mb by 0900 EDT, although highest winds were only about 50 mi/hr as the circulation remained somewhat poorly organized due to the frontal effects. Dolly attained hurricane force late the same day but was able to maintain it for only about 24 hr, having been cut off somewhat from the tropical air mass by the Atlantic ridge."
- ATSR: "The depression intensified slowly as it moved northeast over the Gulf Stream waters. The satellite picture on 11 August shows the depression near 32N, 78W with a weak polar front approaching from the north."
- ATSR: "The depression was upgraded to tropical storm DOLLY the following day [12]. Good outflow aloft allowed DOLLY to reach minimum hurricane intensity late on 12 August…"

- Reanalysis: A central pressure of 1005 mb was present in the original HURDAT at 00Z on the 12th and has been removed based on ship and aircraft reconnaissance data indicating that the central pressure of Dolly was lower at this time. A reconnaissance aircraft investigated Dolly at 1240Z on the 12th measuring a central pressure of 994 mb, estimating surface winds of 45 kt and an eye diameter of 25 n mi. A central pressure of 994 mb suggests maximum surface winds of 53 kt from the north of 25N pressure-wind relationship and 58 kt from the north of 35N Landsea et al. pressure-wind relationship. An eye diameter of 25 n mi suggests an RMW of about 19 n mi and the climatological value is 30 n mi. Based on a forward speed of about 23 kt, an intensity of 65 kt is analyzed at 12Z on the 12th, up from 45 kt originally in HURDAT, a major intensity change. It is interesting to note that HURDAT originally showed Dolly becoming a tropical storm at 12Z on the 12th, but the data suggests that it became a hurricane at this time. Satellite images indicated that Dolly was just south of a frontal boundary, as depicted in the synoptic maps, and consisted of a well-organized area of convection with good outflow to the south and a hint of an eye.

August 13:

1. Maps and old HURDAT:
- HWM analyzes a hurricane of at most 1012 mb at 37.6N, 61.5W with a frontal boundary just to the northwest at 12Z.
- HURDAT lists a 65 kt hurricane at 37.6N, 62W at 12Z.
- Microfilm shows a hurricane of at most 1012 mb at 37.5N, 61.8W with a frontal boundary just to the north at 12Z.

2. Ship highlights:
- 40 kt WSW and 1015 mb at 34.5N, 66.5W at 00Z (COADS).
- 40 kt NE and 1014 mb at 37.3N, 67W at 03Z (COADS).
- 35 kt SW and 1018 mb at 35.3N, 62.5W at 12Z (COADS).

3. Aircraft highlights:
a. Penetration center fix extrapolated a central pressure of 1001 mb from 700 mb, estimated surface winds of 65 kt and an eye diameter of 18-27 n mi at 37.6N, 61.3W at 13Z (WALLET). (However, using today's formulas for computing sea level pressure, this gives a central pressure of 995 mb.)
b. Penetration center fix extrapolated a central pressure of 1001 mb from 700 mb and estimated surface winds of 45 kt at 38.3N, 59.9W at 1745Z (WALLET). (However, using today's formulas for computing sea level pressure, this gives a central pressure of 996 mb.)

4. Discussion:
- ATSR: "… on 13 August, a 200 mb trough in the westerlies overtook her and she temporarily lost hurricane intensity."
- Reanalysis: Dolly continued to move away from the United States into the north Atlantic at a fast-forward speed on the 13th. A reconnaissance aircraft measured a central pressure of 985 mb, estimating surface winds of 65 kt and an eye diameter of 15 n mi at 2225Z on the 12th. A central pressure of 985 mb suggests maximum surface winds of 68 kt from the north of 35N pressure-wind relationship. An eye diameter of 15 n mi suggests an RMW of about 11 n mi and the climatological value is 29 n mi. Based on a forward speed of about 25 kt and small RMW, an intensity of 75 kt is analyzed at 00Z on the 13th, up from 65 kt originally in HURDAT, a minor intensity change. 75 kt is also the peak intensity of Hurricane Dolly, up from 70 kt originally shown in HURDAT on the 14th at 12Z. Another penetration center fix extrapolated a central pressure of

995 mb (corrected) from 700 mb, estimated surface winds of 65 kt and eye diameter of 18-27 n mi at 13Z. A central pressure of 995 mb suggests maximum surface winds of 56 kt from the north of 35N pressure-wind relationship. An eye diameter of 18-27 n mi suggests an RMW of about 14-20 n mi and the climatological value is 35 n mi. Based on a forward speed of about 22 kt and small RMW, an intensity of 60 kt is selected at 12Z on the 13th, down from 65 kt originally shown in HURDAT, a minor intensity change. Satellite images showed that Dolly was experiencing westerly shear with most of the convection over the eastern quadrant. Another penetration center fix extrapolated a central pressure of 996 mb (corrected) from 700 mb and estimated surface winds of 45 kt at 1745Z. An intensity of 60 kt is also selected at 18Z on the 13th, up from 45 kt originally in HURDAT, a minor intensity change.

August 14:

1. Maps and old HURDAT:

- HWM analyzes a closed low pressure of at most 1014 mb at 40.5N, 50.5W with a frontal boundary going through the center at 12Z.
- HURDAT lists a 70 kt hurricane at 39.8N, 51.3W at 12Z.
- Microfilm shows a hurricane of at most 1016 mb at 39.5N, 51.8W with a frontal boundary just to the north at 12Z.

2. Ship highlights:

- 40 kt N and 1015 mb at 40.3N, 59W at 06Z (COADS).
- 35 kt NW and 1017 mb at 38.8N, 55.7W at 12Z (COADS).

3. Aircraft highlights:

- Penetration center fix measured a central pressure of 999 mb and estimated an eye diameter of 12-20 n mi at 38.8N, 57.5W at 00Z (WALLET).
- Penetration center fix measured a central pressure of 992 mb and estimated surface winds of 90 kt at 39.8N, 51.1W at 1230Z (WALLET). (However, using today's formulas for computing sea level pressure, this gives a central pressure of 986 mb.)

4. Discussion:

- MWR: "After being downgraded to a tropical storm for about 36 hr, Dolly once again became a hurricane. By this time Dolly was nearly at lat. 40°N. At such northerly latitude, baroclinic deepening would seem to be a logical explanation. A careful examination of the surface data beginning at 00 GMT on the 14th, shows dewpoint temperatures in the southwesterly flow into the storm as high as 77°F (25°C) from near the storm southwestward almost to Bermuda. Another contributing feature could be a break in the Atlantic ridge allowing moist air also to come up around the Azores high-pressure cell. She attained her greatest force on August 14, when an Air Force aircraft measured winds of 81 mi/hr at the 700-mb flight level and a central pressure of 992 mb."
- ATSR: "As more favorable divergent flow returned at 200 mbs, DOLLY regained hurricane strength on 14 August near 40N, 52W and continued on an east-northeast track."
- Reanalysis: A reconnaissance aircraft measured a central pressure of 999 mb and estimated an eye diameter of 12-20 n mi at 00Z on the 14th. A central pressure of 999 mb suggests maximum surface winds of 50 kt from the north of 35N pressure-wind relationship. An eye diameter of 12-20 n mi suggests an RMW of about 8-15 n mi and the climatological value is 35 n mi. Based on a forward speed of about 29 kt and small RMW, an intensity of 60 kt is analyzed at 00Z on the 14th, up from 55 kt originally in HURDAT, a minor intensity change. The next penetration center fix measured a central pressure of 986 mb (corrected)

and estimated surface winds of 90 kt at 1230Z on the 14th. A central pressure of 986 mb suggests maximum surface winds of 67 kt from the north of 35N pressure-wind relationship. Based on a forward speed of about 29 kt and small RMW, an intensity of 75 kt is analyzed at 12Z on the 14th, up from 70 kt originally in HURDAT, a minor intensity change. 75 kt is also the second peak intensity of Dolly. Satellite images continued to show a system affected by westerly shear over the north Atlantic.

August 15:

1. Maps and old HURDAT:
- HWM analyzes a hurricane of at most 1008 mb at 41.5N, 42W with a frontal boundary just to the north at 12Z.
- HURDAT lists a 65 kt hurricane at 40.8N, 41.2W at 12Z.
- Microfilm shows a hurricane of at most 1016 mb at 41N, 41.7W with a frontal boundary just to the north at 12Z.

2. Ship highlights:
- 35 kt W and 1011 mb at 40.1N, 47.9W at 00Z (COADS).

3. Aircraft highlights:
- Radar center fix estimated an eye diameter of 8 n mi at 40.7N, 46.3W at 0038Z (WALLET).
- Penetration center fix measured a central pressure of 999 mb and estimated surface winds of 75 kt at 41N, 41.7W at 1226Z (WALLET). (The minimum pressure was 999 mb from a dropsonde, which is supported by the 850 mb height data on the drop. The 700 mb height and temperature in the vortex message suggest a pressure of 990 mb. However, the post-flight summary says the minimum 700 mb height was 30 n mi southwest of the eye, which makes the 990 mb extrapolation suspect. Because of the uncertainty involved, the 999 mb central pressure is removed from HURDAT.)
- Penetration center fix [estimation: unable to positively locate eye] at 42.8N, 37.8W at 22Z (WALLET).

4. Satellite highlights:
- ESSA 5 estimated a center fix at 41N, 38.5W at 2019Z (WALLET).

5. Discussion:
- Reanalysis: A reconnaissance aircraft estimated surface winds of 75 kt at 1226Z on the 15th. An intensity of 65 kt is retained at 12Z on the 15th. Weakening below hurricane intensity is analyzed at 18Z on the 15th, eighteen hours earlier than originally shown in HURDAT based on synoptic and aircraft reconnaissance observations. Satellite images showed a small tropical cyclone with most of the convection removed from the center due to westerly shear. The displacement between the 700 mb and surface centers at 1226Z suggests the possibility that extratropical transition was underway at the time of the fix. Another reconnaissance aircraft investigated Dolly late on the 15th but was not able to locate the center. It measured a minimum pressure of 1006 mb, which was present in HURDAT at 00Z on the 16th and has been removed.

August 16:

1. Maps and old HURDAT:
- HWM analyzes a tropical storm of at most 1008 mb at 43.7N, 29.2W at 12Z.
- HURDAT lists a 30 kt tropical depression at 42.6N, 31.6W at 12Z.
- Microfilm shows a tropical storm of at most 1016 mb at 44.2N, 27W at 12Z.

2. Aircraft highlights:

- Penetration center fix measured a central pressure of 1011 mb at 42.8N, 28.5W at 21Z (WALLET).

3. Discussion:

- MWR: "These conditions seemed to continue until the 16th. Dolly finally became extratropical some 300 mi north of the Azores on August 16."
- ATSR: "By 16 August, DOLLY again began to weaken and lost hurricane intensity as she moved over colder water and was influenced by cold air aloft."
- Reanalysis: Transition to an extratropical cyclone is analyzed at 12Z on the 16th while north of the Azores based on the development of a temperature gradient across the circulation. Satellite images showed that Dolly had become less organized just ahead of a large extratropical cyclone. Weakening below gale-force winds is analyzed at 12Z on the 16th, same as originally shown in HURDAT. It is interesting to note that HURDAT originally showed Dolly weakening from 65 kt to 30 kt in a 6-hour period, from 06Z to 12Z on the 16th. The data available does not suggest such a rapid weakening took place. A reconnaissance aircraft measured a central pressure of 1011 mb at 21Z on the 16th, but the reconnaissance data plotted in microfilm suggests that the central pressure was lower, thus the central pressure of 1011 mb originally present in HURDAT at 00Z on the 17th has been removed.

August 17:

1. Maps and old HURDAT:

- HWM analyzes a closed low pressure of at most 1012 mb at 42.5N, 21W at 12Z.
- HURDAT lists a 30 kt tropical depression at 42.8N, 26.5W at 00Z (last position).
- Microfilm shows a closed low pressure of at most 1012 mb at 43N, 21W at 12Z.

2. Discussion:

- ATSR: "She became extratropical on 17 August north of the Azores."
- Reanalysis: Synoptic observations are sparse in the northeast Atlantic but it suggests that Dolly had dissipated by 12Z. The last position is analyzed at 00Z on the 17th, same as originally shown in HURDAT. Satellite images showed a small and disorganized area of convection just northwest of Portugal, ahead of a large extratropical cyclone.

August 18:

1. Maps and old HURDAT:

- HWM analyzes a large extratropical cyclone in the north Atlantic and Dolly appears to have dissipated at 12Z.

Date	Original HURDAT Central Pressure	Evidence	Changes
Aug 10 12Z	1012 mb	Land: 15 kt SE and 1014 mb at Fort Pierce, FL	Retained
Aug 11 00Z	1011 mb	Ship: 25 kt SE and 1014 mb at 29.9N, 79.7W	
Aug 11 12Z		Penetration center fix: 1004 mb at 1216Z	1004 mb
Aug 12 00Z	1005 mb	No penetration center fix around this time	Removed

Aug 12 12Z	994 mb	Penetration center fix: 994 mb at 1240Z	Retained
Aug 13 00Z	985 mb	Penetration center fix: 985 mb at 2225Z on Aug 12th	
Aug 13 12Z	1001 mb	Penetration center fix: 995 mb (corrected) at 13Z	
Aug 13 18Z		Penetration center fix: 996 mb (corrected) at 1745Z	996 mb
Aug 14 00Z	999 mb	Penetration center fix: 999 mb at 00Z	Retained
Aug 14 12Z	992 mb	Penetration center fix: 986 mb (corrected) at 1230Z	986 mb
Aug 15 12Z	999 mb	Penetration center fix: 999 mb at 1226Z. However, substantial uncertainty with this value suggests that it is unreliable	Removed
Aug 16 00Z	1006 mb	No data near the center	Removed
Aug 16 18Z	1011 mb	Ship: 20 kt ENE and 1012 mb at 43.2N, 29.5W	1010 mb

Sources: NHC microfilm maps, the Historical Weather Maps series, the COADS ship database, Monthly Weather Review, Navy reconnaissance book, Mariners Weather Log, Satellite images from NCDC, and NHC Storm Wallets.

Tropical Depression [August 26-31, 1968] – AL061968

```
45285 08/26/1968 M= 7   6 SNBR= 968 UNNAMED     XING=0 SSS=0
45285 08/26/1968 M= 6   6 SNBR= 968 UNNAMED     XING=0 SSS=0
                    *

45290 08/26*260 875  25    0*261 870  25    0*266 865  25    0*271 859  25    0*
45290 08/26*  0   0   0    0*  0   0   0    0*266 870  25    0*269 870  25    0*
                                                 ***          *** ***

45290 08/27*274 851  25    0*278 846  25    0*281 840  25    0*289 835  25    0*
45290 08/27*272 870  25    0*275 866  25    0*278 860  25    0*282 850  25    0*
            *** ***          *** ***          *** ***          *** ***

45290 08/28*291 830  25    0*289 829  25    0*280 828  25    0*275 827  25    0*
45290 08/28*285 842  25    0*287 835  25    0*288 831  25    0*288 829  25    0*
            *** ***          *** ***          *** ***          *** ***

45290 08/29*271 825  25    0*272 824  25    0*275 823  25    0*278 821  25    0*
45290 08/29*288 829  25    0*287 830  25    0*285 829  25    0*282 826  25    0*
            *** ***          *** ***          *** ***          *** ***

45290 08/30*280 820  25    0*282 820  25    0*283 820  25    0*289 820  25    0*
45290 08/30*279 822  25    0*278 820  25    0*279 820  25    0*282 820  25    0*
            *** ***          ***              ***              ***

45290 08/31*291 818  25    0*295 818  25    0*301 817  25    0*305 811  25    0*
45290 08/31*285 819  25    0*290 817  25    0*294 815  25    0*297 813  25    0*
            *** ***          *** ***          *** ***          *** ***

45290 09/01*310 810  25    0*  0   0   0    0*  0   0   0    0*  0   0   0    0*
(The 1st has been deleted from HURDAT2.)

45290 TD
```

Significant Revisions:

1. Large west-southwestward adjustments were made to the position from 18Z on the 26th through 00Z on the 28th.

Daily Metadata:

August 25th:

Maps and Old HURDAT:

1. The 12Z microfilm map showed a tropical wave over the south central Gulf of Mexico and the Yucatan of Mexico.

August 26th:

Maps and old HURDAT:

1. The 12Z microfilm map showed an open Low near 27N92.5W and was stamped "TD" for the first time.
2. HURDAT indicated a tropical depression at 26.6N 86.5W at 12Z.

Discussion – Reanalysis: HURDAT began the system at 00Z on the 26th, though observations at that time indicated that the system was not yet closed. Revisions show genesis at 12Z, corresponding with the same time that the microfilm indicated "TD" for operational tropical depression status. Satellite imagery shows disorganized deep convection was present in the Gulf of Mexico. The position at 18Z is adjusted substantially toward the west-southwest based upon the surface observations.

August 27th:

Maps and old HURDAT:

1. The 12Z microfilm map indicates a "TC" near 27N86W with a trough extending to the northeast.
2. HURDAT indicated a tropical depression at 28.1N 84.0W at 12Z.

Discussion – Reanalysis: Observation show a weak though closed circulation over the eastern Gulf of Mexico. There is some curvature present in the deep convection over the system. The positions throughout the day are adjusted substantially toward the west-southwest based upon the surface observations.

August 28th:

Maps and old HURDAT:

1. The 12Z microfilm map indicates a "TC" near 29N83W with a 1012 mb closed contour at 12Z, with a trough extending both toward the east-northeast and the southwest.
2. HURDAT indicated a tropical depression at 28.0N 82.8W at 12Z.

Ship highlights:

- 40 kt SSW and 1009 mb at 26.3N 84.6W at 12Z (ICOADS). (No ship history is available with this observation. It appears to be erroneous, given the nearby ship and station observations.)

Discussion:

1. **Monthly Weather Review:** "The tropical depression that formed in the northeast Gulf

of Mexico on August 28 moved slowly across the Florida peninsula by the 31st It produced over 15 in. of rain in the Jacksonville area, which caused extensive local flooding."

2. **Reanalysis:** Observations suggest that the system remains closed, though troughing is also present across the system. The position at 00Z is adjusted substantially toward the west-southwest based upon the surface observations. A large band of deep convection was present over the central and northeastern Gulf of Mexico, across Florida, and into the Atlantic waters.

August 29th:

Maps and old HURDAT:

1. The 12Z microfilm map indicates at "TC" near 28N83W at 12Z with a NE-SW oriented trough extending through it.
2. HURDAT indicated a tropical depression at 27.5N 82.3W at 12Z.

Discussion – Reanalysis: Observations indicate a closed low likely exists, though the system remains embedded along a lengthy surface trough. Satellite imagery indicates substantial deep convection mainly over and to the northeast of the center.

August 30th:

Maps and old HURDAT:

1. The 12Z microfilm maps shows a "TC" centered near 28N83W within a 1014 mb closed isobar. A stationary front is located northeast of the low.
2. HURDAT indicated a tropical depression at 30.1N81.7W.

Discussion

1. **Monthly Weather Review:** "A tornado 10 mi north of Daytona Beach early on the 30th destroyed a motel and several houses."
2. **Reanalysis:** Observations continue to suggest that a closed low is present. Some deep convection remains in conjunction with the tropical depression.

August 31st:

Maps and old HURDAT:

1. The 12Z microfilm maps shows a "TC" centered near 28.5N82.5W within a 1014 mb closed isobar. A stationary front is located northeast of the low.
2. HURDAT indicated a tropical depression at 28.3N82.0W.

Discussion – Reanalysis: Observations continue to suggest that a closed low is present. Little deep convection remains in association with the system.

September 1st:

Maps and old HURDAT:

1. The 12Z microfilm maps shows no features of interest.

2. HURDAT's last position was at 00Z.

Discussion – Reanalysis: Observations suggest that the system had dissipated by 00Z on the 1st.

Sources: NHC microfilm maps, the COADS ship database, Monthly Weather Review, Mariners Weather Log, Satellite images from NCDC, and NHC Storm Wallets.

AL071968:

September 6-11: A tropical wave moved off the African coast during the first few days of September and satellite data suggest that convection increased in association with the disturbance. The first position in HURDAT is as a 25 kt tropical depression at 00Z on the 7th. Synoptic observations do not suggest it developed a closed circulation as it moved westward over the central Atlantic and it remained embedded within the ITCZ. Satellite images show that convection decreased on the 8th and 9th. A reconnaissance aircraft investigated the system on the 10th as reported in the microfilm maps and did not find a closed circulation. The last position in HURDAT is at 12Z on the 10th as a 25 kt tropical depression. The disturbance reached the Lesser Antilles on the 11th and dissipated the next day due to strong westerly shear as illustrated in the satellite images. Therefore, because the system did not have a well-defined low-level circulation, it is removed from HURDAT. This disturbance was in Jack Beven's Lists of Suspects.

Tropical Storm Edna [September 14-17, 1968] – AL081968

```
45615 09/11/1968 M= 9  8 SNBR= 974 EDNA        XING=0 SSS=0
45615 09/14/1968 M= 4  8 SNBR= 974 EDNA        XING=0 SSS=0
         **         *

(September 11th and 12th are removed)
45620 09/11*  0   0   0    0*  0   0   0    0*  0   0   0    0*127 211  25    0*
45625 09/12*130 223  25    0*134 238  25    0*137 252  30    0*139 263  30    0*

45630 09/13*140 272  30    0*142 283  30    0*143 292  30    0*145 300  30    0*
45630 09/13*  0   0   0    0*  0   0   0    0*  0   0   0    0*145 300  25    0*
            *** ***  **      *** ***  **      *** ***  **                **

45635 09/14*148 309  30    0*150 318  30    0*153 329  30    0*156 340  30    0*
45635 09/14*148 309  30    0*150 319  35    0*153 329  45    0*156 339  55    0*
                                 ***  **                **          ***  **

45640 09/15*158 349  50 1005*160 358  55    0*162 367  55    0*164 377  55    0*
45640 09/15*158 349  60    0*160 358  60    0*162 367  60    0*163 377  55    0*
                     **    *          **                **      ***

45645 09/16*164 386  55    0*165 395  55    0*165 407  55    0*166 417  55    0*
45645 09/16*164 386  55    0*165 396  50    0*165 407  45    0*166 417  40    0*
                                 ***  **                **                **

45650 09/17*167 428  55    0*168 439  55    0*169 450  50    0*170 462  40    0*
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```
45650 09/17*167 428  35 1012*168 439  30    0*169 450  30    0*170 462  25    0*
                     ** ****           **                 **                 **

(September 18th and 19th are removed)
45655 09/18*171 477  40    0*172 492  35    0*173 511  30 1013*174 527  25    0*
45660 09/19*176 543  25    0*178 558  25    0*  0   0   0    0*  0   0   0    0*

45665 TS
```

Significant Revisions:

1. September 11th, 12th, 18th and 19th are removed from HURDAT based on synoptic and aircraft reconnaissance data.
2. Intensification to a tropical storm is analyzed eighteen hours earlier than originally shown in HURDAT based on ship observations.
3. Weakening to a tropical depression is analyzed 30 hours earlier than originally shown in HURDAT based on ship and aircraft reconnaissance data.
4. Major intensity changes are indicated on September 14th at 18Z and September 17th from 00Z to 18Z.

Daily Metadata:

September 10:

1. Maps and old HURDAT:

- HWM and microfilm does not show an organized system at 12Z.
- HURDAT does not list an organized system on this date.

2. Discussion:

- MWR: "The disturbance which was to become tropical storm Edna made its appearance over the Atlantic when it moved off the African coast late on September 10 and was almost immediately classified a tropical depression. A weak high level trough, off the African west coast on the 10th together with a warm anticyclone to the east-northeast of the disturbance resulted in a favorable weak shear field in the vicinity of Dakar, Senegal, as the incipient depression moved off the coast"
- Reanalysis: Tropical Storm Edna developed from a tropical wave that moved off the west coast of Africa late on the 10th.

September 11:

4. Maps and old HURDAT:

- HWM and microfilm do not show an organized system at 12Z.
- HURDAT lists a 25 kt tropical depression at 12.7N, 21.1W at 18Z (first position).

5. Satellite highlights:

a. ESSA 7 estimated a center fix at 12.5N, 20.5W at 1521Z (WALLET).

6. Discussion:

- MWR: "ESSA-7 satellite pictures on September 11 indicated it was a well-developed depression."
- ATSR: "Tropical Storm EDNA was the only named storm to develop in the eastern Atlantic during the season, and she lived and died at sea without ever making

landfall. EDNA originated as a weak circulation on the ITCZ and was tracked by satellite as she moved off the African coast on 11 September."

- Reanalysis: Satellite images on the 11th showed a large area of convection between the Cape Verde Islands and the African coast. Synoptic observations indicate that it did not have a closed circulation on this date. The first position in HURDAT is shown at 18Z on the 11th but genesis is delayed based on the ship and coastal data.

September 12:

3. Maps and old HURDAT:
- HWM does not show an organized system at 12Z.
- HURDAT lists a 30 tropical depression at 13.7N, 25.2W at 12Z.
- Microfilm shows at 12.5N, 25.8W at 12Z.

4. Satellite highlights:
a. ESSA 7 estimated a center fix at 14N, 26W at 1616Z (WALLET).

5. Discussion:
- ATSR: "As a tropical depression, she passed 60 miles south of the Cape Verde Islands the following day. FLEWEACEN ROTA issued the initial warning on this depression on 12 September and passed the forecast responsibility to FLEWEAFAC JAX early on 15 September."
- Reanalysis: The disturbance continued westward on the 12th. Satellite images showed a large area of disorganized convection south of the Cape Verde Islands. Ship and coastal observations continued to show that the system did not have a closed low-level circulation as the synoptic flow was associated with the monsoon trough.

September 13:

5. Maps and old HURDAT:
- HWM analyzes a closed low pressure of at most 1012 mb at 15N, 32W at 12Z.
- HURDAT lists a 30 kt tropical depression at 14.3N, 29.2W at 12Z.
- Microfilm shows at 12Z.

6. Satellite highlights:
b. ESSA 7 estimated a center fix at 14N, 29W at 1706Z (WALLET).

7. Discussion:
- MWR: "No appreciable change in organization was noted through the 13th, although some decrease in cloud brightness was observed on the 12th and 13th. Satellite views on successive days suggested some intensification."
- Reanalysis: Satellite images on the 13th showed that the convection had become more concentrated and some banding features were evident, an indication of an increase in organization. Synoptic observations still showed that the monsoon trough and not a closed low-level circulation forced the low-level flow associated with the disturbance. Based upon the continued organization of the satellite imagery, genesis is begun at 18Z on the 13th.

September 14:

4. Maps and old HURDAT:
- HWM analyzes a spot low pressure at 14N, 30.4W at 12Z.
- HURDAT lists a 30 kt tropical depression at 15.3N, 31.8W at 12Z.

- Microfilm shows a closed low pressure of at most 1014 mb at 15.2N, 33.5W at 12Z.

5. Satellite highlights:
c. ESSA 7 estimated a center fix at 15.5N, 33.5W at 1611Z (WALLET).

6. Discussion:
- Reanalysis: Satellite images showed that the disturbance had become much better organized during the past 24 hours with a sheared, but well-defined circulation. Based on satellite images on the 14th and ship data early on the 15th, intensification to a tropical storm is analyzed at 06Z on the 14th.

September 15:

4. Maps and old HURDAT:
- HWM analyzes a closed low pressure of at most 1012 mb at 15.5N, 37.5W at 12Z.
- HURDAT lists a 55 kt tropical storm at 16.2N, 36.7W at 12Z.
- Microfilm shows a tropical storm of at most 1012 mb at 16.2N, 36.8W at 12Z.

5. Ship highlights:
  - 60 kt ENE and 1008 mb at 16.2N, 35.5W at 03Z (COADS/WALLET).
  - 45 kt E and 1010 mb a 16.1N, 35.5W at 06Z (COADS).
  - 35 kt E and 1015 mb a 15.5N, 34.5W at 12Z (COADS).
  - 45 kt E and 1013 mb a 17.1N, 37.5W at 18Z (COADS).
  - 40 kt E and 1014 mb a 17N, 37.4W at 21Z (COADS).

6. Satellite highlights:
d. ESSA 6 estimated a center fix at 16.5N, 37W at 1306Z (WALLET).
e. ESSA 7 estimated a center fix at 16.5N, 37.5W at 1705Z (WALLET).

7. Discussion:
- MWR: "The existence of a tropical storm was confirmed by the ship *Sal Mela* (CPHN), when it reported, at 0300 GMT on September 15, experiencing winds of 69 mi/hr from the east-northeast while located about 1,900 mi east of Puerto Rico. Subsequently, the ship *Mormac Elm* (KPSG) reported winds of about 45 to 50 mi/hr at 1800 GMT on September 15 and 0000 GMT, September 16. The reports from these two ships were most helpful in establishing the existence and location of the storm. The maximum wind known to have been associated with Edna was 69 mi/hr reported by the aforementioned ship, the *Sal Mela*. The lowest pressure achieved by Edna was estimated to have been 1005 mb and is based on ship and reconnaissance reports."
- ATSR: "The depression was upgraded to Tropical Storm EDNA on the 151600Z warning, primarily based on a late ship report for 150300Z. During the next three days, EDNA continued to move westward toward the Leeward Islands, but encountered increasingly less favorable conditions aloft for further development."
- Reanalysis: A couple of ships encountered the circulation of Edna on the 15th measuring sustained winds up to 60 kt at 03Z. An intensity of 60 kt is analyzed between 00Z and 12Z on the 15th, up from 50 kt at 00Z and 55 kt at 06Z and 12Z originally shown in HURDAT, minor intensity changes. 60 kt is also the peak intensity of this tropical storm, up from 55 kt originally shown in HURDAT, a minor intensity change. It is possible that Edna may have reached hurricane intensity on this date but the data available is insufficient to justify an upgrade, especially given the available satellite imagery. A central pressure of 1005 mb was present in the original HURDAT at 00Z on the

15th but ship observations indicate that it was lower at the time, thus it is removed. (The approach of 1 mb/10 kt extrapolation over water to obtain the central pressure is only valid if the observation is inside of the RMW. As it's not clear where the measurement was relative to the RMW, obtaining a 1002 mb central pressure value is uncertain, as it could be considerable lower.) Satellite images showed that the tropical storm continued being affected by southwesterly shear keeping most of the convection over the northeastern quadrant.

September 16:

3. Maps and old HURDAT:
- HWM analyzes a tropical storm of at most 1012 mb at 17N, 40.3W at 12Z.
- HURDAT lists a 55 kt tropical storm at 16.5N, 40.7W at 12Z.
- Microfilm shows a tropical storm of at most 1012 mb at 16.3N, 40.3W at 12Z.

4. Ship highlights:
- 40 kt ENE and 1015 mb a 16.7N, 37.1W at 00Z (COADS).

5. Aircraft highlights:
- Penetration center fix measured a central pressure of 1012 mb at 16.8N, 42.7W at 2127Z (WALLET).

6. Satellite highlights:
f. ESSA 7 estimated a center fix at 16N, 41W at 20Z (WALLET).

7. Discussion:
- MWR: "Four Air Force and Navy investigative flights were flown into Edna on the following 4 days. Only on the first flight was there clear evidence of a closed circulation. Subsequent satellite pictures also suggested a gradual decrease in intensity."
- Reanalysis: Satellite images and aircraft reconnaissance data indicated that Edna lost in organization on the 16th and therefore, a gradual decrease in intensity is shown. The first penetration center fix measured a central pressure of 1012 mb at 2127Z. A central pressure of 1012 mb is added to HURDAT at 00Z on the 17th.

September 17:

3. Maps and old HURDAT:
- HWM analyzes a tropical storm at 16.5N, 43.9W at 12Z.
- HURDAT lists a 50 kt tropical storm at 16.9N, 45W at 12Z.
- Microfilm shows a tropical storm at 16.4N, 43.8W at 12Z.

4. Discussion:
- GULL 2 Edna post flight summary: "Investigated area vicinity 17.0N 46.0W to include a 100 NM semicircle east thru north thru northwest. No indication of any closed cyclonic circulation could be found. Area in question did have somewhat extensive cloudiness but this was of the type normally associated with an upper level trough and not with a cyclonic circulation. Surface winds in the search area were light 15 kt or less and from an easterly direction."
- Reanalysis: The tropical cyclone continued to lose organization based on the satellite images. Weakening to a tropical depression is analyzed at 06Z on the 17th. A reconnaissance aircraft investigated Edna late on the 17th and concluded that the system had weakened to a tropical wave, an assessment that

was also noted during the next couple days of reconnaissance investigations. Thus, the last position is analyzed at 18Z on the 17th.

September 18:

3. Maps and old HURDAT:
- HWM analyzes a tropical storm at 17.8N, 48.2W at 12Z.
- HURDAT lists a 30 kt tropical depression at 17.3N, 51.1W at 12Z.
- Microfilm shows a tropical wave along longitude 50W, extended from 10N-25N at 12Z.

4. Discussion:
- MWR: "On September 18, Edna was downgraded to a tropical depression…"
- Reanalysis: The tropical wave continued westward showing no signs of regeneration. Satellite images showed a decrease in the convective activity.

September 19:

5. Maps and old HURDAT:
- HWM analyzes a closed low pressure of at most 1012 mb at 18N, 55W at 12Z.
- HURDAT lists a 25 kt tropical depression at 17.8N, 55.8W at 06Z (last position).
- Microfilm shows a tropical wave from 13N-22N, 52W-59W at 12Z.

6. Discussion:
- MWR: "…and on the 19th it was downgraded further to an easterly wave. Satellite pictures and ship reports indicated the possibility of a weak vorticity center turning northwestward on the 19th while the wave continued on its westerly course about 400 mi east of the Leeward Islands."
- ATSR: "On 19 September, she moved under the influence of a converge flow at 200 mb and degenerated into an easterly wave."

September 20:

5. Maps and old HURDAT:
- HWM analyzes a closed low pressure of at most 1012 mb at 19N, 55W at 12Z.
- HURDAT does not list an organized system on this date.
- Microfilm shows a trough extended from 21N-31N, along 54W at 12Z.

Sources: NHC microfilm maps, the Historical Weather Maps series, the COADS ship database, Monthly Weather Review, Navy reconnaissance book, Mariners Weather Log, Satellite images from NCDC, and NHC Storm Wallets.

Unnamed Hurricane [September 14-25, 1968] – AL091968

```
45670 09/14/1968 M=10  6 SNBR= 975 SUBTROP 1   XING=0 SSS=0
45670 09/14/1968 M=12  6 SNBR= 975 SUBTROP 1   XING=0 SSS=0
                    **

45675 09/14*  0   0   0    0*  0   0   0    0S315 730  20 1012S318 721  20    0*
45675 09/14*  0   0   0    0*  0   0   0    0E319 730  25 1012E323 718  25    0*
                                             ****      **     **** ***  **
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45680 09/15S321 710  20 1009S325 698  25    0S330 685  25 1009S331 676  30    0*
45680 09/15E328 707  25 1007E332 698  25    0E335 690  30    0E338 683  35    0*
           **** ***  ** ********             **** ***  **    ***** ***  **

45685 09/16S335 670  30 1006S348 676  35    0S360 680  40 1003S373 665  45    0*
45685 09/16E341 679  40    0E348 676  45    0E360 672  45    0E374 662  45    0*
           **** ***  **    **         **     *    ***  **    ***** ***

45690 09/17S385 650  50  997S391 639  50    0S390 630  50  995S388 625  55    0*
45690 09/17S385 650  50    0S389 639  55    0S389 630  55    0S388 624  55    0*
                           * ***      **      ***       **    *     ***

45695 09/18S385 620  60  993S383 615  60    0S380 610  60  993S378 605  60    0*
45695 09/18S385 620  60    0S383 616  60    0S381 612  60    0S379 608  60    0*
                           *     ***          *** ***        * *** ***

45700 09/19S375 600  60  993S373 595  60    0S370 590  60  990S363 579  60    0*
45700 09/19S377 604  60    0S374 598  60    0S371 592  60    0S365 577  60    0*
           *** ***         * *** ***          *** ***        * *** ***

45705 09/20S355 560  60  987S352 526  65    0S355 490  65  985S376 465  70    0*
45705 09/20S359 557  65    0S355 526  70    0S355 495  75  976S366 475  75    0*
           *** ***  **    * ***      **          ***  **  *** *** ***  **

45710 09/21S395 450  70  979S399 443  70    0S403 437  65  982S406 431  65    0*
45710 09/21S380 465  70    0S390 456  70    0S396 447  65  982S400 440  65    0*
           *** ***         * *** ***          *** ***          *** ***

45715 09/22S410 425  60  984S415 416  60    0S420 405  60  986S422 392  55    0*
45715 09/22S404 433  60  984S408 425  60    0E411 417  60    0E415 405  55    0*
           *** ***          *** ***          **** ***        ***** ***

45720 09/23S423 380  55  992S424 369  50    0E425 360  45  995E425 350  40  997*
45720 09/23E419 393  55    0E422 380  50    0E425 366  45    0E428 351  45    0*
           **** ***         ***** ***                ***          *** ***  **    *
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(September 24th and 25th are new to HURDAT)

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45725 09/24E432 336  45    0E438 317  45    0E445 300  45    0E458 274  40    0*
45730 09/25E480 230  35    0*  0   0   0    0*  0   0   0    0*  0   0   0    0*

45735 SS
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Significant Revisions:

1. Genesis analyzed as an extratropical cyclone on September 14th at 12Z. The original HURDAT had the system developing as a subtropical cyclone.
2. Transition to a subtropical cyclone analyzed on September 17th at 00Z based on synoptic and satellite data.
3. Analyzed to have re-acquired extratropical characteristics on September 22nd at 12Z based on synoptic and satellite data, 24 hours earlier than originally shown in HURDAT.
4. Analyzed to have dissipated on September 25th at 00Z, 30 hours later than originally shown in HURDAT based on surface observations.
5. Significant track changes are introduced on September 21st at 00Z and 06Z, and between September 22nd at 12Z and September 23rd at 06Z.

Daily Metadata:

September 13:

1. Maps and old HURDAT:

- HWM and microfilm show a stationary frontal boundary stretching from the northern Gulf of Mexico to the north Atlantic at 12Z.
- HURDAT does not list an organized system on this date.

2. Discussion:

- Reanalysis: Satellite images and synoptic maps showed a stationary frontal boundary over the western Atlantic. The frontal boundary was the same system that absorbed the tropical storm that formed near the Carolinas on the 10th.

September 14:

1. Maps and old HURDAT:

- HWM analyzes an extratropical cyclone of at most 1014 mb at 32.5, 73W at 12Z.
- HURDAT lists a 20 kt subtropical depression at 31.5N, 73W at 12Z (first position).
- Microfilm shows an extratropical cyclone of at most 1014 mb at 31.5, 74W at 12Z.

2. Discussion:

- Reanalysis: Surface observations indicate that a closed low-level circulation developed along a frontal boundary at 12Z on the 14th and a 25 kt extratropical depression is analyzed to have formed at this time. The original HURDAT had a 20 kt subtropical depression at 12Z on the 14th but synoptic data and satellite images suggests that the system was still extratropical. This is consistent with assessments by both HWM and the microfilm synoptic maps.

September 15:

1. Maps and old HURDAT:

- HWM analyzes an extratropical cyclone of at most 1012 mb at 34, 65.5W at 12Z.
- HURDAT lists a 25 kt subtropical depression at 33N, 68.5W at 12Z.
- Microfilm shows an extratropical cyclone of at most 1012 mb at 34.5, 65.3W at 12Z.

2. Discussion:

- MWL: "On the 15th a wave on the polar front deepened rapidly near 35N, 65W. The resulting LOW moved slowly eastward…"
- Reanalysis: The extratropical cyclone moved northeastward and satellite images indicate that the circulation became better organized, along with an increase in convection, especially north of the center. Synoptic observations early on the 16th suggest that the extratropical cyclone reached gale-force winds late on the 15th, thus maximum sustained winds of 35 kt is analyzed at 18Z on the 15th. Gale-force winds are analyzed 12 hours earlier than originally shown in HURDAT.

September 16:

1. Maps and old HURDAT:

- HWM analyzes an extratropical cyclone of at most 1012 mb at 36.5N, 64.5W at 12Z.

- HURDAT lists a 40 kt subtropical storm at 36N, 68W at 12Z.
- Microfilm shows an occluded low pressure of at most 1008 mb at 36N, 63.5W at 12Z.

2. Ship highlights:
a. 35 kt N (E in microfilm) and 1010 mb at 34.5N, 66.9W at 00Z (COADS).
b. 35 kt W and 1002 mb at 34.3N, 67.2W at 06Z (COADS).
c. 40 kt N (E in microfilm) and 1007 mb at 36.5N, 68.1W at 12Z (COADS).
d. 45 kt NW and 992 mb at 37N, 66.5W at 18Z (MWL).

3. Discussion:
- Reanalysis: The extratropical cyclone moved northward and slightly intensified. A few ships reported gale-force winds, up to 45 kt. Satellite images showed organized convection near and north of the center. Synoptic observations indicated that the system retained its extratropical characteristics on this date.

September 17:

1. Maps and old HURDAT:
- HWM analyzes an occluded low pressure of at most 1000 mb at 38.5N, 62W at 12Z.
- HURDAT lists a 50 kt subtropical storm at 39N, 63W at 12Z.
- Microfilm shows an occluded low pressure of at most 1000 mb at 39N, 63W at 12Z.

2. Ship highlights:
- 50 kt SW and 1009 mb at 35.6N, 63.5W at 00Z (COADS).
- 50 kt W and 1005 mb at 36.6N, 65.2W at 06Z (COADS).
- 50 kt E and 1009 mb at 41N, 61.7W at 09Z (COADS).
- 45 kt NE and 1011 mb at 40.9N, 63W at 12Z (COADS).
- 45 kt E and 1011 mb at 41N, 60.5W at 15Z (COADS).
- 35 kt N and 1004 mb at 39.1N, 63.9W at 18Z (COADS).

3. Discussion:
- Reanalysis: Satellite images indicated that the extratropical cyclone had decreased in size and well-organized convection was located near the center, thus based on synoptic and satellite data, transition to a subtropical cyclone is analyzed at 00Z on the 17th. The subtropical storm slowed its forward speed and changed its course to the southeast. A few ships reported gale and storm-force winds on this date, up to 50 kt.

September 18:

1. Maps and old HURDAT:
- HWM analyzes an occluded low pressure of at most 1004 mb at 38N, 61W at 12Z.
- HURDAT lists a 60 kt subtropical storm at 38N, 61W at 12Z.
- Microfilm shows an occluded low pressure of at most 1000 mb at 38N, 62W at 12Z.

2. Ship highlights:
- 60 kt NE and 1002 mb at 40.4N, 62.3W at 00Z (COADS).
- 50 kt NE and 1003 mb at 40.2N, 62.5W at 06Z (COADS).
- 50 kt NNW and 999 mb at 37.4N, 63.6W at 12Z (COADS).
- 50 kt N and 1002 mb at 37.7N, 63.3W at 18Z (COADS).

3. Discussion:

- Reanalysis: The subtropical storm slowly moved southeastward. A few ships reported storm-force winds, up to 60 kt. Satellite images showed a small system with organized convection embedded in a larger circulation. The RMW on this date contracted to about 100 n mi based upon ship observations.

September 19:

1. Maps and old HURDAT:

- HWM analyzes an occluded low pressure of at most 988 mb at 37.5N, 58W at 12Z.
- HURDAT lists a 60 kt subtropical storm at 37N, 59W at 12Z.
- Microfilm shows a closed low pressure of at most 996 mb at 36.5N, 59W at 12Z.

2. Ship highlights:

- 55 kt NE and 1007 mb at 38.1N, 63.1W at 00Z (COADS).
- 40 kt NW and 985 mb at 37.3N, 60.4W at 06Z (COADS).
- 40 kt NNE and 1000 mb at 37.6N, 60.8W at 09Z (COADS).
- 50 kt NNE and 1000 mb at 37.8N, 60.8W at 12Z (COADS).
- 45 kt NW and 997 mb at 35.3N, 60W at 15Z (COADS).
- 55 kt W and 993 mb at 34.5N, 57.5W at 18Z (WALLET).

3. Discussion:

- Reanalysis: The strong subtropical storm continued southeastward on the 19th and satellite images showed an organized system with a hint of an eye. A few ships reported gale and storm-force winds. The intensity is held at 60 kt for the day based upon the 55 kt reports at both 00Z and 18Z.

September 20:

1. Maps and old HURDAT:

- HWM analyzes an occluded low pressure of at most 988 mb at 36N, 50.5W at 12Z.
- HURDAT lists a 65 kt subtropical hurricane at 35.5N, 49W at 12Z.
- Microfilm shows an occluded low pressure of at most 988 mb at 35.6N, 49.2W at 12Z.

2. Ship highlights:

- 55 kt W and 998 mb at 34.5N, 56.6W at 00Z (WALLET).
- 45 kt W and 1003 mb at 31N, 54.5W at 06Z (COADS).
- 50 kt SW and 990 mb at 34.2N, 50W at 09Z (COADS).
- 70 kt SW and 982 mb at 34.3N, 50.4W at 12Z (COADS).
- 40 kt SW and 980 mb at 34.8N, 50.5W at 12Z (COADS).
- 70 kt WNW and 985 mb at 34.9N, 48W at 15Z (COADS).
- 70 kt SSW and 981 mb at 34.9N, 48W at 18Z (COADS).

3. Discussion:

- MWL: "…by the 20th the central pressure was down to 984 mb at 35N, 50W. At 1700 on the 20th Ocean Station "E", situated near 35N, 48W and just east of this very strong cyclone, encountered 70-kt winds and 31-ft seas."
- Reanalysis: Synoptic observations on the 20th indicate that the subtropical storm had reached hurricane intensity. Intensification to hurricane force is analyzed at 00Z on the 20th. A ship reported 40 kt SW and 980 mb at 12Z on the 20th. A peripheral pressure of 980 mb suggests maximum surface winds of at least 73 kt from the north of 25N Brown et al. and north of 35N Landsea et al. pressure-wind relationships. Based on a forward speed of about 29 kt, an intensity of 75 kt is analyzed at 12Z on the 20th, up from 65 kt originally

shown in HURDAT, a minor intensity change. This is consistent with the three 70 kt ship reports at 12Z, 15Z and 18Z. 75 kt is also the peak intensity of this system, up from 70 kt originally shown in HURDAT, a minor intensity change. It is noted that the system looks less tropical at peak intensity on 20 September than it did during the previous two days due to the cold air clouds to the west of the center.

September 21:

1. Maps and old HURDAT:
- HWM analyzes an occluded low pressure of at most 988 mb at 39N, 45.5W at 12Z.
- HURDAT lists a 65 kt subtropical hurricane at 40.3N, 43.7W at 12Z.
- Microfilm shows an occluded low pressure of at most 988 mb at 40.2N, 44.8W at 12Z.

2. Ship highlights:
- 35 kt NE and 999 mb at 41N, 47.6W at 00Z (COADS).
- 60 kt NE and 990 mb at 40.9N, 46.3W at 06Z (COADS).
- 60 kt NE and 988 mb at 40.8N, 45.1W at 09Z (COADS).
- 50 kt NNE and 999 mb at 39.7N, 47.5W at 12Z (COADS).
- 50 kt SW and 991 mb at 38.8N, 43.7W at 15Z (COADS).
- 55 kt SW and 989 mb at 38.8N, 44.1W at 18Z (COADS).
- 55 kt NE and 1003 mb at 44.2N, 41W at 21Z (COADS).

3. Discussion:
- MWL: "The storm then stated to move northeastward, reaching minimum pressure of 981 mb at 1200 on the 21st near 37N, 45W. Throughout the remainder of the storm's intense phase (17th-21st), maximum winds of 50-55 kt were reported close to the center."
- Reanalysis: The subtropical cyclone turned to the northeast and slowly weakened. A few ships reported gale and storm-force winds, up to 60 kt.

September 22:

1. Maps and old HURDAT:
- HWM analyzes an occluded low pressure of at most 1000 mb at 42N, 41.5W at 12Z.
- HURDAT lists a 60 kt subtropical storm at 42N, 40.5W at 12Z.
- Microfilm shows an occluded low pressure of at most 992 mb at 41.8N, 40.5W at 12Z.

2. Ship highlights:
- 40 kt S and 989 mb at 41.7N, 42.8W at 00Z (COADS).
- 40 kt NE and 1006 mb at 44N, 40.5W at 03Z (COADS).
- 40 kt NE and 1005 mb at 43.9N, 40.3W at 06Z (COADS).
- 45 kt NE and 1005 mb at 44.6N, 42.2W at 12Z (COADS).
- 40 kt NE and 1004 mb at 44.3N, 41.6W at 15Z (COADS).
- 35 kt NE and 1004 mb at 44.2N, 41.3W at 18Z (COADS).
- 35 kt NE and 1004 mb at 44N, 41W at 21Z (COADS).

3. Discussion:
- Reanalysis: Synoptic observations on the 22nd indicated that the subtropical cyclone had weakened to below hurricane-force winds at 00Z. At 12Z on the 22nd, ship data showed that the system had become less isothermal and it is analyzed to have acquired extratropical characteristics at this time. A few ships reported gale-force winds, up to 45 kt.

September 23:

1. Maps and old HURDAT:
- HWM analyzes an occluded low pressure of at most 1000 mb at 43.5N, 36.5W at 12Z.
- HURDAT lists a 45 kt extratropical storm at 42.5N, 36W at 12Z.
- Microfilm shows a closed low pressure of at most 1000 mb at 44N, 36.5W at 12Z.

2. Ship highlights:
- 45 kt NE and 1006 mb at 44.2N, 41W at 00Z (COADS).
- 40 kt NE and 988 mb at 41.2N, 44W at 06Z (COADS).
- 35 kt NE and 1008 mb at 43.9N, 40W at 12Z (COADS).
- 35 kt N and 1010 mb at 42.6N, 40.3W at 18Z (COADS).

3. Discussion:
- Reanalysis: The extratropical cyclone moved northeastward on the 23rd while passing hundreds of miles northwest of the Azores. A few ships reported gale-force winds, up to 45 kt.

September 24:

1. Maps and old HURDAT:
- HWM analyzes an extratropical cyclone of at most 1004 mb at 44N, 28.5W at 12Z.
- Microfilm shows a closed low pressure of at most 1004 mb at 44.2N, 27.5W at 12Z.

2. Ship highlights:
- 40 kt NNW and 1011 mb at 43.1N, 38.7W at 00Z (COADS).
- 35 kt NNW and 1010 mb at 43.1N, 36.6W at 06Z (COADS).
- 40 kt N and 1011 mb at 43.1N, 35.1W at 12Z (COADS).
- 40 kt NE and 1011 mb at 42.5N, 32.8W at 18Z (COADS).

3. Discussion:
- Reanalysis: The last position in HURDAT was analyzed at 18Z on the 23rd but synoptic observations indicated that the extratropical cyclone continued northeastward. A few ships reported gale-force winds, up to 40 kt.

September 25:

1. Maps and old HURDAT:
- HWM analyzes an extratropical cyclone of at most 996 mb at 58.5N, 25W at 12Z.

2. Ship highlights:
- 35 kt NNE and 1018 mb at 42.1N, 34.9W at 00Z (COADS).

3. Discussion:
- Reanalysis: Synoptic observations after 00Z on the 25th and satellite images indicated that the extratropical cyclone had weakened and likely become absorbed by a larger extratropical cyclone. The last position is analyzed at 00Z on the 25th.

September 26:

1. Maps and old HURDAT:
- HWM analyzes an extratropical cyclone of at most 980 mb at 53.5N, 26W at 12Z.

September 27:

1. Maps and old HURDAT:

- HWM analyzes an extratropical cyclone of at most 984 mb at 53.5N, 20W at 12Z.

September 28:

1. Maps and old HURDAT:

- HWM analyzes an extratropical cyclone of at most 980 mb at 64N, 11W at 12Z.

Date	Original HURDAT Central Pressure	Evidence	Changes
Sep 14 12Z	1012 mb	No reconnaissance aircraft observations and no ships near the center but appears reasonable based on nearby synoptic data and it is retained	Retained
Sep 15 00Z	1009 mb	Ship: 20 kt WSW and 1009 mb at 00Z on Sep 15th	1007 mb
Sep 15 12Z	1009 mb	No reconnaissance aircraft observations and ships near the center suggest a central pressure value lower than shown in HURDAT, thus these central pressures are removed	Removed
Sep 16 00Z	1006 mb		
Sep 16 12Z	1003 mb		
Sep 17 00Z	997 mb		
Sep 17 12Z	995 mb		
Sep 18 00Z	993 mb		
Sep 18 12Z	993 mb		
Sep 19 00Z	993 mb		
Sep 19 12Z	990 mb		
Sep 20 00Z	987 mb		
Sep 20 12Z	985 mb	Ship: 40 kt and 980 mb at 12Z	976 mb
Sep 21 00Z	979 mb	No data near center	Removed
Sep 21 12Z	982 mb	Ship: 15 kt SE and 983 mb at 12Z on Sep 21st	Retained
Sep 22 00Z	984 mb	No reconnaissance aircraft observations and no ships near the center, thus these central pressures are removed	Removed
Sep 22 12Z	986 mb		
Sep 23 00Z	992 mb		
Sep 23 12Z	995 mb		
Sep 23 18Z	997 mb		

Sources: NHC microfilm maps, the Historical Weather Maps series, the COADS ship database, Monthly Weather Review, Mariners Weather Log, "A Satellite Classification Technique For Subtropical Cyclones" Paul H. Hebert (1975), and Satellite images from NCDC.

Tropical Depression [September 18-20, 1968] – AL101968

```
45240 09/17/1968 M= 5 10 SNBR= 966 UNNAMED       XING=0 SSS=0
45240 09/18/1968 M= 3 10 SNBR= 966 UNNAMED       XING=0 SSS=0
         **         *
```

(September 17th was removed from HURDAT)

```
45245 09/17*120 239  25    0*121 245  25    0*122 252  25    0*124 265  25    0*

45250 09/18*129 281  25    0*130 285  25    0*131 296  25    0*133 303  25    0*
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45250 09/18*  0   0   0    0*  0   0   0    0*126 278  30    0*129 289  30    0*
              *   *   *        *   *   *      *** ***  **      *** ***  **

45255 09/19*138 312  25    0*142 329  25    0*149 339  25    0*154 348  25    0*
45255 09/19*132 300  25    0*137 312  25    0*142 324  25    0*149 336  25    0*
            *** ***          *** ***          *** ***          *** ***

45260 09/20*161 353  25    0*168 368  25    0*171 380  25    0*180 391  25    0*
45260 09/20L156 348  25    0L163 360  25    0L171 372  25    0L180 384  25    0*
           **** ***         **** ***         *    ***         *    ***

(September 21st was removed from HURDAT)
45265 09/21*190 404  25    0*200 414  25    0*210 422  25    0*  0   0   0    0*

45270 TD
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Significant Revisions:

1. First position analyzed 36 hours later than originally shown in HURDAT based on synoptic data and satellite images.
2. Major southeastward track changes analyzed between 12Z on September 18th and 18Z on September 19th based on synoptic data and satellite images.
3. Given the lack of convection, a remnant low stage is now indicated for the 20th.
4. Dissipation analyzed 18 hours earlier than originally shown in HURDAT based on synoptic data and satellite images.

Daily Metadata:

September 16:

7. Maps and old HURDAT:

- HWM analyzes no features of interest at 12Z.
- Microfilm shows a spot low pressure at 11.2N, 23.8W with a tropical wave stretching to the north at 12Z.

8. Discussion:

- Reanalysis: Satellite imagery showed an area of convection over the eastern Atlantic associated with a tropical wave. The disturbance remained disorganized on this date as it moved westward.

September 17:

3. Maps and old HURDAT:

- HWM analyzes no features of interest at 12Z.
- HURDAT lists a 25 kt tropical depression at 12.2N, 25.2W at 12Z.
- Microfilm shows a spot low pressure at 9.7N, 28.7W with a tropical wave stretching to the north at 12Z.

4. Discussion:

- Reanalysis: The first position in HURDAT was at 00Z on September 17th as a 25 kt tropical depression. Synoptic observations over the eastern Atlantic were sparse but satellite data suggests that the disturbance remained disorganized and was not a tropical cyclone on this date.

September 18:

10. Maps and old HURDAT:

- HWM analyzes no features of interest at 12Z.
- HURDAT lists a 25 kt tropical depression at 13.1N, 29.6W at 12Z.
- Microfilm shows a spot low pressure at 9.4N, 34.5W with a tropical wave stretching to the north at 12Z.

11. Discussion:

a. Reanalysis: Satellite imagery indicated that the tropical disturbance had become better organized with convection near the center. The first position is analyzed at 12Z on the 18th as a 25 kt tropical depression. A confirmation that the system had a closed circulation was provided by a ship at 18Z on the 18th that reported 20 kt W and 1011 mb on the southern semicircle. Operationally, it was upgraded to the 16th tropical depression of the season at 18Z on this date. The track of the tropical cyclone was generally shifted southeastward from the original HURDAT positions based on synoptic and satellite data. Given the satellite appearance on this day, a 30-kt intensity at 12 and 18Z is used, up from 25 kt originally.

September 19:

1. Maps and old HURDAT:

- HWM analyzes a spot low pressure at 13.4N, 36.5W at 12Z.
- HURDAT lists a 25 kt tropical depression at 14.9N, 33.9W at 12Z.
- Microfilm shows a tropical cyclone (TC 16) of at most 1012 mb at 13.7N, 32.1W at 12Z.

2. Discussion:

- Reanalysis: The tropical depression moved northwest and remained organized on the satellite imagery with some banding features.

September 20:

1. Maps and old HURDAT:

- HWM analyzes no features of interest at 12Z.
- HURDAT lists a 25 kt tropical depression at 17.1N, 38W at 12Z.
- Microfilm shows a tropical cyclone (TC 16) of at most 1012 mb at 13.8N, 37.1W at 12Z.

2. Discussion:

- Reanalysis: Satellite imagery indicated that the tropical depression had lost most of the convective activity and the last position is analyzed at 18Z on the 20th. Given the lack of convection, a remnant low stage is now indicated for the 20th.

September 21:

1. Maps and old HURDAT:

- HWM analyzes no features of interest at 12Z.
- HURDAT lists a 25 kt tropical depression at 21N, 42.2W at 12Z (last position).
- Microfilm shows a tropical cyclone (TC 16) of at most 1012 mb at 20N, 41.3W at 12Z.

2. Discussion:

- Reanalysis: Satellite imagery showed that the remnants of the tropical depression were approaching a frontal boundary and were absorbed the next day.

September 22:

1. Maps and old HURDAT:

- HWM and microfilm shows no features of interest at 12Z.

Sources: NHC microfilm maps, the Historical Weather Maps series, the COADS ship database, Monthly Weather Review, Mariners Weather Log, Satellite images from NCDC, and NHC Storm Wallets.

AL111968:

September 20-28: Satellite images show a tropical wave moving across the tropical Atlantic with disorganized convection confined to the ITCZ. The first position in HURDAT was on September 23rd at 00Z as a 25 kt tropical depression. Synoptic data indicates that the disturbance did not have a closed circulation, remaining embedded within the ITCZ, and satellite images do no suggest the system became better organized. The tropical wave entered the eastern Caribbean Sea on the 25th and encountered strong westerly wind shear. The last position in HURDAT was on the 25th at 12Z as a 25 kt tropical depression. Convection decreased over the central Caribbean Sea and the system dissipated on the 28th. Therefore, because the system did not have a well-defined low-level circulation, it is removed from HURDAT. This disturbance was in Jack Beven's Lists of Suspects.

Tropical Storm Frances [September 23-29, 1968] – AL121968

```
45730 09/23/1968 M= 8  7 SNBR= 976 FRANCES     XING=0 SSS=0
45730 09/23/1968 M= 7  7 SNBR= 976 FRANCES     XING=0 SSS=0
                     *
45735 09/23*  0   0   0    0*  0   0   0    0*260 740  25    0*267 742  25    0*
45735 09/23*  0   0   0    0*  0   0   0    0S264 735  25    0S272 737  25    0*
                                             **** ***         **** ***

45740 09/24*273 744  25    0*280 744  25    0*287 743  30    0*294 741  30 1012*
45740 09/24S279 739  25    0S284 741  25    0S288 742  30    0S294 741  30 1012*
           **** ***         **** ***         **** ***         *

45745 09/25*301 734  30    0*308 726  30    0*313 717  30 1012*319 707  30    0*
45745 09/25S301 735  30    0S307 726  30    0S313 717  30 1012S319 708  30    0*
           *    ***         ****             *                  *    ***

45750 09/26*323 699  30    0*327 692  30    0*329 688  30    0*332 682  45 1003*
45750 09/26S325 700  30    0S330 694  30    0*334 688  35    0*337 682  40 1003*
           **** ***         **** ***           ***      **      ***      **

45755 09/27*335 677  45    0*338 671  45    0*342 662  50    0*343 653  50 1001*
45755 09/27*339 677  40    0*341 671  45    0*343 662  50    0*345 653  50 1001*
            ***      **      ***      **      ***               ***

45760 09/28*347 637  50    0*349 619  45    0*350 598  45    0*353 578  40 1003*
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45760 09/28*347 637  50    0*349 619  45    0*351 598  45    0*354 578  45 1003*
                                            ***             ***      **

45765 09/29*354 557  40    0*355 535  30 1007E354 507  30    0E353 481  30    0*
45765 09/29*357 557  40    0*360 535  40 1004E358 507  35    0E355 481  35    0*
            ***              ***      ** **** ***      **      ***      **
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(September 30th has been removed from HURDAT)

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45770 09/30E357 452  30    0E362 423  30    0E368 395  30    0E375 365  30    0*

45775 TS
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Significant Revisions:

1. System began as a subtropical depression from 23rd to the 26th.
2. Analyzed to have become a tropical storm on September 26th, six hours earlier than originally shown in HURDAT based on aircraft reconnaissance data.
3. Tropical storm intensity is retained on September 29th based on ship observations. HURDAT originally weakened Frances to a tropical depression at 06Z on the 29th.
4. Dissipation is analyzed 24 hours earlier than originally show in HURDAT based on synoptic and satellite data.

Daily Metadata:

September 21:

1. Maps and old HURDAT:

- HWM does not analyze any features of interest at 12Z.
- HURDAT does not list an organized system on this date.

2. Discussion:

- Reanalysis: Tropical Storm Frances developed from a tropical wave that reached the Bahamas on September 20th. Satellite images indicate that the area had been convectively active for about a week prior due to a weak frontal boundary associated with a subtropical cyclone over the north Atlantic.

September 22:

1. Maps and old HURDAT:

- HWM analyzes a spot low pressure at 26N, 75W at 12Z.
- HURDAT does not list an organized system on this date.
- Microfilm shows a tropical wave over the central Caribbean Sea and into the Bahamas at 12Z.

2. Discussion:

- Reanalysis: Synoptic observations indicate that a sharp tropical wave was located over the western Bahamas, extending to the western Caribbean Sea on the 22nd. Satellite images showed an area of disorganized convection over the western Bahamas.

September 23:

1. Maps and old HURDAT:

- HWM analyzes a closed low pressure of at most 1014 mb at 28.5N, 72W at 12Z.
- HURDAT lists a 25 kt tropical depression at 26N, 74W at 12Z (first position).
- Microfilm shows a tropical cyclone of at most 1014 mb at 27N, 73W at 12Z.

2. Discussion:

- MWR: "A circulation developed at the surface east of the Bahamas on September 23. Convection was enhanced by the presence of a midtropospheric trough and the depression gradually intensified."
- ATSR: "Tropical Storm FRANCES originated as a circulation in the northern portion of an easterly wave just northeast of the Bahamas 23 September. Satellite pictures indicated the initial stages of FRANCES and the 231200Z synoptic surface chart confirmed a closed circulation near 26N, 74W. A tropical depression warning was issued at 231600Z, and during the next 24 hours, the depression tracked northward, then curved toward the northeast following an upper-air trough."
- Reanalysis: Ship and station data indicate that a well-defined, although elongated NE-SW, low-level circulation formed on the 23rd just north of the central Bahamas. Satellite images showed organized convection over the northern and eastern quadrant of the circulation, an indication of southwesterly wind shear. Upper-level maps indicate that the system was interacting with an upper-level trough. A 25 kt subtropical depression is analyzed to have formed at 12Z on the 23rd, same timing as originally shown in HURDAT though the subtropical designation is newly added.

September 24:

1. Maps and old HURDAT:

- HWM analyzes a closed low pressure of at most 1012 mb at 30N, 72W at 12Z.
- HURDAT lists a 30 kt tropical depression at 28.7N, 74.3W at 12Z.
- Microfilm shows a tropical cyclone of at most 1012 mb at 29N, 74W at 12Z.

2. Aircraft highlights:

- Penetration center fix at 29.2N, 74.3W at 1512Z (WALLET).

3. Satellite highlights:

- ESSA 6 estimated a center fix at 30N, 74.4W at 1350Z (WALLET).

4. Discussion:

- Reanalysis: The subtropical depression moved slowly northward and remained poorly organized on the 24th. A reconnaissance aircraft investigated the tropical cyclone at 1512Z on the 24th finding a well-defined circulation center and winds below tropical storm intensity. A central pressure of 1012 mb was present in the original HURDAT at 18Z on the 24th and based on the aircraft reconnaissance and nearby ship observations, it has been retained. Satellite images continued to show a poorly organized system with most of the convection displaced from the center. Upper-level maps indicate that the system was interacting with an upper-level trough.

September 25:

1. Maps and old HURDAT:

- HWM analyzes a closed low pressure of at most 1012 mb at 31N, 73W at 12Z.
- HURDAT lists a 30 kt tropical depression at 31.3N, 71.7W at 12Z.
- Microfilm shows a tropical cyclone of at most 1012 mb at 30.5N, 72.5W at 12Z.

2. Ship highlights:

a. 35 kt NE and 1014 mb at 32.3N, 73.5W at 00Z (COADS).

3. Aircraft highlights:
- Penetration center fix at 30.3N, 72.5W at 1512Z (WALLET).

4. Satellite highlights:
- ESSA 6 estimated a center fix at 32N, 71W at 1412Z (WALLET).

5. Discussion:
- MWR: "A moderate 500-mb trough moving off the mainland late on the 25th turned Frances northeastward."
- Reanalysis: Early on the 25th, the subtropical depression turned to the northeast and increased in forward speed, but remained poorly organized. A ship reported 35 kt about 150 n mi north of the center at 00Z on the 25th, and although the ship's observations prior and after this time appear consistent with the nearby synoptic observations, available data at 00Z on the 25th suggests that this particular observation may have a high bias or it was unrepresentative of the system's intensity. A reconnaissance aircraft investigated the subtropical cyclone at 1412Z and found a closed but elongated circulation with winds below tropical storm intensity. A central pressure of 1012 mb was present in the original HURDAT at 12Z on the 25th and has been retained. Satellite images showed a large area of squally weather extending from this tropical depression to another tropical depression near south Florida and the western Caribbean Sea. Upper-level maps indicate that the system was interacting with an upper-level trough, though the upper trough was weakening.

September 26:

1. Maps and old HURDAT:
- HWM analyzes a closed low pressure of at most 1012 mb at 32N, 69W with a cold front to the northwest at 12Z.
- HURDAT lists a 30 kt tropical depression at 32.9N, 68.8W at 12Z.
- Microfilm shows a tropical cyclone of at most 1012 mb at 32N, 68W at 12Z.

2. Aircraft highlights:
- Penetration center fix measured a central pressure of 1003 mb and estimated surface winds of 45 kt at 33.7N, 68.1W at 1830Z (WALLET).

3. Satellite highlights:
- ESSA 6 estimated a center fix at 33.4N, 68W at 1505Z (WALLET).

4. Discussion:
- MWR: "On September 26, a Navy reconnaissance aircraft found a warm core, a minimum pressure of 1003 mb, and 52 mi/hr winds."
- ATSR: "On 26 September, a Navy reconnaissance aircraft reported 45 knot winds near the center of the circulation, then at 33N, 68W, and the depression was upgraded to Tropical Storm FRANCES."
- Reanalysis: The system encountered more favorable environmental conditions on the 26th and intensified while moving between Bermuda and the Carolinas. Satellite images showed that Frances had become better organized with large area of convection near the center of circulation. Upper-level maps indicate that the system was no longer interacting with an upper-level trough. Transition to a tropical cyclone is now indicated to be at 12Z on the 26th. A reconnaissance aircraft investigated the tropical cyclone at 1830Z on the 26th and measured a central pressure of 1003 mb and estimated surface winds of 45

kt. A central pressure of 1003 mb suggests maximum surface winds of 40 kt from the north of 25N Brown et al. pressure-wind relationship. Based on a forward speed of about 7 kt but a small circulation, an intensity of 40 kt is analyzed at 18Z on the 26th, down from 45 kt originally shown in HURDAT, a minor intensity change. Intensification to a tropical storm is analyzed at 12Z on the 26th, six hours earlier than originally shown in HURDAT. A central pressure of 1003 mb was present in the original HURDAT at 18Z on the 26th and has been retained.

September 27:

1. Maps and old HURDAT:
- HWM analyzes a tropical storm of at most 1008 mb at 35.5N, 65.5W with a cold front to the northwest at 12Z.
- HURDAT lists a 50 kt tropical storm at 34.2N, 66.2W at 12Z.
- Microfilm shows a tropical cyclone of at most 1000 mb at 35N, 66W at 12Z.

2. Ship highlights:
- 25 kt NW and 1002 mb at 34N, 65.8W at 18Z (COADS).

3. Aircraft highlights:
- Penetration center fix measured a central pressure of 1001 mb and estimated surface winds of 50 kt at 34.4N, 65.4W at 1820Z (WALLET).

4. Satellite highlights:
- ESSA 6 estimated a center fix at 34N, 66W at 1415Z (WALLET).
- ESSA 7 estimated a center fix at 34.5N, 65W at 1835Z (WALLET).

5. Discussion:
- MWR: "An Air Force reconnaissance aircraft recorded the lowest central pressure of 1001 mb and 59-mi/hr winds on September 28 [should be 27th], the maximum observed."
- ATSR: "FRANCES continued to intensity slightly during the next 24 hours [27] … maximum intensity of 50 knots, some 150 miles north of Bermuda. Upper-air conditions prevented FRANCES from reaching hurricane intensity as she moved on a more eastward track during the next two days under the influence of the upper-air trough."
- Reanalysis: Frances turned to the east-northeast and intensified slightly. A reconnaissance aircraft investigated the tropical cyclone at 1820Z on the 27th and measured a central pressure of 1001 mb and estimated surface winds of 50 kt. A central pressure of 1001 mb suggests maximum surface winds of 44 kt from the north of 25N pressure-wind relationship and 47 kt from the 35N Landsea et al. pressure-wind relationship. Based on a forward speed of about 12 kt and small circulation, an intensity of 50 kt is retained in HURDAT. 50 kt is also the peak intensity of this tropical cyclone, unchanged from that originally in HURDAT. A central pressure of 1001 mb was present in the original HURDAT at 18Z on the 27th and has been retained. Satellite images showed a well-defined circulation with most of the convection over the eastern quadrant.

September 28:

1. Maps and old HURDAT:
- HWM analyzes a tropical storm of at most 1008 mb at 35.2N, 62W with a cold front just to the northwest at 12Z.
- HURDAT lists a 45 kt tropical storm at 35N, 59.8W at 12Z.

- Microfilm shows a tropical cyclone of at most 1004 mb at 34.8N, 61.8W at 12Z.

2. Aircraft highlights:
- Penetration center fix measured a central pressure of 1003 mb and estimated surface winds of 40 kt at 35.3N, 57.6W at 1940Z (WALLET).

3. Satellite highlights:
- ESSA 6 estimated a center fix at 35N, 59.5W at 1510Z (WALLET).
- ESSA 7 estimated a center fix at 35N, 58W at 1736Z (WALLET).

4. Discussion:
- MWR: "A ship late on the 28th found Frances had weakened and was no longer a storm."
- Reanalysis: Frances increased in forward speed on the 28th and the intensity remained steady. A reconnaissance aircraft investigated the tropical cyclone at 1940Z on the 28th and measured a central pressure of 1003 mb and estimated surface winds of 40 kt. A central pressure of 1003 mb suggests maximum surface winds of 44 kt from the north of 35N and 40 kt from the north of 25N pressure-wind relationships. Based on a forward speed of about 20 kt and small circulation, an intensity of 45 kt is analyzed at 18Z on the 28th, up from 40 kt originally shown in HURDAT, a minor intensity change. A central pressure of 1003 mb was present in the original HURDAT at 18Z on the 28th and has been retained. Ship observations near the system were scarce on the 28th but a gale-force wind was reported at 18Z.

September 29:

1. Maps and old HURDAT:
- HWM analyzes a tropical storm of at most 1008 mb at 36N, 50.2W with a weakening cold front just to the northwest at 12Z.
- HURDAT lists a 30 kt extratropical depression at 35.4N, 50.7W at 12Z.
- Microfilm shows a low pressure with a trough to the southwest at 35.3N, 51.7W at 12Z.

2. Ship highlights:
- 30 SW and 1007 mb at 35.6N, 52.7W at 06Z (WALLET).
- 35 kt S and 1005 mb at 34.9N, 47.9W at 18Z (COADS).

3. Satellite highlights:
- ESSA 7 estimated a center fix at 35N, 48W at 1637Z (WALLET).

4. Discussion:
- ATSR: "FRANCES became extratropical on 29 September…"
- Reanalysis: A ship passed near the center of Frances reporting 30 kt SW and 1007 mb at 06Z on the 29th, suggesting a central pressure of 1004 mb, which has been added to HURDAT in this time slot, replacing the existing 1007 mb. HURDAT originally weakened Frances to a tropical depression at 06Z on the 29th but a ship at 18Z reported 35 kt S and tropical storm intensity has been retained through the 29th. The original HURDAT also indicated that Frances had acquired extratropical characteristics on the 29th at 12Z, though synoptic observations are ambiguous as to whether the tropical cyclone remained ahead of an approaching frontal boundary. Extratropical transition, however, is maintained at 12Z on the 29th. Satellite images did indicate that Frances had becomes less organized compared to the day before.

September 30:

1. Maps and old HURDAT:

- HWM analyzes a cold front over the North Atlantic, Frances appears to have been absorbed or dissipated at 12Z.
- HURDAT lists a 30 kt extratropical depression at 36.8N, 39.5W at 12Z.
- Microfilm shows a closed low pressure of at most 1008 mb with a trough to the southwest and frontal boundary to the north at 37.5N, 39W at 12Z.

2. Satellite highlights:

- ESSA 6 estimated a center fix at 38N, 38W at 14Z (WALLET).

3. Discussion:

- ATSR: "…and weakened as she approached the Azores on 30 September."
- Reanalysis: Satellite and synoptic observations on the 30th indicate that Frances weakened into a trough of low pressure over the north Atlantic. Thus, the last position is analyzed at 18Z on the 29th, 24 hours earlier than originally shown in HURDAT. The remnants of Frances were absorbed by a strong frontal boundary late on the 30th or early on October 1st.

October 1:

1. Maps and old HURDAT:

- HWM and microfilm show a frontal boundary over the North Atlantic at 12Z.

Sources: NHC microfilm maps, the Historical Weather Maps series, the COADS ship database, Monthly Weather Review, Navy reconnaissance book, Mariners Weather Log, Satellite images from NCDC, and NHC Storm Wallets.

Tropical Depression [September 25-28, 1968] – AL131968

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44170 09/25/1968 M= 5 13 SNBR= 913 NOT NAMED   XING=0 SSS=0
44170 09/25/1968 M= 4 13 SNBR= 913 NOT NAMED   XING=0 SSS=0
                     *

44175 09/25*185 850 -99    0*199 849 -99    0*210 843 -99    0*220 842 -99    0*
44175 09/25*  0   0   0    0*  0   0   0    0*  0   0   0    0*200 850  25    0*
              *   *   *        *   *   *        *   *   *      *** ***  **

44180 09/26*229 841 -99    0*241 830 -99    0*250 821 -99    0*255 813 -99    0*
44180 09/26*210 845  25    0*219 840  25    0*228 835  25    0*238 828  30    0*
            *** ***  **      *** ***  **      *** ***  **      *** ***  **

44185 09/27*260 801 -99    0*263 798 -99    0*269 790 -99    0*271 785 -99    0*
44185 09/27*248 820  30 1004*256 812  30    0*261 802  30    0*265 793  25    0*
            *** ***  ** **** *** ***  **      *** ***  **      *** ***  **

44190 09/28*274 771 -99    0*275 765 -99    0*276 754 -99    0*278 750 -99    0*
44190 09/28*268 785  25    0*270 777  25    0*  0   0   0    0*  0   0   0    0*
            *** ***  **      *** ***  **        *   *   *        *   *   *

(September 29th is removed from HURDAT)
44195 09/29*279 739 -99    0*279 721 -99    0*  0   0   0    0*  0   0   0    0*

44200 TD
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Significant Revisions:

1. Genesis is analyzed 18 hours later than originally shown in HURDAT based on synoptic observations.
2. Significant track changes are analyzed between September 25th at 18Z and the 27th at 12Z based on synoptic observations.
3. Dissipation is analyzed 24 hours earlier than originally shown in HURDAT based on synoptic observations.
4. Note original HURDAT did not have winds included for this system.

Daily Metadata:

September 24:

1. Maps and old HURDAT:

- HWM analyzes a tropical wave or trough over the western Caribbean at 12Z.
- Microfilm shows a tropical wave extending from the western Caribbean to the western Bahamas at 12Z.

2. Discussion:

- WALLET: "Low level RECON by modified Bravo track in northwest Caribbean revealed apparent trof vicinity 1600N 8400W NNW to vicinity 2200N 8500W with no evidence of low pressure circulation. Max observed surface wind 060/18 under squalls vicinity 2100N 8500W disorganized mass. Min observed slp 1009 mb at 1627N 8200W."
- Reanalysis: The tropical depression developed from a tropical wave that reached the western Caribbean Sea on September 20th. The northern portion moved northward and intensified into Tropical Storm Frances. The southern portion continued slowly westward and gradually became better organized. Satellite images on the 24th showed a large area of convection extending to the western Bahamas but synoptic observations indicated that the circulation was not closed.

September 25:

3. Maps and old HURDAT:

- HWM analyzes a spot low pressure at 20N, 85W at 12Z.
- HURDAT lists a tropical depression at 21N, 84.3W at 12Z.
- Microfilm shows a tropical cyclone of at most 1008 mb at 17.6N, 86.5W at 12Z.

2. Discussion:

- WALLET: "Radar showed semi circular area open on the southwest side. The heaviest activity was to the north. Proceeded at 500 mb to 19N 85W. Descended to 1500 ft and took ob at 1700Z. Surface pressure 1008.1 winds were under ten knots. Investigated area 100 NM about this point. Weak cyclonic flow indicated centered at appx 18.9N 84.4W. Fix by flight level and surface winds. Pressure pattern also supports but lowest pressure reading was not at center. Unable to get center dye to small area of heavy weather returning. Winds were all under 10 knots."
- Reanalysis: The disturbance remained elongated northeast-southwest during most of the 25th but a closed low-level circulation is analyzed to have developed around 18Z. The first position is analyzed as a 25 kt tropical depression at 18Z on the 25th, 18 hours later than originally shown in HURDAT.

September 26:

4. Maps and old HURDAT:

- HWM analyzes a closed low pressure of at most 1008 mb at 23N, 83.5W and a cold front to the north at 12Z.
- HURDAT lists a tropical depression at 25N, 82.1W at 12Z.
- Microfilm shows a tropical cyclone of at most 1008 mb at 22.8N, 83.5W at 12Z.

5. Ship highlights:

- 30 kt SE and 1010 mb at 26.4N, 83W at 18Z (COADS).

6. Land highlights:

- 25 kt SE at Key West, FL (time unknown) (CLIMO).

7. Discussion:

- WALLET: "Reconned at 500 mb on GULL PAPA route to 18 deg N 80 deg W. Observed no significant weather or surface winds enroute. Descended to 700 mb at 19 deg 06 min N 82 deg 42 min W and reconned to 20 deg N 85 deg W. Surface winds were very calm over area with little cloudiness. Recorded slp of 1008 mb. Proceeded north at 700 mb to 22 deg 48 min N 85 deg 36 min W and descended to 1500 feet at 24 deg N 83 deg W at 1812Z and observed light and variable surface winds and scattered clouds. Slp of 1008.5 mb. Proceeded northeast to 25 deg N 82 deg W and recorded surface winds of 160/25 flight level winds 145/35 slp 1007.8 mb. At 25 deg 30 min N 83 deg 30 min W recorded surface winds 080/15 flight level winds 090/20 slp 1007.8. Proceeded to 25 deg N 83 deg 16 min W recorded 1007 mb. Flight level winds 180/10 surface wind light and variable. No closed circulation observed in area, one band to 25 deg 42 min N 83 deg 48 min W approx. 20 NM wide. Proceeded to base due to fuel considerations at 1930Z."
- Reanalysis: The tropical depression moved northeast and over western Cuba early on the 26th, entering the southeast Gulf of Mexico later in the day. Based on ship observations, an intensity of 30 kt is analyzed at 18Z on the 26th, also the peak intensity of this tropical depression.

September 27:

4. Maps and old HURDAT:

- HWM analyzes a closed low pressure of at most 1008 mb at 25.5N, 81.5W and a cold front to the north at 12Z.
- HURDAT lists a tropical depression at 26.9N, 79W at 12Z.
- Microfilm shows a tropical cyclone of at most 1008 mb at 25.5N, 81W and a cold front to the north at 12Z.

5. Ship highlights:

- 30 kt SE and 1009 mb at 24.8N, 80.5W at 06Z (COADS).

6. Land highlights:

- 10 kt W and 1005 mb at Dry Tortugas, FL at 00Z (micro).

7. Discussion:

- Reanalysis: Dry Tortugas measured 10 kt W and 1005 mb at 00Z on the 27th, suggesting a central pressure of 1004 mb, which has been added to HURDAT. A central pressure of 1004 mb suggests maximum surface winds of 39 kt south of 25N and 34 kt north of 25N from the Brown et al. pressure-wind relationship. Based on a low environmental pressure (1009 mb OCI) and synoptic observations, an intensity of 30 kt is analyzed at 00Z on the 27th. Around 06Z on the 27th, the tropical depression moved over southern Florida. Satellite images showed

that all the convection associated with the depression was located to the northeast, well removed from the center, an indication of strong wind shear.

September 28:

4. Maps and old HURDAT:

- HWM analyzes a closed low pressure of at most 1010 mb at 27.5N, 75W and a cold front to the north at 12Z.
- HURDAT lists a tropical depression at 27.6N, 75.4W at 12Z.
- Microfilm shows a tropical cyclone at 27.5N, 76.7W at 12Z.

5. Discussion:

- Reanalysis: The tropical depression became less organized early on the 28th and synoptic observations indicated that it had weakened into a trough of low pressure around 12Z over the western Bahamas. Satellite images also showed that the convection was disorganized, resembling a trough. The last position is analyzed at 06Z on the 28th, 24 hours earlier than originally shown in HURDAT.

September 29:

4. Maps and old HURDAT:

- HWM analyzes a closed low pressure of at most 1014 mb at 27.5N, 74W and a weakening cold front to the northeast at 12Z.
- HURDAT lists a tropical depression at 27.9N, 72.1W at 06Z (last position).
- Microfilm shows a tropical cyclone of at most 1014 mb at 28.5N, 74W at 12Z.

September 30:

3. Maps and old HURDAT:

- HWM analyzes a trough of low pressure from the northwest Bahamas to the western Atlantic at 12Z.
- Microfilm shows a closed low pressure of at most 1016 mb at 28.5N, 73.5W at 12Z.

Sources: NHC microfilm maps, the Historical Weather Maps series, the COADS ship database, Mariners Weather Log, Climatological Data, satellite images and EV2 Surface Observations from NCDC.

Hurricane Gladys (1968) – AL141968

Revisions to H. Gladys (1968) best track (any revisions shown in red, major changes to intensity indicated in **bold face**) – Contributed by Stacy Stewart

DTG	LAT	LONG	VMAX	MSLP	STATUS
1968101312	14.0N	80.5W	25	0	TD
1968101318	14.6N	81.3W	25	0	TD
1968101400	15.5N	82.0W	25	0	TD
1968101406	16.5N	82.5W	25	0	TD
1968101412	17.2N	82.6W	30	0	TD
1968101418	17.7N	82.5W	35	1002	TS

1968101500	18.3N	82.7W	35	1003	TS	
1968101506	18.9N	83.0W	40	0	TS	
1968101512	19.4N	83.3W	45	999	TS	
1968101518	19.9N	83.4W	50	998	TS	
1968101600	20.5N	83.5W	55	994	TS	
1968101606	21.1N	83.6W	55	0	TS	
1968101612	21.7N	83.5W	55	996	TS	
1968101615	22.2N	83.4W	55	994	**TS**	**----→ LANDFALL**
1968101618	23.0N	83.3W	55	0	TS	
1968101700	24.3N	83.3W	60	990	TS	
1968101706	25.1N	83.7W	65	0	TS	
1968101712	25.8N	84.0W	70	986	HU	
1968101718	26.3N	84.1W	70	986	HU	
1968101800	26.7N	84.2W	70	985	HU	
1968101806	27.0N	84.2W	75	0	HU	
1968101812	27.4N	84.1W	80	980	HU	
1968101818	27.8N	83.7W	80	0	HU	
1968101900	28.3N	83.1W	**85**	977	HU	
1968101904	28.7N	82.7W	**85**	978	HU	**------> LANDFALL**
1968101906	28.8N	82.5W	80	0	HU	
1968101912	30.0N	81.0W	70	987	HU	
1968101918	31.3N	79.7W	75	981	HU	
1968102000	32.9N	78.2W	75	0	HU	
1968102006	34.3N	76.6W	75	985	HU	
1968102012	35.5N	74.6W	70	983	HU	
1968102018	37.0N	72.0W	70	981	EX	
1968102100	38.6N	68.3W	65	0	EX	
1968102106	40.7N	64.9W	65	0	EX	
1968102112	43.9N	62.9W	60	975	EX	
1968102118	46.0N	61.0W	50	0	EX	

Original Best track for tropical cyclone al141968 (GLADYS)

DTG	LAT	LONG	VMAX	MSLP	STATUS
1968101312	14.0N	80.5W	25	0	TD
1968101318	14.6N	80.9W	25	0	TD
1968101400	15.4N	81.4W	25	0	TD
1968101406	16.1N	81.7W	25	0	TD
1968101412	16.8N	82.0W	25	0	TD
1968101418	17.5N	82.4W	30	0	TD
1968101500	18.3N	82.7W	30	1003	TD
1968101506	18.9N	83.0W	30	0	TD
1968101512	19.4N	83.3W	45	999	TS
1968101518	19.9N	83.4W	50	994	TS
1968101600	20.5N	83.5W	50	0	TS
1968101606	21.1N	83.6W	55	0	TS
1968101612	21.7N	83.5W	65	996	HU
1968101618	23.0N	83.3W	65	0	HU
1968101700	24.3N	83.3W	65	990	HU
1968101706	25.1N	83.7W	65	0	HU
1968101712	25.8N	84.0W	65	986	HU
1968101718	26.3N	84.1W	65	986	HU
1968101800	26.7N	84.2W	65	990	HU
1968101806	27.0N	84.2W	65	0	HU
1968101812	27.4N	84.1W	70	980	HU

1968101818	27.8N	83.7W	70	0	HU
1968101900	28.3N	83.1W	70	977	HU
1968101906	28.9N	82.5W	70	978	HU
1968101912	30.0N	81.0W	70	965	HU
1968101918	31.3N	79.7W	75	966	HU
1968102000	32.9N	78.2W	75	0	HU
1968102006	34.3N	76.6W	70	985	HU
1968102012	35.5N	74.6W	70	983	HU
1968102018	37.0N	72.0W	70	981	HU
1968102100	38.6N	68.3W	65	0	HU
1968102106	40.7N	64.9W	65	0	HU
1968102112	43.9N	62.9W	65	975	EX
1968102118	46.0N	61.0W	50	0	EX

Summary of Changes:
No change made to the genesis time of Gladys. Changes early in the track are based on a re-analysis of surface data along with incorporating recon data. The changes to the intensity and track prior to and shortly after landfall are based on radar and surface obs data, and by ignoring some of the recon data which looks bad.

Gladys has been downgraded to a tropical storm when it crossed western Cuba. The aircraft reported central pressures prior to landfall do not directly support hurricane strength, and there are no observations of sustained hurricane-force winds from any Cuban station. In addition, examination of the MF map for 1800 UTC 16 October suggests that the cyclone lacked an inner pressure core that might support hurricane-force winds. These changes were minor downward intensity revisions from 12Z on the 16th through 06Z on the 17th.

Gladys struggled to intensify until around 0600-1200Z 18 Oct 1968 due to the cyclone experiencing southwesterly to westerly shear almost from the outset of its initial formation, owing to the large blocking ridge to the east and northeast of the cyclone. The flow was weakly diffluent, which helped to offset the shear somewhat. Between 1200-1800Z on 18 Oct, however, the westerly 200 mb flow had become weaker and much more diffluent and the storm-relative upper-level shear had decreased markedly as soon after the hurricane had made the sharp turn toward the northeast by 1800Z. These improved shear conditions allowed Gladys to strengthen more significantly.

Recon and radar reports from WSO Tampa and MacDill AFB (Tampa) indicated that Gladys' eye had contracted down from about 26 nmi diameter at 18/1346Z to 10 nmi diameter by 19/0332Z...just before landfall north of Homosassa, Florida and south of Yankeetown, Florida. Even after Gladys had moved well inland over north-central Florida, the Tampa radar was still indicating a 10 nmi diameter eye at 19/0845Z when the center was east of Silver Springs and over or very near my home in the Ocala National Forest. Frictional effects preclude increasing the intensity while Gladys was over land, but contraction of the eye prior to and shortly after landfall, along with surface obs wind reports strongly indicate that Gladys had strengthened prior to landfall. Clearwater Beach reported 78G87kt (90G100mph) at 18/2200Z, which was my justification for increasing the intensity to 85 kt two hours later at 19/0000Z in the best track. Inglis, just north of the landfall point, reported a sustained wind of 82 kt (94 mph); assuming that stronger winds existed in the south side of the eye, I also **added a landfall point** at 19/0400Z with an intensity of 85 kt as well. Given that Gladys was only about 15 nmi inland at 19/0600Z, and that that area is fairly flat and quite marshy like the Everglades region of southwest Florida, an 80-kt intensity just inland seems very plausible. I can attest to the strength of Gladys after it had moved much farther inland and over my house by 0800-0900Z since I had been through Hurricanes Cleo (1964) and Betsy (1965) in south Dade County just a few years before Gladys; trust me, Gladys was no 60-65 kt storm when it passed over

our house the early morning of 19 October. In summary, I have made Gladys a Cat 2 hurricane before it made landfall along the Florida west coast just before midnight 19 October 1968, with peak winds of 85 kt.

After landfall, some erroneously low pressures were in HURDAT for late on the 19th. After reinterpretation, these were significantly revised upward, without a change to the intensity.

Gladys is now also considered to be a Category 1 hurricane impact for North Carolina, though the center remained just offshore.

Extratropical transition is indicated to have occurred 18 hours earlier based upon ship and station observations.

Daily Metadata:

October 6:

1. Maps and old HURDAT:
- HWM does not analyze an organized system at 12Z.
- HURDAT does not list an organized system on this date.
- Microfilm shows a tropical wave over the Lesser Antilles at 12Z.

2. Discussion:
   a. MWR: "A tropical wave passed through the Lesser Antilles on October 6 and traversed the Caribbean with no appreciable intensification during the next 4 days"

October 7:

1. Maps and old HURDAT:
- HWM does not analyze an organized system at 12Z.
- HURDAT does not list an organized system on this date.
- Microfilm shows a tropical wave along longitude 67W, extending from 12N-20N at 12Z.

October 8:

1. Maps and old HURDAT:
- HWM and microfilm show a tropical wave along longitude 74W, extending from 13N-22N at 12Z.
- HURDAT does not list an organized system on this date.

October 9:

1. Maps and old HURDAT:
- HWM does not analyze an organized system at 12Z.
- HURDAT does not list an organized system on this date.
- Microfilm shows a tropical wave along longitude 78W, extending from 14N-26N at 12Z.

October 10:

3. Maps and old HURDAT:
- HWM and microfilm shows a tropical wave along longitude 81W, extending from 13N-26N at 12Z.
- HURDAT does not list an organized system on this date.

October 11:

1. Maps and old HURDAT:

- HWM analyzes a spot low at 19N, 85W with a tropical wave to the north at 12Z.
- HURDAT does not list an organized system on this date.
- Microfilm shows a closed low pressure of at most 1010 mb at 18.5N, 84.5W at 12Z.

2. Discussion:
   a. MWR: "October 11, a tropical depression formed on the wave near Swan Island."
   b. ATSR: "The entire western Caribbean was an area of disturbed weather from 11 to 13 October as an unstable easterly wave persisted over the area from the Florida Straits to Swan Island, and an active ITCZ remained essentially stationary in the southwest sector. An initial tropical depression warning was issued at 111600Z."

October 12:

1. Maps and old HURDAT:

- HWM analyzes a spot low at 19N, 85W at 12Z.
- HURDAT does not list an organized system on this date.
- Microfilm shows a closed low pressure of at most 1010 mb at 19N, 84.5W with a tropical wave to the northeast at 12Z.

2. Discussion:
   a. MWR: "On the following day [October 12] satellite photographs revealed that a disturbance had developed south of Jamaica."

October 13:

1. Maps and old HURDAT:

- HWM analyzes a closed low pressure of at most 1008 mb at 13.5N, 80W at 12Z.
- HURDAT lists a 25 kt tropical depression at 14N, 80.5W at 12Z (first position).
- Microfilm shows a closed low pressure of at most 1008 mb at 13.5N, 85.3W at 12Z.

2. Discussion:
   a. MWR: "October 13, still a third disturbed area formed on the ITC near San Andres. Thus, the western Caribbean was the scene of a broad zone of low pressure and extensive shower activity. It was this third system which, after drifting slowly north-northwestward for 48 hr, developed into Gladys."
   b. ATSR: "A second easterly wave moved westward over Jamaica into this disturbed area early on 13 October and a circulation formed near 15N, 82W."

October 14:

1. Maps and old HURDAT:

- HWM analyzes a tropical wave or trough extending from 18N-35N, 73W-83W at 12Z.
- HURDAT lists a 25 kt tropical depression at 16.8N, 82W at 12Z.
- Microfilm shows a closed low pressure of at most 1006 mb at 17N, 82.5W at 12Z.

2. Station highlights:

- 5 kt N and 1006 mb at 18Z at Swan Island (micro)

3. Aircraft highlights:

- 20 kt and 1004 mb at 18.8N 82.4W at 18Z (micro)

October 15:

1. Maps and old HURDAT:
- HWM analyzes a tropical wave or trough extending from 18N-35N, 75W-85W at 12Z.
- HURDAT lists a 45 kt tropical storm at 19.4N, 83.3W at 12Z.
- Microfilm shows a tropical storm of at most 1004 mb at 19.5N, 83.2W at 12Z.

2. Ship highlights:
- 35 kt SE and 1004 mb at 20.2N, 82.2W at 12Z (COADS).
- 15 kt SSW and 1003 mb at 18.0N, 83.3W at 18Z (COADS).

3. Aircraft highlights:
- Penetration center fix measured a central pressure of 1003 mb and estimated surface winds of 35 kt at 18.2N, 82.6W at 00Z (WALLET).
- Penetration center fix measured a central pressure of 999 mb, estimated surface winds of 45 kt and an eye diameter of 40-50 n mi at 19.5N, 83.4W at 12Z (WALLET).
- Penetration center fix measured a central pressure of 998 mb, estimated surface winds of 45 kt and an eye diameter of 50 n mi at 20.3N, 83.9W at 1907Z (WALLET).
- Penetration center fix measured a central pressure of 994 mb and estimated surface winds of 45 kt at 20N, 83.6W at 2130Z (WALLET).

4. Discussion:
   a. MWR: "A Navy investigative flight found winds of 52 mi/hr and a surface pressure of 999 mb on the morning of October 15. Upon receipt of these data, tropical storm Gladys was named."
   b. ATSR: "Initial warning on Tropical Storm GLADYS was issued at 151600Z."

October 16:

1. Maps and old HURDAT:
- HWM analyzes a tropical storm of at most 1000 mb at 22N, 83.5W at 12Z.
- HURDAT lists a 65 kt hurricane at 21.7N, 83.5W at 12Z.
- Microfilm shows a tropical storm of at most 1004 mb at 21.6N, 83.5W at 12Z.

2. Ship highlights:
- 20 kt W and 1003 mb at 19.1N, 84.1W at 00Z (COADS).
- 20 kt NE and 1002 mb at 20N, 85W at 06Z (COADS).
- 30 kt SW and 1003 mb at 23.3N, 81.6W at 12Z (COADS).
- 35 kt ESE and 1003 mb at 24.7N, 83.3W at 18Z (COADS).

3. Land highlights:
- 35 kt SE and 1003 mb at Nueva Gerona, Cuba at 06Z (micro).
- 70 kt gusts at Nueva Gerona, Cuba (no time given) (MWR).
- 50 kt (fastest mile) at Havana, Cuba (no time given) (MWR).
- 10 kt ENE and 996 mb at Los Palacios, Cuba at 16Z (wallet).

4. Aircraft highlights:
- Penetration center fix measured a central pressure of 996 mb and estimated surface winds of 60 kt at 21.6N, 83.5W at 12Z (WALLET).
- Penetration center fix measured a central pressure of 995 mb and estimated flight level winds of 70 kt at 22.3N, 83.5W at 15Z (WALLET).

- Penetration center fix estimated surface winds of 74 kt at 23.9N, 83.4W at 2112Z (WALLET).

5. Land Radar highlights:
- 22 n mi diameter, open south at 23.8N, 83.2W at Key West, FL at 2140Z (WALLET).

6. Discussion:
   a. MWR: "Gladys became a hurricane shortly before crossing the south coast of western Cuba and continued to strengthen while crossing this narrow but mountainous part of the island. Winds gusted to 80 mi/hr at Gerona on the south coast, and Havana experienced sustained gale force winds for several hours."
   b. ATSR: "The storm moved slowly northward and reached hurricane intensity about 161600Z just before passing over western Cuba."

October 17:

1. Maps and old HURDAT:
- HWM analyzes a hurricane of at most 1004 mb at 25.8N, 83.7W at 12Z.
- HURDAT lists a 65 kt hurricane at 25.8N, 84W at 12Z.
- Microfilm shows a hurricane of at most 1000 mb at 25.7N, 83.7W at 12Z.

2. Ship highlights:
- 80 kt SE and 996 mb at 24.3N, 82.7W at 00Z (COADS).
- 60 kt SE and 1004 mb at 23.9N, 81.9W at 06Z (C0ADS).
- 40 kt N and 1000 mb at 25.7N, 85W at 18Z (COADS).

3. Land highlights:
- 997 mb (minimum pressure), 55 kt E (fastest mile), 75 kt E gusts at Dry Tortugas (no time given but likely early 17th) (MWR).
- 45 kt SE (fastest mile), 48 kt SE gusts at Key West at 0112Z (MWR).

4. Aircraft highlights:
- Penetration center fix measured a central pressure of 990 mb at 24.3N, 83.3W at 0046Z (WALLET).
- Penetration center fix measured a central pressure of 984 mb at 24.8N, 83.4W at 0413Z (WALLET).
- Penetration center fix measured a central pressure of 986 mb and estimated surface winds of 65 kt at 25.6N, 83.8W at 1140Z (WALLET).
- Penetration center fix measured a central pressure of 986 mb and estimated surface winds of 65 kt at 26.2N, 84.2W at 1730Z (WALLET).
- Penetration center fix measured a central pressure of 985 mb at 26.4N, 84.2W at 2105Z (WALLET).
- Penetration center fix measured a central pressure of 990 mb, estimated surface winds of 60 kt and an eye diameter of 20 n mi at 26.8N, 84.1W at 2325Z (WALLET).

5. Land radar highlights:
- 20 n mi eye diameter at 24.4N, 83.4W at Key West, FL at 0040Z (WALLET).
- 30 n mi eye diameter at 25.2N, 83.6W at Key West, FL at 0545Z (WALLET).
- 20 n mi eye diameter, eye elongated WNW/ESE at 25.8N, 84W at Key West, FL 1245Z (WALLET).
- 40 n mi eye diameter, eye open SW at 26.2N, 84W at Tampa, FL 1815Z (WALLET).

6. Discussion:
   a. MWR: "Gladys emerged into the Florida Straits and continued slowly northward, passing just to the west of Dry Tortugas. Highest winds measured on the island were 64 mi/hr with gusts to 86 mi/hr; the pressure fell to 997 mb. The only wind of hurricane force recorded elsewhere in the keys was an 87-mi/hr gust at Plantation Key. Only minor damage was reported."
   b. ATSR: "GLADYS then moved steadily across Cuba toward western Florida, but slowed and became stationary about 100 miles offshore from Tampa."

October 18:

1. Maps and old HURDAT:
- HWM analyzes a hurricane of at most 1004 mb at 27.8N, 84.1W with a frontal boundary to the west at 12Z.
- HURDAT lists a 70 kt hurricane at 27.4N, 84.1W at 12Z.
- Microfilm shows a hurricane of at most 1004 mb at 27.4N, 84W with a frontal boundary to the west at 12Z.

2. Ship highlights:
- 35 kt NW and 1005 mb at 26.2N, 85.9W at 00Z (COADS).
- 35 kt SE and 1018 mb at 33.5N, 77.6W at 06Z (COADS).
- 35 kt SE and 1017 mb at 33.5N, 77.6W at 12Z (COADS).
- 50 kt S and 1005 mb at 26.8N, 83.2W at 18Z (micro).

3. Land highlights:
- 75 kt SE (fastest mile, anemometer blew away) (no time given) at Bayport, FL (MWR).
- Gusts to 85 kt (no time given) at Homosassa, FL (MWR).
- 58 kt (fastest mile), gusts to 75 kt (no time given) at New Port Richey, FL (MWR).

4. Aircraft highlights:
- Penetration center fix measured a central pressure of 980 mb, estimated surface winds of 65 kt and an eye diameter of 26 n mi at 27.5N, 84.2W at 1346Z (WALLET).
- Penetration center fix measured a central pressure of 977 mb at 28.3N, 83.3W at 2345Z (WALLET).

5. Land radar highlights:
- 28 n mi eye diameter at 26.7N, 84.2W at Tampa, FL at 0040Z (WALLET).
- 20 n mi eye diameter at 27.2N, 84.3W at Tampa, FL at 0640Z (WALLET).
- 20 n mi eye diameter at 27.5N, 84.1W at MacDill AFB, FL at 1245Z (WALLET).
- 9 n mi eye diameter at 28N, 84.8W at MacDill AFB, FL at 1845Z (WALLET)

6. Discussion:
a. ATSR: "Late on 18 October, as a polar front approached from the west, the ridge began to move eastward and GLADYS began to move slowly to the northeast."

October 19:

1. Maps and old HURDAT:
- HWM analyzes a hurricane of at most 1000 mb at 30.5N, 81.5W with a frontal boundary to the west at 12Z.
- HURDAT lists a 70 kt hurricane at 30N, 81W at 12Z.

- Microfilm shows a hurricane of at most 1004 mb at 30.2N, 81W with a frontal boundary to the west at 12Z.

2. Ship highlights:
- 35 kt SE and 1018 mb at 32.9N, 75.8W at 00Z (COADS).
- 35 kt S and 1013 mb at 28.8N, 79.7W at 06Z (COADS).
- 50 kt S and 1011 mb at 28.5N, 79.8W at 12Z (COADS).
- 70 kt S and 999 mb at 31.2N, 79.3W at 18Z (COADS).

3. Land highlights:
- 50 kt SW (fastest mile), gusts to 65 kt at St. Petersburg, FL at 01Z (MWR).
- Calm at Ocala, FL at 0547Z (WALLET).
- 82 kt (fastest mile) at Inglis, FL at 0630Z (MWR).
- 993 mb (minimum pressure) at St. Augustine, FL at 1130Z (MWR).
- 49 kt ESE (fastest mile), gusts to 64 kt ESE at Jacksonville Beach, FL at 1140Z (MWR).
- 1003 mb (minimum pressure) at Charleston, SC at 2041Z (MWR).

4. Aircraft highlights:
- Penetration center fix measured a central pressure of 978 mb and an eye diameter of 10 n mi at 28.6N, 82.8W at 0320Z (WALLET).
- Penetration center fix measured a central pressure of 965 mb at 30.4N, 80.6W at 1430Z (WALLET). (However, pressure extrapolated from 700 mb heights is 987 mb using today's formulas.)
- Penetration center fix measured a central pressure of 966 mb and estimated surface winds of 80 kt at 31.3N, 80.2W at 1747Z (WALLET). (However, pressure extrapolated from 700 mb heights is 981 mb using today's formulas.)

5. Land radar highlights:
- 28.2N, 83.1W at Tampa, FL at 0040Z (WALLET).
- 28.9N, 82.3W at Tampa, FL at 0641Z (WALLET).
- 30.1N, 81W at Daytona, FL at 1215Z (WALLET).
- 31.3N, 79.8W at Charleston, SC at 1815Z (WALLET).

6. Discussion:
   a. MWR: "The center passed inland between Bayport and Crystal River, very near Homosassa, about midnight on Saturday, October 19. Gladys began to accelerate in advance of the upper trough, crossing the peninsula at about 15 mi/hr, passing just north of Ocala, and back out to sea near St. Augustine around daybreak. Sustained hurricane force winds were confined to the west coastal area from Clearwater to Bayport and maximum gusts were in the 100 mi/hr range. Gladys moved from the upper east coast of Florida to the northeast about 25 mi/hr in advance of the upper trough, skirting the coasts of Georgia and the Carolinas."
   b. ATSR: "Early on 19 October, aerial reconnaissance and radar indicated that GLADYS was accelerating and moving inland near Crystal River, Florida. During the early morning hours of 19 October, with minimum hurricane intensity, GLADYS moved across the Florida Peninsula and offshore just south of St. Augustine."

October 20:

1. Maps and old HURDAT:
- HWM analyzes a hurricane of at most 996 mb at 35.5N, 74.8W with a frontal boundary very close to the west at 12Z.

- HURDAT lists a 70 kt hurricane at 35.5N, 74.6W at 12Z.
- Microfilm shows a hurricane of at most 1000 mb at 35.3N, 74.4W with a frontal boundary just to the west at 12Z.

2. Ship highlights:
- 45 kt SE and 993 mb at 33.1N, 79.3W at 00Z (COADS).
- 15 kt SW and 989 mb at 33.2N, 78W at 02Z (COADS).
- 70 kt NNW and 996 mb at 33.3N, 77.6W at 05Z (COADS).
- 40 kt NNE and 1009 mb at 36.8N, 76.2W at 12Z (COADS).
- 35 kt S and 1008 mb at 35.8N, 68.2W at 18Z (COADS).

3. Land highlights:
- 55 kt (fastest mile, anemometer blew away) at Nags Head, NC (no time given) (MWR).
- 55 kt and 993 mb at Cape Lookout, NC at 0930Z (SWO).
- 80 kt gusts at Cape Lookout, NC (no time given) MWR).
- 988 mb (minimum pressure) at Cape Hatteras WBO, NC at 0950Z (MWR).
- 45 kt (fastest mile) and gusts to 69 kt at Cape Hatteras WBO, NC at 1050Z (MWR).

4. Aircraft highlights:
- Radar center fix at 33.3N, 78W at 0215Z (WALLET).
- Penetration center fix measured a central pressure of 985 mb and an eye diameter of 35 n mi at 33.8N, 76.5W at 0556Z (WALLET).
- Penetration center fix measured a central pressure of 983 mb and estimated surface winds of 80 kt at 35.8N, 74.6W at 1230Z (WALLET).
- Penetration center fix measured a central pressure of 981 mb and estimated surface winds of 85 kt at 37N, 72.3W at 1730Z (WALLET).

5. Land radar highlights:
- Eye open south, 33.1N, 78.3W at Charleston, SC at 0012Z (WALLET).
- 34.4N, 76.7W at Charleston, SC at 0615Z (WALLET).
- 35.5N, 74.5W at Charleston, SC at 1215Z (WALLET).

6. Discussion:
   a. MWR: "The central pressure in Gladys reached 977 mb shortly before the storm crossed the Florida west coast around midnight of the 19th. The center passed very near Gape Hatteras early on October 20 while continuing to accelerate northeastward. Damage along the Carolina coast was minor. Gusts of hurricane force were confined to the Cape Hatteras area."
   b. ATSR: "Early on 20 October, she brushed the outer banks of North Carolina with hurricane winds and moved rapidly to sea."

October 21:

1. Maps and old HURDAT:
- HWM analyzes an extratropical cyclone of at most 980 mb at 44N, 63.5W at 12Z.
- HURDAT lists a 65 kt extratropical cyclone at 43.9N, 62.9W at 12Z.
- Microfilm shows an extratropical cyclone of at most 980 mb at 44N, 63.5W at 12Z.

2. Ship highlights:
- 30 kt NNE and 990 mb at 41.3N, 69W at 00Z (COADS).
- 50 kt WNW and 1004 mb at 36.3N, 69.6W at 00Z (COADS).

- 10 kt NNW and 989 mb at 42.7N, 65.9W at 06Z (COADS).
- 25 kt N and 982 mb at 42.9N, 65.5W at 09Z (COADS).
- 45 kt SE and 985 mb at 43.7N, 60.5W at 12Z (COADS).
- 55 kt WSW and 990 mb at 42.7N, 64.6W at 15Z (COADS).
- 45 kt SE and 984 mb at 46.3N, 59.5W at 18Z (COADS).
- 50 kt W and 995 mb at 42.6N, 64.8W at 21Z (COADS).

3. Station highlights:
   - 965 mb recorded in Nova Scotia (wallet). (Note that this pressure was from the large, deep extratropical cyclone that absorbed Glady's circulation.)

4. Aircraft highlights:
- Radar center fix at 39N, 67.6W at 0120Z (WALLET).
- Radar center fix estimated surface winds of 45 kt and an eye diameter of 12 n mi at 40.4N, 65W at 0530Z (WALLET).
- Penetration center fix measured a central pressure of 975 mb and estimated surface winds of 65 kt at 44.2N, 62.8W at 1230Z (WALLET).

5. Discussion:
   a. MWR: "Gladys turned north-northeastward in advance of an intensifying trough in the Great Lakes and gradually became extratropical as it merged with a cold front off the coast of Nova Scotia on October 21."
   b. ATSR: "On 21 October, she established a more northerly track due to a cut off low aloft that had formed over Maine. Late on 21 October, GLADYS became extratropical and was finaled as she passed over eastern Nova Scotia."

October 22:

1. Maps and old HURDAT:
- HWM analyzes an extratropical cyclone of at most 980 mb at 47.5N, 60.5W at 12Z.
- HURDAT does not list an organized system on this date.
- Microfilm indicates that the system had moved north of the synoptic map.

2. Ship highlights:
- 45 kt W and 996 mb at 43.1N, 65.5W at 00Z (COADS).
- 40 kt NW and 1000 mb at 43N, 66.2W at 06Z (COADS).
- 50 kt WNW and 980 mb at 46.3N, 60W at 12Z (COADS).
- 40 kt W and 995 mb at 44.6N, 59.8W at 18Z (COADS).

October 23:

1. Maps and old HURDAT:
- HWM analyzes an extratropical cyclone of at most 996 mb at 49N, 51W at 12Z.

October 24:

1. Maps and old HURDAT:
- HWM analyzes an extratropical cyclone of at most 996 mb at 48N, 38W at 12Z.

Sources: NHC microfilm maps, the Historical Weather Maps series, the COADS ship database, Monthly Weather Review, Mariners Weather Log, Satellite images from NCDC, and NHC Storm Wallets.

Subtropical Depression [November 24-25, 1968] – AL151968

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44170 11/24/1968 M= 2 15 SNBR= 913 NOT NAMED   XING=0 SSS=0

44175 11/24*  0   0   0    0*  0   0   0    0*221 728  25    0*245 720  25    0*
44175 11/24*  0   0   0    0*  0   0   0    0*  0   0   0    0S250 718  30    0*
                                                *   *   *     **** ***  **

44180 11/25*261 710  25    0*280 692  25    0*298 675  25    0*  0   0   0    0*
44180 11/25S270 715  30    0S295 705  30    0*  0   0   0    0*  0   0   0    0*
           **** ***  **     **** ***  **        *   *   *

44185 TD
44185 SD
      **
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Significant Revisions:

1. Significant track change on November 25th based on ship observations.
2. System analyzed to have been subtropical during its short lifetime based on synoptic observations and satellite imagery.

Daily Metadata:

November 23:

1. Maps and old HURDAT:

- HWM analyzes a stationary front extending from the central Caribbean Sea to the North Atlantic Ocean at 12Z.

2. Discussion:

- Reanalysis: A frontal boundary extended from the central Caribbean Sea to the north Atlantic on the 23rd. Satellite imagery showed a large area of disorganized convection north of the Bahamas.

November 24:

1. Maps and old HURDAT:

- HWM analyzes a stationary front extending from the central Caribbean Sea to the North Atlantic Ocean at 12Z.
- HURDAT lists a 25 kt tropical depression at 22.1N, 72.8W at 12Z (first position).
- Microfilm shows a closed low pressure of at most 1014 mb at 24N, 72W at 12Z.

2. Ship highlights:

- 30 kt ESE and 1011 mb at 27.5N, 70.5W at 18Z (COADS).

2. Discussion:

- Reanalysis: Synoptic observations indicate that a closed low-level circulation developed just north of the eastern Bahamas at 18Z on the 24th. Satellite imagery showed a well-defined low pressure with most of the convection over the north and eastern semicircles. Due to the non-tropical origin of the disturbance, convective signature, and strongest winds located about 200 n mi from the center, a subtropical depression is analyzed to have developed at 18Z on the 24th.

November 25:

1. Maps and old HURDAT:

- HWM analyzes a closed low pressure of at most 1000 mb at 38N, 68W with a warm front to the east and cold front to the south and an approaching cold front just to the northwest at 12Z.
- HURDAT lists a tropical depression at 29.8N, 67.5W at 12Z (last position).
- Microfilm shows a tropical cyclone of at most 1000 mb at 38N, 68W and an approaching cold front to the northwest at 12Z.

2. Ship highlights:

- 30 kt S and 1008 mb 25.9N, 70.1W at 00Z (COADS).
- 25 kt S and 1000 mb at 26.4N, 70.5W at 00Z (COADS).
- 35 kt SE and 1005 mb 34.4N, 66.7W at 12Z (COADS).
- 15 kt SW and 997 mb at 32.3N, 68.8W at 12Z (COADS).
- 40 kt NW and 998 mb 39.1N, 69.3W at 18Z (COADS).
- 65 kt W and 994 mb 37.3N, 60.2W at 20Z (COADS).

3. Discussion:

- MWL: "Meanwhile a vicious storm was developing on the 25th, in western waters, near 35N, 70W."
- WALLET: "Investigated 1500 ft. 23.0N 67.5W thru 29.5N 67.0W thru 31.5N 68.0W thru 34.0N 68.0W. WSW 25 kts winds becoming NW 25-40 kts sfc and flt level. Pressure decreasing and winds increasing northward along track. Turned NE to 35.0N 65.5W southwesterly winds to the NW of this point. Encountered 50 kt wind necessitating a climb. Unable to climb because of no clearance. Turned south toward Ramey. Minimum pressure 990.8 mb at 35.9N 65.4W not center pressure continuing to fall. Maximum wind 180-240/50 kts WNW winds at 16000 ft on return flight becoming SSW."
- Reanalysis: The subtropical depression moved quickly northward ahead of a strong frontal boundary. Synoptic observations indicate that the cyclone had lost its closed circulation by 12Z on the 25th and the last position is analyzed at 06Z on the 25th. Satellite imagery showed that the system had been absorbed by the developing low to the north. An intense extratropical cyclone developed later on the 25th along the frontal boundary over the north Atlantic and continued northeastward producing hurricane-force winds.

Sources: NHC microfilm maps, the Historical Weather Maps series, the COADS ship database, Mariners Weather Log, and Satellite images from NCDC and NSIDC.

New Tropical Storm [September 10–17, 1968] – AL161968

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45285 09/10/1968 M= 9  5 SNBR= 968 UNNAMED     XING=0 SSS=0
45290 09/10*320 780  25    0*330 777  30    0*340 767  30    0*352 752  30    0*
45295 09/11*370 742  35    0*390 737  45    0*415 730  55  997E440 723  45    0*
45300 09/12E460 716  40    0E478 709  40    0E493 700  35    0E498 683  35    0*
45305 09/13E499 660  40    0E500 635  40    0E501 610  40    0E502 590  40    0*
45310 09/14E505 572  45    0E509 557  45    0E515 545  45    0E521 535  45    0*
45315 09/15E528 525  45    0E534 515  45    0E540 505  45    0E546 495  45    0*
45320 09/16E552 482  45    0E556 467  45    0E559 450  45    0E560 430  45    0*
45325 09/17E560 412  40    0E560 393  40    0*  0   0   0    0*  0   0   0    0*
45330 TS
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U.S. Tropical Storm Landfall

09/11 10Z 40.6N 73.3W 55 kt NY – 997 mb

Significant Revisions:

1. A new tropical storm has been added to HURDAT, not previously shown in McAdie et al. (2009).

Daily Metadata:

September 8:

1. Maps and old HURDAT:
- HWM does not analyze any feature of interest at 12Z.
- Microfilm shows the tail of a weakening frontal boundary over the western Atlantic at 12Z.

2. Discussion:
- Reanalysis: A weakening frontal boundary was present over the western Atlantic on the 8th producing an area of disorganized convection.

September 9:

3. Maps and old HURDAT:
- HWM analyzes a spot low at 30.5N, 79W at 12Z.
- Microfilm shows a closed low pressure of at most 1014 mb at 28.5N, 74.5W at 12Z.

4. Discussion:
- WALLET: "Residual convection and a weak low pressure center off the Georgia coast, which were remnants from an upper trough which moved into the Atlantic late on the 8th…"
- Reanalysis: The disturbance slowly moved westward on the 9th and satellite images showed an increase in convection and organization.

September 10:

1. Maps and old HURDAT:
- HWM analyzes a closed low pressure of at most 1012 mb at 34N, 76.5W with a cold front to the west at 12Z.
- Microfilm shows a tropical cyclone of at most 1012 mb at 34N, 76.5W with a cold front to the west at 12Z.
- MWL shows a center of low pressure at 33.8N, 76.5W at 12Z (WALLET).
- Best track lists a tropical depression at 33.5N, 77.5W at 12Z.

2. Ship highlights:
- 35 kt SE and 1015 mb at 36N, 73.4W at 12Z (COADS).

3. Discussion:
- MWR: "A tropical depression that formed off the Carolina coast on the overnight of September 9th …"
- WALLET: "…began to get organized late on the 9th. The Charleston, South Carolina radar had some slight indications of a weak circulation at that time. On the 10th the depression move north-northeastward in advance of another upper trough with slowly falling pressures. The depression passed just east of Hatteras at 1 pm EST with a minimum pressure of 1009 mb (29.79 in). Winds of 35 mph were reported offshore from the Carolina coast on the 10th. The depression continued north-

northeastward during the remainder of the 10th with coastal stations giving no indication of any significant intensification."

- Reanalysis: Surface observations showed that a well-defined circulation had formed at 00Z on the 10th and therefore, genesis is analyzed at this time as a 25 kt tropical depression. Satellite images around 15Z showed that most of the convection was displaced to the north and east of the center, an indication of southwesterly wind shear. A ship reported 35 kt SE at 12Z on the 10th about 180 n mi northeast of the center and surrounding observations suggest it has a high bias. The tropical depression passed close to the Outer Banks of North Carolina around 12Z on the 10th producing heavy rains while accelerating to the northeast.

September 11:

1. Maps and old HURDAT:

- HWM analyzes an extratropical cyclone at 42N, 72W at 12Z.
- Microfilm shows an extratropical cyclone at 41.5N, 73W at 12Z.
- MWL shows a center of low pressure at 42N, 72.2W at 12Z.
- Best track lists an extratropical cyclone at 41.7N, 72.5W at 12Z (last position) (WALLET).

2. Ship highlights:

  - 35 kt SE and 1006 mb at 40.6N, 70.6W at 12Z (COADS).
  - 35 kt SW and 1019 mb at 40.6N, 70.7W at 18Z (COADS).
  - 35 kt SE and 1009 mb at 43.9N, 67W at 22Z (COADS).

3. Land highlights:

- 50 kt E at Falkners Island, CT at 09Z (WALLET).
- 25 kt SE and 1000 mb at Fire Island, NY at 09Z (WALLET).
- 38 kt ESE and 1003 mb at Moriches, NY at 09Z (WALLET).
- 18 kt ESE and 999 mb at Islip, NY at 0955Z (SWO/WALLET).
- 40 kt SE at Little Gull Island Light, NY at 1230Z (SWO).

4. Discussion:

- MWR: "and moved rapidly north-northeastward, crossing Long Island, NY, early on the 11th, may have briefly been of storm intensity as it crossed."
- WAGNER: "Although the surface synoptic maps prepared operationally every 3 hr. by the Analysis and Forecast Division of the Weather Bureau at the National Meteorological Center did not indicate anything lower than an extrapolated center of 1002 mb until after the storm had come inland over Connecticut, a later inspection of the hourly teletypewriter reports revealed pressures of 998.6 mb and falling rapidly at Islip, N.Y., at 1000 GMT with a southeast wind of 18 kt., and 1000.6 mb and rising rapidly with a southwest wind of the same speed just 1 hr. later. These reports indicate that the storm center must have passed a short distance west of Islip with a central pressure of 998 mb or a little less at the time of first landfall."
- WALLET: "During the early morning hours of the 11th, the Atlantic city, New Jersey and New York City radars picked up a possible low pressure center which accelerated and apparently intensified while approaching Long Island. The movement to the north-northeast of about 30 mph was in good agreement with the 1000 mb to 100 mb pressure weighted mean layer winds over the storm. The storm was absorbed on a cold front over Connecticut about 3 to 6 hours after its Long Island landfall. Highest winds were 45 to 60 mph over eastern Long Island. Lowest pressure reported was 1000 mb (29.53 in.) at Fire Island, New York."

- WALLET CONFERENCE AGENDA ITEM TITLE "THE CYCLONE OF SEPTEMBER 9-11": "This system began as a tropical depression. During the early morning hours of Sep. 11, radar reports, not received in Miami, suggested that was reaching storm force. Winds of storm velocity did occur over eastern Long Island. The system was quickly absorbed by a cold front and it is really not known whether this deepening took place just prior to or with the entry of the front. This is an old problem – the records are full of unnamed tropical storms – many times it is impossible to determine whether a system is warm core or not. Recommendation that the conference review our procedures, see if we can set up better guidelines – better definitions – and better "communications" which will result in better forecasts on these "quickies" and these "hybrids."
- Reanalysis: Intensification to a tropical storm is analyzed at 00Z on the 11th based on synoptic observations later on this date. The tropical cyclone continued to accelerate to the northeast ahead of a frontal boundary and made landfall in Long Island, NY, around 10Z on the 11th. The center passed just west of Islip, NY, which reported a minimum pressure of 998.6 mb and ESE 18 kt around 10Z on the 11th, suggesting a central pressure of 997 mb, which has been added to the 12Z time slot. A central pressure of 997 mb suggests maximum surface winds of 53 kt from the north of 35N Landsea et al. pressure-wind relationship. Based on an observation of 50 kt at 09Z at Falkners Island, CT and a forward speed of about 26 kt, an intensity of 55 kt is analyzed at 12Z on the 11th. 55 kt is also the analyzed intensity at landfall at 10Z on the 11th and the peak intensity of this tropical storm. The surface analysis on the microfilm and HWM suggest that the tropical cyclone had acquired extratropical characteristics at 12Z on the 11th but synoptic observations from stations near the center of the cyclone indicate that it retained an isothermal circulation and therefore, tropical characteristics. A comprehensive surface analysis at 10Z on September 11th shows uniformly warm temperatures and moist conditions surrounding the center of the system at landfall, indicating that it does count as a tropical storm landfall. Satellite images around 15Z on the 11th indicated that the tropical cyclone was becoming embedded within the frontal boundary and acquiring extratropical characteristics. Transition to an extratropical cyclone is analyzed at 18Z on the 11th.

September 12:

1. Maps and old HURDAT:
- HWM analyzes an extratropical cyclone at 49N, 70W at 12Z.
- MWL shows a center of low pressure at 48.8N, 68.2W at 12Z.

2. Discussion:
- Reanalysis: The extratropical cyclone continued to move to the northeast affecting Atlantic Canada on the 12th.

September 13:

1. Maps and old HURDAT:
- HWM analyzes an extratropical cyclone at 51N, 61W at 12Z.
- MWL shows a center of low pressure at 51.5N, 60.5W at 12Z.

2. Ship highlights:
- 40 kt E and 1003 mb at 48.1N, 69.6W at 00Z (COADS).
- 35 kt SSE and 1001 mb at 48.9N, 59W at 12Z (COADS).

September 14:

4. Maps and old HURDAT:
- HWM analyzes an extratropical cyclone at 54N, 51W at 12Z.
- MWL shows a center of low pressure at 53N, 54.5W at 12Z.

5. Ship highlights:
- 35 kt SW and 1003 mb at 43.5N, 59.5W at 00Z (COADS).
- 35 kt NE and 997 mb at 50.8N, 57.9W at 12Z (COADS).
- 45 kt E and 1012 mb at 59.3N, 46.4W at 18Z (COADS).

6. Discussion:
- Reanalysis: The extratropical cyclone crossed Newfoundland and moved into the north Atlantic maintaining gale-force winds.

September 15:

1. Maps and old HURDAT:
- HWM analyzes an extratropical cyclone at 54N, 51W at 12Z.
- MWL shows a center of low pressure at 54.5N, 48.5W at 12Z.

2. Ship highlights:
- 40 kt E and 1012 mb at 59.3N, 46.2W at 00Z (COADS).
- 45 kt E and 1004 mb at 53.1N, 45.2W at 06Z (COADS).
- 35 kt NW and 997 mb at 52.8N, 53.3W at 12Z (COADS).
- 40 kt NW and 1002 mb at 55.1N, 56.7W at 18Z (COADS).

September 16:

1. Maps and old HURDAT:
- HWM analyzes an extratropical cyclone at 56N, 43W at 12Z.
- MWL shows a center of low pressure at 55.5N, 43W at 12Z.

2. Ship highlights:
- 40 kt E and 1001 mb at 59.3N, 44.2W at 00Z (COADS).
- 35 kt W and 1013 mb at 44.9N, 39.1W at 12Z (COADS).
- 45 kt NW and 1007 mb at 52.8N, 48.3W at 18Z (COADS).

September 17:

1. Maps and old HURDAT:
- HWM analyzes an extratropical cyclone at 55N, 27W at 12Z.
- MWL shows a center of low pressure at 57.5N, 35.5W at 00Z (last position).

2. Ship highlights:
- 40 kt W and 1019 mb at 43.6N, 43.5W at 00Z (COADS).
- 35 kt W and 1019 mb at 43.4N, 45.1W at 06Z (COADS).
- 35 kt N and 1008 mb at 54.7N, 47.2W at 12Z (COADS).
- 35 kt NNE and 1008 mb at 55N, 45.6W at 18Z (COADS).

3. Discussion:
- Reanalysis: On the 17th, the extratropical cyclone interacted with another extratropical cyclone based on synoptic observations and by 12Z, it did not have a closed circulation. The last position is analyzed at 06Z on the 17th.

September 18:

1. Maps and old HURDAT:

- HWM analyzes an extratropical cyclone at 56N, 37W at 12Z.

2. Ship highlights:

- 35 kt N and 1007 mb at 55.4N, 44W at 00Z (COADS).
- 35 kt N and 1001 mb at 55.9N, 42.3W at 06Z (COADS).
- 35 kt NNW and 999 mb at 53.1N, 42.3W at 12Z (COADS).

September 19:

1. Maps and old HURDAT:

- HWM analyzes an extratropical cyclone at 48N, 42W at 12Z.

Sources: NHC microfilm maps, the Historical Weather Maps series, the COADS ship database, Mariners Weather Log, Monthly Weather Review, Wagner (1968, MWR, 889-892), EV2 (Surface Weather Observations) and Satellite images from NCDC. This disturbance was in Jack Beven and David Roth's List of Suspects.

1968 Additional Notes

1. January 20-24: Historical Weather Maps, microfilm, Monthly Weather Review, Storm Wallets, and satellite images indicate that a stationary frontal boundary was present over the central Atlantic on January 19th. An area of low pressure developed in the tail-end of the weakening frontal boundary on the 20th and began to move to the northeast. Operationally it was declared a tropical depression at 00Z on the 20th, the first one of the season. Synoptic observations show that it remained weak, broad and elongated northeast-southwest. A reconnaissance aircraft investigated the system on the 21st and found that it had extratropical characteristics, and this assessment agrees with the satellite imagery available on this date. The cyclone accelerated to the northeast on the 22nd and began to produce gale and storm-force winds, up to 50 kt. The system continued into the north Atlantic over the next few days and merged with another extratropical cyclone near southern Greenland on the 26th. Therefore, because the cyclone did not have tropical characteristics, it is not added to HURDAT. This disturbance was in Jack Beven's List of Suspects.

Day	Latitude	Longitude	Status
January 20	Central Atlantic		Cold front
January 20	20N	65W	Low
January 21	22N	57W	Extratropical
January 22	34N	50W	Extratropical
January 23	45N	48W	Extratropical
January 24	47N	46W	Extratropical
January 25	57N	43W	Extratropical
January 26			Merged

2. March 13-17: Historical Weather Maps, microfilm and satellite images show a trough of low pressure over the central Atlantic on March 13th. The disturbance moved westward and the pressure-gradient associated with a strong ridge to the north produced gale-force winds late on the 14th and early on the 15th over the northern portion of the trough. Operationally, the second depression of the season was designated at 12Z on the 14th. The trough weakened as it moved southwestward and dissipated on the 17th. Synoptic observations suggest that the disturbance did not develop a closed circulation. Therefore, because the disturbance did not have a well-defined low level circulation, it not added to HURDAT. This disturbance was in Jack Beven's List of Suspects.

Day	Latitude	Longitude	Status
March 13	20N	45W	Trough
March 14	21N	48W	Trough
March 15	20N	51W	Trough
March 16	18N	54W	Trough
March 17			Dissipated

3. June 26-30: Microfilm and satellite images indicate that a tropical wave entered the eastern Atlantic on June 27th and soon after, it was operationally designated as a tropical depression. The disturbance moved westward and did not become any better organized. Satellite images showed that the system lost its convection and dissipated on the 30th. Therefore, because the data shows that the system did not become a tropical cyclone, it is not added to HURDAT. This disturbance was in Jack Beven's Lists of Suspects.

Day	Latitude	Longitude	Status
June 26	13N	15W	Tropical Wave
June 27	13N	22W	Tropical Wave
June 28	9N	27W	Tropical Wave
June 29	5N	33W	Tropical Wave
June 30			Dissipated

4. July 3-7: Microfilm and satellite images showed a tropical disturbance north of Puerto Rico on July 3rd. The system moved northward and on satellite, it became much better organized on the 4th, but synoptic observation indicated that it was only a trough. The disturbance continued northward ahead of an approaching frontal boundary and became absorbed on the 7th. COADS were obtained and no gales were reported in association with this disturbance. Therefore, because the system did not have a closed low-level circulation, it is not added to HURDAT.

Day	Latitude	Longitude	Status
July 3	North of Puerto Rico		Tropical Disturbance
July 4	28N	67W	Trough
July 5	33N	67W	Trough
July 6	38N	65W	Trough
July 7			Absorbed

5. July 19-21: Satellite images show an increase in convection over the southern Caribbean Sea on July 19th associated with a westerly-moving tropical wave. The disturbance became better organized on the 20th and operationally it was upgraded to a tropical depression at 00Z, but quickly moved inland over Central America, dissipating the next day. Therefore, because the data suggests it did not have a closed circulation, it is not added to HURDAT.

Day	Latitude	Longitude	Status
July 19	10N	77W	Tropical Wave
July 20	10N	82W	Tropical Wave
July 21			Dissipated

6. July 31 – August 3: Historical Weather Maps, microfilm and satellite images indicate that a frontal boundary reached the eastern Atlantic late on July. An area of low pressure developed the next day and slowly moved south of due west. Operationally it was upgraded to a tropical depression at 00Z on the 2nd. Synoptic and satellite data indicate that the system gradually lost strength and weakened to a trough on August 3rd. COADS were acquired and no gales were reported in association with this system. Therefore, because the data suggests that it did not become a tropical cyclone, it is not added to HURDAT. This disturbance was in Jack Beven's Lists of Suspects.

Day	Latitude	Longitude	Status
July 31	Eastern Atlantic		Frontal boundary
August 1	32N	38W	Low
August 2	31N	40W	Low
August 3	30N	44W	Trough
August 4			Dissipated

7. August 2-8: Microfilm and satellite images showed a tropical disturbance over the Bahamas on August 2nd. The system moved northwestward over Florida and into the eastern Gulf of Mexico over the next few days showing no increase in organization at the surface based on synoptic observations. On the 6th, it moved inland and dissipated a few days later. COADS were acquired and no gales were observed. Therefore, because the disturbance did not have a closed low level circulation, it is not added to HURDAT.

Day	Latitude	Longitude	Status
August 2	Bahamas		Tropical Disturbance
August 3	25N	79W	Trough
August 4	27N	81W	Trough
August 5	29N	85W	Trough
August 6	31N	90W	Trough
August 7	33N	92W	Trough
August 8			Dissipated

8. August 16-20: Historical Weather Maps, microfilm and satellite images indicate that a frontal boundary moved into the central Atlantic in mid-August. Convection increased in the tail-end of the frontal boundary but synoptic observations suggest that an area of low pressure did not form. Convection decreased on the 20th and the system dissipated. Therefore, because the system did not have a closed circulation, it is not added to HURDAT.

Day	Latitude	Longitude	Status
August 16	Central Atlantic		Frontal boundary
August 17	32N	57W	Frontal boundary
August 18	30N	59W	Frontal boundary
August 19	28N	62W	Frontal boundary
August 20			Dissipated

9. August 27-31: Historical Weather Maps, microfilm and satellite images indicate a frontal boundary was stationary over the central Atlantic from August 25th to 27th. Synoptic observations indicate that a closed low-level circulation developed late on the 27th. Synoptic observations showed that the circulation was still elongated and satellite images suggested that it was an occluded low, but was attempting to acquire some tropical characteristics late on the 27th. A ship near the center reported 35 kt at 00Z on the 28th. Satellite images on the 28th showed a small area of convection

near the center, and by 12Z, the circulation had become more symmetric and isothermal. On the 29th, synoptic and satellite data indicated that the system had again become less organized and decreased in coverage. An approaching frontal boundary caused the system to turn to the northwest on the 30th and synoptic observations early on the 31st indicated that it no longer had a closed circulation. As the system did not acquire sufficient amounts of organized deep convection, it is not added into HURDAT.

Day	Latitude	Longitude	Status
August 28	35N	45W	Occluded Low
August 29	34N	50W	Occluded Low
August 30	36N	52W	Occluded Low

10. September 5-9: Convection increased as a tropical wave moved into the southern Caribbean Sea on September 5th. The disturbance moved northwestward interacting with Central America and by the 9th, it had dissipated over southern Mexico. COADS were acquired and winds remained below gale intensity. Therefore, because the system did not develop a closed low-level circulation, it is not added to HURDAT.

Day	Latitude	Longitude	Status
September 5	13N	81W	Tropical Wave
September 6	16N	82W	Tropical Wave
September 7	17N	84W	Tropical Wave
September 8	17N	89W	Tropical Wave
September 9			Dissipated

11. October 7-13: Monthly Weather Review indicates that a disturbance developed over the eastern Caribbean Sea on October 7th and moved westward during the next few days. Satellite and synoptic observations show that the system remained disorganized and did not develop a closed circulation before the cloudiness became part of the disturbance that ultimately developed into Hurricane Gladys. Therefore, because the system did not have a well-defined low-level circulation, it is not added to HURDAT.

Day	Latitude	Longitude	Status
October 7	14N	62W	Tropical Wave
October 8	14N	67W	Tropical Wave
October 9	15N	71W	Tropical Wave
October 10	15N	73W	Tropical Wave
October 11	16N	76W	Tropical Wave
October 12	16N	77W	Tropical Wave
October 13			Merged with Gladys

12. October 8-15: A convectively active wave appeared off of the west coast of North Africa on October 8th. The system steadily moved westward over the next few days and did display some signs of convective organization, especially on the 9th to the 13th. The system was flown by aircraft reconnaissance on the 13th and again on the 14th, though neither aircraft indicated a closed low-level circulation was present. A ship at 12Z on the 13th reported SE 35 kt and 1011 mb and the aircraft mission also reported SE 35 kt winds around 18Z. By the 14th and 15th, convection associated with the system diminished and it no longer had a trackable surface trough after the 15th. Because the system did not have a well-defined low-level circulation, it is not added into HURDAT.

Day	Latitude	Longitude	Status
October 8	10N	25W	Tropical Wave
October 9	10N	30W	Tropical Wave
October 10	10N	35W	Tropical Wave
October 11	10N	40W	Tropical Wave
October 12	10N	45W	Tropical Wave
October 13	10N	51W	Tropical Wave
October 14	10N	58W	Tropical Wave
October 15	10N	66W	Tropical Wave

13. October 10-14: A tropical wave reached the western Caribbean Sea on October 10th causing an increase in disorganized convection in the area. The system slowly moved westward during the next few days and a broad area of low pressure developed in the Gulf of Honduras. Operationally, the system was declared "Tropical Depression #20" at 12Z on October 11th, which eventually became Hurricane Gladys. Satellite images show that there was numerous but disorganized convection occurring from the 10th through the 13th. The disturbance gradually lost organization and dissipated early on the 14th, as this system was separate from the disturbance that eventually developed into Hurricane Gladys. (Gladys' first position as a tropical depression was 12Z on the 13th near 15N81W, while this system still remained near 17N85W at the same time.) The system only had one report of at least 10 kt W or SW wind (at 00Z on the 13th) and aircraft reconnassiance investigated it on the 12th and 13th and could not fix a center. Therefore, because the system did not have a well-defined low-level circulation, it is not added to HURDAT. This disturbance was in Jack Beven's Lists of Suspects.

Day	Latitude	Longitude	Status
October 10	18N	82W	Tropical Wave
October 11	18N	84W	Tropical Wave
October 12	19N	84W	Tropical Wave
October 13	18N	86W	Tropical Wave
October 14			Dissipated

14. December 1-5: A frontal boundary exited the east coast of the United States in late November. An extratropical cyclone developed on December 2nd and moved initially southwestward. Satellite and synoptic data suggest the system became an occluded low on the 3rd and continued to lose in organization and strength on the 4th as a strong cold front was approaching from the west. By the next day, the system had dissipated. Operationally it was designed as a tropical depression, the 22nd of the season, at 12Z on the 3rd. A reconnaissance aircraft investigated the cyclone on the 4th encountering 25 kt winds and no well-defined circulation. Therefore, because the system did not acquire tropical characteristics, it is not added to HURDAT. This disturbance was in Jack Beven's Lists of Suspects.

Day	Latitude	Longitude	Status
December 1	Western Atlantic		Cold front
December 2	28N	62W	Extratropical
December 3	23N	66W	Occluded
December 4	27N	70W	Occluded
December 5			Dissipated

15. December 28 – January 5, 1969: An extratropical cyclone developed in the northeastern Atlantic along a frontal boundary on December 29th. The system moved southeastward and synoptic observations indicate it was producing gale-force winds on January 1st. The cyclone meandered over the next few days as it weakened and dissipated on January 5th. Therefore, because the data shows that it did not acquire tropical characteristics, it is not added to HURDAT. This disturbance was in Jack Beven's Lists of Suspects.

Day	Latitude	Longitude	Status
December 28	Northeast Atlantic		Cold front
December 29	47N	34W	Extratropical
December 30	37N	25W	Extratropical
December 31	28N	21W	Extratropical
January 1	32N	18W	Extratropical
January 2	34N	20W	Extratropical
January 3	37N	21W	Extratropical
January 4	39N	28W	Extratropical
January 5			Dissipated

Reanalysis of the 1969 Atlantic Hurricane Season – Sandy Delgado, Chris Landsea, Margie Kieper, and Jack Beven – September 2021

Unnamed – AL011969 – Removed in 2021

May 29 – June 2: Historical Weather Maps, microfilm and satellite images indicated a trough stretching from the western Bahamas to the western Caribbean Sea on May 28th. In HURDAT, the first position is analyzed at 00Z on the 29th as a 25 kt tropical depression over the southern Caribbean Sea. The system moved slowly northward producing a large area of disorganized convection. Operationally, it was upgraded to the 6th tropical depression at 12Z on May 30th. The system remained a trough which interacted with an old frontal boundary extending from the north Atlantic to the Bahamas. Gradually the convective activity decreased over the Caribbean Sea. Synoptic observations indicated that the disturbance did not have a well-defined circulation during its lifetime. COADS were obtained and no gales were found. The last position in HURDAT was at 00Z on June 2nd. Because the system did not have a well-defined circulation, it is removed from HURDAT.

Unnamed – AL021969 – Removed in 2021

May 29-30: Historical Weather Maps, microfilm and satellite images showed a trough over the western Bahamas on May 28th with most of the convection displaced to the east. The first position in HURDAT was analyzed at 00Z on the 29th as a 25 kt tropical depression. The system moved eastward and synoptic observations do not suggest that it had a well-defined circulation. The last position in HURDAT was analyzed at 00Z on the 30th. HWM showed a frontal boundary moving into the area on May 30th and the area remained convectively active for a few more days. Because the disturbance did not have a well-defined center, it is removed from HURDAT. This disturbance was in Jack Beven's List of Suspects.

Unnamed – AL031969 – 2021 Revisions

Green indicates wind changes of 15 kt or greater
Blue indicates lat/long changes greater than 1°
Red indicates a new entry
Yellow indicates a deletion

Tropical Depression [June 8-9, 1969]

