**Best Track Committee Re-Analysis Comments for 1963**

**(Responses by Chris Landsea and Sandy Delgado – June 2017)**

General comments:

1. Please make sure all of the necessary maps and satellite imagery are in the online folders, not only for 1963 but for all of the years we are re-analyzing. This includes the appropriate upper-level maps for those cases where the cyclone in question might be subtropical or undergoing extratropical transition.

**The upper-air maps for possible hybrid/subtropical stages have been added in for both 1963 and will be added in for all years going forward as well.**

1963 Storm #1 (new):

 1. The Committee concurswith adding this system to HURDAT. Since the Historical Weather Map 500 mb chart shows an upper-level low directly over the system, there needs to be more emphasis on how this was likely a subtropical cyclone.

**Agreed. This is now explicitly added in.**

 2. Please include the relevant 500 mb charts from the Historical Weather Maps (HWM) in the scanned materials.

**These are now added in.**

 3. Please re-examine the proposed genesis time. The microfilm (MF) maps for 1200 and 1800 UTC 1 June suggests that a low pressure center with a closed circulation was present at those times. However, the maps for 0000 and 0600 UTC 2 June are more ambiguous on whether a closed circulation existed. Even with that ambiguity, the Committee prefers showing genesis on 1 June.

**Agreed to indicate genesis a day earlier at 12Z June 1st.**

 4. Is there a second 50-kt ship report on the 1200 UTC 2 June MF map? If so, please mention it in the ship highlights section.

**This appears to be the same ship as COADS, plotted one degree too far north, which is now mentioned in the daily summary.**

 5. The daily summary for 3 June mentions a ship with 40 kt and 1001 mb at 0300 UTC. Was this used in the intensity calculations? If not, please note why it might be considered incorrect.

**This was not included explicitly earlier. Cape Hatteras, NC, reported 11 kt SE and 1003 mb at 0659Z on the 3rd, suggesting a central pressure of 1002 mb. However, a few hours earlier at 03Z, a ship reported 40 kt S wind with 1001 mb, which suggests a central pressure of 997 mb. Taking a blend of the two gives 1000 mb, which has been added to the 06Z time slot. A central pressure of 1000 mb suggests maximum surface winds of 42 kt and 47 kt, from the north of 25N Brown et al. and north of 35N Landsea et al. pressure-wind relationships, respectively. Based on a forward speed of about 20 kt, an intensity of 50 kt is analyzed at 06Z on the 3rd and at landfall. This is unchanged from the original proposed intensity.**

 6. Please re-examine the proposed track from Virginia northward to ensure that it is consistent with the surface observations. In particular, the observations in the Norfolk area suggest the track may need to be nudged a little to the east.

**Agreed, track shifted eastward from 12Z June 3rd to 12Z June 4th.**

 7. The Committee does not concur with the assessment of a 1002 mb central pressure at 1800 UTC 3 June based on the 1005 mb and 14 kt at Patuxent River. These data are more consistent with a 1003-1004 mb central pressure.

**Agreed, 1003 mb used as the central pressure.**

1963 Storm #2, Arlene:

 1. The Committee notes that it is hard to reconcile the rather ragged appearance of Arlene in the 1446 UTC 2 August satellite image with the “fully developed hurricane” found by the Navy aircraft two hours later. Was the center located outside of the image? Please comment on this.

**A composite of TIROS satellite images labeled as 1446Z shows a rather ragged appears to Arlene, not resembling a “fully developed hurricane”. However, it is not certain that this time represents the one picture showing Arlene in the composite, nor are the latitude/longitude lines drawn on the imagery. Based on a blend of the pressure-wind relationship and the ragged appearance in satellite, an intensity of 60 kt is selected at 18Z on the 2nd, down from 90 kt originally in HURDAT, a major intensity change.**

 2. Please document as best as possible the observations from the ship *Mormactrader* (call sign WMRH) on 2 August. Two of the observations are noted in an article by Arnold Sugg in the July 1964 Mariners Weather Log, which match the observations shown on the MF maps. However, Sugg does not document any additional observations from the ship.

**Unfortunately, no other observations from the Mormactrader are available.**

2a. The Committee does **no**t concur with changing the time that the system reached tropical storm strength on 1-2 August unless additional observations from the *Mormactrader* can be found. The most interesting of the *Mormactrader* observations is 25 kt/1007 mb at 0600 UTC 2 August, which doesn’t support the current HURDAT intensity, much less the proposed higher intensities. Please keep the original HURDAT intensities until more data becomes available.

**Agreed to keep the original HURDAT intensity values on the 1st and early on the 2nd.**

3. Please re-examine the central pressure for the aircraft mission near 1700 UTC 2 August. The Committee notes that there is a discrepancy between the 987 mb reported by low-level penetration and the 995 mb reported by dropsonde. The data in the Annual Tropical Storm Report (ATSR) shows a 987 mb pressure (extrapolated at low level) at 1605 UTC with variable winds of 10 kt, suggesting that the plane was orbiting inside the eye. At 1642 UTC, the plane reported a 700 mb height of 3030 m and a temperature of 15C. The latter is significant when compared to the dropsonde, which had a 700 mb temperature of 9C. This suggests that the drop was not at the warmest temperatures inside the eye or had a temperature error. Either way, it looks less reliable than the pressure extrapolated from low level. Please use the 987 mb pressure for the intensity assessment at this time.

**Agree to retain the 987 mb as the central pressure for the 18Z slot.**

 4. The fix data for 2338 UTC 2 August extrapolates to a minimum pressure of 1000 mb.

**This is added to the excel spreadsheet for the system.**

 5. The Committee does not concur with the assessment of a 988 mb pressure at 1803 UTC 3 August. The earlier fix from the aircraft near 1400-1500 UTC reported a 1000 mb central pressure, which may have been a low level pressure. Low-level or not, the aircraft reported a 700 mb height of 3130 m and a temperature of 9C, which extrapolates to a pressure above 1007 mb. For the 1803 UTC fix, the aircraft also reported a 3130 m 700 mb height, which is very hard to reconcile with a 12 mb drop in central pressure. The data, though, are very confusing. The fix form in the ATSR states a pressure of 988 mb by (an undocumented) dropsonde and this is used in the fix log in the NHC wallet. However, this does not agree with the fix form in the wallet (see below), which reported 995 mb via dropsonde originally, then changed that to 988 mb in the post-flight summary. An extra complication is that the 3130 m minimum 700-mb height may have been measure in an area of estimated surface winds of hurricane force (ob 17 on the coded mission form in the ATSR). Please resolve this as best as possible.



