

A REANALYSIS OF THE 1916, 1918, 1927, 1928, AND 1935 TROPICAL
CYCLONES OF THE NORTH ATLANTIC BASIN

By

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This thesis research involves a reanalysis of the National Hurricane Center's Atlantic Basin Hurricane Database (HURDAT) for 1916, 1918, 1927, 1928, and 1935. Newly available meteorological records from ship logs (COADS) along with recently discovered historical documents were used to reassess tropical cyclone location and intensity. Tropical cyclone track and intensity alterations are discussed in detail in a supporting metadata file. The overall results of the reanalysis process were minor alterations, with some major changes, to the track and intensity of tropical cyclones in HURDAT. Four tropical storms were added: one in 1918, one in 1927, and two in 1935. Three tropical storms were deleted: one in 1918 and two in 1916. However, the overall tropical activity remained nearly the same for the study period. This research is significant because it will strengthen our understanding of hurricane climatology and improve forecast models that utilize HURDAT.

DEDICATION

I would like to dedicate this research to my beloved parents, Leigh and Samuel Glenn, and my wonderful wife, Melissa.

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CHAPTER I

INTRODUCTION

Hurricanes are considered one of the most destructive natural phenomena on Earth (Barnes, 1998a). A hurricane is generally defined as a warm-core non-frontal synoptic scale cyclone possessing counter-clockwise circulation and maximum sustained surface (10 m) winds (using the U.S. 1-minute average) of at least 65 knots (74 mph) (Glickman, 2000). At the surface, a hurricane contains a low-level closed circulation about a well defined center. Once developed, hurricanes are maintained through the evaporation of warm sea-surface ocean water (Longshore, 2000). Tropical storms and tropical depressions are merely weaker versions of the hurricane: tropical storms are classified as having maximum sustained winds of 34 knots (39 mph) to 63 knots (73 mph) and tropical depressions are classified as 33 knots (38 mph) or less (Glickman, 2000). Hurricanes are more properly known as tropical cyclones but the terms will be used interchangeably throughout this thesis.

Hurricanes are notorious for causing fatalities and devastating damage. For example, in 2004 Hurricane Ivan made landfall near Gulf Shores, Alabama, on September 16th claiming 95 lives with an estimated \$13 billion dollars of damage (Weather Underground Inc., 2005). Another destructive hurricane was Hurricane Andrew which struck the United States just south of Miami, Florida, in 1992. Hurricane Andrew

is known as the costliest hurricane on record causing more than \$26 billion dollars in damage along with 24 fatalities (Jarrell et al, 2001). Another infamous hurricane is the Galveston Hurricane of 1900. The Galveston hurricane created a tremendous storm surge that decimated the entire city and took the lives of an estimated 8000 people in southeast Texas (Jarrell et al, 2001; Rappaport and Partagas, 1995). The number of fatalities and the extent of damage associated with hurricanes mark the need for accurate forecasts to decrease deaths and minimize damages.

Because hurricanes have the potential to cause so many deaths and so much destruction on a regional scale, it is important that we have the ability to forecast them in advance. Forecasts are done on two different time scales, seasonal and daily. Real-time forecasts out to five days are issued by the National Hurricane Center (NHC) in Miami, Florida, as tropical cyclones develop and threaten coastal communities. Seasonal predictions are issued by several scientists from the Hurricane Research Division, also in Miami, the NHC, and the Climate Prediction Center in Maryland (Bell et al, 2004a). Tropical activity forecasts for the entire hurricane season (June to November) are issued in mid-May and in early August. These forecasts are based on trends in atmospheric-ocean observations and hurricane climatology.

One means of making accurate predictions in hurricane activity is to have an understanding of hurricane climatology, especially an understanding of intensity and track variations. The main government entity in charge of this duty is the National Hurricane Center (NHC). NHC houses the North Atlantic Basin's HURricane DATabase or HURDAT (Jarvinen et al, 1984). HURDAT consists of six-hourly reports of "best-

track” intensity and track estimates for known tropical cyclones since 1851. Intensity estimates are given in five knot intervals and position estimates are in latitude and longitude to the nearest tenth of a degree. The term “best-track” is coined from the “best” determination of intensity and location in a post-season analysis (Landsea et al, 2004).

