**Best Track Committee Re-Analysis Comments for 1940**

General comments:

1. The US Weather Bureau (USWB) maps produced from the NHC microfilm are a welcome addition to the available data. Have the observations from these maps been checked to see if they are in COADS/ICOADS?

**Yes, we did play close attention to observations within 500 nm of tropical cyclone and tropical disturbance centers and found that a significant portion of the microfilm ship observations were also found in COADS, on the order of two-thirds. However, there were also many microfilm ship observations that were not found in COADS, on the order of one-third. These extra microfilm observations not found in COADS are often very helpful in the analysis. This is one of the many reasons why microfilm will prove to be a valuable source of data and analysis information going forward in the reanalysis from 1940.**

**Most of the COADS observations within two hours of 00Z, 06Z, 12Z, and 18Z were plotted on microfilm.**

2. The Historical Weather Maps (HWM) begin using tropical storm and hurricane symbols starting in this year. The metadata is inconsistent in regards to mentioning when the HWM used the symbols. Please make sure the metadata consistently mentions the symbols when they are used.

**These are now noted consistently throughout the writeup.**

3. On a related note, why would the HWM use tropical storm and hurricane symbols for systems that were not officially classified as tropical cyclones at the time the HWM were created (e. g. the new Storm #6 of 1940)? Did the analysts do this on their own, or were they using some list/database of cyclones?

**The analysts were conducting their own analysis and indicating the most appropriate symbol accordingly.**

4. Two of the 1940 cyclones are shown as having initial intensities of 20 kt, and this has been a trend in the last few years of re-analysis data. However, this appears inconsistent with current practices where tropical depressions are not started with 20-kt winds. Indeed, the Dvorak Technique intensities start at 25 kt, which more or less precludes weaker systems from being called depressions. Would it be better to treat the 20-kt systems as lows, and call them depressions when the winds reach 25 kt? The committee has not yet reached a consensus on this issue.

**Current best tracks use the convective structure to indicate the differentiation between “Low” and “Tropical Depression” typically. In the absence of satellite imagery, such differentiation is difficult if not impossible. Thus “Low” status is not utilized in the best tracks of the 1940s (and 1950s). Also given the rather limited observations typically available, it is almost never the case that we can really distinguish between a system having a peak wind of 20 kt versus 25 kt. Thus we will be consistent in starting cyclones in the 1940s as tropical depressions with 25 kt intensities at the initial time.**

1940 Storm #1:

 1. The HWM for 17 May shows a trough in the southeastern Bahamas, while the 18 May map shows a low south of Hispaniola. Is it possible that genesis occurred earlier than currently analyzed, including on 18 May?

**Available observations from HWM and COADS do not indicate a closed circulation on either the 17th or 18th of May. These are now plotted up and provided. Thus the genesis at 12Z on the 19th is retained. This is consistent with the MWR assessment of the cyclone as well.**

 2. Is the 991 mb observation in the 21 May daily metadata correct? It is not referenced anywhere else despite being the lowest mentioned pressure.

**This observation is an erroneous value – about 23 mb too low compared with its neighboring shipts – and has now been removed from the daily summary.**

 3. The committee concurs with changing the status for the latter part of the track to extratropical. It is concerned that the transition may have occurred earlier, possibly as early as 1200 UTC 25 May.

**Agreed to indicate extratropical transition at 12Z on the 25th.**

 4. Typos: In the metadata entry for 19 May, line 7 replace, “are” with “area”. In the metadata discussion, line 2, replace “except for the 27th” with “except for the 26th and 27th” as the extratropical stage was introduced on the 26th. In the metadata entry for 23 May, line 9, replace “are” with “area”.

**The first and the third items are corrected. The second item, however, was attempting to just discuss the track (position) changes. This has now been clarified.**

1940 Storm #2:

 1. The committee has concerns over the time of genesis, which is the same in both the original HURDAT and the proposed track. The committee concurs with the reduced intensity during the early part of the track, but the analyzed baroclinic zone (with dewpoints in the 60’s) persists near and north of the cyclone through 3 August. Is it possible that the system remained a frontal wave until it was over the Gulf of Mexico, with the genesis delayed until 3 August? Please examine this possibility.