**It is agreed that this is a confusing and inconsistent case. No other additional information has been located about this particular flight and dropsonde. (Though it is likely that the 1007 mb value was obtained in the periphery of Arlene, not in the center.) Because of the inconsistencies, the 988 mb value is not used as a central pressure. However, the 1000 mb central pressure – already in HURDAT at 12Z – is retained. The central pressure of 1000 mb from 14Z suggests maximum surface winds of 47 kt from the south of 25N pressure-wind relationship. An intensity of 45 kt is assessed at 12Z, a major reduction from 65 kt originally in HURDAT. These revisions indicate that Arlene likely did not achieve hurricane status during the early portion of its lifecycle. It is suggested that the extreme winds estimated by the aircraft crew may have been a transient event, not indicative of the intensity of the system.**

6. Somewhere in the write-up for 4 August, please mention the satellite image showing the partly exposed low-level center of Arlene at 1752 UTC.

**Agree and added in.**

 7. Please correct the following from the Monthly Weather Review (MWR) write-up on 7 August: “as it reflection”.

**Corrected.**

 8. The Committee tentatively concurs with the proposed increases in intensity on 9 August as Arlene passed over Bermuda. However, before it officially signs off on these changes, it would like some additional information:

 8a. Please contact the Meteorological Service of Bermuda for more information on the impacts of Arlene. While there could be sound meteorological reasons for it, the reported lack of impact on Bermuda is nor consistent with the landfall of a 95-kt hurricane.

**We had contacted the Meteorological Service of Bermuda back in 2014 and they had limited additional information about Arlene. We did access “Beware the Hurricane” by Tucker – a book about Bermuda hurricanes. We have added in quotes directly from this book. While it does support hurricane intensity, the impacts do not appear to be that of a major hurricane (even accounting for the sturdy building practices at Bermuda).**

 8b. Please use the wind trace for Kindley Air force Base to calculate the RMW during the eye passage. This should give a better value than an estimation from the aircraft radar eye.

**Using the wind trace from Kindley Air Force Base, a minimum estimate of 8 nm for an RMW can be derived, indicting a quite small RMW. (If anemometer’s measurements did not exactly transect the diameter of the eye, this estimate may be somewhat smaller than the actual value.) Based on a forward speed of about 25 kt and small RMW, an intensity of 95 kt is selected at the time of landfall.**

 8c. Please provide a better explanation of why the peak winds need to be increased from 90 to 100 kt based on the available data as compared to 95 kt.

**After leaving Bermuda, a reconnaissance aircraft investigated Arlene measuring a central pressure of 970 mb – deeper than over Bermuda - and estimated surface winds of 100 kt at 19Z on the 9th. A central pressure of 970 mb suggests maximum surface winds of 88 kt from the north of 25N intensifying subset of the pressure-wind relationship. Based upon a forward speed of about 25 kt and small RMW, an intensity of 100 kt is selected at 18Z on the 9th, up from 90 kt originally in HURDAT, a minor intensity change.**

 9. On the 1200 UTC 11 August MF map, there seems to be an observation near the center that does not correspond to any data in the spreadsheet. However, this ob was used to draw several isobars on the map. What is this observation and does it help clarify the time of extratropical transition?

**Upon closer inspection, this is just a hurricane symbol with an arrow (observed track) drawn toward it.**

 10. The North American map series apparently shows the former Arlene to be trackable as a low until 14 August in contrast to what is shown on the MF and HWM maps. Please work with Dave Roth to resolve this discrepancy.

**Agreed to extend Arlene as an extratropical cyclone until 00Z August 14th.**

1963 Storm #3, Beulah:

 1. Please better mention in the write-up that satellite imagery on 16-19 August showed a disturbance that is likely pre-Beulah.

**Agreed and added in.**

 2. The Committee concurs with the proposed earlier genesis time.

**Agreed.**

 3 Please better explain how the 30 kt and 1003 mb ship report at 0000 UTC 22 August justifies the increase in intensity from 45 to 50 kt.

**Agreed to retain 45 kt at 00Z on the 22nd.**

 4. The Committee concurs with the proposed delay in reaching hurricane strength from 1200 to 1800 UTC 23 August based on the aircraft data. However, it is very concerned that this appears inconsistent with the satellite image at 1355 UTC, which appears to show a hurricane-strength cyclone.

**Agreed. This concern is now mentioned explicitly in the daily summary.**

 5. The Committee notes that the Navy aircraft fix for 1635 UTC 22 August has a 700-mb height of 3170 m and a 700-mb temperature of 13C. This extrapolates to a central pressure of 1009 mb, which is totally inconsistent with other available data, including the earlier fix of 994 mb from the same plane.

**We have noted that occasionally the Navy would report an observation in the periphery of the system which is clearly not a central pressure measurement. This is a good example of such an observation.**

 6. The wallet and the ATSR show that the Navy plane that made the 0700 UTC 23 August fix also made a fix near 0100 UTC. The fix included a dropsonde pressure of 991 mb and 700-mb data that extrapolate to a pressure of 989 mb. Please use this in the intensity evaluation.

**Agreed and added in.**

 7. The Committee notes that on 23 August both Navy and Research aircraft were flying in Beulah. The data appear similar to each other and to what is used in the re-analysis, but please make sure that all the fixes from both aircraft are properly logged. The Research mission data is available on the network drive wallet.

**These are included in full in the excel spreadsheet.**

 8. The Committee does **no**t concur with the change in peak intensity from 105 to 100 kt on 24 August. While the storm motion of 6 kt might support a slightly lower intensity than the 102 kt of the wind pressure relationship, the RMW was smaller than climatology, which would support a higher intensity. Please use the original 105 kt.

**Agreed, 105 kt intensity is retained.**

 9. Please re-check the central pressure for the fix at 1310 UTC 25 August. While the fix form extrapolates a pressure of 985 mb, the reported 700-mb height of 2929 m and temperature of 21C extrapolate to a pressure of 972 mb using today’s formulas. This value is at least more in line with the reported pressures later that day.