Originally developed in the 1960’s, HURDAT was designed to help provide statistical tropical cyclone track prediction in support of the Apollo space program (Jarvinen et al., 1984). The database is updated each year after the NHC’s hurricane specialists conclude their post-analysis of the year’s hurricane activity. Often the “best track” values of position and intensity differ substantially from that utilized in operational forecasts. This is due to the collection of additional data that are not normally available to the NHC hurricane specialists while the tropical cyclone existed. Currently, HURDAT is used to aid forecasters in development and verification of prediction schemes, seasonal forecasting, and climate trend assessment. HURDAT is also used to calculate tropical activity statistics for the adjustment of building code standards in coastal habitats as well as potential losses for insurance agencies (Landsea et al, 2004).

Intensity and duration estimates for tropical cyclones in HURDAT are used to determine the seasonal accumulated cyclone energy (ACE) index (Bell et al., 2000). The ACE index is a method for quantifying the amount of energy accumulated by tropical cyclones, and it allows scientists to gauge seasonal variations in tropical activity, thereby determining active and inactive trends within the hurricane climatology.

Given the necessity and importance of HURDAT, measures need to be taken so that the database is as reliable as possible. Prior to the aircraft reconnaissance era (1944),

HURDAT was found to possess inadequacies and errors (Jarvinen et al, 1984). One type of error in the database has resulted from estimating winds using the Beaufort scale.

Mariners used this rough estimate for their observation of surface winds. Along coastal regions, land stations recorded wind observations using a four-cup anemometer, which was later found to underestimate wind velocities (Landsea et al., 2004). More errors are explained in detail in the next chapter. A process that helps to alleviate these errors is to revisit and reanalyze each tropical cyclone in the database.

Reanalysis is a process that checks, and if needed, corrects various intensity and track errors in the original hurricane database. The reanalysis process is also done to corroborate previous analyses in the original HURDAT record. A reanalysis includes an examination of every available raw observation surrounding a tropical cyclone, including data that were not available during the original post-season analyses (Landsea et al., 2004).

In addition, newly discovered ship observations, such as the recently compiled ocean-atmosphere database, are now available that were not previously available to researchers in the early twentieth century (Woodruff et al., 1987). Additionally, as the understanding of tropical cyclones has developed, so have the analysis techniques at the National Hurricane Center (Landsea et al, 2004). With a better grasp of the inner-workings of hurricanes, researchers are able to more accurately assess abnormalities and anomalies that were previously overlooked. Rapid intensification and extra-tropical transition are examples of such abnormal phenomena not previously understood during the early half of the Twentieth Century.

Therefore, the primary objective of this project is to reanalyze HURDAT for the years of 1916, 1918, 1927, 1928, and 1935. This project involves potentially revising the original HURDAT record by changing the track and intensity of tropical systems in the original hurricane database. It also entails deletion of tropical systems that were incorrectly included in the original HURDAT. Addition of tropical cyclones is also possible through analysis of previously unused ship and station data. The years reanalyzed are chosen to sample different eras/decades in the early Twentieth Century. Other students and researchers have reanalyzed the intervening years.

A secondary objective of this research is to assess the effects of the resulting revisions to HURDAT on the previously reported amount of tropical cyclone activity (ACE). This is done by comparing the original and revised HURDAT ACE index calculations. The computed ACE index values indicate the amount of tropical activity; therefore, if major alterations are suggested for HURDAT then the changes will be apparent in the ACE index computations.

The research efforts presented in this thesis will be carefully reviewed by scientists at the National Hurricane Center and the Hurricane Research Division in preparation for final acceptance into HURDAT. Moreover, this research project is jointly under the direction of Dr. Chris Landsea of the Hurricane Research Division, and is part of a larger project in which the entire Twentieth Century HURDAT database is being reanalyzed.

