

1966 Atlantic Hurricane Database Reanalysis – Sandy Delgado and Chris Landsea – April 2020

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

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
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(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*	160	847	25	0*161	848	25	0*163	848	30	1006*	168	847	30 0*
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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	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	827 100 970*
			**		***	***			*		***		***	*** ***
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	85	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	55	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	1002E	382	729 45 0*
44305	06/13*	363	734	55	0E	370	735	50	0*	376	735	45	0E	382 729 45 1002*
		*	***		**			*	*		*	*	*	****
44310	06/14E	392	721	40	0E	406	713	40	0E	420	705	40	0*	0 0 0 0*

44310 06/14E392 721 40 0E406 714 40 0E420 705 40 0* 0 0 0 0*

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 - 977 mb - 1011 mb OCI - 225
nm ROCI - 20 nm RMW

Significant Revisions:

1. Track adjusted significantly northward on the 5th.
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. Coastal and ship observations around 00Z 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 00Z on the 5th, 18 hours later than originally shown in HURDAT, at a position significantly farther north along the coast of Honduras. 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 Guanamar, 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 of maximum winds near the center or a central pressure. 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 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 used as a central pressure in HURDAT, and peak fastest mile 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. 110 kt fastest mile converts to a 1 min sustained wind of 105 kt. 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 that were not representative of the entire circulation. This possibility is supported by the very short period - 7 minutes - between the lowest pressure observed and the maximum wind report. Additionally, the post-flight summary from the aircraft indicated "The eye itself was rather strange. It was well defined by the wall cloud with radar. There were numerous occasions when the surface winds were readily visible and there were hurricane force winds only a few miles radius from the eye" - also suggestive of an eyewall mesovortex. The central pressure measured by the reconnaissance aircraft appears too high compared to what was observed at Dry Tortugas and the 970 mb from Dry Tortugas is retained in HURDAT at 18Z. Therefore, the assessed intensity of 100 kt is a blend between the observation in Dry Tortugas of 105 kt 1 min sustained equivalent and the Dry Tortugas measurement of 970 mb, suggesting maximum surface winds of 91 kt from the south of 25N intensifying 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). (Note that an extrapolated pressure of 976 mb from flight level suggests the dropsonde pressure is reasonable.)

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 85 kt is analyzed at 12Z on the 9th, same as originally. The last aircraft fix before landfall was at 20Z, about 25 nm south of the coast. Given the consistency of the dropsonde pressure and extrapolated pressure from the aircraft, 977 mb is used as the central pressure at landfall shortly thereafter. (It appears that the 982 mb minimum pressure measured at St. Marks was not a central pressure, though it was inside the RMW.) The 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 22 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 landfall around 21Z near St. Marks. 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. It is noted that despite the temperature gradient across the system apparent in the various analyses, the appearance of the system in satellite imagery looks a lot like a tropical cyclone.

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 5 th	Retained
June 6 06Z		Land: 25 kt SE and 1003 mb at Swan Island, Honduras at 06Z on June 6 th	1000 mb
June 6 12Z	996 mb	Penetration center fix: 996 mb at 12Z on June 6 th	Retained
June 6 18Z	990 mb	Penetration center fix: 990 mb at 1750Z on June 6 th	
June 7 00Z	990 mb	Penetration center fix: 990 mb at 2350Z on June 6 th	
June 7 06Z	986 mb	Penetration center fix: 986 mb at 0545Z on June 7 th	
June 7 12Z	983 mb	Penetration center fix: 983 mb at 12Z on June 7 th	
June 8 00Z	976 mb	Penetration center fix: 976 mb at 23Z on June 7 th	Removed
June 8 06Z	980 mb	A minimum pressure of 980 mb was registered in Havana, Cuba at 1245Z on June 8 th , no central pressures were recorded around 06Z	
June 8 18Z	970 mb	A minimum pressure of 970 mb was recorded at Dry Tortugas at 1815Z	Retained
June 9 00Z	974 mb	Penetration center fix: 974 mb at 00Z on June 9 th	Retained
June 9 12Z	970 mb	Penetration center fix: 970 mb at 12Z on June 9 th	
June 9 18Z	981 mb	Penetration center fix: 981 mb at 18Z on June 9 th	
June 10 00Z	977 mb	Penetration center fix: 977 mb at 20Z on June 9 th	Removed
June 10 12Z		Land: 15 kt WNW and 998 mb at Alma, GA at 1055Z on June 10 th	995 mb
June 10 18Z		Land: 15 kt WNW and 1000 mb at Hunter AFB, GA at 1758Z on June 10 th	998 mb

44335 07/03 414 550 65 0431 560 55 0E447 576 45 0E455 593 35 0*
* *** ** * *** *** *** **

44340 HR

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 18Z 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 18Z 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 July 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 isothermal 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 inside the RMW, 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]

Time	Pressure	Wind	Temp	Clouds	Lat	Long	Pressure	Wind	Temp	Clouds	Lat	Long	Pressure	Wind	Temp	Clouds	Lat	Long
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	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 07/14*	213	623	40	0*221	636	40	0*225	648	40	0*227	658	40	1012*					
	*	***		*	***		****	***		**								
44360 07/15*	227	674	35	0*229	686	35	0*230	694	30	1015*	231	698	25	0*				
44360 07/15*	228	670	35	0*229	682	35	0*230	694	30	1015*	231	710	25	0*				
	****	***		*	***		*			*	***							
44365 07/16*	232	703	25	0*233	709	25	0*233	716	25	0*234	723	25	0*					
44365 07/16*	232	723	25	0*233	733	25	0*233	735	25	0*234	737	25	0*					
	*	***		*	***		*	***		*	***							
44370 07/17*	236	730	25	0*237	737	25	0*237	744	25	0*238	751	25	0*					
44370 07/17*	235	739	25	0*236	742	25	0*237	750	25	0*238	759	25	0*					
	****	***		****	***		*	***		*	***							
44375 07/18*	240	757	25	0*243	763	25	0*248	769	25	0*255	772	25	0*					
44375 07/18*	240	764	25	0*241	765	25	0*242	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*	
						**	*	***		***	***	**		
44395	07/22E498	577	25	0E520	570	25	0*	0	0	0	0	0	0*	
44395	07/22E498	582	50	0E520	570	40	0*	0	0	0	0	0	0*	
	***	**				**								

44400 HR

Significant Revisions:

- Genesis analyzed twelve hours earlier than originally analyzed by HURDAT.
- Intensification to a tropical storm analyzed eighteen hours earlier than originally shown in HURDAT.
- Weakening to a tropical wave analyzed between July 14th at 00Z and 18th at 12Z based on synoptic observations.
- Significant westward adjustment of positions (while as a wave) from late on July 15th through late on the 16th.
- 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

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	0S315	440	25	0S315	435	25	0S317	431	25	0*		
					****	***	**	****	***	**	****	***	**			
44410	07/22*	0	0	0	0*	0	0	0*	0	0	0*	310	410	25	0*	
44410	07/22	S316	427	25	0S314	423	25	0S312	420	25	0S	310	417	25	0*	
		****	***	**	****	***	**	****	***	**	*	***				
44415	07/23*	315	415	25	0*317	417	25	0*318	419	40	0*320	420	40	0*		
44415	07/23	S312	415	30	0S315	417	35	0S320	420	45	0S325	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	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	0	*468	371	45	0E477	366	45	1009*	
								*			*	***		****		
44455	07/31E	490	360	40	0E505	365	40	0E520	370	35	0E535	385	35	0*		
44455	07/31E	490	360	40	0*	0	0	0*	0	0	0*	0	0	0	0*	
					*	*	*	*	*	*	*	*	*	*	*	
44460	HR															

Significant Revisions:

1. Genesis analyzed 36 hours earlier than originally shown in HURDAT.
2. A subtropical storm stage is added from the 21st through the 23rd.
3. Intensification to a (sub)tropical storm analyzed six hours earlier than original shown in HURDAT.
4. 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:

- Erickson: "Dorothy very probably derived a considerable portion of its energy from extratropical sources during the period July 22-23, although convective instability and the release of latent heat undoubtedly contributed to development. In this sense, Dorothy was, at best, a 'half breed'. Later during July 25-28, there is some evidence to indicate that Dorothy did develop a weak warm core and was more nearly a true tropical cyclone."
- 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 system 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. Based upon satellite imagery and analyses from Erickson showing interaction with an upper-level trough, Dorothy is begun as a subtropical depression.

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 subtropical depression became better organized and is analyzed to have intensified into a subtropical 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. This system is estimated to have transitioned from a subtropical storm to a tropical storm around 00Z on the 24th. 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 24 th	Removed
July 24 18Z			998 mb
July 25 18Z	997 mb	Penetration center fix: 997 mb at 19Z on July 25 th	Retained
July 26 12Z	989 mb	Penetration center fix: 989 mb at 1248Z on July 26 th	
July 27 06Z		Penetration center fix: 990 mb at 0858Z on July 27 th	990 mb
July 27 12Z	990 mb		Removed
July 28 00Z		Penetration center fix: 994 mb at 2123Z on July 27 th	994 mb
July 28 12Z	993 mb	Penetration center fix: 993 mb at 1155Z on July 28 th	Retained
July 28 18Z	996 mb	Penetration center fix: 996 mb at 1910Z on July 28 th	
July 29 12Z	996 mb	Penetration center fix: 996 mb at 12Z on July 29 th	
July 29 18Z	999 mb	Penetration center fix: 1000 mb at 18Z on July 29 th	1000 mb
July 30 18Z		Penetration center fix: 1009 mb at 1530Z on July 30 th	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	40	0*188	593	40	0*193	603	40	1008*	198	611	40 1008*
			**			**			**				**
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
	***	**		**		**	*	*	*	*	*	*	*

44505 TS

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).