```
45235 06/07/1969 M= 2  3 SNBR= 966 UNNAMED       XING=0 SSS=0
45235 06/08/1969 M= 2  3 SNBR= 966 UNNAMED       XING=0 SSS=0
         **
```

(June 7th is removed from HURDAT)

```
45240 06/07*165 819  25    0*180 821  25    0*190 824  25    0*200 825  25    0*

45245 06/08*212 824  25    0*221 822  25    0*231 820  25    0*240 818  25    0*
45245 06/08*190 824  25    0*205 822  25    0*220 820  25    0*233 818  25    0*
            ***              ***              ***              ***

45250 06/09*250 817  25    0*  0   0   0    0*  0   0   0    0*  0   0   0    0*
45250 06/09*238 817  25    0*242 815  25    0*  0   0   0    0*  0   0   0    0*
            ***              *** ***  **
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45255 TD

Significant Revisions:

7. The first position is analyzed 24 hours later based on synoptic observations.

8. Major track changes analyzed at 00Z and 06Z on June 8th and 00Z on the 9th based on synoptic data.

Daily Metadata:

June 6:

9. Maps and old HURDAT:

- HWM analyzes a closed low pressure of at most 1008 mb at 12.5N, 81.5W at 12Z.
- Microfilm shows a spot low pressure at 12.5N, 78.5W at 12Z.

10. Discussion:

- Reanalysis: A trough extending from the western Atlantic to the western Caribbean Sea was causing a large area of convection. The system was disorganized due to strong southwesterly shear.

June 7:

5. Maps and old HURDAT:

- HWM analyzes a closed low pressure of at most 1008 mb at 15.2N, 81W at 12Z.
- HURDAT lists a 25 kt tropical depression at 19N, 82.4W at 12Z.
- Microfilm shows a spot low pressure over Nicaragua with a trough extended to the north over the western Caribbean Sea and Florida Straits at 12Z.

6. Discussion:

- Reanalysis: The first position in the original HURDAT is analyzed at 00Z on June 7th but synoptic observations show that the disturbance was still disorganized, lacking a well-defined center. It is important to note that the MWR track map of the 1969 tropical depressions also indicated that the tropical cyclone formed on this date. The track coincided with the positions in the original HURDAT. Satellite images indicated that it was still being affected by strong southwesterly shear.

June 8:

12. Maps and old HURDAT:

- HWM analyzes a closed low pressure of at most 1008 mb at 22N, 82W at 12Z.
- HURDAT lists a 25 kt tropical depression at 23.1N, 82W at 12Z.
- Microfilm analyzes a tropical cyclone (TD #7) of at most 1008 mb at 21.5N, 82W at 12Z.

13. Station highlight:

- NW 10 kt and 1006 mb at 19.4N 99.2W at 18Z (microfilm).

14. Discussion:

a. Tropical Weather Outlook at 0930Z: "Surface and ship reports indicate that a weak depression has developed in the northwestern Caribbean Sea a little northeast of Swan Island. Extensive cloudiness and showers extend northeastward from the depression over much of Cuba, the Florida Straits, central and western Bahamas and northeastward." (WALLET)

b. Reanalysis: Ship and coastal observations indicated that a closed low-level circulation developed at 00Z on June 8th, west of the Cayman Islands. Thus genesis is analyzed at this time as a 25 kt tropical depression. This is analyzed close to the time of genesis of TD #7 operationally, including the position selected, which is about 130 n mi south of the original HURDAT position. The tropical cyclone moved northward toward western Cuba, crossing the island late in the day. Satellite images continued to show a large area of convection mostly to the north and east of the center.

June 9:

3. Maps and old HURDAT:

- HWM analyzes a closed low pressure of at most 1010 mb at 25N, 80W at 12Z.
- HURDAT lists a 25 kt tropical depression at 25N, 81.7W at 00Z (last position).
- Microfilm analyzes a trough extending from the western Bahamas to the western Caribbean Sea at 12Z.

4. Discussion:

- Tropical Depression Bulletin: "Navy reconnaissance aircraft confirmed this morning that the tropical depression has weakened and the morning satellite pictures show the main shower activity is now some 100 to 200 miles east of the center and extending southward across the central and southeastern Bahamas, eastern Cuba and Jamaica." (WALLET)
- Reanalysis: After crossing Cuba, the tropical depression decreased in forward speed and became less organized. Synoptic and reconnaissance data indicated that the tropical depression had weakened into a trough around 12Z on the 9th, thus the last position is analyzed at 06Z on this date. Satellite images showed that most of the convection was displaced to the east, becoming associated with a frontal boundary to the north as an extratropical cyclone developed over the western Atlantic.

June 10:

3. Maps and old HURDAT:

- HWM and microfilm analyze a trough extending from the western Bahamas to the western Caribbean Sea at 12Z.

Sources: NHC microfilm maps, the Historical Weather Maps series, the COADS ship database, Monthly Weather Review, Mariners Weather Log, Satellite images from NCDC, and NHC Storm Wallets.

Unnamed – AL041969 – Removed in 2021

June 12-15: Historical Weather Maps, microfilm and satellite images depicted a trough extending from the Western Caribbean Sea to the Western Bahamas on June 11th. The trough moved slowly westward into the southeastern Gulf of Mexico. The first position in HURDAT was analyzed at 00Z on the 12th as a 25 kt tropical depression. A reconnaissance aircraft investigated the disturbance late on the 14th and did not find a closed circulation. The last position in HURDAT was analyzed at 00Z on the 15th. Satellite images on the 15th and 16th showed that the convection decreased in the Gulf of Mexico and the activity shifted to the Atlantic as another disturbance developed. Synoptic observations suggested that the

disturbance did not develop a well-defined low-level circulation during its lifetime. Because the disturbance did not have a well-defined center, it is removed from HURDAT. This disturbance was in Jack Beven's List of Suspects.

Unnamed – AL051969 – 2021 Revisions

Green indicates wind changes of 15 kt or greater
Blue indicates lat/long changes greater than 1°
Red indicates a new entry
Yellow indicates a deletion

Tropical Depression [July 25-27, 1969]

```
45235 07/25/1969 M= 3  5 SNBR= 966 UNNAMED       XING=0 SSS=0
45240 07/25* 99 551  25    0*100 561  25    0*115 573  30    0*122 583  30    0*
45240 07/25*  0   0   0    0*  0   0   0    0*110 550  25    0*115 560  25    0*
             ** ***  **      *** ***  **      *** ***  **      *** ***  **

45245 07/26*132 596  25    0*141 601  25    0*148 610  25    0*150 616  25    0*
45245 07/26*121 570  25    0*128 580  25    0*136 590  30    0*146 600  30    0*
            *** ***         *** ***          *******  **      *** ***  **

45250 07/27*159 622  25    0*  0   0   0    0*  0   0   0    0*  0   0   0    0*
45250 07/27*158 610  30    0*  0   0   0    0*  0   0   0    0*  0   0   0    0*
            *** ***  **

45255 TD
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Significant Revisions:

1. Major eastward revisions in position are introduced from 25th and late 26th/early 27th and southward revisions on the 27th.

Daily Metadata:

July 25:

1. Maps and old HURDAT:

- HURDAT lists a tropical depression at 11.5N 57.3W 12Z.
- HWM shows no features of interest in the vicinity of the system.
- Microfilm analyzes the ITCZ lying along 8N.

2. Discussion:

- Leary and Thompson: "A visual impression of Figs. 2a [12Z 25th] and 3a [12Z 26th] is that of a piece of the ITCZ with a sharp kink from SW to NE, so the ITCZ is predominantly EW on both sides, but more poleward to the east of kink…this disturbance dissipated without attaining tropical storm intensity…the 25th and 26th of July were chosen because on those days the storm passed through the data network, and appeared most intense on satellite pictures"
- Reanalysis: Observations indicate that this system developed a closed low around 12Z the 25th, so genesis delayed 12 hours to that time. Significant eastward revision in position introduced at 12 and 18Z based on ship, station, and aircraft observations. No high winds or low pressures observed.

July 26:

1. Maps and old HURDAT:

- HURDAT lists a tropical depression at 14.8N 61.0W at 12Z.
- HWM shows no features of interest in the vicinity of the system.
- Microfilm analyzes a tropical wave from 20N56W to 10N62W.

2. Aircraft highlights:

- Center fix at 14.8N 59.6W at 1630Z, max winds 30 kt, minimum pressure 1012 mb (Storm Wallet).
- Center fix at 14.6N 60.3W at 2000Z, min pressure 1011 mb (Storm Wallet).

3. Discussion:

- Reanalysis: Southeastward revisions in position introduced at 00Z-12Z and eastward at 18Z based on ship, station, and aircraft observations. No high winds or low pressures observed.

July 27:

1. Maps and old HURDAT:

- HURDAT lists a last position as a tropical depression at 15.9N 62.2W at 00Z.
- HWM shows an open low near 16N62.5W.

2. Discussion:

- Reanalysis: Eastward revision in position introduced at 00Z based on ship, and station observations. System’s dissipation retained at 06Z.

Sources: NHC microfilm maps, the COADS ship database, Monthly Weather Review, Mariners Weather Log, Satellite images from NCDC, NHC Storm Wallets, and Leary and Thompson (MWR, 1976).

ANNA – AL061969 – 2021 Revision

Green indicates wind changes of 15 kt or greater
Blue indicates lat/long changes greater than 1°
Red indicates a new entry
Yellow indicates a deletion

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45835 07/25/1969 M=12  6 SNBR= 978 ANNA        XING=0 SSS=0
45835 07/25/1969 M=11  6 SNBR= 978 ANNA        XING=0 SSS=0
                    **

45840 07/25*  0   0   0    0* 92 270  30    0* 90 280  30    0* 91 293  30    0*
45840 07/25*  0   0   0    0* 90 270  30    0* 91 280  30    0* 93 290  30    0*
                              **               **               ** ***

45845 07/26* 93 302  30    0* 95 315  30    0*100 328  30    0*104 340  30    0*
45845 07/26* 95 300  30    0* 97 310  30    0*100 320  30    0*104 330  30    0*
             ** ***           ** ***               ***                ***

45850 07/27*108 350  30    0*112 360  35    0*114 364  35    0*116 370  40    0*
45850 07/27*108 340  30    0*112 350  35    0*114 360  35    0*117 370  40 1002*
                ***                ***               ***          ***         ****

45855 07/28*120 380  40    0*123 392  45    0*127 402  50    0*131 413  55    0*
45855 07/28*120 380  40    0*123 390  45    0*127 400  50    0*131 410  50    0*
                                  ***               ***                ***  **

45860 07/29*135 425  55    0*139 439  55    0*140 450  55    0*142 460  60 1003*
45860 07/29*135 421  50    0*139 433  50    0*142 446  50    0*145 460  50 1003*
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                 ***  **          ***  **      *** ***  **      ***      **

45865 07/30*145 476  55    0*147 497  50    0*151 519  45 1005*157 537  45    0*
45865 07/30*148 476  50    0*150 497  50    0*153 519  45 1005*157 540  45 1004*
            ***      **      ***              ***                  ***     ****

45870 07/31*165 558  45 1004*178 581  40    0*191 605  35    0*205 627  30    0*
45870 07/31*161 562  45 1004*168 590  40    0D178 620  35    0D190 650  35    0*
            *** ***          *** ***         **** ***         **** ***  **

45875 08/01*217 653  30    0*236 670  30    0*252 692  30    0*270 715  35 1008*
45875 08/01D210 670  35    0D235 690  35    0*255 703  35    0*270 715  35 1006*
           **** ***  **     **** ***  **      *** ***  **                    ****

45880 08/02*287 732  30 1014*299 741  30    0*312 747  30 1013*326 745  30 1008*
45880 08/02*285 730  30    0*299 741  30    0*312 747  30 1013*326 745  35 1008*
            *** ***     ****                                             **

45885 08/03*340 740  30    0*365 725  50    0*390 695  50    0*409 656  55 1002*
45885 08/03*340 740  40    0*365 725  50    0*390 695  55    0*409 656  60 1002*
                     **                                  **               **

45890 08/04E415 618  50    0E420 575  45    0E425 530  45    0E430 470  45    0*
45890 08/04*415 618  60 1001*420 575  50    0*425 530  45    0*430 470  45    0*
           *         ** *****         **     *                  *

(October 5th has been removed from HURDAT)
45895 08/05E435 420  45    0E445 370  35    0E455 320  35    0*  0   0   0    0*

45900 TS
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Significant Revisions:

1. Major position changes analyzed on July 26th at 18Z and July 27th at 00Z and 06Z.
2. Analyzed to have weakened to a trough between July 31st at 12Z and August 1st at 06Z with estimated positions significantly further west-southwest based on synoptic and aircraft reconnaissance data.
3. Re-intensification to a tropical storm on the 2nd is analyzed twelve hours earlier based on synoptic and aircraft reconnaissance data.
4. No extratropical transition is analyzed before dissipation, unlike the original HURDAT that showed the storm becoming extratropical on August 4th at 00Z, based on synoptic observations.
5. Dissipation analyzed eighteen hours earlier based on synoptic observations.

Daily Metadata:

July 24:

1. Maps and old HURDAT:

- HWM and microfilm do not analyze any features of interest at 12Z.
- HURDAT does not list an organized system on this date.

2. Discussion:

- Reanalysis: Satellite images showed a disorganized area of convection near the western coast of Africa. Synoptic observations did not indicate a closed circulation was present.

July 25:

1. Maps and old HURDAT:

- HWM and microfilm do not analyze any features of interest at 12Z.
- HURDAT lists a 30 kt tropical depression at 9N, 28W at 12Z.

2. Discussion:

- ATSR: "The first indication that a weak circulation had formed on the ITCZ about 400 miles southwest of the Cape Verde Islands were ship reports at 1200Z on 25 July. Satellite pictures later that day confirmed the development of a circulation. However, a tropical disturbance had been observed moving westward off the African coast since 23 July. Fleet Weather Central, Rota issued the first tropical depression warning on this system as Tropical Depression ALPHA at 251820Z."
- Reanalysis: The tropical disturbance continued westward and became better organized based on satellite images, including some banding features. Synoptic observations were sparse but indicate that a closed-low level circulation was present at 06Z on July 25th. The first position is analyzed at this time as a 30 kt tropical depression, same as originally shown in HURDAT.

July 26:

12. Maps and old HURDAT:

- HWM does not analyze any features of interest at 12Z.
- HURDAT lists a 30 kt tropical depression at 10N, 32.8W at 12Z.
- Microfilm shows a tropical cyclone of at most 1012 mb at 9N, 31W at 12Z.

13. Discussion:

- ATSR: "As the depression moved westward across 30W longitude, Fleet Weather Facility) Jacksonville assumed warning responsibility, and it was numbered Tropical Depression Twelve."
- Reanalysis: The tropical depression moved westward at about 10 kt and satellite images showed a well-organized tropical cyclone with some banding features and most of the convection over the southern semicircle. It is likely that dry, SAL air was suppressing the thunderstorm activity over the northern semicircle.

July 27:

9. Maps and old HURDAT:

- HWM does not analyze any features of interest at 12Z.
- HURDAT lists a 35 kt tropical storm at 11.4N, 36.4W at 12Z.
- Microfilm shows a tropical cyclone of at most 1012 mb at 10.5N, 39W at 12Z.

10. Ship highlights:

- 40 kt NE and 1006 mb at 12.3N, 37.2W at 21Z (micro).

11. Discussion:

- MWR: "Anna probably reached storm intensity on the 27th, and may have obtained her maximum intensity during the next 24 hr. The Plymouth Victory reported winds of 40 kt and a surface pressure of 1006 mb late on the 27th while apparently some distance from the center. Satellite photographs also looked

most impressive on the 27th and 28th. When Anna first reached tropical storm intensity, conditions appeared favorable for deepening to hurricane intensity. Instead, the development of a large middle-level and upper level cyclone between Puerto Rico and Bermuda produced an extremely hostile environment, which Anna had to traverse for an extended period. The result was a gradual weakening and contraction in size, with a turn to a more northwesterly heading."

- ATSR: "From post-analysis, ANNA actually attained tropical storm intensity at 0600Z on 27 July."
- Reanalysis: Intensification to a tropical storm is analyzed at 06Z on July 27th. This transition is uncertain due to the sparse data in the central Atlantic, but satellite images did show that the system had become better organized with most of the convection near or over the center. A ship late on the 27th reported sustained winds of 40 kt with 1006 mb pressure. This indicates a central pressure of at most 1002 mb, which would suggest an intensity of at least 43 kt from the south of 25N pressure-wind relationship. Because of the very slow movement of the system, 40 kt is retained in HURDAT for 18Z on the 27th and 00Z on the 28th.

July 28:

9. Maps and old HURDAT:

- HWM analyzes a trough extending 8N-18N, along 39W at 12Z.
- HURDAT lists a 50 kt tropical storm at 12.7N, 40.2W at 12Z.
- Microfilm shows a tropical storm of at most 1006 mb at 11.9N, 40.1W at 12Z.

10. Satellite highlights:

a. ESSA VIII estimated a center fix at 12N, 40.5W at 1448Z (WALLET).

11. Discussion:

a. ATSR: "The depression continued on a west-northwestward course and became Tropical Storm ANNA at 281600Z."
b. Reanalysis: Anna moved on a west-northwest course on the 28th and the few ships near the system remained in the periphery. Satellite images indicated that Anna was a compact tropical cyclone with organized convection near or over the center. Some banding features were present, especially over the southern semicircle.

July 29:

10. Maps and old HURDAT:

- HWM analyzes a tropical storm of at most 1004 mb at 14N, 44.2W at 12Z.
- HURDAT lists a 55 kt tropical storm at 14N, 45W at 12Z.
- Microfilm shows a tropical storm of at most 1008 mb at 13.5N, 44.5W at 12Z.

11. Aircraft highlights:

- Penetration center fix measured a central pressure of 1003 mb, estimated surface winds of 60 kt and an eye diameter of 15 n mi at 14.7N, 46.1W at 1910Z (WALLET).

12. Satellite highlights:

- ESSA VIII estimated a center fix at 14N, 45W at 1113Z (WALLET)

13. Discussion:

- MWR: "An Air Force reconnaissance plane was able to reach the storm during the afternoon of the 29th and found a minimum pressure of 1003 mb and surface winds of 60 kt."
- ATSR: "…she reached her maximum intensity of 60 knots at 291800Z."
- Reanalysis: The first reconnaissance aircraft to investigate the tropical cyclone made a center penetration at 1910Z on the 29th measuring a central pressure of 1003 mb, estimating surface winds of 60 kt and an eye diameter of 15 n mi. A central pressure of 1003 mb suggests maximum surface winds of 41 kt from the south of 25N Brown et al. pressure-wind relationship. An eye diameter of 15 n mi suggests an RMW of about 11 n mi and the climatological value is 13 n mi. Based on a forward speed of about 15 kt, close to average RMW and taking into account the visual estimate, an intensity of 50 kt is analyzed at 18Z on the 29th, down from 60 kt originally shown in HURDAT, a minor intensity change. Satellite images showed a compact tropical cyclone with organized convection near or over the center.

July 30:

11. Maps and old HURDAT:

- HWM analyzes a hurricane of at most 1008 mb at 16N, 51.8W at 12Z.
- HURDAT lists a 45 kt tropical storm at 15.1N, 51.9W at 12Z.
- Microfilm shows a tropical storm of at most 1010 mb at 15.4N, 51.8W at 12Z.

12. Aircraft highlights:

- Penetration center fix measured a central pressure of 1005 mb, estimated surface winds of 45 kt and an eye diameter of 30 n mi at 15.3N, 51.9W at 1210Z (WALLET).
- Penetration center fix measured a central pressure of 1004 mb and estimated surface winds of 20 kt at 16.3N, 55.3W at 2055Z (WALLET).
- Penetration center fix measured a central pressure of 1004 mb and estimated surface winds of 45 kt at 16.3N, 55.5W at 2215Z (WALLET).

13. Satellite highlights:

- ESSA VIII estimated a center fix at 15.1N, 51.9W at 1204Z (WALLET).

14. Discussion:

- Reanalysis: Three penetration center fixes occurred between 1210Z and 2215Z on July 30th measuring central pressures of 1004-1005 mb. Satellite images showed that Anna had become less organized compared to the previous few days with a small cluster of convection near or over the center. Some weakening is indicated and an intensity of 45 kt is analyzed at 12Z and 18Z on the 30th, same as originally shown in HURDAT.

July 31:

11. Maps and old HURDAT:

- HWM analyzes a hurricane of at most 1012 mb at 17.5N, 60.8W at 12Z.
- HURDAT lists a 35 kt tropical storm at 19.1N, 60.5W at 12Z.
- Microfilm shows a tropical storm of at most 1012 mb at 17.2N, 60.7W at 12Z.

12. Ship highlights:

- 35 kt ESE and 1012 mb at 19.7N, 58.7W at 06Z (COADS).
- 35 kt E and 1013 mb at 20.1N, 58W at 10Z (COADS).
- 35 kt E and 1018 mb at 20.5N, 57.1W at 15Z (COADS).
- 35 kt E and 1015 mb at 23.1N, 66.2W at 18Z (COADS).

13. Discussion:

- ATSR: "ANNA then increased her forward speed and began to lose her intensity as she moved under the influence of a 200-mb low over the Virgin Islands."
- Reanalysis: Anna continued to become less organized on July 31st and synoptic observations indicated that it weakened into a trough. Satellite images showed a disorganized area of convection north of the Leeward Islands. The sharp trough moved rapidly to the northwest and the axis was located west-southwest of the position originally shown in HURDAT as a tropical cyclone, thus major position changes are analyzed between 06Z and 18Z on the 31st. The intensity of Anna is gradually decreased and retained at 35 kt at 18Z on the 31st based on synoptic observations, up from 30 kt originally in HURDAT, a minor intensity change.

August 1:

10. Maps and old HURDAT:

- HWM analyzes a spot low pressure at 24.5N, 70.5W at 12Z.
- HURDAT lists a 30 kt tropical depression at 25.2N, 69.2W at 12Z.
- Microfilm shows a tropical cyclone of at most 1014 mb at 25.5N, 70.5W at 12Z.

11. Ship highlights:

- 35 kt ESE and 1015 mb at 21.9N, 63.5W at 06Z (COADS).
- 35 kt SE and 1017 mb at 28.4N, 69.7W at 18Z (COADS).

12. Aircraft highlights:

- Penetration center fix measured a central pressure of 1008 mb and estimated surface winds of 35 kt at 26.6N, 70.7W at 1541Z (WALLET). Observation of 35 kt and 1009 mb at 26.8N 70.5W at 1515Z (WALLET).
- Penetration center fix measured a central pressure of 1014 mb and estimated surface winds of 30 kt at 28.9N, 72.8W at 2330Z (WALLET). (Given that the method was based on triangulation, it appears that the crew did not go through the center and thus 1014 mb is not a central pressure.)

13. Discussion:

- ATSR: "ANNA was downgraded to a tropical depression and continued to move rapidly on a northwestward course toward the southeastern United States."
- Reanalysis: The tropical disturbance quickly moved west-northwest and major position changes are introduced between 00Z and 12Z on August 1st based on synoptic observations. A couple of ships reported gale-force winds on this day, thus the intensity is retained at 35 kt at 00Z and 06Z when the system was analyzed as a trough, up from 30 kt originally in HURDAT, a minor intensity change. A reconnaissance aircraft investigated the system had an observation of 35 kt and 1009 mb, suggesting at most a 1006 mb central pressure. Thus, it is analyzed to have regained a closed low-level circulation at 12Z on August 1st. Satellite images also showed that Anna had become better organized a few hundred miles north of Hispaniola.

August 2:

9. Maps and old HURDAT:

- HWM analyzes a hurricane of at most 1016 mb at 32N, 74W at 12Z.
- HURDAT lists a 30 kt tropical depression at 31.2N, 74.7W at 12Z.
- Microfilm shows a tropical cyclone of at most 1014 mb at 31N, 74.5W at 12Z.

10. Aircraft highlights:

- Penetration center fix measured a central pressure of 1013 mb and estimated surface winds of 20 kt at 31.2N, 74.6W at 12Z (WALLET).

- Penetration center fix measured a central pressure of 1008 mb, estimated surface winds of 45 kt and an eye diameter of 10 n mi at 32.5N, 74.4W at 17Z (WALLET).

11. Discussion:

- MWR: "After finally escaping from the upper level cold system, Anna began to regain intensity as she approached the Hatteras area. Navy reconnaissance during the afternoon of August 2 indicated winds of storm intensity, but also showed a turning away from the mainland."
- ATSR: "ANNA never regained her intensity as a tropical storm as she recurved midway between Jacksonville and Bermuda, passing about 125 miles east of Cape Hatteras."
- Reanalysis: A penetration center fix at 2330Z measuring a central pressure of 1014 mb and estimated surface winds of 30 kt. Weakening to a tropical depression is analyzed at 00Z on August 2nd, same as originally shown in HURDAT, based on synoptic and aircraft reconnaissance observations. The next penetration center fix at 12Z on the 2nd measured a central pressure of 1013 mb and an intensity of 30 kt is analyzed at this time, same as originally shown in HURDAT. The last penetration center fix on this date measured a central pressure of 1008 mb, estimated surface winds of 45 kt and an eye diameter of 10 n mi at 17Z. A central pressure of 1008 mb suggests maximum surface winds of 28 kt from the north of 25N pressure-wind relationship. Based on a forward speed of about 15 kt, small RMW and weighting some the visual estimate, an intensity of 35 kt is analyzed at 18Z on the 2nd, up from 30 kt originally shown in HURDAT, a minor intensity change. Satellite images showed that the convective activity associated with Anna was elongated NE-SW due to an approaching frontal boundary.

August 3:

7. Maps and old HURDAT:

- HWM analyzes a closed low pressure of at most 1016 mb at 39N, 71W with a cold front just to the west at 12Z.
- HURDAT lists a 50 kt tropical storm at 39N, 69.5W at 12Z.
- Microfilm shows a tropical cyclone of at most 1016 mb at 38.5N, 69W at 12Z.

8. Ship highlights:

- 60 kt SSW at 40.5N, 65.1W at 18Z (COADS).

9. Aircraft highlights:

- Penetration center fix measured a central pressure of 1002 mb, estimated surface winds of 50 kt and an eye diameter of 10 n mi at 40.1N, 66.9W at 16Z (WALLET). (Other documentation suggest that this was a radar fix and the 1002 mb was obtained 15 nm from the center. However, a 19Z center fix also suggested 1002 mb.)

10. Discussion:

- MWR: "Five days later [3], the pressure was 1002 mb, and a ship reported winds of 60 kt as Anna was moving out to sea about 250 mi east of Nantucket."
- Reanalysis: Anna accelerated to the northeast away from the United States and intensified. A reconnaissance aircraft measured a central pressure of 1002 mb, estimating surface winds of 50 kt and an eye diameter of 10 n mi at 16Z on August 3rd. A central pressure of 1002 mb suggests maximum surface winds of 45 kt from the north of 35N Landsea et al. pressure-wind relationship. Based on a forward speed of about 36 kt, small RMW and ship report of 60 kt at 18Z, an intensity of 60 kt is analyzed at 18Z on the 3rd, up from 55 kt originally shown in HURDAT, a minor change. 60 kt is also the peak intensity of this

tropical cyclone, same as originally shown in HURDAT but at 18Z on July 29th. Anna may have reached hurricane intensity late on the 3rd or early on the 4th. Satellite images showed that the tropical cyclone had become much better organized, especially later in the day. The compact storm had organized convection near or over the center and banding features over the northern and southern quadrants.

August 4:

5. Maps and old HURDAT:

- HWM analyzes a closed low pressure of at most 1012 mb at 42N, 52.5W with a cold front to the west at 12Z.
- HURDAT lists a 45 kt extratropical storm at 42.5N, 53W at 12Z.
- Microfilm shows a tropical cyclone at 43N, 53W at 12Z.

6. Ship highlights:

- 35 kt W and 1016 mb at 40.7N, 64.2W at 00Z (COADS).
- 30 kt SW and 1004 mb at 41.2N, 61.8W at 00Z (COADS).
- 35 kt SSW and 1010 mb at 41.9N, 52.2W at 12Z (COADS).
- 45 kt W and 1009 mb at 42N, 50.9W at 15Z (COADS).
- 40 kt NW and 1011 mb at 42.1N, 49.7W at 18Z (COADS).

7. Discussion:

- ATSR: "She became extra-tropical south of Nova Scotia and moved rapidly northeastward across the Atlantic at speeds up to 35 knots."
- Reanalysis: Anna turned to the east as it rapidly moved across the north Atlantic ahead of a frontal system. HURDAT originally had the tropical cyclone acquire extratropical characteristics at 00Z on August 4th but the synoptic observations show that it remained in the warm sector of the extratropical cyclone to the northwest, thus retaining tropical characteristics. The tropical storm gradually weakened as it moved over cooler waters. Satellite images showed that the convection was displaced to the east of the center, especially later in the day. A few ships reported gale-force winds, mostly in the southern semicircle.

August 5:

5. Maps and old HURDAT:

- HWM analyzes an extratropical cyclone of at most 988 at 48N, 35W, Anna appears to have been dissipated, at 12Z.
- HURDAT lists a 35 kt extratropical storm at 45.5N, 32W at 12Z (last position).

6. Ship highlights:

- 45 kt W and 1013 mb at 40.3N, 42.4W at 00Z (COADS).
- 35 kt W and 1008 mb at 41.5N, 39.4W at 06Z (COADS).

7. Discussion:

- ATSR: "…and was eventually absorbed by an extratropical cyclone north of the Azores on 5 August."
- Reanalysis: Synoptic observations early on August 5th indicated that as the extratropical cyclone to the north of Anna intensified, the circulation of the tropical cyclone weakened and dissipated. Thus the last position is analyzed at 18Z on the 4th, eighteen hours earlier than originally shown in HURDAT.

Date	Original HURDAT Central Pressure	Evidence	Changes

July 27 18Z		Ship: 40 kt NE and 1006 mb at 21Z	1002 mb
July 29 18Z	1003 mb	Penetration center fix: 1003 mb at 1910Z	Retained
July 30 12Z	1005 mb	Penetration center fix: 1005 mb at 1210Z	
July 30 18Z		Penetration center fix: 1004 mb at 2055Z	1004 mb
July 31 00Z	1004 mb	Penetration center fix: 1004 mb at 2215Z on July 30th	Retained
Aug 01 18Z	1008 mb	Aircraft ob: SE 35 kt and 1009 mb at 1515Z	1006 mb
Aug 02 00Z	1014 mb	1014 mb is a peripheral value, not a central pressure	Removed
Aug 02 12Z	1013 mb	Penetration center fix: 1013 mb at 12Z	Retained
Aug 02 18Z	1008 mb	Penetration center fix: 1008 mb at 17Z	
Aug 03 18Z	1002 mb	Penetration center fix: 1002 mb at 19Z	
Aug 04 00Z		Ship: 30 kt SW and 1004 mb at 00Z	1001 mb

Sources: NHC microfilm maps, the Historical Weather Maps series, the COADS ship database, Monthly Weather Review, Mariners Weather Log, Satellite images from NCDC, and NHC Storm Wallets.

Blanche – AL071969 – 2021 Revision

Green indicates wind changes of 15 kt or greater
Blue indicates lat/long changes greater than 1°
Red indicates a new entry
Yellow indicates a deletion

Hurricane Blanche [August 11-13, 1969]

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45905 08/11/1969 M= 3  2 SNBR= 979 BLANCHE     XING=0 SSS=0
45905 08/10/1969 M= 5  2 SNBR= 979 BLANCHE     XING=0 SSS=0
         **         *
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The 10th is new to HURDAT.

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45910 08/10*  0   0   0    0*  0   0   0    0*  0   0   0    0*263 717  30    0*

45910 08/11*281 717  30    0*302 716  30    0*325 711  35    0*355 699  75  997*
45910 08/11*281 717  35    0*302 716  40    0*325 711  50    0*355 699  70  997*
                     **                **                **                **

45915 08/12*386 680  75    0*417 650  75    0*443 604  65  998E460 549  60    0*
45915 08/12*390 680  75    0*420 647  75    0E443 604  70  996E460 549  65    0*
            ***              *** ***         *         **  ***          **

45920 08/13E471 490  50    0E480 430  40    0*  0   0   0    0*  0   0   0    0*
45920 08/13E471 490  55    0E475 430  40    0E475 380  35 1008E470 345  30 1009*
                     **      ***              **** ***  ** ******** ***  ** ****
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(The 14th is new for HURDAT.)

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45920 08/14E470 310  30 1008E465 275  30 1008E440 230  25 1010E410 180  25 1011*

45925 HR
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Significant Revisions:

17. Intensification to a tropical storm is analyzed twelve hours earlier than originally shown in HURDAT based on synoptic observations.

18. Major increase in intensity at 12Z on August 11th based on reconnaissance aircraft data later on the date.

19. System is extended through 18Z on the 14th as an extratropical cyclone, which is 36 hours longer than originally.

August 8:

8. Maps and old HURDAT:
- HWM does not show any features of interest at 12Z.

9. Discussion:
- MWR: "Blanche, as a tropical disturbance, can be traced back to about 1,300 mi east of the Lesser Antilles, but it is possible that this was the same wave which passed Dakar on August 3. Beginning on August 6, the disturbance moved westnorthwestward at 15 mi hr as a tropical wave in the easterlies."
- ATSR: "An unstable easterly wave was initially detected about 1000 miles east of the Lesser Antilles on 6 August and was kept under observation as it moved westward."
- Reanalysis: Hurricane Blanche developed from a tropical wave that left the west coast of Africa on August 3. The disturbance quickly moved westward and by the 8th, a large area of disorganized convection was visible just northeast of the Leeward Islands in the satellite images.

August 9:

8. Maps and old HURDAT:
- HWM and microfilm analyze a tropical wave over the Leeward Islands at 12Z.

9. Discussion:
- Reanalysis: The tropical wave remained disorganized as it passed north of the eastern Greater Antilles. The satellite images showed a large area of convection with a north-south orientation.

August 10:

8. Maps and old HURDAT:
- HWM and microfilm analyze a tropical wave over the eastern Bahamas at 12Z.

9. Ship highlights:
- 35 kt SE (winds appear high) and 1015 mb at 23.6N, 68.3W at 12Z (COADS).

10. Discussion:
- MWR: "As the crest of the wave rounded the western end of the Bermuda High and passed into a region of light tropospheric wind shear, a circulation formed about 500 mi east of Florida on August 10. The depression accelerated northward under the influence of a trough over the eastern United States."
- Reanalysis: Satellite images indicated that the tropical wave had become much better organized and some banding features were discernable. Synoptic observations early on the 11th indicated that a closed low-level circulation was present and that it had 35 kt winds. Thus genesis is analyzed before that time at 18Z on the 10th, six hours earlier than shown in HURDAT, though it could be even earlier given the uncertainties.

August 11:

9. Maps and old HURDAT:

- HWM analyzes a closed low pressure of at most 1012 mb at 32N, 71W at 12Z.
- HURDAT lists a 35 kt tropical storm at 32.5N, 71.1W at 12Z.
- Microfilm shows a tropical storm of at most 1006 mb at 32.5N, 71.5W at 12Z.

10. Ship highlights:

- 35 kt SSE and 1012 mb at 27.8N, 70.6W at 00Z (WALLET/micro).
- 40 kt SE and 1006 mb at 32.8N, 70.8W at 12Z (COADS).
- 40 kt SSW and 1011 mb at 37.5N, 67.9W at 20Z (WALLET).
- 35 kt SW and 1009 mb at 37.5N, 67.9W at 23Z (WALLET).

11. Aircraft highlights:

- Penetration center fix measured a central pressure of 997 mb and estimated surface winds of 95 kt at 35.5N, 69.9W at 18Z (WALLET).

12. Discussion:

- MWR: "Ships reported winds up to 40 kt east of the center, and Blanche was christened at midday on August 11. Navy reconnaissance indicated rapid deepening, and the storm was upgraded to a hurricane by early evening."
- ATSR: "Ship reports at 0000Z on 11 August indicated that a circulation had developed from this wave northeast of the Bahamas. Fleet Weather Facility, Jacksonville issued a tropical depression warning at 110400Z and twelve hours later upgraded the depression to Tropical Storm BLANCHE. BLANCHE developed rapidly into hurricane intensity as she moved northward at 20 to 30 knots."
- Reanalysis: A ship reported 35 kt S at 00Z on the 11th and this is the basis to indicate the system as a 35 kt tropical storm, up from 30 kt originally in HURDAT, a minor intensity change. Operationally, the first advisory was issued at 03Z on the 11th as a tropical depression. Blanche was located just ahead of an approaching frontal boundary, causing the tropical storm to rapidly move to the northeast. Satellite images showed a well-organized tropical cyclone with a large CDO. The first aircraft to reach Blanche measured a central pressure of 997 mb, estimated surface winds of 95 kt and an eye diameter of 26 n mi at 18Z. A central pressure of 997 mb suggests maximum surface winds of 53 kt from the north of 35N Landsea et al. and 49 kt from the north of 25N Brown et al. pressure-wind relationships. An eye diameter of 26 n mi suggests an RMW of 20 n mi and the climatological value is 30 n mi. Based on a fast forward speed of about 32 kt, small RMW and putting some weight on the visual assessment, an intensity of 70 kt is analyzed at 18Z on the 11th, 5 kt less than originally shown in HURDAT. A central pressure of 997 mb was present in the original HURDAT at 18Z on the 11th and has been retained.

August 12:

10. Maps and old HURDAT:

- HWM analyzes a tropical storm of at most 996 mb at 44.7N, 59.7W with a frontal boundary just to the west at 12Z.
- HURDAT lists a 65 kt hurricane at 44.3N, 60.4W at 12Z.
- Microfilm shows a tropical storm of at most 1000 mb at 44.5N, 60W at 12Z.

11. Ship highlights:

- 80 kt and 992 mb (time and location unknown) (WALLET/MWR). (The Monthly Weather Review season summary says the ship reported 80-kt winds **and** 992 mb, while the season summary in the National Climatological Data said that the ship reported 80 kt winds and was used to estimate a central pressure of 992

mb. Some clarification of this comes from the Rough Log of the Mariners Weather Log in the November/December, which states the Luossa reported 70-kt winds and a pressure of 1001 mb at 00Z 12 August. This appears to correspond to a report on a map in the Storm Wallets from the ship SIDG, and it is likely the 70-kt ob recorded in COADS.

- 70 kt W and 1001 mb at 38.2N, 68W at 00Z (WALLET).
- 45 kt SW and 1012 mb at 39.5N, 64.1W at 03Z (WALLET).
- 45 kt NW and 1001 mb at 41.5N, 64.9W at 06Z (COADS).
- 45 kt WSW and 1009 mb at 43.1N, 60.1W at 12Z (COADS).
- 45 kt SW and 1009 mb at 44.6N, 56.1W at 18Z (COADS).

12. Land highlights:

- 45 kt SSE (gusts to 60 kt) and 999 mb at Sable Island, Canada at 11Z (WALLET).
- 37 kt SW (gusts to 48 kt) and 997 mb at Sable Island, Canada at 12Z (WALLET).
- 45 kt NW (gusts to 50 kt) and 1006 mb at Sable Island, Canada at 13Z (WALLET).

13. Aircraft highlights:

- Penetration center fix measured a central pressure of 998 mb and estimated surface winds of 80 kt at 44.9N, 59.2W at 1330Z (WALLET).

14. Discussion:

- MWR: "Blanche was imbedded in a strong southwesterly current and obtained a forward speed of 40 mi hr. The hurricane passed just to the northwest of Sable Island and skirted Cape Race, Newfoundland, on the 12th. The rapid forward speed distorted the storm's wind field into a very asymmetric pattern. Although Sable Island experienced winds of 45 kt with gusts to 60 kt, no strong winds were observed at any of the stations in the Canadian Maritime Provinces. Blanche probably reached its maximum intensity during the night of August 12 while it traversed the well-traveled New York-to-Europe shipping lanes. The Swedish ship, SS Luossa, reported winds to 80 kt and a sea-level pressure of 992 mb."
- ATSR: "She turned to a more northeasterly course on 12 August and accelerated to 45 knots. BLANCHE was short-lived hurricane and lost her tropical characteristics nearly as rapidly as she developed. By the time she reached the eastern tip of Nova Scotia on 12 August, BLANCHE was just an extratropical low on the polar front."
- Reanalysis: Blanche continued to intensify on the 12th as it moved rapidly northeastward off the east coast of the United States. The Swedish ship, SS Luossa, reported winds up to 80 kt and a pressure of 992 mb. Searching through many sources it was not possible to find the exact time and place where this report occurred but based on reconnaissance and synoptic data, it likely took place either late on the 11th or early on the 12th. A ship in COADS (SIDG) reported 70 kt at 00Z on the 12th; that likely is the SS Luossa. (The seasonal climate summary suggests that the 992 mb was a derived value, not a measurement.) Given these uncertainties, the peak intensity of 75 kt retained at 00Z on the 12th. Blanche's fast forward speed to the northeast and weak gradient to the west meant that the strongest winds were located over the eastern quadrant and Sable Island was the only land station that experienced winds above tropical storm intensity. At 11Z on the 12th, Sable Island reported 45 kt and a minimum pressure of 999 mb. Transition to an extratropical cyclone is analyzed at 12Z on the 12th based on synoptic observations and satellite images, six hours earlier than originally shown in HURDAT. A reconnaissance aircraft investigated Blanche at 1330Z on the 12th measuring a central pressure of 998 mb and estimated surface winds of 80 kt. Sable Island reported SW winds 37 kt a pressure of 997 mb at 12Z, suggesting a central pressure of 993 mb. A

blend of these two estimates gives 996 mb. A central pressure of 996 mb suggests maximum surface winds of 55 kt from the north of 35N pressure-wind relationship. Based on a fast forward speed of about 42 kt and the estimated visual wind, an intensity of 70 kt is selected at 12Z on the 12th, up from 65 kt originally shown in HURDAT. A central pressure of 998 mb was present in the original HURDAT at 12Z on the 12th has been replaced by 996 mb.

August 13:

7. Maps and old HURDAT:

- HWM analyzes an extratropical cyclone at 47N, 38W at 12Z.
- HURDAT lists a 40 kt extratropical storm at 48N, 43W at 06Z (last position).

8. Ship highlights:

- 45 kt SW and 1009 mb at 45.4N, 49.7W at 00Z (COADS).
- 35 kt WSW and 1006 mb at 46.7N, 47.3W at 03Z (COADS).

9. Discussion:

- MWR: "The hurricane filled rapidly as it passed Newfoundland and became absorbed into a frontal zone on the 13th."
- Reanalysis: The extratropical cyclone weakened below hurricane intensity at 00Z on the 13th. This system continued to decay on the 13th.

August 14:

6. Maps and old HURDAT:

- HWM analyzes a stationary front over the north Atlantic at 12Z.

2. Discussion:

- Reanalysis: The system continued as a weak extratropical low until after 18Z on the 14th. This adds 36 hours as an extratropical low to the lifecycle of the system, compared to that originally in HURDAT2.

Sources: NHC microfilm maps, the Historical Weather Maps series, the COADS ship database, Monthly Weather Review, Navy reconnaissance book, Mariners Weather Log, Satellite images from NCDC, and NHC Storm Wallets.

Camille – AL081969 – 2014 Revision

Green indicates wind changes of 15 kt or greater
Blue indicates lat/long changes greater than 1°
Red indicates a new entry
Yellow indicates a deletion

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AL091969,            CAMILLE,     32,
AL091969,            CAMILLE,     37,
                                  **

(00Z to 12Z 14th are new to HURDAT.)
19690814, 0000,  , TD, 18.3N,  79.7W,  30, -999,
19690814, 0600,  , TS, 18.5N,  80.5W,  35, -999,
19690814, 1200,  , TS, 18.8N,  81.3W,  45, -999,

19690814, 1800,  , TS, 19.4N,  82.0W,  50,  991,
19690814, 1800,  , TS, 19.1N,  82.0W,  50, -999,
                       ****                 ***
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19690815, 0000,  , TS, 19.7N,  82.7W,  55, -999,
19690815, 0000,  , TS, 19.5N,  82.7W,  55,  991,
                       ****                ***

19690815, 0600,  , TS, 20.1N,  83.3W,  60, -999,
19690815, 0600,  , HU, 20.0N,  83.3W,  65, -999,
                    **  ****            **

19690815, 1200,  , HU, 20.7N,  83.8W,  85,  970,
19690815, 1200,  , HU, 20.6N,  83.8W,  90,  969,
                       ****            **   ***

19690815, 1800,  , HU, 21.2N,  84.1W, 100,  964,
19690815, 1800,  , HU, 21.3N,  84.1W,  95,  966,
                       ****           ***   ***
(22Z is a new entry to HURDAT.)
19690815, 2200,  , HU, 21.9N,  84.3W,  95, -999,

19690816, 0000,  , HU, 22.3N,  84.4W,  90, -999,
19690816, 0600,  , HU, 23.1N,  85.2W, 105, -999,
19690816, 1200,  , HU, 23.7N,  85.9W, 120, -999,
19690816, 1200,  , HU, 23.8N,  86.0W, 130, -999,
                       ****    ****   ***

19690816, 1800,  , HU, 24.2N,  86.5W, 130,  908,
19690816, 1800,  , HU, 24.3N,  86.6W, 150,  908,
                       ****    ****   ***

19690817, 0000,  , HU, 25.2N,  87.2W, 140,  905,
19690817, 0000,  , HU, 25.2N,  87.2W, 150,  905,
                                      ***

19690817, 0600,  , HU, 26.0N,  87.7W, 155, -999,
19690817, 0600,  , HU, 26.0N,  87.7W, 145, -999,
                                      ***

19690817, 1200,  , HU, 27.0N,  88.2W, 160, -999,
19690817, 1200,  , HU, 27.0N,  88.3W, 140, -999,
                                ****   ***

19690817, 1800,  , HU, 28.3N,  88.7W, 165, -999,
19690817, 1800,  , HU, 28.2N,  88.7W, 135,  919,
                       ****           ***

19690818, 0000,  , HU, 29.4N,  89.1W, 165,  909,
19690818, 0000,  , HU, 29.4N,  89.0W, 140, -999,
                                ****
(04Z is a new entry to HURDAT.)
19690818, 0400,  , HU, 30.3N,  89.4W, 150,  900,

19690818, 0600,  , HU, 30.7N,  89.6W, 100, -999,
19690818, 0600,  , HU, 30.7N,  89.6W, 115, -999,
                                      ***

19690818, 1200,  , HU, 32.2N,  90.0W,  65, -999,
19690818, 1200,  , HU, 32.0N,  89.9W,  75, -999,
                       ****    ****    **

19690818, 1800,  , TS, 33.4N,  90.1W,  50, -999,
19690819, 0000,  , TD, 34.7N,  90.0W,  30, -999,
19690819, 0000,  , TS, 34.7N,  90.0W,  35, -999,
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19690819, 0600,  , TD, 36.0N,  89.3W,  30, -999,
19690819, 1200,  , TD, 37.0N,  88.0W,  30, -999,
19690819, 1800,  , TD, 37.7N,  86.0W,  25, -999,
19690819, 1800,  , TD, 37.6N,  86.0W,  25, -999,
                      ****

19690820, 0000,  , TD, 38.0N,  84.8W,  25, -999,
19690820, 0000,  , TD, 37.6N,  84.0W,  25, -999,
                      ****    ****

19690820, 0600,  , TD, 37.4N,  80.2W,  25, -999,
19690820, 0600,  , TD, 37.4N,  80.6W,  25, -999,
                              ****

19690820, 1200,  , TD, 37.3N,  77.0W,  25, -999,
19690820, 1200,  , TD, 37.2N,  77.3W,  30, -999,
                      ****    ****    **

19690820, 1800,  , TD, 37.0N,  75.1W,  30, -999,
19690820, 1800,  , TS, 37.0N,  75.3W,  45, 1000,
                  **          ****    **  ****

19690821, 0000,  , TS, 36.6N,  73.4W,  40, -999,
19690821, 0000,  , TS, 36.7N,  73.6W,  50, -999,
                      ****    ****    **

19690821, 0600,  , TS, 36.7N,  70.9W,  45, -999,
19690821, 0600,  , TS, 36.7N,  70.9W,  55, -999,
                                       **

19690821, 1200,  , TS, 37.3N,  68.4W,  50, -999,
19690821, 1200,  , TS, 37.1N,  68.1W,  60, -999,
                      ****    ****    **

19690821, 1800,  , TS, 38.0N,  64.9W,  55, -999,
19690821, 1800,  , TS, 37.8N,  64.7W,  60, -999,
                      ****    ****    **

19690822, 0000,  , TS, 39.2N,  61.4W,  60, -999,
19690822, 0000,  , TS, 39.2N,  61.8W,  55, -999,
                              ****    **

19690822, 0600,  , TS, 40.8N,  58.2W,  55, -999,
19690822, 0600,  , TS, 40.8N,  58.2W,  45, -999,
                                       **

19690822, 1200,  , TS, 43.0N,  54.0W,  50, -999,
19690822, 1200,  , ET, 43.0N,  54.0W,  35, -999,
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State hurricane impacts
MS5 LA5
MS5 LA5 AL1
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Minor alterations to the track and major changes to the intensity are made for extremely intense Hurricane Camille from that depicted in McAdie et al. (2009). Another major change is to indicate an extratropical transition late in Camille's lifetime. Data for these changes were obtained from the NHC Storm Wallets, NHC microfilm, surface observations/analyses from the Institute of Meteorology of Cuba, COADS, Climatological Data for various states, Surface Weather Observations from NCDC, Mariner's Weather Log Rough Log and Selected Gales, the Navy Annual Hurricane Summary, Weather Bureau (1969), Environmental Science Services

Administration (1969), Parmenter (1969), Roberts (1969, as well as the Nash Roberts archives at Tulane University), DeAngelis and Nelson (1969), Hamilton and Steere (1969), Simpson et al. (1970), Schwarz (1970), Touliatos and Roth (1971), Shenk and Rodgers (1977), Schwerdt et al. (1979), Riehl and Simpson (1981), Ho et al. (1984), Jarrell et al. (1992), Perez et al. (2000), Sheets and Williams (2001), Kieper (2007), and Frelich and Ostuno (2012).

August 5: Historical Weather Map depicted no features of interest near West Africa. The MWR track map showed a tropical disturbance centered at 15N 18W. No gales or low pressures. "[Camille formed] from a tropical wave which had been tracked from the African coast where it emerged on August 5. This wave, of the inverted 'V' type, described by Frank (1969) was clearly identified on satellite pictures through August 9" (MWR).

August 6: Historical Weather Map depicted no features of interest near the Cape Verde Islands. The MWR track map showed a tropical disturbance centered at 15N 26W. No gales or low pressures.

August 7: Historical Weather Map depicted no features of interest west of the Cape Verde Islands. The MWR track map showed a tropical disturbance centered at 15N 34W. No gales or low pressures.

August 8: Historical Weather Map depicted no features of interest in the central Atlantic. The MWR track map showed a tropical disturbance centered at 15N 42W. No gales or low pressures.

August 9: Historical Weather Map depicted no features of interest east of the Lesser Antilles. The MWR track map showed a tropical disturbance centered at 15N 51W. No gales or low pressures. "On [August 9], cloudiness associated with the wave began to aggregate into a discrete circular area about 500 mi east of the Leeward Islands" (MWR).

August 10: Historical Weather Map depicted a trough of low pressure over the Lesser Antilles. The MWR track map showed a tropical disturbance centered at 16N 59W. No gales or low pressures. "This disturbance passed the Leeward Islands on August 10 without a closed circulation and proceeded to the western Caribbean without evidences of a pressure center" (MWR).

August 11: Historical Weather Map depicted no features of interest in the eastern Caribbean. The MWR track map showed a tropical disturbance centered at 16N 65W. No gales or low pressures.

August 12: Historical Weather Map depicted a trough of low pressure in the central Caribbean. The MWR track map showed a tropical disturbance centered at 17N 71W. No gales or low pressures. Satellite image: 1849Z - ESSA-9 (MWL).

August 13: Historical Weather Map depicted an open low near 16N 76W. The NHC microfilm at 12Z indicated a tropical wave extending from the central Bahamas, across Cuba, and into the western Caribbean. The MWR track map showed a tropical disturbance centered at 17N 76W. No gales or low pressures. Satellite image: 1948Z - ESSA-9 (MWL, Weather Bureau). "On August 13 the wave increased in amplitude and extended its influence into the eastern Bahamas" (MWR). "An Air Force reconnaissance plane investigated this wave on the morning of the 13th, but found no significant change in intensity. However, below-normal pressures and favorable conditions aloft indicated further intensification of this wave" (Navy Annual Summary).

August 14: Historical Weather Map depicted an open low near 19N 83W. The NHC microfilm at 12Z indicated a tropical wave extending from between Florida and the Bahamas to Cuba with a "Td" indicated at 18.5N 81.5W with no closed isobars. The MWR track map showed a tropical disturbance centered at 18N 81W. HURDAT's first entry was at 18Z at 19.4N 82.0 with 50 kt. Ship and land highlights: No gales or low pressures. Aircraft highlights: Navy, 999 mb central pressure, 50 kt flight level winds, eye diameter 20 nm circular, center at 18.8N 81.8W at 1440Z (storm wallets). Satellite: 1852Z (ESSA-9 - DeAngelis,

Weather Bureau, MWL), 2142Z (ESSA-2 - storm wallet). "Camille formed near the island of Grand Cayman in the Caribbean on August 14...On the morning of August 14, reconnaissance aircraft were dispatched to investigate both the possibility of circulation near the southwestern Bahamas and near the vicinity of Grand Cayman Island. The report from the Bahamas was negative; however, from the Caribbean a Navy reconnaissance plane flying back and forth across the wave reported that a circulation was forming, and in late afternoon advised that the pressure center had been identified with a minimum of 991 mb and a maximum wind of 50 kt. It was apparent almost from the outset that Camille would be an explosively deepening storm" (MWR).

August 15: Historical Weather Map depicted a hurricane near 21N 84W with an outer closed isobar of 1008 mb. The NHC microfilm at 12Z showed a closed low near 21N 84W. HURDAT at 12Z indicated an 85 kt hurricane with 970 mb at 20.7N 83.8W. Ship highlights: 50 kt E and 1005 mb at 19.8N 82.6W at 02Z (COADS); 35 kt W and 1009 mb at 20.0N 84.7W at 15Z (COADS). Land highlights: 80 kt SE at Guane, Cuba (no time, MWR); 35 kt SSE and 1009 mb at Nuevo Gerona, Cuba at 21Z (microfilm); 35 kt NE and 1004 mb at Montua, Cuba at 21Z (microfilm); 20 kt NNE and 1002 mb at Cape San Antonio, Cuba at 21Z (microfilm). Aircraft highlights: Navy, 991 mb central pressure, 48 kt surface winds, 50 kt flight level winds (900 ft), eye diameter 20 nm circular, center at 20.0N 82.2W at 0045Z (storm wallets); Navy, 65 kt surface winds, 55 kt flight level winds (1100 ft), center by radar at 20.0N 83.3W at 06Z (storm wallets); ESSA, 969 mb central pressure, 90 kt surface winds, 85 kt flight level winds (1600 ft), elliptical eye E-W 20-10 nm, center at 206.N 93.8W at 1230Z (storm wallets); Air Force, 966 mb central pressure, 70 kt surface winds, 80 kt flight level winds, circular eye 10 nm diameter at 20.9N 84.2W at 1820Z (storm wallets). Satellite images: 1950Z (ESSA-9 - Weather Bureau, MWL), 2130Z (ESSA-2 - storm wallet). "As it approached the western tip of Cuba on the afternoon of August 15, the central pressure had fallen to 964 mb with a maximum wind of 100 kt. During the transit over Cuba, Camille (as a young hurricane) was tracked by Havana radar...Southeast winds of 80 kt were reported at Guane as the eye passed over western Cuba" (MWR). "Camille - August 15-16 - Category 2 hurricane impact in Cuba" (Perez et al.).

August 16: Historical Weather Map depicted a hurricane near 23N 86W with an outer closed isobar of 1008 mb. The NHC microfilm at 12Z showed a hurricane near 24N 86W. HURDAT at 12Z indicated an 120 kt hurricane near 23.7N 85.9W. Ship highlights: 35 kt N and 1007 mb at 22.5N 86.0W at '00Z (COADS); 45 kt SSW and 1012 mb at 23.5N 84.0W at 12Z (microfilm); 45 kt SE and 1006 mb at 25.0N 84.9W at 18Z (COADS); 55 kt SE and 1006 mb at 24.8N 86.7W at 21Z (COADS). Station highlights: 35 kt NW and 999 mb at Cape San Antonio at 00Z (microfilm); 5 kt SE and 991 mb at Montua at 00Z (microfilm). Aircraft highlights: Navy, radar fix at 23.2N 85.3W at 0640Z (storm wallets); Navy, 80 kt flight level winds (800 ft), eye circular 8 nm diameter, radar center at 23.8N 86.0W at 1200Z (storm wallets); Air Force, 908 mb central pressure, circular eye 10 nm diameter, center at 24.4N 86.7W at 1835Z (storm wallets). Satellite images: 1311Z, 1507Z, 1703Z, 1930Z, 2140Z, 2340Z (ATS3-Parmenter), 1710Z (Nimbus-3 - Simpson et al., same picture listed as 1900Z - Shenk and Rodgers), 1858Z (ESSA-9 - DeAngelis and Nelson, Weather Bureau, MWL), 0500Z (Infrared - Nimbus-3 - Shenk and Rodgers, Allison et al.). "Camille was tracked by land-based and aircraft radar during the remainder of August 15 and 16, and indications of further intensification were noted as the eye shrank to less than 8 mi in diameter and strong feeder bands were reported in all quadrants. Because of the small eye of Camille, the Navy reconnaissance aircraft, which reached the storm area just after midnight on the 16th, was unable to penetrate the eye of Camille, and not until the afternoon of the 16th was it possible to obtain a reliable check on the extent of intensification. During the afternoon, an Air Force C-130 reconnaissance aircraft penetrated and reported a surface pressure of 908 mb (26.81 in.) - a record low pressure for reconnaissance aircraft in Atlantic hurricanes. On this occasion, the aircraft reported an 11C temperature rise in the eye at 700 mb. Maximum winds at this flight level could not be obtained during the transit of the heavy rain area in the eye wall " (MWR).

August 17: Historical Weather Map depicted a hurricane near 27N 88W with an outer closed isobar of 1004 mb. The NHC microfilm at 12Z showed the center of the cyclone to be near 27N 88W. HURDAT listed Camille at 27.0N 88.2W as a Category 5 hurricane with 160 kt winds at 12Z. Ship highlights: 45 kt NW and 1010 mb at 24.0N 89.0W at 2330Z 16th (microfilm); 40 kt W and 999 mb at 24.6N 88.4W at 06Z (COADS); 40 kt WSW and 1001 mb at 25.1N 89.8W at 12Z (COADS); 40 kt WSW and 1000 mb at 26.0N 89.6W at 18Z (COADS); 964 mb pressure with 78

kt ENE (30 min) at Oil platform #1 at 29.1N 88.9W at 21Z (Hamilton and Steere); 96 kt S (max wind) at Drilling Rig at 29.1N 88.7W at 2230Z (Roberts) . Land highlights: 941 mb (min pressure) at Garden Island, LA at 2255Z (MWR). Aircraft highlights: Air Force, 905 mb central pressure, 140 kt surface winds, 90 kt flight level winds, circular eye 10 nm, center at 25.2N 87.2W at 0016Z (storm wallets); Navy, eye diameter 10 nm circular, radar fix at 27.3N 87.5W at 06Z (storm wallets); Navy, radar fix at 27.1N 86.3W at 1239Z (storm wallets); Air Force, 919 mb central pressure (corrected from 901 mb), 180 kt surface winds, 95 kt flight level winds, circular eye 8 nm, center at 28.2N 88.8W at 1850Z (storm wallet). Satellite images: 1953Z (ESSA-9 - DeAngelis, Weather Bureau, Environmental Science Services Administration, MWL). "Early on Saturday evening (August 16), the same Air Force plane and crew made a second flight into Camille and reported an even lower central pressure - 905 mb (26.73 in.). Flight-level winds at 700 mb measured by Doppler radar had increased to 140 kt at a point 20 n.mi. from the center. The maximum was not recorded due to attenuation of the radar beam by heavy precipitation. During this period, Camille had continued along a north-northwestward course at about 12 kt...During the night and morning of August 16 and 17, no further penetrations of the hurricane were obtained, although a Navy reconnaissance plane circumnavigated the storm at low levels and reported winds substantially in excess of 100 kt at a radius of 30 to 40 mi from the center. Early in the afternoon of Sunday, August 17, an Air Force WC-130 reconnaissance plane once again penetrated the storm. The hurricane at that time was less than 100 mi from the mouth of the Mississippi River. The crew estimated the highest surface winds to be 180 kt. During this penetration, the aircraft was forced to feather an engine and had to leave the storm area, so that no further reconnaissance data were obtained until the storm crossed the coastline...The minimum pressure in Camille was 905 mb, the lowest of record measured by a hurricane reconnaissance aircraft in the Atlantic and the lowest for an Atlantic hurricane except for the Florida Keys storm of Labor Day, 1935. (Preliminary reports and other publications indicated a lowest pressure of 901 mb. Recently, a check of the raw data indicates this should be corrected to the 905-mb value.)" (MWR). "On Sunday afternoon, August 17, an air force C-130 piloted by Marvin A. Little penetrated Camille's eye and measured a pressure of 26.62 inches of mercury. 'Just as we were near the [eye] wall cloud we suddenly broke into a clear area and could see the sea surface below,' the copilot, Robert Lee Clark, wrote in 1982. 'What a sight! Although everyone on the crew was experienced except me, no one had seen the wind whip the sea like that before...Instead of the green and white splotches normally found in a storm, the sea surface was in deep furrows running along the wind direction...The velocity was beyond the descriptions used in our training and far beyond anything we had ever see.' Those descriptions used in training accounted for winds up to 150 mile per hour. After describing what they saw over the radio to the National Hurricane Center, the crew and the forecasters decided to estimate the winds inside Camille at 190 miles per hour. Soon after leaving the eye, a generator on one of the C-130's engines failed. Clark brought his plane back safely to Ellington Air Force Base near Houston on three engines; no other flights were made into Camille" (Sheets and Williams). "The highest actual measurement on a wind instrument was found on an Easterline Angus wind speed recorder which had been left running on a Transworld Drilling Co. rig located east of Boothville (Main Pass Block 29). The recorder had been switched to double scale before evacuation and recorded an extreme gust of 172 m.p.h. before the paper jammed and the trace was lost." (DeAngelis and Nelson). "The Breath home, prior to Katrina, was the third-oldest home in Bay St. Louis. It had been built in 1820, on what is known as North Beach, and had been owned by the Breath family for 110 years. Underneath the home was a brick cellar (very unusual in the coastal South) that the historical society believed was all that remained of what was originally a fort, on that location. In front of the home was a camellia tree over twenty feet tall, that had been planted around 1880. The home faces the bay on the bluff just south of the modern bridge that connects Hwy 90 to Pass Christian, along with several other homes owned by the Breath family, which were to the west of the bayfront home, along Breath Lane. Charles A. Breath Jr and III were born there, and five generations of Breaths had lived in that home. Hurricane Katrina totally destroyed the home along with five others along the Breath property, including the historic barometer (and also most likely the log). The 909 mbar reading had been taken by Charles A. Breath, Jr. I recently spoke to Charles A. Breath III, and he recalled to me, 'Daddy was in the boat business all his life. He was an old salt! He had a sailboat that he named Romac, which was a ketch built by Jacky Jack Covacevich. Weather meant a lot to him. Nash Roberts was his hero in predicting the weather.' Jacky Jack owned a well-known boatyard in Biloxi Back Bay and

built many of the ships used in the seafood industry centered on Biloxi Point Cadet at that time in history. Nash Roberts was a well-known NOLA meteorologist who had a penchant for correctly predicting landfall locations of hurricanes. He had a brother, Ep Roberts, who owned a store that sold scientific instruments. Ep was also a meteorologist, and would sometimes fill in for Nash if he had to miss a broadcast. Charles Breath told me his recollection from what his father had said, was that the eye passed over Bay St. Louis, the bay, and Pass Christian. He had been in the service at that time, but his sister, Sue, rode out the storm with their parents.
As Camille was approaching the Louisiana and Mississippi Gulf Coasts, Sue Breath McGuire, who was in her mid-twenties and living in NOLA with a roommate, was told by her father to return home to BSL, and bring her roommate, because NOLA was like a saucer and was not safe in the event of a strong hurricane; BSL would be much safer. Sue recalled that Nash Roberts had said this storm was going to be a bad one. So she and the roommate packed up and got in the car and drove east - one of the few cars to do so, as most everyone was driving west to leave the MS coast. She said her dad always had his hurricane precautions, and boarded up the windows with removable shutters. The breakfast area of the home had a magnetic hurricane tracking map, where the magnets would be moved to the new location every time they would get the current coordinates of the storm. Her father had several barometers, but one very good one that he was always careful to keep calibrated, and no one was allowed to touch it. For days before the storm, the barometric pressure would start dropping, and he would keep a log starting at that time, always noting the time and pressure. When Camille came in 1969, Charles Breath Jr. was 65. Sue said of her father, 'Daddy, being the sailor that he was, on the coast all the time, was always so conscious of the weather.' He had been logging the weather for several days prior to Camille's landfall, and that evening he logged pressure readings every 15 minutes or so, tapping the glass to make sure the needle was giving the correct reading. Sue said she could tell her father was getting nervous as the pressure dropped, sometimes rubbing his head after noting a reading. Sue recalled that it was awful being in such a storm at night. She said that the cotton caulking around the doors would whistle when the wind picked up. At one point during the evening the attic stairway blew down, and when they went to see what had happened, they were hit in the face with salt water, because the wind had blown off the front gable of the roof. When the eye came, they left the house to move to one further back from the bluff. Water had never come more than halfway up the walkway from the bay, yet when they went out the back door, they walked into knee deep water. She recalled that her father carried the precious barometer, wrapped in a cloth, and her mother, their dachshund, as she, her roommate, and sister, walked with them to the adjacent house on their property. She said the low reading was taken just before the eye, before they left the main house. Afterwards, she didn't recall how, Nash Roberts came to know of the reading, and the barometer was carefully packaged up and sent to his brother Ep Roberts store, and found to be accurate. After this, Charles Breath recalled, a group from Nash Roberts came to Bay St. Louis and sat down and talked with his father about the readings" (Kieper 2007).

August 18: Historical Weather Map depicted a hurricane inland over Mississippi near 32N 90W with
an outer closed isobar of 1004 mb. The NHC microfilm at 12Z showed the hurricane to be near 32N
90W. HURDAT listed Camille as being at 32.2N 90.0W as a Category 1 hurricane with 65 kt at 12Z.
Ship highlights: 35 kt NE and 1010 mb at 28.5N 92.8W at 00Z (microfilm); 35 kt SSE and 1009 mb
at 26.1N 87.7W at 06Z (MWL). Station highlights: 950 mb (min pressure) at Pilottown, LA at 00Z
(MWR); 113 kt (max wind, 150 kt gust, disabled) at Transworld Drilling Rig Block #92 at 29.6N
88.9W at 0115Z (DeAngelis and Nelson, Roberts); 909 mb (eye) at Bay St. Louis (west end of bridge)
at 0330Z (MWR, Roberts); 904 mb (eye) at Bay St. Louis (N. Beach Blvd.) at 0400Z (Roberts);
897 mb (eye) at Bay St. Louis (one mile west of Bay Bridge) at 0330Z (Roberts, Tulane archives);
958 mb (min pressure) at 0808Z and 104 kt NE at 0808Z (max wind) at Columbia, MS (MWR, Roberts);

61 kt E (max wind) at Brandon, MS at 12Z (MWR); 980 mb (min P) at Jackson, MS at 1256Z (MWR).
Aircraft highlights: No reconnaissance available. Satellite image: 1900Z (ESSA-9, Weather Bureau), no time (ATS-3, Riehl and Simpson). "The approach of Camille to the coast was monitored continuously by radars in New Orleans and Pensacola. The center of the hurricane passed over the Mississippi coast near the towns of Clermont Harbor, Waveland, and Bay St. Louis about 11:30 p.m. (CDT) on Sunday, August 17. Maximum winds near the coastline could not be measured, but from an appraisal of the character of splintering of structures within a few hundred yards of the coast, velocities probably approached 175 kt. The highest recorded storm tide observed, which apparently occurred near Pass Christian, was measured at 24.6 ft, higher than any previous storm tide of record... As Camille continued inward on a northerly course at a speed of about 16 kt" (MWR).
"The lowest land pressure was observed by Mr. Charles A. Breath, Jr. of Bay St. Louis, in his home a few blocks from the west end of Bay St. Louis Bridge. He made the reading of 26.85 in. on his aneroid barometer as the eastern edge of Camille's eye passed overhead. His barometer was later checked and found to be accurate by the New Orleans Weather Bureau Office." (DeAngelis and Nelson).
"Three barometer readings of private individuals in Bay St. Louis at approximately 11:00 p.m. show 26.70, 26.85 and 26.50 inches" (Roberts). "Mrs. Susie B. Western, 123 St. Chas. Ave., Bay St. Louis, not more than 150 yards off beach, 1 mile west of Bay Bridge, 26.50 at 10:30 PM" (Tulane archives).
"Biloxi 11:30-11:50 pm 28.98, Waveland-Lakeshore-Bay St. Louis 26.61 11:30 pm = -2.33 inches in 25 miles, 1/10 inch per mile - extremely steep pressure gradient" (Tulane archives).
"Severe forest damage - more than 2/3 of the trees damaged - extended northward from the coast to Covington County, Mississippi - about 75 nm" (Touliatos and Roth). "Aug. 18, 1969 (Camille), 908 mb central pressure at landfall based upon aircraft reconnaissance at 28.2N 88.8W, 8 nm radius of maximum wind based upon recon, 16 kt translational velocity, landfall point 30.3N 89.3W" (Ho et al.).
"1008 mb outer closed isobar at landfall, 137 kt max 1 min surface wind equivalent' (Schwerdt et al.).
"LA Category 5, MS Category 5, 909 mb central pressure at landfall" (Jarrell et al.).

August 19: Historical Weather Map depicted a low inland over Kentucky near 37N 88W with an outer closed isobar of 1008 mb along with a stationary front a few hundred miles north of the low.
The NHC microfilm at 12Z showed a low near 37N 88W with a stationary front a few hundred miles north of the low. HURDAT listed Camille as a 30 kt tropical depression at 37.0N 88.0W at 12Z.
Station highlights: 996 mb (min pressure) and 9 kt NE at 0300Z at Memphis (SWO); 999 mb (min pressure) and 20 kt S at 0600Z at Jackson, TN (SWO); 1001 mb (min pressure) and 11 kt N at 1000Z at Paducah, KY (SWO).
1946Z (ESSA-9 - DeAngelis, Schwarz). "The remnants of Camille turned eastward across Kentucky, West Virginia, and Virginia [on the 19th and 20th]" (MWR).

August 20: Historical Weather Map depicted a low inland over Virginia near 28N 77W with an outer closed isobar of 1008 mb along with a stationary front draped across the center of the low. The NHC microfilm at 12Z showed a low near 38N 77W with a cold front just north of the center of the low. HURDAT listed Camille as a 25 kt tropical depression at 37.3N 77.0W at 12Z. Station highlights: 1004 mb (min pressure) and 10 kt SW at London, KY at 0000Z (SWO); 1005 mb (min pressure) and 15 kt SW at Elizabeth City, NC at 1000Z (SWO); 1002 mb (min pressure) and 10 kt WSW at 1700Z at Norfolk (SWO). Ship highlights: 40 kt SW and 1007 mb at 35.1N 74.5W at 18Z (COADS). Satellite image: 1850Z (ESSA-9 - MWL).

August 21: Historical Weather Map depicted a tropical storm near 37N 67W with a 1004 mb outer closed isobar, with a cold front extending from its center to the southwest, and with a stationary front extending from its center to the east. Also to the southeast of Camille is another tropical cyclone (Debbie). The NHC microfilm map at 12Z showed a low near 37N 67W (with no frontal boundaries) and another tropical cyclone southeast of Camille. HURDAT listed Camille as a 50 kt tropical storm at 37.3N 68.4W at 12Z. Ship highlights: 45 kt SW and 1001 mb at 36.0N 73.4W at 00Z (COADS); 40 kt N and 1002 mb at 35.9N 72.6W at 06Z (COADS); 25 kt S and 996 mb at 36.9N 66.6W at 12Z (COADS); 60 kt NE and 996 mb at 37.6N 65.9W at 18Z (COADS). "Camille passed into the open Atlantic on August 21, where it quickly regained tropical storm intensity. However, shortly thereafter it encountered a cold front and was modified rapidly into an extratropical system" (MWR).

August 22: Historical Weather Map depicted a low with a 1000 mb outer closed isobar and also with a cold front extending southwest and a warm front extending east of the center. A large extratropical cyclone is several hundred miles north-northwest of Camille and another tropical cyclone (Debbie) is several hundred miles southwest of Camille. HURDAT listed Camille as a 50 kt tropical storm at 43.0N 54.0W at 12Z (last entry). Ship highlights: 35 kt NE and 1006 mb at 38.2N 64.0W at 00Z (COADS).

August 23: Historical Weather Map depicted a frontal boundary extending from a large extratropical low near 63N 35W to a tropical storm (Debbie) near 39N 55W.

Camille began as a tropical wave which left the coast of West Africa on August 5th. The system did not develop until reaching the western Caribbean Sea. Surface observations in the vicinity of the wave on the 13th and 14th were somewhat sparse and are ambiguous as to when the system had a closed circulation until 18Z on the 14th. Moreover, an Air Force aircraft reconnaissance mission on the 13th could not locate a closed circulation. HURDAT originally indicated an "instant" 50 kt tropical storm beginning at 18Z on the 14th. However, satellite imagery late on the 13th indicated that

banding in the deep convection associated with the wave had developed. Given the improved structure seen in the satellite imagery late on the 13th, the ambiguous surface observations, and the subsequent observations of the system being a moderate tropical storm mid-day on the 14th (see below), genesis is now indicated to have occurred at 00Z on the 14th. While this is 18 hours earlier than originally indicated, the exact time of genesis is uncertain to plus/minus six hours. An aircraft reconnaissance (Navy) mission arrived at the system's center at 1440Z on the 14th and showed that the system was already a well-developed, but small, tropical storm with central pressure of 999 mb. This central pressure suggests a maximum wind of 49 kt from the Brown et al. south of 25N pressure-wind relationship. Given the radius of maximum wind (RMW) of about 15 nm (same as climatology by central pressure and latitude - Vickery et al.) but a somewhat slow movement (10 kt), an intensity of 45 kt is selected at 12Z on the 14th and 50 kt at 18Z. Given the quick development of the system, the 999 mb central pressure from 1440Z is not added into HURDAT at 12Z or at 18Z, as it is not representative of either synoptic time. Very small (0.3 degree or less) changes were introduced to the positions of Camille throughout its lifetime based upon a combination of ship, station, aircraft penetration, aircraft radar, land-based radar, and satellite observations. The next aircraft center fix also by the Navy measured 991 mb central pressure at 0045Z on the 15th, which suggests 62 kt from the pressure-wind relationship. The RMW remained about the same (~15 nm) and the cyclone slowed a bit (8 kt), so the 55 kt in HURDAT is retained at 00Z on the 15th. This 991 mb central pressure was in the wrong slot in HURDAT (18Z 14th) and has been moved to 00Z on the 15th. Camille continued deepening on the 15th and an ESSA research aircraft measured central pressures of 970 mb at 1100Z and 969 mb at 1230Z with a circular eye of 15 nm diameter (~12 nm RMW). This pressure suggests an intensity of 91 kt from the pressure-wind relationship. Climatology for this central pressure and latitude is for 15 nm. Given the slightly smaller than usual size, but continued slow (8 kt) speed, 90 kt is selected for 12Z on the 15th - 5 kt higher than HURDAT. 06Z on the 15th is now 65 kt, up from 60 kt originally, and has Camille reaching hurricane intensity six hours earlier than shown in HURDAT. The Air Force reconnaissance aircraft measured 966 mb central pressure and a 10 nm circular eye (~8 nm RMW) at 1820Z on the 15th, which suggests maximum winds of 94 kt from the pressure-wind relationship. 95 kt is selected at 18Z (down 5 kt), given the offsetting aspects of slow movement (6 kt), but small size (~15 nm climatology).

About four hours later at 22Z on the 15th, Camille made landfall in western Cuba near 21.9N 84.3W. No stations were in or near the eye in Cuba, so no central pressures were available. It is

analyzed that the hurricane came ashore as a 95 kt Category 2 hurricane, which is consistent
with the Perez et al. assessment of Category 2 impact in Cuba as well as the limited observations
(80 kt wind at Guane) available. The hurricane only spent about two hours over Cuba and the
90 kt in HURDAT at 00Z on the 16th is unchanged. Once back over water, Camille was investigated
by a Navy reconnaissance aircraft, but this plane did not attempt a penetration fix due to the
tiny eye depicted by their radar. Thus no central pressures were available early on the 16th.
At 1835Z on the 16th, an Air Force reconnaissance aircraft measured 908 mb central pressure from
two separate dropwindsondes along with a circular eye of 10 nm diameter (~8 nm RMW). This pressure
suggests maximum winds of 151 kt from intensifying subset of the Brown et al. south of 25N
pressure-wind relationship. Given a near average environmental pressure (1010 mb outer closed
isobar), a slow movement (9 kt), and a tiny RMW (8 nm versus 12 nm climatology), the intensity
is analyzed at 150 kt - a 20 kt major increase from HURDAT previously at 18Z on the 16th.
The same aircraft observed 905 mb central pressure at 0016Z on the 17th with the same sized eye.
905 mb suggests an intensity of 154 kt from the south of 25N intensifying and 151 kt from
the north of 25N intensifying Brown et al. pressure-wind relationships (as the cyclone is
now straddling the 25N latitude line). An intensity of 150 kt at 00Z on the 17th is analyzed,
up 10 kt from HURDAT. Later on the 17th, a new Air Force reconnaissance aircraft measured
901 mb central pressure from a dropsonde along with a circular eye of 8 nm (~6 nm RMW) at 1815Z.
This pressure, however, was rejected in the post-storm best track and Monthly Weather
Review writeup. Analysis of the original dropsonde data indicates that the actual central
pressure from the dropsonde was about 919 mb. (See supplemental writeup for detailed
analysis and discussion of this dropsonde.) A filling of the hurricane's central pressure
is consistent with the WSR-57 radar imagery from New Orleans and satellite imagery, which
clearly showed a concentric eyewall structure (while this was not mentioned by the
reconnaissance crew, they did note a distinct moat just outside of the inner eyewall).
A 919 mb central pressure (newly added into the 18Z 17th slot) suggests an intensity of
133 kt from the north of 25N and 127 kt from the north of 25N weakening subset of the
Brown et al. pressure-wind relationships. With the concentric eyewall structure, a low
environmental pressure (1008 mb outer closed isobar), a somewhat faster forward speed (12 kt),
and a continued tiny inner RMW, an intensity at 18Z is analyzed to be 135 kt. No further
aircraft reconnaissance fixes were available before landfall in the United States.

The original HURDAT showed a brief landfall in southeastern Louisiana near the mouth of
the Mississippi River just before 00Z on the 18th of August. However, the numerous radar
fixes available indicated that the center of the hurricane remained just offshore, which
is consistent with the radar-based track shown in the Preliminary Report. Camille passed
over the marshy regions of northeastern St. Bernard Parish around 0230-0330Z on the 18th,
but no landfall point is indicated here because of the lack of specific land available.

Camille made landfall near Waveland, Mississippi at 30.3N 89.4W at 0400Z on the 18th of
August, based upon radar fixes and pressure measurements at the coast. The hurricane
displayed a concentric eyewall structure with circular eyes with diameter of 10 nm and
30 nm with some additional prominent banding at larger radii. (The inner eye near the
time of landfall could also be considered elliptical with a major axis of 12 nm oriented
northwest-southeast and a minor axis of 8 nm.) The outer closed isobar at landfall was

a very low 1004 mb, but the hurricane was also quite tiny with a radius of outer closed isobar of 150 nm. Camille's forward speed had increased to about 15 kt at the time of landfall. There were three pressure values of interest near the point of landfall. 909 mb was measured by Mr. Charles Breath at 0300Z at the west of the bridge in Bay St. Louis, Mississippi about 3-4 nm east of the landfall point. This aneroid barometer was subsequently tested and determined that it was calibrated accurately. 909 mb had been the accepted central pressure value at landfall originally as shown in HURDAT and discussed
in Monthly Weather Review. However, Mr. Breath also measured a 904 mb pressure at 0400Z a few blocks west of the first measurement, as reported in Roberts (1969) and confirmed in the Kieper interviews (2007) of the Breath family. (See supplemental additional discussion about this 904 mb measurement.) It is possible that NHC did not include the lower value in the Monthly Weather Review and best track because Mr. Breath did not include it in the log, as the 909 mb was the last entry before he left his damaged home.) There was, in addition to the 909 and 904 mb documented values in Bay St. Louis, an even lower value of 897 mb pressure reading mentioned in the Roberts (1969) report with additional details on its location and time from the Tulane archives. However, there is no documentation on how accurate the barometer was nor could this barometer be located today. (Moreover, the value provided in inches of mercury - 26.50" - appears to be rounded to the nearest 0.5".) Thus this value cannot be assumed to be completely accurate. Given that the 904 mb pressure reading was taken near the eastern edge of the eye about 3-4 nm east of the landfall point (which is known quite accurately through the radar fixes), a 900 mb central pressure is analyzed at landfall. (It is of interest that this corresponds closely to the 901 mb that Roberts analyzed as the central pressure taking a mix of the Waveland-Lakeshore-Bay St. Louis observations.) This central pressure
suggests maximum sustained winds at landfall of 148 kt from the Brown et al. north of 25N pressure-wind relationship and 155 kt from the subset of intensifying systems. Given the somewhat compensating factors of a tiny RMW (~6-8 nm) and a moderate forward speed (15 kt) but a very low pressure of the outer closed isobar (1004 mb), an intensity of 150 kt is reanalyzed for the time of landfall. (The intensity at 00Z on the 18th is set at 140 kt [a major change down from 165 kt originally], showing a recovery from the 135 kt minimum at 18Z on the 17th.) The 150 kt at landfall places Camille as a Category 5 hurricane at landfall in Mississippi. As is typical for landfalling major hurricanes, no anemometer measurement recorded values close to the maximum winds, in part because of anemometer failures, but primarily because of the lack of anemometers in the eastern eyewall at the coast during landfall. The highest observed sustained (roughly 10 min) winds in Camille were 113 kt (at which point the anemometer failed) at the Transworld Drilling Rig Block #92 about halfway between the mouth of the Mississippi River and the Mississippi coast. This measurement was almost certainly higher than 10 m above the ocean, but its exact altitude is unknown. The next highest sustained (fastest mile) wind was 104 kt in Columbia, MS well inland and four hours after landfall. This value adjusts to 99 kt in converting to a peak 1 min wind. With the movement of Camille across the marshlands of northeastern St. Bernard Parish, Category 5 winds are assessed to have occurred in Louisiana as well as Mississippi. Runs of the Schwerdt et al. parametric hurricane wind model suggest maximum sustained winds of 75-80 kt in southwesternmost Alabama. Category 1 winds for Alabama would be consistent with the impacts observed just west of there in Pascagoula, MS.

Runs of the Kaplan and DeMaria inland wind decay model suggest intensities of 116 kt at 06Z on the 18th (2 hours after landfall), 74 kt at 12Z (8 hours), 48 kt at 18Z (14 hours), and 34 kt at 00Z on the 19th (20 hours). Highest observed winds within two hours of these synoptic times were 104 kt, 60 kt, less than 34 kt, and less than 34 kt, though the anemometer data coverage during these times was very sparse. A helpful comparison can be made at 08Z (4 hours after landfall) of the inland wind decay model, which suggests 101 kt, versus the adjusted Columbia measurement of 99 kt, which may have been quite close to the radius of maximum wind. Additionally, the northernmost extent of severe forest damage documented in Touliatos and Roth (1971) occurred about 75 nm from the coast, which was reached by the center of Camille about 5.5 hours after landfall. The Kaplan and DeMaria model suggests maximum sustained winds of about 85 kt at that time. Work by Frelich and Ostuno (2012) indicate that about 90 kt 1 min winds (with a range of 76 to 111 kt) are needed to snap softwood

(like the pine forests of Mississippi) trees at the base. Such an analysis, however, neglects the factors of wind duration and steadiness, which will also contribute to forecast damage. Nonetheless, the Columbia observation and the forest analyses add some measure of reliability to the use of the Kaplan and DeMaria decay model as well as providing some corroboration to the landfall intensity of 150 kt. At 00Z on the 19th, 997 mb with 20 kt NE was observed in Memphis, TN suggesting maximum winds of at least 49 kt (for a marine exposure) from the north of 25N pressure-wind relationship. Accounting for decreased sustained winds over land, the intensity is analyzed at 35 kt. Values in HURDAT after landfall are analyzed at 115 kt at 06Z on the 18th (up from 100 kt), 75 kt at 12Z (up from 60 kt), 50 kt at 18Z (unchanged), and 35 kt at 00Z on the 19th (up from 30 kt). At 06Z on the 19th, Jackson, TN measured 20 kt S with 999 mb pressure. This suggests maximum winds (marine exposure) of at least 45 kt from the north of 25N pressure-wind relationship. The intensity at this time is analyzed at 30 kt, unchanged. Camille is thus reanalyzed to have retained tropical storm status for an additional six hours after landfall. On the 20th as Camille was moving generally eastward across the United States, it began interacting with a frontal boundary to its north. However, satellite imagery and observations indicate that the cyclone did not complete an extratropical transition on the 20th or 21st, as the main frontal boundary remained northeast of Camille.

Late on the 20th, Camille began to reintensify as it approached the Atlantic Ocean coastline. At 12Z on the 20th when Camille was over eastern Virginia, a ship reported 30 kt off of the North Carolina-Virginia border. The intensity is boosted to 30 kt at that time, up from 25 kt originally. At 17Z, Norfolk, VA reported a minimum pressure of 1002 mb with 10 kt WSW winds, which were also at a minimum. With these winds being an overland exposure, a central pressure at that time is estimated to be 1000 mb and is added to the 18Z 20th slot. This central pressure suggests an intensity of 49 kt from the Landsea et al. north of 35N pressure-wind relationship. Peak winds reported at 18Z on the 20th were 40 kt from a ship and an intensity of 45 kt is analyzed at that time (up from 30 kt originally). Additional slight upward changes to the intensity were made from 00Z to 18Z on the 21st, based upon ship observations. (There were no aircraft reconnaissance missions when Camille was over the Atlantic Ocean.) At 18Z on the 21st, a ship reported 996 mb with 60 kt NE winds on the northern (weak semicircle) portion of the cyclone. The intensity is analyzed as 60 kt (up from 55 kt originally), but it is possible that Camille regained hurricane intensity late on 21st. Numerous observations on the 22nd indicate steady weakening occurred on this date and the intensities are at 55 kt at 00Z, 45 kt at 06Z, and 35 kt at 12Z (down from 60, 55, and 50 kt, originally). By 12Z on the 22nd, Camille became embedded within a frontal boundary and extratropical transition is indicated to have occurred at that time. Previously, HURDAT did not indicate an extratropical stage occurred in Camille. After 12Z on the 22nd, Camille's circulation became absorbed within the frontal boundary.

Comparison with the two other known Category 5 hurricanes that have struck the continental United States since 1900, Camille (900 mb and 150 kt) ranks between the 1935 Labor Day hurricane (892 mb and 160 kt) and 1992's Andrew (922 mb and 145 kt) for strongest hurricanes at landfall.

Debbie – AL081969 – 2021 Revision

Green indicates wind changes of 15 kt or greater
Blue indicates lat/long changes greater than 1°
Red indicates a new entry
Yellow indicates a deletion

Hurricane Debbie [August 14-25, 1969]