**Agreed, 972 mb used instead of 985 mb at 12Z.**

 10. There is a 5-kt weakening and re-strengthening shown on 26 August where the Committee believes this is getting too precise with the aircraft data, especially since this is not based on any measured winds. We would prefer to keep 75 kt through this day.

**Agreed to not show 5 kt changes during the day. Given the change noted in #9 above, the data appear to better support 70 kt throughout the 26th.**

 11. The Committee does **not** currently concur with the proposed change in the time of extratropical transition on 27 August, as even the data coverage on the 1800 UTC MF map does not conclusively show fronts through the center at that time. We would prefer 0000 UTC 28 August. It is noted that the 1200 UTC 27 August MF map shows what looks like an aircraft mission near the storm, although these data are not in the ATSR or the storm wallet. Please try to locate these data to see if help clarify when transition occurred.

**Agreed to indicate 00Z August 28th at extratropical transition. The aircraft observations on the map at 12Z August 27th are not available anywhere else. These have now been mentioned in the daily summary.**

 12. The Committee concurs with the addition of several days as an extratropical low. However, the various maps series are not in agreement as to the track and fate of the system on 6 September and beyond. Please work with Dave Roth to resolve this issue.

**Agreed to show the positions through 18Z on the 8th consistent with Dave Roth’s analyses.**

 13. In the write-up for 22 August, please change “my” to “any”.

**Agreed and corrected.**

1963 Storm #4, Unnamed:

 1. The Committee concurs with an earlier genesis, but believes that 0600 UTC 9 September is too early given the lack of data on the 0600 UTC 9 September MF map. It would prefer 1200 UTC for the genesis time based on the data from the MF map for that time.

**Agreed, genesis is now indicated at 12Z on September 9th.**

 1a. Please mention the satellite image for 1645 UTC 9 September as supporting an earlier genesis in the write-up.

**Agreed, this is now mentioned in the daily summary.**

 2. It is noted that the montage of satellite images for 1544 UTC 11 September shows two other interesting systems south of this storm. There are no other known cyclones on this date, and the additional systems write-up has nothing either. While it is unlikely that these were tropical storms, please investigate them as far as the data will allow.

**No ship observations show support for either of these systems, but ship observations in this part of the Atlantic are usually quite sparse. This has now been added into the Additional Notes sections as a new suspect.**

 3. Has any quality control been performed on the reports from the ship *Freiburg*? There is no obvious reason to suspect the data is wrong, but since this ship is the main basis for upgrading this cyclone to a hurricane it is worth an extra check.

**The wind directions, speed, and pressures from other ships are consistent with the Freiburg, which did show up in COADS at 06Z, 09Z, 12Z, 15Z, 18Z, and 21Z on the 12th.**

 3a. Pending the above QC check, the Committee concurs with the proposed upgrade to hurricane strength. It also notes that the satellite image for 1428 UTC 12 September supports this upgrade.

**Agreed, the satellite imagery are mentioned in the daily summary as supportive of hurricane upgrade.**

 4. The Committee does **not** concur with the proposed earlier time of extratropical transition. First, while the 1200 UTC MF map for 13 September suggests a developing warm front, there is a ship west of the alleged developing cold front with a 72F dewpoint. Second, and probably more significantly, the various maps show at this time that the cyclone was embedded in the warm sector of a baroclinic cyclone to the northwest, which is not normally a favorable synoptic pattern for transition. The Committee recommends keeping the original HURDAT transition time.

**Given that the system was absorbed by the larger extratropical system to its north after 12Z on the 14th, the system remained a tropical cyclone until dissipation (see below).**

 5. As with Arlene and Beulah, the various maps differ in how long the system lasted after extratropical transition. In particular, the NH map series extends the track to 17 September. Please work with Dave Roth to resolve this.

**While Arlene and Beulah did make sense to extend the tracks for the extratropical phase, for the unnamed hurricane the available numerous observations from the 14th 18Z and 15th 00Z clearly show no such that no closed low existed near the HURDAT or Dave’s positions at those times. The unnamed hurricane simply became absorbed in separate, much larger extratropical cyclone to its north. This is the same extratropical system that Dave provided positions for later on the 15th and on the 16th. Thus the analysis shows last position at 12Z on the 14th.**

1963 Storm #5, Cindy:

1. Please state more strongly in the write-up that this system originated in the southwestern Gulf of Mexico. While the ATSR writes that the system was spawned by a frontal trough, the MF maps suggests this was not the case.

**Agreed, this is now explicitly stated in the daily writeup on the 16th.**

2. Is there any data available from the oil rigs near the cyclone? None seem to be included in the various post-storm reports, but at least one rig crew apparently rode out the storm on its rig.

**Unfortunately, despite a request to NCEI (old NCDC), there were no additional observations from oil platforms available for this system.**

3. Has any quality control been done on the observations from the ship *Sabine*? These are the only data that support calling Cindy a hurricane, yet the quality is unknown. Indeed, most of the observations are not available for us to review, including the actual report of hurricane-force winds.

**Reports from the *Sabine* showed up four times in COADS (but not the hurricane force report). These four reports appear to be reasonable for wind speed and direction in comparison with other ships nearby. The hurricane-force wind report was not found on COADS, microfilm or MWL, even though other observations from this ship were present in all three sources. It is noted that MWR questioned the accuracy of the report, even though this report was originally used by the forecasters to operationally upgrade the tropical cyclone to a hurricane. The evidence suggests that the 65 kt report was an overestimate of the peak conditions in Cindy.**

4. The Committee concurs with downgrading Cindy to a tropical storm pending the discovery (or lack thereof) of additional observations from the *Sabine*. The available surface observations from the landfall area and the data from the Navy plane do not support a system of hurricane strength. As an alternative, if the report of hurricane-force winds from the Sabine can be found and proven to be correct, then the best course of action might be to briefly make the system a hurricane near 1800 UTC 16 September and then reduce it to a tropical storm before landfall.