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. Aircraft highlights:

- Invest mission unable to close off the vortex, max winds 25 kt, lowest pressure 1012 mb (WALLET).

3. 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. Aircraft highlights:

- Invest mission unable to close off the vortex, max winds 25 kt, lowest pressure 1010 mb (WALLET).

4. 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. A reconnaissance aircraft measured a central pressure of 1008 mb and estimated surface winds of 40 kt at 1750Z on the 26th. An intensity of 40 kt is analyzed at 18Z on the 26th, down from 45 kt originally in HURDAT, a minor intensity change. 40 kt represents the new peak intensity for the system, slightly down from 45 kt originally. 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

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*

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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	70	984*
		***			***	**		***			**	**	***
44530	08/24*153	438	80	0*153	457	80	0*153	477	80	992*156	498	85	0*
44530	08/24*153	438	70	0*153	457	70	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*
	***	***	**	***	***	**	***	***	**		**	**	***
44545	08/27*197	651	75	987*204	663	75	993*210	675	75	989*216	687	75	983*
44545	08/27*197	651	60	0*204	663	60	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	85	965*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	95	960*370	652	95	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	0*447	435	90	0*475	400	90	954*502	365	90	0*
	***	**		*	***	**	*	***	**	*	***	**	

44590	09/05*	528	338	90	0*	552	294	90	0*	573	245	90	0*	587	194	90	0*
44590	09/05	E528	330	90	0	E552	294	85	0	E573	245	80	0	E587	194	E5	0*
	*	***			*		**		*		**		*		**		
44595	09/06*	604	120	90	0*	611	60	65	0E625	30	55	0E6263575	55	0*			
44595	09/06	E602	127	E70	0	E615	70	65	0E625	20	60	0E6283570	60	0*			
	****	***	**		****	**			**	**		****	**				
44600	09/07E	6293530	40	0*	0	0	0	0	0*	0	0	0	0*	0	0	0	0*
44600	09/07E	6303510	E55	0E6343440	55	0E6403370	50	0E6473300	50	0*	0*	0*	0*	0*	0*	0*	0*
	*****	**		*****	**	*****	**	*****	**	*****	**	*****	**	*****	**	*****	**

(September 8th through 13th is new to HURDAT)

44601	09/08E	6573250	50	0E6683205	50	0E6803175	50	0E6953140	50	0*
44603	09/09E	7103105	50	0E7253080	50	0E7403065	50	0E7503058	50	0*
44605	09/10E	7603054	45	0E7703052	45	0E7803050	45	0E7903050	45	0*
44607	09/11E	8003050	45	0E8103050	45	0E8203050	40	0E8253048	40	0*
44609	09/12E	8273045	35	0E8293038	35	0E8303030	35	0E8303022	30	0*
44610	09/13E	8303014	30	0E8303007	30	0E8303000	30	0E8302990	25	0*
44615	HR									

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 to the 28th 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:

3. 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.
4. 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 raining 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 at 700 mb dropsonde and 984 mb via low-level extrapolation, 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 estimating surface winds of 75 kt and an eye diameter of 28 n mi. The penetration was made at low level with a reported central pressure of 984 mb. After a subsequent climb to 700 mb, a dropsonde measured 992 mb. Unfortunately, there is insufficient data to make a quality control check on the drop. However, as the 984 mb value was reported in the post-flight summary, that is the value accepted here. A central pressure of 984 mb suggests maximum surface winds of 72 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 70 kt is analyzed at 18Z, slightly above that 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 estimated a central pressure of 987 mb at 19.9N, 65.2W at 00Z (WALLET). (The fix log has a pressure of 987 mb for the aircraft fix at this time. However, it appears to be a radar fix and not a penetration fix, and the coded fix form has nothing that indicates a 987 mb pressure. Pressure not used in HURDAT.)
- 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: A 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 60 kt is analyzed at 06Z, down from 75 kt originally in HURDAT, a major 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. This did bring back Faith to a hurricane again. 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 965 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). (The fix log showed 970 mb, but the extrapolated pressure for this fix is 966 mb and that there was a dropsonde measurement of 965 mb.)
- 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. 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. A few ships reported winds over gale-force intensity, including 75 kt at 00Z. It is noted that satellite imagery shows an eye this day that was not present the day before, suggested at least as strong as on the 1st.

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 highlights:

- 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 Arctic 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 21 st	Retained
Aug 23 18Z		Penetration center fix: 984 mb at 2025Z on Aug 23 th	984 mb
Aug 24 12Z	992 mb	Penetration center fix: 992 mb at 14Z on Aug 24 th	Retained
Aug 25 00Z	993 mb	Penetration center fix: 993 mb at 22Z on Aug 24 th	
Aug 25 06Z	995 mb	Penetration center fix: 995 mb at 0545Z on Aug 25 th	
Aug 25 12Z	986 mb	Penetration center fix: 986 mb at 12Z on Aug 25 th	
Aug 25 18Z	990 mb	Penetration center fix: 990 mb at 18Z on Aug 25 th	
Aug 26 00Z		Penetration center fix: 994 mb at 00Z on Aug 26 th	994 mb
Aug 26 06Z	997 mb	Penetration center fix: 997 mb at 06Z on Aug 26 th	Retained
Aug 26 12Z	995 mb	Penetration center fix: 995 mb at 1234Z on Aug 26 th	
Aug 26 18Z		Penetration center fix: 994 mb at 21Z on Aug 26 th	994 mb
Aug 27 00Z	987 mb	"Radar" center fix: 987 mb at 00Z on Aug 27 th . The fix log has a pressure of 987 mb for the aircraft fix at this time. However, it appears to be a radar fix and not a penetration fix, and the coded fix form has nothing that indicates a 987 mb pressure. Pressure value removed.	Removed
Aug 27 06Z	993 mb	Penetration center fix: 993 mb at 0555Z on Aug 27.	Retained
Aug 27 12Z	989 mb	Penetration center fix: 989 mb at 1030Z on Aug 27 th	Retained
Aug 27 18Z	983 mb	Penetration center fix: 983 mb at 1830Z on Aug 27 th	
Aug 28 00Z	979 mb	Penetration center fix: 979 mb at 2215Z on Aug 27 th	
Aug 28 06Z	973 mb	Penetration center fix: 973 mb at 0545Z on Aug 28 th	
Aug 28 12Z	962 mb	Penetration center fix: 962 mb at 1212Z on Aug 28 th	

Aug 28 18Z	957 mb	Penetration center fix: 957 mb at 18Z on Aug 28 th	
Aug 29 00Z	956 mb	Penetration center fix: 955 mb at 00Z on Aug 29 th	955 mb
Aug 29 06Z	960 mb	Penetration center fix: 960 mb at 05Z on Aug 29 th	Retained
Aug 29 12Z	963 mb	Penetration center fix: 963 mb at 11Z on Aug 29 th	
Aug 29 18Z	963 mb	Penetration center fix: 963 mb at 18Z on Aug 29 th	
Aug 30 00Z	963 mb	Penetration center fix: 963 mb at 00Z on Aug 30 th	
Aug 30 06Z	970 mb	Penetration center fix: 965 mb at 06Z on Aug 30 th	965 mb
Aug 30 12Z	966 mb	Penetration center fix: 966 mb at 1145Z on Aug 30 th	Retained
Aug 30 18Z		Penetration center fix: 967 mb at 06Z on Aug 30 th	967 mb
Aug 31 00Z	967 mb	Penetration center fix: 967 mb at 2350Z on Aug 30 th	Retained
Aug 31 06Z		Penetration center fix: 973 mb at 0712Z on Aug 31 st	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 31 st	Retained
Sep 01 06Z	963 mb	Penetration center fix: 963 mb at 0630Z on Sep 01 st	
Sep 01 12Z	963 mb	Penetration center fix: 963 mb at 1215Z on Sep 01 st	
Sep 01 18Z	957 mb	Penetration center fix: 957 mb at 1850Z on Sep 01 st	
Sep 02 00Z	958 mb	Penetration center fix: 958 mb at 23Z on Sep 01 st	960 mb
Sep 02 06Z		Penetration center fix: 960 mb at 06Z on Sep 02 nd	
Sep 03 06Z	950 mb	Penetration center fix: 950 mb at 0550Z on Sep 03 rd	Retained
Sep 04 12Z	954 mb	Penetration center fix: 954 mb at 14Z on Sep 04 th	

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.

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44610 09/01/1966 M= 7 7 SNBR= 957 GRETA           XING=0 SSS=0
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*** *** ***
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*** *** ** * **
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44640 09/06*222 637 35 1007*229 651 30 1009*237 667 25 1011*246 682 25 1011*
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44645 09/07*256 697 30 0*261 706 30 0*267 715 30 1013*280 717 25 0*
44645 09/07*256 697 25 0*261 706 25 0*267 715 20 1013*275 723 20 1014*
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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.