```
45985 08/14/1969 M=12  8 SNBR= 981 DEBBIE      XING=0 SSS=0

45990 08/14*  0   0   0    0*  0   0   0    0*130 355  25    0*133 370  25    0*
```

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45990 08/14*  0   0   0    0*  0   0   0    0*130 355  25    0*133 370  30    0*
                                                                        **

45995 08/15*135 385  30    0*138 400  30    0*140 415  35    0*143 430  40    0*
45995 08/15*135 385  35    0*138 400  40    0*140 415  45    0*143 430  50    0*
                     **                **                **                **

46000 08/16*145 445  45    0*147 457  50    0*150 470  55    0*155 480  65    0*
46000 08/16*145 445  55    0*147 457  60    0*150 469  65    0*155 480  65  987*
                     **                **          ***  **                    ***

46005 08/17*160 490  70  984*165 500  75  980*170 508  90  976*177 517  90  971*
46005 08/17*160 490  70    0*165 500  75    0*170 508  85  974*177 517  90    0*
                           *                *          **  ***                 *

46010 08/18*184 526  90  967*191 534 100  968*197 541 100  974*204 547  90  972*
46010 08/18*184 526  90  966*190 533  90  967*196 540  85  971*203 546  85  971*
                         *** *** ***  **  *** *** ***  **  *** *** ***  **  ***

46015 08/19*212 554  70  976*218 567  80  978*224 578  80  974*232 593  95  966*
46015 08/19*210 554  80  977*217 566  80  976*224 578  85  973*231 592 100  964*
            ***      **  *** *** ***      ***          **  *** *** *** ***  ***

46020 08/20*238 605 100  956*245 623  85  953*251 633 105  953*258 642 100  951*
46020 08/20*238 606 110  954*244 621 110  952*251 633 110  954*258 642 110  950*
                *** ***      *** *** ***  ***          ***  ***          ***  ***

46025 08/21*266 649 100  959*274 651  95  960*284 648  95  959*294 640 100  959*
46025 08/21*266 649  95  959*274 651  95  958*284 648  95  959*294 640  95    0*
                    ***  ***               ***                             ***   *

46030 08/22*303 621 100  959*313 614 100    0*326 600 100  964*340 586 100    0*
46030 08/22*303 628  95  959*313 614  90  965*326 600  90    0*339 588  90  963*
                *** ***               ***  ***          ***   * *** *** ***  ***

46035 08/23*354 572 100  965*367 567 100    0*392 548  95    0*416 532  90    0*
46035 08/23*354 575  90    0*369 563  85  967*385 550  80    0E406 538  75    0*
                *** ***    * *** *** ***  *** *** ***  **      *** ***  **

46040 08/24*435 529  90    0*455 528  80    0*480 520  70    0*505 505  65    0*
46040 08/24E430 531  70    0E455 527  65    0E480 520  60    0E505 505  55    0*
           **** ***  **     *    ***  **     *          **     *          **

46045 08/25*530 480  65    0*565 435  55    0*609 378  55    0*  0   0   0    0*
46045 08/25E530 480  50    0E565 435  50    0E605 385  55  988E625 335  50  990*
           *         **     *          **        *   *   *  ******* ***  **  ***
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(The 26th and 27th are new to HURDAT.)

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46045 08/26E635 280  45  992E650 180  45  993E660 100  40  994E660  75  40  995*
46045 08/27E665  50  40  995E645   0  40  995E6453545  35  997*  0   0   0    0*
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46050 HR

Significant Revisions:

1. Intensification to a tropical storm is analyzed twelve hours earlier based satellite imagery.

2. Intensification to a major hurricane delayed 36 hours based on reconnaissance aircraft data.
3. Major intensity changes on August 18th at 12Z, 20th at 06Z, 23rd at 06Z, 12Z and 18Z, 24th at 00Z and 06Z, and 25th at 00Z based on reconnaissance data.
4. Major track change on August 23rd at 18Z based on synoptic observations.
5. Extratropical phase added starting on August 23rd at 18Z at 00Z based on synoptic observations. The original HURDAT did not show Debbie becoming an extratropical cyclone.
6. Two additional days are added to the lifecycle of this system while an extratropical cyclone.

Daily Metadata:

August 13:

1. Maps and old HURDAT:

- HWM and microfilm does not show any features of interest at 12Z.
- HURDAT does not list an organized system on this date.

2. Satellite highlights:

- ESSA IX estimated a center fix at 12N, 31W at 1815Z (WALLET).

3. Discussion:

- MWR: "There was a large convective mass of clouds off the African coast on August 13 which moved toward the west-northwest."
- ATSR: "DEBBIE developed from a tropical wave which was located along 30 degrees west on 13 August."
- Reanalysis: Satellite images showed a large area of convection associated with a tropical wave over the eastern Atlantic.

August 14:

1. Maps and old HURDAT:

- HWM and microfilm does not show any features of interest at 12Z.
- HURDAT lists a 25 kt tropical depression at 13N, 35.5W at 12Z.
- HURDAT does not list an organized system on this date.

2. Satellite highlights:

- ESSA IX estimated a center fix at 13N, 37W at 1913Z (WALLET).

3. Discussion:

- MWR: "…developed into a depression on the 14th."
- Reanalysis: The tropical disturbance continued generally westward and it is analyzed to have become a tropical depression at 12Z on the 14th, same as originally shown in HURDAT. Time of genesis is uncertain due to the sparsity of the ship data in the central and eastern Atlantic. Satellite images indicated that the convection had become better organized and banding features had developed.

August 15:

1. Maps and old HURDAT:

- HWM analyzes a closed low pressure of at most 1012 mb at 14.2N, 40.2W at 12Z.
- HURDAT lists a 35 kt tropical storm at 14N, 41.5W at 12Z.

- Microfilm shows a tropical cyclone of at most 1012 mb at 14N, 41.5W at 12Z.

2. Satellite highlights:
- ESSA IX estimated a center fix at 14.5N, 43W (time unknown, likely ~18Z) (WALLET).

3. Discussion:
- MWR: "…a storm on the 15th."
- ATSR: "Satellite pictures on the 15th confirmed the fact that a definite circulation had developed near 14N and 42w and was well organized and appeared to be of tropical storm intensity. The first warning was issued at 151600Z, with DEBBIE already of tropical storm intensity."
- Reanalysis: Satellite images showed that the tropical depression had continued to become better organized with a CDO and banding features. Intensification to a tropical storm is analyzed at 00Z on the 15th, twelve hours earlier than originally in HURDAT, based on the convective signature and organization pattern of the tropical cyclone in the satellite images, showing a stronger system in comparison to the intensity estimates in HURDAT on this date.

August 16:

1. Maps and old HURDAT:
- HWM analyzes a tropical storm of at most of 1008 mb at 15.1N, 47.3W at 12Z.
- HURDAT lists a 55 kt tropical storm at 15N, 47W at 12Z.
- Microfilm shows a hurricane of at most 1008 mb at 15.2N, 47.3W at 12Z.

2. Aircraft highlights:
- Penetration center fix measured a central pressure of 987 mb, estimated surface winds of 65 kt and an elliptical eye with major axis 60°-240°, major axis of 24 n mi and minor axis of 5 n mi at 15.8N, 48.8W at 2053Z (WALLET).

3. Satellite highlights:
- ESSA VIII estimated a center fix at 15.2N, 47.5W at 1315Z (WALLET).
- ESSA IX estimated a center fix at 15.5N, 48W at 1659Z (WALLET).

4. Discussion:
- MWR: "…and a hurricane the following day."
- ATSR: "She moved west-northwestward, gradually intensifying to hurricane intensity late on the 16th. She then veered more toward the northwest, away from the Leeward Islands."
- Reanalysis: The first reconnaissance aircraft to reach Debbie occurred at 2053Z measuring a central pressure of 987 mb, estimating surface winds of 65 kt and an eye diameter of 5-24 n mi. A central pressure of 987 mb suggests maximum surface winds of 68 kt from the south of 25N Brown et al. pressure-wind relationship. An eye diameter of 5-24 n mi suggests an RMW of about 4-18 n mi and the climatological value is 13 n mi. Based on a forward speed of about 11 kt, an intensity of 65 kt is analyzed at 18Z on the 16th, same as originally shown in HURDAT. Intensification to a hurricane is analyzed at 12Z on the 16th, six hours earlier than originally in HURDAT, based in part on the on the increase in organization observed in the satellite images. Satellite images showed a well-organized tropical cyclone with a CDO and banding features.

August 17:

1. Maps and old HURDAT:

- HWM analyzes a hurricane of at most of 1008 mb at 16.2N, 52.2W at 12Z.
- HURDAT lists a 90 kt hurricane at 17N, 50.8W at 12Z.
- Microfilm shows a hurricane of 974 mb at 17N, 50.9W at 12Z.

2. Ship highlights:

- 35 kt SE and 1013 mb at 17.6N, 49.7W at 15Z (COADS).
- 50 kt SE and 1010 mb at 17.4N, 49.8W at 18Z (COADS).
- 40 kt SE and 963 mb (very low bias) at 17.6N, 49.7W at 21Z (COADS).

3. Aircraft highlights:

- Penetration center fix measured a central pressure of 974 mb and estimated surface winds of 90 kt at 17N, 50.9W at 1215Z (WALLET).
- Penetration center fix at 17.7N, 52.2W at 1730Z (WALLET).

4. Satellite highlights:

- ESSA VIII estimated a center fix at 17N, 50.5W at 1210Z (WALLET).
- ESSA VIII estimated a center fix at 17.5N, 51.5W at 1758Z (WALLET).

5. Discussion:

- Reanalysis: The hurricane continued on a northwestward track and intensified. A reconnaissance aircraft measured a central pressure of 974 mb and estimated surface winds of 90 kt at 1215Z on the 17th. A central pressure of 974 mb suggests maximum surface winds of 85 kt from the south of 25N Brown et al. pressure-wind relationship. Based on a forward speed of about 10 kt and putting some weight on the visual estimate, an intensity of 85 kt is analyzed at 12Z on the 17th, down from 90 kt originally in HURDAT, a minor intensity change. A couple of ships around the periphery of Debbie reported gale and storm-force winds. Satellite imagery showed a well-organized tropical cyclone with a CDO over the center and banding features over the northern and eastern semicircles.

August 18:

1. Maps and old HURDAT:

- HWM analyzes a hurricane of at most of 1000 mb at 19.4N, 53.7W at 12Z.
- HURDAT lists a 100 kt hurricane at 19.7N, 54.1W at 12Z.
- Microfilm shows a hurricane of at most 1004 mb at 19.6N, 53.8W at 12Z.

2. Ship highlights:

- 35 kt SE and 1010 mb at 16.6N, 50.5W at 06Z (COADS).
- 50 kt ESE and 1011 mb at 19.4N, 51.6W at 12Z (COADS).
- 45 kt SE and 1010 mb at 20N, 52W at 18Z (COADS).

3. Aircraft highlights:

- Penetration center fix measured a central pressure of 966 mb at 18.4N, 52.6W at 0016Z (WALLET).
- Penetration center fix measured a central pressure of 967 mb at 18.8N, 53.3W at 05Z (WALLET).
- Penetration center fix measured a central pressure of 971 mb and estimated an eye diameter of 24 n mi at 19.5N, 54W at 1155Z (WALLET).
- Penetration center fix measured 971 mb central pressure with 93 kt maximum flight-level (650 mb) winds and 22.5 n mi RMW at 24N 54W at ~13Z (Gray and Shea). (The latitude appears to be a typo.)

- Penetration center fix measured a central pressure of 971 mb and estimated an eye diameter of 40 n mi at 20.2N, 54.3W at 1752Z (WALLET).

4. Discussion:

- ATSR: "DEBBIE was seeded during Project STORMFURY operations on the 18th and 20th as she continued to move in a northwesterly track midway between Puerto Rico and Bermuda."
- Reanalysis: A penetration center fix at 0016Z on the 18th measured a central pressure of 966 mb, suggesting maximum surface winds of 94 kt from the south of 25N pressure-wind relationship. Due to its slow forward speed of about 9 kt, an intensity of 90 kt is analyzed at 00Z on the 18th, same as originally shown in HURDAT. Another penetration center fix measured a central pressure of 967 mb at 05Z on the 18th and an intensity of 90 kt is analyzed at 06Z on this date, same as originally shown in HURDAT. Satellite imagery continued to show a well-organized tropical cyclone with a large CDO over the center. Penetration center fixes at 1155Z and 1752Z on the 18th indicated that the central pressure of Debbie had risen to 971 mb and the eye diameter had also increased to 24 n mi and 40 n mi, respectively. A central pressure of 971 mb suggests maximum surface winds of 89 kt from the south of 25N pressure wind relationship. Eye diameters of 24 n mi and 40 n mi suggest RMWs of about 18 n mi and 30 n mi (a research mission explicitly measured an RMW of 22.5 n mi.), and the climatological value is 15 n mi. Based on a slow forward speed of about 9 kt and large eye diameter/RMW, an intensity of 85 kt is analyzed at 12Z and 18Z on the 18th, down from 100 kt and 90 kt, respectively. A major intensity change at 12Z from the original HURDAT and a minor intensity change at 18Z.

August 19:

1. Maps and old HURDAT:

- HWM analyzes a hurricane of at most of 1000 mb at 22.3N, 57.5W at 12Z.
- HURDAT lists an 80 kt hurricane at 22.4N, 57.8W at 12Z.
- Microfilm shows a hurricane of at most 1004 mb at 22.4N, 58W at 12Z.

2. Ship highlights:

- 35 kt SE and 1012 mb at 19.7N, 52.2W at 00Z (COADS).

3. Aircraft highlights:

- Penetration center fix measured a central pressure of 977 mb and estimated an eye diameter of 20 n mi at 21.1N, 55.3W at 00Z (WALLET).
- Penetration center fix measured a central pressure of 976 mb and estimated surface winds of 74 kt at 21.7N, 55.8W at 0357Z (WALLET).
- Penetration center fix measured a central pressure of 973 mb, estimated surface winds of 100 kt and an eye diameter of 40 n mi at 22.5N, 57.9W at 1202Z (WALLET).
- Penetration center fix measured a central pressure of 964 mb, estimated surface winds of 115 kt and an eye diameter of 20 n mi at 23.3N, 59.5W at 1836Z (WALLET).
- Penetration center fix measured a central pressure of 954 mb and estimated an eye diameter of 25 n mi at 23.8N, 60.5W at 2330Z (WALLET).

4. Satellite highlights:

- ESSA VIII estimated a center fix at 23N, 58W at 1358Z (WALLET).
- ESSA VIII estimated a center fix at 23.3N, 59.5W at 1836Z (WALLET).

5. Discussion:

- Reanalysis: Debbie continued moving northwestward as it passed northeast of the Leeward Islands. A reconnaissance aircraft measured a central pressure of 977 mb and estimated an eye diameter of 20 n mi. A central pressure of 977 mb suggests maximum surface winds of 81 kt from the south of 25N pressure-wind relationship. An eye diameter of 20 n mi suggests an RMW of about 15 n mi and the climatological value is 16 n mi. Based on a forward speed of about 12 kt, an intensity of 80 kt is analyzed at 00Z on the 19th, up from 70 kt originally shown in HURDAT, a minor intensity change. The next penetration center fix occurred at 0357Z on the 19th and measured a central pressure of 976 mb, thus an intensity of 80 kt is selected at 06Z on this date, same as originally shown in HURDAT. Another penetration center fix measured a central pressure of 973 mb, estimated surface winds of 100 kt and eye diameter of 40 n mi at 1202Z on the 19th. A central pressure of 973 mb suggests maximum surface winds of 86 kt from the south of 25N pressure-wind relationship. An eye diameter of 40 n mi suggests an RMW of about 30 n mi and the climatological value is 17 n mi. Based on a forward speed of about 15 kt, an intensity of 85 kt is analyzed at 12Z on the 19th, up from 80 kt originally shown in HURDAT, a minor intensity change. The next penetration center fix measured a central pressure of 964 mb, estimated surface winds of 115 kt and eye diameter of 20 n mi at 1836Z on the 19th. A central pressure of 964 mb suggests maximum surface winds of 98 kt from the south of 25N pressure-wind relationship intensifying subset. An eye diameter of 20 n mi suggests an RMW of about 15 n mi and the climatological value is 17 n mi. Based on a forward speed of about 15 kt and weighing some the visual estimate, an intensity of 100 kt is analyzed at 18Z on the 19th, up from 95 kt originally shown in HURDAT, a minor intensity change. Satellite imagery indicated that Debbie had become a smaller tropical cyclone, losing the banding features it had been displaying during the past few days, and becoming a well-organized circular CDO with an eye visible in the center of the convection. Synoptic observations showed that all the ships in the vicinity stayed away from the RMW and the highest report was 35 kt at 00Z. It appears that Debbie went through a concentric eyewall cycle on the 18th and 19th, with the system observed to be filling and having a larger eye diameter from 00Z on the 18th through 06Z on the 19th, then deepening and having a smaller eye diameter from 06Z to 18Z on the 19th.

August 20:

1. Maps and old HURDAT:

- HWM analyzes a hurricane of at most of 1004 mb at 25.2N, 63.1W at 12Z.
- HURDAT lists a 105 kt hurricane at 25.1N, 63.3W at 12Z.
- Microfilm shows a hurricane of at most 1000 mb at 25.2N, 63.2W at 12Z.

2. Ship highlights:

- 40 kt SW and 1006 mb at 24.1N, 63W at 12Z (COADS).
- 35 kt S and 1008 mb at 25.4N, 63W at 18Z (COADS)

3. Aircraft highlights:

- Penetration center fix measured a central pressure of 952 mb and estimated an eye diameter of 30 n mi at 24.6N, 62.5W at 07Z (WALLET).
- Penetration center fix – 954 mb, 99 kt maximum flight-level (650 mb), 12.5 n mi RMW at 25N64W at ~10Z (Gray and Shea).
- Penetration center fix measured a central pressure of 954 mb and estimated an eye diameter of 23 n mi at 25.1N, 63.1W at 1139Z (WALLET).
- Penetration center fix – 950 mb, 99 kt maximum flight-level (650 mb), 22.5 n mi RMW at 25N64W at ~15Z (Gray and Shea).

- Penetration center fix measured a central pressure of 950 mb and estimated an eye diameter of 20 n mi at 25.7N, 64.2W at 1730Z (WALLET).
- Penetration center fix measured a central pressure of 959 mb and estimated an eye diameter of 30 n mi at 26.5N, 64.9W at 2343Z (WALLET). (Note that a vortex message at 2225Z reported concentric eyewalls of 17 and 35 n mi diameter.)

4. Satellite highlights

- ESSA IX estimated a center fix at 26N, 64.5W at 19Z (WALLET).

5. Discussion:

- MWR: "Debbie reached her greatest strength on the 20th. Hurricane Camille's circulation was still strong at upper levels as it moved off the mid-Atlantic coast on the 20th and passed north of Debbie on the 21st and 22nd. Without Camille's presence, Debbie most likely would have passed close to Bermuda and probably would have made landfall in Newfoundland."
- Reanalysis: A penetration center fix measured a central pressure of 954 mb and estimated an eye diameter of 25 n mi at 2330Z on the 19th. A central pressure of 954 mb suggests maximum surface winds of 109 kt from the south of 25N and 106 kt from the north of 25N pressure-wind relationship intensifying subsets. An eye diameter of 25 n mi suggests an RMW of about 19 n mi and the climatological value is 17 n mi. Based on a forward speed of about 15 kt, an intensity of 110 kt is analyzed at 00Z on the 20th, up from 100 kt originally shown in HURDAT, a minor intensity change. 110 kt is also the peak intensity of Debbie, up from 105 kt originally shown in HURDAT at 12Z on the 20th, a minor intensity change. The next three penetration center fixes measured central pressure values of 952 mb, 954 mb and 950 mb at 07Z, 1139Z and 1730Z, respectively, on the 20th. An intensity of 110 kt is analyzed at 06Z, 12Z and 18Z on the 20th, up from 85 kt, 105 kt, and 100 kt, respectively, originally in HURDAT. A major intensity change is analyzed at 06Z and minor intensity changes at 12Z and 18Z from the original values shown in HURDAT. Satellite imagery showed a well-organized tropical cyclone with a CDO and banding features. It is possible that the concentric eyewalls reported by aircraft late on the day indicates that the system may have started to go through a concentric eyewall cycle. However, Debbie did not restrengthen after weakening began early on the 20th, so it does not appear that the system completed a second concentric eyewall cycle.

August 21:

1. Maps and old HURDAT:

- HWM analyzes a hurricane of at most 1000 mb at 28.4N, 64.5W with a frontal boundary to the northwest at 12Z.
- HURDAT lists a 95 kt hurricane at 28.4N, 64.8W at 12Z.
- Microfilm shows a hurricane of at most 1004 mb at 28.5N, 64.7W with a frontal boundary to the northwest at 12Z.

2. Ship highlights:

- 40 kt S and 1009 mb at 29.3N, 61.9W at 18Z (COADS).

3. Aircraft highlights:

- Penetration center fix measured a central pressure of 958 mb and estimated an eye diameter of 30 n mi at 27.4N, 65W at 0610Z (WALLET).
- Penetration center fix measured a central pressure of 959 mb, estimated surface winds of 110 kt and an eye diameter of 5 n mi at 28.3N, 64.8W at 1137Z (WALLET).

- Penetration center fix measured a central pressure of 959 mb, estimated surface winds of 110 kt and a concentric eye diameter of 17-35 n mi at 29.9N, 63.4W at 2225Z (WALLET).

4. Discussion:

- MWR: "…then turned toward the north-northeast on the 21st."
- ATSR: "On the 21st, she headed toward the North and presented a serious threat to Bermuda before veering toward the northeast later in the day."
- Reanalysis: Debbie turned to the north and northeast on this date as a frontal boundary associated with Camille approached from the west. A reconnaissance aircraft at 2343Z on the 20th measured a central pressure of 959 mb and estimated eye diameter of 30 n mi. A central pressure of 959 mb suggests maximum surface winds of 92 kt from the north of 25N pressure-wind relationship weakening subset. An eye diameter of 30 n mi suggests an RMW of about 23 n mi and the climatological value is 19 n mi. Based on a forward speed of about 10 kt, an intensity of 95 kt is analyzed at 00Z on the 20th, down from 100 kt originally shown in HURDAT, a minor intensity change. The next two penetration center fixes measured central pressure values of 958 mb and 959 mb at 0610Z and 1137Z, respectively, on the 21st. An intensity of 95 kt is analyzed at 06Z and 12Z on the 21st, same as originally shown in HURDAT.

August 22:

1. Maps and old HURDAT:

- HWM analyzes a hurricane of at most 1000 mb at 32.6N, 59.5W with a frontal boundary just to the just northwest at 12Z.
- HURDAT lists a 100 kt hurricane at 32.6N, 60W at 12Z.
- Microfilm shows a hurricane of at most 1000 mb at 32.6N, 59.6W with a frontal boundary to the northwest at 12Z.

2. Ship highlights:

- 45 kt SSE (70 kt micro) and 1003 mb at 29.9N, 61.8W at 00Z (COADS).
- 40 kt WSW and 1005 mb at 29.5N, 60.3W at 06Z (COADS).
- 40 kt SE and 1010 mb at 32.7N, 56.6W at 12Z (micro).
- 35 kt SE and 1010 mb at 34.3N, 54.5W at 18Z (COADS).
- 35 kt S and 1011 mb at 33.5N, 54.6W at 21Z (COADS).

3. Aircraft highlights:

- Penetration center fix measured a central pressure of 965 mb, estimated surface winds of 110 kt and an eye diameter of 40 n mi at 31.3N, 61.4W at 0528Z (WALLET).
- Penetration center fix measured a central pressure of 963 mb, estimated surface winds of 100 kt and an eye diameter of 30 n mi at 34.2N, 58.5W at 1852Z (WALLET).

4. Satellite highlights:

- ESSA VIII estimated a center fix at 33N, 59W at 1430Z (WALLET).
- ESSA IX estimated a center fix at 33.5N, 59W at 1710Z (WALLET).

5. Discussion:

- Reanalysis: Debbie continued northeastward over the open Atlantic passing well to the east of Bermuda. A penetration center fix at 2225Z on the 21st measured a central pressure of 959 mb and an intensity of 95 kt is analyzed at 00Z on the 22nd, down from 100 kt originally shown in HURDAT, a minor intensity change. The next penetration center fix measured a central pressure of 965 mb,

estimated surface winds of 110 kt and eye diameter of 40 n mi at 0528Z on the 22nd. A central pressure of 965 mb suggests maximum surface winds of 90 kt from the north of 25N pressure-wind relationship. An eye diameter of 40 n mi suggests an RMW of about 30 n mi and the climatological value is 23 n mi. Based on a forward speed of about 16 kt, an intensity of 90 kt is analyzed at 06Z on the 22nd, down from 100 kt originally shown in HURDAT, a minor intensity change. Another penetration center fix measured a central pressure of 963 mb at 1852Z on the 22nd and an intensity of 90 kt is analyzed at 18Z on this date, down from 100 kt originally shown in HURDAT, a minor intensity change. Satellite imagery indicated that shear had increased over the tropical cyclone causing most of the convective activity to be located over the center and eastern semicircle.

August 23:

1. Maps and old HURDAT:

- HWM analyzes a hurricane of at most 1000 mb at 38.8N, 54.9W with a warm front to the northeast and a cold front to the south at 12Z.
- HURDAT lists a 95 kt hurricane at 39.2N, 54.8W at 12Z.
- Microfilm shows a hurricane of at most 1000 mb at 38N, 55W with a frontal boundary to the northwest at 12Z.

2. Ship highlights:

- 30 kt ESE and 1002 mb at 37.5N, 54.3W at 06Z (COADS).
- 35 kt NE and 1003 mb at 39.3N, 57W at 09Z (COADS).
- 75 kt E and 998 mb at 39N, 54.6W at 12Z (COADS).
- 50 kt NNE and 1000 mb at 41.3N, 54.5W at 15Z (COADS).
- 60 kt N and 996 mb at 41.2N, 55.9W at 18Z (COADS).
- 981 mb at 43N, 52.9W at 21Z (COADS).

3. Aircraft highlights:

- Penetration center fix measured a central pressure of 967 mb and estimated an eye diameter of 35 n mi at 36.6N, 56.7W at 06Z (WALLET).

4. Satellite highlights:

- ESSA VIII estimated a center fix at 39.5N, 54.5W at 1315Z (WALLET).

5. Discussion:

- Reanalysis: Debbie continued on a general northeastward track as it interacted with the frontal boundary to the west and began to lose its tropical characteristics. The last penetration center fix measured a central pressure of 967 mb and estimated eye diameter of 35 n mi at 06Z on the 23rd. A central pressure of 967 mb suggests maximum surface winds of 85 kt from the north of 35N Landsea et al. pressure-wind relationship. An eye diameter of 35 n mi suggests an RMW of about 26 n mi and the climatological value is 29 n mi. Based on a forward speed of about 22 kt, an intensity of 85 kt is analyzed at 06Z on the 23rd, down from 100 kt originally shown in HURDAT, a major intensity change. Major intensity changes are also introduced at 12Z and 18Z on the 23rd as HURDAT originally showed intensities of 95 kt and 90 kt, respectively, and the selected intensities are 80 kt and 75 kt, respectively. Debbie moved into the north Atlantic shipping lane encountering many ships that reported winds up to hurricane intensity, including 75 kt at 12Z. Satellite imagery still showed a robust cyclone with convection over and to the north of the center and the development of a front to the south as it acquired extratropical characteristics. Late on the 23rd, synoptic data showed that the hurricane had

become less isothermal with a temperature gradient of about 4 degrees across the circulation, as it became embedded within the frontal boundary. Thus, transition to an extratropical cyclone is analyzed at 18Z on the 23rd. The original HURDAT did not show Debbie becoming extratropical.

August 24:

2. Maps and old HURDAT:

- HWM analyzes a hurricane of at most 988 mb at 52N, 51.5W with a cold front to the northwest, warm front to the northeast and another cold front to the east at 12Z.
- HURDAT lists a 70 kt hurricane at 48N, 52W at 12Z.

3. Ship highlights:

a. 35 kt ESE and 996 mb at 43.9N, 51.3W at 00Z (COADS).
b. 40 kt NE and 1000 mb at 46.2N, 53.9W at 03Z (COADS).
c. 45 kt NE and 1000 mb at 44.2N, 50.2W at 06Z (COADS).
d. 50 kt S and 988 mb at 47.6N, 51.7W at 12Z (COADS).
e. 50 kt S and 998 mb at 50.5N, 47W at 18Z (COADS).

4. Land highlights:

a. 40 kt (gusts to 50 kt) at Argentia, Canada at 09Z (WALLET).

5. Discussion:

a. MWR: "and after passing Newfoundland lost force rapidly over the extremely cold waters and died east of Greenland."
b. ATSR: "On the 23rd and 24th, DEBBIE accelerated on a more northerly course, passing 50 miles east of St. John, Newfoundland later on the 24th with gusts to 55 knots recorded by that city. She had rapidly lost her tropical characteristics, becoming extra-tropical over the cold waters of the North Atlantic. The final tropical warning was issued at 241800z, as she headed on a track that took her over Iceland on the 27th of August."
c. Environment Canada:
   i. 50 kt (likely gusts) in eastern Newfoundland
   ii. 75 kt (likely gusts) in St. John's
d. Reanalysis: On early on the 24th, Debbie took a more northerly track passing close to Newfoundland and producing gusts to hurricane force. Major intensity changes are introduced at 00Z and 06Z on the 24th as HURDAT originally had intensities of 90 kt and 80 kt, respectively, and 70 kt and 65 kt, respectively, were selected. Weakening below hurricane intensity is analyzed at 12Z on the 24th, 18 hours earlier than originally shown in HURDAT.

August 25:

1. Maps and old HURDAT:

- HWM analyzes an extratropical cyclone of at most 992 mb at 61N, 39W at 12Z.
- HURDAT lists a 55 kt tropical storm at 60.9N, 37.8W at 12Z (last position).

2. Ship highlights:

- 35 kt SE and 998 mb at 55.8N, 42.6W at 00Z (COADS).
- 40 kt S and 998 mb at 56.4N, 40.8W at 06Z (COADS).
- 40 kt W and 1004 mb at 56.9N, 38.9W at 12Z (COADS).
- 35 kt W and 994 mb at 60.9N, 33.9W at 18Z (COADS).

3. Discussion:

- Reanalysis: The strong extratropical cyclone accelerated to the northeast and began to interact with another extratropical cyclone positioned southeast of Greenland.

August 26:

1. Maps and old HURDAT:
- HWM analyzes an extratropical cyclone of at most 1000 mb at 65N, 10W at 12Z.

2. Ship highlights:
- 35 kt WSW and 1011 mb at 60N, 25.9W at 00Z (COADS).
- 40 kt W and 1018 mb at 56N, 14.9W at 06Z (COADS).
- 35 kt W and 1019 mb at 51.3N, 5.2W at 12Z (COADS).
- 35 kt W and 1010 mb at 60.4N, 13.5W at 18Z (COADS).

August 27:

1. Maps and old HURDAT:
- HWM analyzes an extratropical cyclone of at most 1000 mb at 64N, 4E at 12Z.

2. Ship highlights:
- 35 kt NW and 1004 mb at 62N, 8W at 06Z (COADS).
3. Discussion:
- Reanalysis – The system continued as a slowly weakening extratropical gale on the 26th and 27th until being absorbed by a strong cyclone centered over southern Sweden after 12Z on the 27th. 2.25 additional days were added to HURDAT to the lifecycle of the system, while an extratropical cyclone.

Date	Original HURDAT Central Pressure	Evidence	Changes
Aug 16 18Z	987 mb	Penetration center fix: 987 mb at 2053Z on August 16th	Retained
Aug 17 00Z	984 mb	No penetration center fixes or ships nearby	Removed
Aug 17 06Z	980 mb		
Aug 17 12Z	976 mb	Penetration center fix: 974 mb at 1215Z on August 17th	974 mb
Aug 17 18Z	971 mb	No penetration center fixes or ships nearby	Removed
Aug 18 00Z	967 mb	Penetration center fix: 966 mb at 0016Z on August 18th	966 mb
Aug 18 06Z	968 mb	Penetration center fix: 967 mb at 05Z on August 18th	967 mb
Aug 18 12Z	974 mb	Penetration center fix: 971 mb at 1155Z on August 18th	971 mb
Aug 18 18Z	972 mb	Penetration center fix: 971 mb at 1752Z on August 18th	971 mb
Aug 19 00Z	976 mb	Penetration center fix: 977 mb at 0Z on August 19th	977 mb
Aug 19 06Z	978 mb	Penetration center fix: 976 mb at 0357Z on August 19th	976 mb
Aug 19 12Z	974 mb	Penetration center fix: 973 mb at 1202Z on August 19th	973 mb
Aug 19 18Z	966 mb	Penetration center fix: 964 mb at 1836Z on August 19th	964 mb
Aug 20 00Z	956 mb	Penetration center fix: 954 mb at 2330Z on August 20th	954 mb
Aug 20 06Z	953 mb	Penetration center fix: 952 mb at 07Z on August 20th	952 mb

Aug 20 12Z	953 mb	Penetration center fix: 954 mb at 1139Z on August 20th	954 mb
Aug 20 18Z	951 mb	Penetration center fix: 950 mb at 1730Z on August 20th	950 mb
Aug 21 00Z	959 mb	Penetration center fix: 959 mb at 2343Z on August 20th	Retained
Aug 21 06Z	960 mb	Penetration center fix: 958 mb at 0610Z on August 21th	958 mb
Aug 21 12Z	959 mb	Penetration center fix: 959 mb at 1137Z on August 21th	Retained
Aug 21 18Z	959 mb	No penetration center fixes or ships nearby	Removed
Aug 22 00Z	959 mb	Penetration center fix: 959 mb at 225Z on August 21th	Retained
Aug 22 06Z		Penetration center fix: 965 mb at 0528Z on August 22nd	965 mb
Aug 22 12Z	964 mb	No penetration center fixes or ships nearby	Removed
Aug 22 18Z		Penetration center fix: 963 mb at 1852Z on August 22nd	963 mb
Aug 23 00Z	965 mb	No penetration center fixes or ships nearby	Removed
Aug 23 06Z		Penetration center fix: 967 mb at 06Z on August 23rd	967 mb

Sources: NHC microfilm maps, the Historical Weather Maps series, the COADS ship database, Monthly Weather Review, Navy reconnaissance book, National Hurricane Research Project (NHRP), Mariners Weather Log, Environmental Canada, Satellite images from NCDC, NHC Storm Wallets, Gray and Shea Colorado State University Paper 257 in 1976.

Camille – AL091969 – Reanalyzed previously in 2016

Unnamed – AL101969 – Removed in 2021

August 24-28: Historical Weather Maps, microfilm and satellite images showed a tropical wave exiting the west coast of Africa on August 24th. The first position in HURDAT is analyzed at 00Z on the 24th, but synoptic observations suggested that it did not have a well-defined center at this time. As the tropical wave moved westward, the convective activity remained disorganized. Satellite images between the 26th and 29th showed an exposed weak circulation with disorganized convection over the northern semicircle. Synoptic observations were sparse over the eastern Atlantic, but do not suggest it had a well-defined center. The last position in HURDAT was analyzed at 00Z on the 28th. Because the system did not have a well-defined center, it is removed from HURDAT. This disturbance was in Jack Beven's List of Suspects.

Unnamed – AL111969 – Removed in 2021

August 24-26: Historical Weather Maps, microfilm and satellite images depicted an active tropical wave near 50W on August 23rd. A reconnaissance aircraft investigated the tropical disturbance late on the 24th and found a closed circulation with a central pressure of 1008 mb but winds no greater than 15 kt. The system continued westward and another penetration center fix on the 25th did not find a closed circulation. The last position in HURDAT was analyzed at 00Z on the 26th. On the 27th, the tropical wave moved across the Lesser Antilles and became less organized. Because the circulation was poorly organized and transient, it is removed from HURDAT. This disturbance was in Jack Beven's List of Suspects.

Eve – AL121969 – 2021 Revision

Green indicates wind changes of 15 kt or greater
Blue indicates lat/long changes greater than 1°

Red indicates a new entry
Yellow indicates a deletion

Tropical Storm Eve [August 24-27, 1969]

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46050 08/25/1969 M= 4  12 SNBR= 982 EVE         XING=0 SSS=0

(August 24th is new to HURDAT)
46055 08/24*  0   0   0    0*  0   0   0    0*  0   0   0    0*294 792  25    0*
                                                              *** ***  **

46060 08/25*295 785  30    0*296 778  30    0*297 769  30    0*298 760  40    0*
46060 08/25*294 785  30    0*294 776  30    0*295 769  35    0*297 761  40    0*
            ***              *** ***          ***      **      *** ***

46065 08/26*300 751  50  999*303 743  45    0*308 736  45  996*314 727  40  997*
46065 08/26*300 752  40  999*303 744  45    0*307 737  45  995*313 729  45  997*
                ***  **          ***          *** ***      *** *** ***  **

46070 08/27*320 715  30    0*325 700  30    0*327 688  30    0*328 675  25 1009*
46070 08/27*320 715  40    0*325 700  35    0*  0   0   0    0*  0   0   0    0*
                     **                **        *   *   *        *   *   *    *

46075 TS
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Significant Revisions:

1. Genesis is analyzed six hours earlier than originally shown in HURDAT based on synoptic observations.
2. Intensification to a tropical storm analyzed six hours earlier than originally shown in HURDAT based on synoptic observations.
3. Weakening to a tropical depression is delayed six hours than originally shown in HURDAT based on synoptic observations.
4. Dissipation is analyzed twelve hours earlier than originally shown in HURDAT based on reconnaissance aircraft and synoptic data.

August 23:

1. Maps and old HURDAT:

- HWM and microfilm show an area of low pressure over the Florida panhandle along a stationary frontal boundary at 12Z.

2. Discussion:

- Reanalysis: Tropical Storm Eve developed from a weakening frontal boundary that on the 23rd was producing a large area of disorganized convection over the southeast United States and offshore waters. A weak area of low pressure formed over northern Florida and slowly moved eastward.

August 24:

1. Maps and old HURDAT:

- HWM and microfilm show a stationary frontal boundary extending from the western to the north Atlantic at 12Z.

2. Discussion:

- MWR: "Several days prior to the appearance of Eve, cold air swept over the eastern United States in the wake of Camille and eventually covered the entire Southern States, leaving a quasi-stationary front across north Florida. A center of positive vorticity drifted slowly southeastward from the Great Lakes, reaching northern Florida on the 24th. The influx of vorticity aloft activated the weak baroclinic field associated with the old frontal trough and produced a low-level circulation east of Daytona Beach, Fla."
- Reanalysis: The disturbance gradually became better organized and synoptic observations indicate that a closed low-level circulation developed at 18Z on the 24th about 100 n mi to the east of northeastern Florida. Genesis is analyzed at this time as a 25 kt tropical depression.

August 25:

1. Maps and old HURDAT:
- HWM analyzes a closed low pressure of at most 1008 mb at 29N, 77W with a frontal boundary going through the center at 12Z.
- HURDAT lists a 30 kt tropical depression at 29.7N, 76.9W at 12Z.
- Microfilm shows a tropical cyclone of at most 1008 mb at 29N, 77W at 12Z.

2. Ship highlights:
a. 35 kt NE and 1010 mb at 30.7N, 76.3W at 12Z (COADS).
b. 35 kt NE and 1009 mb at 30.3N, 77.4W at 15Z (COADS).
c. 40 kt NE and 1009 mb at 30.5N, 77.2W at 18Z (micro).

3. Discussion:
- MWR: "The next day, satellite pictures indicated widespread convective activity, suggesting that tropical processes were becoming more important."
- ATSR: "A weak low pressure center that formed on the polar front over Northern Florida moved slowly eastward over the warmer waters of the Gulf Stream and, by 25 August, had assumed tropical characteristics. A tropical depression warning was issued at 250400Z by Fleet Weather Facility, Jacksonville as the depression moved east-northeast at six to eight knots."
- Reanalysis: The tropical depression continued eastward at about 8 kt and slowly intensified. A couple of ships reported 35 kt at 12Z on the 25th and at this time it is analyzed that Eve became a tropical storm. Another ship reported 40 kt at 18Z on the 25th. Satellite images showed that the cyclone had become better organized but most of the convection remained over the northern and eastern quadrants.

August 26:

1. Maps and old HURDAT:
- HWM analyzes a tropical storm of at most 1004 mb at 30.5N, 73.3W with a stationary front to the northeast at 12Z.
- HURDAT lists a 45 kt tropical storm at 30.8N, 73.6W at 12Z.
- Microfilm shows a tropical storm of at most 1000 mb at 30.8N, 73.5W at 12Z.

2. Ship highlights:
a. 25 kt S and 1002 mb at 29.9N, 74.7W at 00Z (COADS).
b. 25 kt ENE and 1004 mb at 31.6N, 74.8W at 06Z (COADS).

3. Aircraft highlights:
- Penetration center fix measured a central pressure of 999 mb and estimated flight level winds of 50 kt at 30.1N, 75.3W at 0042Z (WALLET).

- Penetration center fix measured a central pressure of 995 mb and estimated surface winds of 30 kt at 30.7N, 73.9W at 1247Z (WALLET).
- Penetration center fix measured a central pressure of 997 mb and estimated surface winds of 25 kt at 31.3N, 73W at 1758Z (WALLET).

4. Satellite highlight:
a. ESSA IX estimated a center fix at 31N, 72.5W at 1909Z (WALLET).

5. Discussion:
- MWR: "Winds up to 50 kt and a minimum sea-level pressure of 999 mb were reported by aircraft reconnaissance that afternoon [25th]. Eve drifted toward the northeast, struggling against her environment, with no significant changes for the next 24 hr."
- ATSR: "At 260040Z, a Navy reconnaissance aircraft investigating the area found winds of 50 knots and a minimum pressure of 999 mb. The depression was upgraded to Tropical Storm EVE at 260400Z. EVE was short lived as she moved east of the Gulf Stream into a colder environment."
- Reanalysis: The first reconnaissance aircraft to reach Eve measured a central pressure of 999 mb at 0042Z on the 26th. A central pressure of 999 mb suggests maximum surface winds of 45 kt from the north of 25N Brown et al. pressure-wind relationship. Based on a slow forward speed of 8 kt and synoptic observations, an intensity of 40 kt is analyzed at 00Z on the 26th, down from 50 kt originally shown in HURDAT, a minor intensity change. A central pressure of 999 mb was present in the original HURDAT at 00Z on the 26th and has been retained. The next penetration center fix measured a central pressure of 995 mb and estimated surface winds of 30 kt at 1247Z on the 26th. A central pressure of 995 mb suggests maximum surface winds of 52 kt from the north of 25N pressure-wind relationship. Based on a slow forward speed of 8 kt, an intensity of 45 kt is analyzed at 12Z on the 26th, same as originally shown in HURDAT. 45 kt is also the analyzed peak intensity of this tropical cyclone, down from 50 kt originally shown in HURDAT, a minor intensity change. A central pressure of 996 mb was originally in the 12Z slot on the 26th and has been changed to 995 mb based on the 1247Z penetration center fix. Another penetration center fix measured a central pressure of 997 mb at 1758Z on the 26th. An intensity of 45 kt has been selected for 18Z on the 26th, up from 40 kt originally in HURDAT, a minor intensity change.

August 27:

1. Maps and old HURDAT:
- HWM analyzes a spot low at 32.5N, 70W with an approaching cold front to the northwest at 12Z.
- HURDAT lists a 30 kt tropical depression at 32.7N, 68.8W at 12Z.
- Microfilm shows a tropical cyclone at 32N, 68.5W at 12Z.

2. Ship highlights:
a. 30 kt N and 1006 mb at 32.5N, 70.4W at 06Z (micro).

3. Aircraft highlights:
- Penetration center fix at 32.4N, 70.7W (broad trof) at 04Z (WALLET).
- Penetration center fix measured a central pressure of 1009 mb and estimated surface winds of 30 kt at 32.8N, 67.7W at 1745Z (WALLET).

4. Satellite highlights:
a. ESSA VIII estimated a center fix at 32.5N, 68W at 1449Z (WALLET).

5. Discussion:

- MWR: "The slow forward motion allowed cold air to penetrate the core, thwarting the tropical processes, and brought a quick death blow on the afternoon of the 27th."
- ATSR: "By the 27th, she had decreased to tropical depression intensity, and by the end of the day, she had degenerated into a trough of low pressure that extended southwestward from the vicinity of Bermuda."
- Reanalysis: On the 27th, the interaction of Eve and an approaching frontal boundary caused the tropical cyclone to weaken. Observations from the reconnaissance aircraft investigation around 04Z and synoptic data at 12Z on the 27th indicate that the circulation of Eve dissipated into a pre-frontal trough. This is also discernable in the satellite images. Another reconnaissance aircraft was able to fix a center at 1740Z on the 27th but the synoptic observations show that Eve was a trough. Therefore, the last position is analyzed at 06Z on the 27th, twelve hours earlier than originally shown in HURDAT.

August 28:

1. Maps and old HURDAT:

- HWM analyzes an extratropical cyclone at 32N, 61W at 12Z.
- Microfilm shows an extratropical cyclone at 32N, 63W at 12Z.

August 29:

1. Maps and old HURDAT:

- HWM analyzes a stationary front extending from the western to the north Atlantic at 12Z.

Sources: NHC microfilm maps, the Historical Weather Maps series, the COADS ship database, Monthly Weather Review, Navy reconnaissance book, Mariners Weather Log, Satellite images from NCDC, and NHC Storm Wallets.

Francelia – AL131969 – 2021 Revision

Green indicates wind changes of 15 kt or greater
Blue indicates lat/long changes greater than 1°
Red indicates a new entry
Yellow indicates a deletion

Hurricane Francelia [August 29 - September 4, 1969]

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46080 08/29/1969 M= 7 13 SNBR= 983 FRANCELIA   XING=0 SSS=0

46085 08/29*115 620  30    0*118 635  30    0*120 650  30    0*125 665  30 1005*
46085 08/29*120 620  30    0*121 640  30    0*123 659  30    0*127 677  30 1005*
            ***              *** ***          *** ***          *** ***

46090 08/30*132 692  30    0*137 707  30    0*143 722  40    0*149 743  50 1000*
46090 08/30*131 694  30    0*135 710  40    0*138 726  50 1001*141 742  55  999*
            *** ***          *** ***  **      *** ***  ** **** *** ***  **  ***

46095 08/31*153 758  55    0*156 767  60    0*160 776  60    0*162 786  60    0*
46095 08/31*144 757  55    0*148 769  55    0*153 778  55    0*158 786  50    0*
            *** ***          *** ***  **      *** ***  **      *** ***  **

46100 09/01*164 794  55 1002*168 806  55    0*171 820  60    0*173 832  65  995*
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46100 09/01*162 795  45 1002*166 807  45    0*170 820  50    0*173 833  55  995*
            *** ***  **      *** ***  **      *** ***  **          ***  **

46105 09/02*171 847  75    0*168 855  80  990*166 862  85    0*164 867 100  973*
46105 09/02*172 846  65  987*169 854  70  983*166 861  80  976*164 867  85  973*
            *** ***  **  *** *** ***  **  ***     ***  **  ***           **

46110 09/03*163 876  95    0*163 879  85    0*162 882  85    0*162 886  85    0*
46110 09/03*163 873  85    0*163 877  85    0*162 882  85    0*162 886  85    0*
                ***  **          ***

46115 09/04*161 888  70    0*161 892  60    0*162 897  40    0*  0   0   0    0*
46115 09/04*162 890  70    0*162 894  45    0*162 898  25    0*  0   0   0    0*
            *** ***          *** ***  **          ***  **

46120 HR

Hurricane Landfall
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09/03 21Z 16.2N 88.8W 85 kt Belize
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Significant Revisions:

1. Intensification to a hurricane is analyzed twelve hours later than originally shown in HURDAT based on aircraft reconnaissance data.
2. Major intensity changes are indicated on September 2nd at 18Z and September 4th at 06Z and 12Z based on aircraft reconnaissance data and synoptic observations.
3. Peak intensity analyzed at 85 kt, down from 100 kt originally shown in HURDAT. Thus, Francelia is no longer analyzed as a major hurricane.

Daily Metadata:

August 27:

1. Maps and old HURDAT:

- HWM analyzes a spot low pressure at 10.5N, 53.8W at 12Z.
- HURDAT does not list an organized system on this date.
- Microfilm shows a tropical disturbance near 11N, 54W at 12Z.

2. Discussion:

- MWR: "Francelia developed from a complex system that moved off Africa during August 19 and 20. The wave, which may have contained a depression, moved westward. A significant enhancement of convection occurred on August 26 when the wave was located about 800 mi east of Barbados."
- ATSR: "FRANCELIA developed from an unstable easterly wave which was initially detected by satellite over the west coast of Africa on 19 August."
- Reanalysis: Hurricane Francelia developed from a tropical wave that left the west coast of Africa on August 19th. The disturbance moved westward and satellite images showed that convection increased as it approached the Lesser Antilles.

August 28:

7. Maps and old HURDAT:

- HWM analyzes a closed low pressure of at most 1008 at 11N, 57.2W at 12Z.
- HURDAT does not list an organized system on this date.
- Microfilm shows a tropical disturbance near 12N, 58.5W at 12Z.

8. Discussion:
- MWR: "…but Navy reconnaissance east of the Windward Islands on the 28th found no evidence of a closed circulation."
- Reanalysis: A reconnaissance aircraft investigated the tropical disturbance but did not find a closed low-level circulation, which is also supported by the synoptic observations. Satellite images showed a large area of disorganized convection associated with the tropical wave.

August 29:

6. Maps and old HURDAT:
- HWM analyzes a closed low pressure of at most 1008 mb at 13.2N, 67W at 12Z.
- HURDAT lists a 30 tropical depression at 12N, 65W at 12Z.
- Microfilm shows a tropical cyclone of at most 1008 mb at 13.5N, 65.5W at 12Z.

7. Aircraft highlights:
- Penetration center fix measured a central pressure of 1005 mb at 12.9N, 68.4W at 21Z (WALLET).

8. Satellite highlights:
- ESSA II estimated a center fix at 12.5N, 68.5W at 2115Z (WALLET).

9. Discussion:
- MWR: "After the disturbance passed through the island chain, ship and land reports indicated that a depression with maximum winds of 30 kt had formed in the extreme eastern Caribbean. Air Force reconnaissance on the 29th showed that the depression was speeding toward the westnorthwest at almost 20 kt with no intensification. As the disturbance approached the Windward Islands, environmental conditions were becoming increasingly favorable for intensification. This trend continued in the large-scale flow patterns, but the historically unfavorable location seemed to allow no increase in intensity until the more favorable western Caribbean was reached."
- ATSR: "…and was tracked for nearly ten days before a vortex was detected about 290000Z as it moved through the Windward Islands. A tropical depression warning was issued at 291900z as the circulation moved west-northwest over the eastern Caribbean Sea."
- Reanalysis: A reconnaissance aircraft reached the disturbance late on the 29th and found a well-defined center, and satellite images indicated that it had become better organized with some banding features. Genesis is analyzed at 00Z on the 29th as a 30 kt tropical depression, same as originally shown in HURDAT. A penetration center fix at 21Z on the 29th measured a central pressure of 1005 mb. A central pressure of 1005 mb suggests maximum surface winds of 37 kt from the south of 25N Brown et al. pressure-wind relationship. Even though the system has a fast forward speed of about 18 kt, the aircraft did not report any tropical-storm-force winds either from surface estimates or from flight level even in the post-flight summary. That, combined with the lack of strong winds from ship, suggest that the system still remained a tropical depression late on the 29th and early on the 30th.

August 30:

8. Maps and old HURDAT:

- HWM analyzes a spot low pressure at 13N, 72.2W at 12Z.
- HURDAT lists a 40 kt tropical storm at 14.3N, 72.2W at 12Z.
- Microfilm shows a tropical cyclone of at most 1008 mb at 14.5N, 72.5W at 12Z.

9. Ship highlights:

a. 40 kt E and 1011 mb at 14.9N, 72W at 12Z (micro).
b. 35 kt ESE and 1010 mb at 13.5N, 69.8W at 18Z (micro).

10. Aircraft highlights:

a. Penetration center fix measured a central pressure of 1001 mb and estimated surface winds of 40 kt at 14.5N, 73.1W at 1420Z (WALLET).
b. Penetration center fix measured a central pressure of 999 mb and estimated surface winds of 55 kt at 14.4N, 74.6W at 19Z (WALLET).
c. Penetration center fix measured a central pressure of 1005 mb, estimated surface winds of 65 kt and an eye diameter of 30 n mi at 15.4N, 75.2W at 2145Z (WALLET).

11. Discussion:

- MWR: "Reconnaissance reports on the morning of the 30th indicated winds up to 40 kt and a sea-level pressure of 1001 mb. A maturing Francelia was named about 250 mi south of Haiti."
- ATSR: "It was upgraded to Tropical Storm FRANCELIA the following day [30]."
- Reanalysis: On the 30th, Francelia moved into the central Caribbean Sea and continued to intensify. A reconnaissance aircraft measured a central pressure of 1001 mb at 1420Z on the 30th. A central pressure of 1001 mb suggests maximum surface winds of 45 kt from the south of 25N pressure-wind relationship. Based on a fast forward speed of about 17 kt, an intensity of 50 kt is analyzed at 12Z on the 30th, up from 40 kt originally in HURDAT, a minor intensity change. A central pressure of 1001 mb was present in the original HURDAT at 12Z and has been retained. The system is estimated to have become a tropical storm at 06Z, six hours earlier than estimated originally. Another penetration center fix measured a central pressure of 999 mb and estimated surface winds of 55 kt at 19Z on the 30th. A central pressure of 999 mb suggests maximum surface winds of 49 kt from the south of 25N pressure-wind relationship. Based on a forward speed of about 16 kt, an intensity of 55 kt is analyzed at 18Z on the 30th, up from 50 kt originally in HURDAT, a minor intensity change. A central pressure of 1000 mb was present in the original HURDAT at 18Z on the 30th and has been replaced with 999 mb based on reconnaissance aircraft data. The next penetration center fixes occurred at 2145Z and 2350Z on the 30th, reporting a pressure of 1005 mb and 1006 mb, respectively. These fixes were about a degree north compared to the previous fixes on the 30th and the sudden increase in central pressure of about 6 mb in less than 3 hours make these reports suspicious. It is possible that because of the poor organization of the tropical cyclone due to the wind shear, the reconnaissance aircraft was not in the center of Francelia. Another possible issue is that since both fixes were made from 700 mb, the vortex might not have been fully developed at that level. Thus, these fixes were not used in this reanalysis. Satellite images indicated that Francelia was being affected by westerly wind shear.

August 31:

7. Maps and old HURDAT:

- HWM analyzes a hurricane of at most 1004 mb at 15.7N, 78.6W at 12Z.
- HURDAT lists a 60 kt tropical storm at 16N, 77.6W at 12Z.
- Microfilm shows a hurricane of at most 1006 mb at 15.3N, 78.1W at 12Z.

8. Aircraft highlights:

- Radar center fix at 16.6N, 79.1W at 1335Z (WALLET).

9. Satellite highlights:

- ESSA VIII estimated a center fix at 16.7N, 78.7W at 1430Z (WALLET).
- ESSA IX estimated a center fix at 16.5N, 79W at 2008Z (WALLET).

10. Discussion:

- Reanalysis: Francelia continued on a generally west-northwest track on the 31st with little changes in intensity. Satellite images indicated that westerly shear was still impacting the circulation with most of the convection over the eastern quadrant.

September 1:

8. Maps and old HURDAT:

- HWM analyzes a hurricane of at most 1008 mb at 17.4N, 82.4W at 12Z.
- HURDAT lists a 60 kt tropical storm at 17.1N, 82W at 12Z.
- Microfilm shows a hurricane of at most 1008 mb at 16.8N, 82.2W at 12Z.

9. Land highlights:

a. 60 kt NE and 999 mb at Swan Island, Honduras at 1945Z (WALLET).
b. 994 mb (minimum pressure, "eye") at Swan Island, Honduras at 2130Z (WALLET).

10. Aircraft highlights:

a. Penetration center fix measured a central pressure of 1002 mb, estimated surface winds of 35 kt and an eye diameter of 10 n mi at 16.3N, 79.6W at 01Z (WALLET).
b. Radar center fix at 16.6N, 80.7W at 06Z (WALLET).
c. Penetration center fix measured a central pressure of 1006 mb and estimated surface winds of 60 kt at 16.9N, 82.1W at 1220Z (WALLET).
d. Penetration center fix measured a central pressure of 995 mb and estimated surface winds of 70 kt at 17.3N, 83.2W at 1730Z (WALLET).

11. Satellite highlights:

a. ESSA VIII estimated a center fix at 17.4N, 82.4W at 1521Z (WALLET).
b. ESSA IX estimated a center fix at 17.5N, 83.5W at 1911Z (WALLET).

12. Discussion:

- MWR: "The trend toward intensification, so far as central pressure was concerned, did not continue. As late as the morning of September 1, the central pressure had risen to 1006 mb. In spite of this rather minor trend in pressure, winds were increasing and were reported as high as 65 kt, mainly in squalls, during the 2 days. By early afternoon of September 1, the ESSA Research Flight Facility aircraft found winds of 70 kt and a sea level pressure of 995 mb; further intensification proceeded as had been expected earlier."
- ATSR: "…but did not become well organized until late on 1 September. By the time FRANCELIA passed over Swan Island at about 012145Z, she was a hurricane. ESSA Weather Bureau observers on Swan Island were successful in launching a radiosonde into the eye of FRANCELIA since the relative calm of the eye lasted for about an hour. Only four previous ascents have been made in hurricane eyes."
- Reanalysis: A reconnaissance aircraft measured a central pressure of 1002 mb and estimated surface winds of 35 kt at 01Z on September 1st. A central

pressure of 1002 mb suggests maximum surface winds of 43 kt from the south of 25N pressure-wind relationship. Based on a forward speed of about 13 kt, an intensity of 45 kt is analyzed at 00Z on the 1st, down from 55 kt originally in HURDAT, a minor intensity change. A central pressure of 1002 mb was present at 00Z on the 1st in the original HURDAT and has been retained. The next center fix measured a pressure of 1006 mb at 1220Z but it appears to be erroneous as five hours later, at 1730Z, another penetration center fix measured 995 mb. One possible reason for a discrepancy is that this fix was made from 700 mb, while the other fixes in question were made from low level. Therefore, the 1006 mb measurement was not used in this reanalysis. A central pressure of 995 mb suggests maximum surface winds of 56 kt from the south of 25N pressure-wind relationship. Based on a forward speed of about 14 kt, an intensity of 55 kt is analyzed at 18Z on the 1st, down from 65 kt originally shown in HURDAT, a minor intensity change. A central pressure of 995 mb was present in the original HURDAT at 18Z on the 1st and has been retained. Around 2130Z on the 1st, the center of Francelia passed just south of Swan Island. The lowest pressure measured at Swan Island was 994 mb at 2130Z and the strongest winds were 60 kt at 1945Z, both on the 1st. Satellite images indicated that the tropical cyclone had become much better organized with an eye-like feature and banding.

September 2:

8. Maps and old HURDAT:

- HWM analyzes a hurricane of at most 1000 mb at 17N, 87W at 12Z.
- HURDAT lists an 85 kt hurricane at 16.6N, 86.2W at 12Z.
- Microfilm shows a hurricane of at most 1004 mb at 16.8N, 86W at 12Z.

9. Ship highlights:

- 50 kt N and 996 mb at 16.4N, 87.7W at 00Z (COADS) [likely to be the 3rd instead].
- 5 kt W and 1000 mb at 17.3N, 87.8W at 18Z (micro).

10. Land highlights:

- 35 kt W and 1000 mb at Utila, Honduras at 18Z (micro).
- 35 kt SSW and 984 mb (appears erroneous) at Tela, Honduras at 21Z (WALLET).

11. Aircraft highlights:

- Penetration center fix measured a central pressure of 993 mb and estimated an eye diameter of 20 n mi at 17N, 85W at 01Z (WALLET). (It is noted that the extrapolated pressure is 987 mb using today's extrapolation formulas. This value is used.)
- Penetration center fix measured a central pressure of 990 mb and estimated an eye diameter of 22 n mi at 16.9N, 85.3W at 0530Z (WALLET). (It is noted that the extrapolated pressure is 983 mb using today's extrapolation formulas. This value is used.)
- Penetration center fix measured a central pressure of 976 mb, estimated surface winds of 100 kt and an elliptical eye with major axis 0°-180°, major axis of 30 n mi and minor axis of 15 n mi at 16.5N, 86.2W at 13Z (WALLET).
- Penetration center fix measured a central pressure of 973 mb, estimated surface winds of 100 kt and an elliptical eye with major axis 90°-270°, major axis of 25 n mi and minor axis of 20 n mi at 16.5N, 86.7W at 17Z (WALLET).

12. Discussion:

- MWR: "When it looked as if Francelia would pass just to the north of Swan Island, there was a gradual building of pressures north of the hurricane, which resulted in a turn toward the west, and the center passed over the island during the early evening. Francelia turned to the west-southwest; and by early afternoon on the 2nd, Air Force reconnaissance found winds to 100 kt and a sea-level pressure of 973 mb. This was just as the center passed to the north of the Bahia Islands located some 30 mi north of the coast of Honduras. The hurricane was now moving at less than 8 kt. Reports from two ships, the Aragon and the Elets, indicated Francelia was maintaining intensity."
- ATSR: "On the 2nd of September, FRANCELIA turned toward the west-southwest on a track toward southern British Honduras, with top winds of 95 to 100 knots. This was caused by a strong persistent high pressure ridge to the north over the Gulf of Mexico and the Bahamas."
- Reanalysis: Francelia turned to the southwest after passing near Swan Island and rapidly intensified on the 2nd. A reconnaissance aircraft measured a central pressure of 987 mb and estimated an eye diameter of 20 n mi at 01Z on the 2nd. A central pressure of 987 mb suggests maximum surface winds of 68 kt from the south of 25N pressure-wind relationship. An eye diameter of 20 n mi suggests an RMW of about 15 n mi, same as the climatological value. Based on a slow forward speed of 8 kt and observations from Swan Island, an intensity of 65 kt is analyzed at 00Z on the 2nd, down from 75 kt originally shown in HURDAT, a major intensity change. The next penetration center fix measured a central pressure of 983 mb and estimated an eye diameter of 22 n mi at 0530Z on the 2nd. A central pressure of 983 mb suggests maximum surface winds of 74 kt from the south of 25N pressure-wind relationship. An eye diameter of 22 n mi suggests an RMW of about 16 n mi and the climatological value is 15 n mi. Based on a slow forward speed of 8 kt, an intensity of 70 kt is analyzed at 06Z on the 2nd, down from 80 kt originally shown in HURDAT, a major intensity change. Another penetration center fix measured a central pressure of 976 mb, estimated surface winds of 100 kt and an eye diameter of 15-30 n mi at 13Z on the 2nd. A central pressure of 976 mb suggests maximum surface winds of 84 kt from the south of 25N pressure-wind relationship intensifying subset. An eye diameter of 15-30 n mi suggests an RMW of about 11-23 n mi and the climatological value is 14 n mi. An intensity of 80 kt is analyzed at 12Z on the 2nd, down from 85 kt originally shown in HURDAT, a minor intensity change. The last penetration center fix on the 2nd measured a central pressure of 973 mb, estimated surface winds of 100 kt and an eye diameter of 20-25 n mi at 17Z on the 2nd. A central pressure of 973 mb suggests maximum surface winds of 87 kt from the south of 25N pressure-wind relationship intensifying subset. An eye diameter of 20-25 n mi suggests an RMW of about 15-19 n mi and the climatological value is 14 n mi. An intensity of 85 kt is analyzed at 18Z on the 2nd, down from 100 kt originally shown in HURDAT, a major intensity change. 85 kt is also the peak intensity of this hurricane, down from 100 kt originally in HURDAT, a major intensity change. Central pressures of 993 mb and 976 mb has been added to HURDAT at 00Z and 12Z on the 2nd based on reconnaissance aircraft data. Central pressures of 990 mb and 973 mb were present in the original HURDAT at 06Z and 18Z on the 2nd and have been retained. The center of Francelia passed just north of the Bay Islands of Honduras late on the 2nd and it is likely that the southern eyewall produced hurricane-force winds at those islands. A ship reported 50 kt N and 996 mb at 00Z on the 2nd but its location in reference to the hurricane makes it more likely that the report was on the 3rd and not the 2nd. Satellite images indicated that Francelia had a well-defined eye and banding features.

September 3:

5. Maps and old HURDAT:

- HWM analyzes a hurricane of at most 1000 mb at 16.5N, 89W at 12Z.
- HURDAT lists an 85 kt hurricane at 16.2N, 88.2W at 12Z.
- Microfilm shows a hurricane of at most 996 mb at 16.4N, 88.5W at 12Z.

6. Ship highlights:
a. 55 kt ENE and 996 mb at 16.7N, 87.4W at 00Z (COADS/MWL).
b. 45 kt E and 1001 mb at 16.8N, 87.1W at 02Z (COADS).
c. 40 kt E and 1004 mb at 16.8N, 86.9W at 04Z (COADS).
d. 70 kt SW and 994 mb at 16.1N, 88.1W at 12Z (micro).
e. 60 kt SE and 1002 mb at 16.1N, 88.1W at 15Z (WALLET).

7. Land highlights:
a. 25 kt W and 1005 mb at Puerto Barrios, Guatemala at 1130Z (WALLET).
b. 35 kt E and 1007 mb at Belize City, Belize at 17Z (WALLET).
c. 50-55 kt NE at Savannah Forest, Belize at 18Z (WALLET).
d. 95 kt ESE (maximum estimated winds) at Punta Gorda, Belize at 2133Z (WALLET).
e. 991 mb (minimum pressure, time unknown, ~21Z) at Punta Gorda, Belize (WALLET).

8. Aircraft highlights:
a. Commercial flight made a center fix at 16.2N, 88.1W at 1330Z (WALLET).

9. Discussion:
- MWR: "Another ship, the Rio Cobre, and a commercial aircraft located the center some 30 mi east of the southern British Honduras coast, moving toward the west-southwest at a very slow speed of 3 kt. These reports were very important since the hurricane's center was so close to land and the adjoining coastal ranges that it was impossible to carry on conventional aerial reconnaissance during the final hours prior to landfall. Gale-force winds occurred over British Honduras from Belize southward, and hurricane-force winds were confined to a small area along the coast just north of the landfall."
- ATSR: "By the 3rd, the hurricane became nearly stationary about 30 miles east of Punta Gorda, British Honduras. Later in the day she started drifting slowly westward over that city."
- Reanalysis: The slow-moving hurricane continued westward and no change in intensity is analyzed until it made landfall at 21Z on the 3rd as an 85 kt hurricane (same as originally shown in HURDAT) just northeast of Punta Gorda, Belize. The intensity at landfall is uncertain as there were no penetration center fixes for over 24 hours before landfall. A ship reported 70 kt SW and 994 mb at 12Z and Punta Gorda, Belize, measured a minimum pressure of 991 mb at 21Z on the 3rd. The eye apparently passed just north of the town of Punta Gorda, which reported a minimum pressure of 991 mb and no lull. In addition, the estimated strongest winds of 100-110 mph occurred after the eye had passed. Thus, even given the uncertainty of the estimated winds, there is a chance that the winds were stronger than the 85 kt retained in HURDAT. Satellite images on the 3rd indicated that most of the convective activity was over Central America.

September 4:

5. Maps and old HURDAT:
- HWM analyzes a spot low pressure at 16.2N, 90.8W at 12Z.
- HURDAT lists a 40 kt tropical storm at 16.2N, 89.7W at 12Z (last position).
- Microfilm shows a closed low pressure of at most 1004 mb at 16N, 89.5W at 12Z.

6. Discussion:

- ATSR: "…and moved inland on the 4th, breaking up over the mountains northwest of Punta Gorda. FRANCELIA caused torrential rain and severe flooding over British Honduras and Guatemala, washing out railroads and highways."
- Reanalysis: The Kaplan and DeMaria model was run for 00Z, 06Z and 12Z on the 4th yielding 67 kt, 51 kt and 40 kt, respectively. An intensity of 70 kt is selected for 00Z, 45 kt at 06Z and 25 kt at 12Z on the 4th (same at 00Z, down from 60 kt at 06Z and down from 40 kt at 12Z, respectively, originally in HURDAT), major intensity changes at 06Z and 12Z due to the fact that the tropical cyclone was moving over some mountainous terrain. Weakening to a tropical storm is analyzed at 06Z on the 4th and the last position is analyzed at 12Z, both same as originally shown in HURDAT. The dissipation of the low-level circulation of Francelia is uncertain due to the lack of synoptic observations over western Central America and eastern Mexico.

September 5:

7. Maps and old HURDAT:
- HWM and microfilm show a closed low pressure of at most 1004 mb over the Gulf of Tehuantepec at 12Z.

8. Discussion:
- MWR: "After emerging into the Pacific Ocean, the disturbance regained a circulation, and was eventually named tropical storm Glenda on September 7."
- Reanalysis: The remnants of Francelia crossed into the eastern Pacific and reorganized into tropical storm Glenda a few days later. However, since a well-defined center could not be tracked continuously across Central America, the reformation from Francelia's remnants are treated as a separate tropical cyclone.

Sources: NHC microfilm maps, the Historical Weather Maps series, the COADS ship database, Monthly Weather Review, Navy reconnaissance book, Mariners Weather Log, Satellite images from NCDC, and NHC Storm Wallets.

Unnamed – AL141969 – Removed in 2021

August 29 – September 1: Historical Weather Maps, microfilm and satellite images indicated a trough over the western Bahamas on August 28th. The weak disturbance slowly moved westward and over the Florida peninsula on the 29th. In HURDAT, the first position was analyzed at 00Z on the 29th as a 25 kt tropical depression. The system moved into the northeastern Gulf of Mexico on the 30th and into the Florida panhandle on the 31st. Satellite imagery suggests this system may have had some subtropical characteristics. Synoptic observations indicated that the low-level circulation was very poorly organized and not closed. The last position in HURDAT was analyzed at 00Z on September 1st. Because the system did not have a well-defined center, it is removed from HURDAT. This disturbance was in Jack Beven's List of Suspects.

Unnamed – AL151969 – 2021 Revisions

Green indicates wind changes of 15 kt or greater
Blue indicates lat/long changes greater than 1°
Red indicates a new entry
Yellow indicates a deletion

Tropical Depression [September 7-10, 1969]

```
45235 09/05/1969 M= 5 15 SNBR= 966 UNNAMED       XING=0 SSS=0
45235 09/07/1969 M= 4 15 SNBR= 966 UNNAMED       XING=0 SSS=0
```

(September 5th and 6th are removed from HURDAT)

```
45240 09/05*149 170  25    0*149 179  25    0*150 189  25    0*152 199  25    0*
45245 09/06*159 210  25    0*159 219  25    0*160 239  30    0*165 253  30    0*

45250 09/07*165 265  30    0*166 271  30    0*166 283  30    0*166 298  30    0*
45250 09/07*  0   0   0    0*  0   0   0    0*180 275  30    0*177 286  30    0*
              *   *   *        *   *   *      ***  ***         ***  ***

45255 09/08*166 309  30    0*169 321  30    0*169 345  30    0*170 365  30    0*
45255 09/08*174 297  30    0*172 308  30    0*170 320  30    0*168 333  30    0*
            ***  ***         ***  ***         ***  ***         ***  ***

45260 09/09*170 371  25    0*169 393  25    0*169 410  25    0*169 435  25    0*
45260 09/09*166 348  25    0*165 364  25    0*165 380  25    0*165 397  25    0*
            ***  ***         ***  ***         ***  ***         ***  ***

45265 09/10*169 450  25    0*  0   0   0    0*  0   0   0    0*  0   0   0    0*
45265 09/10*165 415  25    0*  0   0   0    0*  0   0   0    0*  0   0   0    0*
            ***  ***

45270 TD
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Significant Revisions:

1. First position analyzed 60 hours later than originally shown in HURDAT based on synoptic observations and satellite images.

2. Major eastward position changes analyzed during the entire lifetime of the tropical cyclone.

Daily Metadata:

September 4:

1. Maps and old HURDAT:

- HWM does not analyze any features of interest at 12Z.
- Microfilm shows a spot low at 17N, 18W at 12Z.

2. Discussion:

- Reanalysis: Satellite images and synoptic observations showed a tropical wave over the west coast of Africa.

September 5:

1. Maps and old HURDAT:

- HWM does not analyze any features of interest at 12Z.
- HURDAT lists a 25 kt tropical depression at 15N, 18.9W at 12Z.
- Microfilm shows a broad closed low pressure of at most 1012 mb at 14.6N, 16.4W at 12Z.

2. Discussion:

- Reanalysis: Synoptic observations indicated that the tropical wave left the coast of Africa late on the 5th. Satellite images showed disorganized convection between the Cabo Verde Islands and Africa. HURDAT originally indicated that a tropical depression had formed at 00Z on this date over western Africa, contrary to synoptic and satellite data.

September 6:

1. Maps and old HURDAT:

- HWM does not analyze any features of interest at 12Z.
- HURDAT lists a 25 kt tropical depression at 16N, 23.9W at 12Z.
- Microfilm shows a broad closed low pressure of at most 1014 mb at 11.5N, 28.5W at 12Z.

2. Discussion:

- Reanalysis: The tropical wave moved westward and became better organized. Satellite images showed an increase in organized convection, although at a high latitude, about 18N, and some signs of a circulation. Synoptic observations were sparse but suggested that at the surface it remained a sharp tropical wave.

September 7:

4. Maps and old HURDAT:

- HWM and microfilm do not analyze any features of interest at 12Z.
- HURDAT lists a 30 kt tropical depression at 16.6N, 28.3W at 12Z.

5. Discussion:

- Reanalysis: The large tropical disturbance continued to organize, and based on synoptic observations and satellite images, a tropical depression is analyzed to have formed at 12Z on the 7th. Due to the sparse data available over the eastern Atlantic, the exact position of the tropical depression is difficult to determine. Nonetheless, the data available, especially the satellite imagery, clearly suggested that it was much farther east than shown in HURDAT, and this continued during the lifetime of the tropical depression. An intensity of 30 kt is analyzed at this time, same as originally shown in HURDAT, and it is also the peak intensity of this tropical depression. By this time, the system had developed a tight circulation with organized convection near or over the center while still drawing moisture from the ITCZ as shown in the satellite images.

September 8:

4. Maps and old HURDAT:

- HWM analyzes a tropical wave along 30W at 12Z.
- HURDAT lists a 30 kt tropical depression at 16.9N, 34.5W at 12Z
- Microfilm shows a spot low at 14N, 31.5W at 12Z.

5. Discussion:

- Reanalysis: The tropical depression continued westward and satellite images showed a tight center with organized convection, especially north of the circulation.

September 9:

3. Maps and old HURDAT:

- HWM does not analyze any features of interest at 12Z.
- HURDAT lists a 25 kt tropical depression at 16.9N, 41W at 12Z.
- Microfilm shows a closed low pressure of at most 1012 mb at 17N, 38W at 12Z.

4. Discussion:

- Reanalysis: On the 9th, the tropical depression looked less organized than during the previous two days in the satellite images. The intensity is analyzed to have decreased to 25 kt as originally shown in HURDAT.

Interestingly, operationally it was upgraded to the 26th tropical depression of the season at 12Z on the 9th.

September 10:

2. Maps and old HURDAT:

- HWM analyzes a closed low pressure of at most 1012 mb at 15.5N, 42.5W at 12Z.
- HURDAT lists a 25 kt tropical depression at 16.9N, 45W at 00Z (last position).
- Microfilm shows a tropical cyclone of at most 1014 mb at 16N, 43W at 12Z.

3. Discussion:

- Reanalysis: Satellite images indicated that the tropical depression had become very disorganized and the last position is analyzed at 00Z on the 10th, same as originally shown in HURDAT.

September 11:

1. Maps and old HURDAT:

- HWM analyzes a spot low at 16N, 45.8W at 12Z.
- Microfilm shows a tropical cyclone of at most 1014 mb at 17.5N, 50W at 12Z.

2. Discussion:

- Reanalysis: The remnants of the tropical depression continued westward producing disorganized convection. Synoptic observations suggested that it did not regenerate.

September 12:

1. Maps and old HURDAT:

- HWM analyzes a tropical wave along 59W at 12Z.
- Microfilm shows a tropical cyclone of at most 1014 mb at 17.5N, 58W at 12Z.

September 13:

1. Maps and old HURDAT:

- HWM does not analyze any features of interest at 12Z.
- Microfilm shows a tropical cyclone of at most 1014 mb at 17.5N, 59.5W at 12Z.

2. Discussion:

- Reanalysis: The remnants of the tropical depression crossed the Leeward Islands early on the 13th. Operationally, the tropical depression weakened into a tropical wave after 12Z on the 13th.

September 14:

1. Maps and old HURDAT:

- HWM analyzes a tropical wave along 75W at 12Z.

Sources: NHC microfilm maps, the Historical Weather Maps series, the COADS ship database, Monthly Weather Review, Mariners Weather Log and satellite images from NCDC.

Gerda – AL161969 – 2021 Revision

Green indicates wind changes of 15 kt or greater

Blue indicates lat/long changes greater than 1°
Red indicates a new entry
Yellow indicates a deletion

Hurricane Gerda [September 7-10, 1969]

```
46125 09/06/1969 M= 5  7 SNBR= 984 GERDA       XING=1 SSS=1
46125 09/06/1969 M= 4  7 SNBR= 984 GERDA       XING=1 SSS=1
                    *

(September 6th has been removed from HURDAT)
46130 09/06*245 770  25 1015*254 780  25    0*260 790  25    0*264 796  25 1014*

46135 09/07*266 802  25 1012*273 811  25    0*278 808  25 1010*285 804  25    0*
46135 09/07*263 804  25 1011*270 806  25    0*276 807  25 1010*282 804  30    0*
            *** ***     **** *** ***          *** ***          ***      **

46140 09/08*290 800  30 1006*297 797  35    0*307 790  45 1002*320 780  65    0*
46140 09/08*288 800  35    0*295 796  40    0*304 790  50 1000*317 780  60  993*
            ***      **    * *** ***  **      ***      ** **** ***      **  ***

46145 09/09*334 764  70  991*353 744  85  986*378 722 110  984*401 699 110  979*
46145 09/09*334 763  70  991*354 744  80  986*380 722  90  984*409 694 105  980*
                ***         ***      **      ***      **      *** *** ***  ***

46150 09/10*440 675  95  979E485 660  70    0E530 650  40    0*  0   0   0    0*
46150 09/10*440 675  75    0E485 660  55  982E530 650  40  984E560 635  40  982*
                     **    *           **  ***               ******* ***  **  ***
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The 11th and 12th are new to HURDAT:

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46150 09/11E590 620  45  977E610 610  45  977E620 600  45  977E635 600  45  977*
46150 09/12E650 620  45  980E665 640  50  980*  *   *   *    **  *   *   *    **

(Removed from HURDAT)
46155 HR ME1
```

U.S. Tropical Storm Impact

09/09 18Z 40.9N 69.4W 35 kt Massachusetts

Canada Hurricane Impact

09/10 00Z 44.0N 67.5W 70 kt Nova Scotia

U.S. Hurricane Landfall

09/10 01Z 44.7N 67.3W 70 kt Maine (estimated peak winds of 60 kt over eastern Maine)

Significant Revisions:

1. Genesis is analyzed 24 hours later based on synoptic data.
2. Two days added to the end of the lifecycle of the system, as an extratropical cyclone.
3. Major decreases in intensity analyzed at 12Z on September 9th, 00Z and 06Z on September 10th based on reconnaissance aircraft and synoptic data.

September 5:

1. Maps and old HURDAT:

- HWM does not analyze any features of interest at 12Z.
- HURDAT does not list an organized system on this date.
- Microfilm shows a tropical wave extended between 20N-27N, along 79W at 12Z.

2. Discussion:

- MWR: "Hurricane Gerda had a comparatively short life for an early September hurricane. However, prior to development into a depression, the disturbance that probably generated the tropical cyclone can be traced across the Atlantic from the interior of northwestern Africa. The track from Africa was developed by following cloud masses on daily satellite pictures. Some of the cloud masses were organized, others disorganized. On September 3, the disturbance merged with a degenerating midtropospheric cyclone to the north of Hispaniola and Puerto Rico. A larger cloud mass developed and continued toward the west-northwest at 10 mi hr until there were indications of a surface circulation forming in the western Bahamas on the 5th."
- ATSR: "An easterly wave developed over Africa on, 21 August and crossed the Atlantic in the wake of the wave that spawned FRANCELIA."
- Reanalysis: Satellite images indicated that convection associated with a tropical wave increased on September 1st while the system was located north of Puerto Rico. The disturbance moved westward over the next couple of days and changed little in organization. On the 5th, synoptic observations and satellite images showed that the tropical wave had reached the western Bahamas but still lacked a well-defined center.

September 6:

1. Maps and old HURDAT:

- HWM analyzes a tropical wave over western Bahamas at 12Z.
- HURDAT lists a 25 kt tropical depression at 26N, 79W at 12Z.
- Microfilm shows a closed low pressure of at most 1014 mb at 26.7N, 79W at 12Z.

2. Discussion:

- MWR: "The weak tropical depression moved into southeastern Florida on the 6th, then drifted very slowly northward."
- ATSR: "It was two weeks later on 6 September that a low pressure center developed over the Bahamas as this unstable easterly wave approached the lower east coast of Florida."
- Reanalysis: Synoptic observations on the 6th indicated that the tropical disturbance still lacked a well-defined low-level circulation. Satellite images showed a small tropical disturbance over southern Florida and the western Bahamas.

September 7:

1. Maps and old HURDAT:

- HWM analyzes a closed low pressure of at most 1012 mb at 28.2N, 81.5W at 12Z.
- HURDAT lists a 25 kt tropical depression at 27.8N, 80.8W at 12Z.
- Microfilm shows a closed low pressure of at most 1012 mb at 27.5N, 80.5W at 12Z.

2. Discussion:

- MWR: "…before emerging into the Atlantic near Cape Kennedy on the afternoon of the 7th. Thereafter, a northeasterly course with a steady fall in pressure began, and on."

- ATSR: "The center remained weak as it moved inland over Florida early on the 7th. It then changed to a more northerly course, which brought it back out over the water just north of Cape Kennedy, where it began to intensify. A tropical depression warning was issued at 072200Z."
- Reanalysis: The tropical disturbance became better organized on the 7th and synoptic observations showed that a well-defined circulation developed at 00Z on this date, 24 hours later than originally shown in HURDAT. The first position is over southeast Florida. After forming, the tropical depression moved northward and emerged over the Atlantic Ocean around 16Z on the 7th. Satellite imaged showed that the tropical depression had become much better organized, developing banding features.

September 8:

1. Maps and old HURDAT:

- HWM analyzes a closed low pressure of at most 1004 mb at 31.5N, 79.9W with a cold front to the northwest at 12Z.
- HURDAT lists a 40 kt tropical storm at 30.7N, 79W at 12Z.
- Microfilm shows a closed low pressure of at most 1004 mb at 30.5N, 79.2W at 12Z.

2. Ship highlights:

a. 40 kt SSE and 1009 mb at 29N, 78.2W at 06Z (COADS).
b. 35 kt SSE and 1007 mb at 30.2N, 77.6W at 12Z (COADS).
c. 30 kt NNW and 1003 mb at 30.4N, 79.7W at 13Z (COADS).
d. 40 kt S and 1000 mb at 30.9N, 77.4W at 18Z (COADS).
e. 35 kt SE and 1005 mb at 326N, 75.3W at 21Z (COADS).

3. Aircraft highlights:

a. Penetration center fix measured a central pressure of 1002 mb, estimated surface winds of 45 kt and an eye diameter of 20 n mi at 30.5N, 79.2W at 1112Z (WALLET). (Also a 1000 mb central pressure at 1245Z.)
b. Penetration center fix measured a central pressure of 993 mb and estimated surface winds of 70 kt at 32.5N, 77.2W at 2030Z (WALLET).

4. Discussion:

- MWR: "On the next morning a Navy reconnaissance aircraft found winds up to 50 kt and a sea-level pressure of 1000 mb. The approach of a major trough in the westerlies produced rapid acceleration, and Gerda reached hurricane intensity on the afternoon of the 8th. The hurricane proceeded on a northeast to north-northeast course within 100 mi of the US east coast."
- ATSR: "…and the depression was upgraded to Tropical Storm GERDA at 081300Z."
- Reanalysis: After moving over the ocean, the tropical depression quickly intensified. Intensification to a tropical storm is analyzed at 00Z on the 8th, six hours later than originally shown in HURDAT. A penetration center fix measured a central pressure of 1000 mb, estimated surface winds of 45 kt and an eye diameter of 20 n mi at 1112Z/1245Z on the 8th. A central pressure of 1002 mb suggests maximum surface winds of 44 kt from the north of 25N Brown et al. pressure-wind relationship. An eye diameter of 20 n mi suggests an RMW of about 15 n mi and the climatological value is 24 n mi. Based on a forward speed of 13 kt and small RMW, an intensity of 50 kt is analyzed at 12Z on the 8th, slightly higher than originally shown in HURDAT. The next penetration center fix measured a central pressure of 993 mb and estimated surface winds of 70 kt at 2030Z on the 8th. A central pressure of 993 mb suggests maximum surface winds of 55 kt from the north of 25N pressure-wind relationship. Based on a forward speed of about 21 kt, an intensity of 60 kt is analyzed at 18Z on the 8th, down from 65 kt originally shown in HURDAT, a minor intensity change.

Intensification to a hurricane is delayed six hours compared to the original HURDAT. Satellite images indicated that Greta had continued to become better organized but was being impacted by southwesterly shear, displacing most of the convection toward the northern and eastern quadrants. A few ships reported gale-force winds on the 8th.

September 9:

1. Maps and old HURDAT:

- HWM analyzes a hurricane of at most 996 mb at 38.7N, 72.7W with a cold boundary just to the west at 12Z.
- HURDAT lists a 110 kt hurricane at 37.8N, 72.2W at 12Z.
- Microfilm shows a hurricane of at most 996 mb at 38N, 72.5W with a cold boundary just to the west at 12Z.

2. Ship highlights:

a. 50 kt S and 992 mb at 33N, 76W at 00Z (COADS).
b. 50 kt SW and 1002 mb at 32.5N, 75.5W at 03Z (COADS).
c. 55 kt NNW and 1002 mb at 34N, 75.5W at 06Z (COADS).
d. 45 kt NE and 989 mb at 36.8N, 73.7W at 09Z (COADS).
e. 35 kt N and 1000 mb at 38.5N, 74.2W at 12Z (COADS).
f. 55 kt SW and 1000 mb at 40.7N, 67.2W at 18Z (COADS).
g. 50 kt SE and 987 mb at 41.8N, 68.2W at 19Z (COADS).

3. Land highlights:

a. 100 kt SE and 985 mb at Nantucket Lightship, MA at 18Z (SWO).
b. 110 kt (time unknown but likely around 18Z) at Nantucket Lightship, MA (MWR).
c. 35 kt (time unknown but likely around 18Z) at Nantucket, MA (CLIMO).

4. Aircraft highlights:

a. Penetration center fix measured a central pressure of 991 mb at 33.2N, 76.1W at 00Z (WALLET).
b. Penetration center fix measured a central pressure of 986 mb at 36.4N, 70W at 0845Z (WALLET).
c. Penetration center fix measured a central pressure of 984 mb and estimated surface winds of 70 kt at 37.7N, 72.6W at 1133Z (WALLET).
d. Penetration center fix measured a central pressure of 982 mb and estimated surface winds of 125 kt at 40.4N, 69.9W at 1640Z (WALLET).
e. Penetration center fix measured a central pressure of 980 mb and estimated surface winds of 85 kt at 40.9N, 69.4W at 1805Z (WALLET).
f. Penetration center fix measured a central pressure of 979 mb, estimated surface winds of 60 kt and an eye diameter of 20-30 n mi at 42.1N, 68.7W at 20Z (WALLET).

5. Discussion:

- MWR: "…eventually obtained a forward speed of 40 mi hr as the center passed 50 mi off Cape Cod. The Nantucket lightship, about 75 mi southeast of Cape Cod, measured winds of 125 mi hr and gusts to 140 mi hr, as the center passed directly over the ship. Only gales were reported at Nantucket. The extremely high wind velocities, normally not produced by a hurricane with a central pressure of 979 mb, can be attributed, in part, to the rapid movement of the system and to the interaction with a strong trough in the westerlies."
- ATSR: "GERDA rapidly developed into a hurricane as she accelerated northeastward passing just east of Cape Hatteras early on the 9th. Later in the day, she was moving at 35 knots as she neared Cape Cod."
- Reanalysis: Gerda rapidly intensified as it accelerated northeastward ahead of a frontal boundary on the 9th. A penetration center fix measured a central

pressure of 991 mb at 00Z on the 9th. A central pressure of 991 mb suggests maximum surface winds of 56 kt from the north of 25N pressure-wind relationship. Based on a fast forward speed of about 24 kt, an intensity of 70 kt is analyzed at 00Z on the 9th, same as originally shown in HURDAT. The next penetration center fix measured a central pressure of 986 mb at 0845Z on the 9th. A central pressure of 986 mb suggests maximum surface winds of 68 kt from the north of 25N and 67 kt from the north of 35N Landsea et al. pressure-wind relationships. Based on a fast forward speed of about 31 kt, an intensity of 80 kt is analyzed at 06Z on the 9th, down from 85 kt originally shown in HURDAT, a minor intensity change. At 06Z on the 9th, Gerda made its closest approach to the North Carolina Outer Banks, passing about 70 n mi to the east. No gales were observed on these barrier islands. Another penetration center fix measured a central pressure of 984 mb and estimated surface winds of 70 kt at 1133Z on the 9th. A central pressure of 984 mb suggests maximum surface winds of 69 kt from the north of 35N pressure-wind relationship. Based on a fast forward speed of 31 kt and synoptic observations later on the date, an intensity of 90 kt is analyzed at 12Z on the 9th, down from 110 kt originally in HURDAT, a major intensity change. Around 18Z on the 9th, Gerda moved over the Nantucket Lightship, stationed about 50 n mi southeast of Nantucket Island, MA. Monthly Weather Review indicates that the lightship measured sustained winds of 110 kt and gusts to 125 kt. The time of this observation was not given but it was likely around 18Z on the 9th. Surface Observations of the Nantucket Lightship obtained from NCDC show an observation of sustained winds of 100 kt and a pressure of 985 mb at 18Z on the 9th. The height of the anemometer was 60 ft or 18 meters. Adjusting the measurement of 110 kt to a height of 10 meters gives 107 kt. A penetration center fix measured a central pressure of 980 mb and estimated surface winds of 85 kt at 1805Z on the 9th (and the fix two hours earlier suggested 125 kt surface winds). A central pressure of 980 mb suggests maximum surface winds of 73 kt from the north of 35N pressure-wind relationship. Based on a very fast forward speed of about 35 kt and the Nantucket Lightship measurement, an intensity of 105 kt is analyzed at 18Z on the 9th, down from 110 kt originally shown in HURDAT, a minor intensity change. 105 kt is also the analyzed peak intensity of Gerda, down from 110 kt originally in HURDAT, a minor intensity change. The western quadrant of Gerda was very weak due in large part to the very fast forward speed. Satellite images showed a well-organized tropical cyclone with a CDO and banding features, but also affected by southerly wind shear. Ships reported gale and storm-force winds on the 9th.

September 10:

2. Maps and old HURDAT:

- HWM analyzes an extratropical cyclone at 52.5N, 65W at 12Z.
- HURDAT lists a 40 kt extratropical storm at 53N, 65W at 12Z (last position).

3. Ship highlights:

- 50 kt SE and 999 mb at 45.2N, 64.5W at 00Z (COADS).
- 45 kt ESE and 988 mb at 48.8N, 63.9W at 06Z (COADS).
- 40 kt WSW and 992 mb at 49.9N, 64.9W at 12Z (COADS).
- 35 kt SW and 1000 mb at 49.3N, 66.5W at 18Z (COADS).

4. Land highlights:

- 35 kt W and 1011 mb at Nantucket Light Ship at 00Z (SWO).
- 20 kt ENE and 989 mb at Eastport, ME at 00Z (SWO).

5. Discussion:

- "44.7N, 67.3W – 979 mb – 1011 mb Penv – speed 40 kt – 74 kt est max sustained 10m, 10-min wind" (Schwardt et al. (1979)). central pressure measured by aircraft reconnaissance at 41.2N, 68.7W – 40 kt forward speed – landfall pt 44.6N, 67.3W" (Ho et al. (1987). "Sep – ME1 – Cat 1 – 980 mb" (Jarrell et al. (1992).
- MWR: "…moved inland over the extreme eastern tip of Maine by late afternoon and evening of September 9 [local time]."
- ATSR: "GERDA passed just east of Cape Cod, moving at 40 to 45 knots before she made landfall near Eastport, Maine, about 0100Z on the 10th. She became extra-tropical about five hours later and rapidly lost her intensity over eastern Canada."
- Environment Canada:
  - Nova Scotia - 133 km/h (72 kt) winds in Yarmouth. Tore shingles from roofs and blew down trees in the province.
  - New Brunswick - 74–92 km/h (40–50 kt) winds in the province. Damage was minimal.
- Reanalysis: The fast forward speed brought the center of the hurricane over eastern Maine around 01Z on the 10th. The Storm Data indicates that winds up to 50 kt (possibly gusts) impacted Washington County, the easternmost county of Maine, where the center of Gerda made landfall. After running the Schwerdt et al. parametric hurricane wind model and based on the wind (likely gusts) and damage reports from New Brunswick and Nova Scotia, Canada, it appears that no hurricane-force winds affected Maine as these were confined over the eastern quadrant. Storm Data suggests that only minor damage was caused by Gerda on Maine. The wind and damage reports from Canada suggest that Gerda had weakened quickly after reaching its peak intensity late on the 9th. An intensity of 75 kt is analyzed at 00Z on the 10th, down from 95 kt originally shown in HURDAT, a major intensity change. Transition to an extratropical cyclone is analyzed at 06Z on the 10th based on synoptic observations, same as originally shown in HURDAT. Weakening below hurricane intensity is analyzed at 06Z on the 10th, same as originally shown in HURDAT. Gerda continued rapidly to the north as it lost in strength. Synoptic data at 00Z on the 11th is sparse but it suggests that Gerda had merged with another extratropical cyclone over the Labrador Sea. Thus, the last position is analyzed at 18Z on the 10th, six hours later than originally shown in HURDAT.

September 11:

1. Map and old HURDAT:
- HWM analyzes an extratropical cyclone at 62.5N, 60.5W at 12Z

Date	Original HURDAT Central Pressure	Evidence	Changes
Sep 07 00Z	1012 mb	Land: 5 kt SW and 1012 mb at Miami, FL at 00Z	1011 mb
Sep 07 12Z	1010 mb	Land: 5 kt S and 1011 mb at Vero Beach, FL at 12Z	Retained
Sep 08 00Z	1006 mb	No penetration center center fix or ships near the center around 00Z on Sep 8th	Removed
Sep 08 12Z	1002 mb	Penetration center fix: 1002 mb at 1112Z on Sep 08th	Retained
Sep 08 18Z		Penetration center fix: 993 mb at 2030Z on Sep 08th	993 mb
Sep 09 00Z	991 mb	Penetration center fix: 991 mb at 00Z on Sep 09th	Retained
Sep 09 06Z	986 mb	Penetration center fix: 986 mb at 0845Z on Sep 09th	

Sep 09 12Z	984 mb	Penetration center fix: 984 mb at 1133Z on Sep 09th	
Sep 09 18Z	979 mb	Penetration center fix: 980 mb at 1805Z on Sep 09th	980 mb
Sep 10 00Z	979 mb	Penetration center fix: 979 mb at 20Z on Sep 09th	Removed

Sources: NHC microfilm maps, the Historical Weather Maps series, the COADS ship database, Monthly Weather Review, Mariners Weather Log, Satellite images from NCDC, Schwardt et al. (1979), Ho et al. (1987), Jarrell et al. (1992), Local Climatological Data, Surface Weather Observations from EV2, Environmental Canada and NHC Storm Wallets.

Holly – AL171969 – 2021 Revision

Green indicates wind changes of 15 kt or greater
Blue indicates lat/long changes greater than 1°
Red indicates a new entry
Yellow indicates a deletion

Hurricane Holly [September 13-18, 1969]

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46160 09/14/1969 M= 8 17 SNBR= 985 HOLLY       XING=0 SSS=0
46160 09/13/1969 M= 6 17 SNBR= 985 HOLLY       XING=0 SSS=0
         **         *

(The 13th is new to HURDAT.)
46165 09/13*  0   0   0    0*  0   0   0    0*  0   0   0    0*112 465  30    0*

46165 09/14*  0   0   0    0*  0   0   0    0*119 474  25    0*123 481  30 1000*
46165 09/14*114 470  30    0*116 474  35    0*119 478  40    0*122 482  40 1000*
            *** ***  **      *** ***  **          ***  **      *** ***  **

46170 09/15*127 485  40    0*133 488  50    0*140 490  60    0*145 495  75  992*
46170 09/15*126 485  45    0*132 488  50    0*139 491  55  994*145 495  60  992*
            ***      **      ***              *** ***  **  ***          **

46175 09/16*150 500  70    0*153 502  65    0*155 504  65  994*160 509  70  984*
46175 09/16*150 499  60    0*154 502  60  992*157 504  60  994*160 508  70  984*
                ***  **      ***      **  *** ***      **          ***

46180 09/17*164 512  65  999*166 517  65    0*169 522  65 1000*170 531  65 1002*
46180 09/17*163 513  55  999*166 518  55  997*168 523  50 1000*170 529  45 1002*
            *** ***  **          ***  **  *** *** ***  **          ***  **

46185 09/18*171 538  45 1004*170 543  45    0*169 552  40    0*168 553  35    0*
46185 09/18*170 536  40 1004*168 543  40 1004*166 552  35    0*164 562  30    0*
            *** ***  **      ***      ** **** ***      **      *** ***  **

(September 19th-21st are removed from HURDAT)
46190 09/19*167 555  30    0*164 587  30    0*162 600  30    0*159 610  25    0*
46195 09/20*158 620  25    0*155 630  25    0*153 640  25    0*150 650  25    0*
46200 09/21*148 659  25    0*  0   0   0    0*  0   0   0    0*  0   0   0    0*

46205 HR
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Significant Revisions:

1. Genesis is analyzed 18 hours earlier than originally shown in HURDAT based on synoptic observations and satellite images.
2. Intensification to a tropical storm is analyzed eighteen hours earlier based on aircraft reconnaissance data.
3. Intensification to a hurricane is analyzed 24 hours later based on aircraft reconnaissance data.
4. Weakening to a tropical storm is analyzed 24 hours earlier based on aircraft reconnaissance data.
5. Major intensity changes are analyzed at 12Z on September 14th, 18Z on September 15th, and 12Z and 18Z on September 17th based on aircraft reconnaissance data.
6. Dissipation is analyzed 54 hours earlier based on aircraft reconnaissance and synoptic data.
7. A few central pressures were added based upon aircraft reconnaissance center fixes and ship data.

Daily Metadata:

September 12:

1. Maps and old HURDAT:
- HWM does not analyze any feature of interest at 12Z.
- HURDAT does not list an organized system on this date.
- Microfilm shows a spot low pressure at 8N, 43W at 12Z.

2. Satellite highlights:
- ESSA VIII estimated a center fix at 10N, 40W at 1119Z (WALLET).

3. Discussion:
- MWR: "The disturbance that became hurricane Holly could be identified as early as September 8, after it had moved off the African coast. Subsequently, it moved westward near 10N latitude until it reached 40 longitude, where it began a west-northwestward track. By September 12, the disturbance had begun to show better organization on satellite pictures."
- ATSR: "A tropical disturbance appeared on the ITCZ near 10 N about 300 miles south of the Cape Verde Islands on 9 September."
- Reanalysis: Hurricane Holly developed from a tropical wave that left the west coast of Africa on September 8th. The disturbance moved westward and showed little signs of organization over the eastern Atlantic.

September 13:

1. Maps and old HURDAT:
- HWM does not analyze any feature of interest at 12Z.
- HURDAT does not list an organized system on this date.
- Microfilm shows a tropical disturbance near 15N, 44W at 12Z.

2. Satellite highlights:
- ESSA VIII estimated a center fix at 11N, 44W at 1112Z (WALLET).

3. Discussion:
- MWR: "…it was a depression on the 13th."

- Reanalysis: MWR indicates that the system was a tropical depression on this date but operationally it was only a tropical disturbance ("TD") based on the microfilm's synoptic maps. Operationally the system was upgraded to a tropical depression ("TC") at 12Z on the 14th and to a tropical storm at 19Z on the 14th. Given the well-organized cloud pattern in satellite imagery on this date, the system is started as a tropical depression at 18Z even though surface observations are scarce. This is 18 hours earlier than shown originally.

September 14:

1. Maps and old HURDAT:
- HWM analyzes a spot low pressure at 12.2N, 47.8W at 12Z.
- HURDAT lists a 25 tropical depression at 11.9N, 47.4W at 12Z (first position).
- Microfilm shows a tropical cyclone of at most 1010 mb at 12N, 47W at 12Z.

2. Satellite highlights:
- ESSA VIII estimated a center fix at 12N, 47.3W at 1113Z (WALLET).

3. Aircraft highlights:
- Penetration center fix measured a central pressure of 1000 mb and estimated surface winds of 30 kt at 12.2N, 48.2W at 18Z (WALLET).

4. Discussion:
- MWR: "and Navy reconnaissance aircraft found a central pressure of 1000 mb on the following day. Steady but not rapid deepening occurred for the next 2 days."
- ATSR: "This disturbance was tracked westward until the 14th when it attained depression intensity at 141200Z near 12N, 47W. It then turned toward the northwest and developed rapidly. A warning was issued at 142200Z upgrading this depression to Tropical Storm HOLLY."
- Reanalysis: Intensification to a tropical storm is analyzed at 06Z on the 14th based on a reconnaissance aircraft later on this date. The first reconnaissance aircraft to investigate the tropical cyclone measured a central pressure of 1000 mb and estimated surface winds of 30 kt at 18Z on the 14th. A central pressure of 1000 mb suggests maximum surface winds of 47 kt from the south of 25N Brown et al. pressure-wind relationship. Based on a slow forward speed of 5 kt, an intensity of 40 kt is analyzed at 18Z on the 14th, up from 30 kt originally shown in HURDAT, a minor intensity change. Satellite images indicated that southwesterly wind shear had increased over the tropical cyclone with most of the convection over the north and eastern quadrants.

September 15:

1. Maps and old HURDAT:
- HWM analyzes a tropical storm of at most 1008 mb at 15.7N, 50.1W at 12Z.
- HURDAT lists a 60 kt tropical storm at 14N, 49W at 12Z.
- Microfilm shows a hurricane of at most 1008 mb at 14N, 49W at 12Z.

2. Ship highlights:
- 30 kt SW and 1000 mb at 14N, 49W at 18Z (COADS/micro).

3. Aircraft highlights:
- Penetration center fix measured a central pressure of 994 mb, estimated surface winds of 75 kt and an eye diameter of 20 n mi at 14.4N, 49.3W at 1415Z (WALLET).

- Penetration center fix measured a central pressure of 992 mb, estimated surface winds of 75 kt and an eye diameter of 20 n mi at 14.6N, 49.5W at 1745Z (WALLET).

4. Discussion:
- MWR: "Hurricane intensity was obtained on the 15th."
- ATSR: "The following day [15], she was a minimal hurricane and attained her maximum intensity later that same day. HOLLY then began a struggle for survival as the moved into an area of relatively cool temperatures east of the Antilles and convergence at the 200 mb level."
- Reanalysis: Holly continued to intensify on the 15th as it moved slowly to the northwest. The next reconnaissance aircraft measured a central pressure of 994 mb, estimated surface winds of 75 kt and an eye diameter of 20 n mi at 1415Z on the 15th. A central pressure of 994 mb suggests maximum surface winds of 58 kt from the south of 25N pressure-wind relationship. An eye diameter of 20 n mi suggests an RMW of about 15 n mi and the climatological value was 14 n mi. Based on a slow forward speed of 6 kt, an intensity of 55 kt is analyzed at 12Z on the 15th, down from 60 kt originally shown in HURDAT, a minor intensity change. Another penetration center fix measured a central pressure of 992 mb, estimated surface winds of 75 kt and an eye diameter of 20 n mi at 1745Z on the 15th. A central pressure of 992 mb suggests maximum surface winds of 61 kt from the south of 25N pressure-wind relationship. An eye diameter of 20 n mi suggests an RMW of about 15 n mi and the climatological value was 13 n mi. An intensity of 60 kt is analyzed at 18Z on the 15th, down from 75 kt originally shown in HURDAT, a major intensity change. Satellite images showed a small tropical cyclone under southwesterly wind shear causing most of the convection to be displaced over the northern and eastern quadrants.

September 16:

1. Maps and old HURDAT:
- HWM analyzes a hurricane of at most 1008 mb at 16N, 50.7W at 12Z.
- HURDAT lists a 65 kt hurricane at 15.5N, 50.4W at 12Z.
- Microfilm shows a hurricane of at most 1008 mb at 15.5N, 50.5W at 12Z.

2. Aircraft highlights:
- Penetration center fix estimated surface winds of 45 kt at 15N, 50W at 01Z (WALLET).
- Penetration center fix measured a central pressure of 992 mb and estimated an eye diameter of 20 n mi at 15N, 50W at 0620Z (WALLET).
- Penetration center fix measured a central pressure of 994 mb, estimated surface winds of 60 kt and an eye diameter of 20 n mi at 15.6N, 50.4W at 1204Z (WALLET).
- Penetration center fix measured a central pressure of 984 mb, estimated surface winds of 70 kt and an eye diameter of 10 n mi at 16.1N, 50.9W at 1806Z (WALLET).

3. Discussion:
- MWR: "winds reached 75 kt, and the central pressure dropped to 984 mb on the following day [16]. Thereafter, the hurricane began to weaken steadily."
- Reanalysis: Aircraft reconnaissance observations indicated that the intensity of Holly remained generally steady except for some intensification later in the day. The first two penetration center fixes measured central pressures of 992 mb and 994 mb at 0620Z and 1204Z on the 16th and the intensity was analyzed at 60 kt at 06Z and 12Z, down from 65 kt originally in HURDAT at both times,

minor intensity changes. A penetration center fix measured a central pressure of 984 mb, estimated surface winds of 70 kt and an eye diameter of 10 n mi at 1806Z on the 16th. A central pressure of 984 mb suggests maximum surface winds of 73 kt from the south of 25N pressure-wind relationship intensifying subset. An eye diameter of 10 n mi suggests an RMW of about 8 n mi and the climatological value was 14 n mi. Based on a slow forward speed of 5 kt but small RMW, an intensity of 70 kt is analyzed at 18Z on the 16th, same as originally shown in HURDAT. 70 kt is also the peak intensity of Holly, down from 75 kt originally shown in HURDAT at 18Z on the 15th, a minor intensity change. Satellite images showed a disorganized system due to strong wind shear.

September 17:

1. Maps and old HURDAT:

- HWM analyzes a hurricane of at most 1008 mb at 17.5N, 52.5W at 12Z.
- HURDAT lists a 65 kt hurricane at 16.9N, 52.2W at 12Z.
- Microfilm shows a hurricane of at most 1008 mb at 17.3N, 52.1W at 12Z.

2. Aircraft highlights:

- Penetration center fix measured a central pressure of 999 mb and estimated an eye diameter of 10 n mi at 16.6N, 51.4W at 0227Z (WALLET).
- Penetration center fix measured a central pressure of 997 mb and estimated an eye diameter of 15 n mi at 16.8N, 51.5W at 0537Z (WALLET).
- Penetration center fix measured a central pressure of 1000 mb, estimated surface winds of 55 kt and an elliptical eye with major axis 20º-200º, major axis of 15 n mi and minor axis of 10 n mi at 16.5N, 52.4W at 1159Z (WALLET).
- Penetration center fix measured a central pressure of 1002 mb and estimated surface winds of 45 kt at 17.1N, 52.8W at 1743Z (WALLET).
- Penetration center fix measured a central pressure of 1004 at 17.2N, 52.6W at 2355Z (WALLET).

3. Discussion:

- MWR: “On September 17, it was downgraded to a tropical storm.”
- ATSR: “Late on the 17th, she had decreased in intensity to a tropical storm near 17N, 53W and had turned toward the West.”
- Reanalysis: Holly steadily lost strength on the 17th. A reconnaissance aircraft measured a central pressure of 999 mb and estimated an eye diameter of 10 n mi at 0227Z on the 17th. A central pressure of 999 mb suggests maximum surface winds of 50 kt from the south of 25N pressure-wind relationship weakening subset. An intensity of 55 kt is analyzed at 00Z on the 17th, down from 65 kt originally shown in HURDAT, a minor intensity change. Another penetration center fix measured a central pressure of 997 mb and estimated an eye diameter of 15 n mi at 0537Z on the 17th. A central pressure of 997 mb suggests maximum surface winds of 53 kt from the south of 25N pressure-wind relationship. An intensity of 55 kt is analyzed at 06Z on the 17th, down from 65 kt originally shown in HURDAT, a minor intensity change. The next penetration center fix measured a central pressure of 1000 mb, estimated surface winds of 55 kt and an eye diameter of 10-15 n mi at 1159Z on the 17th. A central pressure of 1000 mb suggests maximum surface winds of 47 kt from the south of 25N pressure-wind relationship weakening subset. An intensity of 50 kt is analyzed at 12Z on the 17th, down from 65 kt originally shown in HURDAT, a major intensity change. And yet another penetration center fix measured a central pressure of 1002 mb and estimated surface winds of 45 kt at 1743Z on the 17th. A central pressure of 1002 mb suggests maximum surface winds of 43 kt from the south of 25N pressure-wind relationship weakening subset. An intensity of 45 kt is analyzed

at 18Z on the 17th, down from 65 kt originally shown in HURDAT, a major intensity change. Satellite images on the 17th showed an exposed low level circulation with disorganized convection to the northeast.

September 18:

1. Maps and old HURDAT:
- HWM analyzes a tropical storm at 17.2N, 55.7W at 12Z.
- HURDAT lists a 40 kt tropical storm at 16.9N, 55.2W at 12Z.
- Microfilm shows a tropical storm of at most 1008 mb at 16.8N, 55.7W at 12Z.

2. Ship highlights:
- 25 kt E and 1007 mb at 16.6N, 53.3W at 06Z (micro).

3. Aircraft highlights:
- Penetration center fix at 16.5N, 54.4W at 06Z (WALLET).

4. Discussion:
- MWR: "and to a depression on the 18th. When Holly was downgraded to a depression, it was still 300 mi east of the Leeward Islands. It then moved west-southwestward and continued to weaken as it moved into the eastern Caribbean when it was barely perceptible from surface data."
- ATSR: "HOLLY continued to weaken on the 18th as she turned toward the west-southwest and was a depression by the end of the day."
- ESSA WEATHER BUREAU: "HOLLY HAS DEGENERATED INTO AN OPEN WAVE AROUND 275 MILES EAST OF THE LEEWARD ISLANDS. THIS WILL BE THE LAST ADVISORY."
- Reanalysis: The poorly-organized tropical storm turned to the southwest as it continued to lose strength. A reconnaissance aircraft at 2355Z on the 17th measured a central pressure of 1004 mb. A central pressure of 1004 mb suggests maximum surface winds of 39 kt from the south of 25N pressure-wind relationship. An intensity of 40 kt is analyzed at 00Z on the 18th, down from 45 kt originally shown in HURDAT, a minor intensity change. Satellite images showed an exposed low-level circulation with some convection to the northeast. The last position is analyzed at 18Z based on synoptic and reconnaissance aircraft data late on the 18th and early on the 19th. Operationally, the last advisory was issued at 22Z on the 18th.

September 19:

1. Maps and old HURDAT:
- HWM analyzes a tropical wave extending from 15N-25N, along 60W at 12Z.
- HURDAT lists a 30 kt tropical depression at 16.2N, 64.0W at 12Z.
- Microfilm shows tropical wave extending from 13N-22N, along 60W at 12Z.

2. Satellite highlights:
- ESSA VIII estimated a center fix at 16.3N, 60W at 1113Z (WALLET).

3. Discussion:
- ATSR: "HOLLY had degenerated into an easterly wave as she moved through the Leeward Islands on the 19th and 20th."
- Reanalysis: Observations indicate that Holly degenerated into an open trough before 00Z and dissipation is indicated at that time. This is 54 hours earlier than HURDAT, but is consistent with the operational advisories. The remnants of Holly continued westward across the Lesser Antilles. Satellite images

indicated that the convective activity was very limited and no signs of organization were observed during the next few days.

September 20:

1. Maps and old HURDAT:
- HWM analyzes a tropical wave over the eastern Caribbean Sea at 12Z.
- HURDAT lists a 25 kt tropical depression at 15.3N, 64W at 12Z.
- Microfilm shows tropical wave extending from 11N-22N, along 65W at 12Z.

September 21:

1. Maps and old HURDAT:
- HWM analyzes a tropical wave over the eastern Caribbean Sea at 12Z.
- HURDAT lists a 25 kt tropical depression at 14.8N, 65.9W at 00Z (last position).
- Microfilm shows tropical wave extending from 14N-23N, along 68W at 12Z.

2. Discussion:
- MWR: "The last satellite pictures of an identifiable circulation showed weak but clear low-level banding with the cirrus canopy completely gone. By midday of the 21st, all traces of Holly had vanished."
- ATSR: "and dissipated over the Eastern Caribbean Sea by 21 September."

Date	Original HURDAT Central Pressure	Evidence	Changes
Sep 14 18Z	1000 mb	Penetration center fix: 1000 mb at 18Z	Retained
Sep 15 12Z		Penetration center fix: 994 mb at 1415Z	994 mb
Sep 15 18Z	992 mb	Penetration center fix: 992 mb at 1745Z	Retained
Sep 16 06Z		Penetration center fix: 992 mb at 0620Z	992 mb
Sep 16 12Z	994 mb	Penetration center fix: 994 mb at 1204Z	Retained
Sep 16 18Z	984 mb	Penetration center fix: 984 mb at 1806Z	
Sep 17 00Z	999 mb	Penetration center fix: 999 mb at 0227Z	
Sep 17 06Z		Penetration center fix: 997 mb at 0537Z	997 mb
Sep 17 12Z	1000 mb	Penetration center fix: 1000 mb at 1159Z	Retained
Sep 17 18Z	1002 mb	Penetration center fix: 1002 mb at 1743Z	

Sep 18 00Z	1004 mb	Penetration center fix: 1004 mb at 2355Z on Sep 18th	
Sep 18 06Z		Ship: 25 kt E and 1007 mb at 06Z	1004 mb

Sources: NHC microfilm maps, the Historical Weather Maps series, the COADS ship database, Monthly Weather Review, Navy reconnaissance book, Mariners Weather Log, Satellite images from NCDC, and NHC Storm Wallets.

Unnamed – AL181969 – Removed in 2021

September 16-20: Historical Weather Maps, microfilm and satellite images showed a weak disturbance over the central Gulf of Mexico on September 15th. The disturbance slowly moved westward producing disorganized convection and remained very poorly organized at the surface. The first position is in HURDAT at 00Z on the 16th. On the 20th, it moved into northeastern Mexico and dissipated soon after. The last position in HURDAT was analyzed at 00Z on the 20th. COADS were obtained and no gales were observed. Because available surface maps suggest a decent circulation existed, but the satellite imagery indicates it lacked sufficient organized convection to be considered a tropical cyclone, it is removed from HURDAT. This disturbance was in Jack Beven's List of Suspects.

Unnamed – AL191969 – 2021 Revisions

Green indicates wind changes of 15 kt or greater
Blue indicates lat/long changes greater than 1°
Red indicates a new entry
Yellow indicates a deletion

Tropical Depression [September 19-23, 1969]

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45235 09/19/1969 M= 5 19 SNBR= 966 UNNAMED       XING=0 SSS=0

45240 09/19*250 850  25    0*252 851  25    0*259 854  25    0*264 858  25    0*
45240 09/19*  0   0   0    0*  0   0   0    0*240 854  30    0*245 856  30 1007*
              *   *   *        *   *   *      ***       **      ***  ***  **  ****

45240 09/20*270 862  25    0*275 862  25    0*283 865  25    0*292 865  25    0*
45240 09/20*250 858  30    0*256 860  30    0*264 862  30    0*272 863  30    0*
            ***  ***  **      ***  ***  **      ***  ***  **      ***  ***  **

(September 21st through the 23rd are new to HURDAT)
45245 09/21*282 863  30    0*292 862  30    0*301 861  30    0*307 860  30    0*
45245 09/22*309 860  25    0*310 860  25    0*311 860  20    0*311 860  20    0*
45245 09/23*311 860  20    0*311 860  20    0*311 860  20    0*  0   0   0    0*
45250 TD
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Significant Revisions:

1. First position is analyzed twelve hours later than originally shown in HURDAT based on aircraft reconnaissance and synoptic observations.

2. Major position changes analyzed between 12Z on September 19th and 18Z on the 20th based on aircraft reconnaissance and synoptic observations.

3. Dissipation is analyzed 66 hours later than originally shown in HURDAT based on synoptic observations.

Daily Metadata:

September 18:

1. Maps and old HURDAT:

- HWM and microfilm show a trough or tropical wave over the eastern Gulf of Mexico and western Caribbean Sea at 12Z.

2. Discussion:

- Reanalysis: Satellite images showed an area of disorganized convection over the Florida Straits and eastern Gulf of Mexico. Synoptic observations indicated that the tropical disturbance lacked a well-defined circulation.

September 19:

1. Maps and old HURDAT:

- HWM does not analyze any features of interest in the eastern Gulf of Mexico at 12Z.
- HURDAT lists a 25 kt tropical depression at 25.9N, 85.4W at 12Z.
- Microfilm shows a tropical disturbance at 26.5N, 84.5W at 12Z.

2. Ship highlights:

- 30 kt ESE and 1013 mb at 25.2N, 84.1W at 12Z (COADS).
- 35 kt E (25 kt micro) and 1014 mb at 25.3N, 84.9W at 12Z (COADS).

3. Aircraft highlights:

- Penetration center fix measured a central pressure of 1007 mb and estimated surface winds of 45 kt at 24.8N, 85.5W at 19Z (WALLET).

4. Discussion:

- Reanalysis: The disturbance became better defined at the surface on the 19th and synoptic observations at 12Z indicated that a closed low-level circulation had developed. The first position is analyzed at this time, 12 hours later than originally shown in HURDAT. The analyzed intensity at 12Z on the 19th is 30 kt based on ship observations, 5 kt higher than originally shown in HURDAT, a minor intensity change. 30 kt is also the peak intensity of this tropical depression. A penetration center fix measured a central pressure of 1007 mb and estimated surface winds of 45 kt at 19Z on the 19th. A central pressure of 1007 mb suggests maximum surface winds of 32 kt from the south of 25N and 30 kt from the north 25N Brown et al. pressure-wind relationships. Due to the slow forward speed of about 5 kt and synoptic observations, an intensity of 30 kt is analyzed at 18Z on the 19th, up from 25 kt originally shown in HURDAT, a minor intensity change. Satellite images showed that the cyclone had become better organized compared to the day before, but the system was under the influence of strong southwesterly shear, displacing most of the convection to the northeast.

September 20:

1. Maps and old HURDAT:

- HWM analyzes a closed low pressure of at most 1010 mb at 27N, 87.5W at 12Z.
- HURDAT lists a 25 tropical depression at 28.3N, 86.5W at 12Z.
- Microfilm shows a tropical cyclone of at most 1010 mb at 26.5N, 86.5W at 12Z.

2. Ship highlights:

- 30 kt E and 1010 mb at 25.8N, 86.2W at 00Z (COADS).
- 30 kt E and 1010 mb at 26.8N, 86.2W at 06Z (COADS).
- 30 kt SSW and 1009 mb at 26.3N, 85.3W at 12Z (COADS).
- 30 kt E and 1015 mb at 29.5N, 87.8W at 18Z (COADS).

3. Discussion:

- Public Advisory at 0930Z: "A TROPICAL DEPRESSION DEVELOPED IN THE SOUTHEAST GULF OF MEXICO LATE FRIDAY AND AT 5 AM WAS CENTERED AROUND 350 MILES WEST NORTHWEST OF KEY WEST FLORIDA.
- Reanalysis: The tropical depression continued slowly northward with no appreciable changes in intensity. Satellite images indicated that the system was under strong westerly shear and most of the convection was to the east of the center. Multiple ships reported winds up to 30 kt, and it is possible that the cyclone was a minimal tropical storm, but the data available is inconclusive.

September 21:

1. Maps and old HURDAT:

- HWM analyzes a closed low pressure of at most 1008 mb at 30.5N, 86.5W at 12Z.
- Microfilm shows a tropical cyclone of at most 1008 mb at 29.7N, 86W at 12Z.

2. Discussion:

- New Orleans Bulletin at 11Z: "AT 6 AM CDT THE CENTER OF THE TROPICAL DEPRESSION WAS MOVING INLAND ON THE NORTHWEST FLORIDA COAST BETWEEN VALPAISO AND PANAMA CITY. WINDS TO ABOUT 35 MPH IN GUSTS AND SQUALLS AND HEAVY RAIN WERE OCCURRING OVER NORTHWEST FLORIDA EXTREME SOUTHEAST ALABAMA AND SOUTH GEORGIA."
- Reanalysis: The tropical depression continued northward making landfall in the Florida panhandle around 14Z on the 21st with maximum sustained winds of 30 kt. Satellite images showed a large area of convection over the southeastern United States.

September 22:

1. Maps and old HURDAT:

- HWM analyzes a closed low pressure of at most 1012 mb at 31N, 87.5W at 12Z.
- Microfilm shows a tropical cyclone of at most 1012 mb at 30.5N, 86.5W at 12Z.

2. Discussion:

- Reanalysis: The tropical depression remained generally stationary after landfall. Satellite images showed that the tropical depression was well organized with convection over the center.

September 23:

1. Maps and old HURDAT:

- HWM analyzes a trough over the northeastern Gulf of Mexico at 12Z.
- Microfilm shows a tropical cyclone of at most 1012 mb at 30.5N, 86W at 12Z.

2. Discussion:

- Reanalysis: The tropical depression continued to weaken, as it remained almost stationary just inland. Synoptic observations indicated that the tropical depression weakened to a trough after 12Z on the 23th, thus the last position is analyzed at 12Z. While the trough continued for a few more days, the

subsequent re-formation as an extratropical gale over New Brunswick, Canada on the 28th is a separate cyclone and thus not included into HURDAT.

Sources: NHC microfilm maps, the Historical Weather Maps series, the COADS ship database, Monthly Weather Review, Mariners Weather Log, Satellite images from NCDC, and NHC Storm Wallets.