**Agreed to delay genesis until the 3rd when the system was in the Gulf of Mexico.**

 2. The committee has concerns with the location of the radius of maximum wind (RMW) with respect to Port Arthur, Texas, and the corresponding effects on both the best track positions and intensities. The proposed track has the center passing 6-8 n mi from Port Arthur, and with the proposed 10 n mi RMW this would put the station inside the RMW. However, there is no data in the Original Monthly Record (OMR) or in any other account that suggests an eye passage or lull at Port Arthur. This suggests either the RMW was smaller than 10 n mi, or that the track is a little to the south of what is proposed. Please re-examine this, and the impact this has on the analyzed landfall intensity. Note that any revision of the RMW might also require a re-interpretation of the data from Cameron, Louisiana.

**Agreed to slightly adjust the track to south by 0.1N at 18Z 7th and by south by 0.1N/west by 0.1W at 00Z 8th. This keeps the RMW just outside (southwest) of Port Arthur. The landfall time/location is adjusted accordingly. However, the intensity does not therefore need any adjustment, though the southwestward adjustment of the positions, meant landfall farther west in Texas allowing for Category 2 winds to likely impact the extreme northern Texas coast.**

 3. Is the observed tropical-storm wind in Dallas on 9 August representative of the strength of the system given its distance from the center?

**The gale in Dallas may not have been representative of the cyclone’s circulation given its large distance from the center. However, given the observed 45 kt from a ship at 18Z on the 8th, analysis of 40 kt intensity at 00Z on the 9th is reasonable even without the Dallas observation.**

 4. The HWM for 11 August shows a low along a frontal system in southeastern Missouri. Could this be the remains of the cyclone?

**The wave along the frontal boundary is not a closed low on the 11th of August. This is in agreement with the MWR Tracks of Lows, which indicated a final position of the tropical cyclone at 12Z on the 10th.**

1940 Storm #3:

 1. The committee concurs with the later genesis times and the reduced intensities from 6-10 August. The argument for the reduction on 6-10 August needs to be made more concise.

**Done.**

 2. The quote from the OMR at the end of the 6 August daily metadata would be better if parsed out to the appropriate days.

**Done.**

 3. The microfilm map for 0630 UTC 11 August shows two reports of “hurricane” and one penciled-in report of “force 12”. These do not seem to be mentioned in the daily metadata. Are they noted anywhere (e. g. the Monthly Weather Review)?

**The first is 70 kt W with 1002 mb at 30.7N 79.4W via microfilm. The second is 70 kt ESE after 07Z near 32.3N 78.5W via Monthly Weather Review. These are now both included in the daily summary.**

 4. While the committee concurs with increasing the intensity from the original HURDAT, it does not concur with the downgrade from Category 2 to Category 1. Examination of the SLOSH display program Maximum Envelope of Water data suggests that a Category 1 hurricane would not normally caused the observed surge in Charleston, South Carolina, even if the RMW passed over the station. The proposed landfall location and RMW size make it unlikely that the RMW passed over Charleston (as acknowledged in the metadata summary), therefore it was likely that the hurricane was stronger. Please re-examine the landfall intensity, and if necessary contact Cary Mock for any information he may have on the impacts of the system along the coast south of Charleston.

**Agree to retain intensity as Category 2 (85 kt).**

 5. Should the central pressure based on the Macon, Georgia ob be 998 mb instead of 997 mb?

**The one mb per 10 kt rule of thumb has been used primarily for marine exposure conditions. For an inland location like Macon, the rule of thumb should be increased to roughly two mb per 10 kt due to higher values of friction. Thus the 19 kt with 1000 mb measurement should correspond approximately to a 996 mb central pressure.**

 6. The committee does not concur with the removal of 14 August, but does concur with the removal of 15 August.

**Agreed.**

 7. The 15 August daily metadata has an OMR quote at the end that appears to be extraneous text. Please fix this.

**Corrected.**

1940 Storm #4:

 1. The committee concurs with the earlier genesis. Given the 15 kt westerly winds south of the center, is it possible that the initial intensity on 26 August was stronger than 20 kt? Also see point 4 in the General Comments.

**Agreed to boost the intensity to 25 kt.**

 2. The committee has concerns that the proposed positions on 30-31 August are too far to the north and east. Most notably, the 979 mb observation at 0000 UTC 31 August suggests a position farther west than the proposed position. Please re-examine this.