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.) (Note that a ship with call sign GNDE on both the microfilm and Historical Weather Map series reported

very low pressures at 12Z on the 2nd (1006 mb), 18Z (1003 mb) and 00Z/3rd (1004 mb). The "?" notation on the microfilm indicates their skepticism with the value. Looks like the ship was 5 to 10 mb biased too low.)

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 was 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.

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. Dissipation retained after 18Z on the 7th.

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.

Date	Original HURDAT Central Pressure	Evidence	Changes
Sep 02 00Z	1011 mb	Penetration center fix: 1011 mb at 21Z on Sep 2 nd	
Sep 03 00Z	1010 mb	Penetration center fix: 1010 mb at 22Z on Sep 2 nd	Retained

Sep 03 12Z	1013 mb	Penetration center fix: 1013 mb at 12Z on Sep 2 nd	
Sep 04 12Z	1009 mb	Penetration center fix: 1009 mb at 1450Z on Sep 04 th	
Sep 04 18Z		Penetration center fix: 1004 mb at 2010Z on Sep 04 th	1004 mb
Sep 05 00Z	1004 mb		Removed
Sep 05 18Z	1007 mb	Penetration center fix: 1007 mb at 18Z on Sep 05 th	Retained
Sep 06 00Z	1009 mb	Penetration center fix: 1007 mb at 2308Z on Sep 05 th	1007 mb
Sep 06 06Z	1009 mb	Penetration center fix: 1009 mb at 0615Z on Sep 06 th	Retained
Sep 06 12Z	1011 mb	Penetration center fix: 1011 mb at 14Z on Sep 06 th	
Sep 06 18Z	1011 mb	Penetration center fix: 1011 mb at 19Z on Sep 06 th	
Sep 07 12Z	1013 mb	Penetration center fix: 1013 mb at 1140Z	Retained
Sep 07 18Z		Penetration center fix: 1014 mb at 18Z	1014 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 NSIDC, and NHC Storm Wallets.

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

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

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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 50 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*
* * * *

44675 TS

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 20th, 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 at 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. This data from Nautla would suggest a central pressure between 995 and 1000 mb, suggesting a range of 47 to 56 kt for the intensity. Intensity at 06Z and 12Z retained at 50 kt from the earlier 50 kt value at 00Z. 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 Storms Inga in 1961 and Edouard in 1984 are analogs 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

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*
		***				***			***							
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*	
		**			***	***		***							***	
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	140	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	140		928*172	697	140		0*175	710	140		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	773	65		0*207	785	65		0*213	794	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	85	977*237	850	85	974*233	857	85	974*228	864	85	974*
		**	**	***		**	***	***	**		***	**	
44765	10/07*223	872	105	961*221	881	110	0*219	890	110	0*217	900	115	972*
44765	10/07*223	872	100	961*220	881	95	0*218	890	90	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*
44785	10/11*221	992	30	0*218	999	25	0*2151006	20		0*	0	0	0*
						**		**					

44790 HRBFL1
44790 HRBFL2CFL2

Hurricane Landfall

September 27th 17Z 16.2N 61.6W 110 kt 958 mb Guadeloupe
September 29th 14Z 17.7N 71.4W 140 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 - 10 nm RMW
October 04th - 23Z - 24.7N 81.3W - 85 kt - Category 2 - 988 mb - 1009 mb OCI - 225 nm ROCI - 10 nm RMW

October 05th - 02Z - 24.6N 81.8W - 85 kt - Category 2 - 988 mb - 1009 mb OCI - 225 nm ROCI - 10 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. Significant decreases in intensity on September 6 at 18Z, at 06Z on the 7th to 00Z 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 19Z (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. (However the Shea and Gray compilation instead suggests a central pressure of 967 mb.) A central pressure of 971 mb suggests maximum surface winds of 87 kt from the south of 25N pressure-wind relationship weakening subset (91 kt for 967 mb). It was considered to add in a special best track point at 21Z with an intensity of 95 kt. However, neither value can be properly quality controlled. So no large weakening of Inez is shown late on the 27th.

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 140 kt is analyzed at 18Z on the 28th, up from 130 kt originally shown in HURDAT, a minor intensity change. 140 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 140 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 140 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).
- 120 kt (fastest mile) at Guantamamo Bay, Cuba (MWR).

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 fastest mile winds of 120 kt (equivalent to 114 kt 1 min) 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."
- 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 (minimum 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 10 n mi and the climatological value is 20 n mi. (RMW estimated from North Key Largo, Flamingo, and Tavernier minimum pressure and maximum wind observations range from 10 to 20 nm.) Based on a ship report of 85 kt at 15Z and 85 kt sustained (10 m anemometer height above the ground) 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 highlights:

- 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 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. An intensity of 85 kt is analyzed at 06Z on the 6th, lower than originally shown in HURDAT. While Inez had a small RMW late on the 4th and on the 5th, it appears (though there is substantial noise in the estimates) that the inner core had expanded some on the 6th with larger eye diameter reported, even though the pressure had dropped. Thus the intensity is analyzed to be 85 kt at all times on the 6th. The 18Z intensity is 15 kt lower than original, a large reduction.

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 100 kt is analyzed at 00Z on the 7th, slightly less than 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 9th, 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. Because of the small eye diameter (10 nm), 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. It is suspected that because the central pressure stopped dropping and the eye diameter abruptly increased, that Inez went through a concentric eyewall cycle. 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 24 th	Retained
Sep 24 18Z	1008 mb	Penetration center fix: 1008 mb at 20Z on Sep 24 th	
Sep 25 12Z	1000 mb	Penetration center fix: 1000 mb at 1202Z on Sep 25 th	
Sep 25 18Z	1000 mb	Penetration center fix: 1000 mb at 19Z on Sep 25 th	

Sep 26 12Z	995 mb	Penetration center fix: 995 mb at 1115Z on Sep 26 th	
Sep 26 18Z	982 mb	Penetration center fix: 982 mb at 1730Z on Sep 26 th	
Sep 27 06Z	965 mb	Penetration center fix: 965 mb at 06Z on Sep 27 th	
Sep 27 12Z	961 mb	Penetration center fix: 961 mb at 1050Z on Sep 27 th	
Sep 27 18Z	962 mb	Land: Pointe-a-Pitre, Guadeloupe measured 958 mb at 17Z on Sept 27 th	958 mb
Sep 28 00Z		Penetration center fix: 964 mb at 0245Z on Sep 28 th	964 mb
Sep 28 06Z	955 mb	Penetration center fix: 955 mb at 0545Z on Sep 28 th	Retained
Sep 28 18Z	932 mb	Penetration center fix: 927 mb at 1920Z on Sep 28 th	927 mb
Sep 29 00Z	929 mb	Penetration center fix: 928 mb at 0140Z on Sep 29 th	928 mb
Sep 30 00Z	987 mb	Penetration center fix: 987 mb at 2355Z on Sep 29 th	
Oct 02 18Z	999 mb	Penetration center fix: 999 mb at 1815Z on Oct 02 nd	
Oct 03 00Z	995 mb	Penetration center fix: 995 mb at 220Z on Oct 02 nd	
Oct 03 06Z	989 mb	Penetration center fix: 989 mb at 0605Z on Oct 03 rd	Retained
Oct 03 12Z	985 mb	Penetration center fix: 985 mb at 1155Z on Oct 03 rd	
Oct 03 18Z	986 mb	Penetration center fix: 986 mb at 18Z on Oct 03 rd	
Oct 04 00Z	985 mb	Penetration center fix: 985 mb at 2315Z on Oct 03 rd	
Oct 04 06Z		Penetration center fix: 988 mb at 0630Z on Oct 04 th	988 mb
Oct 04 12Z	987 mb	Penetration center fix: 987 mb at 12Z on Oct 04 th	
Oct 04 18Z	984 mb	Penetration center fix: 984 mb at 1745Z on Oct 04 th	
Oct 05 00Z	988 mb	Penetration center fix: 988 mb at 00Z on Oct 05 th	Retained
Oct 05 06Z	985 mb	Penetration center fix: 985 mb at 0610Z on Oct 05 th	
Oct 05 18Z	980 mb	Penetration center fix: 980 mb at 18Z on Oct 05 th	
Oct 06 00Z	970 mb	Penetration center fix: 977 mb at 2345Z on Oct 05 th	977 mb
Oct 06 06Z	983 mb	Penetration center fix: 974 mb at 0850Z on Oct 06 th	974 mb

Oct 06 12Z	974 mb	Penetration center fix: 974 mb at 1310Z on Oct 06 th	Retained
Oct 06 18Z	974 mb	Penetration center fix: 974 mb at 1919Z on Oct 06 th	
Oct 07 00Z	961 mb	Penetration center fix: 961 mb at 0015Z on Oct 07 th	
Oct 07 18Z	972 mb	Penetration center fix: 972 mb at 1825Z on Oct 07 th	
Oct 08 00Z	972 mb		Removed
Oct 08 12Z	953 mb	Penetration center fix: 953 mb at 0915Z on Oct 08 th	Retained
Oct 08 18Z	956 mb	Penetration center fix: 956 mb at 1730Z on Oct 08 th	
Oct 09 00Z	948 mb	Penetration center fix: 948 mb at 00Z on Oct 09 th	
Oct 09 06Z	951 mb	Penetration center fix: 951 mb at 0620Z on Oct 09 th	951 mb
Oct 09 12Z		Penetration center fix: 951 mb at 12Z on Oct 09 th	
Oct 09 18Z	953 mb	Penetration center fix: 961 mb at 18Z on Oct 09 th	
Oct 10 00Z	960 mb	Penetration center fix: 961 mb at 00Z on Oct 10 th	Retained
Oct 10 06Z	962 mb	Penetration center fix: 962 mb at 03Z on Oct 10 th	
Oct 10 12Z	961 mb	Penetration center fix: 961 mb at 1213Z on Oct 10 th	

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

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*
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44820 TS

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. Note that the quality of the satellite imagery is not sufficient to allow a detailed intensity analysis.