Inga – AL201969 – 2021 Revisions

Green indicates wind changes of 15 kt or greater
Blue indicates lat/long changes greater than 1°
Red indicates a new entry
Yellow indicates a deletion

Hurricane Inga [September 20 – October 15, 1969]

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46210 09/20/1969 M=26 20 SNBR= 986 INGA        XING=0 SSS=0

46215 09/20*  0   0   0    0*  0   0   0    0*160 470  25    0*163 480  25    0*
46215 09/20*  0   0   0    0*  0   0   0    0*160 470  25    0*163 482  25    0*
                                                                     ***

46220 09/21*165 490  30    0*167 502  35    0*168 511  40 1001*169 517  45    0*
46220 09/21*165 493  30    0*167 504  35    0*168 513  35 1004*169 519  40    0*
                ***              ***              ***  ** ****     ***  **

46225 09/22*170 523  45    0*171 529  45    0*172 535  50 1007*173 541  50    0*
46225 09/22*170 524  40    0*171 529  40    0*172 535  35 1007*173 541  35 1007*
                ***  **                **                **                ** ****

46230 09/23*174 547  55    0*176 554  50    0*178 561  35 1006*180 569  30    0*
46230 09/23*174 547  35 1006*176 554  35    0*178 561  35 1006*180 569  30 1007*
                     ** ****          **                                     ****

46235 09/24*182 578  30    0*184 587  25    0*186 596  25 1007*188 603  25    0*
46235 09/24*182 578  30 1006*184 587  30    0*186 596  30 1007*188 603  30    0*
                        ****          **                **                ** 

46240 09/25*190 609  30    0*193 615  30    0*196 620  30    0*200 623  25    0*
46240 09/25*190 609  25    0*193 615  25    0*196 619  25    0*200 622  25    0*
                     **                **          ***  **          ***

46245 09/26*204 625  25    0*208 628  25    0*212 630  25    0*216 632  25    0*
46245 09/26*204 624  25    0*208 626  25    0*213 627  25 1008*218 628  25    0*
                ***              ***         *** ***     **** *** ***

46250 09/27*219 633  25    0*222 635  25    0*225 636  25    0*228 637  25    0*
46250 09/27*222 629  25    0*225 630  25    0*227 631  30    0*228 632  35 1003*
            *** ***          *** ***         *** ***  **          ***  ** ****

46255 09/28*230 638  25    0*232 639  25    0*235 640  30 1000*238 642  35    0*
46255 09/28*230 634  35    0*232 637  35    0*235 640  40 1000*238 642  40    0*
                ***  **          ***  **                **                **

46260 09/29*242 644  35    0*245 646  40    0*248 648  50  992*254 650  55    0*
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46260 09/29*241 644  45    0*245 646  45    0*249 648  50  992*254 649  50  991*
            ***      **                **      ***                   ***  **  ***

46265 09/30*261 647  65    0*267 642  70    0*272 638  75  990*278 634  80    0*
46265 09/30*260 647  50  994*267 642  50  990*272 638  50  994*278 634  55  989*
            ***      **  ***           **  ***           **  ***           **  ***

46270 10/01*283 630  80    0*288 626  80    0*293 622  80  990*297 618  80    0*
46270 10/01*283 630  55  988*288 626  55  991*293 622  55  991*297 618  60  987*
                     **  ***           **  ***           **  ***           **  ***


46275 10/02*297 616  80    0*293 615  80    0*289 616  80  987*285 618  80    0*
46275 10/02*297 616  60  986*293 615  60    0*289 616  60  989*285 618  60  987*
                     **  ***           **                **  ***           **  ***

46280 10/03*281 621  70    0*278 627  70    0*276 634  70  989*276 642  70    0*
46280 10/03*281 621  60  986*278 627  60    0*276 634  60  989*276 642  60  990*
                     **  ***           **                **                **  ***

46285 10/04*277 650  70    0*279 654  70    0*284 657  75  980*291 651  80    0*
46285 10/04*277 649  65  986*280 655  70    0*284 657  75  980*291 651  90  969*
               ***   **  *** *** ***                                    **  ***

46290 10/05*297 638  90    0*305 623  95    0*312 607  95  964*319 595 100    0*
46290 10/05*297 638  90  968*305 623  95    0*312 607  95  964*319 595  95  964*
                     **  ***                                          ***  ***

46295 10/06*325 583  95    0*331 573  90    0*336 565  80  980*339 560  80    0*
46295 10/06*326 583  90    0*332 573  75  978*337 565  70    0*340 560  65  983*
            ***      **      ***      **  *** ***      **    * ***      **  ***

46300 10/07*341 555  80    0*343 550  80    0*344 545  85  981*345 540  85    0*
46300 10/07*342 555  65    0*343 551  70    0*344 547  70  980*345 542  70  983*
            ***      **          ***  **          ***  **  ***     ***  **  ***

46305 10/08*345 536  85    0*344 532  70    0*343 528  65  988*341 524  75    0*
46305 10/08*345 536  65  989*344 532  65    0*343 528  65  989*341 524  70  983*
                     **  ***           **                  ***           **  ***

46310 10/09*339 520  75    0*333 517  75    0*327 515  75  985*322 514  75    0*
46310 10/09*339 520  70    0*333 517  70    0*327 515  65    0*322 514  65  986*
                     **                **                **    *           **  ***

46315 10/10*317 513  70    0*312 512  70    0*306 511  60  993*300 510  60    0*
46315 10/10*317 513  60    0*312 512  60    0*306 511  55  994*300 511  55  992*
                     **                **                **  ***     ***  **  ***

46320 10/11*293 514  60    0*287 519  55    0*282 525  50  998*277 531  40    0*
46320 10/11*294 512  50    0*288 518  45    0*282 525  45    0*277 531  40  998*
            *** ***  **      *** ***  **                **    *              ***

46325 10/12*272 539  40    0*268 547  40    0*264 555  35 1001*262 563  35    0*
46325 10/12*272 539  40    0*268 547  40    0*264 555  35    0*262 563  35 1001*
                                                           *              ****

46330 10/13*260 571  35    0*259 579  30    0*258 588  30 1003*258 596  30    0*
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46330 10/13*260 571  35    0*258 579  35    0*256 588  35    0*254 594  35 1003*
                            ***      **      ***      **    * *** ***  ** ****

46335 10/14*258 602  30    0*258 607  30    0*259 610  25 1008*260 613  25    0*
46335 10/14*253 597  30    0*252 599  30    0*252 600  25    0*252 601  25    0*
            *** ***         *** ***  **      *** ***  **    * *** ***

46340 10/15*261 616  25    0*  0   0   0    0*  0   0   0    0*  0   0   0    0*
46340 10/15*252 602  25    0*252 603  20    0*252 604  20    0*  0   0   0    0*
            *** ***         *** ***  **      *** ***  **

46345 HR
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Significant Revisions:

1. Multiple central pressures were added, primarily based upon aircraft reconnaissance.
2. Re-intensification to a tropical storm is analyzed 24 hours earlier based on synoptic observations.
3. Intensification to a hurricane is analyzed four days later based on reconnaissance aircraft data.
4. Weakening to a tropical storm is analyzed twelve hours earlier based on reconnaissance aircraft data.
5. Weakening to a tropical depression is analyzed eighteen hours later based on reconnaissance aircraft data.
6. Major downward intensity changes are analyzed between September 22nd at 12Z and September 23rd at 06Z, 00Z-18Z on September 30th, October 1st and 2nd, 06Z and 18Z on October 6th, 00Z, 12Z and 18Z on October 7th and 00Z on October 8th.
7. Major east-southeastward track changes at 18Z on October 14th and 00Z on October 15th based on synoptic observations.
8. Dissipation analyzed twelve hours later based on synoptic observations.
9. Many central pressure were moved from 12Z to 18Z, as these aircraft reconnaissance based values were in the wrong synoptic time.
10. System did not reach major hurricane intensity. Peak of 95 kt analyzed, versus 100 kt originally.

September 18:

1. Maps and old HURDAT:

- HWM does not show any features of interest at 12Z.
- Microfilm analyzes a tropical disturbance near 12N, 43W at 12Z.

2. Discussion:

- MWR: "Inga (longest lived Atlantic tropical cyclone of record) spent 25 days inside a relatively small circle (radius less than 700 mi) over the open Atlantic. It was born under adverse conditions, made a rather tight loop southeast of Bermuda, and then passed within 200 mi of Bermuda. It was along this northeastward track that the hurricane reached her greatest strength; winds were estimated to be 90 kt, and the sea-level pressure was reported to

be 964 mb. A cold Low to the east turned the hurricane toward the south; later, under the influence of a cold High to the north, Inga drifted westward and dissipated some 250 mi from where she first reached hurricane force."

- Reanalysis: A large area of disorganized convection was observed in the satellite images over the central Atlantic associated with a tropical wave that had left the west coast of Africa about a week earlier. Synoptic observations over this part of the Atlantic were sparse.

September 19:

1. Maps and old HURDAT:

- HWM does not show any features of interest at 12Z.
- Microfilm analyzes a tropical disturbance near 14N, 47W at 12Z.

2. Discussion:

- Reanalysis: Satellite images showed that the disturbance had become better organized but synoptic observations indicated that it had not acquired a closed low-level circulation.

September 20:

1. Maps and old HURDAT:

- HWM does not show any features of interest at 12Z.
- HURDAT lists a 25 kt tropical depression at 16N, 47W at 12Z (first position).
- Microfilm analyzes a tropical disturbance near 14N, 47W at 12Z.

2. Ship highlights:

a. 40 kt NE (looks biased) and 1013 mb at 20N, 52W at 18Z (COADS).

3. Discussion:

- ATSR: "INGA was one of the longest-lived tropical cyclones on record. ESSA 9 satellite first detected the system as a tropical disturbance near 16N, 47W on 20 September."
- Reanalysis: The first position is analyzed at 12Z on the 20th, same as originally shown in HURDAT, as a 25 kt tropical depression. The time of genesis is uncertain due to the sparse data available over the central Atlantic. Satellite images indicated that the system had continued to become better organized and some banding features were evident.

September 21:

1. Maps and old HURDAT:

- HWM analyzes a trough northeast of the Leeward Islands at 12Z.
- HURDAT lists a 40 kt tropical storm at 16.8N, 51.1W at 12Z.
- Microfilm shows a tropical cyclone at 16.5N, 51W at 12Z.

2. Aircraft highlights:

- Penetration center fix measured a central pressure of 1004 mb and estimated surface winds of 25 kt at 17.2N, 51.5W at 15Z (WALLET). (A 1001 mb pressure on the aircraft fix at 15Z is based on a dropsonde. However, the extrapolated pressures using the 700 and 850 mb data on the drop are 1003-1004 mb, and the initial low-level penetration pressure was 1004 mb. Thus 1004 mb is used as the central pressure.)

3. Discussion:

- ATSR: "INGA attained tropical depression and storm intensity the following day [21] …"
- Reanalysis: The tropical depression moved west-northwest and intensified. The first reconnaissance aircraft to reach the tropical cyclone measured a central pressure of 1004 mb and estimated surface winds of 25 kt at 15Z on the 21st. A central pressure of 1001 mb suggests maximum surface winds of 39 kt from the south of 25N Brown et al. pressure-wind relationship. Based on a slow forward speed of about 6 kt, an intensity of 35 kt is analyzed at 12Z on the 21st, slightly lower than originally shown in HURDAT. Intensification to a tropical storm is analyzed at 06Z on the 21st, same as originally shown in HURDAT. Satellite images showed a tropical cyclone with an organized CDO and banding features.

September 22:

1. Maps and old HURDAT:

- HWM analyzes a tropical storm of at most 1008 mb at 18N, 53.5W at 12Z.
- HURDAT lists a 50 kt tropical storm at 17.2N, 53.5W at 12Z.
- Microfilm shows a tropical storm of at most 1008 mb at 17.7N, 53.3W at 12Z.

2. Aircraft highlights:

- Penetration center fix measured a central pressure of 1007 mb, estimated surface winds of 45 kt and an eye diameter of 20 n mi at 17.7N, 53.2W at 1145Z (WALLET).
- Penetration center fix measured a central pressure of 1007 mb, estimated surface winds of 55 kt and an eye diameter of 12 n mi at 16.6N, 53.6W at 1950Z (WALLET).
- Penetration center fix measured a central pressure of 1006 mb and estimated surface winds of 55 kt at 16.8N, 53.8W at 2340Z (WALLET).

3. Discussion:

- Reanalysis: Inga weakened on the 22nd as it moved into an area of higher wind shear. A reconnaissance aircraft made a penetration center fix measuring a central pressure of 1007 mb and estimating surface winds of 45 kt at 1145Z on the 22nd. A central pressure of 1007 mb suggests maximum surface winds of 32 kt from the south of 25N pressure-wind relationship. Weighing some the visual intensity estimate, an intensity of 35 kt is analyzed at 12Z on the 22nd, down from 50 kt originally shown in HURDAT, a major intensity change. Another penetration center fix measured a central pressure of 1007 mb at 18Z on the 22nd and an intensity of 35 kt is analyzed at 12Z on the 22nd, down from 50 kt originally shown in HURDAT, a major intensity change. The positions of the penetration center fixes on the 22nd were very erratic, likely a result of the poor organization of the tropical storm and could be due to the far distance of the aircraft reconnaissance mission to the closest landmass (making navigation of longitude more difficult). Satellite images showed an exposed circulation with most of the convection displaced to the southeast.

September 23:

1. Maps and old HURDAT:

- HWM analyzes a tropical storm of at most 1008 mb at 17.5N, 55.8W at 12Z.
- HURDAT lists a 35 kt tropical storm at 17.8N, 56.1W at 12Z.
- Microfilm shows a tropical storm of at most 1008 mb at 18.2N, 55.8W at 12Z.

2. Aircraft highlights:

- Penetration center fix measured a central pressure of 1006 mb, estimated surface winds of 35 kt and an eye diameter of 30 n mi at 16.9N, 55.6W at 1130Z (WALLET).
- Penetration center fix measured a central pressure of 1007 mb and estimated surface winds of 20 kt at 18.1N, 56.3W at 1558Z (WALLET).
- Penetration center fix measured a central pressure of 1006 mb and estimated surface winds of 27 kt at 18.5N, 56.8W at 2130Z (WALLET).

3. Discussion:

- ATSR: "…but was downgraded to a tropical depression on the 23rd as she moved west-northwest at 6 to 8 knots toward the Leeward Islands."
- Reanalysis: Inga remained a weak tropical cyclone as it moved westward on the 23rd. A penetration center fix occurred at 2340Z on the 22nd measuring a central pressure of 1006 mb and estimated surface winds of 55 kt. 1006 mb central pressure suggests an intensity of 35 kt from the south of 25N pressure-wind relationship. An intensity of 35 kt is analyzed at 00Z on the 23rd, down from 55 kt originally in HURDAT, a major intensity change. Another penetration center fix measured a central pressure of 1006 mb and estimated surface winds of 35 kt at 1130Z on the 23rd. An intensity of 35 kt is analyzed at 12Z on the 23rd, same as originally shown in HURDAT. An intensity of 35 kt is also analyzed at 06Z on the 23rd, down from 50 kt originally in HURDAT, a major intensity change. The next penetration center fix measured a central pressure of 1007 mb and estimated surface winds of 20 kt at 1558Z on the 23rd. An intensity of 30 kt is analyzed at 18Z on the 23rd, same as originally shown in HURDAT. Weakening to a tropical depression is analyzed at 18Z on the 23rd, same as originally shown in HURDAT. The positions of the penetration center fixes on the 23rd were also erratic, thus no track changes were introduced. Satellite images continued to show an exposed circulation with most of the convection removed to the southeast.

September 24:

1. Maps and old HURDAT:

- HWM analyzes a tropical depression of at most 1008 mb at 19.5N, 60W at 12Z.
- HURDAT lists a 25 kt tropical depression at 18.6N, 59.6W at 12Z.
- Microfilm shows a tropical cyclone of at most 1008 mb at 19N, 60W at 12Z.

2. Ship highlights:

- 30 kt NE and 1009 mb at 17.8N, 62.5W at 18Z (micro).

3. Aircraft highlights:

- Penetration center fix measured a central pressure of 1007 mb and estimated surface winds of 17 kt at 19N, 60.7W at 1130Z (WALLET).
- Penetration center fix estimated surface winds of 45 kt at 18.3N, 60.7W at 2215Z (WALLET).

4. Discussion:

- ATSR: "INGA briefly reached tropical storm intensity late on the 24th…"
- Reanalysis: A reconnaissance aircraft investigated Inga at 2130Z on the 23rd measuring a central pressure of 1006 mb and maximum surface winds of 27 kt. 1006 mb central pressure suggests an intensity of 35 kt from the south of 25N pressure-wind relationship. An intensity of 30 kt is analyzed based upon a blend of the pressure-wind relationship and the very weak winds visually observed at 00Z on the 24th, same as originally shown in HURDAT. The next penetration center fix measured a central pressure of 1007 mb and estimated surface winds of 17 kt at 1130Z. An intensity of 30 kt is analyzed at 12Z on

the 24th, up from 25 kt originally shown in HURDAT, a minor intensity change. Satellite images indicated that Inga had continued to lose organization with a disorganized area of convection to the east of the center.

September 25:

1. Maps and old HURDAT:

- HWM analyzes a tropical storm of at most 1008 mb at 19.5N, 62W at 12Z.
- HURDAT lists a 30 kt tropical depression at 19.6N, 62W at 12Z.
- Microfilm shows a tropical storm of 1007 mb at 19N, 62.3W at 12Z.

2. Discussion:

- ATSR: "…but by the 25th was again back down to tropical depression intensity."
- Reanalysis: Inga continued slowly to the northwest as a weak tropical depression. Reconnaissance aircrafts investigated the tropical cyclone on the 25th around 12Z and 18Z, but no central pressure was recorded in the Storm Wallets likely because no center fixes were sent on this very weak system. Operationally, the advisories were discontinued at 22Z on the 25th. Nonetheless, synoptic observations showed that Inga retained a weak but closed circulation. Satellite images continued to show that the convection remained displaced to the east of the center.

September 26:

1. Maps and old HURDAT:

- HWM analyzes a closed low pressure of at most 1008 mb at 21.5N, 61W at 12Z.
- HURDAT lists a 25 kt tropical depression at 21.2N, 63W at 12Z.
- Microfilm shows a tropical cyclone of 1007 mb at 23N, 63W at 12Z.

2. Discussion:

- Reanalysis: Inga remained a weak system on the 26th. A reconnaissance aircraft investigated the tropical depression around 12Z on the 26th but again no central pressure or center was recorded in the Storm Wallets. Synoptic data indicated that Inga had a broad low-level circulation and satellite images showed that the convection was located generally over the northeastern semicircle. Note that it is possible that the system was subtropical during part of the 26-28 September period since it was apparently under an upper-level low.

September 27:

1. Maps and old HURDAT:

- HWM analyzes a closed low pressure of at most 1008 mb at 24N, 62W at 12Z.
- HURDAT lists a 25 kt tropical depression at 22.5N, 63.6W at 12Z.
- Microfilm shows a tropical cyclone of 1004 mb at 22.5N, 63W at 12Z.

2. Ship highlights:

- 30 kt E and 1014 mb at 28.2N, 60.2W at 15Z (COADS).
- 35 kt E and 1007 mb at 26.3N, 60.9W at 18Z (COADS).
- 10 kt SE and 1004 mb at 22.4N, 63W at 18Z (micro).

3. Discussion:

- Reanalysis: Inga remained poorly organized on the 27th but gradually it began to gain strength. Re-intensification to a tropical storm is analyzed at 18Z on the 27th based on a ship report of 35 kt, and another ship near the center that recorded 10 kt SW and 1004 mb, suggesting a central pressure of 1003 mb, which

has been added to HURDAT. A central pressure of 1003 mb suggests maximum surface winds of 41 kt from the south of 25N pressure-wind relationship. Since Inga was almost stationary and had a broad circulation, an intensity of 35 kt is selected at 18Z, up from 25 kt originally shown in HURDAT, a minor intensity change. Reconnaissance aircrafts investigated the tropical cyclone on the 27th but again no central pressures were recorded in the Storm Wallets. Satellite images showed that the center of Inga was exposed with most of the convection removed to the east.

September 28:

1. Maps and old HURDAT:

- HWM analyzes a closed low pressure of at most 1000 mb at 23.7N, 65.8W at 12Z.
- HURDAT lists a 30 kt tropical depression at 23.5N, 64W at 12Z.
- Microfilm shows a tropical cyclone of 1000 mb at 23.5N, 63.5W at 12Z.

2. Ship highlights:

- 30 kt SW and 1006 mb at 22.9N, 61.4W at 00Z (COADS).
- 35 kt E and 1007 mb at 28.8N, 62.5W at 06Z (COADS).
- 35-40 kt SE and 1004 mb at 24.3N, 62.6W at 12Z (micro).
- 30 kt SSE and 1004 mb at 24N, 61.7W at 18Z (COADS).

3. Discussion:

- ATSR: "She then turned toward the north-northwest, moving very slowly and reached tropical storm intensity late on the 28th."
- Reanalysis: Inga continued to become better organized on the 28th. Satellite images indicated that the convection had increased markedly, especially over the eastern semicircle. Reconnaissance aircrafts investigated the tropical storm on the 28th and although no central pressures were recorded in the Storm Wallets, a central pressure of 1000 mb was present in the original HURDAT at 12Z and based on synoptic observations, it appears reliable and has been kept. A central pressure of 1000 mb suggests maximum surface winds of 47 kt from the south of 25N pressure-wind relationship. Based on a slow forward speed of about 3 kt, an intensity of 40 kt is analyzed at 12Z on the 28th, up from 30 kt originally in HURDAT, a minor intensity change.

September 29:

1. Maps and old HURDAT:

- HWM analyzes a closed low pressure of at most 996 mb at 25N, 65W at 12Z.
- HURDAT lists a 50 kt tropical storm at 24.8N, 64.8W at 12Z.
- Microfilm shows a tropical cyclone of 992 mb at 24.8N, 64.8W at 12Z.

2. Ship highlights:

- 35 kt SE and 1005 mb at 25.9N, 63.4W at 00Z (COADS).
- 25 kt W and 1003 mb at 21.7N, 66.6W at 06Z (COADS).
- 40 kt SSE and 1005 mb at 24.7N, 63W at 12Z (micro).
- 40 kt S and 1006 mb at 24.3N, 62.2W at 18Z (COADS).

3. Aircraft highlights:

- Penetration center fix measured a central pressure of 992 mb, estimated surface winds of 35 kt and an eye diameter of 40 n mi at 24.8N, 64.8W at 1230Z (WALLET).
- Penetration center fix measured a central pressure of 991 mb, estimated surface winds of 45 kt and an eye diameter of 40 n mi at 25.7N, 64.9W at 1740Z (WALLET).

4. Discussion:

- ATSR: "INGA developed into a hurricane late on the 29th, becoming a threat to the Island of Bermuda. She then began the erratic movement that perplexed forecasters for the next several days by making a loop about 250 miles southeast of Bermuda."
- Reanalysis: The tropical cyclone continued to slowly intensify on the 29th. Satellite images showed a well-organized circulation with most of the convection over the eastern semicircle, leaving the center slightly exposed. A reconnaissance aircraft investigated Inga at 1230Z on the 29th measuring a central pressure of 992 mb, estimated surface winds of 35 kt and an eye diameter of 40 n mi. A central pressure of 992 mb suggests maximum surface winds of 61 kt from the south of 25N and 56 kt from the north of 25 kt pressure-wind relationships. An eye diameter of 40 n mi suggests an RMW of 30 n mi and the climatological value is 20 n mi. Based on a slow forward speed of about 5 kt and large RMW, an intensity of 50 kt is analyzed at 12Z on the 29th, same as originally shown in HURDAT. Another penetration center fix measured a central pressure of 991 mb at 1740Z on the 29th and an intensity of 50 kt is selected at 18Z, down from 55 kt originally shown in HURDAT, a minor intensity change. Operationally, advisories were re-initiated at 22Z on the 29th. A few ships over the eastern quadrant reported gale-force winds.

September 30:

1. Maps and old HURDAT:

- HWM analyzes a closed low pressure of at most 1000 mb at 28N, 63.3W with a stationary front to the northwest at 12Z.
- HURDAT lists a 75 kt hurricane at 27.2N, 63.8W at 12Z.
- Microfilm shows a tropical storm of 997 mb at 27.5N, 63.7W with a cold front to the northwest at 12Z.

2. Ship highlights:

- 45 kt SE and 1006 mb at 25.6N, 61.1W at 00Z (COADS).
- 40 kt SSE and 1009 mb at 25N, 60.5W at 06Z (C0ADS).
- 40 kt SSE and 1010 mb at 23.3N, 59.6W at 12Z (micro).

3. Aircraft highlights:

- Penetration center fix measured a central pressure of 994 mb at 26.6N, 63.6W at 0217Z (WALLET).
- Penetration center fix measured a central pressure of 990 mb at 27N, 63.6W at 0546Z (WALLET).
- Penetration center fix measured a central pressure of 994 mb and estimated surface winds of 80 kt at 27.3N, 63.8W at 1230Z (WALLET).
- Penetration center fix measured a central pressure of 989 mb, estimated surface winds of 60 kt and an elliptical eye with major axis 90º-270º, major axis of 100 n mi and minor axis of 75 n mi at 27.6N, 63.7W at 18Z (WALLET).
- Penetration center fix measured a central pressure of 988 mb, estimated surface winds of 80 kt and an elliptical eye with major axis 90º-270º, major axis of 80 n mi and minor axis of 60 n mi at 28.1N, 63.3W at 2304Z (WALLET).

4. Discussion:

- Reanalysis: Inga turned to the northeast ahead of an approaching frontal boundary on the 30th. Penetration center fixes on the 30th indicated that the central pressure of the tropical storm fluctuated between 990-994 mb between 0217Z and 1230Z. 992 mb central pressure supports an intensity of 56 kt from

the north of 25N pressure-wind relationship. In part due to the slow motion of the system, an intensity of 50 kt is analyzed between 00Z and 12Z, down from 65 kt at 00Z, 70 kt at 06Z and 75 kt at 12Z, originally in HURDAT, major intensity changes. A penetration center fix measured a central pressure of 989 mb and estimated surface winds of 60 kt at 18Z. A central pressure of 989 mb suggests maximum surface winds of 61 kt from the north of 25N pressure-wind relationship. Due to a forward speed of about 7 kt, an intensity of 55 kt is analyzed at 18Z on the 30th, down from 80 kt originally shown in HURDAT, a major intensity change. Satellite images continued to depict a tropical cyclone under moderate to strong westerly shear.

October 1:

1. Maps and old HURDAT:

- HWM analyzes a hurricane of at most 992 mb at 30.6N, 61.7W with a stationary front to the northeast at 12Z.
- HURDAT lists an 80 kt hurricane at 29.3N, 62.2W at 12Z.
- Microfilm shows a hurricane of 991 mb at 29.6N, 61.6W with a cold front to the northwest at 12Z.

2. Ship highlights:

- 40 kt ENE and 990 mb at 29.2N, 63.1W at 00Z (COADS).
- 45 kt ENE and 989 mb at 29.7N, 62W at 06Z (MWL).
- 30 kt SSE and 1015 mb at 26.5N, 56.9W at 12Z (COADS).

3. Aircraft highlights:

- Penetration center fix measured a central pressure of 991 mb and estimated an elliptical eye with major axis 60º-240º, major axis of 60 n mi and minor axis of 40 n mi at 29.4N, 62.3W at 0630Z (WALLET).
- Penetration center fix measured a central pressure of 991 mb, estimated surface winds of 65 kt and an elliptical eye with major axis 60º-240º, major axis of 40 n mi and minor axis of 20 n mi at 29.8N, 61.5W at 1150Z (WALLET).
- Penetration center fix measured a central pressure of 987 mb, estimated surface winds of 50 kt and an eye diameter of 40 n mi at 29.7N, 61.8W at 18Z (WALLET).
- Penetration center fix measured a central pressure of 986 mb, estimated surface winds of 65 kt and an elliptical eye with major axis 90º-270º, major axis of 80 n mi and minor axis of 50 n mi at 29.7N, 61.8W at 2217Z (WALLET).

4. Discussion:

- Reanalysis: Penetration center fixes between 2304Z on the 30th and 1150Z on the 1st indicated that the central pressure fluctuated between 988-991 mb. An intensity of 55 kt is selected between 00Z and 12Z on the 1st, down from 80 kt originally shown in HURDAT, major intensity changes. A penetration center fix at 18Z on the 1st measured a central pressure of 987 mb and estimated surface winds of 50 kt. A central pressure of 987 mb suggests maximum surface winds of 64 kt from the north of 25N pressure-wind relationship. Based on a slow forward speed of about 6 kt and a large RMW, an intensity of 60 kt is analyzed at 18Z on the 1st, down from 80 kt originally shown in HURDAT, a major intensity change. Penetration center fixes late on the 1st and early on the 2nd indicated that the movement of Inga was erratic, the storm may have been stationary for a few hours. Due to the erratic nature of the positions of the center fixes and distance of the tropical storm from land, no track changes were introduced during this time. A couple of ships reported gale-force winds. Satellite images showed that westerly shear was still impacting Inga but convection had increased over the center.

October 2:

1. Maps and old HURDAT:

- HWM analyzes a hurricane of at most 992 mb at 29.8N, 61.7W at 12Z.
- HURDAT lists an 80 kt hurricane at 28.9N, 61.6W at 12Z.
- Microfilm shows a hurricane of 989 mb at 29N, 61.5W at 12Z.

2. Ship highlights:

- 35 kt SW and 1006 mb at 27.5N, 60.3W at 00Z (micro).
- 25 kt NE and 1003 mb at 29.5N, 64.1W at 06Z (COADS).
- 25 kt NW and 999 mb at 28.2N, 62.6W at 12Z (COADS).
- 40 kt SW and 1000 mb at 26.5N, 61W at 18Z (COADS).
- 40 kt SSW and 1002 mb at 25.8N, 60.2W at 21Z (COADS).

3. Aircraft highlights:

- Penetration center fix estimated an elliptical eye with major axis 90º-270º, major axis of 80 n mi and minor axis of 40 n mi at 29.5N, 61.5W at 0535Z (WALLET).
- Penetration center fix measured a central pressure of 989 mb, estimated surface winds of 65 kt and an elliptical eye with major axis 0º-180º, major axis of 40 n mi and minor axis of 20 n mi at 28.8N, 61.6W at 1220Z (WALLET).
- Penetration center fix measured a central pressure of 987 mb, estimated surface winds of 80 kt and an elliptical eye with major axis 30º-210º, major axis of 30 n mi and minor axis of 20 n mi at 28.5N, 61.6W at 1730Z (WALLET).
- Penetration center fix measured a central pressure of 986 mb, estimated surface winds of 65 kt and an elliptical eye with major axis 0º-180º, major axis of 53 n mi and minor axis of 40 n mi at 28.5N, 61.2W at 2210Z (WALLET).

4. Discussion:

- Reanalysis: The frontal boundary that had caused Inga to move northeastward weakened and a strong ridge to the north caused the tropical cyclone to move southward. The intensity of Inga remained generally steady on the 2nd. Penetration center fixes indicated that the central pressure of the tropical storm fluctuated between 986-989 mb between 2217Z on the 1st and 1730Z on the 2nd. A central pressure of 986 mb suggests maximum surface winds of 65 kt from the north of 25N pressure-wind relationship. In part because of the large RMW, an intensity of 60 kt is selected between 00Z and 18Z on the 2nd, down from 80 kt originally shown in HURDAT, major intensity changes. A few ships reported gale-force winds on the 2nd. Satellite images continued to show westerly shear impacting the tropical cyclone, with most of the convection over the eastern quadrant.

October 3:

1. Maps and old HURDAT:

- HWM analyzes a hurricane of at most 1000 mb at 27.6N, 63.8W at 12Z.
- HURDAT lists a 70 kt hurricane at 27.6N, 63.4W at 12Z.
- Microfilm shows a hurricane of 989 mb at 27.3N, 63W at 12Z.

2. Ship highlights:

- 40 kt S and 1005 mb at 25N, 59.7W at 00Z (COADS).
- 30 kt NNE and 1004 mb at 27.1N, 64W at 06Z (COADS).
- 35 kt NE and 1002 mb at 27.6N, 65.9W at 09Z (COADS).
- 40 kt SE and 1007 mb at 25.2N, 61.3W at 12Z (COADS).

- 45 kt SSE and 1008 mb at 27.5N, 61.2W at 18Z (COADS).
- 35 kt W and 1001 mb at 25.9N, 65.6W at 21Z (COADS).

3. Aircraft highlights:

- Penetration center fix estimated an elliptical eye with major axis 40º-220º, major axis of 45 n mi and minor axis of 30 n mi at 28.1N, 61W at 06Z (WALLET).
- Penetration center fix measured a central pressure of 989 mb, estimated surface winds of 80 kt and an elliptical eye with major axis 20º-200º, major axis of 50 n mi and minor axis of 20 n mi at 27.6N, 63.4W at 1145Z (WALLET).
- Penetration center fix measured a central pressure of 990 mb, estimated surface winds of 40 kt and an elliptical eye with major axis 20º-200º, major axis of 50 n mi and minor axis of 20 n mi at 27.8N, 64.3W at 1815Z (WALLET).
- Penetration center fix measured a central pressure of 986 mb and estimated surface winds of 70 kt at 27.8N, 64.6W at 2155Z (WALLET).

4. Discussion:

- Reanalysis: Inga turned to the southwest, and later west, on the 3rd as the strong ridge to the north moved eastward. The intensity of the strong tropical storm remained steady on this date. Penetration center fixes between 2210Z on the 2nd and 1815Z on the 3rd indicated that the central pressure fluctuated between 986-990 mb. An intensity of 60 kt is selected between 00Z and 18Z on the 3rd, down from 70 kt originally shown in HURDAT, minor intensity changes. Satellite images indicated that the organization state of Inga had not changed much compared to the previous few days, still affected by westerly shear on the 3rd.

October 4:

1. Maps and old HURDAT:

- HWM analyzes a hurricane of at most 996 mb at 29.5N, 66W with a cold front to the northwest at 12Z.
- HURDAT lists a 75 kt hurricane at 28.4N, 65.7W at 12Z.
- Microfilm shows a hurricane of 980 mb at 29N, 65.6W with a cold front to the northwest at 12Z.

2. Ship highlights:

- 35 kt E and 1008 mb at 32.6N, 64.9W at 00Z (COADS).
- 45 kt E and 1004 mb at 31.3N, 65.2W at 06Z (COADS).
- 45 kt SSE and 1001 mb at 27.9N, 63W at 12Z (micro).
- 35 kt S and 1007 mb at 26.6N, 61.7W at 15Z (COADS).
- 50 kt S and 996 mb at 27.5N, 62.9W at 18Z (micro).
- 45 kt S and 1004 mb at 25.7N, 61.8W at 20Z (COADS).

3. Aircraft highlights:

- Penetration center fix measured a central pressure of 980 mb, estimated surface winds of 75 kt and an elliptical eye with major axis 90º-270º, major axis of 20 n mi and minor axis of 12 n mi at 28.4N, 65.7W at 1145Z (WALLET).
- Penetration center fix measured a central pressure of 969 mb, estimated surface winds of 90 kt and an eye diameter of 3 n mi at 29.1N, 65.1W at 1730Z (WALLET).
- Penetration center fix measured a central pressure of 968 mb, estimated surface winds of 85 kt and an elliptical eye with major axis 0º-180º, major axis of 33 n mi and minor axis of 23 n mi at 29.4N, 64.3W at 2135Z (WALLET).

4. Discussion:

- Reanalysis: Another frontal boundary approached Inga and caused the tropical cyclone to turn to the north, and later to the northeast, on the 4th. Wind shear apparently decreased on the 4th and Inga rapidly intensified. A penetration center fix measured a central pressure of 986 mb and estimated surface winds of 70 kt at 2155Z on the 3rd. A central pressure of 986 mb suggests maximum surface winds of 65 kt from the north of 25N pressure-wind relationship. An intensity of 65 kt is analyzed at 00Z on the 4th, down from 70 kt originally shown in HURDAT, a minor intensity change. Another penetration center fix measured a central pressure of 980 mb, estimated surface winds of 75 kt and an eye diameter of about 16 n mi at 1145Z on the 4th. A central pressure of 980 mb suggests maximum surface winds of 73 kt from the north of 25N pressure-wind relationship. An eye diameter of 16 n mi suggests an RMW of about 12 n mi and the climatological value is 22 n mi. Based on a slow forward speed of about 4 kt but small RMW, an intensity of 75 kt is analyzed at 12Z on the 4th, same as originally shown in HURDAT. The next penetration center fix measured a central pressure of 969 mb, estimated surface winds of 90 kt and an eye diameter of about 3 n mi at 1730Z on the 4th. A central pressure of 969 mb suggests maximum surface winds of 89 kt from the north of 25N pressure-wind relationship intensifying subset. Based on a forward speed of about 9 kt and small RMW, an intensity of 90 kt is analyzed at 18Z on the 4th, up from 80 kt originally shown in HURDAT, a minor intensity change. Satellite images indicated that Inga had become better organized with a CDO and banding features, especially over the eastern quadrant. A few ships reported gale-force winds and a ship recorded storm-force winds at 18Z on the 4th.

October 5:

1. Maps and old HURDAT:

- HWM analyzes a hurricane of at most 992 mb at 31.5N, 61W with a cold front to the north at 12Z.
- HURDAT lists a 95 kt hurricane at 31.2N, 60.7W at 12Z.
- Microfilm shows a hurricane of 964 mb at 31N, 60.5W with a cold front to the north at 12Z.

2. Ship highlights:

- 35 kt SW and 1001 mb at 27.6N, 62.4W at 00Z (micro).
- 35 kt NNE and 1005 mb at 31.9N, 67.8W at 06Z (COADS).
- 40 kt S and 1001 mb at 27.8N, 58.2W at 09Z (COADS).
- 50 kt S and 1002 mb at 27.9N, 57.5W at 12Z (COADS).
- 45 kt S and 1002 mb at 28N, 56.9W at 15Z (COADS).
- 50 kt S and 1001 mb at 27.8N, 56.9W at 18Z (COADS).
- 50 kt SSW and 1002 mb at 27.9N, 56.3W at 21Z (COADS).

3. Land highlights:

- 20 kt NE and 998 mb at Bermuda at 06Z (micro).

4. Aircraft highlights:

- Penetration center fix estimated an eye diameter of 43 n mi at 30.3N, 62.3W at 0553Z (WALLET).
- Penetration center fix measured a central pressure of 964 mb, estimated surface winds of 100 kt and an eye diameter of 5 n mi at 31N, 60.6W at 1204Z (WALLET). (However, the maximum surface winds were reported as being 50 n mi from the center and the maximum flight-level winds as 65 n mi from the center, which are no consistent with a 5-n mi wide eye.)

- Penetration center fix measured a central pressure of 964 mb and estimated surface winds of 80 kt at 32.1N, 60W at 1758Z (WALLET).
- Penetration center fix measured a central pressure of 965 mb, estimated surface winds of 120 kt and an eye diameter of 15 n mi at 32.2N, 58.5W at 21Z (WALLET). (However, the post-flight summary indicates that the maximum winds were 30-40 n mi from the center.)

5. Discussion:

- ATSR: "…before moving northeast away from the island on 5 October in front of an advancing cold front. INGA reached her maximum intensity on the 5th and was sustained by a line of convergence extending south- west to Hispaniola, which did not allow the cold air from the front to the north to penetrate the center."
- Reanalysis: Inga continued to intensify as it moved northeastward. A penetration center fix measured a central pressure of 968 mb and estimated surface winds of 85 kt at 2135Z on the 4th. An intensity of 90 kt is analyzed at 00Z on the 5th, same as originally shown in HURDAT. Another penetration center fix measured a central pressure of 964 mb, estimated surface winds of 100 kt and an RMW of about 50 n mi at 1204Z on the 5th. A central pressure of 964 mb suggests maximum surface winds of 91 kt from the north of 25N pressure-wind relationship. Based on a forward speed of about 14 kt and large RMW, an intensity of 95 kt is retained. Intensification to a major hurricane is analyzed six hours earlier than originally shown in HURDAT. A reconnaissance aircraft measured a central pressure of 964 mb at 1758Z and an intensity of 95 kt is selected at 18Z on the 5th, 5 kt less than originally shown in HURDAT. This minor change means that Inga did not become a major hurricane. Peak intensity is now 95 kt, versus 100 kt originally. A few ships reported gale and storm-force winds on the 5th. Satellite images indicated that the convective pattern of Inga had evolved with its interaction with the passing frontal boundary. Shear was still affecting the tropical cyclone and most of the convection was located over the northeastern semicircle.

October 6:

1. Maps and old HURDAT:

- HWM analyzes a hurricane of at most 992 mb at 35N, 56W with a stationary front to the northeast at 12Z.
- HURDAT lists an 80 kt hurricane at 33.6N, 56.5W at 12Z.
- Microfilm shows a hurricane of 992 mb at 34.3N, 55.7W with a cold front to the north at 12Z.

2. Ship highlights:

- 45 kt SSW and 1002 mb at 28N, 55.7W at 00Z (COADS).
- 45 kt NE and 1007 mb at 36.1N, 58.6W at 03Z (COADS).
- 50 kt S and 1004 mb at 28.2N, 53.8W at 06Z (COADS).
- 45 kt S and 1009 mb at 27.2N, 53.3W at 12Z (COADS).
- 40 kt NNE and 1011 mb at 37.6N, 58.8W at 18Z (COADS).

3. Aircraft highlights:

- Penetration center fix at 32.8N, 58.3W at 0040Z (WALLET).
- Penetration center fix measured a central pressure of 978 mb at 33.9N, 56.6W at 08Z (WALLET).
- Penetration center fix estimated surface winds of 75 kt at 34.1N, 56.1W at 1747Z (WALLET).

- Penetration center fix measured a central pressure of 983 mb, estimated surface winds of 80 kt and an eye diameter of 90 n mi at 34.1N, 55.9W at 21Z (WALLET).

4. Discussion:

- Reanalysis: The rapid intensity increase observed on the 5th was followed by a rapid intensity decrease on the 6th as reported by reconnaissance aircraft data. A penetration center fix measured a central pressure of 978 mb at 08Z on the 6th. A central pressure of 978 mb suggests maximum surface winds of 72 kt from the north of 25N pressure-wind relationship weakening subset. Based on a forward speed of about 10 kt, an intensity of 75 kt is analyzed at 06Z on the 6th, down from 90 kt originally shown in HURDAT, a major intensity change. Weakening below major hurricane intensity is analyzed at 00Z on the 6th, same as originally shown in HURDAT. Another penetration center fix measured a central pressure of 983 mb, estimated surface winds of 80 kt and an eye diameter of about 90 n mi at 21Z on the 6th. A central pressure of 983 mb suggests maximum surface winds of 69 kt from the north of 25N pressure-wind relationship and 70 kt from the north of 35N Landsea et al. pressure-wind relationship. An eye diameter of 90 n mi suggests an RMW of about 68 n mi and the climatological value is 29 n mi. Based on a slow forward speed of about 6 kt and large RMW, an intensity of 65 kt is analyzed at 18Z on the 6th, down from 80 kt originally shown in HURDAT, a major intensity change. A few ships reported gale and storm-force winds. Note that Inga may have undergone a partial extratropical transition on this date as suggested by satellite imagery.

October 7:

1. Maps and old HURDAT:

- HWM analyzes a hurricane of at most 1004 mb at 35.2N, 56W with a stationary front to the northeast at 12Z.
- HURDAT lists an 85 kt hurricane at 34.4N, 54.5W at 12Z.
- Microfilm shows a hurricane of 980 mb at 34N, 55.2W with a cold front to the northeast at 12Z.

2. Ship highlights:

- 40 kt NE and 1008 mb at 37.4N, 54.5W at 00Z (micro).
- 40 kt NE and 1006 mb at 36.5N, 54W at 06Z (COADS).
- 45 kt SSE and 1000 mb at 34.7N, 47.8W at 12Z (micro).
- 40 kt NE and 1011 mb at 37.1N, 55.3W at 15Z (COADS).
- 65 kt NE and 1000 mb at 35.3N, 53.8W at 18Z (COADS).
- 45 kt NE and 1015 mb at 36.5N, 55.5W at 21Z (COADS).

3. Aircraft highlights:

- Penetration center fix measured a central pressure of 980 mb, estimated surface winds of 100 kt and an elliptical eye with major axis 160º-340º, major axis of 30 n mi and minor axis of 10 n mi at 34.9N, 55.3W at 1025Z (WALLET).
- Penetration center fix measured a central pressure of 983 mb, estimated surface winds of 90 kt and an eye diameter of 10 n mi at 34.4N, 54.7W at 1545Z (WALLET).
- Penetration center fix measured a central pressure of 989 mb, estimated surface winds of 65 kt and an eye diameter of 45 n mi at 34.6N, 53.8W at 2145Z (WALLET).

4. Discussion:

- ATSR: "INGA continued to move northeast until the 7th and 8th when she was blocked by a large anticyclone about 600 miles to the north near 45N, 55W. This caused more erratic movement as she turned toward the east then south-southeast, almost making another complete loop."
- Reanalysis: The frontal boundary that caused Inga to accelerate northeastward during the past few days continued to weaken and its influence over the tropical cyclone decreased. The tropical storm slowed its forward speed and turned to the east later on the date. A reconnaissance aircraft measured a central pressure of 980 mb, estimated surface winds of 100 kt and an eye diameter of about 20 n mi at 1025Z on the 7th. A central pressure of 980 mb suggests a maximum surface winds of 73 kt from the north of 25N and also from the north of 35N pressure-wind relationships. An eye diameter of 20 n mi suggests an RMW of about 15 n mi and the climatological value is 29 n mi. Based on a slow forward speed of about 4 knots but small RMW, an intensity of 70 kt is analyzed at 12Z on the 7th, down from 85 kt originally shown in HURDAT, a mayor intensity change. The next penetration center fix measured a central pressure of 983 mb, estimated surface winds of 90 kt and an eye diameter of about 10 n mi at 1545Z on the 7th. A central pressure of 983 mb suggests a maximum surface winds of 69 kt from the north of 25N and 70 kt from the north of 35N pressure-wind relationships. Based on a slow forward speed of about 5 knots but small RMW, an intensity of 70 kt is analyzed at 18Z on the 7th, down from 85 kt originally shown in HURDAT, a mayor intensity change. Ships near the center of Inga registered gale-force winds and even a 65 kt report at 18Z on the 7th. Satellite images showed a compact tropical cyclone with most of the convection over the northern quadrant.

October 8:

1. Maps and old HURDAT:

- HWM analyzes a hurricane of at most 1008 mb at 34.5N, 52.4W at 12Z.
- HURDAT lists a 65 kt hurricane at 34.3N, 52.8W at 12Z.
- Microfilm shows a hurricane of 990 mb at 34.4N, 52.8W at 12Z.

2. Ship highlights:

- 40 kt NE and 1013 mb at 35.8N, 55.2W at 00Z (COADS).
- 45 kt NE and 1015 mb at 36.5N, 55.6W at 06Z (micro).
- 50 kt NE and 1010 mb at 36N, 55W at 09Z (COADS).
- 45 kt NNE and 1011 mb at 35.1N, 53.8W at 12Z (COADS).
- 50 kt NNE and 1007 mb at 34.5N, 54.5W at 18Z (COADS).

3. Aircraft highlights:

- Penetration center fix measured a central pressure of 989 mb, estimated surface winds of 55 kt and an eye diameter of 10 n mi at 34.3N, 53W at 1105Z (WALLET).
- Penetration center fix measured a central pressure of 983 mb, estimated surface winds of 75 kt and an eye diameter of 40 n mi at 34.1N, 51.9W at 2045Z (WALLET).

4. Discussion:

- Reanalysis: Inga moved slowly to the southeast as another ridge was establishing to the north. The intensity of the hurricane remained generally steady on the 8th. A reconnaissance aircraft measured a central pressure of 989 mb, estimated surface winds of 65 kt and an eye diameter of about 45 n mi at 2145Z on the 7th. A central pressure of 989 mb suggests a maximum surface winds of 61 kt from the north of 25N and 64 kt from the north of 35N pressure-wind relationships. An eye diameter of 45 n mi suggests an RMW of about 34 n mi and

the climatological value is 30 n mi. An intensity of 65 kt is analyzed at 00Z on the 8th, down from 85 kt originally shown in HURDAT, a major intensity change. Another penetration center fix measured a central pressure of 989 mb at 1150Z on the 8th and an intensity of 65 kt is analyzed at 12Z on this date, same as originally shown in HURDAT. The next penetration center fix measured a central pressure of 983 mb, estimated surface winds of 75 kt and an eye diameter of 40 n mi at 2045Z on the 8th. A central pressure of 983 mb suggests a maximum surface winds of 69 kt from the north of 25N and 70 kt from the north of 35N pressure-wind relationships. An eye diameter of 40 n mi suggests an RMW of about 30 n mi and the climatological value is 29 n mi. An intensity of 70 kt is analyzed at 18Z on the 8th, down from 75 kt originally shown in HURDAT, a minor intensity change. A few ships reported gale and storm-force winds on the 8th. Satellite images showed a small tropical cyclone with a compact CDO.

October 9:

1. Maps and old HURDAT:

- HWM analyzes a hurricane of at most 1004 mb at 34.3N, 51.2W with a weakening front to the east at 12Z.
- HURDAT lists a 75 kt hurricane at 32.7N, 51.5W at 12Z.
- Microfilm shows a hurricane of 983 mb at 33.6N, 50.6W at 12Z.

2. Ship highlights:

- 40 kt NW and 1005 mb at 33.2N, 53.2W at 00Z (COADS).
- 40 kt W and 1005 mb at 32N, 52.2W at 06Z (COADS).
- 40 kt SW and 1008 mb at 30.5N, 51.2W at 12Z (COADS).
- 40 kt WSW and 1007 mb at 30N, 49.7W at 18Z (COADS).

3. Aircraft highlights:

- Penetration center fix measured a central pressure of 986 mb, estimated surface winds of 75 kt and an elliptical eye with major axis 0º-180º, major axis of 10 n mi and minor axis of 6 n mi at 32.2N, 51.6W at 18Z (WALLET).

4. Discussion:

- Reanalysis: Inga turned to the south and slowly weakened. A penetration center fix measured a central pressure of 986 mb, estimated surface winds of 75 kt and an eye diameter of about 8 n mi at 18Z on the 9th. A central pressure of 986 mb suggests a maximum surface winds of 65 kt from the north of 25N pressure-wind relationship. An eye diameter of 8 n mi suggests an RMW of about 6 n mi and the climatological value is 29 n mi. Based on a slow forward speed of about 5 kt but small RMW, an intensity of 65 kt is analyzed at 18Z on the 9th, down from 75 kt originally shown in HURDAT, a minor intensity change. A few ships reported gale-force winds on the 9th. Satellite images showed a small tropical cyclone with a compact CDO and a hint of an eye.

October 10:

1. Maps and old HURDAT:

- HWM analyzes a tropical storm of at most 1000 mb at 30.5N, 50.4W with a stationary front to the east at 12Z.
- HURDAT lists a 60 kt tropical storm at 30.6N, 51.1W at 12Z.
- Microfilm shows a tropical storm of 994 mb at 30.5N, 50.5W at 12Z.

2. Ship highlights:

- 35 kt E and 1015 mb at 35.4N, 52.3W at 00Z (COADS).
- 25 kt S and 1004 mb at 29.7N, 49.3W at 06Z (COADS).
- 45 kt ESE and 1011 mb at 31.6N, 46.3W at 12Z (COADS).
- 35 kt ENE and 1014 mb at 34.1N, 52.8W at 18Z (COADS).

3. Aircraft highlights:

- Penetration center fix measured a central pressure of 994 mb and estimated surface winds of 45 kt at 30.5N, 50.6W at 1029Z (WALLET).
- Penetration center fix measured a central pressure of 992 mb, estimated surface winds of 65 kt and an elliptical eye with major axis 70º-250º, major axis of 20 n mi and minor axis of 10 n mi at 30.3N, 51.2W at 1815Z (WALLET).

4. Discussion:

- ATSR: "As INGA weakened to tropical storm intensity on the 10th, she started moving toward the south and southwest."
- Reanalysis: Inga continued southward on the 10th. Weakening to a tropical storm is analyzed at 00Z on the 10th based on data later on the date. A penetration center fix measured a central pressure of 994 mb and estimated surface winds of 45 kt at 1029Z on the 10th. A central pressure of 994 mb suggests maximum surface winds of 53 kt from the north of 25N pressure-wind relationship. An intensity of 55 kt is analyzed at 12Z on the 10th, down from 60 kt originally shown in HURDAT, a minor intensity change. The next penetration center fix measured a central pressure of 992 mb and estimated surface winds of 65 kt at 1815Z on the 10th. An intensity of 55 kt is selected at 18Z on the 10th, down from 60 kt originally shown in HURDAT, a minor intensity change. A few ships reported gale-force winds. Satellite images showed a small tropical storm under westerly shear, causing most of the convection to be displaced to the east.

October 11:

1. Maps and old HURDAT:

- HWM analyzes a tropical storm of at most 1004 mb at 28.8N, 52.5W with a stationary front to the east at 12Z.
- HURDAT lists a 50 kt tropical storm at 28.2N, 52.5W at 12Z.
- Microfilm shows a tropical storm of 995 mb at 28.6N, 52.5W at 12Z.

2. Ship highlights:

- 35 kt E and 1021 mb at 36N, 48.1W at 00Z (COADS).
- 25 kt NW and 1004 mb at 27.8N, 53W at 06Z (COADS).
- 25 kt NW and 1005 mb at 27N, 52.9W at 12Z (COADS).
- 55 kt SW (high wind bias) and 1008 mb at 25.6N, 51.9W at 12Z (micro).
- 35 kt E and 1013 mb at 31.6N, 51.4W at 18Z (COADS).

3. Aircraft highlights:

- Penetration center fix measured a central pressure of 998 mb and estimated surface winds of 40 kt at 28.4N, 53.1W at 1750Z (WALLET).

4. Discussion:

- Reanalysis: Inga turned to the southwest and continued to weaken. A penetration center fix measured a central pressure of 998 mb and estimated

surface winds of 40 kt at 1750Z on the 11th. A central pressure of 998 mb suggests a maximum surface winds of 47 kt from the north of 25N pressure-wind relationship. Based on a slow forward speed of about 8 kt, an intensity of 40 kt is analyzed at 18Z on the 11th, same as originally shown in HURDAT. A few ships reported gale-force winds. A ship reported 55 kt SW at 12Z on the 10th but data from nearby ships indicate that it had a high bias. Satellite images showed an exposed circulation with some convection over the eastern quadrant.

October 12:

1. Maps and old HURDAT:

- HWM analyzes a tropical storm of at most 1000 mb at 26N, 56W at 12Z.
- HURDAT lists a 35 kt tropical storm at 27N, 56W at 12Z.
- Microfilm shows a tropical storm of 998 mb at 26N, 56W at 12Z.

2. Ship highlights:

- 25 kt NW and 1000 mb at 25.7N, 56.3W at 00Z (COADS).
- 25 kt NW and 993 mb at 26N, 55.6W at 06Z (COADS).
- 35 kt NE and 1004 mb at 26.7N, 55.9W at 12Z (COADS).
- 35 kt E and 1007 mb at 27.2N, 55.2W at 15Z (COADS).
- 35 kt E and 1007 mb at 27.8N, 54.6W at 18Z (COADS).

3. Aircraft highlights:

- Penetration center fix measured a central pressure of 1001 mb and estimated surface winds of 25 kt at 26.3N, 56.4W at 1802Z (WALLET).

4. Discussion:

- ATSR: "She continued to weaken, becoming a depression again late on the 12th near 28N, 57W."
- Reanalysis: Inga continued southwestward and gradually kept weakening. A penetration center fix measured a central pressure of 1001 mb and estimated surface winds of 25 kt at 1802Z on the 12th. A central pressure of 1001 mb suggests a maximum surface winds of 42 kt from the north of 25N pressure-wind relationship. Based on a slow forward speed of about 8 kt, an intensity of 35 kt is analyzed at 18Z on the 12th, same as originally shown in HURDAT. A couple of ships reported gale-force winds on the 12th. Satellite images showed an exposed circulation with meager convection to the east of the center.

October 13:

1. Maps and old HURDAT:

- HWM analyzes a closed low pressure of at most 1004 mb at 25.5N, 60W at 12Z.
- HURDAT lists a 30 kt tropical depression at 25.8N, 58.8W at 12Z.
- Microfilm shows a tropical cyclone of 1001 mb at 26.8N, 59W at 12Z.

2. Ship highlights:

- 35 kt SE and 1013 mb at 28.7N, 53.4W at 00Z (COADS).
- 30 kt SE and 1011 mb at 25.6N, 54.6W at 12Z (COADS).

3. Aircraft highlights:

- Penetration center fix measured a central pressure of 1003 mb, estimated surface winds of 25 kt and an eye diameter of 75 n mi at 25.8N, 60.3W at 1910Z (WALLET).

4. Discussion:

- Reanalysis: The weak tropical storm turned to the west. A penetration center fix measured a central pressure of 1003 mb and estimated surface winds of 25 kt at 1910Z on the 13th. A central pressure of 1003 mb suggests a maximum surface winds of 38 kt from the north of 25N pressure-wind relationship. An intensity of 35 kt is analyzed at 18Z on the 13th, up from 30 kt originally shown in HURDAT, a minor intensity change. Satellite images indicated that Inga had changed little in organization compared to the past few days. The circulation remained exposed with some convection over the eastern quadrant.

October 14:

1. Maps and old HURDAT:

- HWM analyzes a closed low pressure of at most 1012 mb at 26N, 61W at 12Z.
- HURDAT lists a 25 kt tropical depression at 25.9N, 61W at 12Z.
- Microfilm shows a tropical disturbance at 24N, 58.5W at 12Z.

2. Discussion:

- ATSR: "INGA finally dissipated on 14 October about 375 miles southeast of Bermuda near her first loop, almost completing the large loop pattern and providing a most unusual track for a tropical cyclone since she approached the same approximate Position on three different occasions."
- Reanalysis: Weakening to a tropical depression is analyzed at 00Z on the 14th, eighteen hours later than originally shown in HURDAT. Ships near the center of Inga reported winds below gale-force intensity. Satellite images indicated that the tropical cyclone remained exposed with some convection displaced to the southeast of the center.

October 15:

1. Maps and old HURDAT:

- HWM analyzes a spot low pressure at 26.5N, 61W at 12Z.
- HURDAT lists a 25 kt tropical depression at 26.1N, 61.6W at 00Z (last position).
- Microfilm shows a tropical disturbance at 25.6N, 60.5W at 12Z.

2. Discussion:

- Reanalysis: The weak tropical depression was almost stationary on the 15th. The synoptic observations at 18Z on this date indicated that the closed low-level circulation of Inga had dissipated, thus the last position is analyzed at 12Z on the 15th, twelve hours later than originally shown in HURDAT. Satellite images showed a small area of convection. Hurricane Inga lasted 25.25 days, making it the 3rd longest lasting tropical cyclone ever observed in the Atlantic, behind the San Ciriaco hurricane of 1899 and Hurricane Ginger, 1971. Inga is the second longest lasting hurricane to be reanalyzed up to date.

October 16:

1. Maps and old HURDAT:

- HWM does not analyze any feature of interest at 12Z.
- Microfilm shows a tropical disturbance at 26N, 61W at 12Z.

Date	Original HURDAT Central Pressure	Evidence	Changes
Sep 21 12Z	1001 mb	Penetration center fix: 1004 mb at 15Z on Sep 21st	1004 mb
Sep 22 12Z	1007 mb	Penetration center fix: 1007 mb at 1145Z on Sep 22nd	Retained
Sep 22 18Z		Penetration center fix: 1007 mb at 1950Z on Sep 22nd	1007 mb
Sep 23 00Z		Penetration center fix: 1006 mb at 2340Z on Sep 22nd	1006 mb
Sep 23 12Z	1006 mb	Penetration center fix: 1006 mb at 1130Z on Sep 23rd	Retained
Sep 23 18Z		Penetration center fix: 1007 mb at 1558Z on Sep 23rd	1007 mb
Sep 24 00Z		Penetration center fix: 1006 mb at 2130Z on Sep 23rd	1006 mb
Sep 24 12Z	1007 mb	Penetration center fix: 1007 mb at 1130Z on Sep 24th	Retained
Sep 26 12Z		Ship: 5 kt NW and 1009 mb at 12Z on Sep 26th	1008 mb
Sep 27 18Z		Ship: 10 kt SW and 1004 mb at 18Z on Sep 27th	1003 mb
Sep 28 12Z	1000 mb	Ship: 35-40 kt SE and 1004 mb at 12Z on Sep 28th	Retained
Sep 29 12Z	992 mb	Penetration center fix: 992 mb at 1230Z on Sep 29th	
Sep 29 18Z		Penetration center fix: 991 mb at 1740Z on Sep 29th	991 mb
Sep 30 00Z		Penetration center fix: 994 mb at 0217Z on Sep 30th	994 mb
Sep 30 06Z		Penetration center fix: 990 mb at 0546Z on Sep 30th	990 mb
Sep 30 12Z	990 mb	Penetration center fix: 994 mb at 1230Z on Sep 30th	994 mb
Sep 30 18Z		Penetration center fix: 989 mb at 18Z on Sep 30th	989 mb
Oct 01 00Z		Penetration center fix: 988 mb at 2304Z on Sep 30th	988 mb
Oct 01 06Z		Penetration center fix: 991 mb at 0630Z on Oct 1st	991 mb
Oct 01 12Z	990 mb	Penetration center fix: 991 mb at 1150Z on Oct 1st	991 mb
Oct 01 18Z		Penetration center fix: 987 mb at 18Z on Oct 1st	987 mb
Oct 02 00Z		Penetration center fix: 986 mb at 2217Z on Oct 1st	986 mb
Oct 02 12Z	987 mb	Penetration center fix: 989 mb at 1220Z on Oct 2nd	989 mb
Oct 02 18Z		Penetration center fix: 989 mb at 1730Z on Oct 2nd	987 mb
Oct 03 00Z		Penetration center fix: 986 mb at 2210Z on Oct 2nd	986 mb
Oct 03 12Z	989 mb	Penetration center fix: 989 mb at 1145Z on Oct 3rd	Retained
Oct 03 18Z		Penetration center fix: 990 mb at 1815Z on Oct 3rd	990 mb
Oct 04 00Z		Penetration center fix: 986 mb at 2155Z on Oct 3rd	986 mb
Oct 04 12Z	980 mb	Penetration center fix: 980 mb at 1145Z on Oct 4th	Retained
Oct 04 18Z		Penetration center fix: 969 mb at 1730Z on Oct 4th	969 mb
Oct 05 00Z		Penetration center fix: 968 mb at 2135Z on Oct 4th	968 mb
Oct 05 12Z	964 mb	Penetration center fix: 964 mb at 1204Z on Oct 5th	Retained
Oct 05 18Z		Penetration center fix: 964 mb at 1758Z on Oct 5th	964 mb
Oct 06 06Z		Penetration center fix: 978 mb at 08Z on Oct 6th	978 mb

Oct 06 12Z	980 mb	No reconnaissance aircraft penetration center fix or ships near the center at or around 12Z on Oct 6th	Removed
Oct 06 18Z		Penetration center fix: 983 mb at 21Z on Oct 6th	983 mb
Oct 07 12Z	981 mb	Penetration center fix: 980 mb at 1025Z on Oct 7th	980 mb
Oct 07 18Z		Penetration center fix: 983 mb at 1545Z on Oct 7th	983 mb
Oct 08 00Z		Penetration center fix: 989 mb at 2145Z on Oct 7th	989 mb
Oct 08 12Z	988 mb	Penetration center fix: 989 mb at 1105Z on Oct 8th	989 mb
Oct 08 18Z		Penetration center fix: 983 mb at 2045Z on Oct 8th	983 mb
Oct 09 12Z	985 mb	No reconnaissance aircraft penetration center fix or ships near the center at or around 12Z on Oct 6th	Removed
Oct 09 18Z		Penetration center fix: 986 mb at 18Z on Oct 9th	986 mb
Oct 10 12Z	993 mb	Penetration center fix: 994 mb at 1029Z on Oct 10th	994 mb
Oct 10 18Z		Penetration center fix: 994 mb at 1815Z on Oct 10th	992 mb
Oct 11 12Z	998 mb	Penetration center fix: 998 mb at 1750Z on Oct 11th	Removed
Oct 11 18Z			998 mb
Oct 12 12Z	1001 mb	Penetration center fix: 1001 mb at 1802Z on Oct 12th	Removed
Oct 12 18Z			1001 mb
Oct 13 12Z	1003 mb	Penetration center fix: 1003 mb at 1910Z on Oct 13th	Removed
Oct 13 18Z			1003 mb
Oct 14 12Z	1008 mb	No reconnaissance aircraft penetration center fix or ships near the center at or around 12Z on Oct 6th	Removed

Sources: NHC microfilm maps, the Historical Weather Maps series, the COADS ship database, Monthly Weather Review, Navy reconnaissance book, Mariners Weather Log, Satellite images from NCDC, and NHC Storm Wallets.

Unnamed – AL211969 – 2021 Revisions

Green indicates wind changes of 15 kt or greater
Blue indicates lat/long changes greater than 1°
Red indicates a new entry
Yellow indicates a deletion

Unnamed Hurricane [September 21-29, 1969]

```
46350 09/21/1969 M= 6 21 SNBR= 987 NOT NAMED   XING=0 SSS=0
46350 09/21/1969 M= 9 21 SNBR= 987 NOT NAMED   XING=0 SSS=0
                     *

46355 09/21*  0   0   0    0*  0   0   0    0S340 710  30 1010S341 705  35    0*
46355 09/21*  0   0   0    0*  0   0   0    0E340 720  40    0E341 710  45    0*
                                             *    ***  **    **    ***  **

46360 09/22S342 700  40 1007S343 695  45    0S345 690  45 1002S347 685  50    0*
46360 09/22E342 700  45    0E343 692  45    0S345 685  45  995S347 677  50    0*
           *         **    **    ***              ***      ***     ***

46365 09/23S350 680  50  995S352 675  50    0S355 670  55  992S359 668  55    0*
46365 09/23S350 672  50  994S352 668  50    0S355 666  55  992S358 664  55  990*
                ***      ***     ***              ***          *** ***      ***
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46370 09/24S363 665  60  990S367 663  60    0*370 660  65  987*375 657  65    0*
46370 09/24S362 662  60    0S367 660  60    0*375 657  65    0*384 650  65    0*
                ***        *     ***          *** ***        * *** ***

46375 09/25*385 650  65  985*402 628  65    0*420 600  65  985*434 579  65    0*
46375 09/25*393 641  65  987*403 625  65    0*416 603  65    0*429 580  65    0*
            *** ***      *** *** ***          *** ***        * *** ***

46380 09/26*445 560  65    0*  0   0   0    0*  0   0   0    0*  0   0   0    0*
46380 09/26*441 560  65    0*454 538  65    0E470 510  60    0E492 470  60    0*
            ***              *** ***  **     **** ***  **     **** ***  **
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(September 27th through 29th are added to HURDAT)

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46385 09/27E513 420  55    0E533 360  55    0E550 300  55    0E567 240  55    0*
46390 09/28E584 185  60    0E597 135  65    0E605 085  70    0E612 033  70    0*
46395 09/29E6203580  70    0E6333525  70    0E6503470  65    0E6703420  55    0*
46400 HR
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Significant Revisions:

1. Extratropical phase added between September 21st at 12Z and 22nd at 06Z based on synoptic and satellite data.
2. Track extended 3 days based on synoptic observations.

Daily Metadata:

September 20:

1. Maps and old HURDAT:

- HWM and microfilm shows a stationary frontal boundary extending over the western Atlantic at 12Z.
- HURDAT does not list an organized system on this date.

2. Discussion:

- Reanalysis: HWM and microfilm maps indicated that a stationary frontal boundary was located off the southeast coast of the United States. Satellite images showed a large area of disorganized convection along the frontal boundary.

September 21:

1. Maps and old HURDAT:

- HWM analyzes an extratropical cyclone of at most 1016 mb at 34N, 72W at 12Z.
- HURDAT lists a 30 kt subtropical depression at 34N, 71W at 12Z (first position).
- Microfilm shows an extratropical cyclone of at most 1014 mb at 34.5N, 71.5W at 12Z.

2. Ship highlights:

- 40 kt NE and 1016 mb at 35.7N, 70.9W at 12Z (COADS).
- 45 kt ENE and 1015 mb at 35.1N, 72.2W at 15Z (COADS).
- 40 kt E and 1016 mb at 36.2N, 69W at 18Z (COADS).

3. Discussion:

- Reanalysis: Synoptic observations indicated that an area of low pressure gradually developed between the Outer Banks of North Carolina and Bermuda. By 12Z on the 21st, a surface circulation had formed, although it is uncertain if it was closed or was still a trough at this time. Nonetheless, the first

position is analyzed at 12Z on the 21st based on the ship observations, same as originally shown in HURDAT. A few ships reported gale-force winds, including 40 kt at 12Z and 45 kt at 15Z on the 21st. Thus, an intensity of 40 kt is analyzed at 12Z on the 21st, up from 30 kt kt originally in HURDAT, a minor intensity change. The original HURDAT initiated the system as a subtropical cyclone, but ship and satellite data indicated that it had the characteristics of an extratropical cyclone, especially the elongated circulation. Thus the system is begun as an extratropical cyclone instead of subtropical.

September 22:

1. Maps and old HURDAT:

- HWM analyzes an occluded cyclone of at most 1000 mb at 34.5N, 69W at 12Z.
- HURDAT lists a 45 kt subtropical storm at 34.5N, 69W at 12Z.
- Microfilm shows an occluded cyclone of at most 1004 mb at 34.5N, 68.5W at 12Z.

2. Ship highlights:

- 35 kt SE and 1013 mb at 36.2N, 68.8W at 00Z (COADS).
- 35 kt E and 1012 mb at 36N, 66.8W at 06Z (COADS).
- 35 kt SW and 999 mb at 34.2N, 68.6W at 12Z (COADS).
- 45 kt E and 1003 mb at 35.9N, 65.7W at 12Z (COADS).
- 40 kt E and 1006 mb at 36.8N, 66.7W at 18Z (COADS).

3. Discussion:

- Reanalysis: The extratropical cyclone moved generally eastward and gradually acquired some tropical characteristics. Satellite images indicated that the cyclone had occluded and had an organized area of convection over its center. Synoptic data at 12Z on the 22nd showed that surface circulation had become better defined, more symmetric, and gale-force winds were occurring in the southern quadrant, about 30 n mi from the center. Transition to a subtropical storm is analyzed at 12Z on the 22nd.

September 23:

1. Maps and old HURDAT:

- HWM analyzes an occluded cyclone of at most 996 mb at 35.5N, 69W at 12Z.
- HURDAT lists a 55 kt subtropical storm at 35.5N, 67W at 12Z.
- Microfilm shows an occluded cyclone of at most 996 mb at 35.5N, 67W at 12Z.

2. Ship highlights:

- 40 kt E and 1006 mb at 37.4N, 66W at 00Z (COADS).
- 35 kt NE and 998 mb at 35.5N, 67.4W at 00Z (micro).
- 35 kt NW and 998 mb at 34N, 69W at 06Z (COADS).
- 35 kt NW and 996 mb at 34.8N, 69W at 12Z (COADS).
- 35 kt N and 994 mb at 35.6N, 69.1W at 18Z (COADS).

3. Discussion:

- Reanalysis: The subtropical cyclone continued to become better organized on the 23rd as it slowly moved to the northeast. Satellite images showed a very compact cyclone, with a small CDO, in the middle of a large circulation, remnant of its extratropical past. A few ships reported gale-force winds. The analyzed intensity is not changed from the original HURDAT based on the likely small RMW of the subtropical cyclone and its appearance on satellite images.

September 24:

1. Maps and old HURDAT:

- HWM analyzes a closed low pressure of at most 992 mb at 37N, 66.5W with a frontal boundary to the northwest at 12Z.
- HURDAT lists a 65 kt hurricane at 37N, 66W at 12Z.
- Microfilm shows a closed low pressure of at most 996 mb at 36N, 66W at 12Z.

2. Ship highlights:

- 30 kt NE and 995 mb at 36.9N, 69.1W at 00Z (COADS).
- 20 kt E and 996 mb at 37.7N, 66.9W at 06Z (COADS).
- 20 kt E and 992 mb at 37.3N, 65.8W at 12Z (COADS).
- 35 kt SE and 992 mb at 39.1N, 64.5W at 18Z (COADS).
- 45 kt S and 999 mb at 38.8N, 63.4W at 21Z (micro).

3. Discussion:

- Reanalysis: Synoptic observations indicated that all frontal boundaries associated with the subtropical cyclone had dissipated by early on the 24th. Satellite images showed a very well-organized cyclone with a small CDO and an eye. Transition to a tropical cyclone is analyzed at 12Z on the 24th, same as originally shown in HURDAT. It is also analyzed that it became a hurricane at this time, same as originally shown in HURDAT, mostly based on its appearance on satellite images since the strongest winds reported by ships on this date were 45 kt at 21Z. Thus, the exact timing that the cyclone became a hurricane is uncertain. 65 kt is the peak analyzed intensity of this hurricane, same as originally shown in HURDAT.

September 25:

1. Maps and old HURDAT:

- HWM analyzes a closed low pressure of at most 996 mb at 43N, 61.5W with a frontal boundary to the northwest at 12Z.
- HURDAT lists a 65 kt hurricane at 42N, 60W at 12Z.
- Microfilm shows a closed low pressure of at most 1000 mb at 42N, 60W with a frontal boundary to the northwest at 12Z.

2. Ship highlights:

- 35 kt SW and 996 mb at 38.8N, 63.4W at 00Z (COADS).
- 25 kt NNW and 990 mb at 39.8N, 65.5W at 00Z (COADS).
- 35 kt SSW and 1000 mb at 39.1N, 62W at 03Z (micro).
- 25 kt W and 995 mb at 40N, 62.7W at 06Z (COADS).
- 25 kt SSW and 999 mb at 40.6N, 60.5W at 12Z (COADS).
- 20 kt NE and 994 mb at 43.1N, 58.5W at 18Z (COADS).

3. Discussion:

- Reanalysis: The hurricane accelerated to the northeast ahead of a frontal boundary. Satellite images showed a well-organized and compact CDO, but slightly larger than in the past two days. A few ships reported gale-force winds.

September 26:

1. Maps and old HURDAT:

- HWM analyzes an closed low pressure of at most 996 mb at 47N, 51W with a frontal boundary just to the west at 12Z.

- HURDAT lists a 65 kt hurricane at 44.5N, 56W at 00Z (last position).

2. Ship highlights:
- 40 kt S and 993 mb at 44N, 54.5W at 00Z (COADS).
- 35 kt SW and 1000 mb at 44N, 53.1W at 06Z (COADS).
- 40 kt SSE and 1003 mb at 46.7N, 47.5W at 12Z (MWL).
- 50 kt SE and 1001 mb at 48.8N, 44.7W at 18Z (COADS).

3. Discussion:
- Reanalysis: The last position in HURDAT was at 00Z on the 26th as a 65 kt hurricane about 120 n mi south of Newfoundland. Ship data indicated that it actually continued northeastward for a couple more days. The hurricane passed about 40 n mi southeast of Newfoundland early on the 26th as it was becoming an extratropical cyclone. Environment Canada indicated that this system caused no effects on the Atlantic Provinces. Synoptic observations at 12Z on the 26th indicated that the cyclone had become less isothermal, acquiring extratropical characteristics. Transition to an extratropical cyclone is analyzed at 12Z on the 26th. Based on the synoptic observations, it is analyzed that the winds associated with the extratropical cyclone weakened below hurricane intensity at 12Z on the 26th.

September 27:

1. Maps and old HURDAT:
- HWM analyzes an extratropical cyclone of at most of 1000 mb at 56N, 32W at 12Z.

2. Ship highlights:
- 40 kt SW and 1002 mb at 49N, 42.3W at 00Z (COADS).
- 40 kt SSW and 1011 mb at 50.8N, 33.9W at 06Z (COADS).
- 40 kt SW and 1003 mb at 53.3N, 30.1W at 12Z (COADS).
- 40 kt SW and 1012 mb at 51.4N, 25.6W at 18Z (COADS).

3. Discussion:
- Reanalysis: The strong extratropical cyclone kept moving northeastward at a fast-forward speed and a few ships reported gale-force winds.

September 28:

1. Maps and old HURDAT:
- HWM analyzes an extratropical cyclone of at most of 976 mb at 61N, 5W at 12Z.

2. Ship highlights:
- 40 kt NE and 990 mb at 58.9N, 19.5W at 00Z (COADS).
- 45 kt N and 993 mb at 58.8N, 19.6W at 03Z (COADS).
- 50 kt SW and 976 mb at 57.6N, 14W at 06Z (COADS).
- 60 kt SW and 990 mb at 56.5N, 8.5W at 09Z (COADS).
- 65 kt W and 996 mb at 56.6N, 7.5W at 12Z (COADS).
- 70 kt N and 987 mb at 61N, 5.9W at 18Z (COADS).

3. Discussion:
- Reanalysis: Early on the 28th, the extratropical cyclone passed south of Iceland and around midday, it passed between the Faroe Islands and Scotland. Ship observations indicate that the system intensified over the northeast Atlantic and it is analyzed to have regained hurricane-force winds at 06Z on

the 28th. A few ships reported gale and storm-force winds on this date and also a report of 70 kt at 18Z.

September 29:

1. Maps and old HURDAT:

- HWM analyzes an extratropical cyclone of at most of 976 mb at 65N, 13W at 12Z.

2. Ship highlights:

- 50 kt NW and 974 mb at 61.1N, 1W at 00Z (COADS).
- 70 kt WSW and 989 mb at 58.9N, 3.5E at 03Z (COADS).
- 60 kt WNW and 998 mb at 56.5N, 3.2E at 06Z (COADS).
- 50 kt WNW and 1008 mb at 56.8N, 6.8E at 12Z (COADS).
- 45 kt SW and 1006 mb at 56.1N, 17E at 18Z (COADS).

3. Discussion:

- Reanalysis: The intense extratropical cyclone reached the coast of Norway around 09Z on the 29th. A few ships, especially early on the date, reported storm and hurricane-force winds associated with this system. After reaching northern Europe, the extratropical cyclone interacted with another extratropical cyclone. HWM indicates that the systems had merged on the 30th and due to its geographical position, it is difficult to determine when it occurred. Thus, the last position is analyzed at 18Z on the 29th.

September 30:

1. Maps and old HURDAT:

- HWM analyzes an elongated circulation, possibly associated with the merging of the extratropical cyclone we had been following and another extratropical cyclone, over northern Europe at 12Z.

2. Ship highlights:

- 45 kt NNW and 1008 mb at 60.4N, 20.7E at 00Z (COADS).

Date	Original HURDAT Central Pressure	Evidence	Changes
Sep 21 12Z	1010 mb	No ship data near the center to determine the central pressure of the cyclone	Removed
Sep 22 00Z	1007 mb		
Sep 22 12Z	1002 mb	Ship: 35 kt SW and 999 mb at 12Z	995 mb
Sep 23 00Z	995 mb	Ship: 35 kt NE and 998 mb at 00Z	994 mb
Sep 23 12Z	992 mb	Ship: 35 kt NW and 996 mb at 12Z	Retained
Sep 23 18Z		Ship: 35 kt N and 994 mb at 18Z	990 mb
Sep 24 00Z	990 mb	No ship data near the center to determine the central pressure of the cyclone	Removed
Sep 24 12Z	987 mb		
Sep 25 00Z	985 mb	Ship: 25 kt NNW and 990 mb at 00Z	987 mb
Sep 25 12Z	985 mb	No ship data near the center to determine the central pressure of the cyclone	Removed

Sources: NHC microfilm maps, the Historical Weather Maps series, the COADS ship database, Monthly Weather Review, Mariners Weather Log, Satellite images from NCDC, and NHC Storm Wallets.

Unnamed – AL221969 – 2021 Revisions

Green indicates wind changes of 15 kt or greater
Blue indicates lat/long changes greater than 1°
Red indicates a new entry
Yellow indicates a deletion

Unnamed Tropical Storm [September 23-30, 1969]

```
46385 09/24/1969 M= 7 22 SNBR= 988 NOT NAMED   XING=0 SSS=0
46385 09/23/1969 M= 8 22 SNBR= 988 NOT NAMED   XING=0 SSS=0
         **         *

(September 23rd is new to HURDAT)
46390 09/23*  0   0   0    0*  0   0   0    0E405 350  35    0E395 350  35    0*

46395 09/24*  0   0   0    0*  0   0   0    0S365 350  30 1005S355 357  30    0*
46395 09/24E385 350  35    0E375 350  35    0E365 352  35    0E357 357  35 1004*
           **** ***  **     **** ***  **     *    ***  **    * ***      ** ****

46400 09/25S350 365  30    0S350 376  30    0S350 385  35 1003S351 389  40    0*
46400 09/25S352 365  40    0S350 373  40 1004S350 380  40    0S351 386  40 1005*
            ***      **          ***  ** ****     ***  **    *     ***     ****

46405 09/26S352 392  45    0*353 396  50    0*355 400  50  997*360 400  50    0*
46405 09/26S352 390  45    0*353 393  50    0*355 395  50    0*360 396  50    0*
                ***              ***              ***        *     ***

46410 09/27*365 395  55    0*370 387  60    0*375 380  60  990*382 375  60    0*
46410 09/27*365 397  55    0*370 397  60    0*375 397  60    0*381 397  60    0*
                ***              ***              ***        * *** ***

46415 09/28*390 372  60    0*400 370  60    0*410 370  60  990*416 373  60    0*
46415 09/28*387 397  60    0*394 398  60    0*400 399  60    0*406 401  60    0*
            *** ***          *** ***          *** ***        * *** ***

46420 09/29*422 380  60    0*428 395  60    0*435 410  60  990*448 414  55    0*
46420 09/29*412 404  60    0*418 407  60    0*425 410  60    0*435 412  55    0*
            *** ***          *** ***          ***            * *** ***

46425 09/30*470 410  50    0*  0   0   0    0*  0   0   0    0*  0   0   0    0*
46425 09/30*452 410  50    0*  0   0   0    0*  0   0   0    0*  0   0   0    0*
            ***

46430 TS
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Significant Revisions:

1. Track began one day earlier as an extratropical cyclone based on synoptic observations.
2. Major track changes introduced between September 27th at 12Z and the 30th at 00Z based on synoptic observations.
3. Central pressures were in the original HURDAT at 12Z and have been removed, and a few other central pressures were added based on synoptic observations.

Daily Metadata:

September 21:

1. Maps and old HURDAT:

- HWM analyzes a frontal boundary over the central north Atlantic at 12Z.
- HURDAT does not list an organized system on this date.
- Microfilm shows an extratropical cyclone of at most 1016 mb at 40N, 38W at 12Z.

2. Discussion:

- Reanalysis: Satellite and synoptic observations showed a frontal boundary over the north central Atlantic on the 21st. Surface data indicated that a surface circulation had not developed on this date.

September 22:

1. Maps and old HURDAT:

- HWM analyzes an extratropical cyclone of at most 1012 mb at 42.5N, 35W at 12Z.
- HURDAT does not list an organized system on this date.
- Microfilm shows an extratropical cyclone of at most 1012 mb at 41.2N, 35W at 12Z.

2. Ship highlights:

- 20 kt S and 1005 mb at 41.3N, 35.2W at 18Z (COADS).

3. Discussion:

- Reanalysis: Satellite images showed an extratropical cyclone forming along the frontal boundary. Synoptic observations are sparse and it is difficult to determine if a closed low level circulation developed on this date.

September 23:

1. Maps and old HURDAT:

- HWM analyzes an occluded cyclone of at most 1004 mb at 41N, 35W at 12Z.
- HURDAT does not list an organized system on this date.
- Microfilm shows an occluded cyclone of at most 1004 mb at 40.5N, 34.5W at 12Z.

2. Ship highlights:

- 45 kt N and 1005 mb at 40.6N, 36.4W at 00Z (COADS).
- 45 kt N (high bias) and 1010 mb at 39.7N, 37.8W at 06Z (COADS).
- 25 kt NW and 999 mb (low bias) at 39.7N, 35.5W at 12Z (COADS).
- 35 kt NW and 1013 mb at 38.7N, 39.4W at 12Z (COADS).
- 35 kt NNW and 1007 mb at 38.9N, 37.5W at 18Z (COADS).

3. Discussion:

- Reanalysis: Ship data indicated that a closed low level circulation had developed at 12Z on the 23rd as the extratropical cyclone developed. The first position is analyzed at 12Z on the 23rd, one day earlier than originally shown in HURDAT, as an extratropical cyclone. A couple of ships reported gale-force winds on the 23rd, thus the initial intensity estimate is 35 kt.

September 24:

4. Maps and old HURDAT:

- HWM analyzes an occluded cyclone of at most 1008 mb at 37N, 35.5W at 12Z.

- HURDAT lists a 30 kt subtropical depression at 36.5N, 35W at 12Z (first position).
- Microfilm shows an occluded cyclone of at most 1008 mb at 36.5N, 35W at 12Z.

5. Ship highlights:
- 35 kt N and 1010 mb at 39.5N, 37.6W at 00Z (COADS).
- 35 kt W at 35.9N, 35.3W at 06Z (COADS).
- 35 kt WNW at 35.9N, 35.8W at 09Z (COADS).
- 35 kt W and 1010 mb at 34.5N, 35.8W at 12Z (COADS).
- 35 kt NW at 35.7N, 36.8W at 15Z (COADS).
- 35 kt NNW at 35.7N, 37.5W at 18Z (COADS).
- 40 kt NW at 35.7N, 37.8W at 21Z (COADS).

6. Discussion:
- Reanalysis: The cyclone moved southward on this date. Satellite images showed that the frontal boundaries associated with this system had continued to weaken and some convection had developed over the southeastern semicircle. A few ships reported gale-force winds on the 24th and an intensity of 35 kt is analyzed between 00Z and 18Z.

September 25:

1. Maps and old HURDAT:
- HWM analyzes a closed low pressure of at most 1008 mb at 35N, 38.5W at 12Z.
- HURDAT lists a 35 kt subtropical storm at 35N, 38.5W at 12Z.
- Microfilm shows a closed low pressure of at most 1008 mb at 35N, 38W at 12Z.

2. Ship highlights:
- 35 kt NE and 1014 mb at 37.5N, 38.7W at 00Z (COADS).
- 35 kt NW at 35.2N, 38.2W at 03Z (COADS).
- 35 kt NE and 1014 mb at 37.4N, 37.6W at 06Z (COADS).
- 35 kt N and 1015 mb at 36.6N, 41.6W at 18Z (COADS).

3. Discussion:
- Reanalysis: Synoptic observations showed that the temperature gradient had dissipated by early on the 24th and the RMW was about 150 n mi, while the convection became organized by early on the 25th. Thus, it is analyzed at 00Z on the 25th to have become a subtropical cyclone, twelve hours later than originally shown in HURDAT. On the 25th, the subtropical storm turned to the west and continued to become better organized. Synoptic observations and satellite images suggest that the frontal boundaries had dissipated and convection had continued to increase over the center. Ship data reported a few gale-force winds.

September 26:

1. Maps and old HURDAT:
- HWM analyzes a closed low pressure of at most 1012 mb at 35.5N, 42W at 12Z.
- HURDAT lists a 50 kt tropical storm at 35.5N, 40W at 12Z.
- Microfilm shows a closed low pressure of at most 1012 mb at 35N, 39.5W at 12Z.

2. Ship highlights:
- 30 kt NNE and 1013 mb at 36.5N, 41.2W at 00Z (COADS).

- 35 kt ESE and 1022 mb at 39N, 33W at 06Z (COADS).
- 30 kt ESE and 1014 mb at 37.1N, 38.3W at 12Z (COADS).
- 30 kt SE and 1017 mb at 34.1N, 36.1W at 18Z (COADS).

3. Discussion:

- Reanalysis: Satellite images indicated that the convective structure of the cyclone had continued to improve and a banding feature had developed about 2/3 around the center. Thus, transition to a tropical storm is analyzed at 06Z on the 26th, same as originally shown in HURDAT. Ship data near the center was sparse on the 26th and the wind reports were mostly below gale intensity. Satellite images would suggest that the system had a small RMW and based on the increase in organization, an increase in intensity is analyzed on this date, same as originally shown in HURDAT.

September 27:

1. Maps and old HURDAT:

- HWM analyzes a closed low pressure of at most 1012 mb at 38N, 41W with a frontal boundary to the northwest at 12Z.
- HURDAT lists a 60 kt tropical storm at 37.5N, 38W at 12Z.
- Microfilm shows a closed low pressure of at most 1012 mb at 38N, 39W at 12Z.

2. Ship highlights:

- 30 kt SSW and 1013 mb at 36N, 37.7W at 00Z (COADS).
- 30 kt E and 1012 mb at 39.5N, 38.4W at 06Z (COADS).
- 30 kt SE and 1016 mb 40.4N, 36.3W at 18Z (COADS).

3. Discussion:

- Reanalysis: Satellite images on the 27th suggested that the tropical storm had not become any better organized. The original intensities were retained, though there is little data in the inner core to verify that these are reasonable.

September 28:

1. Maps and old HURDAT:

- HWM analyzes a closed low pressure of at most 1012 mb at 40N, 40W with a frontal boundary just to the northwest at 12Z.
- HURDAT lists a 60 kt tropical storm at 41N, 37W at 12Z.
- Microfilm shows a closed low pressure of at most 1012 mb at 39N, 39.5W with a frontal boundary to the northwest at 12Z.

2. Ship highlights:

- 30 kt N and 1018 mb at 39.6N, 45.9W at 00Z (COADS).
- 30 kt N and 1015 mb at 41.5N, 41.7W at 12Z (COADS).

3. Discussion:

- Reanalysis: Satellite images on the 28th indicated that the tropical storm had become much better organized, developing a compact CDO and maybe an eye. An intensity of 60 kt is analyzed at 12Z on the 28th, same as originally shown in HURDAT. 60 kt is also the peak intensity of this tropical storm. Nonetheless, based on its satellite appearance, it is possible that it reached hurricane intensity on this date. Ship data near the center was scarce and the highest reported winds were below gale intensity.

September 29:

1. Maps and old HURDAT:

- HWM analyzes a closed low pressure of at most 1012 mb at 42.5N, 41.5W with a weakening frontal boundary to the northwest at 12Z.
- HURDAT lists a 60 kt tropical storm at 43.5N, 41W at 12Z.
- Microfilm shows a closed low pressure of at most 1012 mb at 42N, 42W at 12Z.

2. Ship highlights:

- 30 kt SE and 1018 mb at 43.2N, 37.6W at 00Z (COADS).

3. Discussion:

- Reanalysis: Satellite images indicated that the tropical storm remained well organized with a compact CDO and possibly an eye as a strong frontal boundary approached from the west. An intensity of 60 kt is analyzed between 00Z and 12Z on the 29th, same as originally shown in HURDAT.

September 30:

1. Maps and old HURDAT:

- HWM analyzes a spot low pressure at 51N, 42W with a strong extratropical cyclone to the west at 12Z.

2. Discussion:

- Reanalysis: Synoptic observations at 06Z on the 30th indicated that the surface circulation of the tropical storm had dissipated as a strong extratropical cyclone intensified to the northwest. Thus, the last position is analyzed at 00Z on the 30th, same as originally shown in HURDAT.

October 1:

1. Maps and old HURDAT:

- HWM analyzes a strong extratropical cyclone near 55N, 39W, the original cyclone appears to have merged, at 12Z.

Date	Original HURDAT Central Pressure	Evidence	Changes
Sep 24 12Z	1005 mb	No penetration center fixes or ships near the center	Removed
Sep 24 18Z		Ship: 20 kt S and 1006 mb at 18Z on Sep 24th	1004 mb
Sep 25 06Z		Ship: 20 kt NW and 1006 mb at 06Z on Sep 25th	1004 mb
Sep 25 12Z	1003 mb	No penetration center fixes or ships near the center	Removed
Sep 25 18Z		Ship: 15 kt SE and 1007 mb at 18Z on Sep 25th	1005 mb
Sep 26 12Z	997 mb	No penetration center fixes or ships near the center	Removed
Sep 27 12Z	990 mb		
Sep 28 12Z	990 mb		
Sep 29 12Z	990 mb		

Sources: NHC microfilm maps, the Historical Weather Maps series, the COADS ship database, Monthly Weather Review, Mariners Weather Log, Satellite images from

NCDC, and NHC Storm Wallets.

Unnamed – AL231969 – 2021 Revisions

Green indicates wind changes of 15 kt or greater
Blue indicates lat/long changes greater than 1°
Red indicates a new entry
Yellow indicates a deletion