**A careful re-review of all the observations on 30-31 August has been performed. Due to the observation referred to above by the committee, the positions are moved westward at 8/30 18Z through 8/31 12Z.**

 3. This hurricane seems to have been rather small, and this should be noted in the metadata summary. Also, would the small size be an adjustment factor for the peak intensity, possibly justifying a peak intensity of 95 kt?

**It is agreed that because of the compact size and the cyclone being near recurvature that a 95 kt peak intensity is justifiable.**

 4. Is there any data from Canada that would refine the landfall intensity in Nova Scotia, or whether the system was becoming extratropical by that time?

**A request has been made of Environment Canada (Chris Fogarty) to provide any relevant observations from Canada for this system. Additional observations/impacts that he provided indicate that a high end tropical storm is appropriate for the landfall intensity.**

 5. Given the strong winds at Nantucket Island and the small size of the cyclone, is it possible that the track is adjusted too far to the east on 2 September? Or was the system growing in size by this time?

**The cyclone certainly is likely to be growing in size on the 2nd, but the position was adjusted too far east. The reanalysis now has it 0.3W farther west than originally proposed.**

1940 Storm #5:

 1. There are no binder maps for 7-9 September. Please provide them. The committee defers a decision on the proposed earlier genesis time until the maps are available.

**Now provided.**

 2. Is there any data from Canada that would refine the landfall intensity in Nova Scotia and the time of extratropical transition? The committee is currently split on the timing of the transition, with some favoring an earlier transition and some a later transition. Please re-examine this.

**Environment Canada (Chris Fogarty) has been contacted to obtain some additional observations. Impacts and observations provided by Chris indicate that the cyclone was likely a hurricane at landfall in Nova Scotia and that it continued to be quite strong on the 18th as well. Extratropical transition is now indicated to be at 12Z on the 17th, after landfall, but a day before that shown in HURDAT originally.**

1940 Storm #6 (new):

 1. The committee concurs with the inclusion of this system in HURDAT.

**Thank you.**

 2. Regarding the genesis, please see point 4 in the General Comments. Also, the evidence for starting it as early as 19 September looks a little thin. Perhaps the genesis could be delayed until 20 or 21 September?

**Agreed to delay the first best track position by two days.**

 3. The committee has concerns over the lack of hurricane-force wind reports from the Azores. The MWR has an extract from a report from the Meteorological Service of the Azores. Can that service (or the Meteorological Service of Portugal) be contacted to get a copy of the original report? This may help refine the intensity over the Azores.

**The Meteorological Service of Portugal has been contacted to obtain some additional information, if possible.**

1940 Storm #7 (formerly #6):

 1. Given that the HWM show a low pressure area over the southwestern Caribbean sea on 18 September, is it possible that genesis was earlier than proposed? Please re-examine this.

**Agreed to indicate genesis a day earlier on the 18th in the southwestern Caribbean Sea.**

 2. Please re-examine the passage across the Yucatan Peninsula and see if an earlier time of weakening to a tropical depression is warranted.

**Agreed to indicate weakening to a tropical depression six hours earlier (12Z on the 21st).**

 3. Please replace “the system made oceanfall” with “the center emerged” in the metadata summary.

**Done.**

 4. Please re-examine the track near the time of the Louisiana landfall. The metadata summary states that the 1004 mb pressure in Lake Charles was likely a central pressure with the track near that location. However, the MWR and the Louisiana Climate Data state that the center passed closer to Lafayette, which is 60 n mi east of Lake Charles. Please obtain the Lake Charles OMR to refine the track during this period.

**The Lake Charles Airway Weather Reports were obtained from the new EV2 system. This showed that the 1004 mb pressure (actually 1003.4 mb) occurred at 1035Z along with NE 8 kt wind. This supports a central pressure of 1002 mb, which is now included in the 12Z slot. It is agreed to adjust the track to pass closer to Lafayette (~15 nm) rather than Lake Charles (~25 nm). The landfall and after-landfall intensities are not altered.**

 5. What is the relevance of the winds in San Antonio given the distance from the storm? Please clarify this or remove the observation.

**The San Antonio Original Monthly Records were obtained. Peak observed winds were 35 kt N in San Antonio on the 24th, but these winds well removed from the cyclone’s center were a transient event (likely a squall line) as prevailing winds on the 24th were quite weak.**

 6. Did the cyclone actually dissipate, or was it absorbed by the cold front shown on the 25 September HWM? Please clarify this.