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

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	0*	S255	505	30	0*	S255	512	30	0*
										****	***	**		****	***	**	
44835	11/05*	262	540	25	0*	256	554	25	0*	250	560	25	0*	248	557	25	998*
44835	11/05*	S254	521	35	0*	S253	533	35	0*	S252	548	35	0*	S249	557	S20	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	S20	998*	242	547	40	0*	240	542	S20	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	988*	E427	306	60	0*
						***				***	***			****	***	**	
44865	11/11*	439	288	65	0*	450	272	65	0*	458	257	65	0*	464	239	65	0*
44865	11/11*	E436	290	60	0*	E445	275	55	0*	E449	260	55	0*	E450	245	S20	0*
		****	***	**		****	***	**		****	***	**		****	***	**	
44870	11/12*	E468	221	65	0E	470	210	60	0E	467	200	55	0E	459	186	45	0*
44870	11/12*	E450	233	S20	0E	E450	220	50	0E	E450	203	45	0E	E449	186	45	0*
		***	***	**		***	***	**		***	***	**		***			
44875	11/13*	E450	172	45	0E	443	163	45	0E	435	155	45	1016*	E425	148	45	0*
44875	11/13*	E445	172	45	0E	440	163	45	0E	432	160	40	0*	E420	E165	35	0*
		***				***				***	***	**		*	***	***	**
44880	11/14*	E412	143	45	0*	0	0	0	0*	0	0	0	0*	0	0	0	0*
44880	11/14*	E411	E169	S20	0E	E405	175	30	0*	0	0	0	0*	0	0	0	0*

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.
3. Significant increase in intensity on November 5th and 6th based on synoptic and reconnaissance aircraft data.
4. Significant reduction in intensity on November 11th and 12th based on ship observations.
5. Transition to an extratropical cyclone is analyzed 30 hours earlier than originally shown in HURDAT.
6. 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 12 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. (Note that the system was operationally listed as a tropical depression - "T.D." on microfilm maps.)

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. This is an unusual structure to have the strongest winds that from the center for a tropical cyclone. It is noted that while this system at least somewhat resembled a subtropical cyclone, the 500 mb charts do not indicate enough cold air in the system at that level to justify a subtropical classification. 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. First indication of "T.D." at 12Z, indicating operationally it was carried as a tropical depression.
- 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).
- 9 kt W and 1006 mb at Dry Tortugas, FL at 09Z (SWO).
- 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 25-27, 1966] - AL131966

44345	07/25/1966	M= 2	13	SNBR= 953	UNNAMED	XING=0	SSS=0								
44350	07/25*	0	0	0	0*	0	0	0	0*280	870	20	0*284	880	20	0*
44350	07/26*286	890	20		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														

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. As a closed low became evident by 12Z on the 25th, tropical depression formed at that time in the northeastern Gulf of Mexico. (Note that this system apparently was not considered a tropical depression operationally, as no "T.D." nomenclature was indicated on the microfilm maps.)

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 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	14	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													

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. At 00Z, the notation "T.D." was used, indicating that the system was considered a tropical depression operationally.

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 15	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*	136	220	25	0*	136	220
44355	10/04*	137 220 25	0*	138 220 25	0*	140	220	25	0*	142	220	25	0*	142	220	25	0*	142	220
44355	10/05*	144 219 30	0*	147 217 40	0*	150	214	40	0*	153	211	40	0*	153	211	40	0*	153	211
44360	10/06*	156 207 40	0*	160 204 40	0*	163	202	40	0*	167	201	40	0*	167	201	40	0*	167	201
44365	10/07*	171 201 40	0*	174 202 40	0*	177	203	40	0*	180	204	40	0*	180	204	40	0*	180	204
44370	10/08*	182 205 35	0*	183 206 30	0*	183	208	30	0*	183	214	30	0*	183	214	30	0*	183	214
44375	10/09*	182 222 30	0*	180 235 30	0*	177	250	25	0*	174	265	25	0*	174	265	25	0*	174	265
44380	10/10L	171 280 25	0L	168 295 25	0L	165	308	25	0L	160	319	25	0*	160	319	25	0*	160	319
44385	10/11L	155 330 25	0L	148 340 20	0L	140	350	20	0L	133	360	20	0*	133	360	20	0*	133	360
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:

7. 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.

8. 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." No additional information was found to indicate why Kendra was "unnamed" immediately after the 1966 hurricane season.

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 06Z. (The ship - *SJNX* - reported at 12Z 4th (15 kt NE/1015mb), 06Z 5th (30 kt N/1007 mb), and 12Z 5th (10 kt W/1013 mb). No obvious bias appears in either the winds or pressures.) This pressure indicates a central pressure of 1004 mb or lower, suggesting an intensity of at least 39 kt from the Brown et al. south of 25N pressure-wind relationship. The intensity is increased to 35 kt at 00Z and 40 kt at 06Z. 40 kt is the peak intensity for the system. 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 best organized on satellite images between the 4th and 7th.

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: Peak ship reports on the 7th were 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, though the winds do not appear to be biased. 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. A "TD" is indicated at 12Z, suggesting that the system was operationally considered a tropical depression at that time.
- 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. The 00Z map indicated "Kendra" on the map, suggesting it was carried operationally as a tropical storm at that time.
- 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

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															

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. (This Ship "-445" reported for several days and showed a near zero bias for pressure.) 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. (This ship "B808" reported for several days and had perhaps a 2 mb low bias.) 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 summarized 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

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																

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 gale.

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. Discussion:

- 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. It is noted that the microfilm map for 12Z had a nephanalysis on it suggesting the cyclone had a subtropical or tropical cyclone cloud pattern.

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. However, it is noted that satellite imagery suggests that the suspect low did develop some convection, but likely did not have it for a long enough period of time to be considered a tropical cyclone.

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
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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

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

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*
									***		**	****	***	***	**	
55565	06/11*180	855	0	0*180	858	0	0*179	860	0	0*181	862	0	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	0*	
55570	06/12*184	862	25	0*185	867	25	0*185	873	25	0*	0	0	0	0	0*	
	***	***	**	***	**		***	***	**							

55575 TD

Significant Revisions:

- The original HURDAT did not have intensities for the positions of this non-developing tropical depression.

Daily Metadata:

June 7:

- Maps and old HURDAT:
 - HWM and microfilm show a tropical wave over the western Caribbean Sea at 12Z.
- 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	0	S290	740	30	0*
		*	*		*	*			*	*				****	***	**	
12355	06/16*	301	756	0	0*	305	758	0	0*	311	759	0	0*	316	768	0	0*
12355	06/16*	S292	748	30	0	S294	756	30	0	S296	763	35	0	S299	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	06/20E	379	730	35	0E387	717	40	0E398	706	45	0E405	701	45	0*			
12380	06/21E	407	703	40	0E405	705	35	0E407	701	30	0E412	696	30	0*			
12385	06/22E	420	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

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	1	SNBR= 945	ARLENE		XING=0	SSS=0								
43805	08/28/1967	M= 9	1	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*185	401	30	0*
43815	08/29*164	368	30	0*171	379	30	0*178	390	30	0*185	402	35	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													

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 1 st	
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 3 rd suggest that this penetration fix missed the center, thus it is removed from HURDAT	Removed
Sep 04 00Z	982 mb	Penetration center fix: 982 mb at 22Z on Sep 3 rd	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

45040 09/05/1967 M=17 3 SNBR= 964 CHLOE XING=0 SSS=0
 45040 09/04/1967 M=18 3 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	75	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	70	0*264	427	70	0*263	439	70	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	75	0*260	474	80	0*262	486	85	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	85	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*
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*
	***		**	* ***		**	***			***		*

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 Fieta Schulze 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 21 st	Removed

Sep 21 18Z	996 mb	Synoptic observations in HWM at 12Z over France suggested that the central pressure at 18Z was likely lower	
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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

42675	09/05/1967	M=18	2	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*
		***	***	***	***	**			***	***	**		***	***	**		
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	960*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*

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 absence 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 begun 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 kt 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 12 th	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 18 th Penetration center fix: 963 mb around 0301Z on Sep 19 th	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

45115 09/07/1967 M=14 4 SNBR= 924 DORIA XING=1
45115 09/04/1967 M=17 4 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*

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	09/19*310	740	25	0*305	735	25	0*300	730	25	0*297	723	25	0*
		*		*	***		*			***			
45200	09/20*295	715	25	1010*295	708	25	0*295	700	25	0*295	693	25	0*
45200	09/20*295	715	25	1010*295	708	25	0*295	700	25	0*295	695	25	0*
		*		*			*			*			
45205	09/21*295	685	25	0*295	679	25	0*295	675	25	0*	0	0	0*
45205	09/21*295	690	25	0*295	685	25	0*295	680	25	0*	0	0	0*
		*	***	*	***		*	***					