Subtropical Storm One [September 29 – October 3, 1969]

```
46435 09/29/1969 M= 3 23 SNBR= 989 SUBTROP 1   XING=0 SSS=0
46435 09/29/1969 M= 5 23 SNBR= 989 SUBTROP 1   XING=0 SSS=0
                     *

46440 09/29*  0   0   0    0*  0   0   0    0S235 855  30 1005S240 857  45 1002*
46440 09/29*  0   0   0    0*  0   0   0    0S235 855  30 1004S240 857  35 1002*
                                                          ****          **

46445 09/30S245 860  50 1001S250 863  50    0S255 865  50 1000S265 865  50    0*
46445 09/30S245 860  40 1002S250 862  40 1002S255 864  45 1000S262 865  50    0*
                     ** ****          ** ****     ***  **      ***

46450 10/01S275 866  50  998S285 866  40    0S295 865  30  996S310 865  25  999*
46450 10/01S269 866  50  996S279 866  50  995S292 867  45  995S308 868  35  999*
            ***          *** ***      **  *** *** ***  **  *** *** ***  **

(October 2nd and 3rd are new to HURDAT)
46455 10/02S330 869  25 1001S353 868  20 1003S380 860  20    0S405 840  20    0*
46460 10/03S412 820  20    0*  0   0   0    0*  0   0   0    0*  0   0   0    0*

46465 SS
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U.S. Subtropical Storm Impact

10/01 06Z 27.9N 86.6W 35 kt Louisiana

U.S. Subtropical Storm Landfall

10/01 16Z 30.4N 86.8W 40 kt FL - 999 mb

Significant Revisions:

1. Weakening to a subtropical depression is analyzed twelve hours later based on synoptic observations.
2. Dissipation analyzed 30 hours later based on synoptic observations.

September 28:

1. Maps and old HURDAT:

- HWM analyzes a spot low pressure at 20N, 94W at 12Z.
- Microfilm shows a tropical disturbance at 25N, 87.5W at 12Z.

2. Discussion:

- Reanalysis: A tropical wave reached the Gulf of Mexico on September 25 causing an increase in cloudiness over the southeastern part of the basin. The Historical Weather Maps at 500 mb indicate that a trough of low pressure was

present across the eastern United States, extending to the eastern Gulf of Mexico. The microfilm's synoptic maps show that a tropical depression developed over the Bay of Campeche and moved southeastward into southern Yucatan. (This other system is discussed in detail in Additional Notes #18.) Satellite images showed that the system was under westerly shear and most of the thunderstorm activity was displaced from the center.

September 29:

1. Maps and old HURDAT:

- HWM analyzes a trough over the eastern Gulf of Mexico at 12Z.
- HURDAT lists a 30 kt subtropical depression at 23.5N, 85.5W at 12Z.
- Microfilm shows a closed low pressure of at most 1004 mb at 23.5N, 85.5W at 12Z.

2. Ship highlights:

- 35 kt NNE and 1007 mb at 25.5N, 86.8W at 12Z (COADS).
- 5 kt S and 1005 mb at 23N, 84.5W at 12Z (COADS).
- 10 kt NNE and 1004 mb at 24.6N, 86.6W at 18Z (COADS).

3. Discussion:

- Reanalysis: The tropical depression dissipated inland over Central America but the southeast Gulf of Mexico remained unstable with showers and thunderstorms. Synoptic observations indicate that a closed low-level circulation developed northwest of western Cuba at 12Z on the 29th, same as originally shown in HURDAT. The first position in the original HURDAT was of a 30 kt subtropical depression. Synoptic observations showed that the circulation was elongated NE-SW and the HWM 500 mb maps indicated that an upper level low was located over the eastern Gulf of Mexico, thus the reanalysis concurs with the original assessment of subtropical characteristics. The subtropical depression moved northwestward and intensified to a subtropical storm at 18Z on the 29th based on ship observations early on the 30th. A ship reported 35 kt NE at 12Z on the 29th but synoptic data nearby suggests that it had a high bias. Similarly, another ship reported 55 kt NE at 18Z on the 29th but nearby observations indicate that it had a very high bias. Satellite images showed that the subtropical cyclone was still under westerly shear, displacing most of the convection over the northern and eastern quadrants.

September 30:

1. Maps and old HURDAT:

- HWM analyzes a closed low pressure of at most 1004 mb at 25N, 87W at 12Z.
- HURDAT lists a 50 kt subtropical storm at 25.5N, 86.5W at 12Z.
- Microfilm shows a tropical cyclone of at most 1002 mb at 25.5N, 86.3W at 12Z.

2. Ship highlights:

a. 40 kt NE and 1006 mb at 28.1N, 87.3W at 00Z (COADS).
b. 20 kt NE and 1004 mb at 25.1N, 87.2W at 00Z (COADS).
c. 35 kt NE and 1011 mb ay 24.5N, 88.8W at 06Z (COADS).
d. 20 kt SE and 1004 mb at 24.8N, 84.9W at 06Z (COADS).
e. 65 kt NE (likely high bias) and 1003 mb at 27.2N, 68.8W at 12Z (COADS/MWL).
f. 20 kt N and 1002 mb at 24.5N, 87.1W at 12Z (COADS).
g. 40 kt NE and 1008 mb at 27.8N, 88W at 15Z (COADS).
h. 50 kt NE and 995 mb at 27N, 86.7W at 18Z (micro).
i. 50 kt N and 1005 mb at 27.9N, 87.7W at 21Z (COADS).

3. Discussion:

- Reanalysis: The subtropical storm gradually intensified as it moved northward. A few ships reported gale and storm-force winds. A ship reported 65 kt NE at 12Z on the 30th but nearby data suggests that it had a high bias. A peak intensity of 50 kt is analyzed at 18Z on the 30th based on synoptic observations, same as originally shown in HURDAT. Satellite images showed that the subtropical cyclone was still under southwesterly winds shear displacing most of the convection to the northern quadrant.

October 1:

1. Maps and old HURDAT:

- HWM analyzes a closed low pressure of at most 1000 mb at 30N, 87W at 12Z.
- HURDAT lists a 30 kt subtropical depression at 29.5N, 86.5W at 12Z.
- Microfilm shows a tropical cyclone of 996 mb at 29.5N, 86.5W at 12Z.

2. Ship highlights:

- 45 kt NE and 1005 mb at 28.4N, 88.9W at 00Z (COADS).
- 30 kt NE and 999 mb at 27.2N, 86.9W at 00Z (COADS).
- 45 kt NE and 1007 mb at 29.9N, 87.8W at 03Z (COADS).
- 20 kt N and 997 mb at 28N, 87.3W at 03Z (micro).
- 40 kt NE and 1001 mb at 28.8N, 85.1W at 06Z (COADS).
- 35 kt NNW and 999 mb at 28.3N, 88.1W at 09Z (COADS).
- 20 kt N and 997 mb at 28.1N, 87W at 09Z (COADS).
- 35 kt N and 1004 mb at 28.8N, 88.7W at 12Z (COADS).
- 25 kt WSW and 1003 mb at 29.7N, 87.1W at 18Z (COADS).

3. Land highlights:

a. 35 kt NE and 1008 mb at Burrwood, LA at 07Z (SWO).
b. 5 kt N and 1000 mb at Pensacola, FL at 16Z (SWO).
c. 31 kt SE (time unknown) at Apalachicola, FL (CLIMO).

4. Discussion:

- Reanalysis: The subtropical storm continued northward toward the northern Gulf coast. Satellite images showed that the subtropical cyclone had become better organized but still under southerly shear displacing most of the convection to the north of the center. A few ships reported gale-force winds, especially over the northern quadrant. The subtropical storm produced gale-forced winds over the mouth of the Mississippi River according to the observation at Burrwood, LA at 07Z on this date. Thus, Louisiana is listed as a subtropical storm impact. Based on synoptic data, the subtropical cyclone weakened before making landfall around 16Z on the 1st near Fort Walton Beach, FL. The strongest winds registered in Florida associated with this system were 31 kt at Apalachicola, though sustained winds elsewhere along the coast were likely stronger. An intensity of 40 kt and central pressure of 999 mb are analyzed at the time of landfall. The central pressure values are not used to estimate the intensity because the system was not tropical in nature. Ship and station observations on the 1st showed that a stationary frontal boundary extended from the western Atlantic to the southeast United States, although this frontal boundary was not depicted in the HWM and microfilm. Nonetheless, the circulation of the subtropical cyclone was symmetrical and observations near the center do not suggest that the frontal boundary extended to the center of the cyclone.

October 2:

1. Maps and old HURDAT:

- HWM analyzes a spot low at 37N, 88W with an approaching cold front to the west at 12Z.
- Microfilm shows a spot low at 37.5N, 86.7W with an approaching cold front to the west at 12Z.

2. Land highlights:

- 10 kt E and 1003 mb at Birmingham, AL at 00Z (micro).
- 5 kt NE and 1004 mb at Nashville, TN at 06Z (micro).

3. Discussion:

- Reanalysis: After moving inland, the subtropical cyclone weakened below gale-intensity at 00Z on the 2nd, eighteen hours later than originally shown in HURDAT. The last position in HURDAT was analyzed at 18Z on the 1st but synoptic observations clearly indicate that the cyclone retained a closed low-level circulation as it moved northward ahead of an approaching frontal boundary.

October 3:

1. Maps and old HURDAT:

- HWM analyzes a spot low at 40N, 76W with a cold front to the northwest at 12Z.

2. Discussion:

- Reanalysis: Synoptic observations at 06Z on the 3rd indicated that system had moved into the Great Lakes area ahead of an approaching frontal boundary and because it is difficult to determine if a closed low-level circulation was still present, the last position is analyzed at 00Z on the 3rd, 30 hours later than originally shown in HURDAT.

Date	Original HURDAT Central Pressure	Evidence	Changes
Sep 29 12Z	1005 mb	Ship: 5 kt S and 1005 mb at 23N, 84.5W at 12Z	1004 mb
Sep 29 18Z	1002 mb	Ship: 10 kt NNE and 1004 mb at 24.6N, 86.6W at 18Z	Retained
Sep 30 00Z	1001 mb	Ship: 20 kt S and 1004 mb at 25.1N, 87.2W at 00Z	1002 mb
Sep 30 06Z		Ship: 20 kt SE and 1004 mb at 24.8N, 84.9W at 06Z	1002 mb
Sep 30 12Z	1000 mb	Ship: 20 kt N and 1002 mb at 24.5N, 87.1W at 12Z	Retained
Oct 01 00Z	998 mb	Ship: 30 kt NE and 999 mb at 27.2N, 86.9W at 00Z	996 mb
Oct 01 06Z		Ship: 20 kt N and 997 mb at 28N, 87.3W at 03Z	995 mb
Oct 01 12Z	996 mb	Ship: 20 kt N and 997 mb at 28.1N, 87W at 09Z	995 mb
Oct 01 18Z	999 mb	Ship: 5 kt N and 1000 mb at Pensacola, FL at 18Z	Retained
Oct 02 00Z		Ship: 10 kt E and 1003 mb at Birmingham, AL at 00Z	1001 mb
Oct 02 06Z		Ship: 5 kt NE and 1004 mb at Nashville, TN at 06Z	1003 mb

Sources: NHC microfilm maps, the Historical Weather Maps series, the COADS ship database, Mariners Weather Log, Satellite images from NCDC and NSIDC, Climatological Data Center and NHC Storm Wallets.

Jenny – AL241969 – 2021 Revisions

Green indicates wind changes of 15 kt or greater
Blue indicates lat/long changes greater than 1°
Red indicates a new entry
Yellow indicates a deletion

Tropical Storm Jenny [October 1-5, 1969]

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46460 10/01/1969 M= 6 24 SNBR= 990 JENNY       XING=1 SSS=0
46460 10/01/1969 M= 5 24 SNBR= 990 JENNY       XING=1 SSS=0
                     *

46465 10/01*  0   0   0    0*  0   0   0    0*190 837  25    0*203 832  25    0*
46465 10/01*  0   0   0    0*  0   0   0    0*190 837  25 1005*200 832  25 1005*
                                                          **** ***         ****

46470 10/02*218 828  25    0*230 824  25    0*243 823  30    0*255 821  40 1000*
46470 10/02*212 828  25    0*227 825  30    0*242 823  40 1000*256 820  40 1001*
            ***              *** ***  **      ***      ** **** *** ***     ****

46475 10/03*264 818  35    0*274 812  30    0*285 807  30    0*288 807  30    0*
46475 10/03*266 816  35 1001*276 812  30    0*285 807  30    0*289 806  30 1004*
            *** ***     **** ***                              *** ***     ****

46480 10/04*290 809  25    0*291 812  25    0*290 814  25    0*287 817  25    0*
46480 10/04*291 809  25 1005*291 812  25 1008*290 815  25 1009*284 822  25 1008*
            ***         ****             ****     ***     **** *** ***     ****

46485 10/05*280 828  25    0*276 843  25    0*275 858  25    0*275 872  25    0*
46485 10/05*277 830  25    0*  0   0   0    0*  0   0   0    0*  0   0   0    0*
            *** ***            *   *   *        *   *   *        *   *   *
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(October 6th is removed from HURDAT)

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46490 10/06*275 886  25    0*275 900  25    0*275 914  25    0*275 928  25    0*

46495 TS
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U.S. Tropical Storm Landfall

10/02 21Z 26.1N 81.8W 40 kt FL - 1001 mb

Significant Revisions:

1. Several central pressure values were added between 12Z on October 1st at and 18Z on the 4th based on reconnaissance aircraft and synoptic observations.
2. Dissipation analyzed 42 hours earlier based on synoptic observations.

September 30:

1. Maps and old HURDAT:

- HWM does not analyze any feature of interest at 12Z.
- Microfilm shows a tropical disturbance at 13.5N, 80.5W at 12Z.

2. Discussion:

- Reanalysis: Convection increased over the southern Caribbean Sea in association with a tropical wave. Synoptic observations suggested that a closed low-level circulation had not developed on this date.

October 1:

1. Maps and old HURDAT:
- HWM does not analyze any feature of interest at 12Z.
- HURDAT lists a 25 kt tropical depression at 19N, 83.7W at 12Z (first position).
- Microfilm shows a tropical cyclone of at most 1006 mb at 19N, 83W at 12Z.

2. Ship highlights:
- 35 kt SE (high bias) and 1011 mb at 20.2N, 82.7W at 12Z (COADS).

3. Discussion:
- MWR: "Under the influence of a deep southerly current associated with the Gulf Low, the depression moved northward across western Cuba into the Florida Straits."
- ATSR: "A weak tropical depression was detected over the western Caribbean Sea on 1 October by surface reports and satellite pictures."
- Reanalysis: The disturbance moved northward and became better organized. The first position is analyzed at 12Z on the 1st as a 25 kt tropical depression, same as originally shown in HURDAT. Synoptic data shows that although there was enough evidence to suggest that a closed low-level circulation had developed, it was poorly organized, and late on the 1st and early on the 2nd, the system may have been a trough. Satellite images showed a large area of organized convection.

October 2:

1. Maps and old HURDAT:
- HWM analyzes a closed low pressure of at most 1004 mb at 24.5N, 83W at 12Z.
- HURDAT lists a 30 kt tropical depression at 24.3N, 82.3W at 12Z.
- Microfilm shows a tropical cyclone of 1004 mb at 24.5N, 82.5W at 12Z.

2. Ship highlights:
a. 30 kt SE and 1003 mb at 24.4N, 82W at 12Z (COADS).
b. 35 kt SE and 1008 mb at 24.3N, 81.8W at 12Z (COADS).

3. Land highlights:
a. 35 kt SE at Key West, FL at 1228Z (WALLET).
b. 18 kt E and 1005 mb at Fort Myers, FL at 2155Z (SWO).

4. Aircraft highlights:
a. Penetration center fix measured a central pressure of 1001 mb, estimated surface winds of 35 kt and an eye diameter of 25 n mi at 25.4N, 82.2W at 1630Z (WALLET).

5. Radar highlights:
a. Key West center fix at 25.4N, 82.3W at 1740Z (WALLET).
b. Miami center fix estimated an eye diameter of 40 n mi at 25.4N, 82.2W at 1810Z (WALLET).
c. Tampa center fix at 26.3N, 81.6W at 2312Z (WALLET).

6. Discussion:

- MWR: "The Air Force found a minimal tropical storm northwest of Key West on October 2; winds were up to 35 kt, and the sea level pressure was 1001 mb. During the afternoon, several unsuccessful attempts to sustain an eye were observed on the Key West and Miami radars. Landfall occurred on the southwest Florida coast between Fort Myers and Naples; gales occurred in passing squalls."
- ATSR: "It moved northward at 12 knots over the Isle of Pines and Western Cuba, passing about 30 miles west of Key West, Florida. An Air Force reconnaissance aircraft observed 40 knot winds at 021630Z, and this tropical depression was upgraded to Tropical storm JENNY at 021800Z just before she made landfall near Cape Romano, Florida."
- Reanalysis: The tropical depression accelerated northeastward and intensified. Synoptic observations over the Florida Straits indicated that the low-level circulation became better organized. A ship at 12Z on the 1st reported 30 kt SE and 1003 mb, suggesting a central pressure of 1000 mb, which has been added to HURDAT. The ship had a tracking number in COADS and the pressure values it reported before and after 12Z on the 2nd appear consistent with the reports of other ships and land stations. A central pressure of 1000 mb suggests maximum surface winds of 47 kt from the south of 25N and 44 kt from the north of 25N Brown et al. pressure-wind relationships. Based on nearby synoptic data and low environmental pressures (OCI 1010 mb), an intensity of 40 kt is analyzed at 12Z on the 2nd, up from 30 kt originally shown in HURDAT, a minor intensity change. Intensification to a tropical storm is analyzed six hours earlier than originally shown in HURDAT. 40 kt is also the peak intensity of this tropical cyclone. At 1228Z on the 2nd, Key West reported sustained winds of 35 kt. A reconnaissance aircraft reached the tropical storm at 1630Z on the 2nd measuring a central pressure of 1001 mb and estimating surface winds of 35 kt. An intensity of 40 kt is also selected at 18Z on the 2nd, same as originally shown in HURDAT. Jenny made landfall in southwest Florida around 21Z on the 2nd with maximum sustained winds of 40 kt. Satellite images showed a small tropical cyclone with some weak banding features.

October 3:

1. Maps and old HURDAT:

- HWM analyzes a closed low pressure of at most 1008 mb at 28.5N, 82W at 12Z.
- HURDAT lists a 30 kt tropical depression at 28.5N, 80.7W at 12Z.
- Microfilm shows a tropical cyclone of at most 1008 mb at 28N, 81W at 12Z.

2. Aircraft highlights:

a. Penetration center fix measured a central pressure of 1004 mb and estimated surface winds of 30 kt at 28.9N, 80.6W at 1747Z (WALLET).
b. Penetration center fix measured a central pressure of 1005 mb and estimated surface winds of 25 kt at 29.1N, 80.8W at 2230Z (WALLET).

3. Radar highlights:

a. Daytona Beach center fix at 28.8N, 80.5W at 1245Z (WALLET).
b. Daytona Beach center fix at 29N, 80.4W at 1745Z (WALLET).
c. Daytona Beach center fix at 29.1N, 80.9W at 2345Z (WALLET).

4. Discussion:

- MWR: "Jenny moved up the Florida Peninsula and appeared headed for the open Atlantic before responding to strong ridging over the eastern United States, which resulted in a reversal of the track and a turning toward the west. Navy reconnaissance and the Daytona Beach radar indicated that the center briefly emerged from the peninsula north of Cape Kennedy during the afternoon of the 3rd."

- ATSR: "JENNY was a very short-lived storm and weakened to a tropical depression over land early on the 3rd. She continued north-northeast over Florida and moved offshore just north of Cape Kennedy later in the day."
- Reanalysis: Jenny weakened as it swiftly moved across the Florida peninsula. Weakening to a tropical depression is analyzed at 06Z on the 3rd, same as originally shown in HURDAT. The center of the tropical depression reached the Atlantic coast of Florida around 15Z on the 3rd. A reconnaissance aircraft made a penetration center fix at 1747Z on the 3rd measuring a central pressure of 1004 mb and estimating surface winds of 30 kt. A central pressure of 1004 mb suggests maximum surface winds of 36 kt from the north of 25N pressure-wind relationship. Due to the slow forward speed, about 4 kt, and low environmental pressures (OCI 1010 mb), an intensity of 30 kt is analyzed at 18Z on the 3rd, same as originally shown in HURDAT. Satellite images showed a compact system off the Florida coast with some weak banding features.

October 4:

1. Maps and old HURDAT:

- HWM analyzes a spot low at 29.5N, 82.8W at 12Z.
- HURDAT lists a 25 kt tropical depression at 29N, 81.4W at 12Z.
- Microfilm shows a tropical cyclone of at most 1010 mb at 28.5N, 81.5W at 12Z.

2. Discussion:

- ATSR: "It appeared that the depression would regain intensity as it moved out over the water but this was not to occur. A Navy reconnaissance aircraft was dispatched to investigate the area while the depression was partially over water just off Cape Kennedy and reported 30 knot winds. Before the depression could reintensify to tropical storm intensity, it turned slowly inland toward the West early on the 4th, then moved southwest toward Tampa, Florida, becoming more disorganized and was finalled as a tropical depression at 042200Z. A large high pressure ridge over the Eastern United States on 4 and 5 October blocked the northward movement of the remaining circulation and forced it to gradually move westward into the Gulf of Mexico. It moved offshore just north of Tampa, Florida, lost its mid-level circulation.
- Reanalysis: Jenny turned to the west and weakened further. A penetration center fix at 2230Z on the 3rd measured a central pressure of 1005 mb and estimated surface winds of 25 kt. An intensity of 25 kt is analyzed at 00Z on the 4th, same as originally shown in HURDAT. The tropical depression moved inland near New Smyrna Beach around 00Z on the 4th. Satellite images showed a small system with organized but weak convection. Operationally, the last advisory as a tropical depression was issued at 04Z on the 4th.

October 5:

1. Maps and old HURDAT:

- HWM analyzes a spot low at 27.5N, 87.5W at 12Z.
- HURDAT lists a 25 kt tropical depression at 27.5N, 85.8W at 12Z.
- Microfilm shows a tropical cyclone of 1009 mb at 27.2N, 85.8W at 12Z.

2. Discussion:

- MWR: "The remnant of Jenny slipped back into the Gulf of Mexico on the 5th."
- Reanalysis: Synoptic observations over the eastern Gulf of Mexico and Florida indicated that the surface circulation had dissipated by 06Z on the 5th, thus the last position is analyzed at 00Z on this date.

October 6

1. Maps and old HURDAT:

- HWM and microfilm do not analyze any feature of interest at 12Z.
- HURDAT lists a 25 kt tropical depression at 27.5N, 91.4W at 12Z.

2. Discussion:

- ATSR: "…finally dissipated over the central Gu1f of Mexico near 27.5N and 93W on 6 October."
- Reanalysis: The remnants of Jenny were quickly absorbed by a frontal boundary moving into the southern United States on this date.

October 7:

1. Maps and old HURDAT:

- HWM does not analyze any feature of interest at 12Z.

2. Discussion:

- MWR: "…eventually interacted with a cold front producing heavy rains over southern Louisiana on the 7th."

Date	Original HURDAT Central Pressure	Evidence	Changes
Oct 01 12Z		Ship: 10 kt SSE and 1006 mb at 19.9N, 82.5W at 12Z	1005 mb
Oct 01 18Z		Ship: 5 kt SE and 1006 mb at 20.4N, 83.2W at 18Z	1005 mb
Oct 02 12Z		Ship: 30 kt SE and 1003 mb at 24.4N, 82W at 12Z	1000 mb
Oct 02 18Z	1000 mb	Penetration center fix: 1001 mb at 1630Z	1001 mb
Oct 03 00Z		18 kt E and 1005 mb at Fort Myers, FL at 2155Z on the 2nd	1001 mb
Oct 03 18Z		Penetration center fix: 1004 mb at 1747Z	1004 mb
Oct 04 00Z		Penetration center fix: 1005 mb at 2230Z on the 3rd	1005 mb
Oct 04 06Z		5 kt S and 1009 mb at Daytona Beach, FL at 06Z	1008 mb
Oct 04 12Z		5 kt SE and 1010 mb at Daytona Beach, FL at 12Z	1009 mb
Oct 04 18Z		5 kt WNW and 1009 mb at Tampa, FL at 18Z	1008 mb

Sources: NHC microfilm maps, the Historical Weather Maps series, the COADS ship database, Mariners Weather Log, Satellite images from NCDC and NSIDC, Climatological Data Center and NHC Storm Wallets.

Kara – AL251969 – 2021 Revisions

Green indicates wind changes of 15 kt or greater
Blue indicates lat/long changes greater than 1°
Red indicates a new entry
Yellow indicates a deletion

Hurricane Kara [October 7-19, 1969]

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46500 10/07/1969 M=13 25 SNBR= 991 KARA        XING=0 SSS=0

46505 10/07*  0   0   0    0*  0   0   0    0*205 680  25    0*207 692  25    0*
46505 10/07*  0   0   0    0*  0   0   0    0*198 682  30 1005*201 690  30    0*
                                              *** ***  ** **** *** ***  **

46510 10/08*209 700  25    0*211 708  25    0*213 720  30    0*225 732  30    0*
45425 10/08*205 700  30    0*209 711  30    0*215 723  30    0*224 732  30    0*
            ***      **      *** ***  **      *** ***          ***

46515 10/09*235 736  30    0*247 737  30    0*257 736  30 1006*272 733  35    0*
45430 10/09*235 736  30    0*247 737  30    0*258 736  35 1006*268 733  40 1002*
                                              ***      **      ***      ** ****

46520 10/10*279 728  40    0*284 724  45    0*287 721  40 1001*295 713  40    0*
46520 10/10*278 728  40    0*284 724  40    0*289 720  40 1001*294 714  40 1000*
            ***                         **      *** ***          *** ***     ****

46525 10/11*299 705  35  999*307 698  35    0*324 698  35    0*340 702  35 1001*
46525 10/11*300 706  40  999*307 699  40  999*321 698  40  998*340 702  40 1001*
            *** ***  **          ***  **  *** ***      **  ***          **

46530 10/12*345 706  40    0*348 707  45  997*349 719  50    0*342 714  55    0*
46530 10/12S345 706  45  998S348 707  45  997S348 709  45  997S343 713  45  999*
            *          **  ****                 **** ***  **  ******* ***  **  ***

46535 10/13*336 715  55    0*333 714  55    0*327 728  55    0*319 738  60    0*
46535 10/13S338 714  45  997S332 716  45  998S327 727  45  995S319 738  45    0*
            **** ***  **  ****    ***  **  ****    ***  **  ****         **

46540 10/14*310 747  60    0*314 750  60    0*320 757  60  990*313 763  60    0*
46540 10/14S312 745  45  998S314 750  45  996*318 755  55  990*316 760  55  990*
            **** ***  **  ****         **  *** *** ***  **      *** ***  **  ***

46545 10/15*314 754  60  988*322 745  65    0*327 735  65  984*333 724  65    0*
46545 10/15*316 753  60  988*320 745  65  985*327 735  65  984*331 724  60  990*
            *** ***          ***          ***                     ***      **  ***

46550 10/16*337 712  65    0*343 700  65    0*348 688  70  994*357 672  75  990*
46550 10/16*335 712  60  992*341 700  60  992*348 687  60  994*357 672  65  990*
            ***      **  *** ***      **  ***     ***  **                  **

46555 10/17*369 648  75    0*382 627  75    0*396 602  80  985*411 563  85  978*
46555 10/17*369 650  65  990*383 627  70  986*396 600  75  985*411 563  80  978*
                ***  **  *** ***      **  ***     ***  **                  **

46560 10/18*433 508  90    0*452 453  80  980*461 400  65    0*462 351  60    0*
46560 10/18E433 508  80    0E452 453  75  980E461 400  65    0E462 351  60    0*
            *          **     *         **     *                  *

46565 10/19E460 303  55    0E458 280  45    0*  0   0   0    0*  0   0   0    0*

46570 HR
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U.S. Tropical Storm Impact

10/15 12Z 32.7N 73.5W 45 kt North Carolina

Significant Revisions:

1. Analyzed to have been a subtropical cyclone between October 12th at 00Z and October 14th at 06Z based on satellite images and 500 mb maps.
2. Major position change on October 12th at 12Z.
3. Major intensity decreases analyzed between October 13th at 18Z and October 14th at 06Z.
4. Transition to an extratropical cyclone analyzed 24 hours earlier based on synoptic and satellite data.
5. Many central pressures were added from October 7th at 12Z to October 17th at 06Z based on synoptic observations and aircraft data.

Daily Metadata:

October 6:

1. Maps and old HURDAT:

- HWM does not analyze any features of interest at 12Z.
- HURDAT does not list an organized system on this date.
- Microfilm shows a closed low pressure of at most 1006 mb at 21.5N, 66W at 12Z.

2. Discussion:

- MWR: "During the early days of development, Kara was imbedded in a cold trough extending from the southwest Caribbean north-northeastward through Cuba into the southwest Atlantic."
- Reanalysis: Satellite images showed disorganized convection north of Hispaniola and Puerto Rico associated with a trough.

October 7:

1. Maps and old HURDAT:

- HWM analyzes a spot low pressure at 22N, 66W at 12Z.
- HURDAT lists a 25 kt tropical depression at 20.5N, 68W at 12Z (first position).
- Microfilm shows a tropical cyclone of at most 1008 mb at 21N, 67W at 12Z.

2. Ship highlights:

- 35 kt ESE (high bias) and 1006 mb at 22.2N, 68.5W at 06Z (COADS).
- 30 kt SW and 1008 mb at 19.4N, 67.9W at 12Z (micro).
- 40 kt E (high bias) and 1008 mb at 22.9N, 69.4W at 18Z (COADS).

3. Discussion:

- Reanalysis: Synoptic observations indicated that a closed low level circulation became better organized and a tropical depression is analyzed to have formed at 12Z on October 7th, same as originally shown in HURDAT. Satellite images showed that the convective structure had become better organized, especially later in the day. A ship at 12Z on the 7th reported 30 kt SW and 1008 mb, suggesting a central pressure of 1005 mb. A central pressure of 1005 mb suggests maximum surface winds of 37 kt from the south of 25N Brown et al. pressure-wind relationship. Due to its slow forward speed of about 9 kt and ship observations, an intensity of 30 kt is analyzed at 12Z on the 7th, up from 25 kt originally shown in HURDAT, a minor intensity change. A few ships

reported gale-force winds but nearby data indicated that they had high biases. It is possible that the system was subtropical on October 7-9 as it was interacting with an upper-level trough. However, it is more likely that the system was a sheared tropical cyclone on these dates.

October 8:

1. Maps and old HURDAT:

- HWM analyzes a closed low pressure of at most 1008 mb at 22N, 72W at 12Z.
- HURDAT lists a 30 kt tropical depression at 21.3N, 72W at 12Z.
- Microfilm shows a tropical cyclone of at most 1006 mb at 22N, 71.5W at 12Z.

2. Discussion:

- Reanalysis: Synoptic observations on this day indicated that the tropical depression was disorganized and although it had a broad low level circulation, it is difficult to determine if a well-defined circulation was present.

October 9:

1. Maps and old HURDAT:

- HWM analyzes a closed low pressure of at most 1008 mb at 25.5N, 74.5W with a frontal boundary to the north at 12Z.
- HURDAT lists a 30 kt tropical depression at 25.7N, 73.6W at 12Z.
- Microfilm shows a tropical cyclone of at most 1008 mb at 25.5N, 73.5W with a frontal boundary to the northwest at 12Z.

2. Ship highlights:

- 35 kt E and 1001 mb at 30.2N, 73.2W at 21Z (COADS).

3. Aircraft reconnaissance:

- Penetration center fix measured a central pressure of 1006 mb and estimated surface winds of 20 kt at 25.7N, 73.5W at 1204Z (WALLET).
- Penetration center fix measured a central pressure of 1002 mb, estimated surface winds of 35 kt and an eye diameter of 20 n mi at 27.1N, 73.4W at 1825Z (WALLET).

4. Discussion:

- MWR: "Aircraft reconnaissance measured only a 1 or 2 temperature rise in the center. Even after Kara reached tropical storm intensity, there was no well-defined eye, and feeder bands were absent. The most singular aspect of Kara was its relationship to an upper cold Low which seemed to govern its movement and resulted in a most unusual track. The first threat was to the eastern seaboard from the Carolinas to New England, then Florida, and finally to the shipping lanes as it accelerated northeastward over the North Atlantic. Kara reached tropical storm intensity on October 9 while moving toward the northeast in the southwesterly flow associated with the upper trough."
- Reanalysis: A penetration center fix measured a central pressure of 1006 mb and estimated surface winds of 20 kt at 1204Z on the 9th. A central pressure of 1006 mb suggests maximum surface winds of 35 kt from the south of 25N and 32 kt from the north of 25N pressure-wind relationships. An intensity of 35 kt is analyzed at 12Z on the 9th, up from 30 kt originally shown in HURDAT, a minor intensity change. Another penetration center fix measured a central pressure of 1002 mb, estimated surface winds of 35 kt and an eye diameter of 20 n mi at 1825Z on the 9th. A central pressure of 1002 mb suggests maximum surface winds of 40 kt from the north of 25N pressure-wind relationships. An eye diameter of 20 n mi suggests an RMW of about 15 n mi and the climatological value is 20 n

mi. Due to a small RMW but slow forward speed of about 10 kt, an intensity of 40 kt is analyzed at 18Z on the 9th, up from 35 kt originally shown in HURDAT, a minor intensity change.

October 10:

1. Maps and old HURDAT:

- HWM analyzes a hurricane of at most 1000 mb at 28.7N, 72.5W at 12Z.
- HURDAT lists a 40 kt tropical storm at 28.7N, 72.1W at 12Z.
- Microfilm shows a tropical storm of at most 1008 mb at 28.5N, 72.3W at 12Z.

2. Ship highlights:

- 35 kt N and 1007 mb at 26.5N, 74.2W at 00Z (COADS).
- 35 kt SSE and 1009 mb at 27.9N, 69.4W at 06Z (COADS).
- 35 kt S and 1009 mb at 26.6N, 68.9W at 12Z (COADS).
- 35 kt S and 1011 mb at 25.2N, 68.3W at 18Z (COADS).

3. Aircraft highlights:

- Penetration center fix measured a central pressure of 1006 mb and estimated surface winds of 38 kt at 28.4N, 72.4W at 06Z (WALLET).
- Penetration center fix measured a central pressure of 1001 mb and estimated surface winds of 40 kt at 28.4N, 72.3W at 12Z (WALLET).
- Penetration center fix measured a central pressure of 1000 mb and estimated surface winds of 35 kt at 29.5N, 71.3W at 19Z (WALLET).

4. Discussion:

- MWR: "The next day [10], Kara was located 500 mi east of Daytona Beach, and a cold upper trough was moving eastward off the North Carolina coast."
- Reanalysis: Kara moved generally northward. A few penetration center fixes occurred between 06Z and 19Z on the 10th. A central pressure of 1006 mb was reported at 06Z on the 10th but it appears that the center was missed based on synoptic observations and lower central pressures observed by aircraft observed both late on the 9th and later on the 10th. Thus 1006 mb is not accepted as a central pressure in this reanalysis. Central pressures of 1000-1001 mb were reported at 12Z and 19Z on the 10th and an intensity of 40 kt is analyzed at 12Z and 18Z, same as originally in HURDAT. Satellite images showed that the low-level circulation had become better organized but the system was under strong southerly shear causing most of the convection to be displaced to the north. A few ships experienced gale-force winds on this day.

October 11:

1. Maps and old HURDAT:

- HWM analyzes a tropical storm of at most 1000 mb at 32.5N, 70.1W at 12Z.
- HURDAT lists a 35 kt tropical storm at 32.4N, 69.8W at 12Z.
- Microfilm shows a tropical storm of at most 1004 mb at 32N, 69.9W at 12Z.

2. Ship highlights:

- 35 kt N (high bias) and 1014 mb at 31.1N, 79.2W at 00Z (COADS).
- 35 kt N and 1013 mb at 34.9N, 74.5W at 18Z (COADS).

3. Aircraft highlights:

- Penetration center fix measured a central pressure of 999 mb at 30N, 70.7W at 0008Z (WALLET).

- Penetration center fix measured a central pressure of 999 mb at 30.6N, 69.9W at 0552Z (WALLET).
- Penetration center fix measured a central pressure of 998 mb, estimated surface winds of 30 kt and an eye diameter of 30 n mi at 32N, 69.9W at 1112Z (WALLET).
- Penetration center fix measured a central pressure of 1001 mb and estimated surface winds of 30 kt at 34.5N, 70.5W at 19Z (WALLET).

4. Discussion:

- MWR: "Later [11], a closed upper Low formed off Cape Hatteras only 300 mi northwest of the tropical storm. Kara's reaction to this was to appear to accelerate north-northwestward."
- Reanalysis: Kara rapidly moved to the north on the 11th with no appreciable change in intensity. The intensity was analyzed at 40 kt on this day, up from 35 kt originally in HURDAT, a minor intensity change, due to central pressures of 998 mb and 1001 mb reported between 0008Z and 19Z. Satellite images indicated that the convective structure had not changed from the 10th, with most of the convection displaced to the north.

October 12:

1. Maps and old HURDAT:

- HWM analyzes a tropical storm of at most 1000 mb at 35.2N, 71.5W with a frontal boundary to the northwest at 12Z.
- HURDAT lists a 50 kt tropical storm at 34.9N, 71.9W at 12Z.
- Microfilm shows a tropical storm of at most 1008 mb at 35N, 70.9W at 12Z.

2. Ship highlights:

- 45 kt NW and 1006 mb at 35.1N, 72.5W at 00Z (COADS). (A 60 kt ENE with 1008 mb observation at 00Z from microfilm does not appear to be reliable for winds, given that two nearby observations only indicate 30 kt.)
- 50 kt NE and 1008 mb at 36.8N, 69.5W at 06Z (COADS).
- 40 kt NE and 1010 mb at 37.6N, 71W at 12Z (COADS).
- 40 kt N and 1012 mb at 34.1N, 75.2W at 18Z (COADS).
- 35 kt E and 1002 mb at 35.2N, 71.8W at 21Z (COADS).

3. Aircraft highlights:

- Penetration center fix measured a central pressure of 998 mb at 34.8N, 71.2W at 0130Z (WALLET).
- Penetration center fix measured a central pressure of 997 mb and estimated an eye diameter of 40 n mi at 34.8N, 70.2W at 0555Z (WALLET).
- Penetration center fix measured a central pressure of 997 mb, estimated surface winds of 45 kt and an eye diameter of 30 n mi at 35N, 70.9W at 1115Z (WALLET).
- Penetration center fix measured a central pressure of 999 mb, estimated surface winds of 55 kt and an eye diameter of 50 n mi at 34.3N, 71.8W at 1650Z (WALLET).
- Penetration center fix measured a central pressure of 997 mb at 33.8N, 71.2W at 2330Z (WALLET).

4. Discussion:

- MWR: "…and by the following day [12], the two systems had merged. It was apparent that the surface center reformed under the upper Low. At this juncture, there was not much about the system that was tropical. But as

pressures and heights northwest of the storm began to rise, the storm moved southward and warmed, gradually assuming a more tropical character each day."

- Reanalysis: Kara slowed its forward speed a few hundred miles east of the Carolinas. Satellite images and synoptic observations showed that Kara had acquired subtropical characteristics. Convection decreased near the center with most of the shower activity in the periphery of the circulation as an upper-low became situation near the center of Kara. Ship observations indicated that the circulation had expanded and the RMW was about 200 n mi. There were only minor fluctuations in the central pressure values reported by penetration center fixes, 997 mb to 999 mb, between 0130Z and 2330Z on the 12th. A central pressure of 997 mb was measured at 1115Z on the 12th, suggesting maximum surface winds of 49 kt from the north of 25N pressure-wind relationship. The intensity is analyzed at 45 kt on this day based on synoptic observations and the subtropical structure. This is 5 kt higher at 00Z, same at 06Z, 5 kt lower at 12Z and 10 kt lower at 18Z than originally shown in HURDAT, minor intensity changes.

October 13:

1. Maps and old HURDAT:

- HWM analyzes a tropical storm of at most 1000 mb at 32.7N, 74W with a frontal boundary to the north at 12Z.
- HURDAT lists a 55 kt tropical storm at 32.7N, 72.8W at 12Z.
- Microfilm shows a tropical storm of at most 1004 mb at 32.7N, 73.2W at 12Z.

2. Ship highlights:

- 40 kt N and 1010 mb at 34.3N, 75W at 00Z (COADS).
- 45 kt N and 1013 mb at 32.9N, 75.9W at 04Z (micro).
- 35 kt SE and 1000 mb at 33.2N, 71.9W at 06Z (COADS).
- 40 kt SSE and 1002 mb at 32.3N, 70.6W at 09Z (COADS).
- 35 kt S and 1004 mb at 31.9N, 70.3W at 12Z (COADS).

3. Aircraft highlights:

- Penetration center fix measured a central pressure of 998 mb and estimated an eye diameter of 10 n mi at 33N, 71.7W at 0630Z (WALLET).
- Penetration center fix measured a central pressure of 995 mb, estimated surface winds of 45 kt and an eye diameter of 15 n mi at 32.9N, 72.9W at 1130Z (WALLET).
- Penetration center fix measured a central pressure of 1002 mb and estimated surface winds of 28 kt at 32N, 73.6W at 1753Z (WALLET).
- Penetration center fix measured a central pressure of 998 mb and estimated surface winds of 30 kt at 31N, 74.7W at 23Z (WALLET).

4. Discussion:

- Reanalysis: Kara moved to the southwest with no appreciable changes in intensity or structure (as a subtropical cyclone). Penetration center fixes reported central pressures between 995 mb and 998 mb on this day. A central pressure report of 1002 mb at 1753Z is not utilized in this reanalysis based on central pressure reports at 1130Z and 23Z suggesting that the 1753Z fix missed the center. An intensity of 45 kt is analyzed on the 13th, down from 55 kt originally in HURDAT between 00Z and 12Z, minor intensity changes, and down from 60 kt at 18Z, a major intensity decrease. Satellite images showed very weak convective activity associated with the subtropical cyclone.

October 14:

1. Maps and old HURDAT:

- HWM analyzes a hurricane of at most 1004 mb at 32N, 76W with a frontal boundary to the west at 12Z.
- HURDAT lists a 60 kt tropical storm at 32N, 75.7W at 12Z.
- Microfilm shows a tropical storm of at most 1004 mb at 32N, 75.7W with a frontal boundary to the west at 12Z.

2. Ship highlights:
- 25 kt N and 1001 mb at 31.3N, 75.1W at 00Z (COADS).
- 40 kt NE and 1005 mb at 33.6N, 76.5W at 06Z (COADS).
- 40 kt SE and 1007 mb at 33.4N, 73.3W at 12Z (COADS).
- 35 kt S and 1003 mb at 31.9N, 73.5W at 18Z (COADS).

3. Aircraft highlights:
- Penetration center fix measured a central pressure of 996 mb and estimated an eye diameter of 25-30 n mi at 31.4N, 74.9W at 0630Z (WALLET).
- Penetration center fix measured a central pressure of 990 mb, estimated surface winds of 45 kt and an eye diameter of 10 n mi at 32.1N, 75.7W at 1130Z (WALLET).
- Penetration center fix measured a central pressure of 990 mb, estimated surface winds of 55 kt and an eye diameter of 18 n mi at 31.2N, 76.2W at 1747Z (WALLET).
- Penetration center fix measured a central pressure of 988 mb, estimated surface winds of 45 kt and an eye diameter of 6 n mi at 31.3N, 75.2W at 2245Z (WALLET).

4. Discussion:
- MWR: "The movement toward the south and southwest ended when the upper westerlies dipped to the south and eroded the ridge northwest of Kara. Kara first developed an eye when it was located about 300 mi south of Cape Hatteras on the morning of October 14. It was only after the storm had begun its northeastward acceleration away from land that it reached hurricane strength."
- Reanalysis: Convection increased over the center of the cyclone and transition to a tropical storm is analyzed at 12Z on the 14th. A penetration center fix measured a central pressure of 990 mb, estimated an eye diameter of 10 n mi and surface winds of 45 kt at 1130Z. A central pressure of 990 mb suggests maximum surface winds of 59 kt from the north of 25N pressure-wind relationship. Based on a slow forward speed of about 9 kt, an intensity of 55 kt is analyzed at 12Z on the 14th, down from 60 kt originally shown in HURDAT, a minor intensity change. Another penetration center fix measured a central pressure of 990 mb at 1747Z on the 14th and an intensity of 55 kt is analyzed at 18Z, down from 60 kt originally shown in HURDAT, a minor intensity change.

October 15:

1. Maps and old HURDAT:
- HWM analyzes a tropical storm of at most 1000 mb at 33N, 74.5W with a stationary frontal boundary to the northwest at 12Z.
- HURDAT lists a 65 kt hurricane at 32.7N, 73.5W at 12Z.
- Microfilm shows a hurricane of at most 1000 mb at 32.5N, 73.6W with a frontal boundary to the northwest at 12Z.

2. Ship highlights:
- 45 kt SSW and 1002 mb at 30.9N, 73.9W at 00Z (COADS).
- 40 kt WSW and 1002 mb at 31.1N, 75.6W at 06Z (COADS).
- 30 kt SSE and 998 mb at 32.4N, 73W at 12Z (COADS).
- 35 kt SSW and 1006 mb at 31.3N, 71.3W at 18Z (COADS).

3. Land highlights:

- 45 kt NE and 1013 mb at Oregon Inlet, NC (elevated site) at 12Z (WALLET).
- 45 kt NE and 1015 mb at Oregon Inlet, NC (elevated site) at 14Z (WALLET).
- 40 kt NE and 1015 mb at Oregon Inlet, NC (elevated site) at 18Z (WALLET).

4. Aircraft highlights:

- Penetration center fix measured a central pressure of 985 mb and estimated an eye diameter of 15 n mi at 32.3N, 74.3W at 0645Z (WALLET).
- Penetration center fix measured a central pressure of 984 mb, estimated surface winds of 65 kt and an eye diameter of 15 n mi at 32.6N, 73.8W at 1140Z (WALLET).
- Penetration center fix measured a central pressure of 990 mb and estimated surface winds of 55 kt at 33N, 72.2W at 1910Z (WALLET).
- Penetration center fix measured a central pressure of 992 mb, estimated surface winds of 45 kt and an eye diameter of 32 n mi at 33.4N, 71.1W at 2237Z (WALLET).

5. Discussion:

- Reanalysis: Kara made a final turn to the northeast and accelerated. A penetration center fix measured a central pressure of 988 mb, estimated surface winds of 45 kt and an eye diameter of 6 n mi at 2245Z on the 14th. A central pressure of 988 mb suggests maximum surface winds of 62 kt from the north of 25N pressure-wind relationship. Based on a slow forward speed of 9 kt but small RMW, an intensity of 60 kt is analyzed at 00Z on the 15th, same as originally shown in HURDAT. The next penetration center fix measured a central pressure of 985 mb and estimated an eye diameter of 15 n mi at 0645Z on the 15th. A central pressure of 985 mb suggests maximum surface winds of 66 kt from the north of 25N pressure-wind relationship. An eye diameter of 15 n mi suggests an RMW of about 12 n mi and the climatological value is 25 n mi. Based on a forward speed of 12 kt and small RMW, an intensity of 65 kt is analyzed at 06Z on the 15th, same as originally shown in HURDAT. At 1140Z on the 15th, a penetration center fix measured a central pressure of 984 mb and an intensity of 65 kt is analyzed at 12Z, same as originally shown in HURDAT. Oregon Inlet, NC, reported gale-force winds during the second half of the 15th, due to the pressure-gradient between Kara and a strong high pressure over the Great Lakes. At 12Z on the 15th, Oregon Inlet, NC, at an elevation of 16 meters, reported 45 kt, suggesting winds of about 44 kt at 10 meters. Thus, it is analyzed that tropical storm force winds impacted the coastline of North Carolina. Late on the 15th, Kara appears to have weakened slightly based on reconnaissance aircraft reports. A penetration center fix reported a central pressure of 990 mb and estimated surface winds of 55 kt at 1910Z on the 15th. A central pressure of 990 mb suggests maximum surface winds of 57 kt from the north of 25N weakening subset. An intensity of 60 kt is analyzed at 18Z on the 15th, down from 65 kt originally in HURDAT, a minor intensity change. Satellite images indicated that Kara had become better organized compared to the previous few days, showing an increase in organized convection near or over the center.

October 16:

1. Maps and old HURDAT:

- HWM analyzes a hurricane of at most 996 mb at 35.2N, 69.8W with a frontal boundary just to the west at 12Z.
- HURDAT lists a 70 kt hurricane at 34.8N, 68.8W at 12Z.
- Microfilm shows a hurricane of at most 1000 mb at 34.6N, 69.2W with a frontal boundary just to the northwest at 12Z.

2. Ship highlights:

- 45 kt W and 1006 mb at 31.5N, 71.6W at 00Z (COADS).
- 40 kt NW and 1010 mb at 31.8N, 71.9W at 06Z (COADS).
- 35 kt NE and 1008 mb at 37.1N, 70.5W at 12Z (COADS).

3. Aircraft highlights:

- Penetration center fix measured a central pressure of 992 mb and estimated an eye diameter of 15 n mi at 34.1N, 70W at 06Z (WALLET).
- Penetration center fix measured a central pressure of 994 mb, estimated surface winds of 65 kt and an eye diameter of 15 n mi at 34.7N, 69.3W at 1130Z (WALLET).
- Penetration center fix measured a central pressure of 990 mb and estimated surface winds of 85 kt at 35.8N, 67W at 1915Z (WALLET).
- Penetration center fix measured a central pressure of 990 mb and estimated surface winds of 65 kt at 36.1N, 66.3W at 21Z (WALLET).

4. Discussion:

- Reanalysis: Kara continued northeastward ahead of an approaching frontal boundary. The central pressure values reported by the penetration center fixes between 2237Z on the 15th and 1130Z on the 16th were between 992 mb and 994 mb, indicating minor fluctuations in intensity. An intensity of 60 kt is analyzed between 00Z and 12Z on the 16th, down from 65 kt at 00Z and 06Z and 70 kt at 12Z originally in HURDAT, minor intensity decreases. The tropical cyclone began to re-intensify late on the 16th. A penetration center fix measured a central pressure of 990 mb and estimated surface winds of 85 kt at 1915Z on the 16th. A central pressure of 990 mb suggests maximum surface winds of 59 kt from the north of 25N and 63 kt from the north of 35N Landsea et al. pressure-wind relationships. Based on a fast forward speed of about 21 kt, an intensity of 65 kt is analyzed at 18Z on the 16Z, down from 75 kt originally in HURDAT, a minor intensity change. Satellite images showed a well-organized tropical cyclone.

October 17:

1. Maps and old HURDAT:

- HWM analyzes a hurricane of at most 992 mb at 40.8N, 61W with a warm front to the east and a cold front to the southeast at 12Z.
- HURDAT lists an 80 kt hurricane at 39.6N, 60.2W at 12Z.
- Microfilm shows a hurricane of at most 1000 mb at 40N, 60W with a warm front to the east at 12Z.

2. Ship highlights:

- 35 kt SE and 1004 mb at 36.7N, 60.7W at 00Z (micro).
- 35 kt SE and 1000 mb at 44.7N, 52.4W at 21Z (micro).

3. Aircraft highlights:

- Penetration center fix estimated an eye diameter of 30 n mi at 36.9N, 65W at 00Z (WALLET).
- Penetration center fix measured a central pressure of 986 mb and estimated surface an eye diameter of 13 n mi at 38.4N, 62.7W at 0605Z (WALLET).
- Penetration center fix measured a central pressure of 985 mb, estimated surface winds of 80 kt and an eye diameter of 15 n mi at 39.9N, 60W at 1215Z (WALLET).
- Penetration center fix measured a central pressure of 978 mb, estimated surface winds of 75 kt and an eye diameter of 60 n mi at 40.4N, 57.5W at 1710Z (WALLET).

4. Discussion:

- Reanalysis: Kara continued to intensify over the north Atlantic. A reconnaissance aircraft measured a central pressure of 986 mb and an eye diameter of 13 n mi at 0605Z on the 17th. A central pressure of 986 mb suggests maximum surface winds of 67 kt from the north of 35N pressure-wind relationship. Due to a small RMW and fast forward speed of about 25 kt, an intensity of 70 kt is analyzed at 06Z on the 17th, down from 75 kt originally shown in HURDAT, a minor intensity change. The next penetration center fix measured a central pressure of 985 mb, estimated surface winds of 80 kt and an eye diameter of 15 n mi at 1215Z on the 17th. Based on a small RMW and fast forward speed of about 32 kt, an intensity of 75 kt is analyzed at 12Z on the 17th, down from 80 kt originally shown in HURDAT, a minor intensity change. 75 kt is also the peak intensity of this hurricane, down from 90 kt analyzed at 00Z on the 18th originally in HURDAT, a major intensity change. A reconnaissance aircraft investigated Kara at 1710Z on the 17th measuring a central pressure of 978 mb, estimating surface winds of 75 kt and an eye diameter of 60 n mi. A central pressure of 978 mb suggests maximum surface winds of 75 kt from the north of 35N pressure-wind relationship. An intensity of 80 kt is analyzed at 18Z on the 17th due to the fast forward speed of about 32 kt, down from 85 kt originally shown in HURDAT, a minor intensity change.

October 18:

1. Maps and old HURDAT:

- HWM analyzes an extratropical cyclone of at most 1000 at 48N, 45W at 12Z.
- HURDAT lists a 65 kt hurricane at 46.1N, 40W at 12Z.

2. Ship highlights:

- 45 kt SE and 1002 mb at 45.7N, 47.3W at 00Z (COADS).
- 35 kt SW and 1000 mb at 43N, 43.3W at 06Z (COADS).
- 40 kt SW and 1006 mb at 42.5N, 40.7W at 09Z (COADS).
- 40 kt SW and 1010 mb at 42.4N, 37.7W at 12Z (COADS).
- 35 kt SE and 1008 mb at 45.5N, 32.6W at 15Z (COADS).
- 45 kt SSW and 1008 mb at 42.3N, 33.3W at 18Z (COADS).

3. Aircraft highlights:

- Penetration center fix estimated an eye diameter of 50 n mi at 43.5N, 49.8W at 0040Z (WALLET).
- Penetration center fix measured a central pressure of 980 mb and estimated surface an eye diameter of 30 n mi at 45.7N, 44.2W at 0640Z (WALLET).

4. Discussion:

- MWR: “It lost intensity rapidly as it encountered a cold trough over the northeast Atlantic.”
- Reanalysis: Synoptic observations around 00Z on the 18th indicated that Kara had acquired extratropical characteristics, especially the temperature gradient that had already developed across the circulation. Thus, transition to an extratropical cyclone is analyzed at 00Z on the 18th, 24 hours earlier than originally shown in HURDAT. The hurricane-force extratropical cyclone turned to the east and gradually weakened. Kara is analyzed to have weakened to an extratropical storm at 18Z on the 18th, same as originally shown in HURDAT.

October 19:

5. Maps and old HURDAT:

- HWM analyzes a strong extratropical cyclone at 55N, 43W, Kara appears to have dissipated, at 12Z.
- HURDAT lists a 45 kt extratropical storm at 45.8N, 28W at 06Z (last position).

6. Ship highlights:

- 35 kt SE and 1001 mb at 45.7N, 27.1W at 06Z (COADS).

7. Discussion:

- Reanalysis: Synoptic observations late on the 18th and early on the 19th indicated that an extratropical cyclone developed northeast of Kara and quickly intensified. Ship reports at 12Z on the 19th showed that the circulation of Kara had dissipated and the system was being absorbed by the larger extratropical cyclone to the north. The last position is analyzed at 06Z on the 19th, same as originally shown in HURDAT.

Date	Original HURDAT Central Pressure	Evidence	Changes
Oct 07 12Z		Ship: 30 kt SW and 1008 mb at 19.4N, 67.9W at 12Z	1005 mb
Oct 09 12Z	1006 mb	Penetration center fix: 1006 mb at 1204Z	Retained
Oct 09 18Z		Penetration center fix: 1002 mb at 1825Z	1002 mb
Oct 10 12Z	1001 mb	Penetration center fix: 1001 mb at 12Z	Retained
Oct 10 18Z		Penetration center fix: 1000 mb at 19Z	1000 mb
Oct 11 00Z	999 mb	Penetration center fix: 999 mb at 0008Z	Retained
Oct 11 06Z		Penetration center fix: 999 mb at 0552Z	999 mb
Oct 11 12Z		Penetration center fix: 998 mb at 1112Z	998 mb
Oct 11 18Z	1001 mb	Penetration center fix: 1001 mb at 19Z	Retained
Oct 12 00Z		Penetration center fix: 998 mb at 0130Z	998 mb
Oct 12 06Z	997 mb	Penetration center fix: 997 mb at 0555Z	Retained
Oct 12 12Z		Penetration center fix: 997 mb at 1115Z	997 mb
Oct 12 18Z		Penetration center fix: 999 mb at 1650Z	999 mb
Oct 13 00Z		Penetration center fix: 997 mb at 2330Z on Oct 12	997 mb
Oct 13 06Z		Penetration center fix: 998 mb at 0630Z	998 mb
Oct 13 12Z		Penetration center fix: 995 mb at 1130Z	995 mb
Oct 14 00Z		Penetration center fix: 998 mb at 23Z on Oct 13	998 mb
Oct 14 06Z		Penetration center fix: 996 mb at 0630Z	996 mb
Oct 14 12Z	990 mb	Penetration center fix: 990 mb at 1130Z	Retained
Oct 14 18Z		Penetration center fix: 990 mb at 1747Z	990 mb
Oct 15 00Z	988 mb	Penetration center fix: 988 mb at 2245Z on Oct 14	Retained
Oct 15 06Z		Penetration center fix: 985 mb at 0645Z	985 mb
Oct 15 12Z	984 mb	Penetration center fix: 984 mb at 1140Z	Retained
Oct 15 18Z		Penetration center fix: 990 mb at 1910Z	990 mb
Oct 16 00Z		Penetration center fix: 992 mb at 2237Z on Oct 15	992 mb
Oct 16 06Z		Penetration center fix: 992 mb at 06Z	992 mb

Oct 16 12Z	994 mb	Penetration center fix: 994 mb at 1130Z	Retained
Oct 16 18Z	990 mb	Penetration center fix: 990 mb at 1915Z	
Oct 17 00Z		Penetration center fix: 990 mb at 21Z on Oct 16	990 mb
Oct 17 06Z		Penetration center fix: 986 mb at 0605Z	986 mb
Oct 17 12Z	985 mb	Penetration center fix: 985 mb at 1215Z	Retained
Oct 17 18Z	978 mb	Penetration center fix: 978 mb at 1710Z	
Oct 18 06Z	980 mb	Penetration center fix: 980 mb at 0640Z	

Sources: NHC microfilm maps, the Historical Weather Maps series, the COADS ship database, Monthly Weather Review, Mariners Weather Log, Satellite images from NCDC, and NHC Storm Wallets.

Laurie – AL261969 – 2021 Revisions

Green indicates wind changes of 15 kt or greater
Blue indicates lat/long changes greater than 1°
Red indicates a new entry
Yellow indicates a deletion

Hurricane Laurie [October 17-27, 1969]

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46575 10/17/1969 M=11 26 SNBR= 992 LAURIE      XING=0 SSS=0

46580 10/17*173 851  25 1007*176 854  25    0*179 857  25    0*181 859  25    0*
46580 10/17*180 853  25 1007*183 854  25    0*186 855  25    0*189 856  30 1005*
            *** ***          ***              *** ***         *** ***  ** ****

46585 10/18*183 861  25    0*187 865  25    0*191 869  25    0*197 876  30    0*
46585 10/18*191 858  30    0*193 862  30    0*196 867  30 1006*200 875  30    0*
            *** ***  **      *** ***  **      *** ***  ** **** *** ***

46590 10/19*204 883  30 1005*210 890  30    0*215 895  45 1000*224 902  45    0*
46590 10/19*206 883  30 1005*212 890  30    0*218 896  40 1000*224 902  40    0*
            ***              ***              *** ***  **                **

46595 10/20*233 908  50    0*238 909  55    0*243 910  65  993*249 911  70    0*
46595 10/20*232 907  40 1000*238 909  45  998*243 910  55  993*250 911  65  987*
            *** ***  ** ****          **  ***          **      ***      **  ***

46600 10/21*258 910  70  973*262 904  75    0*263 896  90  973*263 889  90    0*
46600 10/21*257 910  80  973*263 905  80  974*265 898  80  973*265 890  75  977*
            ***      **      *** ***  **  *** *** ***  **      *** ***  **  ***

46605 10/22*262 883  85  980*260 875  80    0*254 868  75  987*251 865  70    0*
46605 10/22*263 882  75  980*259 874  70  983*255 869  65  987*251 865  65  987*
            *** ***  **      *** ***  **  *** *** ***  **                **  ***

46610 10/23*247 862  65  992*244 861  60    0*241 862  45    0*238 868  40    0*
46610 10/23*247 862  55  992*244 861  50  996*241 862  50  998*238 867  45 1000*
                     **               **  ***          **  ***     ***  ** ****

46615 10/24*236 875  35    0*235 880  35    0*234 886  35 1001*232 895  30    0*
46615 10/24*236 873  45    0*235 879  40    0*234 886  40 1001*233 894  35 1004*
                ***  **      *** ***  **                **      *** ***  ** ****
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46620 10/25*231 904  30    0*229 911  30    0*224 917  25 1007*220 922  25    0*
46620 10/25*232 904  35    0*229 912  35    0*225 919  35    0*220 925  35 1003*
            ***      **          ***  **      *** ***  **    *     ***  ** ****

46625 10/26*214 926  30    0*208 929  30    0*201 930  30    0*194 930  30 1006*
46625 10/26*214 928  30    0*208 930  30    0*201 931  30    0*194 931  30 1006*
                ***             ***              ***              ***

46630 10/27*187 931  25    0*180 931  20    0*  0   0   0    0*  0   0   0    0*

46635 HR
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Significant Revisions:

1. Intensification to a hurricane is analyzed twelve hours later than based on synoptic observations.
2. Weakening to a tropical depression is delayed 66 hours based on synoptic and reconnaissance aircraft data.
3. Major intensity decrease analyzed at 18Z on the 21st based on reconnaissance aircraft data.
4. Several central pressures, primarily from aircraft reconnaissance, have been added in.

October 15:

1. Maps and old HURDAT:

- HWM analyzes a trough over the northwest Caribbean Sea at 12Z.
- Microfilm shows a tropical disturbance at 20N, 83W at 12Z.

2. Discussion:

- MWR: "A well-defined 500-mb Low developed near Swan Island late on October 15."
- Reanalysis: Convection increased over the eastern and central Caribbean Sea on October 7th. The northern portion of the disturbance intensified into a tropical cyclone, later named Kara, and moved northwestward, while the southern portion continued westward into the western Caribbean Sea and remained disorganized. By the 15th, satellite images indicated that the disturbance was becoming better organized near the Cayman Islands but synoptic observation showed that it did not have a closed circulation.

October 16:

1. Maps and old HURDAT:

- HWM analyzes a spot low pressure at 19.5N, 81W at 12Z.
- Microfilm shows a tropical disturbance at 19.5N, 82W at 12Z.

2. Discussion:

- MWR: "The next day [16], pressures were rising all around a large area of disturbed weather which had developed in the northwest Caribbean, and it was here that a depression formed about 75 mi west of Swan Island."
- Reanalysis: The disturbance continued to move westward while showing signs of organization but no closed low-level circulation developed on this date.

October 17:

1. Maps and old HURDAT:

- HWM analyzes a closed low pressure of at most 1008 mb at 19N, 85.5W at 12Z.
- HURDAT lists a 25 kt tropical depression at 17.9N, 85.7W at 12Z.
- Microfilm shows a tropical cyclone of at most 1008 mb at 19N, 84.5W at 12Z.

2. Aircraft highlights:
   - 10 kt SW and 1006 mb at 19.5N 84.0W at 1745Z (micro).
3. Land highlights:
   - 10 kt S and 1009 mb at Swan Island, Honduras at 00Z (micro).

4. Discussion:

- ATSR: "Following the development of KARA, an area of disturbed Early on 17 October, a polar trough induced a circulation to form just west of Swan Island, and moved slowly northwest toward the Yucatan Peninsula. A tropical depression warning was issued at 171000Z based on ship and synoptic reports. Aircraft reconnaissance observed the tropical depression on the 17th and 18th, reporting a large area of showers and squalls, but a poorly defined circulation."
- Reanalysis: Based on synoptic observations, the first position is analyzed at 00Z on the 17th as a 25th tropical depression, same as originally shown in HURDAT. Satellite images showed a large area of convection south of Cuba with some hints of banding. The tropical depression slowly moved northwestward.

October 18:

1. Maps and old HURDAT:

- HWM analyzes a closed low pressure of at most 1008 mb at 20.5N, 87W at 12Z.
- HURDAT lists a 25 kt tropical depression at 19.1N, 86.9W at 12Z.
- Microfilm shows a tropical cyclone of at most 1008 mb at 20.5N, 86.5W 12Z.

2. Ship highlights:

a. 30 kt E and 1009 mb at 20.7N, 84.4W at 00Z (COADS).
b. 35 kt NE and 1010 mb at 23.4N, 88.6W at 12Z (COADS).
c. 30 kt E and 1008 mb at 22.9N, 87.4W at 18Z (COADS).

3. Aircraft highlights:

a. Penetration center fix measured a central pressure of 1006 mb at 20.4N, 86.4W at 1215Z (WALLET).
b. Penetration center fix at 19.8N, 87.8W at 18Z (WALLET).

4. Satellite highlights:

a. ESSA VIII estimated a center fix at 19.8N, 87W at 1615Z (WALLET).

5. Discussion:

- Reanalysis: Ship observations indicated that the tropical depression was slowly intensifying as it moved toward the Yucatan peninsula. Satellite images continued to show a large area of organized convection associated with this system. A reconnaissance aircraft investigated the tropical depression measuring a central pressure of 1006 mb at 1215Z. A central pressure of 1006 mb suggests maximum surface winds of 35 kt from the south of 25N Brown et al. pressure-wind relationship. Based on a slow forward speed of about 4 kt, an intensity of 30 kt is selected at 12Z on the 18th, up from 25 kt originally shown in HURDAT, a minor intensity change. A ship reported 35 kt at 12Z about 250 n mi northwest of the center, but a closer look into this ship reports at other times compared to surrounding data indicates that it has a high bias.

Late on the 18th, the tropical depression moved over the northern Yucatan peninsula.

October 19:

1. Maps and old HURDAT:

- HWM analyzes a closed low pressure of at most 1008 mb at 22N, 90.5W at 12Z.
- HURDAT lists a 45 kt tropical storm at 21.5N, 89.5W at 12Z.
- Microfilm shows a tropical cyclone of at most 1004 mb at 22N, 89.5W 12Z.

2. Ship highlights:

- 35 kt SE and 1007 mb at 22.4N, 86.3W at 00Z (COADS).
- 40 kt SE (high bias) and 1009 mb at 22.2N, 85.6W at 06Z (COADS).
- 35 kt SE and 1010 mb at 22.2N, 87W at 12Z (micro).
- 35 kt SE and 1012 mb at 25.7N, 88.8W at 18Z (COADS).
- 35 kt SE and 1014 mb at 26.3N, 85.6W at 21Z (COADS).

3. Land highlights:

- 10 kt N and 1006 mb at Merida, Mexico at 01Z (WALLET).

4. Aircraft highlights:

- Penetration center fix measured a central pressure of 1000 mb and estimated surface winds of 45 kt at 21.8N, 89.7W at 1311Z (WALLET).
- Penetration center fix measured a central pressure of 1004 mb and estimated surface winds of 45 kt at 23.4N, 90.6W at 1755Z (WALLET).
- Penetration center fix measured a central pressure of 1000 mb at 2130Z by ESSA research mission (WALLET).
- Penetration center fix measured a central pressure of 1004 mb, estimated surface winds of 38 kt and an eye diameter of 40 n mi at 23.3N, 90.7W at 2354Z (WALLET).

5. Discussion:

- MWR: "All criteria seemed to be present for rapid intensification, but this did not occur until the 19th when the depression moved off the Yucatan Peninsula into the southern Gulf of Mexico."
- ATSR: "It moved across the Yucatan peninsula early on the 19th, intensifying as it moved offshore into the Gulf of Mexico. This depression was upgraded to Tropical Storm LAURIE at 191600Z."
- Reanalysis: Late in the morning of the 19th, the center of the tropical cyclone entered the Gulf of Mexico. A reconnaissance aircraft made a penetration center fix at 1311Z and measured a central pressure of 1000 mb and estimated surface winds of 45 kt. A central pressure of 1000 mb suggests maximum surface winds of 47 kt from the south of 25N Brown et al. pressure-wind relationship. Based on a slow forward speed of about 9 kt, an intensity of 40 kt is analyzed at 12Z on the 19th, down from 45 kt originally shown in HURDAT, a minor intensity change. Intensification to a tropical storm is analyzed at 12Z on the 19th, same as originally shown in HURDAT. Satellite images showed that the tropical cyclone had become much better organized with a large convective shield and banding features. But there were still some signs of westerly shear and dry air over the western quadrant. A few penetration center fixes late on the 19th measured pressures in the range of 1002-1004 mb, but ship reports at 18Z on the 19th and 00Z on the 20th, and the location of the center fixes, indicated that they likely missed the center. Additionally, research aircraft reported that the 12000 ft center was about 60 n mi northeast of the surface center at 15Z, and that the 18000 ft center was about 70 n mi southeast of the

surface center near 19Z. Thus, these observations were not used to estimate the intensity at 18Z on the 19th.

October 20:

1. Maps and old HURDAT:

- HWM analyzes a tropical storm of at most 1004 mb at 24.6N, 91.9W at 12Z.
- HURDAT lists a 65 kt hurricane at 24.3N, 91W at 12Z.
- Microfilm shows a tropical storm of 993 mb at 24.3N, 91.6W 12Z.

2. Ship highlights:

- 40 kt S and 1005 mb at 23.9N, 89.5W at 00Z (COADS).
- 40 kt S and 1005 mb at 23.5N, 90.7W at 06Z (COADS).
- 35 kt WNW and 1005 mb at 23.1N, 93.5W at 09Z (COADS).
- 40 kt S and 1005 mb at 22.8N, 90.3W at 13Z (COADS).
- 60 kt SSE and 1005 mb at 24.4N, 88.9W at 18Z (COADS).

3. Land highlights:

- 35 kt NW at Triangulo Oeste Reef, Mexico at 00Z (micro).

4. Aircraft highlights:

- Penetration center fix measured a central pressure of 998 mb at 23.8N, 90.8W at 0630Z (WALLET).
- Penetration center fix measured a central pressure of 993 mb at 24.3N, 91.1W at 1130Z (WALLET).
- Penetration center fix measured a central pressure of 987 mb, estimated surface winds of 85 kt and an eye diameter of 25 n mi at 25.3N, 91W at 1830Z (WALLET).

5. Discussion:

- ATSR: "LAURIE continued to intensify as she turned northward toward the Central Gulf, reaching hurricane intensity within 24 hours [20]."
- Reanalysis: On the 20th, Laurie turned to the north and intensified. A reconnaissance aircraft measured a central pressure of 998 mb at 0630Z. A central pressure of 998 mb suggests maximum surface winds of 51 kt from the south of 25N pressure-wind relationship. Accounting for Laurie's continued slow (6 kt) forward speed, an intensity of 45 kt is analyzed at 06Z on the 20th, down from 55 kt originally shown in HURDAT, a minor intensity change. The next penetration center fix measured a central pressure of 993 mb at 1130Z. A central pressure of 993 mb suggests maximum surface winds of 59 kt from the intensifying TCs south of 25N and 57 kt from intensifying TCs north of 25N pressure-wind relationships. An intensity of 55 kt is retained at 12Z. A few ships reported winds of tropical storm intensity, including 60 kt at 18Z. Laurie is analyzed to have reached 65 kt – hurricane-force - by 18Z, six hours later than originally shown in HURDAT. Satellite images showed a well-organized tropical cyclone with a developing CDO and banding features, especially over the eastern quadrant.

October 21:

1. Maps and old HURDAT:

- HWM analyzes a hurricane of at most 996 mb at 26.5N, 90.7W at 12Z.
- HURDAT lists a 90 kt hurricane at 26.3N, 89.6W at 12Z.
- Microfilm shows a hurricane of 973 mb at 26.5N, 90.2W 12Z.

2. Ship highlights:

- 40 kt S and 1005 mb at 23.9N, 89.5W at 00Z (micro).
- 45 kt SE and 1004 mb at 26N, 88W at 06Z (COADS).
- 65 kt S and 1000 mb at 25.3N, 89.1W at 12Z (COADS).
- 55 kt SW and 994 mb at 24.9N, 89.5W at 18Z (COADS).
- 65 kt SW and 984 mb at 25.3N, 89.1W at 21Z (MWL).

3. Aircraft highlights:

- Penetration center fix estimated an elliptical eye with major axis 30º-210º, major axis of 53 n mi and minor axis of 28 n mi at 25.9N, 90.9W at 0010Z (WALLET).
- Penetration center fix estimated an eye diameter of 40 n mi at 26.3N, 90.5W at 0550Z (WALLET).
- Penetration center fix measured a central pressure of 974 mb at 26.4N, 90.1W at 0850Z (WALLET).
- Penetration center fix measured a central pressure of 973 mb, estimated an eye diameter of 40 n mi, and measured 700-mb flight-level winds of 105 kt 30 NM from the center at 26.3N, 90W at 1136Z (WALLET).
- Penetration center fix measured a central pressure of 977 mb, estimated surface winds of 75 kt and an eye diameter of 30 n mi at 26.5N, 88.9W at 1850Z (WALLET).
- Penetration center fix measured a central pressure of 980 mb, estimated surface winds of 80 kt and an eye diameter of 30 n mi at 26.3N, 88.6W at 2348Z (WALLET).

4. Discussion:

- MWR: "The hurricane reached maximum strength about 250 mi south of New Orleans on the 21st. Drier air gradually weakened Laurie as she recurved toward the east, then south, then west and southwest, and finally entered Mexico.
- ATSR: "Early on the 21st, LAURIE made a sharp turn toward the east as she reached her maximum intensity of 90 knots. She was now centered about 200 miles south of New Orleans. A polar front had moved over the Southeastern United States on the 21st, but the westerlies aloft were too far north to have much influence on LAURIE at this time."
- Reanalysis: Laurie continued to gain strength as it turned to the east over the central Gulf of Mexico. A reconnaissance aircraft made a center penetration at 0010Z on the 21st estimating an eye diameter of 28-53 n mi. No central pressure was available in the Storm Wallets but a central pressure of 973 mb was present in the original HURDAT and it appears reliable. A central pressure of 973 mb suggests maximum surface winds of 85 kt from the north of 25N and 87 kt south of 25N pressure-wind relationship intensifying subsets. An eye diameter of 28-53 n mi suggests an RMW of about 21-40 n mi and the climatological value is 19 n mi. Based on a slow forward speed of about 8 n mi, a large RMW, and weighting lightly the 105 kt flight-level winds, an intensity of 80 kt is analyzed at 00Z on the 21st, up from 70 kt originally in HURDAT, a minor intensity change. The next two penetration center fixes measured central pressures of 974 mb at 0850Z and 973 mb at 1136Z on the 21st and an intensity of 80 kt is selected at 06Z and 12Z, same at 06Z and down from 90 kt at 12Z as originally shown in HURDAT, a major intensity change at 12Z on the 21st. A peak intensity of 80 kt is analyzed between 00Z and 12Z on the 21st, down from 90 kt at 12Z and 18Z on the 21st, originally shown in HURDAT, a minor intensity change. Later on the 21st, Laurie began to weaken as the central pressure started to rise. A penetration center fix measured a central pressure of 977 mb, estimated surface winds of 80 kt and an eye diameter of 30 n mi at 1850Z on the 21st. A central pressure of 977 mb suggests maximum surface winds of 76 kt from the north of 25N pressure-wind

relationship. An eye diameter of 30 n mi suggests an RMW of about 23 n mi and the climatological value is 20 n mi. Based on a slow forward speed of 8 kt, an intensity of 70 kt is analyzed at 18Z, down from 90 kt originally shown in HURDAT, a major intensity change. Many ships reported tropical-storm-force winds on the 21st and a couple even registered hurricane-force winds at 12Z and 21Z. Satellite images showed a well-organized tropical cyclone with a CDO and an eye. There was still some southwesterly wind shear impinging the circulation.

October 22:

1. Maps and old HURDAT:

- HWM analyzes a hurricane of at most 992 mb at 25.8N, 87W at 12Z.
- HURDAT lists a 75 kt hurricane at 25.4N, 86.8W at 12Z.
- Microfilm shows a hurricane of 987 mb at 25.6N, 86.7W 12Z.

2. Ship highlights:

- 70 kt SW and 984 mb at 25.8N, 88.3W at 00Z (COADS).
- 40 kt S and 1004 mb at 25.2N, 86.2W at 06Z (COADS).
- 40 kt SSW and 997 mb at 24.7N, 86.7W at 12Z (COADS).
- 50 kt S and 1003 mb at 24.7N, 86W at 15Z (COADS).
- 50 kt NE and 998 mb at 25.3N, 87.5W at 18Z (COADS).

3. Aircraft highlights:

- Penetration center fix estimated an elliptical eye with a major axis of 35 n mi and minor axis of 30 n mi at 26N, 88.2W at 0252Z (WALLET).
- Penetration center fix measured a central pressure of 983 mb and estimated an eye diameter of 30 n mi at 25.7N, 88W at 0552Z (WALLET).
- Penetration center fix measured a central pressure of 987 mb, estimated surface winds of 95 kt and an eye diameter of 20 n mi at 25.4N, 86.8W at 12Z (WALLET).
- Penetration center fix measured a central pressure of 987 mb, estimated surface winds of 75 kt and an elliptical eye with major axis 20º-200º, major axis of 25 n mi and minor axis of 10 n mi at 25.3N, 86.7W at 1747Z (WALLET).
- Penetration center fix measured a central pressure of 992 mb, estimated surface winds of 85 kt and an eye diameter of 20 n mi at 24.9N, 86.3W at 2223Z (WALLET).

4. Discussion:

- ATSR: "By the 22nd, a large intense anticyclone on the surface was centered over the Great Lakes region. This high continued to intensify during the next three days as it drifted east-southeast toward the middle Atlantic States. This forced LAURIE to make a complete loop and tum toward the Southwestern Gulf of Mexico."
- Reanalysis: Laurie turned to the southeast and gradually weakened. A penetration center fix measured a central pressure of 980 mb, estimated surface winds of 80 kt and an eye diameter of 30 n mi at 2348Z on the 21st. A central pressure of 980 mb suggests maximum surface winds of 73 kt from the north of 25N pressure-wind relationship. An intensity of 75 kt is analyzed at 00Z on the 22nd partly due to the ship report of 70 kt, down from 85 kt originally shown in HURDAT. The next penetration center fix measured a central pressure of 983 mb and estimated an eye diameter of 30 n mi at 0552Z on the 22nd. A central pressure of 983 mb suggests maximum surface winds of 69 kt from the north of 25N pressure-wind relationship. An eye diameter of 30 n mi suggests an RMW of about 23 n mi and the climatological value is 20 n mi. An

intensity of 70 kt is analyzed at 06Z on the 22nd, down from 80 kt originally shown in HURDAT, a minor intensity change. A penetration center fix at 12Z on the 22nd measured a central pressure of 987 mb, estimated surface winds of 95 kt and an eye diameter of 20 n mi. A central pressure of 987 mb suggests maximum surface winds of 64 kt from the north of 25N and 68 kt from the south of 25N pressure-wind relationships. An eye diameter of 20 n mi suggests an RMW of about 15 n mi and the climatological value is 20 n mi. Based on a slow forward speed of about 6 kt and RMW smaller than average, an intensity of 65 kt is analyzed at 12Z on the 22nd, down from 75 kt originally shown in HURDAT, a minor intensity change. Another penetration center fix measured a central pressure of 987 mb at 1747Z on the 22nd and an intensity of 65 kt is analyzed at 18Z, down from 70 kt originally shown in HURDAT, a minor intensity change. Many ships reported tropical-storm-force winds on the 22nd and a ship at 00Z registered 70 kt. Satellite images indicated that Laurie had weakened from the previous day, the convective shield had decreased in size and the eye had disappeared.

October 23:

1. Maps and old HURDAT:

- HWM analyzes a tropical storm of at most 1004 mb at 24.5N, 86.5W at 12Z.
- HURDAT lists a 45 kt tropical storm at 24.1N, 86.2W at 12Z.
- Microfilm shows a tropical storm of 998 mb at 24.1N, 86.1W 12Z.

2. Ship highlights:

- 30 kt NNW and 1005 mb at 24.7N, 88.4W at 00Z (COADS).
- 45 kt NW and 999 mb at 24N, 87W at 03Z (micro).
- 50 kt NE and 1010 mb at 26.4N, 88.2W at 12Z (COADS).
- 45 kt ENE and 1001 mb at 24.4N, 86.2W at 15Z (COADS).
- 45 kt SE and 1002 mb at 24.4N, 85.5W at 18Z (COADS).

3. Aircraft highlights:

- Penetration center fix measured a central pressure of 992 mb and estimated an eye diameter of 30 n mi at 24.7N, 86.5W at 0007Z (WALLET).
- Penetration center fix measured a central pressure of 996 mb and estimated an elliptical eye with major axis 350º-170º, major axis of 10 n mi and minor axis of 35 n mi at 24.3N, 85.9W at 0745Z (WALLET).
- Penetration center fix measured a central pressure of 998 mb at 24.2N, 86.2W at 1132Z (WALLET).
- Penetration center fix measured a central pressure of 1000 mb and estimated surface winds of 35 kt at 24N, 86.6W at 2035Z (WALLET).

4. Discussion:

- ATSR: "By the 23rd, LAURIE had lost her hurricane winds … The anticyclone aloft dominated the Gulf of Mexico by the 23rd, with LAURIE losing her mid-level circulation. On the 26th, LAURIE turned south over the south-western Gulf of Mexico, moving inland over southern Mexico near Paraiso on the 26th. LAURIE was the third hurricane of the season to make a loop."

- Reanalysis: Laurie turned to the south and southeast as it continued to weaken. A penetration center fix measured a central pressure of 992 mb and estimated an eye diameter of 30 n mi at 0007Z on the 23rd. A central pressure of 992 mb suggests maximum surface winds of 61 kt from the south of 25N and 54 kt from the north of 25N pressure-wind relationships weakening subset. An eye

diameter of 30 n mi suggests an RMW of about 23 n mi and the climatological value is 20 n mi. Based on a slow forward speed of about 5 kt, an intensity of 55 kt is analyzed at 00Z on the 23rd, down from 65 kt originally shown in HURDAT, a minor intensity change. Weakening to a tropical storm is analyzed at 00Z on the 23rd, six hours earlier than originally shown in HURDAT. The next penetration center fix measured a central pressure of 996 mb at 0745Z on the 23rd. A central pressure of 996 mb suggests maximum surface winds of 54 kt from the south of 25N and 50 kt from the north of 25N pressure-wind relationships. Based on a slow forward speed of about 3 kt, an intensity of 50 kt is analyzed at 06Z on the 23rd, down from 60 kt originally shown in HURDAT, a minor intensity change. Another penetration center fix measured a central pressure of 998 mb at 1132Z on the 23rd. A central pressure of 998 mb suggests maximum surface winds of 51 kt from the south of 25N pressure-wind relationship. An intensity of 50 kt is analyzed at 12Z on the 23rd, up from 45 kt originally shown in HURDAT, a minor intensity change. The last penetration center fix on the 23rd measured a central pressure of 1000 mb and estimated surface winds of 35 kt at 2035Z. A central pressure of 1000 mb suggests maximum surface winds of 47 kt from the south of 25N pressure-wind relationship. An intensity of 45 kt is analyzed at 18Z on the 23rd, up from 40 kt originally shown in HURDAT, a minor intensity change. Satellite images showed a very compact tropical cyclone with a small CDO.

October 24:

1. Maps and old HURDAT:

- HWM analyzes a closed low pressure of at most 1008 mb at 23.7N, 89.2W at 12Z.
- HURDAT lists a 35 kt tropical storm at 23.4N, 88.6W at 12Z.
- Microfilm shows a tropical cyclone of 1002 mb at 23.5N, 88.4W 12Z.

2. Ship highlights:

- 50 kt NE (high bias) and 1011 mb at 26.3N, 85.8W at 00Z (COADS).
- 40 kt NE and 1012 mb at 26.5N, 87.3W at 03Z (micro).
- 40 kt E and 1011 mb at 25.6N, 84.9W at 06Z (COADS).
- 30 kt NW and 1009 mb at 23N, 89.5W at 12Z (COADS).
- 50 kt ESE (high bias) at 25.5N, 87.5W at 13Z-14Z (WALLET).
- 35 kt ESE and 1010 mb at 24.6N, 86.8W at 18Z (micro).

3. Aircraft highlights:

- Penetration center fix measured a central pressure of 1001 mb and estimated surface winds of 35 kt at 23.5N, 88.6W at 1230Z (WALLET).
- Penetration center fix measured a central pressure of 1004 mb and estimated surface winds of 25 kt at 23.3N, 89.8W at 2045Z (WALLET).

4. Discussion:

- ATSR: "… and weakened into a depression by late the following day [24]"

- Reanalysis: The tropical storm continued to weaken as it moved southeast, passing north of the Yucatan peninsula. A reconnaissance aircraft measured a central pressure of 1001 mb and estimated surface winds of 35 kt at 1230Z on the 24th. A central pressure of 1001 mb suggests maximum surface winds of 45 kt from the south of 25N pressure-wind relationship. Based on a forward speed of

about 8 kt, an intensity of 40 kt is analyzed at 12Z on the 24th, up from 35 kt originally shown in HURDAT, a minor intensity change. The next penetration center fix measured a central pressure of 1004 mb and estimated surface winds of 25 kt at 2045Z on the 24th. A central pressure of 1004 mb suggests maximum surface winds of 39 kt from the south of 25N pressure-wind relationship. Based on a forward speed of about 10 kt, an intensity of 35 kt is analyzed at 18Z on the 24th, up from 30 kt originally shown in HURDAT, a minor intensity change. A few ships reported tropical-storm-force winds. Satellite images showed a small tropical cyclone with a compact CDO.

October 25:

1. Maps and old HURDAT:

- HWM analyzes a closed low pressure of at most 1012 mb at 23.2N, 91W at 12Z.
- HURDAT lists a 25 kt tropical depression at 22.4N, 91.7W at 12Z.
- Microfilm shows a tropical cyclone of 1007 mb at 23N, 92W 12Z.

2. Ship highlights:

- 40 kt NE and 1018 mb at 27.6N, 92W at 00Z (COADS).
- 30 kt NE and 1017 mb at 27N, 90.6W at 06Z (COADS).
- 30 kt ENE and 1017 mb at 26.3N, 89W at 12Z (COADS).
- 30 kt E and 1027 mb at 26.9N, 89.8W at 18Z (COADS).

3. Land highlights:

- 35 kt W and 1009 mb at Triangulo Oeste Reef, Mexico at 18Z (micro).

4. Aircraft highlights:

- Penetration center fix measured a central pressure of 1007 mb and estimated surface winds of 25 kt at 23N, 92.2W at 1158Z (WALLET).
- Penetration center fix measured a central pressure of 1003 mb, estimated surface winds of 25 kt and an elliptical eye with major axis 30º-210º, major axis of 15 n mi and minor axis of 5 n mi at 22N, 92.4W at 1830Z (WALLET).

5. Discussion:

- Reanalysis: Laurie continued southeastward as a weak tropical storm. A reconnaissance aircraft measured a central pressure of 1003 mb and estimated surface winds of 25 kt at 1830Z on the 25th. A central pressure of 1003 mb suggests maximum surface winds of 41 kt from the south of 25N pressure-wind relationship. Based on a forward speed of about 7 kt and measurement of 35 kt at a Mexican reef, an intensity of 35 kt is analyzed at 18Z on the 25th, up from 25 kt originally shown in HURDAT, a minor intensity change. Only one gale-force wind was reported by ships on this date. Satellite images showed a small system with little or no banding features.

October 26:

1. Maps and old HURDAT:

- HWM does not analyze any feature of interest at 12Z.
- HURDAT lists a 25 kt tropical depression at 22.4N, 91.7W at 12Z.
- Microfilm shows a tropical cyclone of 1007 mb at 20.5N, 94.5W 12Z.

2. Aircraft highlights:

- Penetration center fix measured a central pressure of 1006 mb and estimate surface winds of 30 kt at 19.3N, 93.2W at 2042Z (WALLET).

3. Discussion:

- Reanalysis: Laurie continued to weaken as it turned to the south. A reconnaissance aircraft measured a central pressure of 1006 mb and estimated surface winds of 30 kt at 2042Z on the 26th. A central pressure of 1006 mb suggests maximum surface winds of 35 kt from the south of 25N pressure-wind relationship. Based on a forward speed of about 7 kt, an intensity of 30 kt is analyzed at 18Z on the 26th, same as originally shown in HURDAT. Weakening to a tropical depression is analyzed at 00Z on the 26th, 30 hours later than originally shown in HURDAT. Satellite images showed a disorganized system with most of the convection over the Bay of Campeche.

October 27:

1. Maps and old HURDAT:

- HWM does not analyze any feature of interest at 12Z.
- HURDAT lists a 20 kt tropical depression at 18N, 93.1W at 06Z (last position).
- Microfilm shows a closed low pressure of at most 1008 mb at 15.5N, 94W 12Z.

2. Discussion:

- Reanalysis: Laurie made landfall in southern Mexico after 00Z on the 27th. Synoptic observations were sparse at 12Z but there was no indication that a closed circulation was present, thus the last position is analyzed at 06Z on the 27th, same as originally shown in HURDAT. Satellite images showed an area of disorganized cloudiness over the Bay of Campeche, which lasted for a few more days, but no redevelopment was observed.

October 28:

1. Maps and old HURDAT:

- HWM does not analyze any feature of interest at 12Z.

Date	Original HURDAT Central Pressure	Evidence	Changes
Oct 17 00Z	1007 mb	Land: 10 kt S and 1009 mb at 00Z at Swan Island, Honduras	Retained
Oct 17 18Z		Aircraft observation: 10 kt SW and 1006 mb at 1745Z on Oct 17th	1005 mb
Oct 18 12Z		Penetration center fix: 1006 mb at 1215Z on Oct 18th	1006 mb
Oct 19 00Z	1005 mb	Land: 10 kt N and 1006 mb at 01Z at Merida, Mexico	Retained
Oct 19 12Z	1000 mb	Penetration center fix: 1000 mb at 1311Z on Oct 19th	
Oct 20 06Z		Penetration center fix: 998 mb at 0630Z on Oct 20th	998 mb
Oct 20 12Z	993 mb	Penetration center fix: 993 mb at 1130Z on Oct 20th	Retained
Oct 20 18Z		Penetration center fix: 987 mb at 1830Z on Oct 20th	987 mb
Oct 21 00Z	973 mb	Penetration center fix at 0010Z on Oct 21st, but no central pressure reported in the Storm Wallets	Retained

Oct 21 06Z		Penetration center fix: 974 mb at 0850Z on Oct 21st	974 mb
Oct 21 12Z	973 mb	Penetration center fix: 973 mb at 1136Z on Oct 21st	Retained
Oct 21 18Z		Penetration center fix: 977 mb at 1850Z on Oct 21st	977 mb
Oct 22 00Z	980 mb	Penetration center fix: 980 mb at 2348Z on Oct 21st	Retained
Oct 22 06Z		Penetration center fix: 983 mb at 0552Z on Oct 22nd	983 mb
Oct 22 12Z	987 mb	Penetration center fix: 987 mb at 12Z on Oct 22nd	Retained
Oct 22 18Z		Penetration center fix: 987 mb at 1747Z on Oct 22nd	987 mb
Oct 23 00Z	992 mb	Penetration center fix: 992 mb at 0007Z on Oct 23rd	Retained
Oct 23 06Z		Penetration center fix: 996 mb at 0745Z on Oct 23rd	996 mb
Oct 23 12Z		Penetration center fix: 998 mb at 1132Z on Oct 23rd	998 mb
Oct 23 18Z		Penetration center fix: 1000 mb at 2035Z on Oct 23rd	1000 mb
Oct 24 12Z	1001 mb	Penetration center fix: 1001 mb at 1230Z on Oct 24th	Retained
Oct 24 18Z		Penetration center fix: 1004 mb at 2045Z on Oct 24th	1004 mb
Oct 25 12Z	1007 mb	Appears to have missed the center based on reconnaissance aircraft data late on the 24th and 25th	Removed
Oct 25 18Z		Penetration center fix: 1003 mb at 1830Z on Oct 25th	1003 mb
Oct 26 18Z	1006 mb	Penetration center fix: 1006 mb at 2042Z on Oct 26th	Retained

Sources: NHC microfilm maps, the Historical Weather Maps series, the COADS ship database, Monthly Weather Review, Mariners Weather Log, Satellite images from NCDC, and NHC Storm Wallets.

Unnamed – AL271969 – 2021 Revisions

Green indicates wind changes of 15 kt or greater
Blue indicates lat/long changes greater than 1°
Red indicates a new entry
Yellow indicates a deletion

Unnamed Tropical Storm [October 28-31, 1969]

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46640 10/28/1969 M= 4 27 SNBR= 993 NOT NAMED   XING=0 SSS=0
46640 10/28/1969 M= 5 27 SNBR= 993 NOT NAMED   XING=0 SSS=0
                     *

46645 10/28*  0   0   0    0*  0   0   0    0S305 425  25 1014S313 436  30    0*
46645 10/28*  0   0   0    0*  0   0   0    0S305 425  35 1014S313 435  35    0*
                                                        **          ***  **

46650 10/29S320 445  35 1007S328 453  45    0S335 460  50  995S340 466  55    0*
46650 10/29S320 445  40    0S327 453  45    0*333 459  50  995*338 464  55    0*
                     **    * ***             **** ***        **** ***

46655 10/30*345 470  55  993*353 468  60    0*360 460  60  990*368 447  60    0*
46655 10/30*342 468  55    0*347 470  60    0*355 468  60    0*365 465  50    0*
            *** ***        * *** ***          *** ***        * *** ***  **

46660 10/31*375 430  60  990*379 409  55    0*380 385  50  995E380 350  45    0*
46660 10/31*380 460  40  990*420 460  40  992E450 450  40  994E470 425  35  996*
            *** ***  **      *** ***  **  ******* ***  **  *** *** ***  **  ***
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(The 1st is new to HURDAT.)

46660 11/01E485 400 35 998E505 375 30 1000E525 300 30 1001E550 220 30 1002*

46665 TS

Significant Revisions:

1. Intensification to a subtropical storm analyzed twelve hours earlier based on synoptic observations.
2. Transition to a tropical storm is analyzed twelve hours earlier based on synoptic and satellite observations.
3. Dissipation is analyzed 24 hours later based on synoptic and satellite data.
4. Major position alteration to the west analyzed at 18Z on the 30th and 00Z on the 31st as well as to the northwest at 06Z to 18Z on the 31st based on synoptic observations.
5. Major intensity decrease analyzed at 00Z and 06Z on the 31st based on synoptic observations.
6. Central pressures in HURDAT were removed at 00Z on the 29th, 00Z and 12Z on the 30th and 31st based on the absence of synoptic observations.

October 27:

1. Maps and old HURDAT:

- HWM and microfilm show a frontal boundary over the central Atlantic at 12Z.

2. Discussion:

- Reanalysis: An area of low pressure developed over the central Atlantic in the tail-end of a weakening frontal boundary. Satellite images on the 27th showed a large area of disorganized convection.

October 28:

1. Maps and old HURDAT:

- HWM analyzes a stationary front over the central Atlantic at 12Z.
- HURDAT lists a 25 kt subtropical depression at 30.5N, 42.5W at 12Z (first position).
- Microfilm shows a closed low pressure of at most 1016 mb with a frontal boundary going through the center at 30N, 42.5W at 12Z.

2. Ship highlights:

- 35 kt NE and 1024 mb at 32N, 45.5W at 12Z (COADS).
- 45 kt NE (likely high bias) and 1016 mb at 30.9N, 45.6W at 12Z (COADS).
- 10 kt S and 1015 mb at 30.5N, 41W at 12Z (COADS).

3. Discussion:

- Reanalysis: The disturbance became better organized and synoptic observations showed that a closed low-level circulation had developed at 12Z on the 28th. The first position is analyzed at 12Z on the 28th, same as originally shown in HURDAT. The elongated circulation and large RMW of about 200 n mi at 12Z on the 28th suggests that the system still retained some non-tropical characteristics, thus it is analyzed as a subtropical cyclone, same as

originally shown in HURDAT. A couple of ships reported gale-force winds at 12Z on the 28th and the subtropical cyclone is initialized with 35 kt, up from 25 kt originally shown in HURDAT, a minor intensity change. A central pressure of 1014 mb was present at 12Z on the 28th in the original HURDAT and it is retained based on a ship report of 10 kt S and 1015 mb. Satellite images indicated that the convective structure had become much better organized on this date.

October 29:

1. Maps and old HURDAT:

- HWM analyzes a closed low pressure of at most 1000 mb at 33.7N, 46W at 12Z.
- HURDAT lists a 50 kt subtropical storm at 33.5N, 46W at 12Z.
- Microfilm shows a closed low pressure of at most 1008 mb at 33N, 46W at 12Z.

2. Ship highlights:

a. 20 kt NE and 1001 mb at 32.2N, 46W at 06Z (COADS).
b. 50 kt NW and 1000 mb at 33N, 46.6W at 12Z (COADS).
c. 45 kt SSE and 1008 mb at 33.5N, 45.8W at 18Z (COADS).
d. 35 kt NNE and 1008 mb at 35N, 48W at 21Z (COADS).

3. Discussion:

- Reanalysis: The subtropical cyclone continued to intensify on the 29th as it moved to the northwest. Transition to a tropical storm is analyzed at 12Z on the 29th based on synoptic and satellite data. Ships near the center of the cyclone indicate that the circulation had become isothermal, the RMW had contracted to about 100 n mi (though this is still quite large for a tropical cyclone), and microfilm and HWM showed that the frontal boundaries had dissipated near the system at 12Z on the 29th. Also, satellite images showed that the center was located under the convection and ahead of a strong frontal boundary situated to the west. A ship reported 50 kt NW and 1000 mb at 12Z on the 29th, a basis to retain the central pressure of 995 mb that was originally present in HURDAT. A central pressure of 995 mb suggests maximum surface winds of 52 kt from the north of 25N pressure-wind relationship. Based on a forward speed of about 8 kt and synoptic observations, an intensity of 50 kt is analyzed at 12Z on the 29th, same as originally shown in HURDAT.

October 30:

1. Maps and old HURDAT:

- HWM analyzes a closed low pressure of at most 1004 mb at 36N, 47.5W with a cold front to the west at 12Z.
- HURDAT lists a 60 kt tropical storm at 36N, 46W at 12Z.
- Microfilm shows a closed low pressure of at most 1000 mb at 36N, 47W with a cold front to the west at 12Z.

2. Ship highlights:

a. 35 kt NE and 1006 mb at 34.9N, 48.1W at 00Z (COADS).
b. 35 kt N and 1009 mb at 33.6N, 50.5W at 06Z (COADS).
c. 30 kt ESE and 1001 mb at 36.8N, 45.8W at 12Z (COADS).
d. 35 kt W and 1007 mb at 33.9N, 47.5W at 15Z (COADS).
e. 35 kt S and 1000 mb at 36.5N, 44.7W at 18Z (COADS).
f. 35 kt W and 1006 mb at 34.8N, 46W at 21Z (COADS).

3. Discussion:

- Reanalysis: Satellite images showed a small but well-organized tropical cyclone ahead of a strong frontal boundary. A peak intensity of 60 kt is analyzed at 06Z and 12Z on the 30th, same as originally shown in HURDAT.

October 31:

1. Maps and old HURDAT:
- HWM and microfilm indicate that the tropical cyclone has been absorbed by a large extratropical cyclone over the north Atlantic at 12Z.
- HURDAT lists a 50 kt tropical storm at 38N, 38.5W at 12Z.

2. Ship highlights:
a. 35 kt WSW and 1002 mb at 36.8N, 45.8W at 00Z (COADS).

3. Discussion:
- Reanalysis: The system began interacting early on the 31st with a frontal boundary and a baroclinic low to its west. The position in HURDAT, however, do not correspond even remotely toward the actual position of either system. The tropical storm quickly moved toward the north-northeast on this date, while weakening and undergoing extratropical transition around 12Z. The positions chosen on the 31st were very far to the northwest of the original positions.

November 1:

1. Maps and old HURDAT:
- HWM analyzes an extratropical cyclone over the north Atlantic at 12Z.
2. Discussion:
- Reanalysis: The system continued moving toward the northeast on the 1st while gradually weakening until dissipation after 18Z.

Sources: NHC microfilm maps, the Historical Weather Maps series, the COADS ship database, Monthly Weather Review, Mariners Weather Log, Satellite images from NCDC, and NHC Storm Wallets.

Unnamed – AL281969 – 2021 Revisions

Green indicates wind changes of 15 kt or greater
Blue indicates lat/long changes greater than 1°
Red indicates a new entry
Yellow indicates a deletion

Unnamed Hurricane [October 29 – November 8, 1969]

```
46670 10/30/1969 M= 9 28 SNBR= 994 NOT NAMED   XING=0 SSS=0
46665 10/28/1969 M=13 28 SNBR= 994 NOT NAMED   XING=0 SSS=0
         **        **

(October 28th and 29th are new to HURDAT)
46670 10/28*  0   0   0    0*  0   0   0    0E380 690  20    0E380 685  25    0*
46670 10/29E382 675  30    0*387 655  35    0E395 625  40    0E410 605  45    0*


46675 10/30*  0   0   0    0*  0   0   0    0E425 570  50    0E418 563  50    0*
46675 10/30E425 589  55    0E428 575  60    0E423 567  60    0E415 560  60    0*
           **** ***  **     **** ***  **      *** ***  **      *** ***  **
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46680 10/31E410 555  50   992E403 548  50    0S395 540  55  988S390 530  55    0*
46680 10/31E406 550  60     0E400 540  60    0E396 531  60  988E392 523  65    0*
            *** ***  **      *** ***  **      *** ***  **      *** ***  **

46685 11/01S385 520  60    0S380 510  60    0S375 500  60  992S356 492  60    0*
46685 11/01E387 515  65    0E382 508  65    0E373 500  60    0E362 492  60    0*
           **** ***  **     **** ***  **     ****            *****

46690 11/02S335 485  55    0S325 480  50    0*315 475  50  998*305 466  50    0*
46690 11/02S348 485  55    0S333 480  50    0S318 475  45    0S305 468  45    0*
            ***              ***             ****      **    ***** ***  **

46695 11/03*295 455  55    0*283 443  60    0*270 430  60  995*264 414  60    0*
46695 11/03*293 459  45  995*283 449  45    0*275 438  50  992*270 424  55    0*
            *** ***  **  ***     ***  **      *** ***  **  *** *** ***  **

46700 11/04*265 400  60    0*271 390  60    0*280 380  65  992*292 370  65    0*
46700 11/04*269 410  60    0*271 398  60    0*278 388  65    0*290 378  65    0*
            *** ***             ***           *** ***        * *** ***

46705 11/05*303 360  65    0*314 350  65    0*325 340  60    0*338 330  60    0*
46705 11/05*302 369  70    0*314 360  75    0*325 350  80    0*338 340  80    0*
            *** ***  **           ***  **           ***  **           ***  **

46710 11/06*350 320  60    0*363 307  55    0*375 290  50    0*388 271  50    0*
46710 11/06*350 327  80    0*362 312  80    0*373 293  75    0*382 276  70    0*
                ***  **      *** ***  **      *** ***  **      *** ***  **

46715 11/07*400 250  45    0*  0   0   0    0*  0   0   0    0*  0   0   0    0*
46715 11/07*387 264  60    0*389 252  50    0L388 238  45    0L383 220  40    0*
            *** ***  **      *** ***  **      **** ***  **      **** ***  **
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(November 8th and 9th are new to HURDAT)

```
46720 11/08L373 195  35    0L360 175  35    0L351 155  30    0L345 140  25    0*
46720 11/09L340 120  20    0*  0   0   0    0*  0   0   0    0*  0   0   0    0*
```

46725 HR

Significant Revisions:

1. First position analyzed 48 hours earlier based on synoptic observations.
2. Transition to a subtropical cyclone is analyzed 36 hours later based on synoptic observations.
3. Transition to a tropical storm is analyzed twelve hours later based on synoptic observations.
4. Weakening to a tropical storm is analyzed 36 hours later based on synoptic observations.
5. Major position changes at 18Z on November 3rd, 00Z on the 4th, 06Z-18Z on the 5th, and 00Z on the 7th.
6. Major intensity decrease at 06Z on November 3rd, and major intensity increases between 12Z on the 5th and 00Z on the 7th.
7. System's dissipation analyzed to be 48 hours earlier based upon ship observations. Most of which are analyzed as a Post-Tropical (but not extratropical) Low.

8. A few central pressures were removed from 00Z on October 31st to 12Z on November 4th based on synoptic observations.

Daily Metadata:

October 27:

1. Maps and old HURDAT:

- HWM and microfilm shows a frontal boundary over the eastern United States at 12Z.
- HURDAT does not list an organized system on this date.

October 28:

1. Maps and old HURDAT:

- HWM analyzes an extratropical cyclone at 38.2N, 70.5W at 12Z.
- HURDAT does not list an organized system on this date.
- Microfilm shows an extratropical cyclone at 38.5N, 69.5W at 12Z.

2. Ship highlights:

- 35 kt N and 1016 mb at 33.8N, 72.3W at 18Z (COADS).

3. Discussion:

- MWL: "A cyclone that developed along a cold front on October 28 near 41N, 72W, moved southeastward to the 37th parallel, and the northeastward to near 44N, 57W. Once there, it looped and moved southeastward again."
- Reanalysis: A frontal boundary entered the northwest Atlantic late on the 27th or early on the 28th causing an increase in convection. Synoptic observations indicated that a surface circulation began to organize late on the 28th. System begun as a weak extratropical cyclone at 12Z, 48 hours earlier than shown in HURDAT originally.

October 29:

1. Maps and old HURDAT:

- HWM analyzes an extratropical cyclone of at most 1012 mb at 39.5N, 61.5W at 12Z.
- HURDAT does not list an organized system on this date.
- Microfilm shows an occluded cyclone of at most 1012 mb at 39.5N, 61W at 12Z.

2. Ship highlights:

- 35 kt S and 1017 mb at 36.1N, 62.4W at 06Z (COADS).
- 40 kt N and 1019 mb at 45N, 60.7W at 12Z (COADS).
- 40 kt N and 1019 mb at 45N, 60.7W at 18Z (COADS).

3. Discussion:

- Reanalysis: The extratropical cyclone is analyzed to have become gale force around 06z based upon ship observations.

October 30:

1. Maps and old HURDAT:

- HWM analyzes an occluded cyclone of at most 1004 mb at 37.5N, 58W at 12Z.
- HURDAT lists a 50 kt extratropical storm at 42.5N, 57W at 12Z (first position).

- Microfilm shows an extratropical cyclone of at most 1008 mb at 43.5N, 56W at 12Z.

2. Ship highlights:
- 55 kt N and 1005 mb at 42.8N, 58.4W at 00Z (COADS).
- 60 kt N and 1008 mb at 43.3N, 59.6W at 06Z (COADS).
- 60 kt N and 1004 mb at 43.3N, 58.5W at 12Z (COADS).
- 55 kt NNW and 1001 mb at 42.3N, 57.9W at 18Z (COADS).

3. Discussion:
- Reanalysis: The extratropical cyclone rapidly intensified and early on the 30th ships were reporting winds of 60 kt. The cyclone was moving northeastward but a strengthening ridge to the northwest caused the system to change course and move southeastward late on the 30th.

October 31:

1. Maps and old HURDAT:
- HWM analyzes an occluded cyclone of at most 988 mb at 40N, 53.5W at 12Z.
- HURDAT lists a 55 kt subtropical cyclone at 39.5N, 54W at 12Z.
- Microfilm shows an occluded cyclone of at most 992 mb at 40N, 52.5W at 12Z.

2. Ship highlights:
- 55 kt NNW and 1008 mb at 40N, 60W at 00Z (COADS).
- 45 kt NNW and 1009 mb at 41.5N, 58.5W at 06Z (COADS).
- 20 kt SW and 991 mb at 39.3N, 53W at 09Z (COADS).
- 55 kt NNE at 42.4N, 54.9W at 12Z (COADS).
- 60 kt NE and 1003 mb at 42.4N, 54.7W at 15Z (COADS).
- 60 kt NNE and 1009 mb at 42.1N, 55.8W at 18Z (COADS).

3. Discussion:
- Reanalysis: The powerful extratropical cyclone continued to move southeastward. Satellite images and synoptic data showed that the system had become occluded on this date, with a small area of convection over its center. Synoptic observations during the nighttime hours late on the 31st and early on November 1st showed a significant temperature gradient across the circulation and there was no appreciable reduction in the RMW. Thus, originally in HURDAT transition to subtropical cyclone was analyzed at 12Z on the 31st but based on the data, it has been delayed until early on the 2nd. (It is interesting to mention that this system was the first one in the original HURDAT shown to transition from an extratropical cyclone to a subtropical cyclone.)

November 1:

1. Maps and old HURDAT:
- HWM analyzes a closed low pressure of at most 996 mb at 38.5N, 49.5W at 12Z.
- HURDAT lists a 60 kt subtropical storm at 37.5N, 50W at 12Z.
- Microfilm shows a closed low pressure of at most 992 mb at 37.5N, 50W at 12Z.

2. Ship highlights:
- 60 kt N and 1006 mb at 41.3N, 52.9W at 00Z (COADS).
- 78 kt N (high bias) and 1002 mb at 42.5N, 49W at 00Z (MWL).
- 55 kt NE and 1000 mb at 40.5N, 52.2W at 06Z (COADS).
- 55 kt NNW and 998 mb at 37.9N, 52.2W at 12Z (COADS).

- 60 kt NNE and 1016 mb at 40.5N, 54.8W at 12Z (MWL).
- 55 kt N and 1004 mb at 37.2N, 53.1W at 18Z (COADS).

3. Discussion:

- MWL: "At 0000 on November 1, the 989 mb LOW was near 40N, 51W. The GENERAL A.F. CEBESOY, a Turkish vessel situated near 42.5N, 49W, at that hour, had a raging battle with northerly 78 kt hurricane-force winds blowing beneath funnel clouds aloft. Twelve hours later, the Norwegian ship HAVSUL near 41N, 55W, or 330 mi west-northwest of the 990 mb, battled 39-ft seas and somewhat lesser gales of 60 kt."
- Reanalysis: The extratropical cyclone continued southeastward while producing winds near hurricane intensity. A ship reported 78 kt at 00Z on the 1st but it appears to have a high bias based on nearby synoptic data. The system is analyzed to have reached hurricane-force (65 kt) intensity while an extratropical cyclone from 18Z 31st through 06Z 1st. Satellite images and synoptic data showed that the occluded front continued to dissipate and also a small increase in convection over the center.

November 2:

1. Maps and old HURDAT:

- HWM analyzes a closed low pressure of at most 1004 mb at 32.5N, 46.5W at 12Z.
- HURDAT lists a 50 kt tropical storm at 31.5N, 47.5W at 12Z.
- Microfilm shows a closed low pressure of at most 1000 mb at 31.5N, 47.5W at 12Z.

2. Ship highlights:

- 45 kt N and 1012 mb at 36.6N, 54.2W at 00Z (COADS).
- 40 kt N and 1007 mb at 31.9N, 53.3W at 06Z (COADS).
- 40 kt N and 1012 mb at 33.5N, 52.9W at 12Z (COADS).
- 35 kt NE and 1012 mb at 34.1N, 52.3W at 18Z (COADS).

3. Discussion:

- MWL: "The LOW moved south-southeastward from the dawn of the month until midday on the 2nd when it swung to the southeast. The central pressure of the center rose to 1002 mb late on the 2nd."
- Reanalysis: Synoptic data early on the 2nd indicated that the circulation had become more isothermal and symmetric. Satellite images showed a small system with organized convection and banding features. Therefore, transition to a subtropical cyclone is analyzed at 00Z on the 2nd. Synoptic data also indicated that the cyclone weakened on this date, thus the intensity is reduced slightly more than originally shown in HURDAT.

November 3:

1. Maps and old HURDAT:

- HWM analyzes a closed low pressure of at most 1000 mb at 27.5N, 43.5W at 12Z.
- HURDAT lists a 60 kt tropical storm at 27N, 43W at 12Z.
- Microfilm shows a closed low pressure of at most 1000 mb at 27N, 43W at 12Z.

2. Ship highlights:

- 35 kt NNW and 1003 mb at 30.1N, 46.3W at 00Z (COADS).
- 35 kt N and 998 mb at 29.1N, 46.3W at 03Z (COADS).
- 35 kt N and 1004 mb at 28.3N, 42.8W at 06Z (COADS).
- 35 kt NW and 996 mb at 27.6N, 44W at 12Z (COADS).
- 40 kt NNW and 1004 mb at 27.2N, 46.2W at 12Z (COADS).

- 35 kt N and 1007 mb at 32N, 45.1W at 18Z (COADS).

3. Discussion:

- MWL: "…strengthening again on the 3rd. Shortly before renewed intensification commenced, the highest winds within the circulation of the storm were less than 40 kt."
- Reanalysis: Synoptic observations early on the 3rd indicated that the strongest winds associated with the cyclone were occurring near the center and satellite images showed a small but organized area of deep convection. Thus, transition to a tropical storm is analyzed at 00Z on the 3rd. A ship near the center at 00Z on the 3rd reported 20 kt SW and 997 mb, suggesting a central pressure of 995 mb, which has been added to HURDAT. A central pressure of 995 mb suggests maximum surface winds of 52 kt from the north of 25N Brown et al. pressure-wind relationship. Based on a forward speed of about 15 kt, synoptic data and low environmental pressures (OCI 1005 mb), an intensity of 45 kt is analyzed at 00Z on the 3rd, down from 55 kt originally in HURDAT, a minor intensity change. Another ship near the center at 09Z suggested a central pressure of 992 mb, which has been added to HURDAT at 12Z on the 3rd. A central pressure of 992 mb suggests maximum surface winds of 61 kt from the north of 25N pressure-wind relationship. An intensity of 50 kt is analyzed at 12Z on the 3rd, down from 60 kt originally in HURDAT, a minor intensity change.

November 4:

1. Maps and old HURDAT:

- HWM analyzes a closed low pressure of at most 996 mb at 28N, 39W at 12Z.
- HURDAT lists a 65 kt hurricane at 28N, 38W at 12Z.
- Microfilm shows a closed low pressure of at most 996 mb at 27.5N, 38W at 12Z.

2. Ship highlights:

- 35 kt NE and 997 mb at 27.6N, 40.9W at 00Z (micro).
- 25 kt NW and 1004 mb at 28.3N, 44.9W at 06Z (COADS).
- 25 kt WSW and 1004 mb at 25.1N, 38.1W at 12Z (COADS).
- 35 kt NE at 29N, 40.5W at 12Z (HWM).
- 60 kt SE and 1000 mb at 28.5N, 36.6W at 18Z (COADS).

3. Discussion:

- MWL: "…reaching 26N, 41W at 0000 on the 4th. After deepening to 992 mb by 0000 on the 4th, the cyclone remained at the pressure while changing course again toward the northeast."
- Reanalysis: The tropical storm turned to the east and later northeast on this date while increasing in intensity. Satellite images showed a small but well-organized tropical cyclone with an eye. A ship reported 60 kt at 18Z on the 4th and intensification to a hurricane is analyzed at 12Z on this date, same as originally shown in HURDAT. Synoptic observations over the central Atlantic was sparse and it is possible that hurricane intensity was achieved earlier on the 4th.

November 5:

1. Maps and old HURDAT:

- HWM analyzes a closed low pressure of at most 1004 mb at 33.5N, 35.5W at 12Z.
- HURDAT lists a 60 kt tropical storm at 32.5N, 34W at 12Z.
- Microfilm shows a closed low pressure of at most 992 mb at 31.5N, 36.5W at 12Z.

2. Ship highlights:

- 20 kt SE and 993 mb at 31.4N, 36.9W at 00Z (COADS).
- 40 kt S and 1010 mb at 27.2N, 36.6W at 06Z (COADS).
- 50 kt N and 998 mb at 33.4N, 37.7W at 12Z (COADS).
- 45 kt N and 1000 mb at 34.1N, 37W at 15Z (COADS).
- 60 kt NNE and 996 mb at 35.4N, 35.4W at 18Z (COADS).

3. Discussion:

- MWL: "The ATTLEBORO VICTORY near 35N, 35W, or 100 mi northwest of the LOW, fought 60-kt gales and 31 ft seas at 1800 on the 5th.
- Reanalysis: The hurricane continued to move northeastward. Satellite images showed a small tropical cyclone with a well-organized eye. The highest winds reported on this date were 60 kt, but based on the satellite signature of the tropical cyclone and synoptic data on the 6th, an intensity of 80 kt is analyzed at 12Z and 18Z on the 5th, up from 60 kt originally in HURDAT, major intensity changes. 80 kt is also the peak intensity of this hurricane.

November 6:

1. Maps and old HURDAT:

- HWM analyzes a closed low pressure of at most 1000 mb at 37.5N, 30W at 12Z.
- HURDAT lists a 50 kt tropical storm at 37.5N, 29W at 12Z.
- Microfilm shows a closed low pressure of at most 1000 mb at 37.5N, 29W at 12Z.

2. Ship highlights:

- 55 kt NE (65 kt microfilm) and 1002 mb at 36.8N, 34.1W at 00Z (COADS).
- 50 kt NNE and 1009 mb at 36.5N, 34.4W at 06Z (COADS).
- 70 kt S and 995 mb at 36.9N, 29.4W at 09Z (COADS).
- 70 kt SW and 994 mb at 36.9N, 29.4W at 12Z (COADS).
- 60 kt SSW and 996 mb at 37N, 27.6W at 15Z (COADS).
- 50 kt SW and 1000 mb at 37.3N, 27.8W at 18Z (COADS).
- 45 kt W and 1013 mb at 37.3N, 27.9W at 21Z (COADS).

3. Discussion:

- MWL: "Eighteen hours later [12Z on the 6th], the FANWOOD near 39N, 31W, or 125 miles north of the 996 mb cyclone was also blasted by near hurricane-force 60-kt winds. Between 0000 on the 6th and 1200 on the 7th, the central pressure of the storm oscillated between 993 mb and 998 mb."
- Reanalysis: Satellite images showed that the hurricane had become less organized with most of the convection over the northern semicircle on the 6th. Nonetheless, 70 kt were reported at 09Z and 12Z on this date. Weakening is analyzed later on the 6th as the hurricane moved over cooler waters near the Azores.

November 7:

1. Maps and old HURDAT:

- HWM analyzes a closed low pressure of at most 996 mb at 38.5N, 23.5W with a stationary front to the northeast at 12Z.
- HURDAT lists a 45 kt tropical storm at 40N, 25W at 00Z (last position).
- Microfilm shows a closed low pressure of at most 1000 mb at 40N, 21.5W at 12Z.

2. Ship highlights:

- 50 kt W and 1011 mb at 37.4N, 28W at 00Z (COADS).
- 45 kt NW and 1013 mb at 37.4N, 28W at 03Z (COADS).
- 40 kt NW and 1017 mb at 36.8N, 29.4W at 06Z (COADS).
- 40 kt NE and 1015 mb at 40.9N, 24.3W at 12Z (COADS).
- 40 kt N and 1016 mb at 38.4N, 25.8W at 18Z (COADS).

- 35 kt NNE and 1021 mb at 38.6N, 27W at 21Z (COADS).

3. Discussion:
- MWL: "The center of the LOW crossed the Azores late on the 6th and then veered to the southeast once more. Gales ceased on the 7th."
- Reanalysis: Weakening to a tropical storm is analyzed at 00Z on the 7th based on synoptic and satellite data. Satellite images showed that the circulation of the tropical cyclone had become devoid of convection. Thus the system is indicated to have become a Post-tropical Cyclone (but not an extratropical cyclone) which continued to have gale force wind through early on the 8th.

November 8:

1. Maps and old HURDAT:
- HWM analyzes a closed low pressure of at most 35.5N, 15W at 12Z.

2. Ship highlights:
- 30 kt NNE and 1021 mb at 39.1N, 24.8W at 00Z (COADS).

3. Discussion:
- Reanalysis: The Post-tropical Cyclone gradually weakened and it is analyzed that they system became a remnant low around 12Z.

November 9:

1. Maps and old HURDAT:
- HWM analyzes a cold front over the NE Atlantic, the original system appears to have dissipated, at 12Z.

2. Discussion:
- MWL: "The swiftly filling center dissipated over Morocco on the 9th."
- Reanalysis: The system dissipated after 00Z.

Date	Original HURDAT Central Pressure	Evidence	Changes
Oct 31 00Z	992 mb	No synoptic observations near the center	Removed
Oct 31 12Z	988 mb	Ship: 30 kt N and 992 mb at 39.5N, 54.3W at 12Z	Retained
Nov 01 12Z	992 mb	No synoptic observations near the center	Removed
Nov 02 12Z	998 mb		
Nov 03 00Z		Ship: 20 kt SW and 997 mb at 29.3N, 45.4W at 00Z	995 mb
Nov 03 12Z	995 mb	Ship: 35 kt NW and 996 mb at 27.6N, 44W at 12Z	992 mb
Nov 04 12Z	992 mb	No synoptic observations near the center	Removed

Sources: NHC microfilm maps, the Historical Weather Maps series, the COADS ship database, Monthly Weather Review, Mariners Weather Log, Satellite images from NCDC, and NHC Storm Wallets.

Martha – AL291969 – 20121 Revisions

Green indicates wind changes of 15 kt or greater
Blue indicates lat/long changes greater than 1°

Red indicates a new entry
Yellow indicates a deletion

Hurricane Martha [November 20-25, 1969]

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46725 11/21/1969 M= 5 29 SNBR= 995 MARTHA      XING=0 SSS=0                    L
46720 11/20/1969 M= 6 29 SNBR= 995 MARTHA      XING=0 SSS=0                    L
         **         *

(November 20th is new to HURDAT)
46725 11/20*  0   0   0    0*  0   0   0    0*112 798  25    0*110 799  30    0*

46730 11/21*  0   0   0    0*  0   0   0    0*103 810  45    0*103 810  55    0*
46730 11/21*108 800  35 1003*106 802  45    0*105 805  55    0*104 808  65    0*
            *** ***  **      *** ***  **      *** ***  **      *** ***  **

46735 11/22*103 810  65    0*103 810  70    0*103 810  80  979*102 810  75    0*
46735 11/22*103 810  75    0*103 810  80    0*103 810  80  979*102 810  75  982*
                     **                **                                   ***

46740 11/23*101 810  70  986*100 810  65    0* 98 810  60  999* 96 810  60    0*
46740 11/23*101 810  70  986*100 810  55    0* 99 810  45  999* 97 810  45 1000*
                                      **       **      **       **      **  ****

46745 11/24* 94 810  60 1000* 92 810  60    0* 90 810  60 1000* 88 811  40    0*
46745 11/24* 94 810  45  999* 92 810  45    0* 90 810  45 1000* 88 811  40    0*
                     **  ***          **                **

46750 11/25* 87 813  30    0* 86 816  30    0* 85 820  25    0*  0   0   0    0*

46755 HR
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Tropical Storm Landfall

11/24 18Z 8.8N 81.1W 40 kt Panama

Significant Revisions:

1. First position analyzed 24 hours earlier based on synoptic observations.
2. Intensification to a tropical storm analyzed twelve hours earlier based on synoptic observations.
3. Major intensity decreased analyzed between November 23th at 12Z and 24th at 12Z based on reconnaissance aircraft data.

November 19:

1. Maps and old HURDAT:
- HWM and microfilm do not analyze any feature of interest over the southern Caribbean Sea at 12Z.

2. Discussion:
- ATSR: "A large, strong anticyclone moved southward on 15 and 16 November over the Gulf of Mexico, with the polar front trailing into the Southwestern Caribbean."
- Reanalysis: Satellite images showed that convection increased over the southern Caribbean Sea around November 14. The disturbance remained

disorganized and mostly stationary over the next following days based on synoptic and satellite data.

November 20:

1. Maps and old HURDAT:

- HWM does not analyze any feature of interest at 12Z.
- Microfilm shows a spot low pressure at 10N, 81W at 12Z.

2. Discussion:

- MWR: "Winds aloft from San Andres and the Panama Canal Zone showed a moderate cyclonic circulation on November 20."
- Reanalysis: Synoptic observations and satellite images showed that the disturbance became better organized on the 20th. Ship and coastal data indicated that a closed low-level circulation had developed at 12Z on this date, thus the first position is analyzed at this time, 24 hours earlier than originally shown in HURDAT. Given that the system has observations to support a tropical storm at 00Z 21st, the system is begun as 25 kt at 12Z and 30 kt at 18Z on the 20th.

November 21:

1. Maps and old HURDAT:

- HWM analyzes a closed low pressure of at most 1008 mb at 11.5N, 80.5W at 12Z.
- HURDAT lists a 45 kt tropical storm at 10.3N, 81W at 12Z (first position).
- Microfilm shows a closed low pressure of at most 1008 mb at 11N, 80W at 12Z.

2. Ship highlights:

a. 15 kt SSW and 1005 mb at 11N, 79W at 00Z (COADS).

3. Land highlights:

a. 35 kt NNE and 1008 mb at Isla San Andrés, Colombia at 12Z (micro).

4. Discussion:

- ATSR: "Disturbed weather with above normal cloudiness and shower activity persisted over the southwest Caribbean following this period until a second polar front moved far south over the western Caribbean on 21 November. A vortex formed at the junction of the polar trough and the ITCZ about 100 miles north of the panama Isthmus on 21 November."
- Reanalysis: Data from two ships near the center at 00Z on the 21st indicated that the central pressure was about 1003 mb, which has been added to HURDAT. A central pressure of 1003 mb suggests maximum surface winds of 41 kt from the south of 25N Brown et al. pressure-wind relationship. Since the tropical cyclone was almost stationary, an intensity of 35 kt is analyzed at 00Z on the 21st. Satellite images indicated that Martha quickly organized with a small CDO and banding features wrapping all the way to the center. Based on the satellite imagery, and ship and reconnaissance aircraft data on the 22nd, intensification to a hurricane is analyzed at 18Z on the 22nd, six hours earlier than originally shown in HURDAT. The signature of the tropical cyclone on the satellite images suggest that that Martha could have become a hurricane earlier than analyzed.

November 22:

1. Maps and old HURDAT:

- HWM analyzes a closed low pressure of at most 1008 mb at 10.7N, 81.6W at 12Z.
- HURDAT lists an 80 kt hurricane at 10.3N, 81W at 12Z.

- Microfilm shows a closed low pressure of at most 1004 mb at 10N, 81W at 12Z.

2. Ship highlights:
a. 60 kt N, 979 mb at 10N, 81W at 12Z (micro/WALLET).

3. Aircraft highlights:
a. Penetration center fix measured a central pressure of 980 mb, estimated surface winds of 75 kt and an eye diameter of 6 n mi at 10.3N, 81W at 1525Z (WALLET).
b. Penetration center fix measured a central pressure of 982 mb, estimated surface winds of 50 kt and an eye diameter of 15 n mi at 10.2N, 81.1W at 1730Z (WALLET).
c. Penetration center fix measured a central pressure of 986 mb, estimated surface winds of 70 kt and an eye diameter of 8 n mi at 10.2N, 81W at 23Z (WALLET).

4. Discussion:
- MWR: "…early on the 22nd, reports from an Air Force plane indicated that a small hurricane had formed. Martha drifted toward the south, gradually weakened."
- ATSR: "It developed rapidly into Tropical Storm MARTHA. MARTHA reached hurricane intensity before reconnaissance aircraft could be dispatched to the area on 22 November. MARTHA remained nearly stationary as she reached her maximum intensity on 22 November."
- Reanalysis: Martha continued to intensify as it remained almost stationary about 60 n mi north of Panama. At 12Z on the 22nd, a ship reported 60 kt N and 979 mb, and the 979 mb was used as a central pressure in the original HURDAT. It is unclear if these measurements occurred simultaneously. A thorough search for more data on this ship did not produce any results. The only mention of the ship was in the Storm Wallets and because it was a plain language summary it appears that these observations may not have been simultaneous. Additionally, the 979 mb is quite similar to the 982 mb central pressure measured by aircraft just a couple hours later at 1525Z. Thus, the 979 mb is retained as a central pressure under the assumption that the wind and pressure measurements did not occur simultaneously. A central pressure of 979 mb suggests maximum surface winds of 79 kt from the south of 25N pressure-wind relationship. Since Martha was almost stationary, but had a small RMW (5 n mi) based on aircraft reconnaissance data received at 1525Z on this date, an intensity of 80 kt is analyzed at 12Z on the 22nd, same as originally shown in HURDAT. 80 kt is also the peak intensity of Martha. A reconnaissance aircraft made a penetration center fix at 1730Z measuring a central pressure of 982 mb, estimating surface winds of 50 kt and an eye diameter of 15 n mi. A central pressure of 982 mb suggests maximum surface winds of 75 kt from the south of 25N pressure-wind relationship. An eye diameter of 15 n mi suggests an RMW of about 12 n mi and the climatological value is 11 n mi. An intensity of 75 kt is analyzed at 18Z on the 22nd, same as originally shown in HURDAT.

November 23:

1. Maps and old HURDAT:
- HWM analyzes a hurricane of at most 1008 mb at 10.2N, 81.9W at 12Z.
- HURDAT lists a 60 kt tropical storm at 9.8N, 81W at 12Z.
- Microfilm shows a hurricane of at most 1008 mb at 9.9N, 81.2W at 12Z.

2. Aircraft highlights:

a. Penetration center fix measured a central pressure of 999 mb, estimated surface winds of 55 kt and an eye diameter of 30 n mi at 9.9N, 81.1W at 1248Z (WALLET).
b. Penetration center fix measured a central pressure of 1000 mb, estimated surface winds of 48 kt and an eye diameter of 30 n mi at 9.7N, 81.2W at 1815Z (WALLET).
c. Penetration center fix measured a central pressure of 999 mb and estimated an eye diameter of 40 n mi at 9.7N, 81W at 2351Z (WALLET).

3. Discussion:

- ATSR: "She then began to drift very slowly to the south, decreasing to tropical storm intensity on 23 November."
- Reanalysis: A reconnaissance aircraft measured a central pressure of 986 mb, estimated surface winds of 70 kt and an eye diameter of 8 n mi at 23Z on the 22nd. A central pressure of 986 mb suggests maximum surface winds of 70 kt from the south of 25N pressure-wind relationship. An eye diameter of 8 n mi suggests an RMW of about 6 n mi and the climatological value is 11 n mi. Due to the slow forward speed, almost stationary, and small RMW, an intensity of 70 kt is analyzed at 00Z on the 23rd, same as originally shown in HURDAT. The next penetration center fix indicated that Martha had weakened. The report at 1248Z on the 23rd showed a central pressure of 999 mb, surface winds of 55 kt and an eye diameter of 30 n mi. A central pressure of 999 mb suggests maximum surface winds of 49 kt from the south of 25N pressure-wind relationship. An eye diameter of 30 n mi suggests an RMW of about 23 n mi and the climatological value is 11 n mi. Since Martha was almost stationary and the RMW was larger than normal, an intensity of 45 kt is analyzed at 12Z on the 23rd, down from 60 kt originally in HURDAT, a major intensity change. Weakening to a tropical storm is analyzed at 06Z on the 23rd, six hours earlier than originally shown in HURDAT. Another reconnaissance aircraft measured a central pressure of 1000 mb at 1815Z on the 23rd. An intensity of 45 kt is also analyzed at 18Z on the 23rd, down from 60 kt originally in HURDAT, a major intensity change. Satellite images showed a well-organized tropical cyclone with a small CDO and banding features.

November 24:

1. Maps and old HURDAT:

- HWM analyzes a tropical storm of at most 1008 mb at 10N, 81.8W at 12Z.
- HURDAT lists a 60 kt tropical storm at 9N, 81W at 12Z.
- Microfilm shows a tropical storm of at most 1008 mb at 9N, 80.9W at 12Z.

2. Aircraft highlights:

a. Penetration center fix measured a central pressure of 1000 mb, estimated surface winds of 65 kt and an eye diameter of 8 n mi at 9N, 81W at 1154Z (WALLET).

3. Discussion:

- MWR: "Martha moved southward into Panama on November 24. Undoubtedly, there have been other tropical cyclones that moved into Panama, but this was the first one that was definitely tracked. Reached the north coast of Panama with only storm intensity."
- ATSR: "MARTHA moved inland against the coastal mountain range of Northern Panama on the 24th and then dissipated over Western Panama on the 25th."
- Reanalysis: Martha continued southward toward Panama as a moderate tropical storm. A reconnaissance aircraft measured a central pressure of 999 mb and estimated surface an eye diameter of 40 n mi at 2351Z on the 23rd. An intensity of 45 kt is analyzed at 00Z on the 24th, down from 60 kt originally in HURDAT,

a major intensity change. The last penetration center fix measured a central pressure of 1000 mb and estimated surface winds of 65 kt at 1154Z. An intensity of 45 kt is also analyzed at 12Z on the 24th, down from 60 kt originally in HURDAT, a major intensity change. The center of Martha crossed the coast of Panama around 18Z with maximum sustained winds of 40 kt. Satellite images showed that most of the convection had already moved over Panama.

November 25

1. Maps and old HURDAT:
a. HWM does not analyze any features of interest at 12Z.
b. HURDAT lists a 25 kt tropical depression at 8.5N, 82W at 12Z (last position).
c. Microfilm shows a closed low pressure of at most 1008 mb at 9N, 84W at 12Z.

2. Discussion:
- Reanalysis: Weakening to a tropical depression is analyzed at 00Z on the 25th, same as originally shown in HURDAT. The depression continued southwestward and is analyzed to have dissipated after 12Z on this date, thus 12Z is the last position, same as originally shown in HURDAT. The time of dissipation is uncertain due to the sparse synoptic data in the area. Satellite images showed that most of the convection had already moved into the eastern Pacific.

November 26:

1. Maps and old HURDAT:
- HWM does not analyze any feature of interest at 12Z.
- Microfilm shows a spot low pressure at 10N, 81.5W at 12Z.

2. Discussion:
- Reanalysis: Satellite images showed that convection continued over the western Caribbean Sea and eastern Pacific on the 26th but the synoptic data suggests that the remnants of Martha did not redevelop.

Date	Original HURDAT Central Pressure	Evidence	Changes
Nov 21 00Z		Ship: 25 kt SSW and 1005 mb at 11N, 79W at 00Z	1003 mb
Nov 22 12Z	979 mb	Ship: 60 kt N, 979 mb at 10N, 81W at 12Z (uncertain if the measurements were simultaneous)	Retained
Nov 22 18Z		Penetration center fix: 982 mb at 1730Z	982 mb
Nov 23 00Z	986 mb	Penetration center fix: 986 mb at 23Z on November 22nd	Retained
Nov 23 12Z	999 mb	Penetration center fix: 999 mb at 1248Z	
Nov 23 18Z		Penetration center fix: 1000 mb at 1815Z	1000 mb
Nov 24 00Z	1000 mb	Penetration center fix: 999 mb at 2351Z on November 23rd	999 mb
Nov 24 12Z	1000 mb	Penetration center fix: 1000 mb at 1154Z	Retained

Sources: NHC microfilm maps, the Historical Weather Maps series, the COADS ship database, Mariners Weather Log, Satellite images from NCDC and NSIDC, and NHC

Storm Wallets.

New – AL301969 – 2017 Addition

Green indicates wind changes of 15 kt or greater
Blue indicates lat/long changes greater than 1°
Red indicates a new entry
Yellow indicates a deletion

Tropical Depression [August 7-8, 1969]

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45235 08/07/1969 M= 2 30 SNBR= 966 UNNAMED       XING=0 SSS=0

45240 08/07*  0   0   0    0*  0   0   0    0*220 955  30    0*218 963  30    0*
45245 08/08*215 969  30    0*212 975  30    0*210 980  25    0*  0   0   0    0*
45250 TD
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Significant Revisions:

1. A new tropical depression is introduced into HURDAT based on reconnaissance aircraft and synoptic data.

Daily Metadata:

August 6:

1. Maps and old HURDAT:

- HWM and microfilm show a trough or tropical wave over the western Gulf of Mexico at 12Z.

2. Discussion:

- Reanalysis: Satellite images showed disorganized convection over the western Gulf of Mexico associated with a trough. Surface observations over this area were sparse, thus it is difficult to assess the organizational state of the disturbance, but it likely did not have a closed circulation on this date.

August 7:

1. Maps and old HURDAT:

- HWM and microfilm do not show any feature of interest at 12Z.

2. Aircraft highlights:

- Penetration center fix measured a central pressure of 1010 mb and estimated surface winds of 35-40 kt at 17Z (WALLET).

3. Discussion:

- Navy Reconnaissance Aircraft: "LOW PRESSURE CENTER 1009.5 MILIBARS 2148N 9620W AT 1700Z CIRCULATION COMPLETE BUT WEAK SOUTH QUADRANT HEAVY RADAR ECHOED WEST NORTH EAST OF CENTER MAX WINDS 35-40 KNOTS IN HEAVY SWELLS NORTHEAST OF CENTER NO SIGNIFICANT TEMPERATURE CHANGE OBSERVED IN CENTER CLOUD ECHOES NORTH AND WEST SHOW CYCLONIC CENTER NO WALL CLOUDS EVIDENT." (WALLET)
- Reanalysis: A reconnaissance aircraft investigated the tropical disturbance late on the 7th finding a closed low-level circulation, estimating winds of 35-40 kt and a pressure of 1010 mb. The 1010 mb pressure is not analyzed as a central pressure because Tuxpan, Mexico was reporting 1008 mb around the same time (18Z), thus it is not added. The time of genesis is uncertain but is analyzed at 12Z on the 7th as a 30 kt tropical depression. This tropical

cyclone was not included in the original HURDAT but it was operationally labeled as TD #15 according to microfilm and the MWR track map of the 1969 tropical depressions. Also, based on the estimated winds reported by the reconnaissance aircraft, it is possible that this system was a low-end tropical storm.

August 8:

1. Maps and old HURDAT:

- HWM does not show any feature of interest at 12Z.
- Microfilm analyzes a closed low pressure of at most 1008 mb at 22.5N, 99.5W at 12Z.

2. Discussion:

- Reanalysis: Based on the sparse data available, the tropical depression moved southwestward and made landfall around 06Z on the 8th about 20 n mi north of Tuxpan, Mexico. Synoptic observations indicated that the circulation dissipated after 12Z, thus this is analyzed as the last position.

Sources: NHC microfilm maps, the Historical Weather Maps series, the COADS ship database, Monthly Weather Review, Mariners Weather Log, Satellite images from NCDC, and NHC Storm Wallets.

1969 Additional Notes

1. January 26 – February 2: Historical Weather Maps, microfilm and satellite images indicated that a cold front was located over the central Atlantic on January 26th. An extratropical cyclone developed on the 27th as it slowly moved eastward and by the 28th, it had evolved into an occluded cyclone. The large occluded cyclone peaked in intensity on the 31st, producing gale-force winds over the next few days. The system gradually weakened and dissipated by February 2nd. Because the cyclone did not develop organized deep convection, it is not added to HURDAT. This disturbance was in Jack Beven's List of Suspects.

Day	Latitude	Longitude	Status
January 26	Central Atlantic		Cold front
January 27	32N	37W	Extratropical
January 28	32N	35W	Occluded
January 29	32N	31W	Occluded
January 30	35N	31W	Occluded
January 31	38N	30W	Occluded
February 1	36N	27W	Occluded
February 2			Dissipated

2. February 2-13: Historical Weather Maps, microfilm and satellite images showed that a broad area of low pressure was located over the north Atlantic on February 2nd. The disturbance moved slowly southeastward during the next few days and became better organized, especially on the 6th and 7th. Gale-force winds were reported by nearby ships on those days, but also indicated that the system was a frontal low pressure. The disturbance gradually weakened over the next few days and dissipated on the 13th. Because the cyclone remained baroclinic and did not develop organized deep convection, it is not added to HURDAT. This disturbance was in Jack Beven's List of Suspects.

Day	Latitude	Longitude	Status
February 2	38N	35W	Extratropical
February 3	38N	34W	Extratropical
February 4	39N	33W	Extratropical
February 5	38N	25W	Extratropical
February 6	37N	21W	Extratropical
February 7	36N	18W	Extratropical
February 8	35N	15W	Extratropical
February 9	35N	12W	Extratropical
February 10	37N	12W	Extratropical
February 11	33N	15W	Extratropical
February 12	30N	12W	Extratropical
February 13			Dissipated

3. April 18-23: Microfilm and satellite images depicted a large area of convection along a surface trough north of the Leeward Islands on April 18th. The convection decreased over the next few days but a low formed north of the islands and on the 21st at 12Z, it was designated operationally as the first tropical depression of the season. The system moved northward and continued poorly organized. Satellite images indicated that the convective activity was minimal and synoptic observations showed that the surface circulation was very poorly organized. No gales were observed. Because the system did not have a well-defined low-level circulation, and the convection was minimal and poorly organized, it is not added to HURDAT. This disturbance was in Jack Beven's List of Suspects.

Day	Latitude	Longitude	Status
April 18	19N-33N	63W	Trough
April 19	21N	63W	Low
April 20	21N	65W	Low
April 21	21N	64W	Low
April 22	23N	64W	Low
April 23			Dissipated

4. April 28 – May 3: Microfilm and satellite images indicated that a weakening frontal boundary was interacting with a trough extending over the western Caribbean Sea and the western Bahamas on April 28th. A low pressure developed the next day and moved to the northeast. Operationally, it was upgraded to the 2nd tropical depression of the season on April 29th at 12Z. Satellite images showed that the convective activity was minimal and poorly organized. The disturbance remained very weak and by late on May 2nd, it was absorbed by a strong cold front over the central Atlantic. No gales were observed. Because the system never had a well-defined circulation and the convective activity was minimal, it is not added to HURDAT. This disturbance was in Jack Beven's List of Suspects.

Day	Latitude	Longitude	Status
April 28	17N-27W	80W	Trough

April 29	25N	78W	Low
April 30	26N	73W	Low
May 1	30N	64W	Low
May 2	33N	57W	Low
May 3			Absorbed

5. May 4-8: Microfilm and satellite images showed a weakening frontal boundary over the central Atlantic extending to the north of the Greater Antilles on May 4th. An extratropical cyclone developed between Hispaniola and Bermuda in the tail-end of the frontal boundary. The system moved eastward and operationally was designated as a tropical depression, the 3rd of the season, at 00Z on May 5th. Satellite images and synoptic observations indicated that the disturbance was extratropical. The system continued generally eastward and dissipated by May 8th. COADS were obtained and only one gale (on May 5th) was observed associated with this system. Because the system was baroclinic and did not have organized deep convection, it is not added to HURDAT. This disturbance was in Jack Beven's List of Suspects.

Day	Latitude	Longitude	Status
May 4	Central Atlantic		Weakening cold front
May 5	25N	69W	Extratropical
May 6	28N	62W	Extratropical
May 7	26N	55W	Extratropical
May 8			Dissipated

6. May 27-30: Microfilm and satellite images depicted a stationary frontal boundary over the central Atlantic producing disorganized convection on May 27th. A low developed the next day and began to move northeastward ahead of another frontal boundary. Operationally, it was upgraded to a tropical depression at 18Z on the 28th. The weak extratropical system began to interact with the frontal boundary on the 29th and was absorbed the next day. Because the system was baroclinic and did not have organized deep convection, it is not added to HURDAT. This disturbance was in Jack Beven's List of Suspects.

Day	Latitude	Longitude	Status
May 27	Central Atlantic		Stationary front
May 28	28N	60W	Extratropical
May 29	32N	55W	Extratropical
May 30			Dissipated

7. May 29 – June 2: Historical Weather Maps, microfilm and satellite images indicated a trough stretching from the western Bahamas to the western Caribbean Sea on May 28th. In HURDAT, the first position is analyzed at 00Z on the 29th as a 25 kt tropical depression over the southern Caribbean Sea. The system moved slowly northward producing a large area of disorganized convection. Operationally, it was upgraded to the 6th tropical depression at 12Z on May 30th. The system remained a trough which interacted with an old frontal boundary extending from the north Atlantic to the Bahamas. Gradually the convective activity decreased over the Caribbean Sea. Synoptic observations indicated that the disturbance did not have a well-defined circulation during its lifetime. COADS were obtained and no gales were found. The last position in HURDAT was at 00Z on June 2nd. Because the system did not have a well-defined circulation, it is removed from HURDAT.