**Agreed, given the likely overestimate of the 20Z *Sabine* report, to downgrade Cindy to a tropical storm.**

1963 Storm #6, Debra:

 1. The Committee does **not** concur with the proposed upgrade to a tropical storm at 0600-1200 UTC 19 September. While the Committee agrees that the satellite appearance is impressive, the cloud pattern has not been quantified into a useful intensity by the Dvorak Technique or any other method. In addition, a ship report from the area does not support tropical storm strength. Please use the original HURDAT intensities at those times.

**Agreed to use the original intensities on the 19th.**

 2. On the MF map for 1800 UTC 20 September, is there a ship with west winds 25 kt and 1011 mb near the center? If so, perhaps this is the source of the 1008 mb central pressure originally listed in HURDAT? Please examine this and add it to the obs spreadsheet if necessary. Note that if 1008 mb is the central pressure the proposed 50 kt intensity might be too high.

**The 25 kt W wind report is from reconnaissance, but it does not appear that it has a corresponding pressure reading. Based upon the 50 kt reported by the ship at 12Z on the 20th, the report of an eye visible in radar images by the reconnaissance aircraft, and westerly winds of 25 kt in the southern quadrant, an intensity of 50 kt is selected at 12Z on the 20th, up from 25 kt originally in HURDAT, a major intensity change.**

 3. The Committee notes that the satellite images on 21 September do not obviously support hurricane strength.

**Agreed, this comment is now added in.**

 4. Has any QC been performed on the ship with the 55 kt winds on 21 September? It is noted that this ship was outside the RMW and possibly not in the strongest part of the cyclone. This raises the possibility that the peak intensity was 60-65 kt. If it turns out that there are no obvious errors in this report, the Committee would prefer to keep the peak intensity of 65 kt on this day. However, if this ship appears to have a high wind bias, then Debra should be downgraded to a tropical storm.

**A few observations are available from this same ship. These do look reasonable in comparison to other ships and it does appear that the 55 kt report was taken outside of the RMW. Thus it is agreed to retain the system as a 65 kt hurricane.**

5. The Committee favors using the original HURDAT dissipation time of 1800 UTC 24 September, but does not concur with the original HURDAT that the system became extratropical before dissipating. It is noted that the data coverage is not sufficient to determine exactly when the circulation dissipated, thus favoring the original HURDAT time. However, the 1800 UTC 24 September MF map suggests the cold front was still some distance from what remained of Debra, which argues against extratropical transition. Note that the HURDAT and proposed scenario do not agree with that of the NH maps series, so please work with Dave Roth to see if there needs to be an extension of Debra’s track.

**The key time is early on September 25th. Fortunately, the location in question is in the middle of the shipping lanes and both the microfilm, HWM, and COADS have numerous data available. The September 25th 00Z clearly shows that no low existed, either in a location extrapolated from the original HURDAT (near 38N 47W) or where the Northern Hemispheric map indicated (36N 45W). Instead just south to southwesterly flow covers the area near the latter position. Thus dissipation is indicated after 18Z on September 24th.**

1963 Storm #7, Edith:

 1. The Committee notes that the satellite images for 1110 UTC 21 September and 1235 UTC 22 September show what looks like a well-organized system that is labelled Edith. Please investigate the possibility that genesis occurred before 23 September and provide the appropriate MF maps.

**The microfilm map – annotated with additional COADS observations – at 12Z on the 22nd indicated that a sharp trough was occurring, but it was ambiguous if the system had become a tropical cyclone. Other maps on the 21st and 22nd have very few observations in the area and cannot assist in the determination of the system. Genesis is kept at 12Z on the 23rd, but noted that it may have been earlier.**

 2. In the write-up for 23 September, please delete the “image not available” comment, as the 1156 UTC image in question is available.

**Agreed. These images became available after submission of the reanalysis.**

 3. Is there any documentation available for the reconnaissance fix on 23 September? It cannot be found in either the NHC wallet or the ATSR.

**Aside from what was on the microfilm map at 18Z on the 23rd and the account in MWR, no additional information about this reconnaissance fix.**

 4. The Committee notes that the satellite image for 1217 UTC 24 September does not seem to support a hurricane strength system at that time.

**Agreed, this is added into the discussion.**

 5. Please better explain the 1000 mb pressure listed for the aircraft fix near 1800 UTC 24 September. The value used in the re-analysis is 1000 mb, which matches a pressure apparently written in in a correction on the NHC wallet fix log. It also is a good match for a 1001 mb pressure measured at low level at 1600 UTC. However, the listed 700-mb height of 2899 mb and center temperature of 14C extrapolate to a pressure of 978 mb. This matches the pressure in the Monthly Weather Review as well as another ‘corrected’ pressure on the fix log in the NHC wallet. The Committee notes that the reported winds, even though estimated, do not appear consistent with a 978 mb pressure.

**The 978 mb central pressure report is simply erroneous, given the earlier 1004 mb at 1315Z on the 24th and the subsequent 993 mb at 1318Z on the 25th. As the committee mentioned, the estimated peak winds are also not consistent with a 978 mb pressure. Note that the TIROS satellite image for 1217Z also does not seem to support a hurricane strength system at that time, much less one that has a 978 mb central pressure six hours later. These points are now included in the writeup.**

 5a. Pending the resolution of the aircraft central pressure, the Committee does not concur with downgrading the system to a tropical storm at 1800 UTC 24 September. If the various positions and eye sizes are correct, the 60-kt ship seems to be located outside the RMW. The Committee also notes that the 60-kt/1004 mb ship supports a central pressure lower than 1000 mb.

**It is agreed to retain Edith as a 65 kt hurricane at 18Z on the 24th.**

 6. The Committee notes that the Navy plane in Edith near 0000 UTC 25 September likely missed the center. The plane reported a 700-mb height of 2979 m and temperature of 12C near 13.7N 58.6W at 0030 UTC 25 September. This extrapolates to a pressure of near 990 mb. However, this is about 60 n mi from the proposed 0000 UTC best track position, and the flight-level winds at the measurement position were 46 kt. These data suggests that the pressure was below 990 mb at the time. It is noted that the plane measured a 993 mb pressure with a dropsonde, but there is no data available about where this sonde was dropped.