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 8 th	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 9 th	
Sep 10 18Z	984 mb	Penetration center fix: 984 mb at 1739Z	987 mb
Sep 11 00Z		Penetration center fix: 987 mb at 2130Z on Sep 10 th	
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 12 th	
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 14 th , four hours after measuring 973 mb, and later on the 15 th , 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 17 th	
Sep 18 12Z	1006 mb	Penetration center fix: 1006 mb at 1231Z	
Sep 18 18Z	1006 mb	Penetration center fix: 1006 mb at 1740Z	Removed
Sep 20 00Z	1010 mb	No ships or reconnaissance aircraft near the cyclone around this time	

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

55555 09/18/1967 M= 9 1 SNBR= 4 UNNAMED
55555 09/19/1967 M= 9 1 SNBR= 4 UNNAMED

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(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*	130	190	25	0*	130	200	25	0*
		*	*		*	*		*	***	***	**	*	***	***	**	
55570	09/20*	145	212	0	0*146	229	0	0*146	241	0	0*146	251	0	0*		
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	09/23*	158	384	25	0*159	397	25	0*160	409	25	0*161	421	25	0*		
		*	***	**	*	***	**	*	***	**	*	***	**			

55590	09/24	*161	436	0	0*162	450	0	0*163	464	0	0*164	474	0	0*	
55590	09/24	L 161	434	25	0 L 162	448	25	0 L 163	462	25	0 L 163	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*
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55610 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.
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 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

55555 09/22/1967 M= 9 1 SNBR= 4 UNNAMED
 55555 09/25/1967 M= 7 1 SNBR= 4 UNNAMED
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(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*
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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*
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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*
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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***
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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*
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(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

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 1 SNBR= 4 UNNAMED

55555 09/26/1967 M= 3 1 SNBR= 4 UNNAMED

(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*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

45215 09/26/1967 M= 6 5 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*
45245	10/01*145	641	30		0*	0	0	0	0*	0	0	0	0	0	0*
		***			*	*	*		*	*	*				

45250 TS

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 6 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 55 0*224 934 65 987*
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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 60 996*
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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 7 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 10/08 202 212 30 0 201 220 30 0 200 228 30 0 197 237 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 1 SNBR= 4 UNNAMED

55555 10/07/1967 M= 7 1 SNBR= 4 UNNAMED

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(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*	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	10/11E	435	675	25	0E	465	665	25	0E	490	640	30	0E	515	620	30	0*
55575	10/12E	535	590	30	0E	545	550	35	0E	555	510	35	0E	560	480	35	0*
55575	10/13E	565	450	35	0*	0	0	0	0*	0	0	0	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 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

12340 10/12/1967 M= 3 2 SNBR= 4 UNNAMED
 12340 10/14/1967 M= 6 2 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	0*	270	715	40	1002	285	712	40	0*	295	705	40	0*
		*	*		****	***	**	*****	***	**			****	***	**		

(October 15th through the 19th are new to HURDAT)

12360	10/15	S303	697	40	0S293	705	40	0S286	713	40	0S287	717	45	0*
12365	10/16	S288	718	45	0S291	719	45	0S294	721	45	0S298	725	40	0*
12370	10/17	S306	730	35	0S320	735	35	0S335	736	35	0*350	730	40	0*
12375	10/18*	S365	720	50	0*385	705	50	0E418	680	45	0E455	655	40	0*
12380	10/19	E470	645	40	0E480	640	35	0*	0	0	0*	0	0	0*
12385	TS													

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, 71.5W 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

55555 10/15/1967 M= 3 1 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

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	8	SNBR=	969	HEIDI		XING=0	SSS=0							L
45315	10/19/1967	M=15	8	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	30	0*214	615	35	1008*	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*		
	***	***		***	***		***	***	**	***	***	***	**	***		
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	11/01E	430	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	11/02E	425	370	40	0E415	360	40	0E395	353	40	0E370	350	40	0*
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45395 HR

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 22 nd	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

12345 06/20/1967 M= 4 2 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*
12370	TS												

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] - A1281967

55555 09/01/1967 M= 5 1 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

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

11. 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.

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,

12. 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,

13. 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,
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,

14. 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,

15. 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,

16. 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.

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,

17. 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.

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,

18. 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.

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,

19. 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

20. 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

21. 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,
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22. 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.

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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,
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23. 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

24. 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

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

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 mb (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 depression 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 6 th 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

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
 ** *

(June 17th has been removed from HURDAT)

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	994*372	462	55	0*	
							***	***		****	***	**		
45520	06/26*378	435	45	0*384	407	30	0*390	380	30	0*	0	0	0	0*
45520	06/26*378	435	40	0*384	407	30	0*390	380	30	0*	0	0	0	0*
	*		**	*		*	*		*					

45525 HR

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 20 th	1008 mb
June 21 12Z	1005 mb	Penetration center fix: 1005 mb at 1205Z on June 21 st	Retained
June 21 18Z	995 mb	Penetration center fix: 995 mb at 1848Z on June 21 st	
June 22 00Z	993 mb	Penetration center fix: 993 mb at 2054Z on June 21 st	Removed
June 22 12Z	998 mb	Penetration center fix: 998 mb at 1407Z on June 22 nd	Retained
June 22 18Z	997 mb	Penetration center fix: 997 mb at 1815Z on June 22 nd	
June 23 00Z	997 mb	Penetration center fix: 997 mb at 2353Z on June 22 nd	
June 23 06Z	995 mb	Penetration center fix: 995 mb at 06Z on June 23 rd	
June 23 12Z	992 mb	Penetration center fix: 992 mb at 1215Z on June 23 rd	
June 24 00Z	991 mb	Penetration center fix: 991 mb at 2330Z on June 23 rd	
June 24 06Z	990 mb	Penetration center fix: 990 mb at 06Z on June 24 th	
June 24 12Z	990 mb	Penetration center fix: 990 mb at 0545Z on June 24 th	
June 25 00Z	997 mb	Penetration center fix: 997 mb at 2329Z on June 24 th	
June 25 12Z	994 mb	Penetration center fix: 994 mb at 1135Z on June 25 th	

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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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

45565	08/10/1968	M= 8	4	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	55	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	0*425	319	30	0*428	295	30	1010*
		***	**	*		**	****	***		*			****
45605	08/17*428	265	30	0*	0	0	0*	0	0	0	0	0	0*
45605	08/17*428	270	30	0*	0	0	0*	0	0	0	0	0	0*
	*	***											

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:

- 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.)
- 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 12 th	
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

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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 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 0*
(The 1st has been deleted from HURDAT2.)

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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: Observations 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 a "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 5 SNBR= 974 EDNA XING=0 SSS=0
 45615 09/14/1968 M= 4 5 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	30	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	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*
45650	09/17*167	428	30	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*	
									****		**	****	***	**		
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	09/20	S355	560	60	987S352	526	65	0S355	490	65	985S376	465	70	0*
45705	09/20	S359	557	65	0S355	526	70	0S355	495	75	976S366	475	75	0*
		***	***	**	* ***		**		***	**	***	***	***	**
45710	09/21	S395	450	70	979S399	443	70	0S403	437	65	982S406	431	65	0*
45710	09/21	S380	465	70	0S390	456	70	0S396	447	65	982S400	440	65	0*
		***	***		* ***	***		***	***		***	***		
45715	09/22	S410	425	60	984S415	416	60	0S420	405	60	986S422	392	55	0*
45715	09/22	S404	433	60	984S408	425	60	0E411	417	60	0E415	405	55	0*
		***	***		***	***		****	***		*****	***		
45720	09/23	S423	380	55	992S424	369	50	0E425	360	45	995E425	350	40	997*
45720	09/23	E419	393	55	0E422	380	50	0E425	366	45	0E428	351	45	0*
		****	***		*****	***		***			***	***	**	*

(September 24th and 25th are new to HURDAT)

45725	09/24	E432	336	45	0E438	317	45	0E445	300	45	0E458	274	40	0*
45730	09/25	E480	230	35	0*	0	0	0	0*	0	0	0	0	0*

45735 SS

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:

- 35 kt N (E in microfilm) and 1010 mb at 34.5N, 66.9W at 00Z (COADS).
- 35 kt W and 1002 mb at 34.3N, 67.2W at 06Z (COADS).
- 40 kt N (E in microfilm) and 1007 mb at 36.5N, 68.1W at 12Z (COADS).
- 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 started 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 15 th	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 21 st	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*
 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 09/20*156 348 25 0*163 360 25 0*171 372 25 0*180 384 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

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 not 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	0	264	735	25	0	272	737	25	0*
									****	***		****	***				
45740	09/24*	273	744	25	0*280	744	25	0*287	743	30	0*294	741	30	1012*			
45740	09/24	279	739	25	0	284	741	25	0	288	742	30	0	294	741	30	1012*
		****	***		****	***		****	***		*						
45745	09/25*	301	734	30	0*308	726	30	0*313	717	30	1012*	319	707	30	0*		
45745	09/25	301	735	30	0	307	726	30	0	313	717	30	1012	319	708	30	0*
		*	***		****			*				*	***				
45750	09/26*	323	699	30	0*327	692	30	0*329	688	30	0*332	682	45	1003*			
45750	09/26	325	700	30	0	330	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*			
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*			
		***			***	**	****	***	**		***	**					