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AL011969,            UNNAMED,     17,
19690529, 0000,  , TD, 12.0N,  82.0W,  25,
19690529, 0600,  , TD, 12.5N,  82.1W,  25,
19690529, 1200,  , TD, 13.2N,  82.2W,  25,
19690529, 1800,  , TD, 14.1N,  82.6W,  25,
19690530, 0000,  , TD, 15.0N,  82.8W,  25,
19690530, 0600,  , TD, 16.0N,  82.8W,  25,
19690530, 1200,  , TD, 17.0N,  82.9W,  25,
19690530, 1800,  , TD, 18.0N,  82.9W,  25,
19690531, 0000,  , TD, 19.0N,  82.7W,  25,
19690531, 0600,  , TD, 19.2N,  82.6W,  25,
19690531, 1200,  , TD, 20.0N,  82.5W,  25,
19690531, 1800,  , TD, 20.5N,  82.4W,  25,
19690601, 0000,  , TD, 21.1N,  82.1W,  25,
19690601, 0600,  , TD, 21.3N,  82.0W,  25,
19690601, 1200,  , TD, 21.7N,  81.9W,  25,
19690601, 1800,  , TD, 22.0N,  81.8W,  25,
19690602, 0000,  , TD, 22.3N,  81.8W,  25,
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8. May 29-30: Historical Weather Maps, microfilm and satellite images showed a trough over the western Bahamas on May 28th with most of the convection displaced to the east. The first position in HURDAT was analyzed at 00Z on the 29th as a 25 kt tropical depression. The system moved eastward and synoptic observations do not suggest that it had a well-defined circulation. The last position in HURDAT was analyzed at 00Z on the 30th. HWM showed a frontal boundary moving into the area on May 30th and the area remained convectively active for a few more days. Because the disturbance did not have a well-defined center, it is removed from HURDAT. This disturbance was in Jack Beven's List of Suspects.

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AL021969,            UNNAMED,      5,
19690529, 0000,  , TD, 26.1N,  77.8W,  25,
19690529, 0600,  , TD, 26.3N,  76.8W,  25,
19690529, 1200,  , TD, 27.0N,  75.0W,  25,
19690529, 1800,  , TD, 28.0N,  73.0W,  25,
19690530, 0000,  , TD, 28.9N,  71.0W,  25,
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9. June 12-15: Historical Weather Maps, microfilm and satellite images depicted a trough extending from the Western Caribbean Sea to the Western Bahamas on June 11th. The trough moved slowly westward into the southeastern Gulf of Mexico. The first position in HURDAT was analyzed at 00Z on the 12th as a 25 kt tropical depression. A reconnaissance aircraft investigated the disturbance late on the 14th and did not find a closed circulation. The last position in HURDAT was analyzed at 00Z on the 15th. Satellite images on the 15th and 16th showed that the convection decreased in the Gulf of Mexico and the activity shifted to the Atlantic as another disturbance developed. Synoptic observations suggested that the disturbance did not develop a well-defined low-level circulation during its lifetime. Because the disturbance did not have a well-defined center, it is removed from HURDAT. This disturbance was in Jack Beven's List of Suspects.

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AL041969,            UNNAMED,     13,
19690612, 0000,  , TD, 20.5N,  85.9W,  25,
19690612, 0600,  , TD, 20.5N,  86.1W,  25,
19690612, 1200,  , TD, 20.6N,  86.3W,  25,
19690612, 1800,  , TD, 20.7N,  86.8W,  25,
19690613, 0000,  , TD, 20.8N,  87.0W,  25,
19690613, 0600,  , TD, 20.9N,  87.2W,  25,
19690613, 1200,  , TD, 21.0N,  87.5W,  25,
19690613, 1800,  , TD, 21.2N,  87.8W,  25,
19690614, 0000,  , TD, 21.5N,  88.1W,  25,
19690614, 0600,  , TD, 21.6N,  88.3W,  25,
19690614, 1200,  , TD, 21.7N,  88.5W,  25,
19690614, 1800,  , TD, 21.9N,  89.1W,  25,
19690615, 0000,  , TD, 22.0N,  89.5W,  25,
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10. June 16-20: Historical Weather Maps, microfilm and satellite images indicated a trough over the Florida peninsula and northern Bahamas producing disorganized convection, mainly over and north of the Bahamas, on June 16th. A low pressure system developed north of the Bahamas on the 17th and accelerated to the northeast ahead of a strong frontal boundary. Operationally, it was upgraded to a tropical depression at 00Z on the 17th. A reconnaissance aircraft investigated the disturbance late on the 17th and found a closed circulation with 10 kt winds near the center. The convective activity remained displaced to the east of the center and on the 18th and 19th, it was stretched north-south, resembling a trough. The low-level circulation remained poorly organized and broad on the 18th and 19th days and gales were only observed once it began to merge with the frontal boundary over the north Atlantic on the 19th. By late on the 19th, the disturbance had been absorbed. Because the disturbance was poorly organized and the closed circulation was transient, it is not added to HURDAT. This disturbance was in Jack Beven's and David Roth's List of Suspects.

Day	Latitude	Longitude	Status
June 16	Florida and northern Bahamas		Trough
June 17	31N	70W	Low
June 18	34N	66W	Low
June 19	41N	51W	Low
June 20			Absorbed

11. June 24-27: Historical Weather Maps, microfilm and satellite images showed a weak trough north of the Leeward Islands. A weak low pressure may have formed on June 24th but synoptic observations suggests that it was not closed or well-defined. The disturbance moved northward and operationally, it was upgraded to a tropical depression at 12Z on the 25th. The convective activity was poorly organized and small in coverage during the lifetime of this disturbance. Early on the 27th, the disturbance had dissipated. Because the disturbance did not have a well-defined center and convective activity was poorly organized, it is not added to HURDAT. This disturbance was in Jack Beven's List of Suspects.

Day	Latitude	Longitude	Status
June 24	22N	62W	Trough
June 25	23N	62W	Trough
June 26	29N	62W	Trough
June 27			Dissipated

12. July 25-27: Historical Weather Maps, microfilm and satellite images depicted that shower and thunderstorm activity increased in associated with a tropical wave on July 24th while located about 500 n mi east of the Lesser Antilles. The disturbance moved westward at about 5 degrees per day. The first position in HURDAT was analyzed at 00Z on the 25th as a 25 kt tropical depression, but synoptic observations suggested that the system did not have a well-defined circulation during its lifetime. The disturbance moved across the Lesser Antilles on the 26th and became less organized on the 27th. The last position in HURDAT was analyzed at 00Z on the 27th. Because the disturbance did not have a closed circulation, it is removed from HURDAT. This disturbance was in Jack Beven's List of Suspects.

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AL051969,            UNNAMED,      9,
19690725, 0000,  , TD,  9.9N,  55.1W,  25,
19690725, 0600,  , TD, 10.0N,  56.1W,  25,
19690725, 1200,  , TD, 11.5N,  57.3W,  30,
19690725, 1800,  , TD, 12.2N,  58.3W,  30,
19690726, 0000,  , TD, 13.2N,  59.6W,  25,
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19690726, 0600,  , TD, 14.1N,  60.1W,  25,
19690726, 1200,  , TD, 14.8N,  61.0W,  25,
19690726, 1800,  , TD, 15.0N,  61.6W,  25,
19690727, 0000,  , TD, 15.9N,  62.2W,  25,
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13. August 6-8: Historical Weather Maps, microfilm and satellite images indicated a tropical wave over the central Caribbean Sea on August 6th. Satellite images showed that convection increased and synoptic observations suggested that the low-level circulation became better organized on the 7th. Operationally, the disturbance was upgraded to a tropical depression at 12Z on the 7th. On the 8th, satellite images showed that the system moved into Central America. Therefore, even though the system may have been briefly a tropical depression, the circulation was transient and thus not added to HURDAT. This disturbance was in Jack Beven's List of Suspects.

Day	Latitude	Longitude	Status
Aug 6	Central Caribbean Sea		Tropical Wave
Aug 7	12N	81W	Low
Aug 8			Dissipated

14. August 24-28: Historical Weather Maps, microfilm and satellite images showed a tropical wave exiting the west coast of Africa on August 24th. The first position in HURDAT is analyzed at 00Z on the 24th, but synoptic observations suggested that it did not have a well-defined center at this time. As the tropical wave moved westward, the convective activity remained disorganized. Satellite images between the 26th and 29th showed an exposed weak circulation with disorganized convection over the northern semicircle. Synoptic observations were sparse over the eastern Atlantic, but do not suggest it had a well-defined center. The last position in HURDAT was analyzed at 00Z on the 28th. Because the system did not have a well-defined center, it is removed from HURDAT. This disturbance was in Jack Beven's List of Suspects.

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AL101969,            UNNAMED,     17,
19690824, 0000,  , TD, 17.5N,  17.0W,  25,
19690824, 0600,  , TD, 17.6N,  18.0W,  25,
19690824, 1200,  , TD, 17.7N,  18.5W,  25,
19690824, 1800,  , TD, 17.9N,  19.0W,  25,
19690825, 0000,  , TD, 18.0N,  20.0W,  25,
19690825, 0600,  , TD, 18.0N,  21.0W,  25,
19690825, 1200,  , TD, 18.1N,  22.0W,  25,
19690825, 1800,  , TD, 18.2N,  23.0W,  25,
19690826, 0000,  , TD, 18.5N,  24.0W,  25,
19690826, 0600,  , TD, 18.5N,  25.1W,  25,
19690826, 1200,  , TD, 18.5N,  27.0W,  25,
19690826, 1800,  , TD, 18.5N,  28.8W,  25,
19690827, 0000,  , TD, 18.5N,  31.1W,  25,
19690827, 0600,  , TD, 18.4N,  32.9W,  25,
19690827, 1200,  , TD, 18.3N,  34.8W,  25,
19690827, 1800,  , TD, 18.2N,  36.1W,  25,
19690828, 0000,  , TD, 18.0N,  38.0W,  25,
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15. August 24-26: Historical Weather Maps, microfilm and satellite images depicted an active tropical wave near 50W on August 23rd. A reconnaissance aircraft investigated the tropical disturbance late on the 24th and found a closed circulation but winds no greater than 15 kt. The system continued westward and another penetration center fix on the 25th did not find a closed circulation. The last position in HURDAT was analyzed at 00Z on the 26th. On the 27th, the tropical wave moved across the Lesser Antilles and became less organized. Because the circulation was poorly organized and transient, it is removed from HURDAT. This disturbance was in Jack Beven's List of Suspects.

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AL111969,            UNNAMED,      9,
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19690824, 0000,  , TD, 15.0N,  52.2W,  25,
19690824, 0600,  , TD, 15.0N,  53.1W,  25,
19690824, 1200,  , TD, 15.0N,  54.1W,  25,
19690824, 1800,  , TD, 15.0N,  55.1W,  25,
19690825, 0000,  , TD, 15.0N,  55.6W,  25,
19690825, 0600,  , TD, 15.1N,  56.2W,  25,
19690825, 1200,  , TD, 15.2N,  57.0W,  25,
19690825, 1800,  , TD, 15.2N,  58.0W,  25,
19690826, 0000,  , TD, 15.2N,  58.3W,  25,
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16. August 29 – September 1: Historical Weather Maps, microfilm and satellite images indicated a trough over the western Bahamas on August 28th. The weak disturbance slowly moved westward and over the Florida peninsula on the 29th. In HURDAT, the first position was analyzed at 00Z on the 29th as a 25 kt tropical depression. The system moved into the northeastern Gulf of Mexico on the 30th and into the Florida panhandle on the 31st. Synoptic observations indicated that the low-level circulation was very poorly organized and not closed. The last position in HURDAT was analyzed at 00Z on September 1st. Because the system did not have a well-defined center, it is removed from HURDAT. This disturbance was in Jack Beven's List of Suspects.

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AL141969,            UNNAMED,     13,
19690829, 0000,  , TD, 27.5N,  79.1W,  25,
19690829, 0600,  , TD, 27.6N,  80.0W,  25,
19690829, 1200,  , TD, 27.6N,  80.7W,  25,
19690829, 1800,  , TD, 27.7N,  81.2W,  25,
19690830, 0000,  , TD, 27.8N,  82.0W,  25,
19690830, 0600,  , TD, 27.9N,  82.5W,  25,
19690830, 1200,  , TD, 28.0N,  83.0W,  25,
19690830, 1800,  , TD, 28.1N,  83.4W,  25,
19690831, 0000,  , TD, 28.2N,  84.0W,  25,
19690831, 0600,  , TD, 28.3N,  84.9W,  25,
19690831, 1200,  , TD, 28.4N,  85.2W,  25,
19690831, 1800,  , TD, 28.6N,  86.0W,  25,
19690901, 0000,  , TD, 28.9N,  87.0W, -99,
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17. September 16-20: Historical Weather Maps, microfilm and satellite images showed a weak disturbance over the central Gulf of Mexico on September 15th. The disturbance slowly moved westward producing disorganized convection and remained very poorly organized at the surface. The first position is in HURDAT at 00Z on the 16th. On the 20th, it moved into northeastern Mexico and dissipated soon after. The last position in HURDAT was analyzed at 00Z on the 20th. COADS were obtained and no gales were observed. Because synoptic data showed that the system did not have a well-defined center, it is removed from HURDAT. This disturbance was in Jack Beven's List of Suspects.

```
AL181969,            UNNAMED,     17,
19690916, 0000,  , TD, 26.0N,  88.1W,  25,
19690916, 0600,  , TD, 26.1N,  88.3W,  25,
19690916, 1200,  , TD, 26.2N,  88.5W,  25,
19690916, 1800,  , TD, 26.2N,  88.7W,  25,
19690917, 0000,  , TD, 26.2N,  89.3W,  25,
19690917, 0600,  , TD, 26.2N,  90.0W,  25,
19690917, 1200,  , TD, 26.2N,  90.2W,  25,
19690917, 1800,  , TD, 26.2N,  90.8W,  25,
19690918, 0000,  , TD, 26.1N,  91.0W,  25,
19690918, 0600,  , TD, 26.1N,  91.4W,  25,
19690918, 1200,  , TD, 26.1N,  92.6W,  25,
19690918, 1800,  , TD, 26.0N,  93.3W,  25,
19690919, 0000,  , TD, 26.0N,  94.5W,  25,
19690919, 0600,  , TD, 26.0N,  95.1W,  25,
19690919, 1200,  , TD, 25.1N,  96.0W,  25,
19690919, 1800,  , TD, 25.8N,  96.7W,  25,
19690920, 0000,  , TD, 25.1N,  97.1W,  25,
```

18. September 26-29: Historical Weather Maps, microfilm and satellite images depicted a trough over the southern Gulf of Mexico on September 26th. The next day, convection increased over the eastern Gulf of Mexico and a surface circulation formed west of the Yucatan peninsula. A reconnaissance aircraft investigated the disturbance late on the 27th and estimated surface winds of 40 kt about 200 n mi northeast of the center. Synoptic observations suggested that this estimate had a high bias. Operationally, it was upgraded to a tropical depression at 12Z on the 27th. The disturbance remained generally stationary and by late on the 28th, synoptic observations indicated that the transient circulation had dissipated. Because the system only had a transient well-defined center and the convection remained disorganized, it is not added to HURDAT. This disturbance was in Jack Beven's List of Suspects.

Day	Latitude	Longitude	Status
Sep 26	Southern Gulf of Mexico		Trough
Sep 27	21N	91W	Low
Sep 28	20N	92W	Low
Sep 29			Dissipated

19. October 3-8: Historical Weather Maps, microfilm and satellite images indicated a tropical wave over the southern Caribbean Sea on October 2nd. The disturbance remained generally stationary and operationally, it was upgraded to a tropical depression at 12Z on the 3rd. The convective activity remained disorganized, although it increased in extent on the 4th. The system remained poorly organized and no gales were observed during its lifetime. The disturbance dissipated on the 8th. Because the disturbance did not have a well-defined circulation and convective activity remained disorganized, it is not added to HURDAT. This disturbance was in Jack Beven's List of Suspects.

Day	Latitude	Longitude	Status
Oct 2	Southern Caribbean Sea		Tropical Wave
Oct 3	12N	80W	Tropical Wave
Oct 4	13N	82W	Low
Oct 5	13N	80W	Low
Oct 6	13N	80W	Low
Oct 7	13N	80W	Low
Oct 8			Dissipated

20. October 29 – November 5: Historical Weather Maps, microfilm and satellite images showed a weakening frontal boundary over the Western Atlantic and Gulf of Mexico on October 29th. A weak extratropical cyclone developed over the Florida Straits on the 30th and remained generally stationary until it began to move quickly to the northeast on November 1st. As the extratropical cyclone moved to the northeast, it began to produce gale and storm-force winds. Frying Pan Shoal Lightship reported 65 kt on the 2nd. The extratropical cyclone affected the eastern United States and on the 4th, it moved into eastern Canada. By the 5th, it merged with another extratropical cyclone. Synoptic observations indicated that the disturbance remained baroclinic, with a substantial temperature gradient across the circulation. Because the system was extratropical and did not develop organized deep convection, it is not added to HURDAT. This disturbance was in Jack Beven's List of Suspects.

Day	Latitude	Longitude	Status
Oct 29	Gulf of Mexico and Western Atlantic		Weakening cold front

Oct 30	24N	81W	Extratropical
Oct 31	26N	80W	Extratropical
Nov 1	29N	80W	Extratropical
Nov 2	35N	76W	Extratropical
Nov 3	40N	70W	Extratropical
Nov 4	48N	65W	Extratropical
Nov 5			Merged

21. November 7-10: Historical Weather Maps, microfilm and satellite images depicted a trough over the central Atlantic producing some disorganized convection on November 7th. Synoptic observations indicated that the surface circulation became better organized on the 8th, but convection remained disorganized, and restricted to the northern semicircle. A couple of gales were reported north of the center on the 8th. On the 9th, synoptic observations showed that the disturbance weakened and on satellite, only a small area of convection was located near the center. By the 10th, the weak system began to move quickly to the east ahead of a strong front and dissipated the next day. Because the organized convective activity was transient and the low-level circulation was not well-defined, it is not added to HURDAT.

Day	Latitude	Longitude	Status
Nov 7	Central Atlantic		Trough
Nov 8	34N	39W	Low
Nov 9	35N	41W	Low
Nov 10	36N	27W	Low
Nov 11			Dissipated

22. November 13-20: Historical Weather Maps, microfilm and satellite images indicated a weakening front over the northeast Atlantic on November 13th. A small and weak extratropical cyclone developed the next day and remained almost stationary over the next couple of days. On the 17th, the disturbance became better organized based on satellite imagery and synoptic observations, thus it may have developed into a subtropical cyclone, although it appears it was transient. Gales were observed on the 17th, about 250 n mi north of the center. By the next day, observations suggested that the disturbance had weakened and the system dissipated on the 20th. Because the system did displayed subtropical characteristics for only a short time, it is not added to HURDAT. This disturbance was in Jack Beven's List of Suspects.

Day	Latitude	Longitude	Status
Nov 13	Northeast Atlantic		Weakening Stationary Front
Nov 14	35N	32W	Extratropical
Nov 15	35N	31W	Extratropical
Nov 16	37N	30W	Extratropical
Nov 17	31N	37W	Extratropical
Nov 18	33N	39W	Extratropical

Nov 19	33N	38W	Extratropical
Nov 20			Absorbed

23. November 16-22: Historical Weather Maps, microfilm and satellite images showed a frontal boundary over the western Atlantic on November 16th. An extratropical cyclone developed the next day southeast of Nova Scotia. The disturbance became occluded on the 18th while producing gales over the northern and western semicircle, about 200 n mi from the center. The system moved southeastward on the 19th, still producing gales to the northwest and southeast of the center. The next day, an approaching frontal boundary caused the disturbance to turn northward and it weakened below gale force. The system moved northward and was absorbed by the 22nd while over the north Atlantic. Because the system did not have organized deep convection, it is not added to HURDAT. This disturbance was in Jack Beven's List of Suspects.

Day	Latitude	Longitude	Status
Nov 16	Western Atlantic		Cold Front
Nov 17	40N	54W	Extratropical
Nov 18	33N	55W	Occluded
Nov 19	31N	51W	Occluded
Nov 20	35N	53W	Occluded
Nov 21	37N	53W	Occluded
Nov 22			Absorbed

Reanalysis of the 1970 Atlantic hurricane season – Sandy Delgado, Andrew Hagen, Brenden Moses, and Chris Landsea – January 2022

Green indicates wind changes of 15 kt or greater
Blue indicates lat/long changes greater than 1°
Red indicates a new entry
Yellow indicates a deletion

Hurricane Alma [May 17-27, 1970] – AL011970

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46760 05/17/1970 M=11  1 SNBR= 996 ALMA        XING=0 SSS=0

46765 05/17*  0   0   0    0*  0   0   0    0*  0   0   0    0*115 790  25    0*

46770 05/18*117 792  25    0*121 797  25    0*123 801  25 1007*125 805  25    0*
46770 05/18*118 793  25    0*121 797  25    0*123 801  25    0*126 805  25    0*
            *** ***                                          * ***

46775 05/19*130 810  25    0*135 815  25    0*140 820  25 1005*145 825  25    0*
46775 05/19*130 810  25    0*135 815  25    0*140 819  25 1005*147 821  30    0*
                                                   ***          *** ***  **

46780 05/20*155 825  35    0*162 823  35    0*168 819  65    0*172 816  70  993*
46780 05/20*155 822  35    0*163 820  45    0*169 817  55    0*174 814  65  993*
                 ***         *** ***  **      *** ***  **      *** ***  **

46785 05/21*180 810  55    0*182 803  50    0*185 802  45    0*190 800  40  998*
46785 05/21*178 810  60    0*182 806  50    0*185 802  45 1002*190 800  45 1003*
            ***      **          ***                      ****          ** ****
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46790 05/22*196 801  35 1004*193 806  30    0*191 811  30    0*190 818  30 1007*
46790 05/22*195 801  45 1004*193 806  40 1005*191 811  35 1007*190 818  30    0*
            ***      **                ** ****          ** ****                 *

46795 05/23*192 827  30    0*198 835  25    0*210 839  25    0*219 840  25    0*
46795 05/23*192 826  30    0*198 835  25    0*208 841  25    0*218 844  25    0*
                ***                           *** ***          *** ***

46800 05/24*230 840  25    0*240 840  25    0*252 840  25 1008*268 839  25    0*
46800 05/24*229 845  25    0*239 843  30 1008*249 841  30 1008*263 839  30    0*
            *** ***          *** ***  ** **** *** ***  **      ***      **

46805 05/25*283 836  25    0*295 829  25    0*306 822  25    0*318 816  25    0*
46805 05/25*280 834  30    0*295 829  30    0*308 822  30    0*318 816  35 1003*
            *** ***  **                **      ***      **                ** ****

46810 05/26*326 812  25 1005*333 807  25    0*348 799  25    0*357 787  25    0*
46810 05/26*326 812  40    0*335 807  40    0*346 799  40    0*357 787  35    0*
            ***      **    * ***      **      ***      **                **

46815 05/27E365 770  25 1003E370 755  25    0*  0   0   0    0*  0   0   0    0*
46815 05/27*365 770  35 1003*  0   0   0    0*  0   0   0    0*  0   0   0    0*
           *         **     *  *   *   *
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46820 HR

Tropical Storm Impact

05/22 00Z 19.5N 80.1W 45 kt Cayman Islands

Significant Revisions:

1. Analyzed to have weakened to a tropical depression twelve hours later than originally shown in HURDAT.
2. Analyzed to have regained tropical storm intensity at 18Z on May 25th based on synoptic observations.
3. Major increase in intensity analyzed between 00Z and 12Z on May 26th based on synoptic observations.
4. Dissipation is analyzed six hours earlier than originally shown in HURDAT as a tropical cyclone based on synoptic observations.

Daily Metadata:

May 16:

1. Maps and old HURDAT:
- HWM does not analyze any features of interest at 12Z.
2. Discussion:
- Reanalysis: Satellite images showed an increase in convection over the southern Caribbean Sea on October 16th.

May 17:

1. Maps and old HURDAT:
- HWM does not analyze any features of interest at 12Z.
- HURDAT lists a 25 kt tropical depression at 11.5N, 79W at 18Z (first position).
- Microfilm shows a closed low pressure of at most 1010 mb at 9N, 78W at 12Z.
2. Discussion:
- MWR: "A weak depression formed in the southwest Caribbean Sea on May 17 and gradually became better organized as it moved northward."

- Reanalysis: Synoptic observations on the 17th suggested that a low level circulation gradually became better organized and intensification to a 25 kt tropical depression is analyzed at 18Z on this date, same as originally shown in HURDAT.

May 18:

1. Maps and old HURDAT:
- HWM does not analyze any features of interest at 12Z.
- HURDAT lists a 25 kt tropical depression at 12.3N, 80.1W at 12Z.
- Microfilm shows a tropical cyclone of at most 1010 mb at 14N, 80W at 12Z.
2. Discussion:
- ATSR: "The first evidence of a definite closed circulation was on 18 May. This circulation maintained itself and drifted slowly northwestward.."
- Reanalysis: The tropical depression moved to the northwest on this date and remained disorganized, as shown in the satellite images. Operationally, it was upgraded to the first tropical depression of the season at 12Z on the 18th.

May 19:

1. Maps and old HURDAT:
- HWM analyzes a closed low pressure of at most 1012 mb at 14N, 81.5W at 12Z.
- HURDAT lists a 25 kt tropical depression at 14N, 82W at 12Z.
- Microfilm shows a tropical cyclone of at most 1012 mb at 14N, 81.5W at 12Z.
2. Discussion:
- Reanalysis: On this date, satellite imagery showed that the tropical cyclone had become much better organized in comparison to the previous days, with some banding over the northern semicircle. Nonetheless, the synoptic observations did not suggest that it attained tropical storm intensity on the 19th.

May 20:

1. Maps and old HURDAT:
- HWM analyzes a closed low pressure of at most 1004 mb at 16N, 82W at 12Z.
- HURDAT lists a 65 kt hurricane at 16.8N, 81.9W at 12Z.
- Microfilm shows a tropical cyclone of at most 1008 mb at 16.5N, 81.2W at 12Z.
2. Ship highlights:
- 35 kt NE and 1011 mb at 18.2N, 83.3W at 12Z (COADS).
- 60 kt NE (likely high bias) and 1008 mb at 17.5N, 82W at 18Z (COADS).
- 35 kt NE and 1005 mb at 18N, 82.1W at 21Z (COADS).
3. Satellite highlights:
- ATS 3 estimated a center fix at 17N, 82W at 1533Z (WALLET).
4. Aircraft highlights:
- Penetration center fix measured a central pressure of 993 mb, estimated surface winds of 70 kt and an eye diameter of 15 n mi at 17.4N, 81.4W at 1758Z (WALLET).
- Radar center fix estimated surface winds of 65 kt at 17.8N, 81.3W at 2138Z (WALLET).
5. Discussion:
- MWR: "Rapid deepening occurred during the night of the 19th; and by midday on the 20th, the system reached what proved to be its maximum intensity when a Navy reconnaissance flight found a central pressure of 993 mb (29.32 in.) and 70-kt winds."
- ATSR: "While an investigative flight was enroute, the first tropical depression warning was issued at 1600Z. When the aircraft reached the area, a fully developed hurricane with a minimum SLP of 993 mb and maximum surface

winds of 70 knots was in evidence. ALMA maintained hurricane intensity for only 12-18 hours."

- Reanalysis: Intensification to a tropical storm is uncertain but based on synoptic and aircraft reconnaissance observations later on this date, it is analyzed at 00Z on the 20th, same as originally shown in HURDAT. A penetration center fix measured a central pressure of 993 mb, estimated surface winds of 70 kt and an eye diameter of 15 n mi at 1758Z on the 20th. A central pressure of 993 mb suggests maximum surface winds of 59 kt from the south of 25N Brown et al. pressure-wind relationship. An eye diameter of 15 n mi suggests an RMW of about 10 n mi and the climatological value is 15 n mi. Due to a slow forward speed, about 7 kt, but RMW being small and weighting some the visual estimate, an intensity of 65 kt is analyzed at 18Z on the 20th, down from 70 kt originally shown in HURDAT, a minor intensity change. 65 kt is also the peak intensity of Hurricane Alma. The rapid increase in intensity analyzed on the 20th is still more gradual than originally shown in HURDAT, since it depicted an increase from 35 kt at 06Z to 65 kt at 12Z on the 20th, which is very unlikely. Satellite images also presented a well-organized tropical cyclone with a CDO over the center.

May 21:

1. Maps and old HURDAT:
- HWM analyzes a hurricane of at most 1000 mb at 19.2N, 79.6W at 12Z.
- HURDAT lists a 45 kt tropical storm at 18.5N, 80.2W at 12Z.
- Microfilm shows a tropical storm of at most 1008 mb at 19N, 80.4W at 12Z.
2. Ship highlights:
- 30 kt NE and 1011 mb at 17.7N, 82.8W at 00Z (COADS).
- 35 kt N and 1018 mb at 18.3N, 81.3W at 15Z (COADS).
3. Aircraft highlights:
- Penetration center fix measured a central pressure of 1002 mb and estimated surface winds of 40 kt at 18.6N, 80.1W at 1315Z (WALLET).
- Penetration center fix measured a central pressure of 1003 mb, estimated surface winds of 40 kt and an elongated eye with a minor axis of 18 n mi and a major axis of 30 n mi at 18.9N, 80W at 1736Z (WALLET).
- Penetration center fix measured a central pressure of 1004 mb and estimated surface winds of 50 kt at 19.7N, 80.1W at 2341Z (WALLET).
4. Land highlights:
- Wind gust of 55 kt at Cayman Brac at 12Z (micro/WALLET).
5. Discussion:
- MWR: "Alma dropped hurricane intensity by the evening of May 20 and weakened to a tropical depression on the following day."
- Reanalysis: On this date, shear increased and Alma weakened. Weakening below hurricane intensity is analyzed at 00Z on the 21st, same as originally shown in HURDAT. A penetration center fix measured a central pressure of 1002 mb and estimated surface winds of 40 kt at 1315Z on the 21st. An intensity of 45 kt is analyzed at 12Z on the 21st, same as originally shown in HURDAT. The Storm Wallets and microfilm suggest that Cayman Brac reported a wind gust of 55 kt around 12Z on this date. The next penetration center fix measured a central pressure of 1003 mb, estimated surface winds of 40 kt and an eye diameter of 18-30 n mi at 1736Z on the 21st. Originally, the Storm Wallets indicated that the central pressure was 998 mb on this RECON fix, however, the extrapolated central pressure from flight-level using today's formula is 1003 mb. A central pressure of 1003 mb suggests maximum surface winds of 41 kt from the south of 25N pressure-wind relationship. An intensity of 45 kt is analyzed at 18Z on the 21st, up from 40 kt as originally shown in HURDAT, a minor intensity

change. Satellite images showed a shared tropical cyclone with most of the convection over Cuba and the Bahamas.

May 22:

1. Maps and old HURDAT:
- HWM analyzes a closed low pressure of at most 1008 mb at 19N, 81W at 12Z.
- HURDAT lists a 30 kt tropical depression at 19.1N, 81.1W at 12Z.
- Microfilm shows a closed low pressure of at most 1008 mb at 18.8N, 81W at 12Z.
2. Ship highlights:
- 40 kt NE and 1010 mb at 19.2N, 82.7W at 06Z (COADS).
- 15 kt SSW and 1007 mb at 19.1N, 80.2W at 06Z (COADS).
3. Aircraft highlights:
- Penetration center fix measured a central pressure of 1007 mb and estimated surface winds of 30 kt at 18.9N, 81.5W at 1440Z (WALLET).
4. Discussion:
- MWR: "The residual depression hesitated south of Cuba for a day …"
- ATSR: "Alma was downgraded to a tropical depression and finaled for the first time at 221600Z."
- Reanalysis: After moving to the northeast for a couple of days, Alma turned to the west passing south of the Cayman Islands. A penetration center fix measured a central pressure of 1004 mb and estimated surface winds of 50 kt at 2341Z on the 21st. A central pressure of 1004 mb suggests maximum surface winds of 39 kt from the south of 25N pressure-wind relationship. An intensity of 45 kt is analyzed at 00Z on the 22nd using a blend of the pressure-wind relationship and RECON estimates, up from 35 kt as originally shown in HURDAT, a minor intensity change. Tropical-storm-force winds likely impacted the Cayman Islands on this date as the tropical cyclone made its closest approach to the island chain, thus Alma is analyzed as a tropical storm impact for this country. A ship reported 15 kt SSW and 1007 mb at 06Z on the 22nd, suggesting a central pressure of 1005 mb. A ship report of 40 kt NE and 1010 mb also at 06Z on the 22nd is the basis for the intensity estimate of 40 kt at 06Z on the 22nd, same as originally shown in HURDAT. The next penetration center fix measured a central pressure of 1007 mb and estimated surface winds of 30 kt at 1440Z on the 22nd. Based partially on the aforementioned ship report of 40 kt at 06Z on the 22nd, an intensity of 35 kt is analyzed at 12Z, up from 30 kt originally in HURDAT, a minor intensity change. Weakening below tropical storm intensity is analyzed at 18Z on the 22nd, twelve hours later than originally shown in HURDAT. Satellite images showed a sheared system with an exposed center and most of the convection over the northern semicircle.

May 23:

1. Maps and old HURDAT:
- HWM analyzes a closed low pressure of at most 1008 mb at 21.5N, 85W at 12Z.
- HURDAT lists a 25 kt tropical depression at 21N, 83.9W at 12Z.
- Microfilm shows a tropical cyclone of at most 1008 mb at 20.7N, 84.5W at 12Z.
2. Discussion:
- MWR: "…before crossing the western part of the island on a northward track…"
- Reanalysis: The weak tropical depression moved toward western Cuba and crossed the westernmost part of the Pinar del Rio province late on this date. Satellite images showed a disorganized cyclone with most of the convection over the southeast Gulf of Mexico due to southwesterly shear. Perez et al. (2000) indicates that Alma was a tropical storm at landfall in Cuba but the data available does not support this analysis.

May 24:

1. Maps and old HURDAT:
- HWM analyzes a spot low at 25N, 85W at 12Z.
- HURDAT lists a 25 kt tropical depression at 25.2N, 84W at 12Z.
- Microfilm shows a tropical cyclone of at most 1010 mb at 25N, 85W at 12Z.
2. Land highlights:
- 30 kt SE and 1011 mb at Dry Tortugas, FL at 06Z (micro).
- 30 kt SE and 1011 mb at Dry Tortugas, FL at 12Z (micro).
3. Radar highlights:
- Key West, FL estimated a center fix at 26N, 82.7W and an eye diameter of 5 n mi at 0852Z (WALLET).
- Miami, FL estimated a center fix at 26.6N, 82.9W and an eye diameter of 18 n at 1210Z (WALLET).
- Tampa, FL estimated a center fix at 27.5N, 83.2W at 1812Z (WALLET).
4. Discussion:
- MWR: "…that ultimately carried it across the upper West Coast of Florida. As the depression passed west of Tampa, radar revealed a remarkably well-formed spiral band structure and the appearance of an eye. However, available data, consisting mainly of peripheral ship reports, indicate that the central pressure at the time was no lower than about 1008 mb (29.77 in.) and highest winds were only about 30 kt in squalls east of the center."
- ATSR: "She managed to maintain a weak circulation while moving west then north across Western Cuba and warnings were resumed on Tropical Depression ONE at 241400Z, located west of Fort Myers, Florida."
- Reanalysis: The tropical depression moved northward into the southeastern Gulf of Mexico. The Tampa radar suggested that the circulation had become better organized and it even seemed like an eye or eye-like feature had developed. Observations from the Key West and Miami radar also suggested that the system had a small RMW. The center fixes from the radar stations placed the center of Alma about 60 n mi to the northeast of the center positions in HURDAT and as suggested by the synoptic observations. A possible explanation for this discrepancy is that the radar stations were following a transient mid-level circulation of Alma, while the low-level circulation was displaced southwestward due to the moderate to strong southwesterly shear. Synoptic observations also do not indicate that Alma regained tropical storm intensity over the eastern Gulf of Mexico. Satellite images showed a tropical cyclone with most of the convection displaced northeast of the center.

May 25:

1. Maps and old HURDAT:
- HWM analyzes a closed low pressure of at most 1012 mb at 30.2N, 83W at 12Z.
- HURDAT lists a 25 kt tropical depression at 30.6N, 82.2W at 12Z.
- Microfilm shows a tropical cyclone of at most 1012 mb at 31N, 81.8W at 12Z.
2. Ship highlights:
- 30 kt SE and 1016 mb at 29N, 79.8W at 00Z (COADS).
- 35 kt SSE and 1013 mb at 31.4N, 78.6W at 18Z (COADS).
3. Land highlights:
- 15 kt SSW and 1006 mb at Savannah, GA at 20Z (NCEI).
4. Discussion:
- ATSR: "Moving northward, it entered Florida near Cedar Key early on 25 May."
- Reanalysis: Early on the 25th, the center of Alma made landfall near Cedar Key and although it was moving over southern Georgia, it became better organized. Satellite images showed a small tropical cyclone with convection over or near the center and banding features to the north. A ship at about 150 n mi to the

east of the center at 18Z on the 25th reported 35 kt and a 20Z, Savannah, GA, recorded a minimum pressure of 1006 mb and 15 kt SSW, suggesting a central pressure of 1003 mb. A central pressure of 1003 mb suggests 38 kt at north of 25N. An intensity of 35 kt is analyzed at 18Z on the 25th, up from 25 kt originally shown in HURDAT, a minor intensity change. It is also analyzed that Alma regained tropical storm intensity at this time, while the center remained inland a short ways from the coast.

May 26:

1. Maps and old HURDAT:
- HWM analyzes a closed low pressure of at most 1008 mb at 34N, 80W with a cold front approaching from the west at 12Z.
- HURDAT lists a 25 kt tropical depression at 34.8N, 79.9W at 12Z.
- Microfilm shows a tropical cyclone of at most 1008 mb at 34.5N, 79.7W with a cold front approaching from the west at 12Z.
2. Ship highlights:
- 35 kt SW and 1009 mb at 37.8N, 73.2W at 18Z (COADS).
3. Land highlights:
- 45 kt S and 1012 mb at Frying Pan Shoals Light at 00Z (COADS).
- 40 kt S and 1011 mb at Frying Pan Shoals Light at 06Z (COADS).
- 45 kt SW and 1009 mb at Frying Pan Shoals Light at 12Z (micro).
4. Discussion:
- ATSR: "While moving northeastward over land, the depression maintained a circulation and, in fact, showed some deepening while moving through Georgia and the Carolinas."
- Reanalysis: Alma continued on a northeastward track over the southeastern United States but remaining close enough to the Atlantic to maintain tropical-storm-force winds. Frying Pan Shoals Light, an elevated site, reported 45 kt S at 00Z and 45 kt SW at 12Z on the 26th. An intensity of 40 kt is analyzed between 00Z and 12Z on the 26th, up from 25 kt originally shown in HURDAT, major intensity increases.

May 27:

1. Maps and old HURDAT:
- HWM and microfilm analyzes a frontal boundary over the western Atlantic, Alma appears to have dissipated, at 12Z.
- HURDAT lists a 25 kt extratropical depression at 37N, 75.5W at 06Z. (last position)
2. Ship highlights:
- 35 kt S and 1017 mb at 37.1N, 70.2W at 00Z (COADS).
- 45 kt SSW and 1008 mb at 36.9N, 70.5W at 06Z (COADS).
3. Discussion:
- MWR: "and northeastward along the coastal sections of the South Atlantic States where it was finally absorbed by an advancing cold front."
- ATSR: "A cold front that had been approaching from the Northwest finally caught up and absorbed the depression as it moved off the coast north of Cape Hatteras early on the 27th."
- Reanalysis: An approaching frontal boundary began to interact with Alma early on the 27th. HURDAT indicated that the cyclone had become extratropical at 00Z on this date but synoptic data suggested that the frontal boundary was still to the west of the center of Alma. By 06Z on the 27th, the synoptic data showed that the tropical cyclone had become absorbed by the strong front, thus the last position is analyzed at 00Z, six hours earlier than originally shown in HURDAT.

Date	Original HURDAT Central Pressure	Evidence	Changes
May 18 12Z	1007 mb	No data near the center	Removed
May 19 12Z	1005 mb	No synoptic observations near the center but seems reasonable based on peripheral data and has been retained	Retained
May 20 18Z	993 mb	Penetration center fix: 993 mb at 1758Z	
May 21 12Z		Penetration center fix: 1002 mb at 1315Z	1002 mb
May 21 18Z	998 mb	Penetration center fix: 998 mb at 1736Z	Retained
May 22 00Z	1004 mb	Penetration center fix: 1004 mb at 2341Z on May 21st	
May 22 06Z		Ship: 15 kt SSW and 1007 mb at 19.1N, 80.2W at 06Z	1004 mb
May 22 12Z		Penetration center fix: 1007 mb at 1440Z	1007 mb
May 22 18Z	1007 mb		Removed
May 24 06Z		Land: 30 kt SE and 1011 mb at Dry Tortugas, FL at 06Z	1008 mb
May 24 12Z	1008 mb	Land: 30 kt SE and 1011 mb at Dry Tortugas, FL at 12Z	Retained
May 25 18Z		Land: 15 kt SSW and 1006 mb at Savannah, GA at 18Z on May 25th	1003 mb
May 26 00Z	1005 mb	Land: 13 kt SSW and 1007 mb at Savannah, GA at 2255Z on May 25th	Retained
May 27 00Z	1003 mb	Ship: 15 kt ESE and 1005 mb at 36.9N, 75.7W at 00Z	

Sources: NHC microfilm maps, the Historical Weather Maps series, the COADS ship database, Monthly Weather Review, Navy reconnaissance book, Mariners Weather Log, EV2 Surface Weather Observations, Satellite images from NCDC, and NHC Storm Wallets.

Green indicates wind changes of 15 kt or greater
Blue indicates lat/long changes greater than 1°
Red indicates a new entry
Yellow indicates a deletion

Tropical Storm Becky [July 19-23, 1970] – AL021970

```
46825 07/19/1970 M= 5  2 SNBR= 997 BECKY       XING=1 SSS=0

46830 07/19*185 835  25    0*188 845  25    0*194 852  30    0*203 856  30 1010*
46830 07/19*185 835  30 1011*188 845  30 1011*194 852  30 1009*203 856  30 1010*
                     ** ****          ** ****          ** ****

46835 07/20*213 859  30    0*223 862  30    0*233 864  40    0*241 866  45 1008*
46835 07/20*213 859  35 1009*223 862  40    0*232 864  40    0*241 866  45 1008*
                        ****                  ***

46840 07/21*250 866  50 1003*258 867  55 1004*266 866  55 1006*275 863  55    0*
46840 07/21*250 867  50 1003*258 868  55 1004*266 867  55 1006*275 863  55    0*
                ***             ***              ***
```

```
46845 07/22*283 860  45    0*292 855  40    0*299 851  30 1009*317 847  25    0*
46845 07/22*283 859  50 1007*291 855  45 1007*300 852  35 1007*315 853  25    0*
                ***  ** **** ***      ** **** *** ***  ** **** *** ***

46850 07/23*334 852  25    0*353 860  25 1015*372 869  20    0*  0   0   0    0*
46850 07/23*334 856  25    0*354 861  20    0*375 867  20    0*  0   0   0    0*
                ***          *** ***  **    * *** ***

46855 TS

U.S. Tropical Storm Landfall
----------------------------
07/22 10Z 29.7N 85.3W 40 kt FL
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Significant Revisions:

1. Intensification to a tropical storm analyzed twelve hours earlier than originally shown in HURDAT based on ship and reconnaissance data.
2. A few central pressures were added and one central pressure was removed based on synoptic and reconnaissance aircraft data.

Daily Metadata:

July 13:

1. Maps and old HURDAT:
- HWM does not analyze any features of interest at 12Z.

July 14:

1. Maps and old HURDAT:
- HWM analyzes a spot low at 13N, 46W at 12Z.
- Microfilm shows a tropical cyclone of at most 1012 mb at 12.5N, 46W at 12Z.
2. Discussion:
- Reanalysis: Satellite images indicated that a tropical wave left the west coast of Africa on July 9th. The tropical disturbance moved westward and operationally, it was upgraded to the 12th tropical depression of the season at 00Z on the 14th. The satellite image at 1404Z on the 14th showed an increase in the amount of convection compared to the previous days but the disturbance's circulation and convection remained disorganized, with no indications that it had become a tropical depression. Furthermore, the synoptic observations over the central Atlantic were sparse, but those available also do not suggest that a closed low-level circulation had formed.

July 15:

1. Maps and old HURDAT:
- HWM does not analyze any features of interest at 12Z.
- Microfilm shows a tropical cyclone at 15N, 55.5W at 12Z.
2. Discussion:
- Reanalysis: The satellite image at 1419Z on the 15th showed a large area of convection east of the Lesser Antilles but synoptic observations clearly showed that it did not have a closed low-level circulation and the environmental pressure were high. Also, no appreciable change in pressures was noticed as the disturbance moved across the Lesser Antilles. A reconnaissance aircraft investigated the disturbance late on the 15th as shown in the microfilm and found a sharp tropical wave.

July 16:

1. Maps and old HURDAT:
- HWM analyzes a tropical wave along 64W at 12Z.
- Microfilm shows a tropical cyclone of at most 1012 mb at 16.7N, 64W at 12Z.
2. Discussion:
- MWR: "Two events contributed to the development of the season's second named tropical cyclone. The main impulse was provided by a massive rain system that surged northward from the ITCZ near Panama on July 16."
- Reanalysis: On this date, the disturbance remained disorganized, with most of the convection located north of the islands. Microfilm maps showed that a reconnaissance aircraft investigated the tropical disturbance around 12Z and it did not find a closed low-level circulation.

July 17:

1. Maps and old HURDAT:
- HWM and microfilm analyze a tropical wave over the central Caribbean Sea at 12Z.
2. Discussion:
- Reanalysis: The tropical disturbance remained disorganized and operationally, the last bulletin on TD #12 was issued at 00Z on the 17th. Most of the convection remained north of the islands.

July 18:

1. Maps and old HURDAT:
- HWM analyzes a tropical wave over the western Caribbean Sea at 12Z.
- Microfilm shows a tropical wave over eastern Cuba at 12Z.
2. Discussion:
- MWR: "By July 18, this zone of convection dominated a broad area between Swan Island and western Cuba. Here, it was joined by a lower tropospheric vorticity maximum that had passed through the Lesser Antilles on July 16."
- Reanalysis: Convection increased over the western Caribbean and the disturbance became better organized. It seems likely that the tropical wave that we had been following interacted with another disturbance, associated with the preceding tropical wave that formed over the southern Caribbean Sea a few days earlier and had been moving northwestward. Nonetheless, the synoptic observations did not show that a closed low-level circulation was present.

July 19:

1. Maps and old HURDAT:
- HWM analyzes a closed low pressure of at most 1012 mb at 19N, 86W at 12Z.
- HURDAT lists a 30 kt tropical depression at 19.4N, 85.2W at 12Z.
- Microfilm shows a closed low pressure of at most 1012 mb at 19.5N, 85.5W at 12Z.
2. Ship highlights:
- 5 kt W and 1012 mb at 17.7N, 83W at 00Z (COADS).
- 35 kt NE and 1014 mb at 20.2N, 79.6W at 00Z (COADS).
- 30 kt E (35 kt micro) and 1014 mb at 20.2N, 84.7W at 06Z (COADS).
- 55 kt ESE (high bias likely) and 1016 mb at 21.7N, 85.1W at 12Z (COADS).
- 55 kt ENE (high bias likely) and 1015 mb at 22.4N, 86.2W at 18Z (COADS).
3. Aircraft highlights:
- Penetration center fix measured a central pressure of 1009 mb and estimated surface winds of 28 kt at 19.3N, 85.4W at 12Z (WALLET).
- Penetration center fix measured a central pressure of 1010 mb and estimated surface winds of 27 kt at 20.7N, 85.5W at 1739Z (WALLET).

4. Discussion:

- ATSR: "This mass moved northwest-to-north and the first indication of a weak circulation was early on 19 July about 150 miles south of the western tip of Cuba. A Navy reconnaissance aircraft at 191200Z confirmed a poorly-organized circulation located near 19.3N, 85.4W, with a minimum sea level pressure of 1009 mb and maximum surface winds of 28 knots. The first warning of Tropical Depression TWO was issued at 191300Z."
- Reanalysis: At 00Z on the 19th, synoptic observations showed that a weak closed-low level circulation had formed northeast of Swan Island. The first position is analyzed at this time as a 30 kt tropical depression, same as originally shown in HURDAT but 5 kt stronger based on synoptic data. Operationally as shown in the microfilm, the system was upgraded to the 13th tropical depression of the season. Two penetration center fixes occurred on the 19th, at 12Z and 1739Z, measuring central pressures of 1009 mb and 1010 mb, respectively, and estimating surface winds of 28 kt and 27th, respectively. An intensity of 30 kt is analyzed at 12Z and 18Z on the 19th, same as originally shown in HURDAT. One ship reported 55 kt winds twice on this date over the Yucatan Channel and based on other synoptic data nearby, the ship's observations seem to have a large high bias. Satellite images showed a large area of convection but the center of the tropical depression was located near the southwestern edge, indicating that the system was under moderate to strong shear.

July 20:

1. Maps and old HURDAT:

- HWM analyzes a closed low pressure of at most 1012 mb at 22.5N, 87.5W at 12Z.
- HURDAT lists a 40 kt tropical storm at 23.3N, 86.4W at 12Z.
- Microfilm shows a tropical storm of at most 1012 mb at 23.2N, 86.9W at 12Z.

2. Ship highlights:

- 35 kt SSE and 1013 mb at 21.5N, 84.9W at 00Z (COADS).
- 35 kt ENE and 1009 mb at 22.9N, 86.3W at 06Z (COADS).
- 55 kt NE (likely high bias) and 1012 mb at 22.7N, 85.9W at 06Z (MWL).
- 35 kt E and 1013 mb at 23.8N, 86.6W at 12Z (COADS).
- 40 kt SE and 1015 mb at 24.7N, 86.7W at 16Z (COADS).
- 45 kt SE and 1016 mb at 25.4N, 85.2W at 21Z (COADS).

3. Land highlights:

- 20 kt SE and 1011 mb at Cabo de San Antonio, Cuba at 00Z (micro).

4. Aircraft highlights:

- Penetration center fix measured a central pressure of 1011 mb and estimated surface winds of 50 kt at 23.3N, 86.9W at 1235Z (WALLET).
- Penetration center fix measured a central pressure of 1008 mb and estimated surface winds of 50 kt at 24.1N, 86.3W at 1739Z (WALLET).

5. Discussion:

- MWR: "A reconnaissance flight found 50-kt winds around a 1011-mb (29.85-in.) pressure center on July 20, and tropical storm Becky was named. As Becky moved into the eastern Gulf of Mexico, a fairly strong low-level circulation had developed; but warming of the central core was still insufficient to form an eye and produce large pressure falls at the surface."
- ATSR: "A new center was located about 100 miles north of the morning position. From that position, it moved almost due north, and on 20 July, another Navy reconnaissance aircraft reported 50 knots of wind on the surface. On the basis of this reconnaissance and satellite pictures, the first advisory on Tropical Storm BECKY was issued at 201600Z. At this time as well as throughout the life cycle of the system, most of the associated weather and strongest winds were in the eastern portion of the storm. The minimum sea level pressure was 1011

mb, this high central pressure was another unusual life-long feature of BECKY."

- Reanalysis: On this date, the tropical cyclone crossed the Yucatan Channel and entered the southeastern Gulf of Mexico. Intensification to a tropical storm is analyzed at 00Z on the 20th based on a ship reported of 35 kt over the eastern semicircle, about 60 n mi from the center. Becky gradually intensified, although based on the convective pattern displayed in the satellite images, the system was under westerly shear. A couple other ships reported gale-force winds, including 45 kt at 21Z on the 20th. Also, a ship reported 55 kt at 06Z and similarly to the day before, it appears to have a high bias based on surrounding data. An intensity of 40 kt is analyzed at 06Z on the 20th based on a blend of the nearby ship data, up from 30 kt originally in HURDAT, a minor intensity change. Similarly, an intensity of 40 kt was analyzed at 12Z on the 20th, same as originally shown in HURDAT. A couple of penetration center fixes occurred on this date at 1235Z and 1739Z, reporting a central pressure of 1011 mb and 1008 mb, respectively, and estimated surface winds of 50 kt in both flights. The report of 1011 mb as a central pressure appears inaccurate based on synoptic observations suggesting a central pressure close to 1009 mb; therefore, it was not added to HURDAT. A central pressure of 1008 mb suggests maximum sustained winds of 30 kt S of 25N from the Brown et al. pressure-wind relationship. However, given the nearby ship observations and taking into account the RECON visual estimates, an intensity of 45 kt is analyzed at 18Z on the 20th, same as originally shown in HURDAT. Satellite images showed an exposed center with a large area of convection removed to the east due to westerly wind shear.

July 21:

1. Maps and old HURDAT:
- HWM analyzes a tropical storm of at most 1012 mb at 26.8N, 87W with a cold front to the north at 12Z.
- HURDAT lists a 55 kt tropical storm at 26.6N, 86.6W at 12Z.
- Microfilm shows a tropical storm of at most 1012 mb at 26.6N, 86.9W with a cold front to the north at 12Z.
2. Ship highlights:
- 45 kt ESE and 1014 mb at 26N, 86.65W at 00Z (COADS).
- 1003 mb at 02Z (MWR).
- 45 kt SE and 1014 mb at 25.8N, 85.7W at 06Z (COADS).
- 55 kt at 10Z (MWR/ATSR).
- 35 kt SSE and 1016 mb at 25.6N, 84.9W at 15Z (COADS).
- 40 kt SSE and 1012 mb at 28.3N, 86W at 20Z (COADS).
3. Aircraft highlights:
- Penetration center fix measured a central pressure of 1008 mb and estimated surface winds of 45 kt at 24.8N, 86.3W at 0013Z (WALLET).
- Penetration center fix measured a central pressure of 1004 mb and estimated surface winds of 40 kt at 26.1N, 86.8W at 0559Z (WALLET).
- Penetration center fix measured a central pressure of 1006 mb and estimated surface winds of 65 kt at 26.6N, 86.9W at 1158Z (WALLET).
- Penetration center fix measured a central pressure of 1013 mb and estimated surface winds of 65 kt at 27.3N, 85.8W at 1830Z (WALLET).
- Penetration center fix measured a central pressure of 1009 mb and estimated surface winds of 45 kt at 27.4N, 86.4W at 2332Z (WALLET).
4. Radar highlights:
- New Orleans estimated a center fix at 27.5N, 87W at 1238Z (WALLET).
- Tampa estimated a center fix at 26.7N, 86.4W at 1245Z (WALLET).
5. Discussion:

- MWR: "The morning reconnaissance flight reported the incipient formation of a wall cloud. Radars at Tampa and New Orleans also spotted the developing eye. Indications were that Becky had winds of 65 kt. On the evening of July 20, a ship (call sign LGHM) reported a pressure of 1002.5 mb (29.60 in.); and later, the SS Socony Vacuum (EIGL) sustained winds of 55 kt. The lowest pressure, 1002.5 mb (29.60 in.), was recorded by the afore-mentioned ship (call sign LGHM) at 7:OO p.m. EDT on July 20 and the highest sustained winds were 55 kt reported by the SS Socony Vacuum at 5:OO a.m. EDT on July 21."
- ATSR: "The lowest pressure reported by a reconnaissance aircraft was 1004 mb at 210559Z, although a ship reported 1002.5 mb at 202300Z with winds gusts to 60 knots. On the basis of Air Force reconnaissance, Tropical Storm BECKY was upgraded to a hurricane at 211430Z. Two successive Air Force flights reported surface winds of 65 knots, but with surface pressures of no less than 1006 mb. After post-analysis, it was determined that, in fact, BECKY never reached hurricane intensity."
- Reanalysis: Becky moved to the north and intensified. A ship late on the 21st (Navy book) or early on the 22nd (MWR), reported 1003 mb and this was originally added to HURDAT as a central pressure. A thorough search was done to find this ship report, but it was not recorded in the usual sources, like COADS and MWL, and the report was not found. Nevertheless, 1003 mb is close to the penetration center fix measurement of 1004 mb at 0559Z, thus it is retained as a central pressure. A penetration center fix at 0013Z reported a central pressure of 1008 mb but due to the poor organization of the tropical cyclone, it suggests it missed the center. A central pressure of 1003 mb suggests maximum surface winds of 41 kt from the south of 25N and 38 kt from the north of 25N Brown et al. pressure-wind relationships. Based on ship reports of 45 kt at 00Z and 55 kt at 10Z, an intensity of 50 kt is analyzed at 00Z on the 21st, same as originally shown in HURDAT. Also, an intensity of 55 kt is analyzed at 06Z on the 21st, same as originally shown in HURDAT. 55 kt is the peak intensity analyzed for Tropical Storm Becky, same as originally shown in HURDAT. Penetration center fixes at 1158Z and 1830Z on the 21st estimated surface winds of 65 kt while reporting a central pressure of 1006 mb and 1013 mb, respectively. This led to Becky being upgraded to a hurricane operationally but it was later downgraded to a tropical storm in the post-analysis. This is possibly the first occurrence of a tropical cyclone being downgraded from hurricane status in the post-analysis. A RECON center fix at 2011Z on the 21st notes that the 700 mb center of Becky was located 35 nm east of the surface center. Satellite images showed that Becky had become better organized with convection over the center but still exhibiting signs of westerly shear with most of the convection over the eastern semicircle.

July 22:

1. Maps and old HURDAT:
- HWM analyzes a tropical storm of at most 1012 mb at 29.8N, 85W with a cold front to the northeast at 12Z.
- HURDAT lists a 30 kt tropical depression at 29.9N, 85.1W at 12Z.
- Microfilm shows a tropical storm of at most 1010 mb at 29.8N, 84.8W with a stationary front to the north at 12Z.
2. Ship highlights:
- 45 kt SSE and 1012 mb at 28N, 85.3W at 00Z (COADS).
- 35 kt SE and 1013 mb at 27.2N, 84.5W at 06Z (COADS).
3. Land highlights:
- 28 kt SE (maximum sustained winds)(gusts to 34 kt) at Apalachicola, FL at 0829Z (WALLET).
- 27 kt (maximum sustained winds)(gusts to 34 kt) at Tallahassee, FL at 1057Z (WALLET).

- 1007 mb at Cape San Blas, FL around 11Z (WALLET).

4. Aircraft highlights:

- Penetration center fix measured a central pressure of 1007 mb and estimated surface winds of 35 kt at 28.8N, 85.3W at 0534Z (WALLET).
- Observation: 35 kt SW and 1018 mb at 29.2N, 84.5W at 13Z (micro).

5. Discussion:

- MWR: "The lowest reported pressure at landfall was 1007 mb (29.74 in.) at the Cape San Blas Coast Guard Station. Gale-force winds in squalls and tides up to 6 ft (about 3 ft above normal) occurred from Apalachicola to St. Marks. Becky weakened rapidly as it moved inland, but a low pressure area accompanied by heavy rains was tracked northward into Kentucky."
- ATSR: "No land station reported gale force winds and the minimum coastal sea level pressure was 1006.8 mb at Cape San Blas, Florida. BECKY made landfall at a point just west of Apalachicola near 221200Z and continued to weaken as she moved north through western Georgia. The last advisory was issued at 221900Z."
- Reanalysis: Becky turned to the northeast as a frontal boundary approached from the north. Synoptic observations suggested that Becky weakened as it approached the Florida panhandle. A penetration center fix at 0534Z estimated surface winds of 35 kt, compared to 65 kt being estimated by reconnaissance aircraft 11 hours earlier. The weakening possibly occurred due to an increase in shear as Becky approached a trough over the Mississippi Valley. No tropical-storm-force winds were recorded on land and the highest winds measured were near 30 kt. Nonetheless, a reconnaissance aircraft estimated 35 kt winds about 60 n mi south of Apalachicola, FL at 13Z on the 22nd. Landfall is analyzed at 10Z on the 22nd near Cape San Blas, FL with an intensity of 40 kt. Satellite images showed a large area of cloudiness stretching from the Mississippi Valley to the Mid-Atlantic associated with a frontal boundary and Becky. Weakening to a tropical depression is analyzed to have occurred at 18Z on the 22nd, six hours later than originally shown in HURDAT.

July 23:

1. Maps and old HURDAT:

- HWM analyzes a spot low at 37N, 88W at 12Z.
- HURDAT lists a 25 kt tropical depression at 37.2N, 86.9W at 12Z. (last position)
- Microfilm shows a spot low at 36.5N, 87W at 12Z.

2. Discussion:

- Reanalysis: The weak tropical depression turned to the north and continued to weaken. Based on synoptic observations, the last position is analyzed over Kentucky at 12Z on the 23rd, same as originally shown in HURDAT.

July 24:

1. Maps and old HURDAT:

- HWM analyzes a spot low at 45N, 85W at 12Z.
- Microfilm does not show any features of interest at 12Z.

Date	Original HURDAT Central Pressure	Evidence	Changes
July 19 00Z		Ship: 5 kt W and 1012 mb at 17.7N, 83W at 00Z	1011 mb
July 19 06Z		Ship: 30 kt E and 1014 mb at 20.2N, 84.7W at 06Z	1011 mb

July 19 12Z		Penetration center fix: 1009 mb at 12Z	1009 mb
July 19 18Z	1010 mb	Penetration center fix: 1010 mb at 1739Z	Retained
July 20 00Z		Land: 20 kt SE and 1011 mb at Cabo de San Antonio, Cuba	1009 mb
July 20 18Z	1008 mb	Penetration center fix: 1008 mb at 1804Z	Retained
July 21 00Z	1003 mb	MWR indicates that a ship reported 1003 mb at 02Z on the 21st, the Navy reconnaissance book suggests that it was at 23Z on the 20th. Nonetheless, the 1003 mb is close to the central pressure reported by the reconnaissance aircraft at 0559Z on the 21st and it is thus retained	
July 21 06Z	1004 mb	Penetration center fix: 1004 mb at 0559Z	
July 21 12Z	1006 mb	Penetration center fix: 1006 mb at 1158Z	
July 22 00Z		A penetration center fix reported 1009 mb at 2332Z on the 21st but a ship reported 45 kt and 1012 mb at 00Z on the 22nd, suggesting a central pressure closer to 1007 mb, which has been added to HURDAT	1007 mb
July 22 06Z		Penetration center fix: 1007 mb at 0534Z	1007 mb
July 22 12Z	1009 mb	Land: 1007 mb at San Blas, FL	1007 mb

Sources: NHC microfilm maps, the Historical Weather Maps series, the COADS ship database, Monthly Weather Review, Navy reconnaissance book, Mariners Weather Log, EV2 Surface Weather Observations, Satellite images from NCDC, and NHC Storm Wallets.

Green indicates wind changes of 15 kt or greater
Blue indicates lat/long changes greater than 1°
Red indicates a new entry
Yellow indicates a deletion

Tropical Depression [July 28 – August 1, 1970] – AL031970

```
45240 07/27/1970 M= 6  3 SNBR= 966 UNNAMED       XING=0 SSS=0
45240 07/28/1970 M= 5  3 SNBR= 966 UNNAMED       XING=0 SSS=0
         **         *

(July 27th has been removed from HURDAT)
45245 07/27*  0   0   0    0*  0   0   0    0*330 765  20    0*335 762  25    0*

45250 07/28*340 760  25    0*345 757  25    0*350 755  25    0*348 745  25    0*
45250 07/28*  0   0   0    0*  0   0   0    0*  0   0   0    0*342 748  25    0*
             *   *   *        *   *   *        *   *   *      *** ***

45255 07/29*347 735  25    0*346 725  25    0*345 715  25    0*339 692  20    0*
45255 07/29*342 742  25    0*342 730  25    0*341 713  30 1013*339 692  30    0*
            *** ***  **      *** ***          *** ***  ** ****          **

45260 07/30*332 670  20    0*326 647  20    0*320 625  20    0*327 613  25    0*
45260 07/30*335 670  30    0*328 650  30    0*322 636  30    0*322 623  30 1009*
            ***      **      *** ***  **      *** ***  **      *** ***  ** ****

45265 07/31*335 602  25    0*342 591  25    0*350 580  25    0*362 577  25    0*
45265 07/31*326 611  30 1010*330 601  30    0*337 594  30    0*350 589  30    0*
            *** ***  ** **** *** ***  **      *** ***  **      *** ***  **

45270 08/01*375 573  25    0*389 569  25    0*400 565  20    0*420 560  20    0*
45270 08/01*365 586  30    0*380 584  30 1008*395 582  30 1010*415 580  30 1010*
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*** *** ** *** *** ** **** *** *** ** **** *** *** ** ****

45275 TD

Significant Revisions:

1. First position analyzed 42 hours later than originally analyzed in HURDAT based on synoptic observations.
2. Major position changes analyzed at 12Z on July 30th and between 06Z on July 31st and 18Z on August 1st based on synoptic data.

Daily Metadata:

July 24:

1. Maps and old HURDAT:
- HWM analyzes a weakening stationary front over the western Atlantic at 12Z.
- Microfilm shows no features of interest at 12Z.
2. Discussion:
- Reanalysis: A weakening frontal boundary was present over the western Atlantic and stretching to the north Atlantic. Convection increased in association with this disturbance but remained disorganized, especially at the surface.

July 25:

1. Maps and old HURDAT:
- HWM analyzes a closed low pressure of at most 1020 mb at 35N, 74W at 12Z.
- Microfilm shows a closed low pressure of at most 1020 mb at 35N, 73W at 12Z.
2. Discussion:
- Reanalysis: Convection increased east of the Carolinas but synoptically, the system remained disorganized.

July 26:

1. Maps and old HURDAT:
- HWM analyzes a closed low pressure of at most 1016 mb at 31N, 75W at 12Z.
- Microfilm shows a closed low pressure of at most 1018 mb at 32.5N, 74.5W at 12Z.
2. Discussion:
- Reanalysis: Convection decreased based on the satellite images, and the system remained disorganized at the surface.

July 27:

1. Maps and old HURDAT:
- HWM analyzes a closed low pressure of at most 1016 mb at 32N, 76.5W at 12Z.
- HURDAT lists a 20 kt tropical depression at 33N, 76.5W at 12Z (first position).
- Microfilm shows a tropical cyclone (TD #15) of at most 1016 mb at 32N, 77W at 12Z.
2. Discussion:
- Reanalysis: Convection increased along the trough located east of the eastern coast of the United States. The first position in HURDAT and operationally, was analyzed at 12Z on July 27th, but ship and coastal observations indicated that the system remained a trough, still lacking a well-defined low-level circulation.

July 28:

1. Maps and old HURDAT:

- HWM analyzes a closed low pressure of at most 1016 mb at 34N, 75W at 12Z.
- HURDAT lists a 25 kt tropical depression at 35N, 75.5W at 12Z.
- Microfilm shows a tropical cyclone of at most 1017 mb at 35N, 74.5W at 12Z.

2. Discussion:

- Reanalysis: Synoptic observations showed that the low-level circulation became better organized on July 28th and it is analyzed to have developed into a 25 kt tropical depression at 18Z on this date. Satellite imagery indicated an increase in convection compared to previous days, but it seemed to be organized along a trough. Ship and coastal observations suggested that the environment around the tropical depression was isothermal, and the 500 mb HWM showed a high pressure over the eastern United States and possibly a weak trough over the northwestern Atlantic.

July 29:

1. Maps and old HURDAT:

- HWM analyzes a closed low pressure of at most 1016 mb at 35N, 71W at 12Z.
- HURDAT lists a 25 kt tropical depression at 34.5N, 71.5W at 12Z.
- Microfilm shows a tropical cyclone of at most 1016 mb at 36N, 70W at 12Z.

2. Ship highlights:

- 30 kt WSW and 1016 mb at 33.5N, 71.3W at 12Z (COADS).

3. Discussion:

- Reanalysis: The tropical depression moved eastward and remained disorganized. The intensity was increased to 30 kt at 12Z based on synoptic observations, 5 kt higher than originally shown in HURDAT, a minor intensity change. 30 kt is also the peak intensity of this tropical depression, up from 25 kt originally shown in HURDAT, a minor intensity change.

July 30:

1. Maps and old HURDAT:

- HWM analyzes a closed low pressure of at most 1012 mb at 31N, 62W at 12Z.
- HURDAT lists a 20 kt tropical depression at 32N, 72.5W at 12Z.
- Microfilm shows a tropical cyclone of at most 1012 mb at 31.5N, 64W at 12Z.

2. Ship highlights:

- 30 kt SSW and 1014 mb at 31.3N, 59.1W at 18Z (COADS).

3. Discussion:

- Reanalysis: Satellite imagery indicated that convection increased on July 30th, especially over the eastern and southern semicircles. Synoptically, the system had a large circulation over the central Atlantic, but the 500 mb HWM does not suggest that it was subtropical.

July 31:

1. Maps and old HURDAT:

- HWM analyzes a closed low pressure of at most 1012 mb at 33N, 59.5W at 12Z.
- HURDAT lists a 25 kt tropical depression at 35N, 58W at 12Z.
- Microfilm shows a tropical cyclone of at most 1012 mb at 33.5N, 60W at 12Z.

2. Discussion:

- Reanalysis: The tropical depression moved to the northeast ahead of a frontal boundary. On satellite imagery, the convective activity was displaced to the east and south of the center, organized along a trough, which gave the system a subtropical appearance. The 500 mb HWM showed a low pressure about 300 n mi

west of the tropical depression.

August 1:

1. Maps and old HURDAT:
- HWM analyzes a closed low pressure of at most 1012 mb at 39.5N, 59.5W at 12Z.
- HURDAT lists a 20 kt tropical depression at 40N, 56.5W at 12Z.
- Microfilm shows a tropical cyclone of at most 1014 mb at 40N, 59W at 12Z.
2. Ship highlights:
- 35 kt SE and 1013 mb at 39.6N, 58.3W at 03Z (COADS).
- 30 kt SE and 1013 mb at 40.4N, 55.8W at 12Z (COADS).
- 30 kt S and 1016 mb at 40.7N, 54.4W at 18Z (COADS).
3. Discussion:
- Reanalysis: The tropical depression moved northward and satellite imagery showed a sheared center with some convection to the north and east. A ship reported 35 kt at 03Z and a couple other ships reported 30 kt, thus it is possible that this tropical depression may have briefly achieved tropical storm status, but the data is inconclusive. Synoptic observations early on the 2nd indicated that the low-level circulation had dissipated and the remnants were absorbed later by a frontal boundary over the north Atlantic and eastern Canada. Thus, the last position is analyzed at 18Z on the 1st, same as originally shown in HURDAT.

August 2:

1. Maps and old HURDAT:
- HWM analyzes a frontal boundary over the north Atlantic at 12Z.
2. Ship highlights:
- 30 kt NW and 1012 mb at 38.8N, 62.3W at 00Z (COADS).

Sources: NHC microfilm maps, the Historical Weather Maps series, the COADS ship database, Monthly Weather Review, Mariners Weather Log and Satellite images from NCDC.

Date	Original HURDAT Central Pressure	Evidence	Changes
July 29 12Z		Ship: 30 kt WSW and 1016 mb at 33.5N, 71.3W at 12Z	1013 mb
July 30 18Z		Ship: 15 kt SW and 1011 mb at 31.1N, 61.6W at 18Z	1009 mb
July 31 00Z		Ship: 15 kt S and 1012 mb at 32.7N, 58.9W at 00Z	1010 mb
Aug 01 06Z		Ship: 15 kt E and 1010 mb at 38.6N, 58.0W at 06Z	1008 mb
Aug 01 12Z		Ship: 20 kt S and 1012 mb at 39.3N, 57.9W at 12Z	1010 mb
Aug 01 18Z		Ship: 10 kt NE and 1011 mb at 41.9N, 57.6W at 18Z	1010 mb

Red indicates wind changes of 15 kt or greater
Yellow indicates lat/long changes greater than 1°
Green indicates a new entry
Blue indicates a deletion

Hurricane Celia [July 31 - August 5, 1970] - AL041970

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46860 07/31/1970 M= 6  3 SNBR= 998 CELIA       XING=1 SSS=3
46860 07/31/1970 M= 6  3 SNBR= 998 CELIA       XING=1 SSS=4
                                                         *

46865 07/31*185 825  25 1008*195 829  25    0*203 832  25    0*211 838  30    0*
46865 07/31*185 825  25 1008*195 829  25    0*203 833  25    0*211 838  30    0*
                                                 ***

46870 08/01*219 843  30 1007*227 850  30    0*233 858  45  993*239 865  60  990*
46870 08/01*219 843  35 1006*227 850  45    0*233 858  60  993*239 865  65  990*
                     ** ****          **                **                **

46875 08/02*243 872 100  965*249 883  90  975*253 896  85  986*258 908  85  984*
46875 08/02*242 872  80    0*247 883  80    0*253 896  75  986*257 908  75  984*
            ***     ***      ***      **                **      ***      **

46880 08/03*262 920  80    0*266 935  75  988*270 949  90  971*275 963 110  945*
46880 08/03*262 920  75  983*266 935  70  988*270 949  90  971*275 963 110  953*
                     **  ***          **                                    ***

Addendum on August 3rd at 21Z
46883 08/03*278 971 120  944*

46885 08/04*281 978  70  950*286 993  55  985*2911008  50  992*2971021  35    0*
46885 08/04*281 978  95    0*286 993  65  977*2911008  55    0*2971021  35    0*
                     **    *          **  ***          **    *

46890 08/05*3031033  30    0*3091048  30    0*3151058  25 1007*3231070  25    0*
46890 08/05*3031033  30    0*3091046  30    0*3151058  25    0*3231070  25    0*
                                ****                          *

46895 HRATX3
46895 HRATX4
      ******
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Tropical Storm Landfall

08/01 00Z 21.9N 84.3W 35 kt Cuba

U.S. Hurricane Landfall

Aug 3rd - 21Z - 27.8N 97.1W - 120 kt - Category 4 - 944 mb - 1010 mb OCI - 150 nm ROCI - 10 nm RMW

Significant Revisions:

1. Intensification to a tropical storm is analyzed 12 hours earlier based on aircraft reconnaissance data.
2. Major intensity increases shown at 06Z and 12Z on August 1st, and 00Z on August 4th based on aircraft reconnaissance and synoptic data.
3. Major intensity decrease at 00Z on August 2nd based on removing the inconsistent aircraft reconnaissance data.
4. Some central pressures previously in HURDAT have been removed, other retained and new values added based on aircraft reconnaissance data.
5. Increase from Category 3 (110 kt) to Category 4 (120 kt) at landfall in South Texas.

Daily Metadata:

July 28:
1. Maps and old HURDAT:

- HWM does not analyze any features of interest at 12Z.
- Microfilm shows a tropical wave over the Lesser Antilles at 12Z.

2. Ship highlights:
- 30 kt E and 1017 mb at 19.8N, 65W at 18Z (COADS).

3. Discussion:
- MWR: "Celia formed in the northwest Caribbean Sea from a seedling disturbance that moved off the African Continent on July 23. The disturbance moved rapidly across the open tropical Atlantic, reaching the Lesser Antilles in only 5 days. In the Caribbean, however, the trade-wind environment was less vigorous; and the tropical wave, after entering the Caribbean on the 28th."
- ATSR: "The system that eventually developed into one of the costliest storms ever to hit Texas had its origin in Africa. It moved off the west coast of Africa on 23 July. The system moved rapidly across the Atlantic, taking only five days to reach the Lesser Antilles. This rapid movement was maintained into the Central Caribbean."

July 29:

1. Maps and old HURDAT:
- HWM analyzes a tropical wave over the western Caribbean Sea along 80W at 12Z.
- Microfilm shows a tropical wave over the central Caribbean Sea along 74W at 12Z.

2. Ship highlights:
- 30 kt E and 1021 mb at 18.8N, 63.5W at 00Z (COADS).
- 30 kt E and 1018 mb at 21.5N, 74.1W at 12Z (COADS).
- 35 kt E and 1015 mb at 19.9N, 74.1W at 18Z (COADS).

July 30:

1. Maps and old HURDAT:
- HWM analyzes a tropical wave over the western Caribbean Sea along 80W at 12Z.
- Microfilm shows a tropical wave over the western Caribbean Sea along 82W at 12Z.

2. Discussion:
- MWR: "…did not reach the vicinity of the Cayman Islands until the 30th, where a closed wind circulation around a low-pressure center developed."
- Reanalysis: A tropical wave entered the Caribbean Sea on July 28th and gradually it became better organized over the next couple of days. Satellite images on the 30th suggested that convection had increased near the center.

July 31:

1. Maps and old HURDAT:
- HWM analyzes a closed low pressure of at most 1010 mb at 20N, 84.5W at 12Z.
- HURDAT lists a 25 kt tropical depression at 20.3N, 83.2W at 12Z.
- Microfilm shows a tropical cyclone of at most 1008 mb at 20N, 84.5W at 12Z.

2. Aircraft highlights:
- Radar center fix estimated a minimum pressure of 1008 mb and surface winds of 30 kt at 21.6N, 83.5W at 1845Z (WALLET).

3. Discussion:
- MWR: "On the 31st, a reconnaissance plane reported a radar "eye" visible near the west coast of the Isle of Pines; however, due to the proximity of land, the aircraft was unable to penetrate and determine the intensity."
- ATSR: "As this circulation gained organization, it developed into a tropical depression on the night of the 30th, while moving toward the western tip of Cuba. The first tropical depression warning was issued at 310400Z. A Navy reconnaissance aircraft sent to investigate the depression reported a radar eye near 21°35N 83°32W at 311845Z. This was so close to the Isle of Pines that a

penetration could not be made. The minimum SLP was less than 1008 mb and maximum surface winds were 30 knots."

- Reanalysis: Ship and coastal observations over the western Caribbean Sea early on the 31st indicated that a closed low-level circulation had developed. The first position is analyzed at 00Z on the 31st as a 25 kt tropical depression, same as originally shown in HURDAT. Satellite images showed that the system had continued to become better organized with deep convection near or over the center and especially over the eastern semicircle. The tropical depression moved northwestward toward western Cuba.

August 1:

1. Maps and old HURDAT:

- HWM analyzes a tropical storm of at most 1008 mb at 23.9N, 85.8W at 12Z.
- HURDAT lists a 45 kt tropical storm at 23.3N, 85.8W at 12Z.
- Microfilm shows a tropical storm of at most 1008 mb at 23.5N, 85.9W at 12Z.

2. Ship highlights:

- 20 kt SW and 996 mb at 22.8N, 85.9W at 12Z (micro).
- 40 kt S at 23.5N, 86W at 18Z (micro).
- 50 kt SE and 999 mb at 24.2N, 86.7W at 21Z (COADS).

3. Aircraft highlights:

- Penetration center fix measured a central pressure of 993 mb and estimated surface winds of 70 kt at 23.5N, 85.9W at 1230Z (WALLET).
- Penetration center fix measured a central pressure of 990 mb, estimated surface winds of 60 kt and an eye diameter of 8 n mi at 23.9N, 86.5W at 1730Z (WALLET).
- Penetration center fix measured a central pressure of 965 mb, estimated surface winds of 100 kt and an eye diameter of 20 n mi at 24.1N, 87.3W at 2344Z. There was also a dropsonde surface pressure of 976 mb at 01Z (WALLET). (The 700 and 850 mb height data from the drop suggest a much higher surface pressure of 1003 and 993 mb, respectively.)

4. Discussion:

- MWR: "During the evening of the 31st, the depression crossed the extreme western tip of Cuba near Cape San Antonio that recorded a minimum pressure of 1007 mb (29.74 in.). Winds gusted to 40-45 kt over a broad area including western Cuba, the Isle of Pines, and the Cayman Islands. As the tropical cyclone emerged over warm water in the Gulf of Mexico and a rich vein of moisture began to feed into the vortex from the Caribbean through the Yucatan Channel, pressures began to fall rapidly; and the characteristic mass circulation of a hurricane was quickly established. Early on August 1, an Air Force plane found that the central pressure had fallen to 993 mb (29.32 in.) with sustained winds of 70 kt in the boundary layer. During the day, ATS 3 photographs revealed that a pronounced feeder band had formed, emanating from the Caribbean through the Yucatan Channel into the vortex, reminiscent of the situation during the rapid deepening of Camille in 1969. In a period of less than 8 hr, the central pressure fell from 990 mb (29.24 in.) to 965 mb (28.50 in.) at 2344 GMT on August 1."
- ATSR: "The depression moved across Western Cuba on the night of 31 July, causing gusts in excess of 40 knots. The narrow and relatively flat land mass of Western Cuba did little to disrupt the organization of the depression. Once the circulation moved northwest from Cuba, to rapidly gained strength from the warm water and intensified to tropical storm intensity. At 1230Z on 1 August, Air Force reconnaissance reported surface winds of 60 advisory issued at 011600Z. This rapid intensification continued 012200Z. A Navy reconnaissance aircraft ac 012344Z reported winds of 100 knots with a minimum SLP of 965 mb."
- Reanalysis: The tropical depression rapidly intensified on the 31st while moving over the southeast Gulf of Mexico. The first reconnaissance aircraft to penetrate the center measured a central pressure of 993 mb and estimated

surface winds of 70 kt at 1230Z on the 31st. A central pressure of 993 mb suggests maximum surface winds of 59 kt from the south of 25N Brown et al. pressure-wind relationship. Based on a forward speed of about 11 kt and weighting some the visual estimate, an intensity of 60 kt is analyzed at 12Z on the 31st, up from 45 kt originally in HURDAT, a major intensity change. Intensification to a tropical storm is analyzed at 00Z on the 31st, twelve hours earlier than originally shown in HURDAT. Celia made landfall in the peninsula of Guanahacabibes, the most western part of Cuba, as a 35 kt tropical storm around 00Z on the 31st. Perez et al. (2000) also counts Celia as a tropical storm impact in Cuba. The next penetration center fix measured a central pressure of 990 mb, estimated surface winds of 60 kt and an eye diameter of 8 n mi at 1730Z on the 31st. A central pressure of 990 mb suggests maximum surface winds of 64 kt from the south of 25N pressure-wind relationship. An eye diameter of 8 n mi suggests an RMW of about 5 n mi and the climatological value is 20 n mi. Based on a slow forward speed of about 9 kt but small RMW, an intensity of 65 kt is analyzed at 18Z on the 31st, up from 60 kt originally shown in HURDAT, a minor intensity change. Intensification to a hurricane is analyzed six hours earlier than originally shown in HURDAT. Satellite images showed a well-organized tropical cyclone with banding features over the eastern semicircle.

August 2:

1. Maps and old HURDAT:
- HWM analyzes a hurricane of at most 1004 mb at 26N, 89.8W at 12Z.
- HURDAT lists an 85 kt hurricane at 25.3N, 89.6W at 12Z.
- Microfilm shows a hurricane of at most 1008 mb at 25.5N, 89.6W at 12Z.

2. Ship highlights:
- 30 kt S and 998 mb at 23.9N, 86.4W at 00Z (COADS).
- 40 kt SSE and 1009 mb at 24.3N, 87.6W at 04Z (COADS).
- 35 kt SE and 1013 mb at 27.1N, 86.9W at 06Z (COADS).
- 40 kt N and 1012 mb at 24.7N, 90.6W at 12Z (micro).
- 45 kt SW and 989 mb at 25.3N, 90.8W at 20Z (micro).

3. Aircraft highlights:
- Radar center fix at 24.5N, 87.4W at 0123Z (WALLET).
- Penetration center fix measured a central pressure of 975 mb and estimated an eye diameter of 30 n mi at 24.6N, 88.4W at 0551Z (WALLET). (Flight-level data indicates a much higher pressure of 998 mb.)
- Penetration center fix measured a central pressure of 986 mb and estimated surface winds of 100 kt at 25.4N, 89.6W at 1145Z (WALLET).
- Penetration center fix measured a central pressure of 984 mb, estimated surface winds of 100 kt and an eye diameter of 8 n mi at 25.6N, 90.8W at 1752Z (WALLET).
- Penetration center fix measured a central pressure of 982 mb and estimated surface winds of 100 kt at 25.8N, 91.1W at 2008Z (WALLET).

4. Discussion:
- MWR: "During the night [early August 2nd], the feeder band migrated westward with the storm system and moved over the Yucatan Peninsula. During this time, the central pressure rose, even though other environmental factors seemed to favor the maintenance of intensity of the storm. The fluctuations in central pressure of this storm led the forecaster to a more conservative assessment of the maximum winds in the hurricane than post-analyzes indicated."
- ATSR: "This very rapid intensification was not maintained, in fact, by mid-morning on 2 August, the central pressure had filled to 986 mb."
- Reanalysis: Due to the severe inconsistencies between the aircraft dropsonde and flight-level data from the mission spanning late on the 1st through early on the 2nd, no quantitative intensity information from the reconn is used for

the reanalysis. As the visually estimated winds were quite high and that the eye diameter did shrink to 20 n mi, intensification from 65 kt at 1st/18Z to 80 kt at 2nd/00Z and 06Z is indicated. This is a major downward revision from the 100 kt originally shown in HURDAT at 00Z. At 1145Z on the 2nd, another penetration center fix measured a central pressure of 986 mb and estimated surface winds of 100 kt. A central pressure of 986 mb suggests maximum surface winds of 62 kt from the north of 25N and 69 kt from the south of 25N pressure-wind relationship weakening subsets. Based on a forward speed of about 14 kt and weighting some the visual estimate, an intensity of 75 kt is analyzed at 12Z on the 2nd, down from 85 kt originally shown in HURDAT, a minor intensity change. A penetration center fix at 1752Z on the 2nd measured a central pressure of 984 mb. An intensity of 75 kt is analyzed at 18Z on the 2nd, down from 85 kt originally shown in HURDAT, a minor intensity change. Satellite images showed a large CDO over the center with some banding features.

August 3:

1. Maps and old HURDAT:

- HWM analyzes a hurricane of at most 1000 mb at 27N, 94.9W at 12Z.
- HURDAT lists a 90 kt hurricane at 27N, 94.9W at 12Z.
- Microfilm shows a hurricane of at most 1004 mb at 26.8N, 94.8W at 12Z.

2. Ship highlights:

- 35 kt S and 1007 mb at 25.6N, 92.6W at 06Z (COADS).
- 40 kt W and 1004 mb at 25.9N, 95W at 12Z (COADS).
- 40 kt SE (35 kt micro) and 1007 mb at 28.1N, 95.1W at 18Z (COADS).

3. Land highlights:

- 113 kt NNE (max sustained) (gusts estimated to 150 kt) at Aransas Pass, TX at 2105Z (MWR).
- 111 kt NNW (max sustained) (gusts to 120 kt) at Gregory, TX at 2120Z (MWR).
- 949 mb (minimum pressure) at Aransas Pass, TX at 2145Z (MWR).
- 952 mb (minimum pressure) at Gregory, TX at 2150Z (MWR).
- 952 mb (minimum pressure) at Taft, TX at 2234Z (MWR).
- 950 mb (minimum pressure) at Corpus Christi, TX [Nueces Bay CPL] at 2230Z-23Z (MWR).
- 944 mb (minimum pressure) at Ingleside, TX (time unknown, likely 21Z-22Z) (MWR).

4. Aircraft highlights:

- Penetration center fix measured a central pressure of 983 mb at 26.3N, 92.7W at 0233Z (WALLET).
- Penetration center fix measured a central pressure of 988 mb at 26.7N, 93.4W at 0552Z (WALLET).
- Penetration center fix measured a central pressure of 971 mb, estimated surface winds of 90 kt and an elongated eye oriented NNW-SSE, major axis diameter of 30 n mi and minor axis diameter of 15 n mi at 26.9N, 94.9W at 1153Z (WALLET).
- Penetration center fix measured a central pressure of 953 mb, estimated surface winds of 120 kt and an elongated eye oriented NNW-SSE, major axis diameter of 18 n mi and minor axis diameter of 10 n mi at 28.4N, 94.4W at 1856Z (WALLET).

5. Radar highlights:

- Lake Charles center fix estimated an eye diameter of 30 n mi at 26.5N, 92W at 0245Z (WALLET).
- Lake Charles center fix estimated an eye diameter of 15 n mi at 26.6N, 93.5W at 0545Z (WALLET).
- Galveston center fix estimated an eye diameter of 25 n mi at 26.5N, 93.4W at 0614Z (WALLET).
- Galveston center fix estimated an eye diameter of 10 n mi at 26.9N, 94.9W at 1144Z (WALLET).

- Victoria center fix estimated an eye diameter of 22 n mi at 27N, 94.9W at 12Z (WALLET).
- Corpus Christi center fix at 27.6N, 96.4W at 1745Z (WALLET).
- Victoria center fix at 27.6N, 96.4W at 1815Z (WALLET).
- Corpus Christi center fix estimated an eye diameter of 12 n mi at 27.8N, 97W at 2045Z (WALLET).
- Victoria center fix at 28N, 97.7W at 2345Z (WALLET).

6. Discussion:

- MWR: "By early morning on August 3, with the storm only 250 mi off the Texas coast, the central pressure had risen to 988 mb (29.18 in.); and sustained winds, measured by Doppler radar, had diminished from a maximum value of 103 to 75 kt. At this time, the pressure again began falling, and the vortex continued to intensify until after it crossed the coast just north of Corpus Christi. At the point of landfall, the minimum sea-level pressure recorded by a land station was 945 mb (27.90 in.), a total drop of 43 mb in approximately 15 hr, 26 mb of which occurred in 9 hr. Not until a second dropsonde was released on the morning of August 3, which verified a continued downward trend in central pressure, did the advices reflect an increase in predicted sustained winds from 90 to 115 mi/hr. It is interesting to note that an Air Force plane flying at 700 mb recorded central pressure values of 970 mb (28.64 in.) and 963 mb (28.44 in.) at 1153 and 1303 GMT, respectively, while maximum flight-level winds were only 70 kt. In this instance, the increase in mass circulation, as in the case of such storms as Cleo (1964), occurred in the lowest few thousand feet and was not reflected as high as the 700-mb level. However, during the penetration at 1856 GMT, the Air Force reconnaissance flight reported a central pressure of 953 mb (28.14 in.) with maximum winds at the surface and at flight level of 120 kt. At the Corpus Christi Weather Service Office at the airport, sustained winds of 70 to 80 mi/hr had been observed for several minutes prior to the great burst that sent the wind speed up to 161 mi/hr for several seconds after which it returned to the previous sustained value."
- ATSR: "CELIA underwent another rapid deepening cyclone in the 12 to 15 hours before making landfall, with the central pressure falling from 988 mb to 945 mb in that time. After making landfall about 032200Z, CELIA maintained her strength and identity for a long time. The lowest official pressure recorded was 949 mb; the highest sustained winds were 105 to 110 knots, with gusts in excess of 140 knots, and maximum tide was 9.2 feet above mean sea level."
- Reanalysis: Celia continued toward the Texas coast as it gained in forward speed. A penetration center fix measured a central pressure of 983 mb at 0233Z on the 3rd and an intensity of 75 kt is analyzed at 00Z. Another penetration center fix measured a central pressure of 988 mb at 0552Z on the 3rd. A central pressure of 988 mb suggests maximum surface winds of 62 kt from the north of 25N pressure-wind relationship. Due to a forward speed of about 16 kt, an intensity of 70 kt is analyzed at 06Z on the 3rd, down from 75 kt originally shown in HURDAT, a minor intensity change. After weakening for about a day, Celia began to rapidly intensify as it approached the Texas coast. A penetration center fix measured a central pressure of 971 mb, estimated surface winds of 90 kt and an elongated eye of 15-30 n mi at 1153Z on the 3rd. A central pressure of 971 mb suggests maximum surface winds of 87 kt from the north of 25N pressure-wind relationship intensifying subset. An eye diameter of 15-30 n mi suggests an RMW of about 12-25 n mi and the climatological value is 20 n mi. Based on a forward speed of about 15 kt, an intensity of 90 kt is analyzed at 12Z on the 3rd, same as originally shown in HURDAT. The next penetration center fix measured a central pressure of 953 mb, estimated surface winds of 120 kt and an elongated eye of 10-18 n mi at 1856Z on the 3rd. A central pressure of 953 mb suggests maximum surface winds of 107 kt from the north of 25N pressure-wind relationship intensifying subset. An eye diameter of

10-18 n mi suggests an RMW of about 8-15 n mi and the climatological value is 18 n mi. Based on a forward speed of about 15 kt, small RMW but low environmental pressures (1010 mb OCI), an intensity of 110 kt is analyzed at 18Z on the 3rd, same as originally shown in HURDAT. Landfall is analyzed at 21Z on the 3rd near Port Aransas, TX. Across Corpus Christi Bay is the city of Ingleside and a resident recorded a central pressure of 944 mb. A quality control of the barometer was performed by the local Weather Bureau office. A central pressure of 944 mb suggests maximum surface winds of 116 kt from the north of 25N pressure-wind relationship intensifying subset. An eye diameter of 12 n mi was estimated by the Corpus Christi radar at 2045Z on the 3rd. An eye diameter of 12 n mi suggests an RMW of about 8 n mi and the climatological value is 18 n mi. Based on a forward speed of about 16 kt, small RMW but low environmental pressures (1010 mb OCI), an intensity of 120 kt is analyzed at 21Z on the 3rd, making Celia a category 4 hurricane at landfall. Celia was previously analyzed to have been a category 3 hurricane at landfall. 113 kt maximum sustained winds were measured at Aransas Pass and 111 kt at Gregory.

August 4:

1. Maps and old HURDAT:

- HWM analyzes a hurricane of at most 996 mb at 29N, 101W at 12Z.
- HURDAT lists a 50 kt tropical storm at 29.1N, 100.8W at 12Z.
- Microfilm shows a tropical storm of at most 1000 mb at 29.2N, 100.9W at 12Z.

2. Land highlights:

- 977 mb (minimum pressure) at Cotulla FAA, TX at 0530Z (MWR).
- 40 kt NE and 993 mb at Del Rio, TX at 12Z (micro).
- 50 kt ESE (gusts to 77 kt) at Del Rio, TX at 1210Z (MWR).

3. Radar highlights:

- Galveston center fix at 28.1N, 97.8W at 0013Z (WALLET).
- Victoria center fix at 28.5N, 99.4W at 0540Z (WALLET).

4. Discussion:

- Reanalysis: Celia quickly moved inland and began to weaken. The Kaplan and DeMaria model was run for 00Z, 06Z, 12Z and 18Z on the 4th yielding 88 kt, 58 kt, 39 kt, and 30 kt, respectively. Peak observed winds near 00Z on the 4th were 110 kt at 2228Z on the 3rd. A central pressure of 977 mb was observed near 06Z, suggesting 73 kt from the north of 25N pressure-wind relationship weakening subset, and taking into account the land friction, which is about 15% less, 62 kt is analyzed. Around 12Z, Del Rio, TX measured 50 kt. No observations of gale-force winds were reported at 18Z. Based on the station data available near the track of the cyclone, an intensity of 95 kt is analyzed at 00Z, 65 kt at 06Z, 55 kt at 12Z and 35 kt at 18Z on the 4th. Up from 70 kt at 00Z, a major intensity change to HURDAT, up from 55 kt at 06Z, a minor intensity change to HURDAT, 50 kt at 12Z, another minor intensity change to HURDAT, and same as the original HURDAT at 18Z on the 4th. It is interesting that Celia was able to maintain such a robust circulation as far inland as Del Rio, Texas, over 200 miles from the landfall point, producing gusts to hurricane intensity.

August 5:

1. Maps and old HURDAT:

- HWM analyzes a closed low pressure of at most 1008 mb at 29N, 107W at 12Z.
- HURDAT lists a 25 kt tropical depression at 31.5N, 105.8W at 12Z.
- Microfilm shows a closed low pressure of at most 1006 mb at 28N, 107.5W at 12Z.

2. Discussion:

- Reanalysis: Celia weakened to a tropical depression at 00Z on the 5th, same as originally shown in HURDAT. Synoptic observations indicated that it had a

closed circulation at 18Z on the 5th but appears to have dissipated late on the 5th or early on the 6th over New Mexico. Thus, the last position is analyzed at 18Z on the 5th, same as originally shown in HURDAT.

August 6:

1. Maps and old HURDAT:

- HWM does not analyze any features of interest at 12Z.

Date	Original HURDAT Central Pressure	Evidence	Changes
July 31 00Z	1008 mb	5 kt W and 1009 mb at Swam Island, Honduras at 00Z	Retained
Aug 01 00Z	1007 mb	20 kt SSW and 1008 mb at 21.3N, 84W at 00Z	1006 mb
Aug 01 12Z	993 mb	Penetration center fix: 993 mb at 1230Z	Retained
Aug 01 18Z	990 mb	Penetration center fix: 990 mb at 1730Z	Retained
Aug 02 00Z	965 mb	Penetration center fix: 965 mb at 2344Z on Aug 1st	Removed
Aug 02 06Z	975 mb	Penetration center fix: 975 mb at 0551Z	Removed
Aug 02 12Z	986 mb	Penetration center fix: 986 mb at 1145Z	Retained
Aug 02 18Z	984 mb	Penetration center fix: 984 mb at 1752Z	Retained
Aug 03 00Z		Penetration center fix: 983 mb at 0233Z	983 mb
Aug 03 06Z	988 mb	Penetration center fix: 988 mb at 0552Z	Retained
Aug 03 12Z	971 mb	Penetration center fix: 971 mb at 1153Z	
Aug 03 18Z	945 mb	Penetration center fix: 953 mb at 1856Z	953 mb
Aug 03 21Z		944 mb measured on a personal barometer at Ingleside, TX (time unknown, likely around 21Z-22Z)	944 mb
Aug 04 00Z	950 mb	950 mb was measured at Corpus Christi, TX at 2230Z-23Z on the 3rd, the central pressure was higher at 00Z on the 4th	Removed
Aug 04 06Z	985 mb	977 mb at Cotulla, TX at 0530Z	977 mb
Aug 04 12Z	992 mb	Microfilm showed 40 kt NE and 993 mb at Del Rio, TX at 12Z, suggesting that the central pressure was lower than originally shown in HURDAT	Removed
Aug 05 12Z	1007 mb	15 kt N and 1007 mb at El Paso, TX at 12Z, suggesting that the central pressure was lower than originally shown in HURDAT	

Sources: NHC microfilm maps, the Historical Weather Maps series, the COADS ship database, Monthly Weather Review, Mariners Weather Log, Satellite images from NCDC, Perez et al. (2000) and NHC Storm Wallets.

Green indicates wind changes of 15 kt or greater
Blue indicates lat/long changes greater than 1°
Red indicates a new entry
Yellow indicates a deletion

```
45240 08/02/1970 M= 2  5 SNBR= 966 UNNAMED       XING=0 SSS=0

45245 08/02*  0   0   0    0*  0   0   0    0*140 180  20    0*145 195  25    0*
45245 08/02*  0   0   0    0*  0   0   0    0*140 180  25    0*145 195  25    0*
                                                          **

45250 08/03*150 210  25    0*155 225  30    0*160 240  30    0*163 255  30    0*
45255 08/04*167 270  30    0*171 285  30    0*175 300  25    0*175 315  25    0*
45255 08/04*166 270  30    0*168 285  30    0*170 300  30    0*170 315  30    0*
            ***      **      ***      **      ***      **      ***      **

45260 08/05*175 330  25    0*175 345  25    0*175 360  25    0*175 380  25    0*
45260 08/05*170 330  30    0*170 345  30    0*170 360  25    0*170 380  25    0*
            ***      **      ***      **      ***               ***

45265 08/06*175 400  20    0*175 420  20    0*175 440  20    0*  0   0   0    0*
45265 08/06*170 400  25    0*170 420  25    0*170 440  25    0*  0   0   0    0*
            ***      **      ***      **      ***      **

45270 TD
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Significant Revisions:

1. None.

Daily Metadata:

August 1:

1. Maps and old HURDAT:
- HWM analyzes a closed low pressure of at most 1008 mb over western Africa at 12Z.
- Microfilm shows no features of interest at 12Z.
2. Discussion:
- Reanalysis: Satellite images showed an active tropical wave over western Africa on July 31st and by August 1st, the convective activity had already reached the easternmost part of the Atlantic. Synoptic observations suggested that the surface circulation was still near the coastline on this date and it is difficult to determine how well organized it was due to the lack of data over the African continent.

August 2:

1. Maps and old HURDAT:
- HWM analyzes a tropical wave along 19W, extending from 10N-20N at 12Z.
- HURDAT lists a 20 kt tropical depression at 14N, 18W at 12Z (first position).
- Microfilm shows a tropical wave over the west coast of Africa at 12Z.
2. Discussion:
- Reanalysis: The surface circulation quickly became well-organized and a 25-kt tropical depression is analyzed to have formed at 12Z on the 2nd based on synoptic data, same as organically shown in HURDAT, although 5 kt stronger, a minor intensity change. Genesis may have occurred earlier on the 2nd but the ship and coastal data is sparse. A ship reported 35 kt at 12Z on the 2nd but appears to have a high wind bias based on ship observations nearby. Satellite imagery showed a tight circulation with organized convection over the center.

August 3:

1. Maps and old HURDAT:
- HWM analyzes a closed low pressure of at most 1012 mb at 17N, 23W at 12Z.
- HURDAT lists a 30 kt tropical depression at 16N, 24W at 12Z.
- Microfilm analyzes a tropical cyclone (TD #18) near 16.5N, 23W at 12Z.

2. Discussion:

- Reanalysis: The tropical depression moved west-northwestward at about 15 kt and intensified. Operationally, it was upgraded to the 18th tropical depression of the season at 12Z on the 3rd. Based on the satellite imagery late on the 3rd showing a well-organized tropical cyclone with some hints of banding, the system may have reached tropical storm intensity on this date.

August 4:

1. Maps and old HURDAT:

- HWM analyzes a closed low pressure of 1013 mb at 18.5N, 30W at 12Z.
- HURDAT lists a 25 kt tropical depression at 17.5N, 30W at 12Z.
- Microfilm shows a tropical cyclone of at most 1012 mb at 17.5N, 30W at 12Z.

2. Discussion:

- Reanalysis: The small system moved westward on the 4th over the eastern Atlantic. Satellite images showed a well-organized circulation with convection over the center and curved banding over the northern semicircle, suggesting that the system may have reached tropical storm intensity.

August 5:

1. Maps and old HURDAT:

- HWM analyzes a spot low pressure at 13N, 38W at 12Z.
- HURDAT lists a 25 kt tropical depression at 17.5N, 36W at 12Z.
- Microfilm shows a tropical cyclone of at most 1014 mb at 17.5N, 36W at 12Z.

2. Discussion:

- Reanalysis: Satellite images showed a well-defined circulation with most of the convection removed from the center.

August 6:

1. Maps and old HURDAT:

- HWM analyzes a tropical wave along 45W, extending from 10N-20N at 12Z.
- HURDAT lists a 20 kt tropical depression at 17.5N, 44W at 12Z (last position).
- Microfilm shows a tropical cyclone of at most 1014 mb at 17.5N, 45W at 12Z.

2. Discussion:

- Reanalysis: The tropical depression continued westward into the central Atlantic and remained very weak. Satellite images showed a well-defined circulation but no organized convection. The last position is analyzed at 12Z on the 6th, same as originally shown in HURDAT.

August 7:

1. Maps and old HURDAT:

- HWM analyzes no features of interest at 12Z.
- Microfilm shows a tropical cyclone at 17N, 49W at 12Z.

2. Discussion:

- Reanalysis: The remnants of the tropical cyclone continued westward and although an increase in convection was observed on the 7th, the disturbance remained weak and did not show signs of regeneration.

Sources: NHC microfilm maps, the Historical Weather Maps series, the COADS ship database, Monthly Weather Review, Mariners Weather Log, Satellite images from NCDC, and NHC Storm Wallets.

Tropical Depression [August 5-7, 1970] - AL061970 - REMOVED

August 5-7: Historical Weather Maps and microfilm showed a weak area of low pressure between the Bahamas and Bermuda on August 4th. The disturbance moved westward and the first position in HURDAT as a non-developing tropical depression was analyzed at 12Z on the 5th as a 20 kt tropical depression. Microfilm maps also indicate that it was upgraded to the 19th TC of the season at 12Z on the 5th. (The track in HURDAT is the same as that shown in the track figure in the 1970 Tropical Systems MWR article.) The system moved westward and late on the 6th moved over Florida. Satellite imagery showed a trough over the western Atlantic and no signs of organization was analyzed as the system moved westward. The last position in HURDAT was analyzed at 00Z on the 7th. Because the system did not have a well-defined circulation and was poorly-organized on satellite imagery, it is removed from HURDAT.

```
AL061970,            UNNAMED,      7,
19700805, 1200,  , TD, 28.0N,  75.0W,  20,
19700805, 1800,  , TD, 28.0N,  76.0W,  25,
19700806, 0000,  , TD, 28.0N,  77.0W,  25,
19700806, 0600,  , TD, 28.0N,  78.0W,  25,
19700806, 1200,  , TD, 28.0N,  79.0W,  25,
19700806, 1800,  , TD, 28.0N,  80.0W,  25,
19700807, 0000,  , TD, 28.0N,  81.0W, -99,
```

Green indicates wind changes of 15 kt or greater
Blue indicates lat/long changes greater than 1º
Red indicates a new entry
Yellow indicates a deletion

Tropical Depression [August 11-18, 1970] - AL071970

```
45240 08/11/1970 M= 4  8 SNBR= 966 UNNAMED       XING=0 SSS=0

45245 08/11*  0   0   0    0*  0   0   0    0*190 210  20    0*190 220  25    0*
45245 08/11*  0   0   0    0*190 200  25    0*190 210  25    0*190 222  25    0*
                             *** ***  **                **          ***

45250 08/12*190 235  25    0*190 248  25    0*190 260  30    0*190 275  30    0*
45250 08/12*190 235  25    0*190 248  25    0D190 260  30    0D190 275  30    0*
                                             *                 *

45255 08/13*190 290  30    0*190 305  30    0*190 320  30    0*188 335  30    0*
45255 08/13D190 290  30    0D190 305  30    0D189 320  30    0D187 335  30    0*
           *                *                *                 ****
45260 08/14*185 350  30    0*182 365  30    0*180 380  30    0*180 395  30    0*
45260 08/14D185 350  30    0D182 365  30    0D180 380  30    0D180 395  30    0*
           *                *                *                 *

45265 08/15*180 410  30    0*180 425  30    0*180 440  30    0*180 460  30    0*
45265 08/15D180 410  30    0D180 425  30    0D180 440  30    0D180 460  30    0*
           *                *                *                 *

45270 08/16*180 480  25    0*180 500  25    0*180 520  25    0*185 535  25    0*
45270 08/16D180 480  25    0D180 500  25    0D182 520  25    0D185 535  25    0*
           *                *                ****              *

45275 08/17*190 550  25    0*195 565  25    0*200 580  25    0*205 595  25    0*
45275 08/17*190 550  30    0*195 565  30    0*200 580  30    0*205 595  30    0*
                     **                **                **                **

45280 08/18*210 610  20    0*215 625  20    0*220 640  20    0*  0   0   0    0*
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45280 08/18*210 610  30    0*217 627  30    0*228 643  25    0*243 656  25    0*
                     **      *** ***  **      *** ***  **      *** ***  **

45285 TD
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Significant Revisions:

1. Analyzed to have been a tropical disturbance between 12Z on August 12th and 18Z on August 16th based on synoptic data and satellite imagery.

Daily Metadata:

August 10:

1. Maps and old HURDAT:
- HWM showed a closed low pressure of at most 1012 mb at 21N, 20W at 12Z.
- Microfilm analyzes no features of interest at 12Z.
2. Discussion:
- Reanalysis: Satellite and synoptic data did not show any signs of organization on this date.

August 11:

1. Maps and old HURDAT:
- HWM and microfilm analyze no features of interest at 12Z.
- HURDAT lists a 20 kt tropical depression at 19N, 21W at 12Z (first position).
2. Discussion:
- Reanalysis: Synoptic observations at 06Z on August 11th suggested that a closed circulation was present. Satellite imagery later on this date showed that the system had organized convection over and to the north of the center. Thus, a tropical depression is analyzed to have formed at 06Z on the 11th, six hours earlier than originally shown in HURDAT.

August 12:

1. Maps and old HURDAT:
- HWM and microfilm analyze a monsoon trough over the eastern Atlantic at 12Z.
- HURDAT lists a 30 kt tropical depression at 19N, 26W at 12Z.
2. Discussion:
- Reanalysis: As the tropical depression moved westward, it became less organized. Synoptic observations and satellite imagery suggested that it weakened into a trough around 12Z on August 12th.

August 13:

1. Maps and old HURDAT:
- HWM shows a spot low at 15N, 33W at 12Z.
- Microfilm analyzes no features of interest at 12Z.
- HURDAT lists a 30 kt tropical depression at 19N, 32W at 12Z.
2. Discussion:
- Reanalysis: Satellite imagery showed a broad trough moving westward across the central Atlantic.

August 14:

1. Maps and old HURDAT:
- HWM shows a tropical wave along 36W, extending from 15N-25N at 12Z.

- Microfilm analyzes a closed low pressure of at most 1008 mb at 12N, 39W along the ITCZ at 12Z.
- HURDAT lists a 30 kt tropical depression at 18N, 38W at 12Z.

2. Discussion:

- Reanalysis: The disturbance continued westward without showing signs of re-development.

August 15:

1. Maps and old HURDAT:

- HWM and microfilm analyze no features of interest at 12Z.
- HURDAT lists a 30 kt tropical depression at 18N, 44W at 12Z.

2. Discussion:

- Reanalysis: A weak circulation developed on this date after the disturbance crossed 40W as seen on the satellite imagery. The convection was transient and the synoptic observations suggested that it did not have a closed circulation.

August 16:

1. Maps and old HURDAT:

- HWM shows no features of interest at 12Z.
- Microfilm analyzes a tropical cyclone (TC 22) of at most 1014 mb at 19N, 52W at 12Z.
- HURDAT lists a 25 kt tropical depression at 18N, 52W at 12Z.

2. Aircraft highlights:

- Pressure center near 19.7N, 52.2W and lowest pressure of 1012 mb around 16Z (WALLET/micro).

3. Discussion:

- Reanalysis: The small and weak circulation continued westward developing transient convection. A reconnaissance aircraft investigated the disturbance late on August 16th, indicating that it did not have a closed circulation.

August 17:

1. Maps and old HURDAT:

- HWM shows a spot low at 20.5N, 59W at 12Z.
- Microfilm analyzes a tropical cyclone at 20N, 58W at 12Z.
- HURDAT lists a 25 kt tropical depression at 20N, 58W at 12Z.

2. Discussion:

- Reanalysis: The convective activity associated with the disturbance became better organized on this date. Synoptic observations over the southern semicircle were sparse and it is difficult to determine if the system had a closed circulation. Nonetheless, based on the data available, it is analyzed that it regained tropical depression intensity at 00Z on the 17th.

August 18:

1. Maps and old HURDAT:

- HWM shows a spot low at 27N, 67.5W with a trough extending to the south at 12Z.
- Microfilm analyzes a tropical wave north of the Leeward Islands at 12Z.
- HURDAT lists a 20 kt tropical depression at 22N, 64W at 12Z (last position).

2. Ship highlights:

- 30 kt E and 1015 mb at 21.8N, 60.4W at 00Z (COADS).

3. Discussion:

- Reanalysis: The tropical depression continued northwestward and began to interact with a mid-level feature causing an increase in vertical shear. A reconnaissance aircraft investigated the system late on this date suggesting that it still had a closed circulation.

August 19:

1. Maps and old HURDAT:

- HWM shows a spot low at 29N, 69W at 12Z.
- Microfilm analyzes a tropical cyclone of at most 1016 mb at 26.5N, 63W at 12Z.

2. Discussion:

- Reanalysis: Observations early on the 19th indicated that the circulation had weakened into a trough, thus the last position is analyzed at 18Z on the 18th, six hours later than originally shown in HURDAT. The remnants of the tropical depression became embedded within the mid-level feature and no re-development was observed.

August 20:

1. Maps and old HURDAT:

- HWM shows a spot low at 31N, 68.5W at 12Z.
- Microfilm analyzes a tropical cyclone of at most 1016 mb at 31N, 67W at 12Z.

August 21:

1. Maps and old HURDAT:

- HWM shows a spot low at 32.6N, 69.8W at 12Z.
- Microfilm analyzes a tropical cyclone of at most 1014 mb at 31N, 67W at 12Z.

August 22:

1. Maps and old HURDAT:

- HWM shows a spot low at 34N, 66W with a frontal boundary to the west at 12Z.
- Microfilm analyzes a tropical cyclone of at most 1012 mb at 34N, 67W with a frontal boundary approaching from the west at 12Z.

August 23:

1. Maps and old HURDAT:

- HWM shows a spot low at 34N, 63W with a warm front to the north at 12Z.
- Microfilm analyzes a tropical cyclone at 33N, 62W at 12Z.

August 24:

1. Maps and old HURDAT:

- HWM shows a trough along 59W, extending from 33N-43N at 12Z.
- Microfilm analyzes no features of interest at 12Z.

Sources: NHC microfilm maps, the Historical Weather Maps series, the COADS ship database, Monthly Weather Review, Mariners Weather Log, Satellite images from NCDC, and NHC Storm Wallets.