**Agreed to include in this discussion about the Navy plane observations early on the 25th. 85 kt originally shown in HURDAT is retained.**

 7. The Committee does **not** concur with the proposed downgrade in intensity as Edith moved through the Lesser Antilles. First, while the central pressure on a 13Z aircraft fix was 993 mb, this was several hours after the center moved over St. Lucia. Second, two stations on Martinique about 35 n mi north of the center reported 995 mb with simultaneous hurricane conditions, suggest a central pressure lower than 993-995 mb. A map in the NHC wallet shows the track of the center across St. Lucia and indicates that the Port Castries weather station is just north of where the center passed. Please contact the Meteorological Service of St. Lucia to see what data are available from the passage of Edith.

**Agreed to make Edith as an 85 kt hurricane at 06Z and at 07Z landfall in St. Lucia. (HURDAT oddly showed 85 kt at 00, 12, and 18Z but only 75 kt at 06Z.) Unfortunately, no additional information was available from the Meteorological Service of St. Lucia with regards to observations from Edith.**

 7a. The Committee also notes that the reported wind gusts of 100-115 kt on Martinique would also support an intensity higher than 75 kt, with the caveat that the terrain of the island may have enhanced those winds.

**Agreed to mention this in support of the higher intensity.**

 8. In regards to the aircraft fix at 0100 UTC 27 September, the Committee notes that the pressure fell from 1000 mb to 992 mb and the eye temporarily re-formed. Based on this, the Committee would favor showing a short-lived intensification to 65 kt in agreement with the original HURDAT.

**Agreed, 65 kt intensity shown at 00Z September 27th.**

 8a. In the 27 September aircraft fix section, the 1236 UTC fix has a typo, “NM” instead of “N”.

**Corrected.**

 9. Is any additional data available from the Dominican Republic for the passage of Edith?

**Unfortunately, no additional information is available from the National Meteorological Service of the Dominican Republic for Edith.**

 10. Has there been any quality control of the 35-kt ship report at 1800 UTC 29 September? The Committee notes there are several other ship in that area with much lighter winds.

**This ship has a high bias in winds compared with other observations, which is why the proposed intensity was for 30 kt. This point is now noted in the daily writeup.**

 10a. Pending the resolution of the ship report above, the Committee concurs with a dissipation after 1800 UTC 29 September. However, given that the satellite image at 1229 UTC 29 September shows a swirl with no associated convection, perhaps a status of remnant low would be better at 1200 and 1800 UTC that day?

**Agreed, remnant low status is shown for 12 and 18Z on the 29th. This is the earliest such usage of “remnant low” in HURDAT.**

1963 Storm #8, Flora:

 1. In the HURDAT excerpt, should there be two lines of data for 26 September?

**Nope. No changes were made on the 26th.**

 2. Please re-examine the genesis of Flora. The initial position at 1200 UTC 26 September is given as 8N 33W. However, the satellite image at 0950 UTC 26 September shows a rather unimpressive system near that location and a much better organized looking system (labelled as Flora) near 12N 39W. What is this second system? It is actually Flora? Are there errors in the satellite navigation that the second cloud cluster is actually Flora? Is there any data to show what the second cluster was? The Committee also notes that on the satellite image at 1014 UTC 27 September the system labelled as Flora looks unimpressive to the point that it might not actually be a tropical depression at that time. Is it possible genesis occurred several days later than 26 September? One possibility might be 1200 UTC 28 September, when the HWM show a ship with west winds and a pressure of 1006.8 mb

**The navigation of the satellite pictures is extremely uncertain over the open ocean. Thus it is quite possible that the more organized system is indeed Flora and that it is close to the original HURDAT position. But it is agreed that the satellite imagery on the 27th depicts such disorganization in the convection (despite the uncertainty in the actual location) that it had not undergone genesis yet. Thus genesis is delayed two days as suggested to 12Z on the 28th.**

 3. Please better explain the proposed changes in intensity on 29 September. The Committee notes that the ship report with 1000 mb at 2330 UTC is at some unknown distance from the center, which makes it unclear whether the proposed changes have enough data to justify them. Also, in the re-analysis section please correct October 29th to September 29th.

**Agreed to retain the original intensities on the 29th and early on the 30th because of the uncertainty of how far the ship was from the center of Flora.**

 4. The Committee notes that the full sequence of observations from the *SS Del Alba* are available in the NHC wallet. Please ensure all of the pertinent data from this ship are in the spread sheet.

**The relevant observations (06Z and 09Z on the 30th) were already in the spreadsheet.**

 5. Please re-examine the proposed landfall intensity on Tobago. First, the central pressure of 974 mb at Crown Point is listed as “uncorrected”, suggesting that it has not been reduced to a sea-level pressure. That being said, the elevation of Crown Point is about 10 m, so this may not be a significant problem. Second, while the proposed 100 kt intensity is lower than that in the original HURDAT, it is 15 kt above what the wind-pressure relationships would justify. Please better explain why this situation requires such a major departure from the wind-pressure relationship. Was the damage on Tobago consistent with the passage of a major hurricane?

**Agreed that the pressure value at Crown Point is likely to be a central pressure, though this uncertainty is now discussed in the writeup. The impacts to Tobago were substantial, but not quantitative enough to help determine whether the intensity was a Category 2 or Category 3 at landfall. However, it is agreed to indicate a lower intensity of 90 kt at landfall in Tobago to be closer to the pressure-wind relationship.**

 6. On a related note, the proposed intensities only increase 5 kt during the period from 1800 UTC 30 September to 1800 UTC 2 October while the central pressure falls 14 mb. Is this meteorologically reasonable? (Also see points 8 and 9 below.)

**Agreed to indicate now a 15 kt increase (90 kt to 105 kt) between 18Z on the 30th and 18Z on the 2nd.**

 7. On the aircraft fix at 1900 UTC 1 October, the pressure extrapolated from the 700-mb parameters on the vortex message is 974 mb compared to the 967 mb dropsonde.

**This is now noted in the writeup. However, it appears that 967 mb is more realistic given the subsequent observations.**

 8. Please re-examine the intensity near 0600 UTC 2 October. First, the 700-mb height (2793 m) and temperature (25C) on the vortex message extrapolate to a pressure near 956 mb, well below the 964 mb reported by a dropsonde. Second, what is the implication for the intensity of the 145 kt flight-level winds? Does they require an increase in the intensity?