**The cyclone was absorbed by the cold front on the 25th (and dissipated). This is now so clarified.**

1940 Storm #8 (formerly #7):

 1. There is a typo in the metadata summary “already present in at the 12Z analysis”.

**Corrected.**

 2. The committee concurs with the proposed upgrade in intensity, but there are concerns between the apparent disconnect between the observed peripheral pressure from the **Castilla** and the lack of wind reports stronger than 45 kt. Is there enough of a history of observations from the **Castilla** to determine if the pressure reading is good?

**Observations from the Castilla via COADS (HO010317) extend from the 21st through the 24th. These indicate that the ship displayed little to no bias in their observed pressures.**

 3. The metadata summary may need to do a better job of explaining the confusion of the **Callista** and the **Contessa** that apparently occurs in the MWR. Note that the gale observation table on page 289 lists both of them as Honduran ships.

**Agreed.**

 4. The HWM for 24 October shows northwesterly winds over the Gulf of Honduras and along the east coast of Belize. Based on this, is it possible that the center took a more westerly or west-northwesterly track after landfall than currently proposed? Please check COADS/ICOADS for ship reports in this area.

**There are no additional ships available in the northwestern Caribbean. The reanalysis of a decaying tropical cyclone over Central America on the 24th remains the most likely scenario.**

1940 Storm #9 (formerly #8):

 1. The committee has concerns about the genesis time. On one side, the HWM for 23 October shows a low near the north coast of Hispaniola that could argue for an earlier genesis time. On the other, the 24 October HWM shows an elongated circulation and an easterly wind in Haiti south of the center, which would argue for a later genesis. Please re-examine this.

**While HWM indicates an “L” north of Hispaniola, there are no observations to support this. Instead a broad trough is evident centered around 71-72W on the 23rd. Thus genesis is retained at 18Z on the 24th as originally shown in HURDAT.**

 2. The southerly winds east of the Bahamas on the 24 October HWM suggests that if the system did exist at the time, the center may have been farther north than currently proposed.

**Agreed to adjust the initial position (at 18Z on the 24th) farther north.**

 3. The committee would like to see a more detailed analysis of the cyclone on 26 October, including maps at 0600 and 1800 UTC if possible. It has concerns over the timing of the extratropical transition, and on the proposed change in dissipation scenario from absorption by the baroclinic zone to strong extratropical low. Revision of the end of the track may be necessary after the committee views the additional analyses.

**Additional analyses were conducted for 06 and 18Z on the 26th. These are consistent with an extratropical transition phase with a slightly revised track to that first presented.**

1940 Storm #10 (new):

 1. The committee is divided on whether to add this system to HURDAT. The lack of strong frontal boundaries near the cyclone argues in favor of calling it a tropical or subtropical cyclone. However, the strongest winds are well removed from the center, and ship reports near the center have pressures of 1015-1016 mb and light winds. This suggests the cyclone lacked the inner core characteristic of a tropical cyclone, and at best it would be a subtropical cyclone. Given the uncertainties of the nature, this should not be added to HURDAT at this time. The committee recommends that the full write-up be moved to the additional systems section. This will leave the door open for re-examination when additional data (i. e., World War II ship report/logs) comes to light.

**Agreed.**

1940 Additional Notes:

1. For system #3, the committee concurs with not adding this to HURDAT. However, the HWM shows a low of the Gulf of Mexico on 17 June. This should be checked to see how it relates to this system.

**There was a low indicated over the Gulf of Mexico by the Historical Weather Maps on the 17th. This system – which appears to be more of an elongated north-south trough – might have been related to the cyclone. This is now mentioned in the writeup.**

2. For system #8, have the USWB maps and COADS data been examined for this system? Since the MWR did not mention this system it is unlikely to have been a significant system, but the extra data may help determine if it was a tropical depression.

**COADS was now collected for this system, which reveals no tropical storm force winds or low pressures. The USWB microfilm maps are not available. Thus this remains as a system in the Additional Notes.**

3. For system #10, the HWM show a persistent area of low pressures in the western Caribbean during the first week of October. It is unlikely that this was associated with a tropical storm, but please investigate this period further.

**COADS was obtained for the first week of October in the western Caribbean, but this indicated nothing more than pressure lower than normal for the week. This is now added into the writeup for system #10.**

4. For system #12, there needs to be “kt” after “2 observed gales of 35”.

**Done.**

5. The committee concurs with leaving all of the other systems out of HURDAT.

**Thank you.**