Green indicates wind changes of 15 kt or greater
Blue indicates lat/long changes greater than 1º

Red indicates a new entry
Yellow indicates a deletion

Unnamed Tropical Storm (now Hurricane) (August 7-24, 1970) - AL081970

```
45815 08/15/1970 M= 5  4 SNBR= 982 NOT NAMED   XING=0 SSS=0
45815 08/07/1970 M=18  4 SNBR= 982 NOT NAMED   XING=1 SSS=0
         **        **                                *

(The 7th through 14th are new to HURDAT)
00000 08/07*  0    0    0     0*  0    0    0     0*140 185  25     0*140 195  25     0*

00000 08/08*140 205  25     0*140 215  30     0*140 225  30 1006*140 237  30     0*

00000 08/09*140 250  30     0*140 265  30     0*140 281  30     0*139 300  30     0*

00000 08/10*138 320  30     0*137 339  30     0*135 357  30     0*133 375  35     0*

00000 08/11*132 395  35     0*134 415  35     0*137 437  40     0*139 460  40     0*

00000 08/12*140 482  35     0*140 504  35     0*140 526  30 1010*140 547  30     0*

00000 08/13*143 565  35     0*153 580  45     0*167 595  50     0*182 613  55     0*

00000 08/14*195 633  55 1003*205 653  45     0*215 675  40     0L225 700  40     0*

45820 08/15*  0    0    0     0*  0    0    0     0*270 755  25 1015*283 770  25     0*
45820 08/15L238 722  35     0L255 740  30     0*270 755  30 1015*279 768  30     0*
            **** ***  **      **** ***  **                **       *** ***  **

45825 08/16*295 780  25     0*300 784  30     0*305 785  30     0*310 785  30     0*
45825 08/16*286 779  30     0*293 785  35     0*300 787  35 1011*310 787  35     0*
             *** ***  **       *** ***  **       *** ***  ** ****     ***  **

45830 08/17*325 780  30 1013*335 780  30     0*350 765  30     0*360 755  30 1011*
45830 08/17*322 785  40     0*335 778  45     0*348 766  50 1007*358 752  55 1002*
             *** ***  ** ****     ***  **       *** ***  ** **** *** ***  ** ****

45835 08/18*370 725  40 1005*390 690  50   997*400 655  55   992*425 585  60   992*
45835 08/18*375 725  60     0*393 693  65     0*413 643  70     0*425 585  70     0*
             *** ***  ** **** *** ***  **  *** *** ***  **  ***           **  ***

45840 08/19E440 560  55     0*  0    0    0     0*  0    0    0     0*  0    0    0     0*
45840 08/19E445 540  65     0E460 520  60     0E475 505  55     0E482 495  50     0*
             *** ***  **      **** ***  **      **** ***  **      **** ***  **

(The 20th through 24th are new to HURDAT)
00000 08/20E485 486  50     0E482 478  50     0E475 475  45     0E467 480  45     0*

00000 08/21E460 485  45     0E454 482  45     0E452 471  45     0E454 459  45     0*

00000 08/22E460 445  45     0E467 430  45     0E477 405  45     0E486 380  45     0*

00000 08/23E492 353  40     0E492 325  40     0E485 300  35     0E475 280  30     0*

00000 08/24E465 264  30 1007E460 251  30     0E457 240  25     0E455 230  25     0*

45845 TS
45845 HR
      **
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U.S. Tropical Storm Landfalls

08/17 11Z 34.7N 76.7W 50 kt 1007 mb Atlantic Beach, NC
08/17 17Z 35.6N 75.5W 55 kt Rodanthe, NC

Significant Revisions:

1. Genesis started 8 days earlier based on surface data and satellite imagery

2. Tropical storm stage added over Central Atlantic based on satellite imagery
3. Trough period added based on operational assessments and surface data
4. Major increases to intensity on August 17-19 based upon surface observations and satellite/radar imagery
5. Hurricane period added on August 18 based on surface data and satellite imagery
6. Extratropical phase extended by 6 days

Daily Metadata:

August 7
1. Maps and old HURDAT:
   a. HWM and microfilm depict nothing of interest
2. Discussion:
   a. Reanalysis – Satellite imagery indicates a well-organized system with symmetric banding of deep convection between Senegal and the Cape Verde Islands. This along with coastal observations indicate that genesis occurred on this date around 12Z.

August 8:
1. Maps and old HURDAT:
   a. HWM and microfilm depict nothing of interest
2. Ship highlights:
   a. 20 kt ESE and 1008 mb at 14.1N 22.3W at 12Z (COADS).
3. Discussion:
   a. Spiegler 1971: "A well-organized tropical disturbance noted on satellite pictures during August 8, south of the Cape Verde Islands in the far eastern tropical Atlantic, intensified to a strong depression as it moved westward."
   b. Reanalysis – Satellite imagery continued to show organized banding of deep convection for the tropical depression. A 12Z ship with 20 kt ESE winds just northeast of the system suggested a central pressure of 1006 mb.

August 9:
1. Maps and old HURDAT:
   a. HWM analyzes possible low near 13N 30W at 12Z.
   b. Microfilm analyzes a tropical cyclone at 14N 29W at 12Z. First operational notation of "TC #21" at 12Z.
2. Discussion:
   a. Reanalysis – The convection with the system became more extensive on the 9th, but with less organization. No ships were in the vicinity of the system. The system is maintained as a tropical depression.

August 10:
1. Maps and old HURDAT:
   a. HWM analyzes a possible low near 12N 35W at 12Z.
   b. Microfilm analyzes a tropical cyclone at 13N 36W at 12Z.
2. Discussion:
   a. Reanalysis - Satellite imagery indicated that the system's deep convection became more concentrated and displayed more banding organization. It is estimated that the system became a tropical storm around 18Z, though no ships were near the inner core of the system.

August 11:

1. Maps and old HURDAT:
    a. HWM analyzes a low of at most 1008 mb over the tropical Atlantic at 12Z.
    b. Microfilm analyzes a tropical cyclone of at most 1008 mb at 14N 43W at 12Z.
2. Discussion:
    a. Reanalysis – Satellite imagery shows well-defined banding of the system's deep convection. Based upon this, intensity as a tropical storm boosted to 45 kt by 18Z.

August 12:

1. Maps and old HURDAT:
    a. HWM analyzes a tropical cyclone at 14N 58.5W at 12Z.
    b. Microfilm analyzes a tropical cyclone of at most 1012 mb at 13.4N 53.1W at 12Z.
2. Aircraft highlights:
    a. Center fix at 13.8N 52.2W with 1010 mb central pressure and maximum surface winds of 15 kt at 1142Z (SW).
    b. Air Force recon did not provide a center fix. Highest observed surface winds were 25 kt (SW).
3. Discussion:
    a. Reanalysis – Satellite imagery showed some weakening of the system's convective structure, though some banding was still present. The Navy aircraft reported a very weak system, though it is likely that stronger winds were occurring north of their flight track. System is weakened back to a tropical depression by 12Z because of the reconnaissance data.

August 13:

1. Maps and old HURDAT:
    a. HWM analyzes an open low near 17N 62W at 12Z.
    b. Microfilm analyzes a tropical cyclone of at most 1012 mb near 16.5N 62.5W at 12Z.
2. Aircraft highlights:
    a. Possible center fix with peak surface winds of 60 kt at 17.9N 61.1W at 1615Z (SW).
    b. Possible center fix with peak surface winds of 70 kt and possible central pressure of 1003 mb (1005 mb with 20 kt SE) at 19.2N 63.0W at 2200Z (SW).
3. Discussion:
    a. Spiegler 1971: "On Thursday, August 13, some further intensification of the system appeared to be taking place while the depression was about 250 mi (217n.mi.) east of San Juan, Puerto Rico. Aircraft reconnaissance reported a large area of dangerous squalls and sustained wind speeds of 52 kt for short periods with gusts above hurricane force north of the apparent center. However, the circulation characteristics typical of tropical storms were not present at the time—only very light winds were reported to the south of the center—therefore, the San Juan National Weather Service Office characterized the disturbance as an "intense tropical depression."
    b. Reanalysis – System's central dense overcast expanded in size, though the convection appears less organized. Aircraft reconnaissance did not send back vortex messages for the system, though two possible center fix locations were identified. Despite

this, the aircraft reported winds as high as 70 kt at the surface. A possible central pressure of 1003 mb at 22Z suggests an intensity of 41 kt from the south of 25N pressure-wind relationship. The intensity is analyzed to be 55 kt, taking a blend of the surface winds visually observed along with the pressure-wind relationship (accounting for the very fast forward speed).

August 14:

1. Maps and old HURDAT:
   a. HWM analyzes a tropical depression at 21.5N 67.0W at 12Z.
   b. Microfilm analyzes a tropical cyclone of at most 1014 mb at 21.5N 67.5W at 12Z.
2. Ship highlights:
   a. 35 kt E and 1014 mb at 19.5N 63.7W at 00Z (COADS).
   b. 35 kt SE and 1015 mb at 21.1N 65.0W at 03Z (COADS).
   c. 40 kt ESE and 1031 mb at 21.2N 64.6W at 06Z (COADS).
   d. 40 kt SE and 1015 mb at 23.2N 66.5W at 11Z (COADS).
   e. 40 kt SE and 1012 mb at 24.9N 69.4W at 18Z (Micro).
3. Aircraft highlights:
   a. Possible center fix with 40 kt surface winds at 21N 67.5W at 1130Z (SW).
4. Discussion:
   a. Spiegler 1971: "Although there was some evidence depicted in an Applications Technology Satellite (ATS 3) film loop of the disturbance becoming better organized for a brief time on August 14, it did not acquire tropical storm characteristics. The large area of very heavy squalls with wind speeds in excess of 52 kt for brief periods continued to be reported by reconnaissance aircraft and ships."
   b. The system showed some increased convective organization in a more concentrated area. However, it continued to move at a very fast rate near 25 kt toward the west-northwest. Around 12Z, an aircraft reconnaissance provided observations of a possible center with peak winds near 40 kt. Later in the day, however, no closed circulation was present. Based upon the aircraft and ship observations, the intensity was gradually brought down to 40 kt by 12Z. However, by 18Z the system weakened to an open trough.

August 15:

1. Maps and old HURDAT
   a. HWM analyzes a tropical wave extending from 21N 82W northeast to 29N 75W at 12Z.
   b. Microfilm analyzes a tropical wave extending from 17.5N 80.5W northeast to 28.5N 74.5W at 12Z. (Operationally, "TC #21" was last used at 06Z.)
   c. HURDAT lists a 25 kt 1015 mb tropical depression at 27.0N 75.5W at 12Z.
2. Discussion:
   a. Reanalysis – No satellite image was available on this date. A recon mission early on the 15th continued to show that no closed circulation existed. However, around 12Z recon found that a closed center re-developed and the best track reflects the system becoming a tropical cyclone again at 12Z. This also occurred as the system slowed its forward speed. Highest observed winds from the recon were 30 kt, which is used for the intensity on this date.

August 16:

1. Maps and old HURDAT:
    a. HWM analyzes a tropical wave extending from 29N 81W northeast to 33N 78W at 12Z.
    b. Microfilm analyzes a tropical wave extending from 19N 84W north-northeast to 33N 78W at 12Z. (Operationally, "TC #21" was reinitiated at 18Z.)
    c. HURDAT lists a 30 kt tropical depression at 30.5N 78.5W at 12Z.
2. Ship highlights:
    a. 35 kt S and 1017 mb at 29.9N 77.1W at 06Z (COADS).
    b. 20 kt SE and 1013 mb at 30.3N 78.5W at 12Z (COADS).
    c. 35 kt SW and 1019 mb at 29.6N 77.8W at 18Z (COADS).
3. Discussion:
    a. Satellite imagery on this date shows substantial deep convection aligned NNE-SSW along a synoptic-scale trough. The system still did appear to have a closed center, though no aircraft reconnaissance was flown on this date. Two ships of 35 kt on this date are the reason that tropical storm intensity was re-attained starting at 06Z. (A 20 kt SE with 1013 mb ship report is evidence for a 1011 mb central pressure, which was added at 12Z.)

August 17:

1. Maps and old HURDAT:
    a. HWM analyzes a low of at most 1016 mb near 35N 77.5W at 12Z.
    b. Microfilm analyzes a low of at most 1016 mb near 35N 77W at 12Z.
    c. HURDAT lists a 30 kt tropical depression at 35.0N 76.5W at 12Z.
2. Station highlights:
    a. 50 kt at Atlantic Beach, North Carolina at 1140-1150Z (Wallet).
    b. 15 kt NE and 1010 mb at Cherry Point, North Carolina, at 1156Z (SWO).
    c. 28 kt SSW and 1014 mb at Cape Hatteras, North Carolina, at 15Z (SWO).
    d. 48 kt NW (likely sustained) at Oregon Inlet, North Carolina, at 18Z (SWO).
3. Ship highlights:
    a. 42 kt at Frying Pan Shoals at 03Z (Wallet).
    b. 40 kt S and 1014 mb at 33.5N 77.6W at 06Z (COADS).
    c. 35 kt WSW and 1016 mb at Diamond Shoals Light at 18Z (COADS/SWO).
    d. 35 kt S and 1006 mb at 35.9N 75.0W at 18Z (COADS).
4. Cape Hatteras radar fixes (MWR):
    a. 34.8N 76.9W at 1130Z ("15 degree spiral overlay")
    b. 35.2N 76.3W with a 9 nmi eye at 1330Z ("New centered formed last hour, now almost closed eye, spiral band area")
    c. 35.8N 75.3W with a 10 nmi eye at 1730Z ("Low center open to NW, spiral band area")
    d. 35.9N 75.2W with a 14 nmi eye at 1830Z ("Low center spiral band area")
    e. 36.4N 74.1W with a 5 nmi eye at 2030Z ("Closed low center, spiral band area")
5. Discussion:
    a. Spiegler 1971: "On Monday, August 17, however, a low pressure area re-formed on the tropical wave. The newly formed tropical depression intensified throughout the day, reaching tropical storm intensity during the evening hours...Satellite pictures taken at midday on August 17 confirmed the well-organized cloud pattern and showed that the storm had developed an eye. A cold frontal cloud band is noted several hundred miles to the north of the tropical system. An ATS 3 film loop also indicated progressively better organization of the system throughout the day."
    b. Reanalysis – The tropical cyclone turned to the north-northeast during the day and continued to intensify. Satellite imagery showed

concentration of the deep convection with some organized banding. Radar from Cape Hatteras indicated a small eye, ranging from 5 to 14 nm diameter. A 15 kt NE wind and 1010 mb observation suggests (with a land exposure) a central pressure of about 1007 mb, which is added at 12Z. A ship with 1006 mb and 35 kt suggests a central pressure of 1002 mb, which is added at 18Z. These pressures suggest intensities of 35 and 45 kt from the north of 35N pressure-wind relationship. However, substantially stronger surface observations are the reason for intensities set at 50 and 55 kt, respectively at 12Z and 18Z, which is consistent with the system's small size and high environmental pressure. This is a major change from HURDAT, which only had 30 kt at both times originally. The tropical storm made landfall at Atlantic Beach, NC around 11Z, passed into the Pamlico Sound, and then made a second landfall in Rodanthe, NC around 17Z. These landfalls occurred with intensities of 50 and 55 kt, respectively. Almost immediately after the second landfall, the system's center moved back over the Atlantic Ocean.

August 18:

1. Maps and old HURDAT:
   a. HWM analyzes a low of at most 1000 mb at near 41.5N 67.5W at 12Z.
   b. Microfilm analyzes a frontal low of at most 1008 mb near 41.5N 66.5W at 12Z.
   c. HURDAT lists a 55 kt 992 mb tropical storm at 40.0N 65.5W at 12Z.
2. Ship highlights:
   a. 55 kt SSW with gusts to 65 kt at 38.0N 71.0W at 0012Z (MWR/Storm Wallet).
   b. 1001 mb with 10 kt N at 38.0N 71.0W at 0310Z (MWR/Storm Wallet).
   c. 35 kt W and 1013 mb at 38.0W 71.0W at 06Z (COADS).
   d. 35 kt WSW and 1014 mb at 37.0W 70.0W at 06Z (COADS).
   e. 60 kt NNW and 996 mb at 42.2N 59.5W at 18Z (COADS).
   f. 30 kt W and 1004 mb at 40.8N 58.4W at 18Z (COADS).
3. Satellite fix:
   a. 41.5N 61.6W at 1545z from Nimbus 3 (MWR).
4. Discussion:
   a. Spiegler 1971: "...and was probably of hurricane intensity during the morning hours of August 18 before encountering a cold front well off the northeast coast of the United States on the afternoon of the 18th…Satellite pictures near noon on August 18 show a well-defined eye near 41.5N 61.6W at 1545 GMT. The National Environmental Satellite Service (NESS) Tropical Disturbance Bulletin for that day classified the storm as stage X, category 3 [Note: not SSHS, author refers reader to Anderson et al. 1969]."
   b. Reanalysis – The system moved toward the east-northeast at an accelerating pace. Peak observation was 60 kt NNW with 996 mb, suggesting a central pressure of at most 990 mb and likely lower. 990 mb pressure indicates at least 63 kt from the north of 35N pressure-wind relationship. The small size (and eye seen from the Nimbus satellite image) and fast forward speed are justification for an intensity of 70 kt at 12 and 18Z. This is a major increase for the day (except for 18Z). Thus the system became a hurricane. (Central pressures were indicated for all of the synoptic times on the 18th, but no inner core observations were available. As these were based upon analyses and are not likely correct [too high], these are removed.) Note also that the 1001 mb reading with 10 kt N winds at 0310Z justifies a 1000 mb central pressure. However, because the system was

intensifying steadily, it would not be appropriate to indicate a central pressure at either the 00Z or 06Z slots.

August 19:

1. Maps and old HURDAT
   a. HWM analyzes a low of at most 996 mb near 48N 50.5W at 12Z.
   b. HURDAT's last position was 44.0N 56.0W as a 55 kt extratropical cyclone at 00Z with dissipation thereafter.
2. Ship highlights:
   a. 50 kt S and 1008 mb at 43.1N 52.6W at 00Z (COADS).
   b. 20 kt SSW and 1000 mb at 44.4N 53.0W at 00Z (COADS).
   c. 35 kt NE and 1012 mb at 49.8N 58.4W at 06Z (COADS).
   d. 10 kt SSW and 999 mb at 47.3N 50.0W at 06Z (COADS).
   e. 35 kt NW and 997 mb at 46.6N 52.4W at 12Z (COADS).
   f. 10 kt S and 1003 mb at 45.2N 48.7W at 18Z (COADS).
3. Discussion:
   a. Reanalysis - The system merged with the frontal boundary around 00Z on this date. Thus the extratropical transition likely occurred at this time, which is unchanged from originally in HURDAT. HURDAT showed dissipation thereafter. However, observations clearly show that the system continued for the next several days. The system began the day as a 65 kt extratropical cyclone and gradually weakened during the day, as it moved east-northeastward.

August 20:

1. Maps and old HURDAT
   a. HWM analyzes a low of at most 1000 mb near 47N 47W at 12Z.
2. Ship highlights:
   a. 45 kt N and 1006 mb at 46.9N 52.5W at 00Z (COADS).
   b. 45 kt N and 1006 mb at 47.1N 51.2W at 06Z (COADS).
3. Discussion:
   a. The extratropical cyclone weakened only slightly down to 45 kt while it occluded and meandered slowly east of Newfoundland.

August 21:

1. Maps and old HURDAT
   a. HWM analyzes a low of at most 1012 mb near 45N 47W at 12Z.

August 22:

1. Maps and old HURDAT
   a. HWM analyzes a low of at most 1012 mb near 47N 38W at 12Z.
2. Ship highlights:
   a. 45 kt NW and 1018 mb at 45.8N 45.8W at 12Z (COADS).
3. Discussion:
   a. Reanalysis -The system continued on the 21st and 22nd with little change in intensity and again began moving toward the east-northeast on the 22nd.

August 23:

1. Maps and old HURDAT
   a. HWM analyzes a low of at most 1008 mb near 48.5N 28.5W at 12Z.

August 24:

1. Maps and old HURDAT
    a. HWM analyzes an open low near 46N 22W at 12Z.
2. Discussion:
    a. Reanalysis – The extratropical cyclone weakened gradually dropping below gale force late on the 23rd and dissipating late on the 24th.

Sources: NHC microfilm maps, the Historical Weather Maps series, the COADS ship database, Monthly Weather Review, Mariners Weather Log, Satellite images from NCDC, and NHC Storm Wallets. Spiegler 1971: The Unnamed Atlantic Tropical Storms of 1970. Anderson 1969: Application of Meteorological Satellite Data in Analysis and Forecasting.

Green indicates wind changes of 15 kt or greater
Blue indicates lat/long changes greater than 1º
Red indicates a new entry
Yellow indicates a deletion

Tropical Storm Dorothy (August 18-22, 1970) – AL091970

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46935 08/17/1970 M= 7  5 SNBR=1000 DOROTHY     XING=0 SSS=0
46935 08/18/1970 M= 5  5 SNBR=1000 DOROTHY     XING=0 SSS=0
                    *

(Removed from HURDAT)
46940 08/17*  0   0   0    0*  0   0   0    0*110 410  25    0*113 427  25    0*

46945 08/18*115 443  25    0*118 459  25    0*120 475  30    0*124 491  30    0*
46945 08/18*115 443  25    0*118 459  25    0*121 475  30    0*124 491  35    0*
                                               ***                        **

46950 08/19*128 507  35    0*131 522  40    0*133 536  50 1000*136 550  55 1005*
46950 08/19*128 507  40    0*131 522  45    0*133 537  50 1001*135 551  50 1005*
                     **                **          ***     **** *** ***  **

46955 08/20*137 565  45 1003*138 580  55  996*139 595  60  998*145 605  60 1002*
46955 08/20*137 565  50 1003*138 580  60  996*141 595  60  998*145 606  60    0*
                     **                **      ***                ***        *

46960 08/21*146 620  55    0*148 635  50    0*150 648  45 1006*152 660  45 1005*
46960 08/21*147 620  55 1002*148 635  50    0*150 648  40 1006*152 660  40 1005*
            ***         ****                            **                **

46965 08/22*154 672  40 1007*156 684  40    0*158 696  35    0*159 708  30    0*
46965 08/22*154 672  35 1007*  0   0   0    0*  0   0   0    0*  0   0   0    0*
                     **        *   *   *        *   *   *        *   *   *

(August 23rd has been removed from HURDAT)
46970 08/23*160 720  30    0*161 732  30    0*162 744  30    0*  0   0   0    0*

46975 TS
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Tropical Storm Landfall:

08/20 19Z 14.5N 60.8W 60 kt Martinique

Significant Revisions:

1. Genesis analyzed twelve hours later than originally shown in HURDAT based on synoptic and satellite data.
2. Dissipation analyzed to have occurred 30 hours earlier than originally shown in HURDAT based on synoptic observations.

Daily Metadata:

August 16:

1. Maps and old HURDAT:
- HWM and microfilm do not show any features of interest at 12Z.
2. Satellite highlights:
- ATS estimated a center fix at 10N, 34.5W at 1850Z (WALLET).
3. Discussion:
- MWR: "Dorothy formed from an African seedling disturbance that emerged from the coast on August 13."
- ATSR: "The impetus for what was eventually to become Tropical Storm DOROTHY moved off the coast of Africa as an easterly wave and/or a perturbation on the inter-tropical convergence zone on August 13. It moved steadily westward, retaining its identity as indicated on satellite photos."
- Reanalysis: A tropical wave left the west coast of Africa on August 13th and moved westward with little signs of organization. Convection was persistent but embedded in the ITCZ.

August 17:

1. Maps and old HURDAT:
- HWM analyzes no features of interest at 12Z.
- HURDAT lists a 25 kt tropical depression at 11N, 41W at 12Z (first position).
- Microfilm shows a tropical cyclone (TC 23) of at most 1012 mb at 11N, 38W at 12Z.
2. Satellite highlights:
- ATS estimated a center fix at 11N, 41W at 13Z (WALLET).
3. Discussion:
- ATSR: "On 17 August, satellite photographs and peripheral ship reports indicated the strong possibility that a circulation had formed near 11N 40W and was moving westward at 12 to 15 knots."
- Reanalysis: The disturbance began to become better organized on August 17th but synoptic and satellite data indicated that it was too broad and not well-defined. The first position in the original HURDAT was at 12Z on the 17th but the synoptic data suggested it did not have a closed circulation.

August 18:

1. Maps and old HURDAT:
- HWM analyzes a tropical wave along 48W, extending from 8N-18N at 12Z.
- HURDAT lists a 30 kt tropical depression at 12N, 47.5W at 12Z.
- Microfilm shows a tropical cyclone of at most 1012 mb at 12N, 48W at 12Z.
1. Satellite highlights:
- ATS estimated a center fix at 12N, 43W at 1030Z (WALLET).
2. Discussion:
- Reanalysis: The first position is analyzed at 00Z on August 18th, twelve hours later originally shown in HURDAT. The tropical depression continued to become better organized and intensification to a tropical storm is analyzed at 18Z on the 18th, six hours earlier than originally shown in HURDAT, based on the improved organization observed in the satellite images and the reconnaissance aircraft data on the 19th.

August 19:

1. Maps and old HURDAT:
- HWM analyzes a tropical storm of at most 1004 mb at 13.6N, 53.6W at 12Z.

- HURDAT lists a 50 kt tropical storm at 13.3N, 53.6W at 12Z.
- Microfilm shows a closed low pressure of at most 1008 mb at 13.8N, 53.8W at 12Z.

2. Aircraft highlights:

- Penetration center fix at 13.5N 53.2W 0940 UTC, with measured central pressure of 1000 mb, estimated surface winds of 50 kt, and measured flight-level winds of 48 kt (WALLET)
- Penetration center fix measured a central pressure of 1001 mb and estimated surface winds of 60 kt at 13.3N, 53.7W at 12Z (WALLET).
- Penetration center fix measured a central pressure of 1005 mb, estimated surface winds of 65 kt and an eye diameter of 30 n mi at 13.7N, 55.8W at 1919Z (WALLET).
- Penetration center fix measured a central pressure of 1003 mb and estimated an eye diameter of 30 n mi at 13.9N, 56.4W at 2330Z (WALLET).

3. Discussion:

- MWR: "The storm was named on August 19 about 500 mi east of the Lesser Antilles, upon receipt of a reconnaissance report of 50-kt winds and a 1000-mb (29.53 mb) pressure center."
- ATSR: "On the morning of 19 August, a Navy investigative flight was dispatched to 13N 53W. Upon arriving at 13.5N 53W, the aircraft found a tropical storm with 50 knots of wind with minimum SLP of 1000 mb. The first tropical storm advisory on DOROTHY was issued at 191200Z."
- Reanalysis: A penetration center fix measured a central pressure of 1001 mb and estimated surface winds of 60 kt at 12Z on August 19th. A central pressure of 1001 mb suggests maximum surface winds of 45 kt from the south of 25N Brown et al. pressure-wind relationship. Based on a forward speed of 15 kt and weighting some the visual estimate of 60 kt, an intensity of 50 kt is analyzed at 12Z on the 19th, same as originally shown in HURDAT. The next penetration center fix measured a central pressure of 1005 mb and estimated surface winds of 65 kt at 1919Z on the 19th. A central pressure of 1005 mb suggests maximum surface winds of 37 kt from the south of 25N pressure-wind relationship. Based on a forward speed of 14 kt and weighting some the visual estimate of 65 kt, an intensity of 50 kt is analyzed at 18Z on the 19th, down from 55 kt originally shown in HURDAT. Satellite imagery indicated that Dorothy was under some westerly shear with most of the convection over the eastern semicircle.

August 20:

1. Maps and old HURDAT:

- HWM analyzes a tropical storm of at most 1008 mb at 14N, 59.5W at 12Z.
- HURDAT lists a 60 kt tropical storm at 13.9N, 59.5W at 12Z.
- Microfilm shows a tropical storm of at most 1008 mb at 14N, 59.5W at 12Z.

2. Aircraft highlights:

- Penetration center fix measured a central pressure of 996 mb and estimated an eye diameter of 4 n mi at 13.8N, 58.5W at 0806Z (WALLET).
- Penetration center fix measured a central pressure of 998 mb and estimated surface winds of 50 kt at 14N, 59.5W at 1142Z (WALLET).
- Penetration center fix reported a central pressure of 1006 mb, which appears erroneous, estimated surface winds of 55 kt and an eye diameter of 25 n mi at 14.6N, 60.6W at 1804Z (WALLET).
- Penetration center fix measured a central pressure of 1002 mb at 14.9N, 61.5W at 2334Z (WALLET).

3. Land highlights:

- 1000 mb (lowest pressure) at Caravelle, Martinique at 2145Z (WALLET).

- 55 kt at Melville Airport, Dominica at 22Z (WALLET).
- 51 kt (maximum sustained winds) and gusts to 74 kt at Caravelle, Martinique (at 21/0650 UTC) (MWR). The MWR report of 58 kt G 86 was a translation error. Based on the report on Dorothy from Meteo France, it was actually 58 mph G 86 mph, which is 51 kt G 74 kt.

4. Discussion:

- MWR: "The storm reached its maximum intensity, with lowest pressure of 996 mb (29.41 in.) and highest minds around 60 kt, as it approached the French West Indies early on the 20th. The center passed over the island of Martinique where a low-pressure reading of 999.7 mb (29.52 in.) and winds of 58 kt with gusts to 86 kt were recorded at the town of Caravelle."
- ATSR: "DOROTHY passed over the island of Martinique about 2000Z on 20 August. The minimum reported sea level pressure was 996 mb and the maximum surface wind was 60 knots."
- Regarding Dorothy in Martinique, the full post-storm report from Meteo France is found in the NHC Storm Wallets online under 1970 -> Dorothy -> Post Event.
- Reanalysis: Dorothy continued westward crossing the Lesser Antilles late on August 20th. A penetration center fix measured a central pressure of 1003 mb at 2330Z on the 19th. A central pressure of 1003 mb suggests maximum surface winds of 41 kt from the south of 25N pressure-wind relationship. Based on a forward speed of 14 kt, an intensity of 50 kt is analyzed at 00Z on the 20th, up from 45 kt originally shown in HURDAT. The next penetration center fix measured a central pressure of 996 mb and estimated a small eye diameter of 4 n mi at 0806Z on the 20th. A central pressure of 996 mb suggests maximum surface winds of 54 kt from the south of 25N pressure-wind relationship. Based on a forward speed of 15 kt and small eye diameter, an intensity of 60 kt is analyzed at 06Z on the 20th, same as originally shown in HURDAT. 60 kt is also the peak intensity of this tropical cyclone, same as originally shown in HURDAT. Another penetration center fix measured a central pressure of 998 mb at 1142Z on the 20th and an intensity of 60 kt is analyzed at 12Z on this date, same as originally shown in HURDAT. A penetration center fix at 1804Z on the 20th reported a central pressure of 1006 mb but this was clearly wrong based on the reconnaissance aircraft data at 1142Z and observations in Martinique late on the 20th, thus it is disregarded. The center of Dorothy made landfall in Martinique around 19Z as a 60 kt tropical storm. Tropical-storm-force winds were observed in Martinique and nearby islands. Caraville on Martinqiue measured a minimum pressure of 999.7 mb at 2145 UTC on the 20th and maximum winds of 51 kt G 74 kt at 0645 UTC on the 21st. All available data gives high confidence that the center made closest approach near the time of the minimum pressure, and that the maximum winds at 0645 UTC of the 21st occurred in squalls well east of the center, several hours after the passage of the center. Satellite images showed that the westerly shear continued to affect the tropical cyclone with most of the convection located over the eastern semicircle.

August 21:

1. Maps and old HURDAT:

- HWM analyzes a tropical storm of at most 1008 mb at 15N, 64.5W at 12Z.
- HURDAT lists a 45 kt tropical storm at 15N, 64.8W at 12Z.
- Microfilm shows a tropical storm of at most 1008 mb at 15N, 64.7W at 12Z.

2. Aircraft highlights:

- Penetration center fix estimated an eye diameter of 20 n mi at 14.8N, 63.4W at 0540Z (WALLET).
- Radar center fix estimated an eye diameter of 25 n mi at 14.8N, 64.8W at 1130Z (WALLET).

- Penetration center fix measured a central pressure of 1005 mb and estimated surface winds of 30 kt at 15.4N, 65.8W at 1809Z (WALLET).
- Penetration center fix measured a central pressure of 1007 mb at 15.3N, 66.9W at 2330Z (WALLET).

3. Discussion:

- Reanalysis: Dorothy moved into the eastern Caribbean Sea and weakened. A penetration center fix measured a central pressure of 1002 mb at 2334Z on August 20th. A central pressure of 1002 mb suggests maximum surface winds of 43 kt from the south of 25N pressure-wind relationship. Based on a forward speed of 14 kt, an intensity of 55 kt is analyzed at 00Z on the 21st, same as originally shown in HURDAT. Fixes at 0540Z and 0654Z only provided extrapolated pressures from 700 mb, and they suggested central pressures in the 1003-1006 mb range around 06Z. A fix at 1130 UTC provided a central pressure of 995 mb (extrapolated from 700 mb), but this value is anomalously low and is disregarded. The next penetration center fix extrapolated a central pressure of 1006 mb at 1345Z on the 21st. A central pressure of 1006 mb suggests maximum surface winds of 35 kt from the south of 25N pressure-wind relationship. Based on a forward speed of 12 kt, an intensity of 40 kt is analyzed at 12Z on the 21st, down from 45 kt originally shown in HURDAT, a minor intensity change. The next penetration center fix measured a central pressure of 1005 mb and estimated surface winds of 30 kt at 1809Z on the 21st. An intensity of 40 kt is analyzed at 18Z on the 21st, down from 45 kt originally shown in HURDAT, a minor intensity change. Satellite imagery showed that the center was almost exposed with most of the convection located over the eastern semicircle.

August 22:

1. Maps and old HURDAT:

- HWM analyzes a tropical storm of at most 1008 mb at 15.8N, 69.8W at 12Z.
- HURDAT lists a 35 kt tropical storm at 15.8N, 69.6W at 12Z.
- Microfilm shows a tropical storm of at most 1008 mb at 16N, 69.8W at 12Z.

2. Land highlights:

- 10 kt NE and 1005 mb at 15.2N, 69.3W at 06Z (COADS).

3. Discussion:

- MWR: "The storm moved under an upper level cold trough in the eastern Caribbean and gradually weakened, dropping below tropical storm force on August 22."
- ATSR: "After entering the Caribbean, DOROTHY never quite regained her organization and was eventually downgraded to a tropical depression at 221600Z."
- Reanalysis: A penetration center fix measured a central pressure of 1007 mb at 2330Z on August 21st. A central pressure of 1007 mb suggests maximum surface winds of 32 kt from the south of 25N pressure-wind relationship. Based on a forward speed of 12 kt, an intensity of 35 kt is analyzed at 00Z on the 22nd, down from 40 kt originally shown in HURDAT. Synoptic observations after 00Z on the 22nd indicated that the circulation of Dorothy had weakened into a trough, thus the last position is analyzed at 00Z on the 22nd. Satellite imagery showed a large area of convection east of the trough axis.

August 23:

1. Maps and old HURDAT:

- HWM analyzes a tropical depression of at most 1008 mb at 15N, 75W at 12Z.
- HURDAT lists a 30 kt tropical depression at 16.2N, 74.4W at 12Z (last position).
- Microfilm shows a tropical wave stretching from 12N-19N and 76W-81W at 12Z.

2. Discussion:

- ATSR: "The depression then continued on a generally westward track and finally degenerated into an easterly wave in the western Caribbean. The final advisory was issued at 232200Z."
- Reanalysis: The remnants of Dorothy continued westward and did not show any signs of redevelopment during the next few days.

August 24:

1. Maps and old HURDAT:

- HWM analyzes a tropical wave along 83W, extending from 13N-23N at 12Z.
- Microfilm shows a tropical wave stretching from 15N-24N and 80W-82W at 12Z.

Date	Original HURDAT Central Pressure	Evidence	Changes
Aug 19 12Z	1000 mb	Penetration center fix: 1001 mb at 12Z	1001 mb
Aug 19 18Z	1005 mb	Penetration center fix: 1005 mb at 1919Z	Retained
Aug 20 00Z	1003 mb	Penetration center fix: 1003 mb at 2330Z on Aug 19th	
Aug 20 06Z	996 mb	Penetration center fix: 996 mb at 0806Z	
Aug 20 12Z	998 mb	Penetration center fix: 998 mb at 1142Z	
Aug 20 18Z	1002 mb	Penetration center fix: 1002 mb at 2334Z on Aug 20th	Removed
Aug 21 00Z			1002 mb
Aug 21 12Z	1006 mb	Penetration center fix: 1006 mb at 1345Z	Retained
Aug 21 18Z	1005 mb	Penetration center fix: 1005 mb at 1929Z	
Aug 22 00Z	1007 mb	Penetration center fix: 1007 mb at 2330Z on Aug 21st	

Sources: NHC microfilm maps, the Historical Weather Maps series, the COADS ship database, Monthly Weather Review, Mariners Weather Log, Satellite images from NCDC, and NHC Storm Wallets.

Green indicates wind changes of 15 kt or greater
Blue indicates lat/long changes greater than 1º
Red indicates a new entry
Yellow indicates a deletion

Unnamed Tropical Storm [September 3-13, 1970] – AL101970

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45240 09/03/1970 M= 7  10 SNBR= 966 UNNAMED       XING=0 SSS=0
45240 09/03/1970 M=11  10 SNBR= 966 UNNAMED       XING=0 SSS=0
                    **

45245 09/03*  0   0   0    0*  0   0   0    0*185 440  20    0*191 442  25    0*
45245 09/03*  0   0   0    0*  0   0   0    0*174 440  25    0*181 443  25    0*
                                               ***      **      *** ***
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45250 09/04*198 445  25    0*204 448  25    0*210 450  25    0*214 447  25    0*
45250 09/04*188 445  25    0*194 446  25    0*200 446  30    0*205 443  30    0*
            ***              *** ***          *** ***  **      *** ***  **

45255 09/05*217 445  25    0*221 442  25    0*225 440  25    0*230 435  25    0*
45255 09/05*209 440  35 1006*213 437  40    0*218 435  40    0*223 436  40    0*
            *** ***  ** **** *** ***  **      *** ***  **      *** ***  **

45260 09/06*235 440  25    0*232 450  20    0*230 460  20    0*227 462  20    0*
45260 09/06*228 439  35    0*229 442  35    0*227 446  35    0*223 450  35    0*
            *** ***  **      *** ***  **      *** ***  **      *** ***  **

45265 09/07*225 465  20    0*222 467  20    0*220 470  20    0*218 475  20    0*
45265 09/07*220 455  30    0*218 461  30    0*216 467  30    0*214 473  30    0*
            *** ***  **      *** ***  **      *** ***  **      *** ***  **

45270 09/08*215 480  20    0*212 485  20    0*210 490  20    0*207 501  20    0*
45270 09/08*212 479  25    0*210 485  25    0*208 491  25    0*206 498  25    0*
            *** ***          ***      **      *** ***  **      *** ***  **

45275 09/09*203 512  20    0*199 523  20    0*  0   0   0    0*  0   0   0    0*
45275 09/09*204 506  25    0*201 515  25    0*198 526  25    0*196 538  25    0*
            *** ***  **      *** ***  **      *** ***  **      *** ***  **

(September 10th through 13th are new to HURDAT)
45280 09/10*195 548  25    0*195 558  25    0*195 568  25    0*195 578  25    0*
45285 09/11*195 590  25    0*195 602  25    0*195 613  25    0*196 623  25    0*
45290 09/12*197 634  25    0*198 645  30    0*200 656  30    0*202 667  30    0*
45295 09/13*204 678  30    0*206 690  30    0*208 702  30    0*  0   0   0    0*

45300 TD
45300 TS
      **
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Significant Revisions:

1. The system is upgraded to a tropical storm, previously analyzed as a tropical depression in HURDAT.
2. Major track changes analyzed at 12Z on September 3rd and 12Z-18Z on September 6th based on synoptic observations.
3. Major intensity increases analyzed between 06Z-18Z on September 5th and 6th based on satellite data.
4. Track extended four days based on synoptic and satellite data.

Daily Metadata:

August 29:

1. Maps and old HURDAT:
- HWM and microfilm analyze no features of interest at 12Z.
2. Discussion:
- Reanalysis: Satellite imagery showed a large area of convection over the eastern Atlantic near the west coast of Africa in association with a westerly-moving tropical wave. Synoptic observations did not show a well-defined circulation.

August 30:

1. Maps and old HURDAT:
- HWM and microfilm analyze no features of interest at 12Z.
2. Discussion:

- Reanalysis: The tropical wave continued westward and became better organized based on satellite imagery. Nonetheless, at the surface, it remained a sharp trough according to synoptic observations.

August 31:

1. Maps and old HURDAT:
- HWM and microfilm analyze no features of interest at 12Z.
2. Discussion:
- Reanalysis: Satellite imagery continued to show a small area of convection near the center but the sparse ship and coastal data did not suggest that a closed circulation was present.

September 1:

1. Maps and old HURDAT:
- HWM analyzes a spot low at 15N, 33.5W at 12Z.
- Microfilm shows a tropical wave extending from 11N-17N and 33W-36W at 12Z.
2. Discussion:
- Reanalysis: The ship data was very sparse over the central Atlantic. Satellite imagery indicated that the disturbance had become better organized with convection over the center and some hints of a circulation. It is possible that it became a tropical depression on this date.

September 2:

1. Maps and old HURDAT:
- HWM analyzes no features of interest at 12Z.
- Microfilm shows a tropical wave extending from 11N-24N, along 41W at 12Z.
2. Discussion:
- Reanalysis: Satellite imagery showed that the disturbance had lost most of the convective activity.

September 3:

1. Maps and old HURDAT:
- HWM analyzes a tropical wave extending from 11N-23N, along 43W at 12Z.
- HURDAT lists a 20 kt tropical depression at 18.5N, 44W at 12Z (first position).
- Microfilm shows a tropical wave extending from 16N-24N, along 45W at 12Z.

2. Ship highlights:
- 45 kt SE (high wind bias) and 1015 mb at 22.1N, 45W at 00Z (COADS).

3. Discussion:
- Reanalysis: Synoptic observation on September 3rd showed that the disturbance was at least a sharp tropical wave but the data was sparse, especially over the southern semicircle. The first position is analyzed at 12Z on the 3rd as a 25 kt tropical depression, same as originally shown in HURDAT, only 5 kt stronger, a minor intensity change. Satellite images showed that convection had increased compared to the previous day, but was displaced over the northern and eastern semicircles.

September 4:

1. Maps and old HURDAT:

- HWM analyzes a tropical wave extending from 15N-25N, along 43W at 12Z.
- HURDAT lists a 25 kt tropical depression at 21N, 45W at 12Z.
- Microfilm shows a tropical wave extending from 16N-25N, along 48W at 12Z.

2. Ship highlights:

- 50 kt E (high wind bias) and 1016 mb at 21N, 46.5W at 00Z (COADS).

3. Discussion:

- Reanalysis: A trough to the north caused the tropical depression to turn northward and gradually strengthened. Satellite images showed a large area of convection, especially over the northern and eastern semicircles.

September 5:

1. Maps and old HURDAT:

- HWM analyzes a closed low pressure of at most 1012 mb at 23N, 43W at 12Z.
- HURDAT lists a 25 kt tropical depression at 22.5N, 44W at 12Z.
- Microfilm shows a tropical cyclone (TD #27) of at most 1012 mb at 23N, 43W at 12Z.

2. Ship highlights:

- 40 kt SSW (high wind bias) and 1017 mb at 24.7N, 40.5W at 00Z (micro).
- 25 kt SE and 1009 mb at 22.5N, 42.2W at 00Z (micro).

3. Aircraft highlights:

- Estimated winds of 40 kt NE and a pressure of 1008 mb at 22.6N, 43.5W at 1543Z (micro).

4. Discussion:

- Reanalysis: The tropical depression became much better organized on this date as shown by satellite images. The low-level center became better defined and although sheared, convection was organized over the center and formed rainbands that wrapped halfway across the circulation. Also, a ship at 00Z on the 5th reported 25 kt SE and 1009 mb, suggesting a central pressure of 1006 mb. A central pressure of 1006 mb suggests maximum sustained winds of 35 kt S of 25N. Thus, it is analyzed that the tropical depression became a tropical storm at 00Z on the 5th. A reconnaissance aircraft investigated the tropical storm late on the 5th and visually estimated surface winds of 40 kt at 1543Z. A peak intensity of 40 kt is analyzed between 06Z and 18Z on the 5th, up from 25 kt originally shown in HURDAT, a major intensity change. Operationally, the system was upgraded to a tropical depression, the 27th of the season, at 00Z on the 5th.

September 6:

1. Maps and old HURDAT:

- HWM analyzes a closed low pressure of at most 1016 mb at 20.5N, 44W at 12Z.
- HURDAT lists a 20 kt tropical depression at 23N, 46W at 12Z.
- Microfilm shows a tropical cyclone of at most 1012 mb at 21.5N, 43.5W at 12Z.

2. Discussion:

- Reanalysis: Satellite imagery showed that the circulation was well-defined but

wind shear had displaced most of the convection to the east. Thus, it is analyzed that the tropical storm weakened on this date but still likely retained minimal tropical storm-force winds. Synoptic observations were very sparse on the 6th.

September 7:

1. Maps and old HURDAT:

- HWM analyzes a closed low pressure of at most 1012 mb at 21.5N, 48.5W at 12Z.
- HURDAT lists a 20 kt tropical depression at 22N, 47W at 12Z.
- Microfilm shows a tropical cyclone of at most 1012 mb at 20.5N, 46.5W at 12Z.

2. Discussion:

- Reanalysis: The tropical cyclone moved to the southeast and is analyzed to have weakened to a tropical depression at 00Z on the 7th. Satellite imagery showed that the system still retained a well-defined circulation with most of the convection displaced to the east.

September 8:

1. Maps and old HURDAT:

- HWM analyzes a closed low pressure of 1011 mb at 21N, 47.8W at 12Z.
- HURDAT lists a 20 kt tropical depression at 21N, 49W at 12Z.
- Microfilm shows a tropical cyclone of at most 1012 mb at 21.5N, 49W at 12Z.

2. Discussion:

- Reanalysis: The tropical depression continued southeastward and weakened. Satellite images showed a well-defined but only some convection east of the center.

September 9:

1. Maps and old HURDAT:

- HWM analyzes a spot low pressure of 1018 mb at 19.5N, 51.8W at 12Z.
- HURDAT lists a 20 kt tropical depression at 19.9N, 52.3W at 06Z (last position).
- Microfilm shows a tropical cyclone of at most 1014 mb at 20N, 51W at 12Z.

2. Discussion:

- Reanalysis: The synoptic observations and satellite images suggested that the tropical depression retained a closed circulation on this date. The last position in HURDAT was analyzed at 12Z on the 9th.

September 10:

1. Maps and old HURDAT:

- HWM analyzes a closed low pressure of at most 1012 mb at 19.5N, 57.7W at 12Z.
- Microfilm shows a tropical cyclone of at most 1012 mb at 18N, 56W at 12Z.

2. Discussion:

- Reanalysis: The tropical depression continued westward and satellite images showed organized convection near or over the center.

September 11:

1. Maps and old HURDAT:

- HWM analyzes a spot low pressure at 19.5N, 61W at 12Z.
- Microfilm shows a tropical cyclone of at most 1014 mb at 19.5N, 61.5W at 12Z.

2. Discussion:
- Reanalysis: The weak tropical depression passed north of the Leeward Islands.

September 12:

1. Maps and old HURDAT:
- HWM analyzes a closed low pressure of at most 1012 mb at 20.5N, 65.7W at 12Z.
- Microfilm shows a tropical cyclone of at most 1012 mb at 20.5N, 65.5W at 12Z.

2. Ship highlights:
- 30 kt E and 1015 mb at 20.9N, 63.9W at 14Z (COADS).

3. Discussion:
- Reanalysis: The tropical depression turned to the west-northwest and passed north of Puerto Rico. The intensity is increased to 30 kt based on synoptic observations. Satellite images showed that convection covered the center and extended over the eastern semicircle.

September 13:

1. Maps and old HURDAT:
- HWM analyzes a spot low pressure of 1012 mb at 21N, 69.5W at 12Z.
- Microfilm shows a tropical cyclone of at most 1014 mb at 20.5N, 70W at 12Z.

2. Ship highlights:
- 30 kt SSE and 1011 mb at 20.6N, 68.2W at 06Z (COADS).

3. Discussion:
- Reanalysis: As the tropical depression moved north of Hispaniola, the surface circulation became less organized and the last position is analyzed at 12Z on the 13th. Satellite imagery showed an area of convection but no signs of organization.

September 14:

1. Maps and old HURDAT:
- HWM analyzes a spot low pressure of 1012 mb at 22N, 75.2W at 12Z.
- Microfilm shows a tropical wave extending from 16N-29N and 78W-68W at 12Z.

2. Discussion:
- Reanalysis: The disturbance remained active with disorganized convection but showed no signs of regeneration.

September 15:

1. Maps and old HURDAT:
- HWM analyzes a tropical wave extending from 20N-30N, along 80W at 12Z.
- Microfilm shows a tropical wave extending from 20N-28N and 81W-77W at 12Z.

Sources: NHC microfilm maps, the Historical Weather Maps series, the COADS ship database, Monthly Weather Review, Mariners Weather Log, Satellite images from NCDC, and NHC Storm Wallets.

Green indicates wind changes of 15 kt or greater
Blue indicates lat/long changes greater than 1º
Red indicates a new entry
Yellow indicates a deletion

Tropical Depression [September 5-7, 1970] – AL111970

```
45240 09/05/1970 M= 3 11 SNBR= 966 UNNAMED       XING=0 SSS=0

45245 09/05*  0   0   0    0*  0   0   0    0*150 190  20    0*152 205  25    0*
45245 09/05*  0   0   0    0*  0   0   0    0*150 180  20    0*152 192  25    0*
                                                 ***              ***

45250 09/06*155 220  25    0*157 235  25    0*160 250  25    0*162 260  25    0*
45250 09/06*155 205  25    0*157 220  25    0*160 235  25    0*162 248  25    0*
                ***              ***              ***              ***

45255 09/07*165 270  25    0*167 280  25    0*170 290  20    0*175 300  20    0*
45255 09/07*165 260  25    0*167 270  25    0*170 280  20    0*175 290  20    0*
                ***              ***              ***              ***

45260 TD
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Significant Revisions:

1. Major eastward position changes analyzed between 18Z on September 4th and 18Z on the 5th based on synoptic data.

Daily Metadata:

September 4:

1. Maps and old HURDAT:
- HWM and microfilm show no features of interest at 12Z.
2. Discussion:
- Reanalysis: Satellite images showed convection associated with a tropical wave over the west coast of Africa.

September 5:

1. Maps and old HURDAT:
- HWM and microfilm show no features of interest at 12Z.
- HURDAT lists a 20 kt tropical depression at 15N, 19W at 12Z (first position).
2. Discussion:
- Reanalysis: The tropical wave moved westward and a 20 kt tropical depression is analyzed to have formed at 12Z on the 5th, same as originally shown in HURDAT. Satellite imagery showed a large area of convection between Africa and the Cabo Verde Islands, with some signs of organization. Synoptic observations suggested that a circulation, although weak and broad, was present; but it is possible that the system was not a tropical cyclone on this date. A peak intensity of 25 kt is analyzed starting at 18Z on the 5th, same as originally shown in HURDAT.

September 6:

1. Maps and old HURDAT:
- HWM analyzes a closed low pressure of at most 1012 mb at 14.5N, 24W at 12Z.
- HURDAT lists a 25 kt tropical depression at 16N, 25W at 12Z.

- Microfilm shows no features of interest at 12Z.

2. Discussion:

- Reanalysis: The tropical depression moved westward with no appreciable changes in intensity or organization. Satellite imagery showed a weak system with convection near or over the center.

September 7:

1. Maps and old HURDAT:

- HWM and microfilm show no features of interest at 12Z.
- HURDAT lists a 20 kt tropical depression at 17N, 29W at 12Z.

2. Discussion:

- Reanalysis: The weak tropical depression moved northward and remained poorly organized. Satellite imagery showed that the convective area was small and displaced to the northwest. The last position is analyzed at 18Z on the 7th, same as originally shown in HURDAT. Due to the very sparse data in this part of the Atlantic, the time of dissipation is quite uncertain. It is interesting to note that operationally it was not upgraded to a tropical depression based on the microfilm maps. Based on the data available, another viable option is to remove this system from HURDAT as a tropical cyclone.

September 8:

1. Maps and old HURDAT:

- HWM and microfilm show no features of interest at 12Z.

2. Discussion:

- Reanalysis: The remnants of the tropical depression continued to produce some disorganized convection as it moved across the central Atlantic but did not show any signs of regeneration.

Sources: NHC microfilm maps, the Historical Weather Maps series, the COADS ship database, Monthly Weather Review, Mariners Weather Log, Satellite images from NCDC, and NHC Storm Wallets.

Green indicates wind changes of 15 kt or greater
Blue indicates lat/long changes greater than 1º
Red indicates a new entry
Yellow indicates a deletion

Hurricane Ella [September 8 – 13, 1970] – AL121970

```
45895 09/08/1970 M= 6  6 SNBR= 984 ELLA        XING=0 SSS=0

45900 09/08*  0   0   0    0*  0   0   0    0*153 835  25    0*160 838  25    0*
45900 09/08*  0   0   0    0*  0   0   0    0*158 828  25 1009*162 831  25 1009*
                                              *** ***     **** *** ***     ****

45905 09/09*166 842  20    0*172 846  25    0*177 850  25    0*186 857  30 1010*
45905 09/09*166 835  25 1008*170 842  25 1007*176 849  25 1007*184 855  30    0*
                ***  ** **** *** ***     **** *** ***     **** *** ***     ****

45910 09/10*194 863  30    0*200 868  30    0*208 876  30    0*220 890  50  997*
45910 09/10*192 861  35 1005*200 868  40    0*208 876  35 1004*220 890  50  997*
            *** ***  ** ****          **                ** ****

45915 09/11*230 908  65  993*236 926  70    0*239 942  75    0*240 955  80  984*
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45915 09/11*230 908  65  993*236 926  65  994*239 942  70    0*240 955  75  984*
                                         ***                              **

45920 09/12*239 965  85  973*238 974 105  967*239 979 110  967*240 985  65    0*
45920 09/12*239 965  85  973*238 974 100  967*239 980  80    0*242 987  55    0*
                                     ***          *** ***  *** *** ***  **
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Addendum on September 12th at 10Z

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46883 09/12*239 977 110  962*

45925 09/13*239 996  40    0*2421005  40    0*  0   0   0    0*  0   0   0    0*
45925 09/13*246 993  35    0*2501000  25    0*  0   0   0    0*  0   0   0    0*
            *** ***  **      *******  **
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45930 HR

Tropical Storm Landfall

9/10 0930Z 20.5N 87.3W 40 kt SW of Puerto Aventuras, Mexico

Hurricane Landfall

9/12 1000Z 23.9N 97.7W 110 kt 962 mb N of La Pesca, Mexico

Significant Revisions:

1. Multiple central pressures added based on ship and aircraft observations
2. Tropical storm stage assessed 18 hour earlier
3. Tropical storm landfall introduced for Yucatan Peninsula
4. Major reduction to intensity at 12z on September 12

Daily Metadata:

September 7

1. Maps and old HURDAT:
   a. HWM analyzes a weak low near 12N 80W at 12z.
   b. Microfilm analyzes a low of at most 1010 mb embedded within a trough, centered near 12N 80W at 12z.

September 8:

1. Maps and old HURDAT:
   a. HWM depicts nothing of interest at 12z.
   b. Microfilm analyzes a broad low of at most 1010 mb centered near 13N 80.5W at 12z.
   c. HURDAT lists a 25 kt tropical depression at 15.3N 83.5W at 12z.
2. Ship highlights:
   a. 20 kt SE and 1011 mb at 16.4N 82.2W at 12Z (COADS).
3. Station highlights:
   a. 10 kt ESE and 1010 mb at Swan Island at 18Z. (Micro).
4. Discussion:
   a. MWR: "Ella resulted from a depression that formed initially on a sharp surface trough which extended from San Andres to southern Florida on September 8. The depression formed near Swan Island and headed northwestward, becoming a tropical storm in the Gulf of Mexico after crossing the northeast corner of the Yucatan Peninsula."
   b. Reanalysis: Satellite imagery indicates a large area of deep convection in the northwestern Caribbean Sea with some organized banding features. No change to Ella's formation as a tropical depression at 12Z.

September 9:

1. Maps and old HURDAT:
    a. HWM analyzes a low of 1006 mb at 17N 86W at 12z.
    b. Microfilm analyzes a tropical cyclone of at most 1008 mb near 17.5N 85.5W at 12z.
    c. HURDAT lists a 25 kt tropical depression at 17.7N 85.0W at 12z.
2. Ship highlights:
    a. 35 kt E and 1009 mb at 18.3N 84.2W at 06Z (COADS).
3. Station highlights:
    a. 5 kt ENE and 1009 mb at Swan Island at 00Z (Micro).
    b. 15 kt ESE and 1009 mb at Swan Island at 06Z (Micro).
    c. 20 kt SE and 1009 mb at Swan Island at 12Z (Micro).
4. Aircraft highlights:
    a. Triangulation center fix at 18.5N 84.6W at 17Z (SW).
5. Discussion:
    a. Reanalysis: Satellite imagery indicates a somewhat consolidated area of deep convection with some banding features. A ship reported 35 kt at 06Z, but based on its history and neighbors it looks significantly high biased. Aircraft reconnaissance late in the day found no low pressures or tropical storm force winds in association with the system, but did obtain a center fix for the tropical depression. No significant changes to HURDAT on this date.

September 10:

1. Maps and old HURDAT:
    a. HWM analyzes a tropical depression of at most 1008 mb at 21.0N 87.5W at 12z.
    b. Microfilm analyzes a tropical cyclone of at most 1008 mb near 20.6N 87.6W at 12z.
    c. HURDAT lists a 30 kt tropical depression at 20.8N 87.6W at 12z.
2. Ship highlights:
    a. 25 kt E and 1008 mb at 19.6N 85.6W at 01Z (Micro).
    b. 35 kt E at 21.5N 86.8W at 18Z (Micro).
    c. 30-35 kt SE and 1015 mb at 24.3N 86.7W at 18Z (Micro/COADS).
3. Station highlights
    a. 30 kt SE and 1007 mb at Cozumel, Mexico, at 12Z (Micro/HWM).
    b. 5 kt N and 1005 mb at Valladolid, Mexico, at 12Z (Micro).
4. Aircraft highlights:
    a. Radar center fix at 20.9N 87.5W at 1135Z (SW).
    b. Penetration center fix with 997 mb and 50 kt surface winds at 22.0N 89.0W at 1749Z (SW).
    c. Penetration center fix with 998 mb, a 20 nmi eye, and 55 kt surface winds at 22.5N 89.8W at 2110Z (SW).
5. Discussion:
    a. MWR: "From this point, with a central pressure of 997 mb (29.44 in) and 50-kt winds, the storm intensified and accelerated on a westward-curving track across the gulf in response to a warm, upper-level anticyclone over the system and a lower tropospheric ridge to the north."
    b. Reanalysis: Satellite imagery indicates an extensive area of deep convection somewhat skewed north of the center of the system but with increased organization of the banding features. A ship with 25 kt E and 1008 mb at 01Z suggests a central pressure of 1005 mb. This central pressure corresponds to a maximum wind of 37 kt from the south of 25N pressure-wind relationship and 36 kt from the intensifying subset. Based upon this, the system is upgraded to a tropical storm with 35 kt at 00Z. Assuming some continued development until landfall in the Yucatan of Mexico, the system is assessed to have reached 40 kt

by landfall at 0930Z southwest of Puerto Aventuras. At 12Z, Valladolid, Mexico reported 5 kt N and 1005 mb, suggesting a central pressure of 1004 mb. A central pressure of 1004 mb suggests maximum sustained winds of 39 kt from the S of 25N Brown et al. pressure-wind relationship. An intensity of 35 kt is analyzed at 12Z on the 10th as Ella crossed Yucatan, up from 30 kt originally in HURDAT, a minor intensity change. The system only clipped the northeastern corner of the Yucatan and was back over the water by 18Z. The tropical storm quickly began reintensifying over the Gulf of Mexico and a recon fix at 1749Z indicated 997 mb central pressure and 50 kt surface winds. This pressure suggests an intensity of 53 kt. 50 kt is retained in HURDAT at 18Z.

September 11:

1. Maps and old HURDAT:
   a. HWM analyzes a hurricane of at most 1000 mb at 24.2N 94.5W at 12z.
   b. Microfilm analyzes a hurricane of at most 1008 mb at 24.2N 94.2W at 12z.
   c. HURDAT lists a 75 kt hurricane at 23.9N 94.2W at 12z.
2. Aircraft highlights:
   a. Penetration center fix with 993 mb and a 20 nmi eye at 23.0N 91.0W at 0028Z (SW).
   b. Penetration center fix with 994 mb, 75 kt flight-level winds, and a 30 nmi eye at 23.5N 92.6W at 0615Z (SW).
   c. Penetration center fix with 984 mb, a 20 nmi eye, and 80 kt surface winds at 23.9N 95.5W at 1718Z (SW).
   d. Penetration center fix with 973 mb, a 25 nmi eye, and 70 kt surface winds at 24.0N 96.3W at 2318Z (SW).
3. Brownsville radar fixes (SW):
   a. 24.1N 95.6W with a 13 nmi eye at 1740Z
   b. 24.2N 95.6W with a 25 nmi eye at 1812Z
4. Discussion:
   a. Reanalysis: Ella continued to deepen and reached 984 mb by 1718Z with 80 kt estimated surface winds as observed by aircraft reconnaissance. This central pressure suggests an intensity of 72 kt from the south of 25N Brown et al. pressure-wind relationship. The 20 nmi eye suggest an RMW of 15 nmi, which is slightly smaller than 19 nmi from climatology of latitude and central pressure. The intensity at 18Z is assessed to be slightly less than that in HURDAT originally. (No satellite images were available.)

September 12:

1. Maps and old HURDAT:
   a. HWM analyzes a hurricane of at most 1000 mb at 24.0N 97.9W at 12z.
   b. Microfilm analyzes a hurricane of at most 1000 mb at 24.0N 97.7W at 12z.
   c. HURDAT lists a 110 kt hurricane at 23.9N 97.9W at 12z.
2. Station highlights:
   a. Peak gust of 130 kt (time unknown, presumed to be around landfall) in La Pesca, Mexico (MWR).
   b. Minimum pressure of 984 mb around 15z (exact time unknown) in Soto la Marina, Mexico (SWO).
3. Aircraft highlights:
   a. Penetration center fix with 972 mb, 55 kt flight-level winds, and a 20 nmi eye at 23.9N 96.7W at 0111Z (SW).

b. Penetration center fix with 967 mb and a 15x30 nmi eye at 23.8N 97.4W at 0610Z (SW).

4. Brownsville radar fixes (SW):
   a. 23.9N 96.5W with a 14 nmi eye at 0014Z
   b. 24.0N 97.2W with an 8 nmi eye at 0540Z
   c. 23.9N 97.3W at 0612Z
   d. 23.9N 97.7W with a 12 nmi eye at 0940Z
   e. 23.9N 97.9W with a 6 nmi eye at 1210Z
5. Discussion:
   a. MWR: "The hurricane decelerated to 7 kt on its approach to the coast as the ridge to the north eroded, while central pressure continued to decrease, falling to 967 mb (28.55 in) shortly before landfall with winds increasing to 80 kt. The center moved inland in the La Pesca-Soto la Marina area about daybreak on September 12. Details of the effects of Ella in Mexico are scarce, but a report of wind gusts to 130 kt at La Pesca was received."
   b. Reanalysis: Ella turned toward the west late on the 11th and continued this movement until landfall north of La Pesca, Mexico around 10Z. The hurricane continued to intensify and reached 967 mb central pressure about four hours before landfall. Given that the system was seen from the Brownsville radar to display a small eye until landfall a continued rate of deepening is assumed, suggesting a central pressure of 962 mb. This pressure indicates a maximum wind of 99 kt from the S of 25N and 100 kt from the intensifying S of 25N Brown et al. pressure-wind relationship. The eye diameters from aircraft and radar were somewhat noisy, but suggest an RMW of about 10 nmi. This is substantially smaller than climatology of 18 nmi for this latitude and central pressure. Intensity at landfall is analyzed to be 110 kt at 12Z, same as originally shown in HURDAT. Runs of the Kaplan-DeMaria inland wind decay model suggest an intensity of 84 kt at 12Z, 59 kt at 18Z, and 43 kt at 00Z on the 13th. However, given the very high terrain of mainland Mexico, Ella would have decayed faster than the model. The intensity is analyzed to be 80 kt at 12Z, 55 kt at 18Z, 35 kt at 00Z, and 25 kt at 06Z. These represent large reductions in HURDAT after landfall for 12Z on the 12th and 06Z on the 13th. (Note that no satellite picture was available on the 12th.)

September 13:

1. Maps and old HURDAT:
   a. HWM analyzes a low of 1006 mb near 23.5N 101W at 12z.
   b. Microfilm analyzes a low near 24N 100.5W at 12z.
2. Discussion:
   a. Continued quick weakening over the high terrain of Mexico occurred until dissipation at 06Z. No change is made to the dissipation. (Note that no satellite picture was available on the 13th.)

Date	Original HURDAT Central Pressure	Evidence	Changes
Sep 8 12Z		COADS: 20 kt SE and 1011 mb at 12Z	1009 mb

Sep 8 18Z		Swan Island: 10 kt ENE and 1010 mb at 18Z (Micro)	1009 mb
Sep 9 00Z		Swan Island: 5 kt ENE and 1008 mb at 00Z (Micro)	1008 mb
Sep 9 06Z		Swan Island: 15 kt ESE and 1009 mb at 06Z (Micro)	1007 mb
Sep 9 12Z		Swan Island: 20 kt SE and 1009 mb at 12Z (Micro)	1007 mb
Sep 9 18Z	1010 mb	Pressure was obtained from a triangulation fix rather than a center fix, value not representative of a central pressure.	Removed
Sep 10 00Z		Micro: 25 kt E and 1008 mb at 01Z	1005 mb
Sep 10 12Z		Valladolid, MX: 5 kt N and 1005 mb at 12Z Playa del Carmen, MX: 30 kt SE and 1007 mb at 12Z	1004 mb
Sep 10 18Z	997 mb	Penetration center fix: 997 mb around 1749Z	Retained
Sep 11 00Z	993 mb	Penetration center fix: 993 mb around 0028Z	Retained
Sep 11 06Z		Penetration center fix: 994 mb around 0615Z	994 mb
Sep 11 18Z	984 mb	Penetration center fix: 984 mb around 1718Z	Retained
Sep 12 00Z	973 mb	Penetration center fix: 973 mb around 2318Z on 11th	Retained
Sep 12 06Z	967 mb	Penetration center fix: 967 mb around 0610Z	Retained
Sep 12 12Z	967 mb	Value obtained from 0610Z center fix, value not representative of 12Z intensity	Removed

Sources: the NHC microfilm maps, the Historical Weather Maps series, the COADS ship database, Monthly Weather Review, Navy reconnaissance book, Mariners Weather Log, National Hurricane Research Project (NHRP), North Atlantic Tropical Cyclones, Local Climatological Data, Surface Weather Observations, Schwerdt et al. (1979), Ho et al. (1987) and Jarrell et al. (1992) and NHC Storm Wallets.

Green indicates wind changes of 15 kt or greater
Blue indicates lat/long changes greater than 1°
Red indicates a new entry
Yellow indicates a deletion

```
47020 09/12/1970 M= 6  7 SNBR=1002 FELICE      XING=1 SSS=0
47020 09/12/1970 M= 8  7 SNBR=1002 FELICE      XING=1 SSS=0
                     *

47025 09/12*255 775  25    0*254 778  25    0*254 780  25    0*253 783  25    0*
47025 09/12*254 775  25    0*254 777  25    0*254 780  25    0*253 783  25    0*
            ***                  ***

47030 09/13*253 785  25    0*252 791  25    0*250 800  25    0*249 810  30    0*
47030 09/13*253 785  25    0*252 791  25    0*250 800  25    0*248 810  30    0*
                                                               ***

47035 09/14*248 820  30 1011*249 830  30    0*253 840  30    0*258 852  30 1008*
47035 09/14*244 820  30 1011*242 830  30 1010*245 841  30    0*254 853  35 1008*
            ***              ***         **** *** ***          *** ***  **

47040 09/15*265 865  45 1006*272 884  50 1006*280 902  50 1003*288 922  55  998*
47040 09/15*264 866  45 1005*272 884  50 1000*280 902  55  998*287 922  60  990*
            *** ***     ****             ****              **** ***      **  ***

47045 09/16*294 941  60  997*299 955  40    0*306 965  30    0*314 971  30 1006*
47045 09/16*293 940  60  994*299 955  40    0*306 964  30    0*314 970  30 1003*
            *** ***      ***                      ***              ***     ****

47050 09/17*322 975  25    0*330 976  25    0*338 972  25    0*  0   0   0    0*
47050 09/17*322 975  30 1001*330 976  25    0*336 972  25    0*342 965  30    0*
                     ** ****                  ***              *** ***  **

(September 18th and 19th are new to HURDAT)
47055 09/18*347 957  30    0E350 945  25    0E352 933  25    0E353 923  20    0*
47055 09/19E355 913  20    0E355 904  15    0E358 898  15    0E362 892  15    0*

47060 TS
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U.S. Tropical Storm Landfall

09/16 02Z 29.5N 94.5W 60 kt TX - 994 mb

Significant Revisions:

1. Dissipation analyzed 30 hours later than originally shown in HURDAT based on synoptic data.

2. Several central pressure values revised based upon assessment of recon data.

Daily Metadata:

September 10:

1. Maps and old HURDAT:
- HWM does not analyze any features of interest at 12Z.
- Microfilm shows a trough over the western Atlantic extending to the Bahamas at 12Z.
2. Discussion:
- Reanalysis: A large area of convection was observed over the Bahamas on September 9th in association with a weakening trough and possibly due to its interaction with the northern portion of the tropical wave that developed into Hurricane Ella. The area of convection remained disorganized on the 10th and synoptic observations suggested that it did not have a closed circulation.

September 11:

1. Maps and old HURDAT:
- HWM analyzes a closed low pressure of at most 1016 mb at 27N, 76W at 12Z.
- Microfilm shows a tropical cyclone of at most 1016 mb at 27.7N, 76.5W at 12Z.

2. Discussion:

- MWR: "An upper level trough that lingered over the western Bahamas for several days spawned a tropical depression just north of Nassau on September 11."
- Reanalysis: Synoptic observations indicated that the disturbance remained disorganized and was still a trough at the surface. Satellite imagery showed disorganized convection just north of the Bahamas. Operationally, microfilm maps showed that it was upgraded to the 30th tropical depression of the season at 12Z on this date.

September 12:

1. Maps and old HURDAT:

- HWM analyzes a spot low at 24N, 77W at 12Z.
- HURDAT lists a 25 kt tropical depression at 25.4N, 78W at 12Z.
- Microfilm shows a closed low pressure of at most 1014 mb at 24.5N, 77.5W at 12Z.

2. Discussion:

- ATSR: "The cloud mass that was to become FELICE had its origin as an off-spin of Tropical Storm ELLA as it moved off the Yucatan Peninsula. The cloud mass formed over the Bahamas in connection with an old upper trough. The trough moved to the east; ELLA moved to the west, and left this residue disturbance. It lingered in the Bahamas, slowly gaining in intensity and organization."
- Reanalysis: Satellite imagery indicated that although the system still looked elongated SW-NE, the cloud pattern was better organized with some hints of banding features. At the surface, the system was still poorly organized, resembling a trough during most of the date. Nonetheless, there were some indications that a weak low-level circulation was present and the first position is analyzed at 00Z on the 12th as a 25 kt tropical depression, same as originally shown in HURDAT.

September 13:

1. Maps and old HURDAT:

- HWM analyzes a trough along 80W, from 22N-30N at 12Z.
- HURDAT lists a 25 kt tropical depression at 25N, 80W at 12Z.
- Microfilm shows a closed low pressure of at most 1012 mb at 25.5N, 79.5W at 12Z.

2. Discussion:

- MWR: "The depression drifted west-southwestward for the next 2 days, passing near Key West and spreading needed rains over southern Florida."
- ATSR: "It began to move slowly westward on 13 September."
- Reanalysis: The tropical depression moved westward passing through the Florida Keys. Synoptic observations continued to show a very weak circulation, at times resembling a trough. Nonetheless, satellite imagery suggested the tropical depression had become better organized with a large area of convection, especially to the northeast of the center, and some banding features.

September 14:

1. Maps and old HURDAT:

- HWM analyzes a spot low of 1012 mb at 23.5N, 83.5W at 12Z.
- HURDAT lists a 25 kt tropical depression at 25.4N, 84W at 12Z.
- Microfilm shows a tropical cyclone of at most 1012 mb at 25N, 84W at 12Z.

2. Aircraft highlights:

- Penetration center fix measured a central pressure of 1008 mb and estimated surface winds of 45 kt at 25.6N, 85.2W at 1748Z (WALLET).
- Penetration center fix measured a central pressure of 1005 mb and estimated surface winds of 80 kt at 26.3N, 86.3W at 2350Z (WALLET).

3. Discussion:

- MWR: "As the system turned west-northwestward in the Gulf, the central pressure fell slowly; and a poorly formed tropical storm developed on September 14."
- ATSR: "… and passed west of Key West early on the 14th. As it moved through the Florida Straits, it acquired organization and intensity, and the first tropical depression warning was issued at 141800Z. At the time of the first warning, a Navy reconnaissance aircraft was enroute to investigate the depression. At 141748Z, this aircraft reported a center located at 26.6N 85.2W with surface wind of 45 knots, and a minimum sea level pressure of 1008 mb. With the reconnaissance report confirming the indications of satellite photographs, the first tropical storm advisory on FELICE was issued at 141930Z. The storm moved on a reasonably constant course of west-northwest throughout its life cycle. The absence of a good inflow at low level and only marginal outflow at high level prevented FELICE from attaining hurricane intensity. Some gusty winds in excess of hurricane force were reported by reconnaissance aircraft in squalls under feeder bands early in the life cycle of FELICE."
- Reanalysis: The tropical depression entered the eastern portion of the Gulf of Mexico and synoptic observations suggested that the low-level circulation became better organized, especially late in the day. Satellite imagery also showed a large area of convection, especially over and to the northeast of the center, with some banding features. It is likely that it was not until this date that this tropical cyclone developed a well-defined low-level circulation. A reconnaissance aircraft investigated the center of this system measuring a central pressure of 1008 mb and estimating surface winds of 45 kt at 1748Z on the 14th. Taking into consideration the surface wind estimate, an intensity of 35 kt is analyzed at 18Z on the 14th, up 5 kt from originally shown in HURDAT, a minor intensity change.

September 15:

1. Maps and old HURDAT:

- HWM analyzes a tropical storm of at most 1012 mb at 28.3N, 90.6W at 12Z.
- HURDAT lists a 50 kt tropical storm at 28N, 90.2W at 12Z.
- Microfilm shows a tropical storm of at most 1010 mb at 28.2N, 90.4W at 12Z.

2. Ship highlights:

- 40 kt NE and 1012 mb at 27.5N, 87W at 00Z (COADS).
- 35 kt E and 1015 mb at 28.3N, 86.4W at 06Z (COADS).

3. Aircraft highlights:

- Penetration center fix measured a central pressure of 1006.5 mb (possibly missed the center) and estimated surface winds of 45 kt at 27.5N, 88.6W at 0637Z (WALLET). (A note was included on the fix: "EST to be 1000 since barometer high leaving Fla."). Thus central pressure of 1000 mb used.)
- Penetration center fix measured a central pressure of 1004 mb and estimated surface winds of 50 kt at 28.1N, 90.2W at 1155Z (WALLET). (Same comment as earlier fix, and central pressure of 998 mb used.)
- Penetration center fix measured a central pressure of 996 mb and estimated surface winds of 65 kt at 29N, 92.9W at 2040Z (WALLET). (There seems to be a lot of confusion over what the pressure was on the 2040Z 15 September fix. The actual vortex message in the Storm Wallet says 999 mb via dropsonde, and pre-vortex eye message said 1000 mb. However, the 700-mb height (3048 m) and

temperature (17C) extrapolates to a pressure of 990 mb using today's formulas. On the fix log, it states that the 700-mb height of 3048 m extrapolates to 996 mb. However, right above the fix, there is a hand-written note that says the pressure should have been 990 mb based on some late correction sent by the Air Force. Based upon all of this a 990 mb central pressure is assessed, though with only moderate confidence.)

4. Discussion:

- MWR: "Early on the 15th, with Felice under surveillance of the New Orleans radar, a new center appeared to form somewhat to the north of the previous track. Later examination of the radar films proved inconclusive in regard to this development, due to technical problems and also because of the ill-formed nature of the storm center. The storm appeared to become better organized as it was tracked south of the Louisiana coast by radars at New Orleans, Lake Charles, and Galveston. This was verified by reconnaissance data that yielded an extrapolated central pressure of 996 mb (29.41 in.) and estimated surface winds of 60 kt."
- ATSR: "The lack of inflow and poor outflow almost allowed FELICE to die as it approached 90W. The end results of this was the formation of a new center about 100 miles to the northwest of the decaying center early on 15 September."
- Reanalysis: Felice continued to increase in intensity and forward speed on this date. A reconnaissance aircraft measured a central pressure of 1005 mb and estimated surface winds of 80 kt at 2350Z on the 14th. A central pressure of 1005 mb suggests maximum surface winds of 34 kt from the north of 25N Brown et al. pressure-wind relationship. Based on a forward speed of about 15 kt, weighting some the surface wind estimate and a ship report of 40 kt at 00Z on the 15th, an intensity of 45 kt is analyzed at 00Z on the 15th, same as originally shown in HURDAT, a minor intensity change. The system steadily deepened for the data. The last penetration center fix on the 15th occurred at 2040Z and measured a corrected central pressure of 990 mb and estimated surface winds of 65 kt. A central pressure of 990 mb suggests maximum surface winds of 62 kt from the intensifying, north of 25N pressure-wind relationship. Based on a forward speed of about 19 kt, an intensity of 60 kt is analyzed at 18Z on the 15th, up from 55 kt originally shown in HURDAT, a minor intensity change. However, it is possible that Felice reached minimal hurricane intensity just before and at landfall in Texas. 60 kt is also the peak intensity of this tropical cyclone, same as originally shown in HURDAT at 00Z on the 16th. Satellite imagery showed a well-organized tropical cyclone with a large dense overcast and banding features.

September 16:

1. Maps and old HURDAT:

- HWM analyzes a closed low pressure of at most 1008 mb at 31N, 97W with a stationary front to the north at 12Z.
- HURDAT lists a 30 kt tropical depression at 30.6N, 96.5W at 12Z.
- Microfilm shows a tropical cyclone of at most 1008 mb at 30.7N, 96.6W at 12Z.

2. Aircraft highlights:

- Penetration center fix measured a central pressure of 994 mb and estimated surface winds of 70 kt at 29.3N, 93.9W at 0010Z (WALLET).

3. Land highlights:

- 40 kt ESE (gusts to 45 kt) at Sabine Pass, LA at 01Z (WALLET).
- 998 mb (minimum pressure) at High Island, TX at 0130Z (WALLET).
- 45 kt N (gusts to 50 kt) at High Island, TX at 02Z (WALLET).
- 37 kt W (gusts to 48 kt) at Galveston, TX at 0254Z (WALLET).
- 25 kt (gusts to 40 kt) and 1004 mb at Houston, TX at 0550Z (WALLET).

4. Discussion:

- MWR: "The center crossed the Texas coast at High Island where the pressure dropped to 998 mb (29.47 in.), and wind gusts of 60 kt were estimated. The highest measured sustained wind was 39 kt at Galveston. The storm weakened rapidly as it moved inland and passed close to Houston."
- ATSR: "FELICE made landfall about 25 miles northeast of Galveston at 160200Z."
- Reanalysis: A final penetration center fix at 0010Z on the 16th measured a central pressure of 994 mb and estimated surface winds of 70 kt. A central pressure of 994 mb suggests maximum surface winds of 53 kt from the north of 25N pressure-wind relationship. Based on a forward speed of about 16 kt, an intensity of 60 kt is analyzed at 00Z on the 17th, same as originally shown in HURDAT. The center of Felice made landfall in the upper Texas coast, near Gilchrist, around 02Z with maximum sustained winds of 60 kt. Maximum sustained winds of 45 kt were reported at High Inland and 37 kt at Galveston. After moving inland, the tropical cyclone slowed its forward speed and turned more to the north as a frontal boundary approached from the west. Weakening to a tropical depression is analyzed at 12Z on the 16th, same as originally shown in HURDAT. Satellite imagery showed a large area of organized convection over eastern Texas already well inland late in the day.

September 17:

1. Maps and old HURDAT:

- HWM analyzes a spot low of at most 1012 mb at 34N, 97W with a stationary front going through the center at 12Z.
- HURDAT lists a 25 kt tropical depression at 33.8N, 97.2W at 12Z (last position).
- Microfilm shows a closed low pressure of at most 1014 mb at 33.8N, 97.8W with a cold front going through the center at 12Z.

2. Station highlights:

- McAlester, OK – 1008 mb (pressure minimum) with NE 12 kt at 23Z with 1016 mb/E 6 kt at 16Z and 1015 mb/NW 10 kt at 05Z on the 18th (SWO).

3. Aircraft highlights:

- 40 kt at 10,000 ft flight-level between 18Z-00Z/18th (Jessup).

4. Discussion:

- MWR: "The remnants curved northward, passing near Waco, and dissipated in cooler air over Oklahoma on September 17."
- JESSUP: "Figure 1A shows well-defined spiral bands encircling the eye centered about 80 nmi southeast of Norman, Okla., as displayed by the NSSL (National Severe Storms Laboratory) WSR-57 (weather surveillance radar). Although tropical storms usually become disorganized shortly after moving over large landmasses, Felice retained a structure of well-defined bands while drifting across southeastern Oklahoma almost 400 nmi inland. Two aircraft were used to observe the cloud and wind patterns. The first aircraft departed Norman at about noon and traveled between precipitation bands as much as possible before entering the eye. Three hours later, an instrumented aircraft was flown directly from Norman toward the eye of the storm to collect temperature, moisture, rainfall rate, and raindrop-size data. Meteorologists aboard the two aircraft described the storm after their return to Norman. Although the second penetration occurred 3 hr after the first, their accounts were similar and provided the following picture. An altocumulus and cirrus overcast and a curving, banded stratus undercast characterized the region between spiral rain bands, while moderate to heavy rains were experienced within the bands. A single stroke of lightning was encountered during the aircraft penetrations;

radar indicated that precipitation extended to only 30,000 ft MSL. In the eye wall, moderate to heavy rain and light to moderate turbulence were experienced. Maximum wind speeds in this region were estimated to be 40 kt at 10,000 ft MSL, the flight level maintained by both aircraft. The maximum rainfall rate encountered was about 2 in./hr along the east side of the eye wall. In the eye, widely scattered light showers occurred with thin spots in the overcast. The ground was observed occasionally through the scattered to broken layer of banded and cyclonically curved low clouds. Felice was apparently still warm-core. Upper air data near the storm's center at 1800 CST on the previous day indicated that the storm was several degrees warmer than its environment up to 500 mb, and the aircraft penetration 21 hr later indicated that temperatures at 10,000 ft MSL average 2°C higher near the center than those at Norman. In Oklahoma, local rain amounts exceeded 4 inches; and maximum speeds of 40 to 50 kt occurred near the eye."

- Reanalysis: As Felice turned to the north and later northeast over northeastern Texas and eastern Oklahoma, the convection was maintained and increased. Radar and satellite images showed a well-organized tropical cyclone on this date and based on the April 1971 MWR article by Edward Jessup. Despite the appearance, in an examination of all 22 weather stations in Oklahoma none of them reported sustained winds higher than 20 kt. Only one station – McAlester – reported significantly lowered pressures with a minimum of 1008 mb at 23Z after being near 1016 mb a few hours earlier and later with a 150 degree wind shift. Peak flight level of 40 kt at 10,000 ft would suggest maximum surface winds of around 35 kt over the ocean. Over land, it is analyzed that the intensity did have a secondary peak of 30 kt at 18Z on the 17th and 00Z on the 18th. The original HURDAT indicated that the system dissipated at 12Z on the 17th, but observations clearly showed the system remained intact for more than one more day.

September 18:

1. Maps and old HURDAT:
- HWM analyzes a closed low pressure of 1012 mb at 35N, 94W with a stationary front extending to the northeast at 12Z.
- Microfilm shows a closed low pressure of at most 1016 mb at 34.5N, 93.7W with a cold front extending to the northeast at 12Z.
2. Discussion:
- Reanalysis: Felice gradually became embedded within the frontal system and transition to an extratropical cyclone is analyzed at 06Z on the 18th based on synoptic and satellite data. The system moved northeastward and synoptic observations early on the 19th suggested that the low-level circulation had weakened into a trough, thus the last position is analyzed at 18Z on the 18th, 30 hours later than originally shown in HURDAT.

September 19:

1. Maps and old HURDAT:
- HWM analyzes a closed low pressure of at most 1016 mb at 36N, 91W with a stationary front extending to the east at 12Z.
- Microfilm shows a closed low pressure of at most 1016 mb at 35.5N, 90.5W with a stationary front extending to the east at 12Z.

September 20:

1. Maps and old HURDAT:
- HWM and microfilm shows a frontal boundary over the eastern United States at 12Z.

Date	Original HURDAT Central Pressure	Evidence	Changes
Sep 14 00Z	1011 mb	Ship: 10 kt SE and 1012 mb at 24.7N, 80.5W at 00Z	Retained
Sep 14 06Z		Ship: 15 kt ENE and 1012 mb at 24.4N, 83.5W at 06Z	1010 mb
Sep 14 18Z	1008 mb	Penetration center fix: 1008 mb at 1748Z	Retained
Sep 15 00Z	1006 mb	Penetration center fix: 1005 mb at 2350Z on Sep 14th	1005 mb
Sep 15 06Z	1006 mb	Penetration center fix: Corrected to 1000 mb at 0637Z	1000 mb
Sep 15 12Z	1003 mb	Penetration center fix: Corrected to 998 mb at 1155Z	998 mb
Sep 15 18Z	998 mb	Penetration center fix: Corrected to 990 mb at 2040Z	990 mb
Sep 16 00Z	997 mb	Penetration center fix: 994 mb at 0010Z	994 mb
Sep 16 18Z	1006 mb	Land: 16 kt N and 1007 mb at Waco, TX at 1755Z	1003 mb
Sep 17 00Z		Land: 6 kt E and 1003 mb at Dempsey Heliport, TX at 2355Z on Sep 16th	1001 mb

Sources: NHC microfilm maps, the Historical Weather Maps series, the COADS ship database, Monthly Weather Review, Navy reconnaissance book, Mariners Weather Log, EV2 Surface Weather Observations, Satellite images from NCDC, NHC Storm Wallets, and Jessup (MWR, 1971).

Green indicates wind changes of 15 kt or greater
Blue indicates lat/long changes greater than 1°
Red indicates a new entry
Yellow indicates a deletion

Tropical Depression [September 22-25, 1970] – AL141970

```
45240 09/22/1970 M= 4 14 SNBR= 966 UNNAMED       XING=0 SSS=0

45245 09/22*  0   0   0    0*  0   0   0    0*155 210  20    0*160 213  25    0*
45250 09/23*165 217  25    0*170 221  25    0*175 225  25    0*183 233  25    0*
45255 09/24*192 242  25    0*201 251  25    0*210 260  25    0*217 270  25    0*
45260 09/25*225 280  25    0*232 290  25    0*240 300  20    0*248 310  20    0*
45260 09/25*225 280  25    0L233 290  25    0L240 300  20    0L248 310  20    0*

45265 TD
```

Significant Revisions:

1. Analyzed to have been a remnant low pressure between 06Z and 18Z on September 25th based on satellite imagery.

Daily Metadata:

September 21:

1. Maps and old HURDAT:

- HWM analyzes no features of interest at 12Z.
- Microfilm shows a closed low pressure of at most 11N, 21W at 12Z.

2. Discussion:

- Reanalysis: Satellite images indicated that the tropical wave that was over western Africa on September 20th reached the easternmost portion of the Atlantic on the 21st. The wave was accompanied by an increase of convection but synoptic observations indicated that it did not have a closed low-level circulation.

September 22:

1. Maps and old HURDAT:

- HWM and microfilm show no features of interest at 12Z.
- HURDAT lists a 20 kt tropical depression at 15.5N, 21W at 12Z (first position).

2. Discussion:

- Reanalysis: The system moved slowly northwestward and became better organized. The first position is analyzed at 12Z on the 22nd based on synoptic observations as a 25 kt tropical depression, same as originally shown in HURDAT but 5 kt stronger, a minor intensity change. 25 kt is also the peak intensity of this tropical depression, same as originally shown in HURDAT. The ship and coastal data was sparse but it suggested that the system might not have been a tropical depression on this date, but a sharp tropical wave. Nonetheless, the data is inconclusive and the system is retained. It is interesting to note that operationally this system was not upgraded to a tropical depression based on the microfilm maps. On satellite imagery, the cloud pattern became better defined on the 22nd with deep convection near the center and some banding features.

September 23:

1. Maps and old HURDAT:

- HWM analyzes a tropical wave along 29W, extending from 12N-22N at 12Z.
- HURDAT lists a 25 kt tropical depression at 17.5N, 22.5W at 12Z.
- Microfilm a closed low pressure of at most 1010 mb at 8.5N, 25.5W at 12Z.

2. Discussion:

- Reanalysis: The weak tropical depression continued northwestward and became disorganized on satellite imagery. Synoptic observations indicated that the surface circulation remained poorly organized.

September 24:

1. Maps and old HURDAT:

- HWM analyzes no features of interest at 12Z.
- HURDAT lists a 25 kt tropical depression at 21N, 26W at 12Z.
- Microfilm shows a tropical wave along 30W, extending from 10N-22N at 12Z.

2. Discussion:

- Reanalysis: The tropical depression moved north of the Cabo Verde Islands and remained weak.

September 25:

1. Maps and old HURDAT:

- HWM and microfilm analyze no features of interest at 12Z.
- HURDAT lists a 25 kt tropical depression at 24N, 30W at 12Z.

2. Discussion:

- Reanalysis: Synoptic observations were sparse on the 25th and satellite imagery showed that most of the convective activity had dissipated. Thus, it is analyzed that it weakened into a remnant low at 06Z on the 25th. Dissipation is analyzed after 18Z on the 25th, same as originally shown in HURDAT. Time of dissipation is uncertain due to the lack of data near the system on the 25th and 26th.

September 26:

1. Maps and old HURDAT:

- HWM and microfilm analyze no features of interest at 12Z.

2. Discussion:

- Reanalysis: Satellite imagery indicated that the convective activity had dissipated and the system did not show any signs of regeneration.

Sources: NHC microfilm maps, the Historical Weather Maps series, the COADS ship database, Monthly Weather Review, Mariners Weather Log, Satellite images from NCDC, and NHC Storm Wallets.

Green indicates wind changes of 15 kt or greater
Blue indicates lat/long changes greater than 1º
Red indicates a new entry
Yellow indicates a deletion