**Agreed to use 956 mb as the central pressure for 06Z on October 2nd. This also casts doubts about the 2110Z October 1st fix with 970 mb pressure, given the 967 mb at 19Z October 1st and 956 mb at 06Z October 2nd. The flight-level winds of this era were only semi-objectively derived and are not reliable enough to use for the reanalysis. 956 mb central pressure suggests a stronger – 105 kt – intensity, which is now used at 06Z.**

 9. Please re-examine the data from the Navy aircraft mission between 1300-2000 UTC 2 October. First, what is the basis for saying that the 968 mb pressure at 1346 UTC was peripheral? Although it looks high compared to other data on this day, the coded forms in the ATSR suggest it was a penetration fix at low level. Second, the 700-mb data for the fix at 1946 UTC extrapolates to a central pressure of 954 mb, and the ATSR shows a dropsonde apparently associated with this fix that reported 957 mb, with extrapolated pressures from the 700- and 850-mb data of 954 and 960 mb.

**Agreed to rephrase the 968 mb pressure value at 1346Z as being close to the center, but likely not being a central pressure. Agreed to use 957 mb as the central pressure for the 1946Z center fix.**

10. In regards to the aircraft missions on 3 October and the peak intensity of Flora: First, please note in the write-up that there were two NHRP aircraft in the storm near 1700 UTC 3 October, and it appears one of these planes reported the 936 mb extrapolated pressure shown in the fix log at 1620 UTC. Second, examination of the data in the Gray and Shay book indicate a penetration near 1708 UTC that measured lower D-values than the penetration at 1620 UTC. The actual D-value of -1630 ft at 715 mb yields an extrapolated pressure of about 936 mb. However, this was reported in a location where the flight-level winds were still 35 kt, suggesting the possibility of a lower central pressure. Would a pressure near 933 mb and the subsequent flight-level winds of 143 kt (if those winds were at 700 mb) justify increasing the peak intensity to 130 kt? It is also noted that the Shea and Gray data includes the flight-level RMWs, and these should be used to calculate the surface RMW instead of inferring it from the eye diameter.

**Agreed to use 933 mb as central pressure for 18Z on October 3rd, based upon this 1708Z fix as well as the explicit RMW from the NHRP flight. This does indeed boost the intensity to 130 kt at this time and at landfall several hours later in Haiti.**

11. The Committee notes a passage in the ATSR that states “Later information from Haiti indicated that winds of 135 kt with gusts to 175 kt occurred as Flora passed over the peninsula”. What is the source of this information, and is it reliable enough to justify changing the Haiti landfall intensity?

**It is unknown why ATSR came to this conclusion. Given that, it is not reliable enough to make additional changes to the Haiti landfall intensity.**

12. The Committee notes an issue with the Navy aircraft fix at 1231 UTC 4 October. The plane reported an extrapolated pressure of 970 mb at low level. However, the 700-mb data extrapolates to a pressure of 967 mb, and a dropsonde (mentioned in the vortex message but otherwise undocumented) apparently measured 958 mb. The Committee has no problem with the 970 mb used in the re-analysis, but the discrepancies should be noted in the write-up.

**The 958 mb dropsonde has been mentioned in the writeup. However, the 967 mb from 700 mb data adjusted to the surface versus 970 mb from low level are the same, given the uncertainties in the methodologies.**

 13. There are several issues with the proposed intensities of Flora during its track over Cuba:

 13a. Please include central pressures based on the Cuban data whenever possible. The Committee has concerns that some pf the original HURDAT pressures are being unnecessarily removed when the center passed near or over several Cuban stations. Most significantly, it is noted that no minimum pressure is available from Camaguey during a center passage described below. Please contact the Meteorological Service of Cuba to see if one is available.

**The Cuban Meteorological Service has been contacted again to obtain additional information about Flora, especially with regards to possible central pressures and the changes proposed to the track and intensity while over Cuba. We are awaiting their response and will adjust reanalysis based upon what they provide, if necessary.**

 13b. Please re-examine the use of the Inland Decay model (and check with Mark DeMaria) to ensure that the latest version has been used for the re-analysis. Also, since Flora moves back over the Caribbean at some point, there may need to be two runs of the model, one for each Cuban landfall.

**There has only been one version of the Inland Wind Decay model available for the subtropical and tropical latitudes. Agreed to provide a second run of the Inland Wind Decay model for the second landfall of Flora in Cuba.**

 13c. The Meteorological Service of Cuba provided a track map for the passage of Flora across Cuba (see below). If the new track makes significant changes to the current HURDAT track over Cuba, please make sure the Meteorological Service of Cuba approves of them. It should be noted that Gladys Rubio in TAFB experienced the eye passage of Flora in Camaguey and reported that it lasted about two hours. Please make sure the revised track reflects that.

**Minor track changes have now been introduced on the 4th to the 8th of October to be in better consistency with the assessment from the Meteorological Service of Cuba but at the same time not showing too much detail that would not be applicable given the six hourly time step in HURDAT. For example, the Meteorological Service of Cuba indicated a tight counter-clockwise loop over six hours between 12 and 18Z. Such a detail, while likely real, is not appropriate to be portrayed in the six hourly time steps in HURDAT. The Cuban Meteorological Service has been informed about these revisions to the best track of Flora. We are awaiting their response about the revisions.**



 13d. Given the seemingly reliable observation of 95 kt at 0000 UTC 5 October, shouldn’t the intensity be set to a higher value? Is there reason to think that this station sampled the maximum wind in Flora at the time? Please take any change here into account when running the Inland Decay model.

**Agreed to indicate 100 kt at 00Z October 5th. This now adjusts the Inland Wind Decay model’s starting point given that Flora closely approached the Atlantic Ocean around 00Z and the RMW likely was back over water at that time.**

 13e. Pending the resolution of the above issues, the Committee concurs with downgrading Flora to a tropical storm at some point during its meandering over Cuba. Please contact the Meteorological Service of Cuba to see if they concur.

**The Meteorological Service of Cuba has been informed about the downgrading of Flora to a tropical storm over Cuba. They provided no evidence to the contrary.**

 14. The Committee notes that the Navy aircraft fix at 1315 UTC 9 October reported a 700-mb height of 2870 m and an eye temperature of 22C. This would extrapolated to a pressure of 966 mb, which is inconsistent with the Air Force fix pressure at 1400 UTC but consistent with later fixes.