(September 30th has been removed from HURDAT)

45770	09/30	E357	452	30	0E362	423	30	0E368	395	30	0E375	365	30	0*
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45775 TS

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 become 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

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	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*
		***	***	**	***	***	**	*	*	*	*	*	*	*	

(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

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	80.9W	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 all141968 (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 (COADS).
- 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 Cape 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 Gladys' 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 finalized 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

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	0	S250	718	30	0*
									*	*	*		****	***	**		

44180	11/25*	261	710	25	0*280	692	25	0*298	675	25	0*	0	0	0	0*
44180	11/25	S270	715	30	0	S295	705	30	0*	0	0	0	0	0	0*
		****	***	**		****	***	**	*	*	*				

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

25. 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

26. 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

27. 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

28. 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

29. 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

30. 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

31. 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

32. 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

33. 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

34. 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

35. 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

36. 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

37. 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 reconnaissance 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

38. 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

39. 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	5	SNBR=	966	UNNAMED		XING=0	SSS=0				
45235	06/08/1969	M= 2	5	SNBR=	966	UNNAMED		XING=0	SSS=0				
		**											
(June 7 th 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*
		***				***	***	**					

45255 TD

Significant Revisions:

- The first position is analyzed 24 hours later based on synoptic observations.
- 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*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

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

45835	07/25/1969	M=12	1	SNBR=	978	ANNA		XING=0	SSS=0				
45835	07/25/1969	M=11	1	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*
		***	**		**	***	**	***	***	**	***	**	**
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			0*	178 620 35		0*	190 650 35	0*
		***	***		**	***	***	***	***	***	***	***	**
45875	08/01*217	653	30		0*	236 670 30		0*	252 692 30		0*	270 715 35	1008*
45875	08/01*	210 670	35		0*	235 690 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	08/04E	415	618	50	0E420	575	45	0E425	530	45	0E430	470	45	0*
45890	08/04*	415	618	60	1001*	420	575	0*425	530	45	0*430	470	45	0*
	*			**	*****		**	*			*			

(October 5th has been removed from HURDAT)

45895	08/05E	435	420	45	0E445	370	35	0E455	320	35	0*	0	0	0	0*
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45900 TS

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 30 th	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]

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
 ** *

The 10th is new to HURDAT.

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	5	0*	355	699	70	997*
				**				**				**				**	
45915	08/12*	386	680	75	0*	417	650	75	0*	443	604	65	998E	460	549	60	0*
45915	08/12*	390	680	75	0*	420	647	75	0*	443	604	70	996E	460	549	65	0*
		***				***	***		*		**	***			**	**	
45920	08/13E	471	490	50	0E	480	430	40	0*	0	0	0	0*	0	0	0	0*
45920	08/13E	471	490	55	0E	475	430	40	0E	475	380	35	1008E	470	345	30	1009*
			**		***				****	***	**	*****	***	**	****	**	****

(The 14th is new for HURDAT.)

45920 08/14E470 310 30 1008E465 275 30 1008E440 230 25 1010E410 180 25 1011*

45925 HR

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.

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	4	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*	
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	0*	406	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*		
		*	**	*	**	**	*	*	*	*****	***	**	***		

(The 26th and 27th are new to HURDAT.)

46045	08/26E635	280	45	992E650	180	45	993E660	100	40	994E660	75	40	995*
46045	08/27E665	50	40	995E645	0	40	995E6453655	35	997*	0	0	0	0*

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 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:

- 35 kt ESE and 996 mb at 43.9N, 51.3W at 00Z (COADS).
- 40 kt NE and 1000 mb at 46.2N, 53.9W at 03Z (COADS).
- 45 kt NE and 1000 mb at 44.2N, 50.2W at 06Z (COADS).
- 50 kt S and 988 mb at 47.6N, 51.7W at 12Z (COADS).
- 50 kt S and 998 mb at 50.5N, 47W at 18Z (COADS).

4. Land highlights:

- 40 kt (gusts to 50 kt) at Argentia, Canada at 09Z (WALLET).

5. Discussion:

- 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 16 th	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 17 th	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 18 th	966 mb
Aug 18 06Z	968 mb	Penetration center fix: 967 mb at 05Z on August 18 th	967 mb
Aug 18 12Z	974 mb	Penetration center fix: 971 mb at 1155Z on August 18 th	971 mb
Aug 18 18Z	972 mb	Penetration center fix: 971 mb at 1752Z on August 18 th	971 mb
Aug 19 00Z	976 mb	Penetration center fix: 977 mb at 0Z on August 19 th	977 mb
Aug 19 06Z	978 mb	Penetration center fix: 976 mb at 0357Z on August 19 th	976 mb
Aug 19 12Z	974 mb	Penetration center fix: 973 mb at 1202Z on August 19 th	973 mb
Aug 19 18Z	966 mb	Penetration center fix: 964 mb at 1836Z on August 19 th	964 mb
Aug 20 00Z	956 mb	Penetration center fix: 954 mb at 2330Z on August 20 th	954 mb
Aug 20 06Z	953 mb	Penetration center fix: 952 mb at 07Z on August 20 th	952 mb
Aug 20 12Z	953 mb	Penetration center fix: 954 mb at 1139Z on August 20 th	954 mb
Aug 20 18Z	951 mb	Penetration center fix: 950 mb at 1730Z on August 20 th	950 mb
Aug 21 00Z	959 mb	Penetration center fix: 959 mb at 2343Z on August 20 th	Retained
Aug 21 06Z	960 mb	Penetration center fix: 958 mb at 0610Z on August 21 th	958 mb
Aug 21 12Z	959 mb	Penetration center fix: 959 mb at 1137Z on August 21 th	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 21 th	Retained
Aug 22 06Z		Penetration center fix: 965 mb at 0528Z on August 22 nd	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 22 nd	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 23 rd	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]

46050 08/25/1969 M= 4 5 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*				
		**		**			*	*	*	*	*	*	*				

46075 TS

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]

46080	08/29/1969	M= 7	6	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*
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	867 973*
	***	***	**	***	***	***	**	***	***	**	***	**	**
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*
46115	09/04*162	890	70	0*162	894	45	0*162	898	25	0*	0	0	0*
	***	***		***	***	**	***	***	**				

46120 HR

Hurricane Landfall

09/03 21Z 16.2N 88.8W 85 kt Belize

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	5	SNBR= 966	UNNAMED		XING=0	SSS=0						
45235	09/07/1969	M= 4	5	SNBR= 966	UNNAMED		XING=0	SSS=0						
(September 5 th and 6 th 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	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*
45265	09/10*165	415	25	0*	0	0	0	0	0	0*	0	0	0	0*
		***	***											
45270	TD													

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	91	984*409	694	105	980 *
	***			***	**	**	***	**	**	***	***	***	***
46150	09/10*440	675	95	979E485	660	70	0E530	650	40	0*	0	0	0*
46150	09/10*440	675	55	0 E485	660	55	982 E530	650	40	984E560	635	40	982 *
	**	*	**	*	**	**	***	**	**	*****	***	**	***

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 40 980E665 640 50 980* * * * ** * * * **
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(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 32.6N, 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 extratropical about five hours later and rapidly lost her intensity over eastern Canada."
- Environment Canada:
 - o Nova Scotia - 133 km/h (72 kt) winds in Yarmouth. Tore shingles from roofs and blew down trees in the province.
 - o 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 8 th	Removed
Sep 08 12Z	1002 mb	Penetration center fix: 1002 mb at 1112Z on Sep 08 th	Retained
Sep 08 18Z		Penetration center fix: 993 mb at 2030Z on Sep 08 th	993 mb
Sep 09 00Z	991 mb	Penetration center fix: 991 mb at 00Z on Sep 09 th	Retained
Sep 09 06Z	986 mb	Penetration center fix: 986 mb at 0845Z on Sep 09 th	
Sep 09 12Z	984 mb	Penetration center fix: 984 mb at 1133Z on Sep 09 th	
Sep 09 18Z	979 mb	Penetration center fix: 980 mb at 1805Z on Sep 09 th	980 mb
Sep 10 00Z	979 mb	Penetration center fix: 979 mb at 20Z on Sep 09 th	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]

46160 09/14/1969 M= 8 8 SNBR= 985 HOLLY XING=0 SSS=0
 46160 09/13/1969 M= 6 8 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	11	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	65	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*