Unnamed Hurricane [September 30 – October 20, 1970] – AL151970

```
00000 09/23/1970 M=19 15 SNBR= XXX NOT NAMED   XING=0 SSS=0
00000 09/30/1970 M=23 15 SNBR= XXX NOT NAMED   XING=0 SSS=0
         **        **

(The 23rd through 29th are removed from HURDAT)
00000 09/23*  0   0   0    0*  0   0   0    0* 90 150  20    0* 90 165  20    0*
00000 09/24* 90 180  25    0* 90 195  25    0* 90 210  25    0* 92 228  25    0*
00000 09/25* 95 245  30    0* 98 262  30    0*100 280  30    0*102 295  30    0*
00000 09/26*105 310  30    0*108 325  30    0*110 340  30    0*110 358  30    0*
00000 09/27*110 375  30    0*110 392  30    0*110 410  30    0*111 428  30    0*
00000 09/28*112 447  30    0*113 466  30    0*115 485  30    0*118 501  30    0*
00000 09/29*122 517  30    0*126 534  30    0*130 550  30    0*131 558  30    0*

00000 09/30*132 567  30    0*133 576  30    0*135 585  30    0*136 591  30    0*
00000 09/30*  0   0   0    0*  0   0   0    0*150 545  40 1001*146 557  40 1001*
            *** ***  **      *** ***  **      *** ***  ** **** *** ***  ** ****

00000 10/01*137 597  30    0*138 602  30    0*140 610  30    0*140 616  30    0*
00000 10/01*142 568  35 1004*139 579  35 1002*138 589  35    0*138 596  35 1004*
            *** ***  **      *** ***  ** **** *** ***  **      *** ***  ** ****

00000 10/02*140 622  30    0*140 628  30    0*140 635  30    0*140 642  30    0*
00000 10/02*139 600  40 1000*140 602  40  999*137 608  40  999*134 615  40    0*
            *** ***  ** ****     ***  **  *** *** ***  **  *** *** ***  **

00000 10/03*140 650  30    0*140 658  30    0*140 665  30    0*141 671  30    0*
00000 10/03*132 622  35    0*133 629  35 1005*136 637  35 1003*137 646  35 1004*
            *** ***  **      *** ***  ** **** *** ***  ** **** *** ***  ** ****

00000 10/04*142 677  30    0*143 682  30    0*145 690  30    0*146 690  30    0*
00000 10/04D137 654  30    0D137 662  30    0D137 670  30    0D138 678  30    0*
           **** ***         **** ***         **** ***         **** ***
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```
00000 10/05*147 690  30    0*148 690  30    0*150 700  30    0*153 702  30    0*
00000 10/05*140 685  30    0*142 690  30    0*145 694  35    0*149 697  35 1004*
            *** ***          ***              *** ***  **      *** ***  ** ****

00000 10/06*157 703  30    0*161 704  30    0*165 705  30    0*166 705  30    0*
00000 10/06*153 699  35 1004*156 700  35    0*158 700  35 1005*157 702  35 1004*
            *** ***  ** **** *** ***  **      *** ***  ** **** *** ***  ** ****

00000 10/07*167 705  30    0*168 705  30    0*170 705  30    0*176 704  30    0*
00000 10/07*156 701  35 1000*153 700  35 1002*154 705  30 1003*161 708  30 1004*
            *** ***  ** **** *** ***  ** **** ***          **** *** ***     ****

00000 10/08*182 703  25    0*188 702  25    0*195 700  25    0*204 695  25    0*
00000 10/08*169 709  30 1004*178 708  30    0*188 706  25    0*197 702  25    0*
            *** ***  ** **** *** ***  **      *** ***          *** ***

00000 10/09*213 690  25    0*221 685  25    0*230 680  25    0*236 664  25    0*
00000 10/09*205 694  25    0*212 684  25    0*220 673  30    0*230 661  30    0*
            *** ***          *** ***          *** ***  **      *** ***  **

00000 10/10*242 648  25    0*248 632  25    0*255 615  25    0*257 599  20    0*
00000 10/10*241 648  30    0*253 632  35    0*265 616  40 1000*274 601  40    0*
            ***      **      ***      **      *** ***  ** **** *** ***  **

00000 10/11*260 580  20    0*263 563  20    0*265 545  20    0*  0   0   0    0*
00000 10/11*275 577  40    0D275 550  35    0D274 520  30    0D273 492  30    0*
            *** ***  **      *** ***  **      **** ***  **      **** ***  **

(The 12th through 22nd are new to HURDAT)
00000 10/12D272 465  30    0D272 440  30    0D274 415  30    0E278 392  30    0*
00000 10/13E283 370  30    0E288 350  35    0E294 330  35    0E302 310  35    0*
00000 10/14E313 288  35    0E326 266  35    0E335 251  40    0E341 239  40    0*
00000 10/15E345 229  40    0E349 221  40    0S352 214  45    0S356 207  45  997*
00000 10/16S360 203  45  998S365 200  45    0S367 202  45  997S370 212  50    0*
00000 10/17*371 227  60  992*367 243  65  989*362 258  65    0*358 275  70    0*
00000 10/18*355 292  70    0*354 307  70    0*354 321  75    0*356 333  75    0*
00000 10/19*360 343  75    0*365 351  75    0*372 359  75    0*380 367  75    0*
00000 10/20*388 374  70    0*398 380  65    0*407 385  60    0*417 388  55    0*
00000 10/21E428 390  50    0E443 388  50    0E465 380  50    0E495 360  45    0*
00000 10/22E525 335  40    0E555 310  40    0*  0   0   0    0*  0   0   0    0*

00000 TD
00000 HR
      **
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Significant Revisions:

1. Genesis delayed by 6.5 days; track extended by 11 days, including regeneration as a hurricane near the Azores
2. System reclassified as a tropical storm during its initial phase near and within the Caribbean based on reconnaissance and ship data
3. Major track revisions for September 30 – October 4, and 7-9
4. Disturbance period added on October 4
5. Multiple central pressures added based on reconnaissance and ship data (see table at end of document)
6. Major intensity changes on October 10 and 11

Daily Metadata:

September 23:

1. Maps:
   - HURDAT lists a 20 kt tropical depression at 9.0N 15.0W at 12Z.
   - HWM depicts nothing of interest

- Microfilm depicts nothing of interest

2. Ship highlights:
   - No gales or low pressures.
3. Discussion:
   - MWR: "From the standpoint of damage, by far the most significant [non-developing tropical depression] was the depression that brought record-breaking floods to Puerto Rico and adjacent islands in October. During the 6 days when this depression wandered aimlessly over the eastern Caribbean, a deluge of more than 30 in. of rain wrought havoc in Puerto Rico, accounting for 18 deaths, 34 missing, and property damage estimated at $65 million (in the U.S. Virgin Islands, one person was killed). The highest rainfall total for the 6 days was 38.4 in. in the Jayuya area, with some 24-hr totals ranging up to 17 in. The rainfall for the event exceeded any known previous record including the 1899 and 1928 hurricanes…The depression formed over Africa and passed off the coast about 300 nmi south of Dakar on September 23. As the system approached the Antilles Islands, residents were alerted to the possibility of tropical storm formation, even though the presence of an upper troposphere trough in the eastern Caribbean did not favor significant intensification."
   - Reanalysis: Surface observations and satellite imagery depict the emergence of a tropical wave off the western coast of Africa by 12Z on September 24. No semblance of a surface circulation can be identified from September 23 to 29, and this period is removed from HURDAT accordingly with the system being assessed as a tropical wave. For unknown reasons, HURDAT is consistently 5 degrees west of where surface observations indicate the wave axis to be. This westward bias in the original HURDAT persists for a large portion of the storm's history.

September 24:

1. Maps:
   - HURDAT lists a 25 kt tropical depression at 9.0N 21.0W at 12Z.
   - HWM depicts nothing of interest
   - Microfilm depicts nothing of interest
2. Ship highlights:
   - No gales or low pressures.
3. Discussion:
   - Reanalysis: Refer to September 23

September 25:

1. Maps:
   - HURDAT lists a 30 kt tropical depression at 10.0N 28.0W at 12Z.
   - HWM depicts nothing of interest
   - Microfilm analyzes a trough extending toward Africa along 10N 25W at 12Z.
2. Ship highlights:
   - No gales or low pressures
3. Discussion:
   - Reanalysis: Refer to September 23

September 26:

1. Maps:
   - HURDAT lists a 30 kt tropical depression at 11.0N 34.0W at 12Z.
   - HWM depicts nothing of interest
   - Microfilm analyzes an area of disturbed weather around 10N 30W at 12Z.
2. Ship highlights:

- No gales or low pressures.

3. Discussion:
   - Reanalysis: Refer to September 23

September 27:

1. Maps:
   - HURDAT lists a 30 kt tropical depression at 11.0N 41.0W at 12Z.
   - HWM depicts nothing of interest
   - Microfilm analyzes a trough along 10N in the eastern Atlantic around 35W at 12Z.
2. Ship highlights:
   - No gales or low pressures.
3. Discussion:
   - Reanalysis: Refer to September 23

September 28:

1. Maps:
   - HURDAT lists a 30 kt tropical depression at 11.5N 48.5W at 12Z.
   - HWM depicts nothing of interest
   - Microfilm analyzes an area of disturbed weather around 15N 40W at 12Z.
2. Ship highlights:
   - No gales or low pressures.
3. Aircraft highlights:
   - A reconnaissance mission around 18Z did not find a closed circulation; however, the entire mission plot is unavailable at the time of reanalysis (Micro).
4. Discussion:
   - Reanalysis: Sparse data precludes proper assessment of the system on September 28; however, satellite imagery at 1501Z from ATS-3 depicts an increasingly organized system with somewhat organized convection accompanying the wave with a potential center near 14N 43W. Reconnaissance data around 18Z shows no indication of a center near this location, thus the system is assessed as a tropical wave.

September 29:

1. Maps:
   - HURDAT lists a 30 kt tropical depression at 13.0N 55.0W at 12Z.
   - HWM depicts nothing of interest
   - Microfilm analyzes a tropical wave extending from 10N 49.5W north to 16.5N 47.5W at 12Z.
2. Ship highlights:
   - No gales or low pressures.
3. Discussion:
   - Reanalysis: Aircraft and ship observations on September 29 reveal the wave becoming more organized; however, a closed low is not present on this day. Peak winds of 30 kt were observed well to the north of the lowest pressures.

September 30:

1. Maps:
   - HURDAT lists a 30 kt tropical depression at 13.5N 58.5W at 12Z.
   - HWM analyzes a tropical depression of 1006 mb at 13N 65W at 12Z.
   - Microfilm analyzes a tropical cyclone of at most 1010 mb at 13.5N 55W at 12Z.
2. Ship highlights:

- 35 kt E and 1011 mb at 17.6N 55.5W at 12Z (COADS).
- 35 kt SE and 1004 mb at 16.8N 54.2W at 12Z (Micro).
- 20 kt SE and 1003 mb at 15.5N 55.3W at 18Z (Micro).
- 35 kt ENE and 1010 mb at 17.2N 54.5W at 18Z (Micro).

3. Aircraft highlights:
   - A reconnaissance mission took place around 12Z; however, it is unknown if a center fix was made as a full mission plot is not available at the time of reanalysis (Micro).
4. Discussion:
   - ATSR: "Tropical Depression FOURTEEN was initially detected early on 30 September about 300 miles east of Barbados. The depression moved westward and entered the Caribbean just south of Martinique on 2 October, with gusts of fifty knots being reported on the island. The westward movement through the Caribbean continued until the depression reached 70W on 5 October with numerous reconnaissance aircraft report of winds in excess of 40 knots. The depression stalled in the vicinity of 15N 70W for approximately 48 hours, then eventually moved north across the eastern half of the Dominican Republic late on 8 October. From there, it moved rapidly northeastward and merged with a frontal system and lost its tropical characteristics."
   - Reanalysis: A reconnaissance mission around 12Z on September 30 revealed southwesterly winds to have developed along the south side of the wave, indicating genesis as a tropical cyclone. Two ships observed 35 kt easterly winds to the north of the center at this time, and an extrapolated central pressure of 1001 mb suggests maximum sustained winds of 46 kt south of 25N from the Brown et. al pressure wind relationship. Environmental pressures at the time were slightly below average, with an OCI of 1011 mb. Based on a blend of these data, the intensity at genesis is assessed at 40 kt. This is a 6.5-day delay in genesis from the original HURDAT.

October 1:

1. Maps:
   - HURDAT lists a 30 kt tropical depression at 14.0N 61.0W at 12Z.
   - HWM analyzes a low of at most 1008 mb near 14N 59W at 12Z.
   - Microfilm analyzes a tropical cyclone of at most 1008 mb at 13.5N 59W at 12Z.
2. Aircraft highlights:
   - Penetration center fix with estimated surface winds of 45 kt and a measured pressure of 1006 mb at 13.6N 59.6 at 2055Z (SW).
3. Ship highlights:
   - 20 kt ESE and 1006 mb at 14.6N 57.1W at 00Z (Micro).
   - 5 kt NW and 1003 mb at 14.0N 59.2W at 06Z (COADS).
4. Station highlights:
   - 5 kt NW and 1007 mb at Barbados at 12Z (Micro).
   - 10 kt NE and 1005 mb at Martinique at 18Z (Micro).
   - Calm and 1005 mb at Barbados at 18Z (Micro).
   - 10 kt W and 1005 mb at Grenada at 18Z (Micro).
5. Discussion:
   - MWR: "The depression moved through the Antilles with winds and pressure hovering near the required values for a tropical storm."
   - Reanalysis: Tracking slowly west-southwest, the tropical storm brought unsettled weather to the Windward Islands. Aircraft and surface observations indicate that the system weakened slightly with central pressures rising to 1004 mb before remaining largely steady state. A

central pressure of 1004 mb suggests maximum sustained winds of 39 kt south of 25N from the Brown et al. pressure-wind relationship. Accounting for deceleration of the storm and below-average environmental pressures, an intensity of 35 kt is chosen for all periods on October 1. The storm made its closest approach to Barbados around 18Z, passing between 25 and 30 nmi to the north.

October 2:

1. Maps:
   - HURDAT lists a 30 kt tropical depression at 14.0N 63.5W at 12Z.
   - HWM analyzes a low of at most 1004 mb at 13.5N 61W at 12Z.
   - Microfilm analyzes a tropical cyclone of at most 1004 mb at 15N 60.6W at 12Z.
2. Aircraft highlights:
   - Penetration center fix with a measured pressure of 999 mb at 14.0N 60.2W at 0610Z (SW).
   - Penetration center fix with estimated surface winds of 40 kt and a measured pressure of 1008 mb at 13.7N 60.6W at 11Z (SW).
   - Penetration center fix with a measured pressure of 999 mb at 13.8N 60.7W at 12Z (SW).
3. Ship highlights:
   - 10 kt NNW and 1001 mb at 12.7N 60.5W at 00Z (COADS).
   - 35 kt ESE and 1007 mb at 14.1N 59.7W at 06Z (COADS).
   - 35 kt ESE and 1006 mb at 14.0N 60.3W at 09Z (COADS).
4. Station highlights:
   - 15 kt N and 1004 mb at St. Lucia at 06Z (MWR/Micro).
5. Discussion:
   - MWR: “The center passed over St. Lucia Island where a minimum pressure of 1004 mb was recorded. Under the influence of the upper trough, the depression slowed down, and a rain shield spread northeastward over the Leeward Islands, the Virgin Islands, and Puerto Rico, with the heaviest amounts concentrated in the vicinity of Puerto Rico.”
   - Reanalysis: The slow-moving storm entered the Caribbean Sea on October 2 while just barely avoiding landfall. Analysis of surface observations and aircraft fixes indicate the system skirted just south of St. Lucia shortly after 12Z and northwest of Saint Vincent near 18Z. Aircraft observations returned a central pressure of 999 mb at 0610Z and 11Z. A central pressure of 999 mb suggests maximum sustained winds of 49 kt south of 25N from the Brown et. al pressure-wind relationship. Environmental pressures continued to decrease, and an OCI of 1007 mb is approximated at 06Z. Given the continued slow forward speed and low environmental pressures, an intensity of 40 kt is chosen for all periods on October 2.

October 3:

1. Maps:
   - HURDAT lists a 30 kt tropical depression at 14.0N 66.5W at 12Z.
   - HWM analyzes a low of at most 1008 mb near 13N 64W at 12Z.
   - Microfilm analyzes a tropical cyclone of 1003 mb at 13.7N 61.7W at 12Z.
2. Aircraft highlights:
   - Penetration center fix with estimated surface winds of 30 kt and a measured pressure of 1003 mb at 13.7N 63.7W at 12Z (SW).
   - Penetration center fix with estimated surface winds of 50 kt and a measured pressure of 1004 mb at 13.7N 64.6W at 1730Z (SW).
3. Ship highlights:

- 10 kt WSW and 1006 mb at 12.7N 63.2W at 06Z (COADS).

4. Discussion:
   - Reanalysis: Weakening took place on October 3 as the system continued to trudge west in the eastern Caribbean Sea. Aircraft and surface observations show generally rising central pressures and decreasing winds. It is possible that the system weakened to tropical depression status on this day, with no ships observing strong winds; however, given inconsistent data from reconnaissance and values from the pressure-wind relationship, winds are estimated at 35 kt for all periods on October 3.

October 4:

1. Maps:
   - HURDAT lists a 30 kt tropical depression at 14.5N 69.0W at 12Z.
   - HWM analyzes a low of at most 1008 mb near 14.5N 70W at 12Z.
   - Microfilm analyzes a tropical cyclone of at most 1008 mb at 13.5N 65.5W at 12Z.
2. Aircraft highlights:
   - Reconnaissance mission around 12Z was unable to fix a circulation center (micro).
3. Ship highlights:
   - No gales or low pressures.
4. Discussion:
   - Reanalysis: An apparent increase in wind shear prompted additional weakening of the cyclone and no circulation center could be identified by 00Z on October 4. Only weak winds are present in the vicinity of the system's center, with easterly observations south of where a closed center would be. Accordingly, the system is reclassified as a disturbance from 00Z to 18Z on this day, and winds are reduced to 30 kt for all periods. A reconnaissance mission around 12Z provides the strongest evidence for this degeneration, with a trough axis readily apparent along 67W.

October 5:

1. Maps:
   - HURDAT lists a 30 kt tropical depression at 15.0N 70.0W at 12Z.
   - HWM analyzes a low of at most 1008 mb near 14.5N 71W at 12Z.
   - Microfilm analyzes a tropical cyclone of at most 1006 mb at 15N 69W at 12Z.
2. Aircraft highlights:
   - Penetration center fix with estimated surface winds of 50 kt and a measured pressure of 1004 mb at 14.9N 69.7W at 2222Z (SW).
3. Ship highlights:
   - 10 kt SW and 1005 mb at 13.7N 69.6W at 18Z (COADS).
4. Discussion:
   - Reanalysis: Regeneration into a tropical depression is estimated by 00Z on October 5, with a shift to westerly winds south of the circulation center. The strongest winds remained displaced well north of the center and partially influenced by a tighter pressure gradient from a ridge over the central Atlantic. Although multiple ships sailed near the storm's center around 06Z and 12Z, the pressure observations are conflicting. As such, no central pressures could be added for these periods. Reconnaissance continued operations into the system late on October 5, and reported a stronger system with estimated surface winds of 50 kt. This appears to be slightly inflated when compared with nearby ship observations. A central pressure of 1004 mb suggests maximum sustained

winds of 39 kt south of 25N from the Brown et al. pressure-wind relationship. Using a blend of surface observations, ship observations, the pressure-wind relationship, the storm's slow movement, and low-environmental pressures, winds are assessed at 35 kt for 12Z and 18Z on this day.

October 6:

1. Maps:
   - HURDAT lists a 30 kt tropical depression at 16.5N 70.5W at 12Z.
   - HWM analyzes an open low centered near 15.5N 70W at 12Z.
   - Microfilm analyzes a tropical cyclone of at most 1006 mb at 15.5N 70W at 12Z.
2. Aircraft highlights:
   - Penetration center fix with estimated surface winds of 40 kt and a measured pressure of 1005 mb at 16.2N 69.9W at 1309Z (SW).
   - Penetration center fix with estimated surface winds of 50 kt and a measured pressure of 1005 mb at 15.9N 70.1W at 15Z (SW).
   - Penetration center fix with estimated surface winds of 40 kt and a measured pressure of 1004 mb at 15.8N 70.2W at 1623Z (SW).
   - Penetration center fix with estimated surface winds of 25 kt and a measured pressure of 1004 mb at 15.8N 70.3W at 1730Z (SW).
3. Ship highlights:
   - 25 kt NNE and 1002 mb at 16.1N 70.7W at 18Z (COADS).
4. Discussion:
   - Reanalysis: The storm became virtually stationary on October 6 to the south of Hispaniola. No change in intensity was observed on this day, with the system retaining winds around 35 kt. Reasoning for the 35 kt intensity remains unchanged from October 5.

October 7:

1. Maps:
   - HURDAT lists a 30 kt tropical depression at 17.0N 70.5W at 12Z.
   - HWM analyzes a low of at most 1004 mb near 16N 70W at 12Z.
   - Microfilm analyzes a tropical cyclone of at most 1004 mb at 15.7N 70.6W at 12Z.
2. Aircraft highlights:
   - Penetration center fix with estimated surface winds of 35 kt and a measured pressure of 1003 mb at 15.2N 70.8W at 1230Z (SW).
   - Penetration center fix with estimated surface winds of 35 kt and a measured pressure of 1004 mb at 16.2N 70.8W at 1730Z (SW).
3. Ship highlights:
   - 25 kt ESE and 1002 mb at 16.3N 70.4W at 00Z (COADS).
   - 15 kt ESE and 1003 mb at 16.8N 69.6W at 00Z (COADS).
   - 25 kt ESE and 1005 mb at 16.0N 69.0W at 06Z (COADS).
   - 20 kt E and 1005 mb at 16.6N 69.5W at 12Z (COADS).
   - 20 kt E and 1005 mb at 17.4N 70.4W at 18Z (COADS).
   - 20 kt NE and 1004 mb at 17.3N 71.6W at 21Z (COADS).
4. Discussion:
   - Reanalysis: An abrupt decrease of environmental pressures appears to have taken place around 00Z on October 7. Multiple ships in the vicinity of the storm reported pressures below 1005 mb, including one observation of 25 kt and 1002 mb at 00Z. This yields an approximate central pressure of 1000 mb. A central pressure of 1000 mb suggests maximum sustained winds of 47 kt south of 25N from the Brown et al. pressure-wind relationship. Accounting for the storm's slow movement, very low environmental

pressures, and nearby surface observations, winds are only assessed at 35 kt for 00Z. The system finally began moving north, though still at a sluggish pace, and its central pressure rose. In accordance with the rising pressures, weakening to tropical depression status is assessed at 12Z.

October 8:

1. Maps:
   - HURDAT lists a 25 kt tropical depression at 19.5N 70.0W at 12Z.
   - HWM analyzes a tropical depression near 17N 70.5 at 12Z
   - Microfilm analyzes a tropical cyclone of at most 1006 mb near 16N 71W at 12Z.
2. Ship highlights:
   - 10 kt SE and 1005 mb at 17.5N 70.2W at 00Z (COADS).
3. Discussion:
   - MWR: "The depression finally responded to the influence of upper westerlies on October 8 and accelerated toward the northeast."
   - Reanalysis: As the depression approached Hispaniola, it became increasingly disheveled. Interaction with the mountainous terrain made finding the surface circulation difficult; however, it is estimated to have made landfall around 10Z near Estebania, Dominican Republic, with winds of 30 kt. The circulation emerged over the Atlantic around 18Z, with a center identifiable just north of the Dominican Republic. Some weakening to 25 kt is assessed based on land interaction and surrounding ship observations.

October 9:

1. Maps:
   - HURDAT lists a 25 kt tropical depression at 23.0N 68.0W at 12Z.
   - HWM analyzes a low of at most 1008 mb near 22N 69W at 12Z.
   - Microfilm analyzes a tropical cyclone of at most 1008 mb near 21.5N 68W at 12Z.
2. Ship highlights:
   - No gales or low pressures.
3. Discussion:
   - Reanalysis: Interaction with a trough to the northeast caused the system to accelerate in that direction. Little change in intensity took place on this day as the system became drastically enlarged. Several ships observed winds of 25 to 30 kt at 12Z and 18Z, and winds for these periods are assessed at 30 kt accordingly.

October 10:

1. Maps:
   - HURDAT lists a 25 kt tropical depression at 25.5N 61.5W at 12Z.
   - HWM analyzes a low of at most 1008 mb near 27N 61W at 12Z.
   - Microfilm analyzes a tropical cyclone of at most 1008 mb near 26N 61.5W at 12Z.
2. Ship highlights:
   - 35 kt NE and 1010 mb at 30.1N 66.0W at 00Z (COADS).
   - 35 kt NE and 1015 mb at 31.9N 65.9W at 12Z (COADS).
   - 40 kt NE and 1009 mb at 29.4N 61.8W at 12Z (COADS).
   - 25 kt SW and 1003 mb at 25.7N 60.2W at 12Z (COADS).
   - 35 kt NE and 1009 mb at 30.7N 60.0W at 18Z (COADS).
   - 15 kt WSW and 1005 mb at 25.3N 61.3W at 18Z (COADS).
3. Discussion:

- Reanalysis: The depression's structure continued to elongate and become less tropical on October 10. Its surface structure hardly resembled a tropical cyclone by 00Z, with a broad, weak center spanning 7 degrees across and strong winds displaced 5 degrees north—responding primarily to the pressure gradient with a ridge. The satellite imagery also indicates an exposed center with substantial convection present well east of the system in association with a frontal boundary. However, baroclinic forcing may have aided in the circulation becoming more compact by 12Z, with stronger winds coalescing closer to the center. Re-intensification to tropical storm status is assessed by 06Z, primarily based on an observation of 25 kt SW and 1003 mb at 12Z which yielded an estimated central pressure of 1000 mb. A central pressure of 1000 mb suggests maximum sustained winds of 47 kt south of 25N from the Brown et al. pressure-wind relationship. The outer closed isobar for this system is around 1008-1009 mb with a very large radius of outer closed isobar. Thus any suggested intensity from the pressure-wind relationship needs to be adjusted downward significantly. An intensity of 40 kt is chosen for 12Z and 18Z based on observed 35-40 kt winds as well as the pressure data.

October 11:

1. Maps:
   - HURDAT lists a 20 kt tropical depression at 26.5N 54.5W at 12Z.
   - HWM analyzes a low of at most 1008 mb near 26N 59W at 12Z.
   - Microfilm analyzes a frontal low of at most 1008 mb near 26.5N 55.5W at 12Z.
2. Ship highlights:
   - 35 kt ENE and 1011 mb at 30.2N 59.2W at 00Z (COADS).
   - 35 kt NE and 1013 mb at 31.6N 58.5W at 00Z (COADS).
3. Discussion:
   - MWR: "Ship reports were not sufficient to confirm the track indicated on the 12th, but satellite pictures suggest the remains of the system continued toward the northeast and experienced a second phase of intensification southeast of the Azores. Trapped by a blocking High, the depression turned westward and passed through the Azores with a central pressure of 994 mb before finally being absorbed into the westerlies."
   - Reanalysis: Ship observations on October 11 indicate that the system lost a defined circulation and degenerated into an elongated trough by 06Z. Multiple gale observations support maintaining the system as a tropical storm through this time. After degenerating into a trough, the storm accelerated east along a frontal boundary. Satellite imagery depicts the storm merging with the aforementioned frontal boundary. It is possible that the system dissipated entirely at this time based on this merger; however, we have defaulted to the original analysis of a single system presented in the *Monthly Weather Review* based on surface observations, satellite imagery, and track analysis. The "new" low that developed on October 12 was within reasonable distance of the original circulation. The analyzed track depicts the system moving no more than 30 kt, fast but not unrealistic for October in the subtropical Atlantic. As no closed low is assessed for 06Z on October 11 through 12Z on October 12, the positions for these periods are a smoothed extrapolation along the trough axis between estimated centers prior to and after.

October 12:

1. Maps:
   - HWM analyzes a frontal low of at most 1008 mb near 29N 37W at 12Z.

- Microfilm analyzes a frontal low of at most 1008 mb centered near 27N 38.5W at 12Z.
- MWL analyzes a low near 29N 36W at 12Z

2. Ship highlights:
   - 35 kt W and 1005 mb at 26.8N 42.5W at 06Z (COADS).
3. Discussion:
   - MWL (1971, p. 85): "A wave cyclone developed along a cold front near 28N 40W at about 0600 on the 12th. This 1006-mb LOW matured very slowly during the first few days of its life as it headed east-northeastward and then northeastward toward the oceanic corridor separating the Azores from Madeira."
   - Reanalysis: Regeneration of a closed circulation, as an extratropical cyclone, is assessed by 18Z on October 12 based on sparse ship observations.

October 13:

1. Maps:
   - HWM analyzes an extratropical cyclone of at most 1008 mb near 31N 29W at 12Z.
   - Microfilm analyzes an extratropical cyclone of at most 1008 mb centered near 31N 29W at 12Z.
   - MWL analyzes a low near 30.5N 29W at 12Z
2. Ship highlights:
   - 35 kt N and 1011 mb at 29.2N 34.0W at 12Z (COADS).
3. Discussion:
   - Reanalysis: Some intensification of the extratropical cyclone took place on October 13 as it continued to the east-northeast and later northeast. A ship at 12Z on this day observed 35 kt winds on the western periphery of the low. Satellite imagery on this day depicts a largely exposed circulation with deep convection offset to the northeast of the center.

October 14:

1. Maps:
   - HWM analyzes an extratropical cyclone low of at most 1012 mb near 34N 24W at 12Z.
   - Microfilm analyzes a frontal low of at most 1012 mb centered near 32N 22W at 12Z.
   - MWL analyzes a low near 34N 23.5W at 12Z
2. Ship highlights:
   - 35 kt NNE and 1014 mb at 34.6N 26.5W at 12Z (COADS).
   - 35 kt NW and 1017 mb at 34.7N 29.0W at 18Z (COADS).
3. Discussion:
   - Reanalysis: On October 14, the system passed south of the Azores as it began occluding. Satellite imagery shows convection becoming more centralized over the storm and upper-level analyses indicate a trough becoming co-located with the system.

October 15:

1. Maps:
   - HWM analyzes an extratropical cyclone of at most 1008 mb near 37.5N 20W at 12Z.
   - Microfilm analyzes an extratropical cyclone of at most 1008 mb centered near 38N 17W at 12Z.
   - MWL analyzes a low near 35N 21W at 12Z
2. Ship highlights:
   - 25 kt NW and 1001 mb at 34.6N 22.3W at 15Z (COADS).

- 25 kt WNW and 1000 mb at 34.7N 21.3W at 18Z (COADS).
- 20 kt W and 999 mb at 34.9N 20.2W at 21Z (COADS).

3. Discussion:
   - MWL (1971, p. 85): Between 1200 on the 15th and 0000 on the 6th the cyclone deepened 7 mb to 999 mb. Winds blowing around the center, however, were below gale intensity until late on the 16th."
   - Reanalysis: Trapped by a westward-propagating ridge over northern Europe, the system slowed between the Azores and Madeira. Surface observations reveal dissipation of frontal features near the low and decreasing central pressures. Satellite imagery depicts continued convection over the circulation center with prominent banding features present. Furthermore, analysis shown in Historical Weather Maps depicts the system co-located with an upper-level low. Based on the aforementioned data, the system is estimated to have transitioned as a subtropical storm at 12Z at 35.2N 21.4W. This would be among the northeastern-most genesis points on record in HURDAT. An observation of 25kt WNW and 1000 mb yields a central pressure of 997 mb at this point.

October 16:

1. Maps:
   - HWM analyzes a low of at most 1000 mb near 38N 19W at 12Z.
   - Microfilm analyzes a low of at most 1004 mb centered near 37N 19.5W at 12Z.
   - MWL analyzes a low near 38N 18W at 12Z
2. Ship highlights:
   - 20 kt SW and 1000 mb at 35.0N 19.2W at 00Z (COADS).
   - 20 kt SW and 992 mb at 36.5N 19.8W at 06Z (COADS).
     - Pressure is suspect, observations before/after suggest higher values.
   - 35 kt NNE and 1013 mb at 41.7N 25.7W at 12Z (COADS).
   - 35 kt S and 1000 mb at 36.5N 18.2W at 12Z (COADS).
   - 25 kt ESE and 998 mb at 38.7N 20.3W at 18Z (COADS).
   - 45 kt S and 1004 mb at 36.8N 18.8W at 18Z (COADS/MWL).
3. Discussion:
   - MWL (1971, p. 85): "At 1800 [on the 16th] the *Export Ambassador* near 38N 19W (120 mi southeast of the 998 mb LOW) was hit by 45-kt winds, 15-ft seas, and 18-ft swells."
   - Reanalysis: The subtropical cyclone reached its easternmost point on October 16 and doubled back to the west in response to an approaching ridge. The system remained largely stable throughout the day, with ships in the area indicating the pressure remaining steady state. Surface observations show a large core, with a radius of maximum wind spanning approximately 2 degrees. Combined with Historical Weather Map upper-level analysis depicting a more robust upper-level low over the circulation, the system is maintained as subtropical through 18Z. Intensification to 50 kt is shown at the end of October 16 as a ship observed 45 kt at 18Z.

October 17:

1. Maps:
   - HWM analyzes a low of at most 1004 mb near 36.5N 35W at 12Z.
   - Microfilm analyzes a low of at most 1000 mb centered near 36.5N 35W at 12Z.
   - MWL analyzes a low near 37N 25W at 12Z
2. Ship highlights:
   - 45 kt NE and 1004 mb at 40.1N 22.4W at 00Z (MWL).

- 30 kt SW and 995 mb at 36.1N 22.9W at 00Z (COADS).
- 40 kt N and 1011 mb at 36.7N 31.6W at 06Z (COADS).
- 25 kt ENE and 994 mb at 37.6N 25.5W at 06Z (COADS).
- 40 kt N and 1006 mb at 36.8N 25.2W at 12Z (COADS).
- 50 kt NE and 1002 mb at 36.9N 29.0W at 18Z (COADS).

3. Station highlights:
   - 15 kt NNE and 992 mb at Santa Maria, Azores at 06Z (Micro).
4. Discussion:
   - MWL (1971, p. 85): "The *Fairland* also encountered 45-kt gales 120 mi north of the center at 0000 on the 17th. By that time, the storm had established a west-southwesterly course after making a 180-turn near 38N 19W. The core of the filling cyclone pass just south of Santa Maria, Azores, at about 1100 on the 17th; it then swung westward."
   - Reanalysis: Observations on October 17 show intensification of the storm and contraction of its wind field. Based on this contraction, the system is estimated to have transitioned into a tropical cyclone at 00Z. A ship observed 30 kt SW and 995 mb near the center at 00Z, providing a central pressure of 992 mb. A central pressure of 992 mb suggests maximum sustained winds of 60 kt north of 35N from the Landsea et al. pressure-wind relationship. Given the storm's steady west-southwest motion and an environmental pressure of 1010 mb (with a strong gradient to the north), an intensity of 60 kt is chosen for 00Z. Intensification to hurricane-status is believed to have occurred at 06Z as the pressure fell to 989 mb (stemming from an observation of 15 kt NNE and 992 mb at Santa Maria, Azores). A central pressure of 989 mb suggests maximum sustained winds of 64 kt north of 35N from the Landsea et al. pressure-wind relationship. Thus 65 kt is chosen for the 06Z intensity. Multiple vessels encountered gale- to storm-force winds near and to the northwest of the hurricane's center throughout October 17. Satellite imagery depicts tight banding features near the storm's core, potentially the onset of a banding eye. This is the first time in the HURDAT reanalysis that satellite imagery has been crucial in determining an upgrade to hurricane-status.

October 18:

1. Maps:
   - HWM analyzes a low of at most 1012 mb near 35N 33W at 12Z.
   - Microfilm analyzes a low of at most 1012 mb centered near 35.5N 31W at 12Z.
   - MWL analyzes a low near 36N 32W at 12Z
2. Ship highlights:
   - 50 kt ENE and 1007 mb at 36.7N 26.9W at 00Z (COADS).
   - 40 kt NE and 1019 mb at 39.8N 33.4W at 06Z (COADS).
   - 40 kt NE and 1015 mb at 36.2N 35.7W at 12Z (COADS).
   - 45 kt N and 1010 mb at 36.6N 35.4W at 18Z (COADS).
3. Discussion:
   - MWL (1971, p. 85): "The *Export Ambassador*, pursuing the storm westward, observed 50-kt winds at 0000 on the 18th near 37N 27W."
   - Reanalysis: No observations near the core of this hurricane were made on October 18. Satellite imagery depicts improved organization, including a large banding eye feature. Such a feature typically corresponds with Dvorak classifications of a range from 4.0-5.0, or 65-90 kt. Based on the improved structure, the system is roughly estimated to have attained peak winds of 75 kt.

October 19:

1. Maps:
   - HWM analyzes a low of at most 1012 mb near 37N 38W at 12Z.
   - Microfilm analyzes a low of at most 1016 mb centered near 35.5N 35W at 12Z.
   - MWL analyzes a low near 37N 37W at 12Z
2. Ship highlights:
   - 40 kt NE and 1011 mb at 38.3N 35.5W at 00Z (COADS).
   - 35 kt N and 1002 mb at 35.5N 32.4W at 00Z (COADS).
   - 35 kt SE and 1002 mb at 37.2N 34.1W at 06Z (COADS).
   - 50 kt S and 1012 mb at 36.9N 34.0W at 12Z (COADS/MWL).
   - 50 kt SE and 1010 mb at 38.5N 34.3W at 15Z (COADS).
   - 50 kt ESE and 1001 mb at 39.5N 35.4W at 18Z (COADS/MWL).
3. Discussion:
   - MWL (1971, p. 85): "Thirty-six hours later [12Z on the 19th], [the *Export Ambassador*] was struck by 48-kt gale-force winds near 37N 34W, or 2000 mi east of the 1008 mb cyclone. The center of the shallow but potent storm had just reached the 38th meridian and was ready to alter its course toward the north-northwest. At 1800 on the 19th, the *Attleboro Victory* near 40N 35W was swept by 50-kt gales, 17-ft swells, and moderate rains. Farther west, the *Sue Lykes* was sailing eastward near 40N 36W at 1800 on the 19th when she fought off east-northeasterly 45-kt winds, 18-ft seas, and 28-ft swells."
   - Reanalysis: The hurricane is estimated to have maintained its strength throughout October 19 based on its satellite appearance with a well-defined banding eye feature. Its forward motion slowed somewhat on this day as it began a gradual turn to the north around the ridge previously steering it west. Multiple ships reported 50 kt winds along the eastern side of the storm.

October 20:
1. Maps:
   - HWM analyzes a low of at most 1012 mb near 41N 39W at 12Z.
   - Microfilm analyzes a low of at most 1016 mb centered near 40.5N 38W at 12Z.
   - MWL analyzes a low near 41N 38W at 12Z
2. Ship highlights:
   - 64 kt E and 1008 mb at 40.0N 35.5W at 00Z (COADS/MWL).
   - 55 kt SE and 1012 mb at 40.0N 35.3W at 06Z (COADS).
   - 40 kt E and 1015 mb at 42.1N 36.4W at 12Z (COADS).
3. Discussion:
   - MWL (1971, p. 85): "The observation sent in [from the *Sue Lykes* at 0000 on the 18th] was too much: easterly 64-kt hurricane-force winds and 39-ft seas during a squall 130 mi northeast of the storm center. The central pressure of the cyclone was somewhere between 990 and 995 mb at that hour. Gales became minimal and the center weakened rapidly during the next 12 hr. The *Ossendrecht* noted the strongest gales (35 kt) at 1200 on the 20th near 37N 36W, or 120 mi east-southeast of the 1010-mb LOW."
   - Reanalysis: At 00Z, the American-flagged *Sue Lykes* encountered 64 kt winds to the northeast of the storm's core in a persistent banding feature. This is the highest wind reported in relation to the hurricane. Steady weakening is assessed on October 20, with winds dropping below hurricane-force at 12Z, likely due to increasing wind shear from an approaching trough. The previously well-defined eye became less prominent and convection less organized. Surface observations indicate it remained tropical, however, with an isothermal core and no frontal features.

October 21:

1. Maps:
   - HWM analyzes a frontal low of at most 1008 mb just ahead of a cold front near 45.5N 36W at 12Z.
   - MWL analyzes a low near 45.5N 36W at 12Z
2. Ship highlights:
   - 35 kt NNE and 1021 mb at 42.6N 44.1W at 12Z (COADS).
   - 45 kt W and 1011 mb at 46.2N 40.0W at 12Z (COADS).
   - 35 kt NW and 1013 mb at 48.1N 36.9W at 18Z (COADS).
3. Discussion:
   - MWL (1971, p. 85): "On the 21st, the cyclone was snatched up by a cold frontal trough stretching southward from a LOW near Kap Farvel. The 9-day-old 1013-mb center lost its identity to the trough late that day near 46N 36W."
   - Reanalysis: Transition into an extratropical cyclone is assessed at 00Z on October 21 as cooler air quickly wrapped into the center and a trough developed to the northwest of the core. The system maintained gale-force winds as it accelerated northeast before ultimately being absorbed into another non-tropical cyclone well to the southeast of Greenland by 12Z on October 22.

October 22:

1. Maps:
   - Maps depict nothing of interest related to the new hurricane as a cold front absorbed it.
2. Ship highlights:
   - 35 kt S and 1010 mb at 51.6N 32.0W at 00Z (COADS).
   - 35 kt S and 1008 mb at 57.0N 27.8W at 06Z (COADS).
   - 20 kt WNW and 1001 mb at 53.6N 31.7W at 06Z (COADS).

Sources: NHC microfilm maps, the Historical Weather Maps series, the COADS ship database, Monthly Weather Review, Mariners Weather Log, Satellite images from NCDC, and NHC Storm Wallets.

Date	Original HURDAT Central Pressure	Evidence	Changes
Sep 30 12Z		Micro: 35 kt SE and 1004 mb at 12Z	1001 mb
Sep 30 18Z		Micro: 20 kt SE and 1003 mb at 18Z	1001 mb
Oct 1 00Z		Micro: 20 kt ESE an 1006 mb at 00Z	1004 mb
Oct 1 06Z		COADS: 5 kt NW and 1003 mb at 06Z	1002 mb
Oct 1 18Z		Martinique: 10 kt NE and 1005 mb at 18Z (Micro)	1004 mb

		Grenada: 10 kt W and 1005 mb at 18Z (Micro)	
Oct 2 00Z		COADS: 10 kt NNW and 1001 mb at 00Z	1000 mb
Oct 2 06Z		Penetration center fix: 999 mb around 0610Z	999 mb
Oct 2 12Z		Penetration center fix: 999 mb around 12Z	999 mb
Oct 3 06Z		COADS: 10 kt WSW and 1006 mb at 06Z	1005 mb
Oct 3 12Z		Penetration center fix: 1003 mb around 12Z	1003 mb
Oct 3 18Z		Penetration center fix: 1004 mb around 17Z	1004 mb
Oct 5 18Z		COADS: 10 kt SW and 1005 mb at 18Z	1004 mb
Oct 6 00Z		Penetration center fix: 1004 mb around 2222Z on the 5th	1004 mb
Oct 6 12Z		Penetration center fix: 1005 mb around 1309Z	1005 mb
Oct 6 18Z		Penetration center fix: 1004 mb around 1623Z and 1730Z	1004 mb
Oct 7 00Z		COADS: 25 kt ESE and 1002 mb at 00Z	1000 mb
Oct 7 06Z		COADS: 25 kt ESE and 1005 mb at 06Z	1002 mb
Oct 7 12Z		Penetration center fix: 1003 mb around 1230Z	1003 mb
Oct 7 18Z		Penetration center fix: 1004 mb around 1730Z	1004 mb
Oct 8 00Z		COADS: 10 kt SE and 1005 mb at 00Z	1004 mb
Oct 10 12Z		COADS: 25 kt SW and 1003 mb at 12Z	1000 mb
Oct 15 18Z		COADS: 25 kt WNW and 1000 mb at 18Z	997 mb

Oct 16 00Z		COADS: 20 kt W and 999 mb at 21Z on October 15th	998 mb
Oct 16 12Z		COADS: 35 kt S and 1000 mb at 12Z	997 mb
Oct 17 00Z		COADS: 25 kt ENE and 994 mb at 00Z	992 mb
Oct 17 06Z		Santa Maria, Azores: 15 kt NNE and 992 mb (Micro)	989 mb

Green indicates wind changes of 15 kt or greater
Blue indicates lat/long changes greater than 1º
Red indicates a new entry
Yellow indicates a deletion

Tropical Storm Greta [September 26 – October 4, 1970] – AL161970

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47060 09/26/1970 M=10  8 SNBR=1003 GRETA       XING=0 SSS=0

47065 09/26*  0   0   0    0*  0   0   0    0*224 754  35 1010*227 762  35    0*
47065 09/26*  0   0   0    0*  0   0   0    0*222 754  35    0*227 762  40 1005*
                                              ***            *          ** ****

47070 09/27*233 772  45 1005*238 783  45    0*241 798  45 1005*244 813  30 1007*
47070 09/27*233 772  40 1007*238 782  40 1006*241 797  40 1005*244 813  35 1007*
                     ** ****     ***  ** ****     ***  **                **

47075 09/28*247 828  30    0*249 834  30    0*250 838  30    0*249 842  30    0*
47075 09/28*247 828  30 1006*249 835  30 1006*250 839  30 1006*249 842  30 1007*
                        ****     ***     ****     ***     ****              ****

47080 09/29*248 845  30    0*247 847  30    0*246 848  30    0*244 851  30    0*
47080 09/29*248 844  30 1006*246 845  30 1007*244 848  30    0*242 851  30    0*
                ***     **** *** ***     **** ***              ***

47085 09/30*241 854  30    0*237 858  30    0*233 863  30    0*230 868  30    0*
47085 09/30*241 854  30    0*240 857  30    0*238 860  30    0*235 863  30 1006*
                              *** ***          *** ***          *** ***     ****

47090 10/01*226 873  30 1007*222 877  30    0*218 882  30 1006*214 888  30    0*
47090 10/01*231 867  30 1004*226 872  30    0*222 878  30 1004*219 884  30    0*
            *** ***     **** *** ***         *** ***     **** *** ***

47095 10/02*211 894  30    0*209 901  30    0*209 907  25    0*209 913  25    0*
47095 10/02*217 890  30 1003*217 895  30    0*216 901  30 1005*216 909  30 1005*
            *** ***     **** *** ***          *** ***  ** **** *** ***  ** ****

47100 10/03*209 919  25 1008*209 925  25    0*210 931  25 1009*211 938  25    0*
47100 10/03*214 917  30    0*212 925  30    0*212 932  25    0*212 939  25    0*
            *** ***  **    * ***      **      *** ***        * *** ***

47105 10/04*213 947  25    0*217 957  25    0*221 969  25 1010*225 982  25    0*
47105 10/04*214 947  25    0*217 957  25    0*221 969  25 1009*225 982  25    0*
            ***                                            ****

(October 5th has been removed from HURDAT)
47110 10/05*230 995  25    0*  0   0   0    0*  0   0   0    0*  0   0   0    0*

47115 TS
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U.S. Tropical Storm Impact

09/27 06Z 23.8N 78.2W 40 kt Bahamas
09/27 12Z 24.1N 79.7W 40 kt FL

Significant Revisions:

1. A few central pressures originally in HURDAT were removed, some were retained and others were added based on synoptic and aircraft reconnaissance data.

Daily Metadata:

September 20:

1. Maps and old HURDAT:
- HWM analyzes a tropical wave along longitude 37W, extending from 10N-22N, at 12Z.
2. Discussion:
- Reanalysis: A tropical wave left the west coast of Africa around September 15th and showed little change in organization over the eastern Atlantic. Between September 19th and 21st, satellite images indicated that the disturbance had become better organized, with some signs of a surface circulation. But the synoptic observations were sparse, thus it is not possible to determine if a closed low-level circulation was present. Nonetheless, it is possible that during those days, this system was a tropical cyclone.

September 21:

1. Maps and old HURDAT:
- HWM analyzes a spot low at 11.2N, 45.3W at 12Z.
- Microfilm shows a tropical wave along longitude 43W, extending from 9N-16N, at 12Z.

September 22:

1. Maps and old HURDAT:
   - HWM analyzes a spot low at 12.2N, 50.5W at 12Z.
   - Microfilm shows a tropical wave along longitude 49W, extending from 11N-19N, at 12Z.

2. Discussion:
- Reanalysis: On this date, satellite images showed that the disturbance had become less organized due to an increase in westerly shear.

September 23:

1. Maps and old HURDAT:
- HWM does not analyze any features of interest at 12Z.
- Microfilm shows a tropical wave along longitude 55W, extending from 11N-20N, at 12Z.
2. Ship highlights:
   - 35 kt E and 1013 mb at 14.1N, 54.2W at 18Z (micro).

3. Aircraft highlights:
   - Observation: 40 kt SE and 1010 mb at 15.1N, 55.1W at 1730Z (micro).

4. Discussion:

- Reanalysis: The disturbance remained disorganized as it approached the Lesser Antilles, but synoptic and aircraft reconnaissance observations showed that it was producing gale-force winds.

September 24:

1. Maps and old HURDAT:
- HWM analyzes a closed low pressure of 1007 mb at 13.5N, 64.5W and a tropical wave extending to the north at 12Z.
- Microfilm shows a tropical wave along longitude 63W, extending from 11N-21N, at 12Z.
2. Discussion:
- ATSR: "The wave in the easterlies that had been tracked across the Atlantic passed through the Lesser Antilles early on 24 September. This had been a moderate to strong wave about 600 miles in its north-south extent as it approached the Lesser Antilles."
- Reanalysis: Satellite images indicated that convection had increased over the eastern Caribbean Sea but synoptic data showed that it was still a strong tropical wave.

September 25:

1. Maps and old HURDAT:
- HWM analyzes a tropical wave extending from 19N-26N and 68W-73W at 12Z.
- Microfilm shows a tropical wave along longitude 71W, extending from 14N-26N, at 12Z.
2. Discussion:
- ATSR: "After passing through the Lesser Antilles, that portion of the wave north of the Greater Antilles maintained itself while the southern portion lost its intensity and identity. A suggestion of a circulation was first indicated at 251800Z; however, this circulation could not definitely be followed."
- Reanalysis: Ship and coastal observations showed that the sharp tropical wave was becoming better organized north of the Greater Antilles, but still lacked a closed low level circulation. Satellite images also indicated that the tropical wave was better organized, but also still under the effect of westerly shear.

September 26:

1. Maps and old HURDAT:
- HWM analyzes a spot low of 1009 mb at 22.5N, 76W and a tropical wave extending to the southwest at 12Z.
- HURDAT lists a 35 kt tropical storm at 22.4N, 75.4W at 12Z.
- Microfilm shows a tropical cyclone of at most 1010 mb at 22.5N, 76W at 12Z.
2. Aircraft highlights:
- Penetration center fix measured a central pressure of 1005 mb and estimated surface winds of 60 kt at 22.9N, 76.6W at 2015Z (WALLET).
3. Discussion:
- MWR: "The season's last named storm and third to form from an African seedling developed near the Bahamas on September 26 from a depression that caused heavy rains and squalls over the Leeward and Virgin Islands and Puerto Rico a few days earlier."
- ATSR: "The first definite circulation was present on the 261200Z surface chart, and the first tropical depression warning was issued at 261600Z. With a Navy reconnaissance aircraft in the area reporting sustained winds of 40 kt

and gusts to 60 kt in squalls, the depression was upgraded to Tropical Storm GRETA at 262301Z."

- Reanalysis: The robust tropical wave continued on a northwestward track and a closed low level circulation is analyzed to have formed at 12Z on the 26th based on synoptic observations. The first position is analyzed at 12Z on the 26th as a 35 kt tropical storm, same as originally shown in HURDAT. Operationally, the tropical cyclone was also upgraded to the 34th tropical depression of the season at this time as shown in the Microfilm maps. The first penetration center fix measured a central pressure of 1005 mb and estimated surface winds of 60 kt (Navy book says 40 kt with gusts to 60 kt) at 2015Z on the 26th. A central pressure of 1005 mb suggests maximum surface winds of 37 kt from the south of 25N Brown et al. pressure-wind relationship. Based on a forward speed of about 12 kt and taking into consideration the visual estimate, an intensity of 40 kt is analyzed at 18Z on the 26th, up from 35 kt originally in HURDAT, a minor intensity change. 40 kt is also the peak intensity analyzed for Greta, down from 45 kt originally shown in HURDAT between 00Z and 12Z on September 7th. Satellite images showed a sheared tropical cyclone with most of the convection over the eastern semicircle.

September 27:

1. Maps and old HURDAT:
- HWM analyzes a tropical storm of at most 1008 mb at 24.2N, 80.2W at 12Z.
- HURDAT lists a 45 kt tropical storm at 24.1N, 79.8W at 12Z.
- Microfilm shows a tropical cyclone of at most 1008 mb at 24.2N, 79.6W at 12Z.
2. Land highlights:
   - 37 kt NE (gusts to 43 kt) at Miami Beach, FL at 14Z-15Z (SWO/WALLET).
   - 45 kt SE (elevated site) at Fowey Rocks, FL at 15Z (WALLET).
   - Gusts to 48 kt at Tavernier, FL at 1745Z (WALLET).

3. Aircraft highlights:
   - Penetration center fix measured a central pressure of 1005 mb at 23.5N, 77.5W at 0250Z (WALLET).
   - Penetration center fix measured a central pressure of 1006 mb at 23.7N, 77.8W at 0548Z (WALLET).
   - Penetration center fix measured a central pressure of 1005 mb at 24.1N, 79.9W at 1316Z (WALLET). Estimate of 40 kt SE (surface wind) at 1245Z (micro).
   - Penetration center fix measured a central pressure of 1007 mb and estimated surface winds of 20 kt at 24.3N, 81.1W at 1815Z (WALLET)

4. Discussion:
- MWR: "On the morning of the 27th, with the storm being monitored by radar at the NHC, the rain bands became disorganized and lost their spiral configuration. Reconnaissance data showed that the central pressure was rising from a minimum of 1005 mb (29.68 in.) in the Florida Straits and winds decreased below gale force as the vortex approached the lower keys. Highest sustained winds dropped from 49 kt at Tavernier on Key Largo to 23 kt as the center passed directly over Key West late on the 27th."
- ATSR: "With a moderate cold front and its associated trough aloft proceeding southeastward from the Mississippi Valley, conditions were never very favorable for any significant development. The only really favorable condition for further development was the warm water of the Gulf Stream which was directly in line with the path of GRETA. The frontal system slowed and became stationary near 28N, the associated trough aloft failed to materialize south

of 30N, and thus, with little low level flow and unfavorable outflow aloft, GRETA was downgraded to a tropical depression at 272200Z. After post-analysis, GRETA was probably not of storm intensity for more than fifteen hours."

- Reanalysis: Greta continued on a track toward southern Florida with little changes in intensity. The tropical storm passed just south of the northwest Bahamas early on the 27th and close to the Florida Keys later on this date. Miami Beach reported sustained gale-force winds between 10Z and 17Z, while Fowey Rocks recorded 45 kt SE (elevated site) at 15Z and gusts to 48 kt were observed (either visually estimated or recorded by an anemometer) for about 15 minutes around 1745Z on Tavernier in the upper Florida Keys. Since the strongest winds were north of the center, Greta is analyzed to produce a tropical storm impact in the Bahamas and Florida on the 27th. The weak tropical storm began to weaken late on the 27th as a frontal boundary entered the northern Gulf of Mexico. The original HURDAT analyzed a rapid decrease in intensity of 45 kt to 30 kt between 12Z and 18Z on the 27th, which does not appear to be correct based on the synoptic data available. Penetration center fixes occurred throughout the 27th and indicated minor fluctuations in the central pressure, between 1005 mb and 1007 mb. Satellite images continued to depict a sheared tropical cyclone with most of the convection east of the center.

September 28:

1. Maps and old HURDAT:

- HWM analyzes a closed low pressure of 1009 mb at 24N, 85W and a stationary front to the north at 12Z.
- HURDAT lists a 30 kt tropical depression at 25N, 83.8W at 12Z.
- Microfilm shows a tropical cyclone of at most 1010 mb at 24.5N, 84.5W and a stationary front to the north at 12Z.

2. Aircraft highlights:

- Penetration center fix measured a central pressure of 1008 mb at 24.7N, 82.8W at 0009Z (WALLET).
- Penetration center fix measured a central pressure of 1012 mb at 24.8N, 84W at 0533Z (WALLET).
- Penetration center fix measured a central pressure of 1006 mb at 24.8N, 84W at 1208Z (WALLET).
- Penetration center fix measured a central pressure of 1007 mb and estimated surface winds of 30 kt at 25.2N, 84.3W at 18Z (WALLET).

3. Discussion:

- Reanalysis: On this date, Greta significantly slowed its forward speed, becoming almost stationary west of Dry Tortugas. A couple of reconnaissance aircraft penetrated the center of Greta on the 28th finding central pressures between 1006 mb and 1008 mb. A central pressure of 1012 mb was reported at 0533Z on the 28th but synoptic observations suggest that the aircraft likely missed the center of the disorganized cyclone. Weakening to a tropical depression is analyzed at 00Z on the 28th, six hours later than originally shown in HURDAT. The decrease in intensity despite the central pressure remaining similar to the previous day was likely due to an increase in shear as a pronounced frontal boundary continued to move across the Gulf of Mexico. Satellite images also showed that the convection associated with the depression had decreased and the cyclone's center was exposed. Synoptic observations also suggested that the surface circulation had become elongated, northeast-southwest, and poorly-organized.

September 29:

1. Maps and old HURDAT:

- HWM analyzes a closed low pressure of 1009 mb at 24N, 85W and a stationary front to the north at 12Z.
- HURDAT lists a 30 kt tropical depression at 24.6N, 84.8W at 12Z.
- Microfilm shows a tropical cyclone of at most 1010 mb at 24.5N, 84.5W and a stationary front to the north at 12Z.

2. Ship highlights:
   - 35 kt NNE and 1013 mb at 25.7N, 86.3W at 18Z (COADS).

3. Aircraft highlights:
   - Penetration center fix measured a central pressure of 1006 mb and estimated surface winds of 15 kt at 25.2N, 84.2W at 0008Z (WALLET).
   - Penetration center fix measured a central pressure of 1007 mb at 24.9N, 84.5W at 0515Z (WALLET).

4. Discussion:
- Reanalysis: The poorly-organized tropical depression drifted southwest on this date. A couple of penetration center fixes early on the 29th measured central pressures of 1006 mb and 1007 mb and estimated surface winds of 15 kt. Satellite images showed that Greta remained sheared with most of the convection over the eastern semicircle. The frontal boundary continued to approach the tropical cyclone but based on synoptic observations and also as seen on the satellite images, it remained north of Greta. At 18Z on the 29th, a ship about 150 n mi northwest of Greta reported 35 kt NE. While the observation is reliable, it was well away from the center in the gradient flow behind the frontal boundary. Thus the wind is not directly associated with Greta and the system is not upgraded back to a tropical storm.

September 30:

1. Maps and old HURDAT:
- HWM analyzes a closed low pressure of 1007 mb at 23N, 86.5W and a stationary front to the north at 12Z.
- HURDAT lists a 30 kt tropical depression at 23.3N, 86.3W at 12Z.
- Microfilm shows a tropical cyclone of at most 1008 mb at 23.5N, 86W and a stationary front just to the west at 12Z.

2. Ship highlights:
   - 40 kt NE and 1016 mb at 26.7N, 86.2W at 15Z (COADS).

3. Discussion:
- Reanalysis: Satellite images showed an increase in convection in association with Greta on this date but westerly shear continued impacting it. The frontal boundary to the north of the tropical storm appeared to weaken on this date, although the synoptic analysis in microfilm at 12Z shows it just west of the circulation, extending from the Bay of Campeche to the western Atlantic. On the other hand, the interpretation of the data by the HWM is that the frontal boundary remained to the north and only extended to the central Gulf of Mexico, and this appears correct based on the synoptic observations. A ship reported 40 kt at 15Z but again is not directly associated with Greta.

October 1:

1. Maps and old HURDAT:
- HWM analyzes a closed low pressure of at most 1008 mb at 22N, 87.5W at 12Z.
- HURDAT lists a 30 kt tropical depression at 21.8N, 88.2W at 12Z.
- Microfilm shows a tropical cyclone of at most 1008 mb at 22N, 88W at 12Z.

2. Ship highlights:

- 35 kt NE and 1009 mb at 25.5N, 87.4W at 00Z (COADS).
- 35 kt NE and 1010 mb at 25.6N, 87.4W at 06Z (COADS).
- 35 kt ENE and 1009 mb at 26.1N, 86.3W at 15Z (COADS).

3. Discussion:

- Reanalysis: Greta continued on its southwest track on October 1st and approached the northern coast of Yucatan. Satellite images showed a disorganized system. A few ships reporting gale-force winds are not directly associated with Greta.

October 2:

1. Maps and old HURDAT:

- HWM analyzes a closed low pressure of at most 1008 mb at 23.5N, 89.5W at 12Z.
- HURDAT lists a 25 kt tropical depression at 20.9N, 90.7W at 12Z.
- Microfilm shows a tropical cyclone of at most 1008 mb at 21.5N, 89.5W at 12Z.

2. Ship highlights:

- 35 kt N and 1008 mb at 22.1N, 91.3W at 00Z (micro).
- 15 kt NE and 1005 mb at 22.3N, 89.5W at 00Z (micro).
- 30 kt SE and 1008 mb at 22.3N, 89.8W at 18Z (micro).

3. Discussion:

- ATSR: "After being downgraded to a depression, the system drifted slowly south-to-southwest until it lost its identity. The final warning was issued at 020400Z near the north coast of the Yucatan Peninsula."
- Reanalysis: On this date, Greta passed north of Yucatan on a southwest track. The original HURDAT had the tropical cyclone moving over northwest Yucatan but synoptic observations suggested that it remained over the ocean. One observation of gale force winds on this date was not directly associated with Greta.

October 3:

1. Maps and old HURDAT:

- HWM analyzes a tropical wave along longitude 92W, extending from 20N-28W, at 12Z.
- HURDAT lists a 25 kt tropical depression at 21N, 93.1W at 12Z.
- Microfilm shows a tropical cyclone of at most 1008 mb at 22.5N, 91.5W at 12Z.

2. Discussion:

- Reanalysis: Satellite images showed a disorganized system over the southern Gulf of Mexico. No gale force winds occurred on this date.

October 4:

1. Maps and old HURDAT:

- HWM analyzes a spot low at 22N, 98W at 12Z.
- HURDAT lists a 25 kt tropical depression at 22.1N, 96.9W at 12Z.
- Microfilm shows a tropical cyclone of at most 1012 mb at 22.5N, 94W at 12Z.

2. Discussion:

- MWR: "The remnants of Greta, still maintaining a closed wind circulation, curved around a high-pressure area in the Gulf of Mexico and eventually crossed the Mexican coast near Tampico on October 4, with a pressure of 1010 mb (29.83 in.)."
- Reanalysis: The tropical depression turned to the northwest and made landfall in Mexico late on the 4th. The system quickly weakened and is analyzed to have dissipated after 18Z on the 4th based on synoptic observations.

October 5:

1. Maps and old HURDAT:

- HWM analyzes no features of interest at 12Z.

Sources: NHC microfilm maps, the Historical Weather Maps series, the COADS ship database, Monthly Weather Review, Mariners Weather Log, Satellite images from NCDC, and NHC Storm Wallets.

Date	Original HURDAT Central Pressure	Evidence	Changes
Sep 26 12Z	1010 mb	Synoptic observations suggested that the central pressure was lower than 1010 mb	Removed
Sep 26 18Z		Penetration center fix: 1005 mb at 2015Z	1005 mb
Sep 27 00Z	1005 mb	Penetration center fix: 1007 mb at 0250Z	1007 mb
Sep 27 06Z		Penetration center fix: 1006 mb at 0548Z	1006 mb
Sep 27 12Z	1005 mb	Penetration center fix: 1005 mb at 1316Z	Retained
Sep 27 18Z	1007 mb	Penetration center fix: 1007 mb at 1815Z	
Sep 28 00Z		Land: 15 kt NE and 1008 mb at Dry Tortugas at 00Z	1006 mb
Sep 28 06Z		Ship: 20 kt SSW and 1008 mb at 24.1N, 83.1W at 09Z	1006 mb
Sep 28 12Z		Penetration center fix: 1006 mb at 1208Z	1006 mb
Sep 28 18Z		Penetration center fix: 1007 mb at 18Z	1007 mb
Sep 29 00Z		Penetration center fix: 1006 mb at 0008Z	1006 mb
Sep 29 06Z		Penetration center fix: 1008 mb at 0515Z	1007 mb
Sep 30 18Z		Ship: 20 kt NNE and 1008 mb at 23.8N, 86.8W at 18Z	1006 mb
Oct 01 00Z	1007 mb	Ship: 25 kt N and 1007 mb at 22.6N, 88W at 00Z	1004 mb
Oct 01 12Z	1006 mb	Ship: 15 kt SE and 1006 mb at 22.6N, 87.5W at 12Z	1004 mb
Oct 02 00Z		Ship: 15 kt NE and 1005 mb at 22.3N, 89.5W at 00Z	1003 mb
Oct 02 12Z		Ship: 5 kt W and 1006 mb at 21.3N, 89.5W at 12Z	1005 mb
Oct 02 18Z		Ship: 20 kt NW and 1007 mb at 21N, 92.1W at 18Z	1005 mb
Oct 03 00Z	1008 mb	No ship or aircraft reconnaissance data near the center around these times	Removed
Oct 03 12Z	1009 mb		
Oct 04 12Z	1010 mb	Ship: 20 kt ENE and 1011 mb at 23.3N, 96.3W at 12Z	1009 mb

Sources: NHC microfilm maps, the Historical Weather Maps series, the COADS ship database, Monthly Weather Review, Navy reconnaissance book, Mariners Weather Log, EV2 Surface Weather Observations, Satellite images from NCDC, and NHC Storm Wallets.

Tropical Depression [September 29-October 1, 1970]-AL171970 - REMOVED

September 27 - October 1: Historical Weather Maps, microfilm and satellite images showed a tropical wave or trough over the central Atlantic on September 27th on a westward track. An approaching cold front caused the system to turn northward on

the 28th while north of the Leeward Islands. On the 28th and 29th, convection became more concentrated. It is difficult to determine if a closed circulation developed on the 28th or 29th due to the paucity of the ship data in the area and rapid movement of the disturbance. Late on the 30th and early on October 1st, it became embedded in the frontal boundary acquiring extratropical characteristics. This system was originally non-developing tropical depression AL17 and the track in HURDAT is consistent with the track plot shown in the 1970 Tropical Systems article in MWR. Based on the data available, the disturbance did not have a well-defined circulation and only maintained minimal organization to the deep convection. Thus it is removed from HURDAT.

```
AL171970,            UNNAMED,      9,
19700929, 1200,  , TD, 27.0N,  62.0W,  20, -999,
19700929, 1800,  , TD, 28.1N,  61.2W,  20, -999,
19700930, 0000,  , TD, 29.2N,  60.3W,  25, -999,
19700930, 0600,  , TD, 30.3N,  59.4W,  25, -999,
19700930, 1200,  , TD, 31.5N,  58.5W,  25, -999,
19700930, 1800,  , TD, 34.3N,  57.0W,  25, -999,
19701001, 0000,  , TD, 37.0N,  55.5W,  25, -999,
19701001, 0600,  , TD, 39.8N,  54.0W,  25, -999,
19701001, 1200,  , TD, 42.5N,  52.5W,  20, -999,
```

Green indicates wind changes of 15 kt or greater
Blue indicates lat/long changes greater than 1º
Red indicates a new entry
Yellow indicates a deletion

Unnamed Hurricane [October 12-17, 1970] - AL181970

```
47120 10/12/1970 M= 7  9 SNBR=1004 NOT NAMED   XING=0 SSS=0
47120 10/12/1970 M= 6  9 SNBR=1004 NOT NAMED   XING=0 SSS=0
                     *

47125 10/12*  0   0   0    0*  0   0   0    0S245 685  30 1003S250 679  30    0*
47125 10/12*  0   0   0    0*  0   0   0    0S245 685  30 1003S250 679  35    0*
                                                                        **

47130 10/13S255 670  30    0S259 655  35    0S263 640  35 1002S267 636  35    0*
47130 10/13S255 670  35    0S259 655  35    0S263 642  35 1002S267 636  35    0*
                     **                           ***

47135 10/14S270 635  40 1001S270 650  40    0S270 665  45 1001S273 672  45    0*
47135 10/14S270 638  40 1001S270 650  45    0S270 663  50 1001S272 670  55  999*
                ***                    **          ***  **      *** ***  **  ***

47140 10/15S275 675  50  997S278 676  55    0S280 675  55  995S288 674  60    0*
47140 10/15*275 673  55  997*278 674  55    0*283 674  55  995*291 674  55  994*
           *    ***  **     *    ***         **** ***         ****       **  ***

47145 10/16*300 670  60  991*307 666  60    0*315 660  65  989*325 647  70    0*
47145 10/16*300 671  60  991*307 666  60  994*315 660  65  989*325 647  75  982*
                ***                       ***                            **  ***

47150 10/17*340 630  75  980*365 617  85    0*390 610  90  974*425 575  70  980*
47150 10/17*340 634  75  983*364 620  85  974*390 605  85  975*420 590  70    0*
                ***      *** *** ***      ***     ***  **  *** *** ***         *

(October 18th has been removed from HURDAT)
47155 10/18E470 530  55    0*  0   0   0    0*  0   0   0    0*  0   0   0    0*
47155 10/18*  0   0   0    0*  0   0   0    0*  0   0   0    0*  0   0   0    0*
           *  *   *   *
```

47160 HR

Hurricane Impact

10/16 16Z 32.3N 64.9W 75 kt Bermuda

Significant Revisions:

1. Intensification to a subtropical storm is analyzed twelve hours earlier based on ship observations.
2. Transition to a tropical cyclone from subtropical has been analyzed 24 hours earlier based on synoptic observations and satellite imagery.
3. A major position change is analyzed at 18Z on October 17th.
4. A few central pressure values were added and one was removed based on synoptic and aircraft reconnaissance data. Details on the table at the end.
5. No extratropical stage is now shown as the system was absorbed and did not transition to extratropical.

Daily Metadata:

October 10:

1. Maps and old HURDAT:
- HWM does not analyze any features of interest at 12Z.
- Microfilm shows a closed low pressure of at most 1008 mb at 25.5N, 70W at 12Z.
2. Discussion:
- Reanalysis: The genesis of this hurricane was complex. The system developed from a trough of low pressure that was left behind north of the Greater Antilles after a tropical cyclone interacted with a weakening frontal boundary. Convection increased over the Bahamas on this date but no organization was observed in the synoptic observations.

October 11:

1. Maps and old HURDAT:
- HWM analyzed a closed low pressure of at most 1008 mb at 24.5N, 70W at 12Z.
- Microfilm shows a trough north of the Greater Antilles at 12Z.
2. Ship highlights:
  - 35 kt NE and 1010 mb at 27.8N, 66.3W at 00Z (COADS).

3. Discussion:
- MWR: “Satellite pictures indicated that a tropical depression had formed north of Hispaniola on Sunday, Oct. 11, 1970, near latitude 24"N and 71"W. The depression drifted slowly eastward for the next 2 days.”
- Reanalysis: The disturbance became much better organized on satellite on October 11th, even showing some signs of banding features over the northern and southern quadrants. Ship and coastal observations continued to show that at the surface the system was still a trough, and a well-defined low-level circulation had not formed.

October 12:

1. Maps and old HURDAT:
- HWM analyzed a closed low pressure of at most 1008 mb at 24N, 69W at 12Z.
- HURDAT lists a 30 kt subtropical depression at 24.5N, 68.5W at 12Z.

- Microfilm shows a tropical cyclone of at most 1008 mb at 24.5N, 68.5W at 12Z.

2. Ship highlights:

- 15 kt SE and 1005 mb at 24.4N, 67.6W at 12Z (COADS).
- 35 kt E and 1011 mb at 27.6N, 63W at 18Z (COADS).

3. Discussion:

- Reanalysis: The disturbance moved slowly eastward and ship observations suggested that a well-defined circulation had formed by 12Z on October 12th. The 500 mb Historical Weather Maps showed a trough extending to the Bahamas from the central Atlantic. Thus, based on the 500 mb data and origin of the system, the first position is analyzed as a 30 kt subtropical depression at 12Z on the 12th, same as originally shown in HURDAT. Ship reports near the center indicated winds around 5 kt, but reports of 30-35 kt were found at about 300 n mi north and northeast of the center. Intensification to a subtropical storm is analyzed at 18Z on the 12th based on a ship report of 35 kt. A satellite image on this date (Spiegler, 1971) shows a small area of organized convection near the center.

October 13:

1. Maps and old HURDAT:

- HWM analyzes a closed low pressure of at most 1008 mb at 26N, 64W with a stationary front to the east at 12Z.
- HURDAT lists a 35 kt subtropical storm at 26.3N, 64W at 12Z.
- Microfilm shows a tropical cyclone of at most 1006 mb at 26N, 64W at 12Z.

2. Ship highlights:

  - 15 kt NE and 1005 mb at 26.8N, 67.5W at 00Z (COADS).
  - 35 kt ENE and 1011 mb at 28.9N, 59.6W at 12Z (COADS).
  - 40 kt NE and 1004 mb at 28.3N, 63.5W at 21Z (COADS).

3. Discussion:

- MWR: “During this 2-day period, central pressure of the system was steady between 1004 and 1005 mb (29.65 and 29.68 in.). The satellite pictures suggest that the cloud mass associated with the depression merged with a cloud mass associated with an old, very weak stationary front along 26"-27"N latitude by October 13. At this stage in its history, the low-pressure system was no longer purely tropical; rather, it might be termed “semitropical.”
- Reanalysis: The subtropical cyclone moved northeastward before coming to a halt later on October 13th. A couple of ships reported gale-force winds northeast of the center. Satellite images on the 13th showed a larger convective envelope, stretching northeast of the center, indicative of a subtropical cyclone.

October 14:

1. Maps and old HURDAT:

- HWM analyzes a closed low pressure of at most 1004 mb at 27N, 67W and a stationary front to the east at 12Z.
- HURDAT lists a 45 kt subtropical storm at 27N, 66.5W at 12Z.
- Microfilm shows a tropical cyclone of at most 1004 mb at 26.5N, 66.8W at 12Z.

2. Ship highlights:

- 35 kt NE and 1006 mb at 28.4N, 62.7W at 00Z (COADS).
- 35 kt N and 1010 mb at 27N, 67.5W at 06Z (micro).
- 45 kt NE and 1009 mb at 28.1N, 67.9W at 12Z (micro).
- 40 kt NW and 1006 mb at 25.6N, 68.5W at 18Z (COADS).

3. Aircraft highlights:

- Penetration center fix measured a central pressure of 1001 mb at 27.2N, 66.1W at 14Z (WALLET).
- Penetration center fix measured a central pressure of 999 mb, estimated surface winds of 65 kt and an eye diameter of 20 n mi at 27.4N, 67.4W at 1725Z (WALLET/MWR).
- Penetration center fix measured a central pressure of 997 mb and estimated surface winds of 60 kt at 27.1N, 67.5W at 2010Z (WALLET).

4. Discussion:

- MWR: "The neuter cyclone, first identified as a subtropical system in a bulletin from NHC on October 14, moved slowly northward toward Bermuda, increasing in size and intensity as it approached the island." "The cyclone in the southwest North Atlantic was classified as a "subtropic storm" of the Kona type by the NHC on Wednesday, October 14, as it began to drift westward and intensify. However, careful analysis of the available data and comparison with the subtropical cyclone model do not appear to support this conclusion. ATS 3 satellite pictures taken every 25 min or so show that the cloud pattern grows somewhat larger and more organized throughout the day. Navy reconnaissance aircraft investigating the cyclone reported maximum surface winds estimated at 65 kt (minimal hurricane force) at a distance of 35 nmi from the center and a central pressure of 999 mb (29.50 in.) at 1725 GMT, October 14. Maximum flight level (150 m) winds were reported to be 55 kt, 35 nmi northwest of the center. The flight summary also indicated that the "eye appears closed visually with wall clouds all quadrants." The size of the eye was "estimated as 20 nmi." The cyclone did not qualify as a tropical storm at this time because the temperature dropped 2°C from 23° to 21°C at 150-m level from outside the center to the center (aircraft report)."
- Reanalysis: Trapped under a large ridge, the system turned to the northwest and slowly intensified on October 14th. A few ships reported gale-force winds, especially over the northern semicircle. A ship at 12Z on the 14th reported 60 kt SE and 1017 mb and possibly the same ship, reported 50 kt E and 1014 mb at 18Z. Both observations appear to have a high wind bias compared to surrounding ship reports, and pressure values also seem to have a high bias. Thus these reports were not used in this reanalysis as they were deemed erroneous. The subtropical cyclone was investigated by reconnaissance aircrafts measuring a central pressure of 1001 mb at 14Z, 999 mb at 1725Z and 997 mb at 2010Z, and estimating surface winds up to 65 kt. These central pressure values were not used to estimate the intensity using the Brown et al. pressure-wind relationship because the system was still subtropical, but the surface wind estimate was weighted to increase the intensity between October 14th at 06Z and 15th at 00Z. By 18Z on the 14th, ship reports indicated that the subtropical cyclone had become more symmetrical and the strongest winds were found closer to the center, thus the system was close to becoming a tropical storm. Satellite imagery showed a large area of convection over or near the center.

October 15:

1. Maps and old HURDAT:

- HWM analyzes a closed low pressure of at most 996 mb at 28.5N, 67W and a stationary front to the east at 12Z.
- HURDAT lists a 55 kt tropical storm at 28N, 67.5W at 12Z.
- Microfilm shows a tropical cyclone of at most 1000 mb at 28N, 67.5W and a stationary front to the east at 12Z.

2. Ship highlights:

- 40 kt NW and 1002 mb at 27.1N, 68.9W at 00Z (COADS).
- 35 kt SW and 1003 mb at 27.2N, 66.6W at 06Z (COADS).
- 40 kt SE and 1002 mb at 29.1N, 66.8W at 12Z (COADS).

- 35 kt S and 996 mb at 28.7N, 66.7W at 18Z (COADS).

3. Aircraft highlights:

- Penetration center fix measured a central pressure of 995 mb, estimated surface winds of 65 kt at and an eye diameter of 20 n mi 28.1N, 67.4W at 1204Z (WALLET/MWR).
- Penetration center fix measured a central pressure of 994 mb and an eye diameter of 25 n mi at 29N, 67.4W at 1750Z (WALLET/MWR).
- Penetration center fix measured a central pressure of 992 mb, estimated surface winds of 65 kt and an eye diameter of 25 n mi at 29.4N, 67.7W at 2010Z (WALLET/MWR).

4. Discussion:

- MWR: "On Thursday, October 15, aircraft reconnaissance, satellite pictures, and ship reports all indicated that the cyclone had intensified to near hurricane strength. The data indicate that the storm drifted slightly west of due north at 4-9 kt on the 15th. Central pressure dropped slowly through the day to 992 mb (29.29 in.) and maximum minds reported by the aircraft were 65 kt-minimal hurricane force."
- Reanalysis: Synoptic observations indicated that the circulation had continued to become more symmetric and satellite imagery showed a large area of organized convection near the center with banding features over the northern semicircle. Thus, transition to a tropical storm is analyzed at 00Z on October 15th. A few ships reported tropical-storm-force winds as the tropical storm moved slowly northward. A penetration center fix measured a central pressure of 995 mb, estimated surface winds of 65 kt and an eye diameter of 20 n mi at 1204Z on the 15th. A central pressure of 995 mb suggests maximum surface winds of 52 kt from the north of 25N pressure-wind relationship. An eye diameter of 20 n mi suggests an RMW of about 15 n mi and the climatological value is 23 n mi. Weighting some the visual estimate, an intensity of 55 kt is analyzed at 12Z on the 15th, same as originally shown in HURDAT.

October 16:

1. Maps and old HURDAT:

- HWM analyzes a closed low pressure of at most 996 mb at 31.5N, 66.5W with a stationary front to the southeast and a strong front to the west at 12Z.
- HURDAT lists a 65 kt hurricane at 31.5N, 66W at 12Z.
- Microfilm shows a closed low pressure of at most 996 mb at 31.3N, 66.3W with a stationary front to the southeast at 12Z.

2. Ship highlights:

- 35 kt E and 1011 mb at 32.2N, 66.4W at 00Z (COADS).
- 45 kt SE and 1001 mb at 30.3N, 64.3W at 06Z (COADS).
- 35 kt SE and 1006 mb at 31.8N, 63.3W at 12Z (COADS).
- 40 kt S and 1005 mb at 31.5N, 62.8W at 18Z (COADS).

3. Land highlights:

- 40 kt ESE (gusts to 51 kt) and 988 mb at Bermuda at 1620Z (WALLET).
- 20 kt SW and 984 mb at Bermuda at 18Z (WALLET).
- 74 kt at 50 ft, 87 kt at 100 ft at NASA Station Bermuda (time unknown) (WALLET).

4. Aircraft highlights:

- Penetration center fix extrapolated 994 mb center pressure and estimated an eye diameter of 40 n mi at 30.4N, 66.6W at 0603Z (WALLET).
- Penetration center fix measured a central pressure of 989 mb, estimated surface winds of 50 kt and an eye diameter of 40 n mi at 31.4N, 66W at 1203Z (WALLET/MWR).
- Penetration center fix measured a central pressure of 982 mb and estimated surface winds of 70 kt at 32.8N, 64.2W at 1920Z (WALLET).

- Penetration center fix measured a central pressure of 983 mb, estimated surface winds of 75 kt at and an eye diameter of 26 n mi 33.8N, 63.5W at 2340Z (WALLET).

5. Discussion:

- MWR: "Reconnaissance data showed that, while winds in the boundary layer had increased nearly to hurricane force at some distance from the pressure center, the mass circulation appeared to be fed mainly by the spiral band structure. As the center approached the island on October 16, a radiosonde released from Bermuda at 1345 GMT indicated winds of 130°/75 kt at 900 mb. The pressure fell to 984.4 mb (29.07 in.) at the U.S. Naval Air Station, Bermuda, at 1800 GMT as the center passed just to the northwest. An anemometer at a 100-ft elevation at the NASA Station Bermuda recorded a maximum reading of 87 kt. By Friday morning, October 16, satellite pictures depicted a cloud pattern typical of tropical hurricanes including an eye, and aircraft reports indicated a warm core at the 700-mb level and central pressure of 989 mb (29.20 in.). These would necessarily lead to the conclusion that the storm was tropical in character and of near hurricane intensity. During the day, the hurricane moved in a north-northeasterly direction at an increasing forward speed, passing just to the west of Bermuda at about 1800 GMT (1300 EST). Highest winds observed at Bermuda were 42 kt with gusts to 50 kt as the storm passed."
- Reanalysis: The tropical storm turned to the northeast ahead of a frontal boundary and intensified as it increased in forward speed. A penetration center fix measured a central pressure of 989 mb, estimated surface winds of 50 kt and an eye diameter of 40 n mi at 1259Z on the 16th. A central pressure of 989 mb suggests maximum surface winds of 61 kt from the north of 25N pressure-wind relationship. An eye diameter of 40 n mi suggests an RMW of about 30 n mi and the climatological value is 26 n mi. Based on a forward speed of about 15 kt, an intensity of 65 kt is analyzed at 12Z on the 16th, same as originally shown in HURDAT. Intensification to a hurricane is analyzed at 12Z on the 16th, same as originally shown in HURDAT. The center of the hurricane passed just to the west of Bermuda around 16Z on the 16th. A NASA Station in Bermuda measured 74 kt at 50 ft and 87 kt at 100 ft, this is reduced to 73 kt and 82 kt at 1-min 10 m, respectively. Nonetheless, it is not clear whether these were sustained winds or gusts. A penetration center fix measured a central pressure of 982 mb and estimated surface winds of 70 kt at 1920Z on the 16th. A central pressure of 982 mb suggested maximum surface winds of 70 kt and 73 kt from north of 25N pressure-wind relationship and intensifying subset, respectively. Based on a forward speed of about 19 kt, an intensity of 75 kt is analyzed at 18Z, up from 70 kt originally in HURDAT, a minor intensity change. Satellite imagery showed a well-organized tropical cyclone with a CDO over the center.

October 17:

1. Maps and old HURDAT:

- HWM analyzes a closed low pressure of at most 980 mb at 38.6N, 61W with a cold front just to the west at 12Z.
- HURDAT lists a 90 kt hurricane at 39N, 61W at 12Z.
- Microfilm shows a closed low pressure of at most 992 mb at 39N, 61.5W with a cold front just to the west at 12Z.

2. Ship highlights:

  - 35 kt WSW and 996 mb at 33.1N, 63.3W at 00Z (COADS).
  - 50 kt SE and 1000 mb at 38.6N, 59.4W at 06Z (COADS).
  - 65 kt SE and 982 mb at 38.7N, 61.5W at 12Z (micro).
  - 50 kt SSE and 995 mb at 41.4N, 56.9W at 15Z (COADS).
  - 45 kt S and 1001 mb at 41N, 56.4W at 18Z (COADS).

3. Aircraft highlights:
   - Penetration center fix measured a central pressure of 974 mb at 36.8N, 61W at 0715Z (WALLET).
   - Penetration center fix extrapolated a central pressure of 975 mb and estimated surface winds of 60 kt and an eye diameter of 10 n mi at 38N, 60.3W at 1020Z (WALLET/MWR)
   - Penetration center fix measured a central pressure of 975 mb, estimated flight level winds of 90 kt and an eye diameter of 15 n mi at 38.6N, 59.5W at 1130Z (WALLET/MWR).

4. Satellite highlights:
   - ATS estimated a center fix at 40N, 59W at 1307Z (WALLET).
   - ATS estimated a center fix at 42.8N, 57.5W at 1728Z (WALLET).

5. Discussion:
- MWR: "After passing Bermuda, the storm accelerated rapidly northward and was finally swept up into a strong frontal zone as it reached Newfoundland on October 17. While the structure and energetics of this cyclone approached or may have reached that of a hurricane for a short period while it was near Bermuda, it was rapidly swept into a baroclinic environment and again modified. Therefore, it was decided not to include it in the inventory of 1970 tropical storms and hurricanes, even though it apparently acquired some tropical cyclone characteristics during a portion of its life cycle. By October 17, the hurricane was accelerating north northeastward. A radio NSS (Washington, D.C.) bulletin at 1200 GMT stated "the severe storm center 300 miles northeast of Bermuda . . . has hurricane characteristics. The storm should begin to lose tropical characteristics as it moves northward over colder mater. ATS 3 satellite pictures taken early in the day on the 17th show the hurricane vortex well defined near 40°N, 60°W. To the west of the hurricane, a strong cold front was approaching as evidenced by the broad cloud band off the east coast of the United States. By 1800 GMT, the cold front was entering the hurricane circulation and the storm began to lose its tropical characteristics."
- Reanalysis: The hurricane continued to accelerate ahead of a strong cold front. A penetration center fix at 2340Z on the 16th measured a central pressure of 983 mb and an intensity of 75 kt is analyzed at 00Z on the 17th, same as originally shown in HURDAT. The next penetration center fix measured a central pressure of 974 mb at 0715Z on the 17th. A central pressure of 974 mb suggests maximum surface winds of 79 kt from the north of 35N pressure-wind relationship. Based on a forward speed of about 30 kt and a small eye diameter of 10 n mi estimated in a penetration center fix at 1030Z, an intensity of 85 kt is analyzed at 06Z on the 17th, same as originally shown in HURDAT. The last penetration center fix measured a central pressure of 975 mb at 1130Z on the 17th, and an intensity of 85 kt is analyzed at 12Z on the 17th, same as originally shown in HURDAT. 85 kt is also the peak intensity of this hurricane, down from 90 kt originally shown in HURDAT, a minor intensity change. As the hurricane moved into the north Atlantic and interacted with the cold front, an extratropical cyclone developed over eastern Canada and became the dominant feature. It is difficult to determine if by 18Z on the 17th the hurricane still had a closed low-level circulation. By 00Z on the 18th, the data suggests that the surface circulation of the hurricane had dissipated and that the hurricane had been absorbed by the extratropical cyclone without the hurricane having an extratropical stage, thus the last position is analyzed at 18Z on the 17th, six hours earlier than originally shown in HURDAT.

October 18:

1. Maps and old HURDAT:
- HWM analyzes an extratropical cyclone at 52N, 53W at 12Z.
- HURDAT lists a 55 kt extratropical cyclone of at most 47N, 53W at 00Z (last position).
2. Ship highlights:
- 50 kt SSE and 1012 mb at 41.7N, 53.5W at 00Z (WALLET).

October 19:

1. Maps and old HURDAT:
- HWM analyzes a large extratropical cyclone near 62N, 61W, the original cyclone appears to have been absorbed, at 12Z.

Sources: NHC microfilm maps, the Historical Weather Maps series, the COADS ship database, Monthly Weather Review, Navy reconnaissance book, Mariners Weather Log, EV2 Surface Weather Observations, Satellite images from NCDC, and NHC Storm Wallets.

Date	Original HURDAT Central Pressure	Evidence	Changes
Oct 12 12Z	1003 mb	Ship: 15 kt SE and 1005 mb at 24.4N, 67.6W at 12Z	Retained
Oct 13 12Z	1002 mb	No data near the center but appears reasonable	
Oct 14 00Z	1001 mb	Ship: 30 kt ENE and 1004 mb at 28.4N, 63.5W at 00Z	
Oct 14 12Z	1001 mb	Penetration center fix: 1001 mb at 14Z	
Oct 14 18Z		Penetration center fix: 999 mb at 1725Z	999 mb
Oct 15 00Z	997 mb	Penetration center fix: 997 mb at 2010Z on Oct 14	Retained
Oct 15 12Z	995 mb	Penetration center fix: 995 mb at 1204Z	
Oct 15 18Z		Penetration center fix: 994 mb at 1750Z	994 mb
Oct 16 00Z	991 mb	No data near the center but appears reasonable	Retained
Oct 16 12Z	989 mb	Penetration center fix: 989 mb at 1203Z	
Oct 16 18Z		Penetration center fix: 982 mb at 1920Z	982 mb
Oct 17 00Z	980 mb	Penetration center fix: 983 mb at 2340Z on Oct 16	983 mb
Oct 17 06Z		Penetration center fix: 974 mb at 0715Z	974 mb
Oct 17 12Z	974 mb	Penetration center fix: 975 mb at 1130Z	975 mb
Oct 17 18Z	980 mb	No penetration center fixes and the ship observations around this time suggests that the central pressure was higher	Removed

Sources: NHC microfilm maps, the Historical Weather Maps series, the COADS ship database, Monthly Weather Review, Unnamed Atlantic Tropical Storms of 1970 (Spiegler, 1971), Navy reconnaissance book, Mariners Weather Log, EV2 Surface Weather Observations, Satellite images from NCDC, and NHC Storm Wallets.

Green indicates wind changes of 15 kt or greater
Blue indicates lat/long changes greater than 1º
Red indicates a new entry
Yellow indicates a deletion

Unnamed Hurricane [October 20-28, 1970] - AL191970

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47165 10/20/1970 M= 9 10 SNBR=1005 NOT NAMED   XING=0 SSS=0                    L


47170 10/20*  0   0   0    0*  0   0   0    0S340 480  25 1013S343 473  30    0*
47170 10/20*  0   0   0    0*  0   0   0    0E340 480  35 1013E343 478  40    0*
                                             *         **     *    ***  **

47175 10/21S345 465  30 1009S348 458  35    0S350 450  35 1005S350 450  40    0*
47175 10/21E346 474  40    0E348 468  45    0E349 460  45    0E350 455  50    0*
           **** ***  **    **    ***  **     **** ***  **    **    ***  **

47180 10/22S350 450  40    0S350 450  45    0S350 450  45 1000S352 447  45    0*
47180 10/22E353 450  50    0E358 445  50    0E363 441  50    0E364 437  50    0*
           ****      **    ***** ***  **     **** ***  **    ***** ***  **

47185 10/23S355 440  45  997S360 432  45    0S365 425  50    0S366 421  50    0*
47185 10/23S364 432  50  997S362 428  55  995S364 423  55    0S368 421  55    0*
            *** ***  **      *** ***  **  ******* ***          ***

47190 10/24S365 418  50    0S363 417  50    0S360 415  50    0S355 413  50    0*
47190 10/24S370 418  50    0S367 417  50    0S362 415  50    0S356 413  55    0*
            ***              ***             ****              ****      **

47195 10/25S350 410  50    0S345 408  55    0*340 405  55  988*335 400  55    0*
47195 10/25*350 410  60    0*345 407  65    0*340 402  70    0*341 394  75    0*
           *         **     *    ***  **          ***  **    * *** ***  **

47200 10/26*350 390  60    0*355 385  60    0*360 380  60  988*365 375  60    0*
47200 10/26*348 385  80    0*355 376  85    0*360 370  85    0*365 365  85    0*
            *** ***  **          ***  **          ***  **    *     ***  **

47205 10/27*370 365  65    0*378 353  65    0*385 340  60    0*393 328  60    0*
47205 10/27*370 359  85    0*377 351  80    0*387 339  75    0*399 325  70    0*
                ***  **      *** ***  **      *** ***  **      *** ***  **

47210 10/28*400 315  60    0*421 291  60    0*460 250  60    0*  0   0   0    0*
47210 10/28*411 311  65    0*428 290  60    0*457 253  55    0*490 210  50    0*
            *** ***  **      *** ***          *** ***  **      *** ***  **

47215 HR
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Hurricane Impact

10/27 18Z 39.9N 32.5W 70 kt Azores

Significant Revisions:

1. Analyzed to have begun as an extratropical cyclone based on synoptic observations and satellite imagery. Previously started as a subtropical cyclone in HURDAT.

2. Major track changes to the NNE analyzed at 12Z and 18Z on October 22nd and 00Z on October 28th based on synoptic observations.
3. Transition to a subtropical cyclone is analyzed at 00Z on October 23rd, 60 hours later than originally shown in HURDAT based on synoptic observations and satellite imagery.
4. Intensification to a hurricane is analyzed at 06Z on October 25th, 66 hours earlier than originally shown in HURDAT based on satellite imagery.
5. Major intensity increases analyzed between October 25th at 12Z and October 27th at 12Z based on synoptic observations and satellite imagery.
6. Substantial increase to peak intensity (85 kt between 06Z to 18Z on October 26th versus 65 kt at 00Z and 06Z on October 27th) based on synoptic observations and satellite imagery.

Daily Metadata:

October 19:

1. Maps and old HURDAT:
- HWM analyzes an extratropical cyclone of at most 1016 mb at 32N, 54W at 12Z.
- Microfilm shows an extratropical cyclone of at most 1016 mb at 32N, 55W at 12Z.

2. Discussion:
- MWL: "A 1015-mb cyclone developed along a stationary front near 29N, 54W, late on the 19th."
- Reanalysis: A weakening cold front was located over the central Atlantic on October 19th. An area of low pressure began to form on this date around 32N and 54W but synoptic observations suggested that it did not have a closed circulation at the surface.

October 20:

1. Maps and old HURDAT:
- HWM analyzes an extratropical cyclone of at most 1012 mb at 35N, 51W at 12Z.
- HURDAT lists a 25 kt subtropical depression at 34N, 48W at 12Z (first position).
- Microfilm shows an extratropical cyclone of at most 1016 mb at 34N, 47.5W at 12Z.

2. Ship highlights:
  - 35 kt N and 1017 mb at 32.9N, 53.3W at 12Z (COADS).
  - 40 kt N and 1015 mb at 36.7N, 51W at 18Z (COADS).

3. Discussion:
- Reanalysis: The area of low pressure continued to become better defined at the surface and by 12Z on October 20th, it is analyzed to have developed into an extratropical cyclone. HURDAT originally also had the first position at 12Z on October 20th but as a subtropical cyclone. Ship data and satellite imagery indicated that the system remained embedded in a frontal boundary and a temperature gradient of about 3-4°C was present across the circulation. Furthermore, as the extratropical cyclone developed, the gradient increased due to a strong high pressure to the northwest, leading to the development of gale-force winds. Thus, the system is initiated as a 35-kt cyclone, up from 25 kt originally in HURDAT, a minor intensity change.

October 21:

1. Maps and old HURDAT:
- HWM analyzed an occluded cyclone of at most 1012 mb at 33N, 46W at 12Z.
- HURDAT lists a 35 kt subtropical storm at 35N, 45W at 12Z.
- Microfilm shows an occluded cyclone of at most 1012 mb at 34N, 45W at 12Z.

2. Ship highlights:
- 35 kt N and 1018 mb at 37.6N, 51.6W at 00Z (COADS).
- 45 kt N and 1021 mb at 38.1N, 51.6W at 06Z (COADS).
- 45 kt N and 1015 mb at 37N, 49.1W at 12Z (MWL).
- 50 kt NNE and 1016 mb at 37.7N, 49.8W at 18Z (COADS).

3. Discussion:
- MWL: "The storm headed northeastward until late on the 20th when it curved eastward along the 35th parallel. At 0000 on the 21st, the CAMITO near 37N, 49W (125 mi northwest of the 1010-mb cyclone) was hit by 40-kt winds, heavy intermittent bursts of rain, and 20-ft swells. The ACADIA FOREST near 37N, 49W (200 mi northwest of the storm center) measured northerly 45-kt gales and 17-ft seas, 12 hr later, during the heavy rain shower."
- Reanalysis: The extratropical cyclone moved slowly eastward and intensified. Many ships reported gale-force winds, especially over the northwest quadrant. A ship reported 50 kt at 18Z on the 21st. Satellite imagery showed an occluded cyclone.

October 22:

1. Maps and old HURDAT:
- HWM analyzes an occluded cyclone of at most 1004 mb at 37N, 44W at 12Z.
- HURDAT lists a 45 kt subtropical storm at 35N, 45W at 12Z.
- Microfilm shows an occluded cyclone of at most 1008 mb at 35N, 43W at 12Z.

2. Ship highlights:
  - 45 kt NNE and 1018 mb at 38.1N, 49.9W at 00Z (COADS).
  - 45 kt N and 1018 mb at 38.6N, 50W at 06Z (COADS).
  - 45 kt N and 1031 mb at 38.4N, 50.3W at 12Z (COADS).
  - 45 kt N and 1022 mb at 39N, 51.4W at 18Z (COADS).

3. Discussion:
- MWL: "The gradually intensifying LOW resumed a north-northeasterly course for about 24 hr on the 21st-22nd, but by 1200 on the latter day, it became quasi-stationary near 37N, 44W. The DIANA, 500 mi southwest of the 1000-mb cyclone, encountered 45-kt gales at 1200 on the 22nd."
- Reanalysis: The intensity remained 50 kt on the 22nd as the system continued its slow movement to the northeast. Satellite imagery showed an increased in convection, especially over the northern semicircle.

October 23:

1. Maps and old HURDAT:
- HWM analyzes an occluded cyclone of at most 1000 mb at 37N, 43W at 12Z.
- HURDAT lists a 50 kt subtropical storm at 36.5N, 42.5W at 12Z.
- Microfilm shows a closed low pressure of at most 1004 mb at 37N, 42.5W with a warm front extending to the northeast at 12Z.

2. Ship highlights:
- 45 kt N and 1024 mb at 39N, 51.4W at 00Z (COADS).
- 45 kt NE and 1016 mb at 43.5N, 41.3W at 06Z (COADS).
- 30 kt NE and 998 mb at 37N, 38.8W at 06Z (COADS).
- 40 kt SW and 1002 mb at 35.6N, 41.6W at 12Z (COADS).
- 50 kt NE and 1014 mb at 42N, 44.5W at 18Z (COADS).

3. Discussion:

- MWL: "With the storm in this quasi-stationary position (due to a blocking 1033-mb HIGH south of Newfoundland), gales increased on the 23rd as that HIGH moved closer to the LOW thereby tightening the pressure gradient. This was especially true within the storm's western semicircle. The BROOKLYN near 42°N, 48°W was stung by 55-kt winds at 0000 on the 23rd. Eight hours later, the USCGC McCULLOCH near 44°N, 42°W measured 55-kt northeasterly winds and 17-ft seas while at Ocean Station "D." At 1200 on the 23rd, the SKAUSUND was battered by 60-kt gales near 36°N, 51°W, or 400 mi west of the stationary 996- mb center."
- Reanalysis: Transition to a subtropical cyclone is analyzed at 00Z on October 23rd based on gale-force winds being closer to the center, an RMW of about 120 n mi and satellite imagery showing a small system with convection near the center. A couple of ships reported 55 and 60-kt force winds but these values appear to have a high bias based on nearby synoptic observations. However, the USCG ship may have been an official weather ship, so the 55 kt it measured at 08Z appears to be believable. Based on these observations, a 55 kt intensity is analyzed at 06 and 12Z on the 23rd. **(AH 10/25/21)**

October 24:

1. Maps and old HURDAT:

- HWM analyzes an occluded cyclone of at most 1000 mb at 36N, 42W at 12Z.
- HURDAT lists a 50 kt subtropical storm at 36N, 41.5W at 12Z.
- Microfilm shows a closed low pressure of at most 1004 mb at 37N, 41.5W with a front extending to the northeast at 12Z.

2. Ship highlights:

- 45 kt NE and 1013 mb at 42.2N, 43.1W at 00Z (COADS).
- 40 kt N and 1023 mb at 43.9N, 44.5W at 06Z (COADS).
- 40 kt NE and 1017 mb at 43.2N, 42.6W at 12Z (COADS).
- 40 kt NE and 1015 mb at 42.9N, 39.3W at 18Z (COADS).

3. Discussion:

- MWL: "Gales diminished to about 45 kt on the 24th as the center filled slightly to 999 mb."
- Reanalysis: The subtropical cyclone maintained a slow crawl on this date, but now to the southeast. Satellite imagery showed a small cyclone with organized convection over the center. However, there were still some cold air clouds observed south of the center, so the cyclone is still maintained as subtropical at 12 and 18Z. Tropical transition is analyzed at 00Z on 25 October (12 hours earlier than the original HURDAT). **(AH 10/25/21)**

October 25:

1. Maps and old HURDAT:

- HWM analyzes a closed low pressure of at most 100 mb at 33N, 42W with a dissipating front to the east at 12Z.
- HURDAT lists a 55 kt tropical storm at 34N, 40.5W at 12Z.
- Microfilm shows a closed low pressure of at most 1000 mb at 33N, 40.5W at 12Z.

2. Ship highlights:

- 45 kt NW and 1007 mb at 35.7N, 45.5W at 00Z (COADS).
- 15 kt SW and 1003 mb at 33.7N, 37.3W at 09Z (COADS).
- 20 kt SW and 1000 mb at 33.4N, 39.6W at 12Z (COADS).
- 35 kt SW and 994 mb at 33.2N, 39.3W at 15Z (COADS).
- 45 kt SW and 991 mb at 32.9N, 39.9W at 18Z (COADS).

3. Discussion:

- MWL: "High pressure north and west of the cyclone pushed it southeastward on the 24th-25th until it reached a point near 34°N, 41°W, by 1200 on the 25th.

Even though the LOW resumed a deepening trend on the 24th, gales subsided by 1200 on the 25th as the areas of high pressure flattened and the resulting gradient loosened."

- Reanalysis: The system continued its slow movement to the southeast. Satellite imagery showing a small but well-defined cyclone with organized convection and an eye. Also based on that data and ship observations late on the 25th, intensification to a hurricane is analyzed at 06Z. Due to the small size of the hurricane, data near the center was sparse, but at 18Z on the 25th, a couple of ships reported pressures in the 990s mb, including 45 kt SW and 991 mb, suggesting a central pressure in the mid-980s mb or lower.

October 26:

1. Maps and old HURDAT:

- HWM analyzes a closed low pressure of at most 1000 mb at 36N, 37.5W with a cold front to the northwest at 12Z.
- HURDAT lists a 60 kt tropical storm at 36N, 38W at 12Z.
- Microfilm shows a closed low pressure of at most 1004 mb at 36N, 37W at 12Z.

2. Ship highlights:

- 25 kt N and 1004 mb at 34.2N, 42W at 00Z (COADS).
- 25 kt N and 997 mb at 38.9N, 39.4W at 06Z (COADS).
- 50 kt NE and 985 mb at 36.2N, 37.5W at 12Z (COADS).
- 35 kt SE and 997 mb at 37N, 36.1W at 18Z (COADS).

3. Discussion:

- MWL: "The cyclone was then able to adopt a northeasterly heading. The storm soon intensified and was carrying gales again by late on the 26th as the central pressure neared the 992-mb mark."
- Reanalysis: The hurricane turned to the northeast and intensified. Satellite imagery showed a very small but strong tropical cyclone with a ring of convection around a well-defined eye, suggesting a Dvorak T number near the T-5.0 range **(AH 10/25/21)**. Based on this image, an intensity of 85 kt is analyzed between 06Z on October 26th and 00Z on October 27th, the peak intensity of this hurricane, up from 65 kt originally in HURDAT, a major intensity change. A ship at 12Z reported 50 kt NE and 985 mb, suggesting a central pressure in the 970s mb, which does support an increase to the assessed intensity.

October 27:

1. Maps and old HURDAT:

- HWM analyzes a closed low pressure of at most 1000 mb at 38.5N, 33.5W with a strong front just to the west at 12Z.
- HURDAT lists a 60 kt tropical storm of at most 38.5N, 34W at 12Z.
- Microfilm shows a closed pressure of at most 1000 mb at 38.5N, 33W at 12Z with a front to the west at 12Z.

2. Ship highlights:

- 40 kt NE and 997 mb at 36.7N, 36.6W at 00Z (COADS).
- 65 kt SE and 994 mb at 37N, 35.1W at 03Z (COADS).
- 40 kt W and 998 mb at 36.8N, 34.4W at 06Z (COADS).
- 40 kt SW and 996 mb at 38.1N, 33.4W at 12Z (COADS).
- 45 kt SSW and 990 mb at 39.7N, 31.4W at 18Z (MWL).
- 65 kt SSW and 994 mb at 39.7N, 31.4W at 19Z (micro).

3. Land highlights:

- 50 kt S and gusts to 70 kt at Flores island, Azores at 18Z (IPMA).

4. Discussion:

- MWR: "A second type of hybrid storm is that of a "minicyclone," one which has the true characteristics of a hurricane and may have full hurricane-force winds for periods of 1 or 2 days, but with maximum winds occurring at extremely small radii, sometimes no more than 5 nmi and gale-force winds extending outward no more than 40 to 60 nmi. These systems often go undetected as they slip through observational networks without appreciably affecting the surrounding wind or pressure patterns. A circulation system that was initially observed on satellite pictures southwest of the Azores in late October may fit into this category. It appeared as a small, tightly coiled, spiraling cloud pattern with the suggestion of an eye at the center. The Pretoria (OYNM) reported winds of 65 kt and a 994-mb (29.34-in.) pressure at 1800 GMT on October 27 near the island of Flores in the Azores. No aircraft data were available from this system, and its thermal structure remains uncertain."
- MWL: "The LEBU close to the center near 36°N, 35°W observed 40-kt northwesterlies and 23-ft swells at 0000 on the 27th. Eighteen hours later, the PRETORIA near 40°N, 31°W (60 mi east-southeast of the cyclone) wrestled 46-kt gales and recorded a 990-mb pressure during heavy, pelting rains."
- Reanalysis: The hurricane accelerated to the northeast as a strong front approached from the west and began to weaken. Two ships reported hurricane-force winds at 03Z and 19Z on the 27th. Based on these ship observations and the appearance of the tropical cyclone on the satellite images on the 27th and 28th, significant intensity changes are introduced on the 28th between 00Z and 12Z compared to the original HURDAT. Late on this date, the hurricane passed close to the island of Flores in the Azores archipelago, near where one of the ships that reported hurricane-force winds was located. Peak winds of 50 kt and gusts to 70 kt were observed at Florida island at 18Z. Satellite imagery continued to depict a small tropical cyclone with organized convection over the center, but the eye was not visible anymore.

October 28:

1. Maps and old HURDAT:

- HWM analyzes a closed low pressure of at most 1000 mb at 38.5N, 33.5W with a strong front just to the west at 12Z.
- HURDAT lists a 60 kt tropical storm of at most 46N, 25W at 12Z (last position).

2. Ship highlights:

- 35 kt SSW and 1011 mb at 41N, 27.5W at 00Z (COADS).
- 35 kt WSW and 1018 mb at 34.9N, 25.9W at 06Z (COADS)
- 45 kt SSW and 1004 mb at 45.6N, 23.8W at 12Z (COADS).
- 35 kt SW and 1013 mb at 46.8N, 21.9W at 18Z (COADS).

3. Discussion:

- MWL: "The FRUBEL ASIA was struck by 45-kt winds at 1200 on the 28th near 46° N, 23° W, or 80 mi southeast of the 996-mb LOW. Later on the 28th, gales over the area ended as a cold front absorbed the cyclone into its frontal trough."
- Reanalysis: The small hurricane is analyzed to have weakened into a tropical storm at 06Z on October 28th, eighteen hours later than originally shown in HURDAT. Observations early on October 29th suggested that the low-level circulation had dissipated and the remnants were likely absorbed by the cold front associated to a strong extratropical cyclone to the north, thus the last position is analyzed at 18Z on the 28th, six hours later than originally shown in HURDAT. Note that as the system remained a tropical cyclone until it was

absorbed, no extratropical phase is indicated despite the high latitude reached.

October 29:

1. Maps and old HURDAT:

- HWM analyzes two extratropical cyclones over the far northeast Atlantic at 12Z.

Date	Original HURDAT Central Pressure	Evidence	Changes
Oct 20 12Z	1013 mb	Ship: 20 kt E and 1015 mb at 35N, 48W at 12Z	Retained
Oct 21 12Z	1005 mb	Ship reports near the center suggest higher central pressure values	Removed
Oct 22 12Z	1000 mb		
Oct 23 00Z	997 mb	Ship: 35 kt NW and 1002 mb at 35.3N, 44.4W at 00Z	Retained
Oct 23 06Z		Ship: 30 kt NE and 998 mb at 37N, 38.8W (likely 43.8W) at 06Z	995 mb
Oct 25 12Z	988 mb	Ship reports near the center suggest higher central pressure values	Removed
Oct 26 12Z	988 mb	Ship reports near the center suggest lower central pressure values	

Sources: NHC microfilm maps, the Historical Weather Maps series, the COADS ship database, Monthly Weather Review, Navy reconnaissance book, Mariners Weather Log, EV2 Surface Weather Observations, Instituto Português do Mar e da Atmosfera (IPMA), Satellite images from NCDC, and NHC Storm Wallets.

New Tropical Depression [September 1-2, 1970] – AL201970

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45240 09/01/1970 M= 2  3 SNBR= 966 UNNAMED       XING=0 SSS=0
45245 09/01*  0   0   0    0*  0   0   0    0*257 966  25    0*268 972  30    0*
45250 09/02*280 975  25 1008*298 974  20    0*320 970  20    0*  0   0   0    0*
45275 TD
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Significant Revisions:

1. A new tropical depression has been added to HURDAT, not previously shown in McAdie et al. (2009). This system was in Jack Beven's List of Suspects.

Daily Metadata:

August 31:

1. Maps and old HURDAT:

- HWM analyzes no features of interest at 12Z.
- Microfilm shows a tropical wave along 93W, extending from 18N-28N at 12Z.

2. Discussion:

- Reanalysis: Convection increased markedly over the western Caribbean on August 29th as a tropical wave entered the area. The disturbance continued westward

into the Gulf of Mexico producing disorganized convection. On the 31st, synoptic observations showed a sharp trough over the western Gulf of Mexico, but the data over the southern portion of the Gulf was very sparse, thus it is not known if it had a closed low-level circulation on this date. Satellite imagery on this date did suggest that at least a strong mid-level circulation was present.

September 1:

1. Maps and old HURDAT:

- HWM analyzes a trough along the coast of Texas and northeastern Mexico at 12Z.
- Microfilm shows a tropical cyclone (TC 26) of at most 1012 mb at 26N, 96.5W at 12Z.

2. Land highlights:

- 18 kt S and 1010 mb at Corpus Christi, TX at 2156Z (SWO).

3. Discussion:

- Reanalysis: The tropical disturbance turned to the northwest on September 1st and became better organized as it approached the coastline. Synoptic observations and coastal data indicated that a well-defined low-level circulation was present at 18Z on this date. Based on the wind shift observed in Brownsville, TX as the system passed to the northwest, the first position is analyzed at 12Z on the 1st as a 25 kt tropical depression. An intensity of 30 kt is analyzed at 18Z on the 1st, peak intensity, based on ship reports of 25 kt. Landfall is analyzed to have occurred near Corpus Christi, TX around 22Z on the 1st with an intensity of 30 kt. Satellite imagery late on the 1st showed an elongated area of convection with some signs of organization. A minimum pressure of 1010 mb and sustained winds of 18 kt were measured at 2157Z on the 1st at Corpus Christi, suggesting a central pressure of 1008 mb, which has been added at 00Z on the 2nd.

September 2:

1. Maps and old HURDAT:

- HWM analyzes a spot low pressure at 32N, 98W at 12Z.
- Microfilm shows a closed low pressure of at most 1012 mb at 32N, 97W at 12Z.

2. Discussion:

- Reanalysis: The tropical depression gradually weakened inland as it turned to the north and later northeast ahead of an approaching frontal boundary. Synoptic observations over northeastern Texas and Oklahoma at 18Z on the 2nd suggested that the low-level circulation had dissipated, thus the last position is analyzed at 12Z on this date.

September 3:

1. Maps and old HURDAT:

- HWM analyzes no features of interest at 12Z.

Sources: NHC microfilm maps, the Historical Weather Maps series, the COADS ship database, Monthly Weather Review, Mariners Weather Log, Satellite images from NCDC, and NHC Storm Wallets.

New Tropical Storm [September 19-23, 1970] – AL211970

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45240 09/19/1970 M= 5  5 SNBR= 966 UNNAMED       XING=0 SSS=0
45245 09/19*  0   0   0    0*  0   0   0    0*  0   0   0    0*268 553  25    0*
45250 09/20*269 561  25    0*270 570  30    0*269 579  30    0*267 585  35    0*
45255 09/21*266 589  40    0*265 594  40    0*265 598  40    0*265 600  35    0*
45260 09/22*265 602  35    0*265 604  30    0*266 606  30    0*267 608  25    0*
45265 09/23*269 610  25    0*  0   0   0    0*  0   0   0    0*  0   0   0    0*

45270 TS
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Significant Revisions:

1. A new tropical storm has been added to HURDAT, not previously shown in McAdie et al. (2009). This system was in Jack Beven's List of Suspects.

Daily Metadata:

September 18:

1. Maps and old HURDAT:
- HWM analyzes a trough northeast of the Leeward Islands at 12Z.
- Microfilm shows a tropical wave extending from 13N-26N and 55W-59W at 12Z.
2. Discussion:
- Reanalysis: Satellite images showed an area of convection over the central Atlantic associated with a weakening frontal system and the northern portion of a tropical wave. Synoptic observations did not suggest it had a closed circulation.

September 19:

1. Maps and old HURDAT:
- HWM analyzes a trough north of the Leeward Islands at 12Z.
- Microfilm shows a tropical wave north of the Leeward Islands at 12Z.
2. Discussion:
- Reanalysis: The disturbance remained almost stationary and gradually became better organized at the surface. Satellite imagery showed some organized convection near the center with banding features over the southeastern quadrant. A 25 kt tropical depression is analyzed at 18Z on the 19th based on synoptic data and satellite imagery.

September 20:

1. Maps and old HURDAT:
- HWM analyzes two spot low pressures of 1015 mb and 1013 mb at 23N, 63.2W and 26N, 59W, respectively, at 12Z.
- Microfilm shows a tropical cyclone (TD #32) of at most 1016 mb at 26N, 59W at 12Z.
2. Aircraft highlights:
- Estimated surface winds of NW 35 kt and a pressure of 1015 mb at 26.9N, 59.4W at 1830Z (micro).
3. Discussion:
- Reanalysis: The tropical depression moved westward. Operationally, it was upgraded to the 32nd tropical depression of the season at 00Z on the 20th. A reconnaissance aircraft investigated the system late on the 20th and an observation at 1830Z showed 35 kt NW and 1015 mb. Based on this data, and a ship report of 35 kt at 00Z on the 21st, an intensity of 35 kt is analyzed at 18Z on the 20th, marking the system's intensification to a tropical storm. Satellite imagery showed a well-organized tropical cyclone with convection over the center.

September 21:

1. Maps and old HURDAT:
- HWM analyzes a closed low pressure of 1010 mb at 26.5N, 58.5W at 12Z.
- Microfilm shows a tropical cyclone of at most 1012 mb at 27N, 59W at 12Z.
2. Ship highlights:
- 35 kt N and 1011 mb at 26.5N, 59W at 00Z (COADS).
3. Discussion:
- Reanalysis: The tropical cyclone continued westward and a peak intensity of 40 kt is analyzed between 00Z and 12Z on the 21st. Satellite imaged showed a small but well-organized tropical cyclone with convection over the center and banding features over the northern semicircle.

September 22:

1. Maps and old HURDAT:
- HWM analyzes a closed low pressure of at most 1012 mb at 27.2N, 60.3W at 12Z.
- Microfilm shows a tropical cyclone of at most 1014 mb at 27N, 60W at 12Z.
2. Discussion:
- Reanalysis: Satellite images indicated that the system had weakened and the center was exposed to the west of the convection. Weakening to a tropical depression is analyzed at 06Z on the 22nd.

September 23:

1. Maps and old HURDAT:
- HWM and microfilm analyze a tropical wave north of the Leeward Islands at 12Z.
2. Discussion:
- Reanalysis: Based on synoptic data and satellite imagery, the last position is analyzed at 00Z on the 23rd. Operationally, the system was downgraded to a tropical wave at 12Z on the 23rd.

September 24:

1. Maps and old HURDAT:
- HWM and microfilm do not show any features of interest north of the Greater Antilles at 12Z.
2. Discussion:
- Reanalysis: The remnants of the tropical cyclone remained disorganized and did not show any signs of regeneration.

Sources: NHC microfilm maps, the Historical Weather Maps series, the COADS ship database, Monthly Weather Review, Mariners Weather Log, Satellite images from NCDC, and NHC Storm Wallets.

New Tropical Depression [November 13-15, 1970] - AL221970

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45235 11/13/1970 M= 3  5 SNBR= 966 UNNAMED       XING=0 SSS=0
45240 11/13*130 820  25    0*134 820  25    0*138 820  30 1005*142 820  30 1004*
45245 11/14*146 821  30 1004*150 823  30    0*154 827  30    0*158 831  30 1005*
45250 11/15*162 833  25    0*166 834  25    0*170 830  25    0*  0   0   0    0*
45255 TD
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Significant Revisions:

1. A new tropical depression has been added to HURDAT, not previously shown in McAdie et al. (2009).

Daily Metadata:

November 7:

1. Maps and old HURDAT:
- HWM and microfilm analyze a stationary frontal boundary over the central Caribbean Sea at 12Z.
2. Discussion:
- Reanalysis: Convection increased over the southern Caribbean Sea during the first week of November, especially after the tail-end of a weakening frontal boundary reached the area on November 5th. On the 7th, the area remained convectively-active but synoptic observations did not show any drop in pressures and no low-level circulation was present.

November 8:

1. Maps and old HURDAT:
- HWM analyzes a closed low pressure of at most 1008 mb at 11N, 80W at 12Z.
- Microfilm shows a stationary frontal boundary over the central and eastern Caribbean Sea at 12Z.
2. Discussion:
- Reanalysis: Convection increased on the 8th and synoptic observations suggested that a broad area of low pressure formed late on the day.

November 9:

1. Maps and old HURDAT:
- HWM analyzes a stationary frontal boundary over the central and eastern Caribbean Sea at 12Z.
- Microfilm shows a spot low pressure at 12N, 82W at 12Z.
2. Discussion:
- Reanalysis: The disturbance was slow-moving on this date as it slowly drifted westward. Synoptically and on satellite imagery, it was poorly organized on the 9th as the low-level circulation was ill-defined.

November 10:

1. Maps and old HURDAT:
- HWM analyzes a closed low pressure of at most 1010 mb at 12N, 83.3W at 12Z.
- Microfilm shows a closed low pressure of at most 1010 mb at 11.8N, 82.8W at 12Z.
2. Discussion:
- Reanalysis: Synoptic observations along the Nicaragua coastline and the island of San Andres suggested that the low-level circulation had become better defined early on the 10th. Satellite imagery showed a large area of convection over and the north of the center, but no signs of organization. It is possible that the disturbance became a tropical depression on this date.

November 11:

1. Maps and old HURDAT:
- HWM analyzes a spot low pressure at 13N, 82.5W at 12Z.
- Microfilm shows a closed low pressure of at most 1008 mb at 12N, 83W at 12Z.

2. Discussion:
- Reanalysis: The disturbance remained almost stationary off the Nicaraguan coastline. Satellite imagery showed that the convection was generally over the northern semicircle.

November 12:

1. Maps and old HURDAT:
- HWM analyzes a closed low pressure of at most 1008 mb at 12.5N, 82W at 12Z.
- Microfilm shows a closed low pressure of at most 1010 mb at 12.3N, 82W at 12Z.
2. Discussion:
- Reanalysis: Synoptic data early on the 12th showed that the low-level circulation had become poorly defined. Satellite images showed a large area of convection but no signs of organization.

November 13:

1. Maps and old HURDAT:
- HWM analyzes a closed low pressure of at most 1008 mb at 12N, 81.5W at 12Z.
- Microfilm shows a tropical cyclone (TC #41) of at most 1004 mb at 14.2N, 81.8W at 12Z.
2. Ship highlights:
- 15 kt SW and 1007 mb at 13.6N, 81.7W at 12Z (COADS).
3. Aircraft highlights:
- Penetration center fix measured a central pressure of 1004 mb at 13.9N, 82.1W at 1703Z (micro).
4. Discussion:
- Reanalysis: Early on the 13th, synoptic data indicated that the low-level circulation had once again become better defined. Observations from San Andres and the Nicaraguan coastline suggested that a closed low-level circulation had formed and a 25 kt tropical depression is analyzed to have developed at 00Z on the 13th. Operationally, it was analyzed to have become the 41st tropical depression of the season at 12Z on the 13th. The weak depression moved slowly northward and a reconnaissance aircraft investigated the system measuring a central pressure of 1004 mb at 1703Z. A central pressure of 1004 mb suggests maximum surface winds of 39 kt from the south of 25N Brown et al. pressure-wind relationship. Based on the slow forward speed of about 4 kt and synoptic observations showing winds well-below gale-force, an intensity of 30 kt is analyzed at 18Z on the 13th. 30 kt is also the peak intensity of this tropical depression. Satellite imagery suggested that the tropical depression had become better organized compared to previous days, showing some banding features over the eastern quadrant.

November 14:

1. Maps and old HURDAT:
- HWM analyzes a closed low pressure of at most 1008 mb at 14N, 83W at 12Z.
- Microfilm shows a tropical cyclone of at most 1010 mb at 14.5N, 81W at 12Z.
2. Ship highlights:
- 20 kt E and 1006 mb at 14.9N, 81.8W at 00Z (COADS).
3. Aircraft highlights:
- Visual estimate of 10 kt and a minimum pressure of 1006 mb at 15.7N, 82.8W at 1635Z (micro).
4. Discussion:

- Reanalysis: On the 14th, the tropical depression turned to the northwest with no appreciable change in intensity. A reconnaissance aircraft investigated the system late on this date finding a closed low-level circulation and no noteworthy change in the central pressure. Satellite imagery showed that a strong frontal boundary was sweeping across the Gulf of Mexico on the 14th, likely causing an increase in shear over the tropical depression, and the reason for the center to be almost exposed with most of the convection over the eastern semicircle.

November 15:

1. Maps and old HURDAT:

- HWM analyzes a frontal boundary over the eastern US and western Caribbean Sea at 12Z.
- Microfilm shows a tropical cyclone of at most 1010 mb at 16.5N, 82.8W with a frontal boundary over the western Caribbean Sea at 12Z.

2. Discussion:

- Reanalysis: As the frontal boundary reached the western Caribbean Sea, the depression turned to the northeast and dissipated late on the 15th between the Grand Cayman and Swam Island. The last position is analyzed at 12Z on the 15th. Operationally, the last position was analyzed at 18Z on the 15th.

November 16:

1. Maps and old HURDAT:

- HWM and microfilm analyze a frontal boundary over the western Caribbean Sea at 12Z.

Sources: NHC microfilm maps, the Historical Weather Maps series, the COADS ship database, Monthly Weather Review, Mariners Weather Log, Satellite images from NCDC, and NHC Storm Wallets.

Date	Evidence	Analyzed Central Pressure
Nov 13 12Z	Ship: 15 kt SW and 1007 mb at 13.6N, 81.7W	1005 mb
Nov 13 18Z	Penetration center fix: 1004 mb at 1703Z	1004 mb
Nov 14 00Z	Ship: 20 kt E and 1006 mb at 14.9N, 81.8W	1004 mb
Nov 14 18Z	Aircraft: 10 kt and 1006 mb at 1635Z	1005 mb

New Tropical Storm [November 26 – December 6, 1970] – AL231970

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12345 11/26/1970 M= 11  17 SNBR=   4 UNNAMED
12350 11/26E350 600  60    0E355 595  60    0E361 590  60    0E366 588  60    0*
12355 11/27E368 591  60    0E363 597  60    0E353 603  60    0E338 605  60    0*
12360 11/28S321 605  55    0S305 604  55    0S291 602  50    0S283 597  50    0*
12365 11/29S280 588  50    0S282 573  50    0S292 556  50    0S306 543  50  987*
12370 11/30S319 536  45    0S331 530  45    0*341 520  45    0*351 500  50    0*
12375 12/01*360 482  50    0*372 466  55    0*391 450  55    0E410 430  55    0*
12380 12/02E434 400  55    0E461 370  55    0E490 340  55    0E525 313  55    0*
12385 12/03E560 300  60    0E585 295  60    0E600 290  60    0E610 283  60    0*
12390 12/04E616 270  60    0E619 245  60    0E620 200  60    0E622 150  60    0*
12395 12/05E628 095  60    0E635 040  60    0E6453585  60    0E6553545  60    0*
12400 12/06E6643520  55    0E6733500  50    0*  0   0   0    0*  0   0   0    0*
12405 TS
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Significant Revisions:

1. A new tropical storm has been added to HURDAT, not previously shown in McAdie et al. (2009).

November 24:

1. Maps and old HURDAT:
- HWM and microfilm show a frontal boundary over the western Atlantic at 12Z.
2. Discussion:
- Reanalysis: Satellite imagery and synoptic maps showed a strong frontal boundary moving eastward across the western Atlantic.

November 25:

1. Maps and old HURDAT:
- HWM analyzes an extratropical cyclone of at most 1012 mb at 30N, 65W at 12Z.
- Microfilm shows an extratropical cyclone of at most 1012 mb at 31N, 64W at 12Z.
2. Discussion:
- Reanalysis: Synoptic observations late on November 25th indicated that an extratropical cyclone was developing near Bermuda. Satellite imagery showed a large but disorganized area of convection over the northwest Atlantic still embedded within the frontal boundary.

November 26:

1. Maps and old HURDAT:
- HWM analyzes an occluded cyclone of at most 996 mb at 36N, 58W at 12Z.
- Microfilm shows an occluded cyclone of at most 996 mb at 34.7N, 58W at 12Z.
- MWL tracks of centers of cyclones estimates a center position at 35.2N, 58W at 12Z.
2. Ship highlights:
- 55 kt NW and 1014 mb at 32.8N, 66.5W at 00Z (COADS).
- 50 kt NNW and 1010 mb at 36.1N, 64W at 06Z (COADS).
- 45 kt SE and 1004 mb at 39.3N, 56.5W at 12Z (COADS).
- 60 kt NNW and 1001 mb at 36.2N, 61.5W at 18Z (COADS).
3. Discussion:
- Reanalysis: Synoptic observations indicated that a powerful extratropical cyclone had formed northeast of Bermuda early on November 26th. The first position is analyzed at 00Z on the 26th with an intensity of 60 kt. A couple of ships reported storm-force winds in association with this system. Satellite imagery indicated that the strong extratropical cyclone was already occluding late on the 26th with convection developing around the center.

November 27:

1. Maps and old HURDAT:
- HWM analyzes a closed low pressure of at most 996 mb at 36N, 58W at 12Z.
- Microfilm shows a closed low pressure of at most 996 mb at 34.7N, 58W at 12Z.
- MWL tracks of centers of cyclones estimates a center position at 35.2N, 58W at 12Z.
2. Ship highlights:
- 60 kt N and 995 mb at 36.7N, 60.7W at 00Z (COADS).
- 55 kt N and 993 mb at 35N, 60.9W at 06Z (COADS).
- 55 kt NW and 989 mb at 34.5N, 66W at 12Z (COADS).
- 50 kt NNE and 991 mb at 34.2N, 61.9W at 18Z (COADS).
3. Discussion:

- Reanalysis: After moving slowly northeastward, a strong ridge to the north caused the extratropical cyclone to start moving southward at an increasingly faster forward speed on November 27th. Ships in the vicinity of the cyclone reported sustained winds up to 60 kt, thus it is possible that the system may have produced hurricane-force winds on this date. Satellite imagery showed that the occluded cyclone was acquiring subtropical characteristics with deeper convection near the center and contracting in size.

November 28:

1. Maps and old HURDAT:
- HWM analyzes an occluded cyclone of at most 996 mb at 28.5N, 61W at 12Z.
- Microfilm shows a closed low pressure of at most 996 mb at 28.5N, 61W at 12Z.
- MWL tracks of centers of cyclones estimates a center position at 28.7N, 61.3W at 12Z.
2. Ship highlights:
- 50 kt NNW and 996 mb at 32.5N, 63.4W at 00Z (COADS).
- 50 kt SW and 1000 mb at 28.8N, 64W (likely 59W) at 06Z (COADS).
- 45 kt NW and 1006 mb at 27.5N, 64.5W at 12Z (COADS).
- 35 kt N and 1008 mb at 29.1N, 65.8W at 18Z (COADS).
3. Discussion:
- Reanalysis: Transition to a subtropical cyclone is analyzed at 00Z on November 28th based on the satellite imagery late on the 27th, synoptic observations showing the strongest winds near the center, and the dissipation of frontal features. The cyclone continued on a southward track moving over increasingly warmer sea-surface temperatures. Ships early on the 28th reported winds up to 50 kt, but the observations were gradually weaker as the day progressed. However, it is also noticeable that the observations near the center decreased, possibly as the ships were becoming aware of the position and direction of the cyclone. Convection continued to increase near the center on this date as seen on satellite imagery becoming organized in a coma-like structure.

November 29:

1. Maps and old HURDAT:
- HWM analyzes a closed low pressure of at most 1000 mb at 29N, 56W at 12Z.
- Microfilm shows a closed low pressure of at most 1004 mb at 29N, 56W at 12Z.
- MWL tracks of centers of cyclones estimates a center position at 29.2N, 56W at 12Z.
2. Ship highlights:
- 35 kt SW and 1007 mb at 25.2N, 54.8W at 00Z (COADS).
- 40 kt SSW and 1005 mb at 25N, 55.8W at 06Z (COADS).
- 45 kt WSW and 1005 mb at 26.2N, 54.8W at 12Z (COADS).
- 45 kt SW and 999 mb at 29.4N, 53.2W at 18Z (COADS).
- 30 kt N and 990 mb at 31.1N, 54.3W at 18Z (COADS).

3. Discussion:
- Reanalysis: The subtropical cyclone reached its southernmost point on November 29th and later accelerated to the northeast. A few ships reported gale-force winds, up to 45 kt, and no change in intensity was analyzed on this date. A ship near the center of the subtropical cyclone reported 30 kt N and 990 mb, suggesting a central pressure of 987 mb. Satellite imagery showed organized convection over or near the center as the system continued to acquire tropical characteristics.

November 30:

1. Maps and old HURDAT:
- HWM analyzes a closed low pressure of at most 996 mb at 33.5N, 52W with a frontal boundary to the west at 12Z.
- Microfilm shows a closed low pressure of at most 1004 mb at 33.2N, 51.2W with a frontal boundary to the northwest at 12Z.
- MWL tracks of centers of cyclones estimates a center position at 34N, 51W at 12Z.
2. Ship highlights:
- 30 kt SW and 1004 mb at 28.9N, 54.1W at 00Z (COADS).
- 20 kt NE and 992 mb at 33.8N, 53.6W at 06Z (COADS).
- 35 kt SW and 1006 mb at 31.2N, 49.3W at 12Z (COADS).
- 35 kt WSW and 1007 mb at 30.9N, 49.9W at 18Z (COADS).
3. Discussion:
- Reanalysis: Transition to a tropical storm is analyzed at 12Z on November 30th based on synoptic observations showing that no temperature gradient across the circulation and satellite imagery indicating a small but well-organized system with convection over the center. A few ships reported tropical-storm-force winds but in general the ships remained in the periphery of the cyclone.

December 1:

1. Maps and old HURDAT:
- HWM analyzes a closed low pressure of at most 996 mb at 39N, 46W with a frontal boundary just to the west at 12Z.
- Microfilm shows an extratropical cyclone of at most 996 mb at 39.5N, 44.5W with a frontal boundary to the northwest at 12Z.
- MWL tracks of centers of cyclones estimates a center position at 39N, 45.2W at 12Z.
2. Ship highlights:
- 35 kt SSE and 1002 mb at 37.6N, 44.8W at 00Z (COADS).
- 45 kt S and 989 mb at 37N, 46.1W at 06Z (COADS).
- 40 kt N and 1001 mb at 39.1N, 47.1W at 12Z (COADS).
- 40 kt SSW and 997 mb at 38.5N, 41.5W at 18Z (COADS).
3. Discussion:
- Reanalysis: The tropical storm accelerated to the northeast ahead of the frontal boundary. A ship at 06Z on December 1st near the center of the tropical cyclone reported 45 kt S and 989 mb, suggesting a central pressure in the low to mid 980s. An intensity of 55 kt is analyzed at 06Z and 12Z on the 1st, also the peak intensity of this system as a tropical cyclone. Transition to an extratropical cyclone is analyzed at 18Z on the 1st based on synoptic observations indicating that the system had become embedded within the frontal boundary. This is consistent with the analysis of the HWM showing that the tropical cyclone was still ahead of the frontal boundary at 12Z on the 1st, in contrast to Microfilm depicting the system already embedded within the frontal boundary by 12Z.

December 2:

1. Maps and old HURDAT:
- HWM analyzes an extratropical cyclone of at most 992 mb at 48N, 34W at 12Z.
- MWL tracks of centers of cyclones estimates a center position at 47.6N, 33.4W at 12Z.
2. Ship highlights:
- 40 kt N and 1001 mb at 42.5N, 43.8W at 00Z (COADS).
- 40 kt WNW and 1007 mb at 40.6N, 40.7W at 06Z (COADS).

- 35 kt SW and 1000 mb at 47.8N, 30.8W at 12Z (COADS).
- 50 kt NW and 1004 mb at 52.1N, 44.9W at 18Z (COADS).

3. Discussion:

- Reanalysis: The strong extratropical cyclone continued northeastward into the north Atlantic. A few ships reported gale and storm-force winds.

December 3:

1. Maps and old HURDAT:

- HWM analyzes an extratropical cyclone of at most 954 mb at 60N, 30W at 12Z.
- MWL tracks of centers of cyclones estimates a center position at 59.3N, 28.5W at 12Z.

2. Ship highlights:

- 40 kt E and 970 mb at 58.3N, 28.6W at 00Z (COADS).
- 50 kt W and 1007 mb at 52.2N, 39.7W at 06Z (COADS).
- 50 kt NE and 952 mb at 61N, 30W at 12Z (COADS).
- 50 kt E and 949 mb at 61.8N, 29.2W at 15Z (COADS).
- 60 kt ESE and 956 mb at 61.8N, 29.1W at 18Z (COADS).

3. Discussion:

- Reanalysis: The intense extratropical cyclone continued to deepen and the central pressure reached the 940s. Synoptic observations suggested that the winds may have reached hurricane intensity on this date.

December 4:

1. Maps and old HURDAT:

- HWM analyzes an extratropical cyclone of at most 964 mb at 62N, 18W at 12Z.
- MWL tracks of centers of cyclones estimates a center position at 61.8N, 18.8W at 12Z.

2. Ship highlights:

- 60 kt WSW and 981 mb at 56.3N, 23.7W at 00Z (COADS).
- 60 kt W and 984 mb at 56.4N, 24W at 06Z (COADS).
- 60 kt SW and 969 mb at 59.5N, 14.8W at 12Z (COADS).
- 45 kt W and 989 mb at 59.7N, 16.5W at 18Z (COADS).

3. Discussion:

- Reanalysis: The extratropical cyclone turned to the east on December 4th passing south of Iceland. The system remained vigorous as a few ships reported winds up to 60 kt, possibly also producing hurricane-force winds on this date.

December 5:

1. Maps and old HURDAT:

- HWM analyzes an extratropical cyclone of at most 984 mb at 66N, 1W at 12Z.
- MWL tracks of centers of cyclones estimates a center position at 68.5N, 2E at 12Z.

2. Ship highlights:

- 45 kt W and 981 mb at 60.1N, 5.4W at 00Z (COADS).
- 45 kt W and 993 mb at 60.3N, 6W at 06Z (COADS).
- 45 kt W and 997 mb at 61.4N, 3.9W at 12Z (COADS).
- 55 kt SSE and 984 mb at 67.4N, 8.5E at 18Z (COADS).

3. Discussion:

- Reanalysis: The extratropical cyclone passed north of the United Kingdom early on December 5th, later approaching Norway. Ships continued to report winds up to 55 kt.

December 6:

1. Maps and old HURDAT:
- HWM analyzes an extratropical cyclone of at most 992 mb at 68N, 14E at 12Z.
- MWL tracks of centers of cyclones estimates a center position at 68.5N, 15E at 12Z.

2. Ship highlights:
- 40 kt SSW and 1001 mb at 65N, 23E at 06Z (COADS).

3. Discussion:
- Reanalysis: The extratropical cyclone approached northern Europe and encountered an elongated trough. The system became embedded and by 12Z on December 6th it did not have a closed circulation, thus the last position is analyzed at 06Z on the 6th.

December 7:

1. Maps and old HURDAT:
- HWM analyzes an extratropical cyclone of at most 996 mb at 70N, 35E at 12Z.

Sources: NHC microfilm maps, the Historical Weather Maps series, the COADS ship database, Monthly Weather Review, Mariners Weather Log, Satellite images from NCDC, and NHC Storm Wallets.

1970 Additional Notes

1. May 19-22: Historical Weather Maps, microfilm and satellite images showed a trough or tropical wave northeast of the Leeward Islands on May 19th. The system slowly moved northward and operationally, it was upgraded to the 2nd tropical depression of the season at 00Z on the 21st. A weak area of low pressure developed on the 21st but satellite imagery suggested that the convective activity was poorly organized. A stronger system to the northwest caused the weak low pressure to dissipate early on the 22nd and soon after, the remnants became part of the larger neighboring system. Synoptic observations suggested that winds stayed below gale intensity. Because the disturbance was poorly organized and the low-level circulation was transient and ill-defined, it is not added to HURDAT. This disturbance was in Jack Beven's List of Suspects.

Day	Latitude	Longitude	Status
May 19	17N-30N	58W-63W	Trough
May 20	17N-30N	58W	Trough
May 21	27N	57W	Low
May 22			Absorbed

2. May 19-26: Historical Weather Maps, microfilm and satellite images showed an extratropical cyclone exiting the northeastern United States on May 19th. The system moved southeastward and convection increased over the center on the 20th, but became less organized during the next few days before being absorbed by a frontal boundary. Because the disturbance did not acquire tropical characteristics, it is not added to HURDAT. This disturbance was in Jack Beven's List of Suspects.

Day	Latitude	Longitude	Status

May 19	41N	69W	Extratropical
May 20	40N	64W	Extratropical
May 21	37N	62W	Extratropical
May 22	31N	59W	Extratropical
May 23	28N	54W	Extratropical
May 24	30N	46W	Extratropical
May 25	31N	44W	Extratropical
May 26			Absorbed

3. June 7-12: Historical Weather Maps, microfilm and satellite images analyzed a frontal boundary over the western Atlantic on June 7th. An extratropical cyclone developed on June 8th and remained generally stationary for a day or so. The system later moved northeastward paralleling the east coast of the United States and began to weaken on the 11th. Observations on the 12th indicated that it had been absorbed by an adjacent frontal boundary. No gales were observed in relations to this system. Because the disturbance did not acquire tropical characteristics, it is not added to HURDAT. This disturbance was in Jack Beven's List of Suspects.

Day	Latitude	Longitude	Status
June 7	Western Atlantic		Cold front
June 8	31N	78W	Extratropical
June 9	31N	78W	Extratropical
June 10	35N	75W	Extratropical
June 11	37N	74W	Extratropical
June 12			Absorbed

4. June 18-20: Historical Weather Maps, microfilm and satellite images depicted a tropical wave moving across the Greater Antilles on June 18th. Satellite imagery showed a large area of convection associated with the disturbance, but mostly on the eastern side of the tropical wave. Synoptic observations suggested that a weak area of low pressure formed on the 19th but satellite imagery indicated that the convection did not show any signs of organization. Operationally, it was upgraded to the 6th tropical depression of the season at 12Z on the 19th. The weak disturbance moved northeastward ahead of a frontal boundary and quickly dissipated on the 20th. Synoptic observations suggested that winds stayed below gale intensity. Because the disturbance was poorly organized and the low-level circulation was transient and ill-defined, it is not added to HURDAT. This disturbance was in Jack Beven's List of Suspects.

Day	Latitude	Longitude	Status
June 18	17N-31N	69W-74W	Tropical Wave
June 19	29N	71W	Low
June 20			Dissipated

5. June 23-27: Historical Weather Maps, microfilm and satellite images indicated that a frontal boundary entered the western Atlantic Ocean on June 23rd. Satellite imagery also showed some disturbed weather over the Bahamas. A low pressure developed in the tail-end of the frontal boundary and moved to the northeast retaining its extratropical characteristics while producing winds up to storm intensity. By the 27th, it had been absorbed by another frontal boundary. Because the disturbance did not acquire tropical characteristics, it is not added to HURDAT. This disturbance was in Jack Beven's and David Roth's List of Suspects.

Day	Latitude	Longitude	Status
June 23	Western Atlantic		Cold Front
June 24	32N	71W	Extratropical
June 25	35N	66W	Extratropical
June 26	39N	60W	Extratropical
June 27			Absorbed

6. June 29 – July 1: Historical Weather Maps, microfilm and satellite images shows a tropical wave over the central Caribbean Sea on June 29th. Synoptic observations on the 30th indicated that a weak area of low pressure formed over the southern Caribbean Sea. Operationally, it was upgraded to the 9th tropical depression of the season at 00Z on the 30th. The weak disturbance moved westward toward Central America and crossed into the eastern Pacific on July 2nd. It was upgraded operationally to Tropical Storm Francesca on the 3rd at 00Z while south of Guatemala. Synoptic observations suggested that winds stayed below gale intensity while over the Caribbean Sea. Because the disturbance was poorly organized and the low-level circulation was transient and ill-defined, it is not added to HURDAT. This disturbance was in Jack Beven's List of Suspects.

Day	Latitude	Longitude	Status
June 29	13N-20N	79W-82W	Tropical Wave
June 30	12N	81W	Low
July 1	12N	85W	Low
July 2	11N	91W	Low
July 3	Eastern Pacific		Tropical Storm Francesca

7. August 5-7: Historical Weather Maps and microfilm showed a weak area of low pressure between the Bahamas and Bermuda on August 4th. The disturbance moved westward and the first position in HURDAT as a non-developing tropical depression was analyzed at 12Z on the 5th as a 20 kt tropical depression. (The track in HURDAT is the same as that shown in the track figure in the 1970 Tropical Systems MWR article.) The system moved westward and late on the 6th moved over Florida. Satellite imagery showed a trough over the western Atlantic and no signs of organization was analyzed as the system moved westward. The last position in HURDAT was analyzed at 00Z on the 7th. Because the system did not have a well-defined circulation and was poorly-organized on satellite imagery, it is removed from HURDAT.

AL061970, UNNAMED, 7,

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19700805, 1200,  , TD, 28.0N,  75.0W,  20,
19700805, 1800,  , TD, 28.0N,  76.0W,  25,
19700806, 0000,  , TD, 28.0N,  77.0W,  25,
19700806, 0600,  , TD, 28.0N,  78.0W,  25,
19700806, 1200,  , TD, 28.0N,  79.0W,  25,
19700806, 1800,  , TD, 28.0N,  80.0W,  25,
19700807, 0000,  , TD, 28.0N,  81.0W, -99,
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8. August 9-13: Historical Weather Maps, microfilm and satellite images depicted a frontal boundary over the western Atlantic on August 9th. An extratropical cyclone developed over the western Atlantic on the 10th producing gale-force winds and moved northeastward paralleling the eastern seaboard of the United States. Late on the 12th, the disturbance moved into Atlantic Provinces of Canada and later turned eastward over the north Atlantic. The extratropical cyclone merged with another system on the 15th. Because the disturbance did not acquire tropical characteristics, it is not added to HURDAT. This disturbance was in Jack Beven's and David Roth's List of Suspects.

Day	Latitude	Longitude	Status
August 9	Western Atlantic		Cold Front
August 10	33N	77W	Extratropical
August 11	38N	72W	Extratropical
August 12	42N	68W	Extratropical
August 13	48N	60W	Extratropical
August 14	51N	45W	Extratropical
August 15			Merged

9. August 18-24: Historical Weather Maps, microfilm and satellite images showed a tropical depression north of the islands on August 18th interacting with a mid-level feature. The mid-level feature seemed well-defined on the satellite images but synoptically it was a weak trough associated with high environmental pressures. The disturbance moved northward and remained poorly organized at the surface with no appreciable drop in pressures and winds stayed below tropical-storm-force. An approaching frontal boundary caused the system to moved northeastward on the 23rd and was absorbed on the 24th. Because the disturbance did not have a well-defined circulation, it is not added to HURDAT. This disturbance was in Jack Beven's List of Suspects.

Day	Latitude	Longitude	Status
August 18	23N	64W	Tropical Depression
August 19	26N	68W	Trough
August 20	31N	67W	Broad low pressure
August 21	31N	67W	Broad low pressure
August 22	34N	67W	Trough
August 23	33N	62W	Trough

August 24	Absorbed

10. September 27 – October 1: Historical Weather Maps, microfilm and satellite images showed a tropical wave or trough over the central Atlantic on September 27th on a westward track. An approaching cold front caused the system to turn northward on the 28th while north of the Leeward Islands. On the 28th and 29th, convection became more concentrated. It is difficult to determine if a closed circulation developed on the 28th or 29th due to the paucity of the ship data in the area and rapid movement of the disturbance. Late on the 30th and early on October 1st, it became embedded in the frontal boundary acquiring extratropical characteristics. This system was originally non-developing tropical depression AL17 and the track in HURDAT is consistent with the track plot shown in the 1970 Tropical Systems article in MWR. Based on the data available, the disturbance did not have a well-defined circulation and only maintained minimal organization to the deep convection. Thus it is removed from HURDAT.

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AL171970,            UNNAMED,      9,
19700929, 1200,  , TD, 27.0N,  62.0W,  20, -999,
19700929, 1800,  , TD, 28.1N,  61.2W,  20, -999,
19700930, 0000,  , TD, 29.2N,  60.3W,  25, -999,
19700930, 0600,  , TD, 30.3N,  59.4W,  25, -999,
19700930, 1200,  , TD, 31.5N,  58.5W,  25, -999,
19700930, 1800,  , TD, 34.3N,  57.0W,  25, -999,
19701001, 0000,  , TD, 37.0N,  55.5W,  25, -999,
19701001, 0600,  , TD, 39.8N,  54.0W,  25, -999,
19701001, 1200,  , TD, 42.5N,  52.5W,  20, -999,
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11. September 28 – October 3: Historical Weather Maps, microfilm and satellite images indicated that an extratropical cyclone developed from a frontal boundary over the northeastern Atlantic Ocean on September 28th. The system quickly became an occluded cyclone and moved southwestward acquiring convection near the center. Satellite imagery on October 1st showed a small system with some organized convection over the center. At the same time, synoptic observations were sparse near the circulation and it is not possible to determine if the system had a well-defined, closed circulation, but they did indicate that the disturbance was embedded in high environmental pressures. The system moved to the northwest on the 2nd and remained poorly organized, later becoming absorbed by a frontal boundary on the 3rd. Because based on the data available, the disturbance did not have a well-defined circulation, it is not added to HURDAT. This disturbance was in Jack Beven's List of Suspects.

Day	Latitude	Longitude	Status
September 28	Northeast Atlantic		Cold front
September 29	35N	21W	Occluded
September 30	34N	30W	Occluded
October 1	33N	36W	Tropical Depression?
October 2	39N	41W	Tropical Depression?
October 3			Absorbed

12. October 30 – November 5: Historical Weather Maps, microfilm and satellite images showed a frontal boundary over the eastern United States on October 30th. The next day, an area of low pressure developed at the end of the frontal boundary and moved to the northeast strengthening baroclinicly. Satellite images showed a strong extratropical cyclone passing east of the Outer Banks on November 1st and east of the Mid-Atlantic on the 2nd while producing winds up to storm intensity. On the 3rd and the 4th, it accelerated to the northeast affecting the Atlantic provinces of Canada and was absorbed over the north Atlantic on the 6th. Because the disturbance did not acquire tropical characteristics, it is not added to HURDAT. This disturbance was in Jack Beven's List of Suspects.

Day	Latitude	Longitude	Status
October 30	Eastern United States		Cold front
October 31	30N	79W	Extratropical
November 1	32N	78W	Extratropical
November 2	36N	73W	Extratropical
November 3	42N	65W	Extratropical
November 4	49N	50W	Extratropical
November 5	59N	38W	Extratropical
November 6			Absorbed