**Agreed to use the 966 mb central pressure for the 12Z October 9th slot. This boosts the intensity at 12Z from the proposed 85 to the revised 95 kt.**

 15. The Committee does not concur with the proposed re-intensification to major hurricane strength on 9 October. While the storm is moving faster than climatology, the RMW is much larger than climatology, which suggests there is no reason to go 10-15 kt above the intensity suggested by the wind-pressure relationships. Please use the original HURDAT values if there isn’t better support for a 100 kt intensity than currently provided.

**Agreed to show a secondary peak of 95 kt on October 9th, based upon a blend of fast forward speed but large RMW.**

 16. The Committee notes that the Shea and Gray book has the flight-level RMWs for the research flight into Flora on 10 October, and they are generally smaller than the 50 n mi inferred from the eye diameter. Please check these data and re-calculate the proposed intensities if necessary.

**These explicit RMW calculations from NHRP ranged from 35 to 50 nm, averaging about 40 nm. Thus these still indicate a larger than climatology RMW size.**

 17. The Committee does **not** concur with the proposed earlier time of extratropical transition at 1800 UTC 11 October. It is noted that an Air Force aircraft was in the storm at the proposed time of transition, and it appears the forecasters of the era chose to keep the system tropical based on that data. That being said, the MF maps suggest the cyclone transitioned early on 12 October, so a time of 0000 or 0600 UTC looks reasonable.

**Agreed to indicate extratropical transition at 00Z on October 12th.**

 17a. Please re-examine the extratropical lifetime of Flora. The MF maps are ambiguous was to whether the cyclone was absorbed after 0000 UTC 13 October, as the 0600 UTC map lacks data near the center. In addition, the Northern Hemisphere map series suggests the possibility that the cyclone survived until 17 October. Please work with Dave Roth to resolve this.

**Agreed to retain Flora through 18Z on the 17th as a gradually weakening extratropical cyclone.**

 18. Please move the damage summary in the 13 October write-up to after the aircraft pressure table, if it is necessary to keep in in the write-up at all.

**These damage summary quotations have been removed.**

1963 Storm #9, Ginny:

 1. Please label the available satellite images with the appropriate date and time.

**Done.**

2. The Committee concurs with the proposed later time of genesis. It is noted that while a circulation is evident in the MF map for 1200 UTC 16 October, subsequent maps show more of a trough than a closed circulation.

**Agreed and this discussion is added into the daily summary for the 16th.**

 2a. Given the statement in the MWR excerpt states the cyclone was not tropical during the first few days of its life, the subtropical or hybrid aspect needs to more played up more in the write-up. This is especially important since the 18 October re-analysis write-up mentions how the system interacts with a stationary boundary.

**Agreed to emphasize that the system may have been a subtropical system early in its lifetime.**

 3. Please re-write the re-analysis section for 19 October. First, please show how the 993 mb ship report mentioned in the ship highlights factored into the re-analysis. Second, the ATSR has details on a Navy reconnaissance mission which reported a pressure of 994 mb at 2100 UTC, with flight-level winds of 20 kt and estimated surface winds of 25 kt. This suggests a pressure lower than 993 mb. Also, please better state why the 35 kt ship reports at 0000 UTC were not considered representative of the strength of the cyclone.

**At 00Z on October 19th, gales were reported about 300 nm northwest of the center but the observations were outside the outermost closed isobar and therefore, not considered part of the circulation and were instead due to the large scale synoptic pressure gradients.** **The 21Z aircraft report indicates a central pressure of 992 mb (close to the 993 mb from the ship with no wind report). This central pressure suggests intensity of 56 kt from the Brown et al. north of 25N pressure-wind relationship. An intensity of 55 kt is analyzed at 18Z, up from 45 kt originally in HURDAT, a minor intensity change.**

 4. Through the day on 20 October, there are several ship reports with winds and pressures suggesting a central pressure between 980-985 mb. Yet, the only analysis based on pressures is for 0000 UTC. Please conduct additional analyses of the intensity based on the available data.

**An existing 983 mb central pressure was in HURDAT at 12Z, which is consistent with a ship with 988 mb and 35 kt. 983 mb suggests an intensity of 69 kt from the north of 25N pressure-wind relationship. The 65 kt intensity at this time is retained. No other additional central pressures can be analyzed for the 20th.**

 5. Please better explain the basis for raising the first peak intensity on 21 October to 80 kt. The write-up currently has no explanation for this.

**The hurricane continued to intensify on the 21st and reached a first peak of 80 kt at 06Z through 18Z, up from 75 kt originally in HURDAT, a minor intensity change. This is based upon ships at 06Z and 18Z reporting 80 kt.**

 6. The Committee notes there is an Air Force aircraft fix at 1900 UTC 22 October which reported a pressure of 990 mb and with 700-mb data extrapolating to a pressure of 989 mb using today’s formulas. This fix is not on the storm wallet fix log but is available in the wallet recondat directory.

**This single missing fix has now been added to the database, but 989 mb central pressure was already available from the 1620Z fix.**

 7. Please re-examine the 987 mb pressure for the aircraft fix at 0055 UTC 23 October. The fix log says this was extrapolated from the 700 mb height. However, the 700-mb data given in the ATSR extrapolates to a pressure of 991 mb using today’s formulas, and a dropsonde in the ATSR that appears to be from this fix reported 993 mb.

**Previously the committee gave guidance that if the different methods for determining central pressure were within 3-4 mb, then – given the large uncertainties in these techniques – no change is required. In this case, the 987 mb central pressure has been replaced by 991 mb.**

 7a. Please also re-examine the 988 mb pressure for the aircraft fix at 0400 UTC 23 October. The 700-mb data given in the ATSR extrapolates to a pressure of 994 mb using today’s formulas, and a dropsonde in the ATSR that appears to be from this fix reported 994 mb.

**Agreed to replace the 988 mb with 994 mb central pressure.**

 7b. There is also a Navy aircraft fix at 1000 UTC 23 October with the 700-mb data extrapolating to a pressure of 992 mb.

**Agreed to add in 992 mb to the database, though the 990 mb from the 1445Z fix is used for the 12Z central pressure slot.**

 8. Please ensure that all of the available aircraft fixes and pressures on 24 October have been logged.

**All 15 center fixes from recon for the 24th of October are included in the database.**

 8a. The fix form for the Navy aircraft fix at 1500 UTC 24 October mentions seeing **three** ships in the eye, one of which is named as the *Marco Martinoli*. Please try to locate whatever data may be available from these ships.