46205 HR

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 she 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 20°-200°, 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 18 th	
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]

```
45235 09/19/1969 M= 5 5 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]

46210	09/20/1969	M=26	9	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*
		***				***				***	**	*****	***	**	

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*		
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*		
46340	10/15*252	602	25	0*	252	603	20	0*252	604	20	0*	0	0	0*	
	***	***		***	***	**	***	***	**	***	***	**			

46345 HR

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 (COADS).
 - 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 90°-270°, 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 90°-270°, 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 60°-240°, 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 60°-240°, 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 90°-270°, 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 90°-270°, 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 0°-180°, 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 30°-210°, 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 0°-180°, 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 40°-220°, 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 20°-200°, 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 20°-200°, 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 90°-270°, 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 0°-180°, 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 not 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 160°-340°, 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 0°-180°, 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 70°-250°, 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 21 st	1004 mb
Sep 22 12Z	1007 mb	Penetration center fix: 1007 mb at 1145Z on Sep 22 nd	Retained
Sep 22 18Z		Penetration center fix: 1007 mb at 1950Z on Sep 22 nd	1007 mb
Sep 23 00Z		Penetration center fix: 1006 mb at 2340Z on Sep 22 nd	1006 mb
Sep 23 12Z	1006 mb	Penetration center fix: 1006 mb at 1130Z on Sep 23 rd	Retained
Sep 23 18Z		Penetration center fix: 1007 mb at 1558Z on Sep 23 rd	1007 mb
Sep 24 00Z		Penetration center fix: 1006 mb at 2130Z on Sep 23 rd	1006 mb
Sep 24 12Z	1007 mb	Penetration center fix: 1007 mb at 1130Z on Sep 24 th	Retained
Sep 26 12Z		Ship: 5 kt NW and 1009 mb at 12Z on Sep 26 th	1008 mb
Sep 27 18Z		Ship: 10 kt SW and 1004 mb at 18Z on Sep 27 th	1003 mb
Sep 28 12Z	1000 mb	Ship: 35-40 kt SE and 1004 mb at 12Z on Sep 28 th	Retained
Sep 29 12Z	992 mb	Penetration center fix: 992 mb at 1230Z on Sep 29 th	
Sep 29 18Z		Penetration center fix: 991 mb at 1740Z on Sep 29 th	991 mb
Sep 30 00Z		Penetration center fix: 994 mb at 0217Z on Sep 30 th	994 mb
Sep 30 06Z		Penetration center fix: 990 mb at 0546Z on Sep 30 th	990 mb

Sep 30 12Z	990 mb	Penetration center fix: 994 mb at 1230Z on Sep 30 th	994 mb
Sep 30 18Z		Penetration center fix: 989 mb at 18Z on Sep 30 th	989 mb
Oct 01 00Z		Penetration center fix: 988 mb at 2304Z on Sep 30 th	988 mb
Oct 01 06Z		Penetration center fix: 991 mb at 0630Z on Oct 1 st	991 mb
Oct 01 12Z	990 mb	Penetration center fix: 991 mb at 1150Z on Oct 1 st	991 mb
Oct 01 18Z		Penetration center fix: 987 mb at 18Z on Oct 1 st	987 mb
Oct 02 00Z		Penetration center fix: 986 mb at 2217Z on Oct 1 st	986 mb
Oct 02 12Z	987 mb	Penetration center fix: 989 mb at 1220Z on Oct 2 nd	989 mb
Oct 02 18Z		Penetration center fix: 989 mb at 1730Z on Oct 2 nd	987 mb
Oct 03 00Z		Penetration center fix: 986 mb at 2210Z on Oct 2 nd	986 mb
Oct 03 12Z	989 mb	Penetration center fix: 989 mb at 1145Z on Oct 3 rd	Retained
Oct 03 18Z		Penetration center fix: 990 mb at 1815Z on Oct 3 rd	990 mb
Oct 04 00Z		Penetration center fix: 986 mb at 2155Z on Oct 3 rd	986 mb
Oct 04 12Z	980 mb	Penetration center fix: 980 mb at 1145Z on Oct 4 th	Retained
Oct 04 18Z		Penetration center fix: 969 mb at 1730Z on Oct 4 th	969 mb
Oct 05 00Z		Penetration center fix: 968 mb at 2135Z on Oct 4 th	968 mb
Oct 05 12Z	964 mb	Penetration center fix: 964 mb at 1204Z on Oct 5 th	Retained
Oct 05 18Z		Penetration center fix: 964 mb at 1758Z on Oct 5 th	964 mb
Oct 06 06Z		Penetration center fix: 978 mb at 08Z on Oct 6 th	978 mb
Oct 06 12Z	980 mb	No reconnaissance aircraft penetration center fix or ships near the center at or around 12Z on Oct 6 th	Removed
Oct 06 18Z		Penetration center fix: 983 mb at 21Z on Oct 6 th	983 mb
Oct 07 12Z	981 mb	Penetration center fix: 980 mb at 1025Z on Oct 7 th	980 mb
Oct 07 18Z		Penetration center fix: 983 mb at 1545Z on Oct 7 th	983 mb
Oct 08 00Z		Penetration center fix: 989 mb at 2145Z on Oct 7 th	989 mb
Oct 08 12Z	988 mb	Penetration center fix: 989 mb at 1105Z on Oct 8 th	989 mb
Oct 08 18Z		Penetration center fix: 983 mb at 2045Z on Oct 8 th	983 mb
Oct 09 12Z	985 mb	No reconnaissance aircraft penetration center fix or ships near the center at or around 12Z on Oct 6 th	Removed
Oct 09 18Z		Penetration center fix: 986 mb at 18Z on Oct 9 th	986 mb
Oct 10 12Z	993 mb	Penetration center fix: 994 mb at 1029Z on Oct 10 th	994 mb
Oct 10 18Z		Penetration center fix: 994 mb at 1815Z on Oct 10 th	992 mb
Oct 11 12Z	998 mb	Penetration center fix: 998 mb at 1750Z on Oct 11 th	Removed
Oct 11 18Z			998 mb
Oct 12 12Z	1001 mb	Penetration center fix: 1001 mb at 1802Z on Oct 12 th	Removed
Oct 12 18Z			1001 mb
Oct 13 12Z	1003 mb	Penetration center fix: 1003 mb at 1910Z on Oct 13 th	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 6 th	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]

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46350 09/21/1969 M= 6 10 SNBR= 987 NOT NAMED XING=0 SSS=0
46350 09/21/1969 M= 9 10 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*
*** *** *** *** ** *** **

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 0*
46380 09/26*441 560 65 0*454 538 65 0E470 510 60 0E492 470 60 0*
*** *** *** ** **** ** ** ***** **

(September 27th through 29th are added to HURDAT)
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 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 11 SNBR= 988 NOT NAMED XING=0 SSS=0
 46385 09/23/1969 M= 8 11 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	09/24	E385	350	35	0E375	350	35	0E365	352	35	0E357	357	35	1004*	
		****	***	**	****	***	**	*	***	**	* ***	**	***	***	
46400	09/25S	350	365	30	0S350	376	30	0S350	385	35	1003S351	389	40	0*	
46400	09/25S	352	365	40	0S350	373	40	1004S	350	380	40	0S351	386	40	1005*
		***	**		***	**	****	***	**	*	***	**	***	****	
46405	09/26S	352	392	45	0*353	396	50	0*355	400	50	997*360	400	50	0*	
46405	09/26S	352	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

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 24 th	1004 mb
Sep 25 06Z		Ship: 20 kt NW and 1006 mb at 06Z on Sep 25 th	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 25 th	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]

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46435 09/29/1969 M= 3 12 SNBR= 989 SUBTROP 1 XING=0 SSS=0
46435 09/29/1969 M= 5 12 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 at 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	Evidence	Changes
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	Central Pressure		
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 13 SNBR= 990 JENNY          XING=1 SSS=0
46460 10/01/1969 M= 5 13 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*  0*
      ***  ***      *  *  *      *  *  *      *  *  *      *  *  *

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(October 6th is removed from HURDAT)

46490 10/06*275 886 25 0*275 900 25 0*275 914 25 0*275 928 25 0*

46495 TS

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 Gulf 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 2 nd	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 3 rd	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]

46500	10/07/1969	M=13	14	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	10/12S	345	706	45	998S	348	707	45	997S	348	709	45	997S	343	713	45	999*
	*		**		****				****	***	**	*****	***	**	***		
46535	10/13*336	715	55		0*333	714	55		0*327	728	55	0*319	738	60	0*		
46535	10/13S	338	714	45	997S	332	716	45	998S	327	727	45	995S	319	738	45	0*
	****	***	**		****	***	**		****	***	**	****		**			
46540	10/14*310	747	60		0*314	750	60		0*320	757	60	990*313	763	60	0*		
46540	10/14S	312	745	45	998S	314	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*	

46570 HR

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]

46575 10/17/1969 M=11 15 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*
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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*

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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*
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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*
	***	**		***	***	**				**	***	***	**	****
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*
46635	HR													

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 30^o-210^o, 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 20^o-200^o, 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 350°-170°, 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 30^o-210^o, 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 17 th	1005 mb
Oct 18 12Z		Penetration center fix: 1006 mb at 1215Z on Oct 18 th	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 19 th	
Oct 20 06Z		Penetration center fix: 998 mb at 0630Z on Oct 20 th	998 mb
Oct 20 12Z	993 mb	Penetration center fix: 993 mb at 1130Z on Oct 20 th	Retained
Oct 20 18Z		Penetration center fix: 987 mb at 1830Z on Oct 20 th	987 mb
Oct 21 00Z	973 mb	Penetration center fix at 0010Z on Oct 21 st , but no central pressure reported in the Storm Wallets	Retained
Oct 21 06Z		Penetration center fix: 974 mb at 0850Z on Oct 21 st	974 mb
Oct 21 12Z	973 mb	Penetration center fix: 973 mb at 1136Z on Oct 21 st	Retained
Oct 21 18Z		Penetration center fix: 977 mb at 1850Z on Oct 21 st	977 mb
Oct 22 00Z	980 mb	Penetration center fix: 980 mb at 2348Z on Oct 21 st	Retained
Oct 22 06Z		Penetration center fix: 983 mb at 0552Z on Oct 22 nd	983 mb
Oct 22 12Z	987 mb	Penetration center fix: 987 mb at 12Z on Oct 22 nd	Retained
Oct 22 18Z		Penetration center fix: 987 mb at 1747Z on Oct 22 nd	987 mb
Oct 23 00Z	992 mb	Penetration center fix: 992 mb at 0007Z on Oct 23 rd	Retained
Oct 23 06Z		Penetration center fix: 996 mb at 0745Z on Oct 23 rd	996 mb
Oct 23 12Z		Penetration center fix: 998 mb at 1132Z on Oct 23 rd	998 mb
Oct 23 18Z		Penetration center fix: 1000 mb at 2035Z on Oct 23 rd	1000 mb
Oct 24 12Z	1001 mb	Penetration center fix: 1001 mb at 1230Z on Oct 24 th	Retained
Oct 24 18Z		Penetration center fix: 1004 mb at 2045Z on Oct 24 th	1004 mb
Oct 25 12Z	1007 mb	Appears to have missed the center based on reconnaissance aircraft data late on the 24 th and 25 th	Removed
Oct 25 18Z		Penetration center fix: 1003 mb at 1830Z on Oct 25 th	1003 mb
Oct 26 18Z	1006 mb	Penetration center fix: 1006 mb at 2042Z on Oct 26 th	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 16 SNBR= 993 NOT NAMED XING=0 SSS=0
46640 10/28/1969 M= 5 16 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 17 SNBR= 994 NOT NAMED XING=0 SSS=0
46665 10/28/1969 M=13 17 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*
**** ** ** **** ** ** ** ** ** ** ** ** ** ** **

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*
**** ** ** **** ** ** **** ** ** ****

(November 8th and 9th are new to HURDAT)

46720	11/08	L373	195	35	0L360	175	35	0L351	155	30	0L345	140	25	0*
46720	11/09	L340	120	20	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]

46725 11/21/1969 M= 5 18 SNBR= 995 MARTHA XING=0 SSS=0 L
 46720 11/20/1969 M= 6 18 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

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 22 nd	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 23 rd	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]