**Unfortunately, despite a search of microfilm, Historical Weather Maps, COADS, MWL, and the Storm Wallets, no data is available for these ships.**

 9. If the radar image mentioned in the 24 October write-up is available, please add it to the electronic folder.

**Unfortunately, the radar image from the 24th is not available.**

 10. Please also re-examine the aircraft data on 26-27 October. There are several fixes where the pressures extrapolated from 700-mb data and dropsondes differ significantly from those reported in the wallet log and fix forms.

**The 01Z October 26th fix did not report an official pressure, but the dropsonde showed 985 mb, while 700 mb height/temp suggest 981 mb and 850 mb height/temp suggest 987 mb. 985 mb used as the central pressure at 00Z October 26th. The 0359Z October 26th fix was recorded as 988 mb in the fix form and drop pressure showed 987 mb. 700 mb height/temp suggests 982 mb, while 850 mb height/temp suggests 987 mb. The 0559Z fix reported 983 mb by dropsonde, though the drop is not available. 983 mb used as central pressure at 06Z October 26th. The 12Z October 26th fix reported 986 mb on the fix form and drop pressure showed 985 mb, while 700 mb height/temp suggests 982 mb and 850 mb height/temp suggests 989 mb. 986 mb used as central pressure at 12Z on the 26th. The 0157Z fix on October 27th indicated a 979 mb central pressure on the fix form, which agrees with the dropsonde reported pressure, while 700 mb height/temp suggests 977 mb and 850 mb height/temp suggests 980 mb. 979 mb is used as the central pressure for 00Z October 27th. The 0645Z October 27th fix indicated 980 mb in fix file (but may have been referring to drop from a few hours previously), while the drop indicates 972 mb. 700 mb height/temp from the drop suggests 972 mb and 850 mb height/temp suggests 974 mb. 972 mb central pressure used at 06Z October 27th. The 0945Z October 27th fix indicated 972 mb, based upon the earlier dropsonde. This 972 mb is thus removed from the 12Z October 27th position.**

 11. Please re-recheck the pressure on the Air Force aircraft fix at 1315 UTC 29 October. The wallet has a mention that the original 958 mb was recomputed to be 948 mb, and the latter is in better agreement with the 947 mb that would be calculated using today’s formulas.

**Agreed to use 948 mb central pressure for the 1315Z fix.**

 11a. Please re-examine the proposed time of extratropical transition. It is noted that the above mentioned Air Force aircraft was in the storm at this time. Does the temperature data from this aircraft (available in the wallet) support the earlier transition?

**After re-examination of the aircraft data, it does appear that Ginny was still warm cored and still east of the approaching cold front at 12Z on the 29th. By 18Z on the 29th, Ginny was undergoing extratropical transition and by 00Z on the 30th the transition was complete. Thus extratropical transition is now indicated to be 00Z on the 30th.**

 12. Is any additional data available from Nova Scotia for Ginny?

**The Meteorological Service of Canada (Chris Fogarty) provided additional observations and impacts for Ginny. These as well as Chris’ analysis indicate that Ginny made landfall in Canada as a Category 2 hurricane, which is now indicated in HURDAT2**

1963 Storm #10, Helena:

 1. The Committee notes that the MWR refers to satellite imagery of this system. Are any of the images available?

**Unfortunately, these satellite images cannot be located, despite working with and going to NCDC in person.**

 2. The following image is an excerpt of the San Juan WBO storm report on Helena which may help with the genesis on 25 October. The remainder of the report is in the wallet archive.

**These observations were already plotted in the microfilm and considered in the reanalysis.**



3. Are any minimum pressure available in the Lesser Antilles beyond those on the MF maps?

**Unfortunately, despite a request to the meteorological services for the countries in the Lesser Antilles, no additional observations were available.**

 4. On the 0600 UTC 25 October MF map, is Barbados showing a west wind? If so, does that mean the system might have existed earlier than currently analyzed?

**Agreed to extend genesis back to 06Z on the 25th based in part on the weak west wind in Barbados.**

 5. In the 26 October re-analysis section, September needs to be replaced with October.

**Corrected.**

 6. Please better explain some of the choices for the proposed winds. On 26 October, the wind-pressure relationship suggests an intensity near 40 kt. Yet, without any support from either a small RMW or a fast motion, a 45 kt intensity is proposed. On 27 October, there is a 40 kt ship report, and the wind pressure relationships suggest an intensity near 45 kt. Yet a 40 kt intensity is chosen on this day. Please better explain these, and change the intensities if necessary.

**Agreed to indicate 40 kt on the 26th and 45 kt on the 27th.**

 7. The Committee concurs with the extended track at the end of the cyclone’s life.

**Agreed.**

1963 Additional Notes:

 1. Suspect #1 [now #2]: The Committee would like additional investigation of this system. On one side, it featured very low central pressures – indeed, the MF map for 0000 UTC 27 September appears to have an observation of 997 mb near the center. On the other hand, the environmental pressures were also low, and there are no reports of tropical-storm winds near the center. Given the proximity to land and the occurrence of multiple reconnaissance missions into the system, it seems unlikely that this was a tropical storm that fell through the cracks. That being said, please locate the data from the reconnaissance missions and whatever data is available from Mexico, including contacting the Meteorological Service of Mexico.

**As is usual for suspects, the only surviving record of these reconnaissance missions are the observations plotted on the microfilm maps. A search of the EV2 NCDC website and contacting the Meteorological Service of Mexico has provided no additional observations of interest for this system.**

2. Suspect #3 [now #4]: Has any quality control work been done on the pressure from the ship mentioned in the write-up? If the 1005-1006 mb pressures are correct and peripheral, it suggests the system had a low enough central pressure that it could be a tropical storm. What were the other ship pressures in the area? Since this ship is the only data point, it is unlikely there is sufficient information to call this a tropical storm, but please investigate the report further.

**Unfortunately, there are no additional ships in the vicinity to validate these observations.**

3. The Committee concurs with leaving all of the other suspect systems out of HURDAT.

**Agreed.**