```
45235 08/07/1969 M= 2  5 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

40. 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

41. 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

42. 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
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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

43. 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

44. 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

45. 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

46. 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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47. 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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48. 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.

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,	

49. 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

50. 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

51. 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,
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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52. 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

53. 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,
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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,

54. 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.

AL111969,			UNNAMED,		9,	
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,

55. 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.

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,

56. 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.

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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,

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57. 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

58. 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

59. 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

60. 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

61. 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 not display 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

62. 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*
          *** **          ***          ***** ** *****
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*
          *          ** * * *
    
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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 finalized 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 21 st	
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 25 th	1003 mb
May 26 00Z	1005 mb	Land: 13 kt SSW and 1007 mb at Savannah, GA at 2255Z on May 25 th	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

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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*
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46855 TS

U.S. Tropical Storm Landfall

07/22 10Z 29.7N 85.3W 40 kt FL

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 7:00 p.m. EDT on July 20 and the highest sustained winds were 55 kt reported by the SS Socony Vacuum at 5:00 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 21 st , the Navy reconnaissance book suggests that it was at 23Z on the 20 th . Nonetheless, the 1003 mb is close to the central pressure reported by the reconnaissance aircraft at 0559Z on the 21 st 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 21 st but a ship reported 45 kt and 1012 mb at 00Z on the 22 nd , 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

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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 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*
           *** *** **                *** *** ** ***** *** *** ** ***** *** *** ** *****
45275 TD
  
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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

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

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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*

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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*

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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*

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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*

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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

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 recon 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 1 st	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 3 rd , the central pressure was higher at 00Z on the 4 th	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

Tropical Depression [August 2-6, 1970] - AL051970

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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*
      ***      **      ***      **      ***      **      **
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45270 TD

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 1°
 Red indicates a new entry
 Yellow indicates a deletion

Tropical Depression [August 11-18, 1970] - AL071970

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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 0*190 260 30 0*190 275 30 0*
          * *
45255 08/13*190 290 30 0*190 305 30 0*190 320 30 0*188 335 30 0*
45255 08/13*190 290 30 0*190 305 30 0*189 320 30 0*187 335 30 0*
          * * * * *
45260 08/14*185 350 30 0*182 365 30 0*180 380 30 0*180 395 30 0*
45260 08/14*185 350 30 0*182 365 30 0*180 380 30 0*180 395 30 0*
          * * *
45265 08/15*180 410 30 0*180 425 30 0*180 440 30 0*180 460 30 0*
45265 08/15*180 410 30 0*180 425 30 0*180 440 30 0*180 460 30 0*
          * * *
45270 08/16*180 480 25 0*180 500 25 0*180 520 25 0*185 535 25 0*
45270 08/16*180 480 25 0*180 500 25 0*182 520 25 0*185 535 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*
45280 08/18*210 610 30 0*217 627 30 0*228 643 25 0*243 656 25 0*
          ** *** ** *** ** *** **

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45285 TD

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 1°
- 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*	0*	
00000	08/10*	138	320	30	0*137	339	30	0*135	357	30	0*133	375	35	0*	0*	
00000	08/11*	132	395	35	0*134	415	35	0*137	437	40	0*139	460	40	0*	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*	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	08/15L	238	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*	0*	
45825	08/16*	286	779	30	0*293	785	35	0*300	787	35	1011*	310	787	35	0*	

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*** ** *      *** ** *      *** ** *      *** ** *
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*
*** ** *      *** ** *      *** ** *      *** ** *

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(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*

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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 reformed 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 1°
Red indicates a new entry
Yellow indicates a deletion

Tropical Storm Dorothy (August 18-22, 1970) - AL091970

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*
			**		*	*	*	*	*	*	*	*	*

(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*
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46975 TS

Tropical Storm Landfall:

08/20 19Z 14.5N 60.8W 60 kt Martinique

Significant Revisions:

- Genesis analyzed twelve hours later than originally shown in HURDAT based on synoptic and satellite data.
- Dissipation analyzed to have occurred 30 hours earlier than originally shown in HURDAT based on synoptic observations.

Daily Metadata:

August 16:

- Maps and old HURDAT:
 - HWM and microfilm do not show any features of interest at 12Z.
- Satellite highlights:
 - ATS estimated a center fix at 10N, 34.5W at 1850Z (WALLET).
- 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:

- 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 winds 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 Martinique 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 19 th	

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 20 th	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 21 st	

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 1°

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*
*** ** *** **

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*

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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*

45300 TD
45300 TS
**

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 1°

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*
		***			***				***			***			

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 1°

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*				
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*				
						***	***	***	***	***	***	***	**				

Addendum on September 12th at 10Z

46883	09/12*239	977	110	962*													
45925	09/13*239	996	40	0*242	1005	40	0*	0	0	0	0*	0	0	0	0*		
45925	09/13*246	993	35	0*250	1000	25	0*	0	0	0	0*	0	0	0	0*		
		***	***	**	*****	**											

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 11 th	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

Tropical Storm Felice [September 12-18, 1970] - AL131970

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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*
      ** * * * *      * * * *      * * * *      * * * *      * * * *      * *

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(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

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 40kt 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 14 th	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 16 th	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 0*233 290 25 0*240 300 20 0*248 310 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 1°
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	10/04*	137	654	30	0*	137	662	30	0*	137	670	30	0*	138	678	30	0*
		**	**	**	**	**	**	**	**	**	**	**	**	**	**	**	**
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	100*	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	0*	275	550	35	0*	274	520	30	0*	273	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*

00000 TD
 00000 HR
 **

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 and 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) Grenada: 10 kt W and 1005 mb at 18Z (Micro)	1004 mb
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 5 th	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 15 th	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 1°

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
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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*
** **** ** ** **** ** **
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**** ** **** ** ****
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*** **** ** ** **** **
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*** ** ** ** ** ** ** ** ** ****
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*** ** **** ** ** ** **** **
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*** ** ** * ** ** ** * **
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47105 10/04*214 947 25 0*217 957 25 0*221 969 25 1009*225 982 25 0*
*** ****
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(October 5th has been removed from HURDAT)

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47110 10/05*230 995 25 0* 0 0 0 0* 0 0 0 0* 0 0 0 0*
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47115 TS

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 1°
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*
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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*
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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 winds 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 water. 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 1°
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 0S340 480 35 1013S343 478 40 0*
* ** * *** **

47175 10/21S345 465 30 1009S348 458 35 0S350 450 35 1005S350 450 40 0*
47175 10/21S346 474 40 0S348 468 45 0S349 460 45 0S350 455 50 0*
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47180 10/22S350 450 40 0S350 450 45 0S350 450 45 1000S352 447 45 0*
47180 10/22S353 450 50 0S358 445 50 0S363 441 50 0S364 437 50 0*
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47185 10/23S355 440 45 997S360 432 45 0S365 425 50 0S366 421 50 0*
47185 10/23S364 432 50 997S362 428 55 99S364 423 55 0S368 421 55 0*
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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*
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47195 10/25S350 410 50 0S345 408 55 0*340 405 55 988*335 400 55 0*
47195 10/25S350 410 60 0S345 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*
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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*
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47215 HR

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.

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).

October 25:

1. Maps and old HURDAT:

- HWM analyzes a closed low pressure of at most 1000 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. 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		

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

Time	Lat	Lon	Pressure	Wind	Temp	Clouds	Other
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 0	0*

45270 TS

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

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,
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,

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.

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,

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 baroclinically. 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