CHAPTER 2

BACKGROUND

The reanalysis project is responsible for revising the original hurricane database based on every available raw observation. This chapter will explain the sources of error within the original HURDAT record and how the reanalysis process can potentially alleviate the inherent problems. The phases of the El Nino Southern Oscillation (ENSO) and the Atlantic Multidecadal Oscillation (AMO) will be discussed further, both of which are known to affect the frequency and intensity of tropical cyclones in the North Atlantic Basin (Landsea 2000, Kerr 2000). The accumulated cyclone energy (ACE) index is one tool that quantifies the amount tropical activity and its processes will be explained in this chapter as well. Special attention will be given to the original tropical cyclone record for 1916, 1918, 1927, 1928, and 1935.

Error Sources in HURDAT

Although HURDAT is utilized in various ways, there are many reasons why the database needs to be reanalyzed. HURDAT contains many systematic and random errors that need correction (Jarvinen et al., 1984; Neumann, 1994). For example, in the 1935 original HURDAT record, storm number six had maximum winds of only Category 1 intensity (70 knots) but was mistakenly classified as a Category 2 hurricane (95 knots). A

study conducted using the Category 2 classification rather than the actual wind velocity could lead to erroneous results.

There are many methods by which errors could have occurred in the original HURDAT analysis. Several factors contributed to the amount of error involved in track and intensity estimates. Transcription, positional, observation, and conversion errors were all means of inaccuracies in the original HURDAT estimates.

Transcription of observations is an integral part of the observation of tropical cyclones. Errors in the transcription of data could have occurred either during the actual hurricane experience or during digitization of the raw ship logs. For instance, if the original documents are not legible then the digitizer could input the wrong value into the database. Transposing shipping fleet records from hand-written accounts into a digital format is needed so that computer analysis can easily be done.

Position estimates during the 1910's, 1920's, and 1930's were reported to the nearest tenth of a degree (six nautical miles). Errors associated with position estimates have been as large as five degrees (300 nautical miles), which can significantly alter the track of a tropical cyclone. It can also mean the difference between hundreds of miles of coastline for the area affected by a tropical cyclone.

Observational errors are perhaps the hardest to correct in an operational sense and can happen in several ways. The Beaufort scale of wind speed estimation is very subjective and large errors can result from using this measurement alone (Table 1).

Table 1: The Beaufort scale of empirical wind speed measurement. The scale can be utilized from either sea or land observations (Table taken from Wikipedia online at http://en.wikipedia.org/wiki/Main_Page).

Beaufort number	Wind speed at 10 m above sea level (knots mph)	Description	Wave height (m)	Sea conditions	Land conditions
0	Less than 1 / 1	Calm	0	Flat.	Calm.
1	2 / 2	Light air	0.1	Ripples without crests.	Wind motion visible in smoke.
2	5 / 6	Light breeze	0.2	Small wavelets.	Wind felt on exposed skin. Leaves rustle.
3	9 / 11	Gentle breeze	0.6	Large wavelets.	Leaves and smaller twigs in constant motion.
4	13 / 15	Moderate breeze	1	Small waves.	Dust and loose paper raised. Small branches begin to move.
5	19 / 22	Fresh breeze	2	Moderate (1.2 m) longer waves. Some foam and spray.	Smaller trees sway.
6	24 / 27	Strong breeze	3	Large waves with foam crests and some spray.	Large branches in motion. Umbrella use becomes difficult.
7	30 / 35	Near gale	4	Sea heaps up and foam begins to streak.	Whole trees in motion. Effort to walk against the wind.
8	37 / 42	Gale	5.5	Moderately high waves with breaking crests forming spindrift. Streaks of foam.	Twigs broken from trees.
9	44 / 50	Severe gale	7	High waves (2.75 m) with dense foam. Wave crests start to roll over. Considerable spray.	Light structure damage.
10	52 / 60	Storm	9	Very high waves. The sea surface is white and there is considerable tumbling. Visibility is reduced.	Trees uprooted. Considerable structural damage.
11	60 / 69	Violent storm	11.5	Exceptionally high waves.	Widespread structural damage.
12	64 / 73 and higher	Hurricane	14+	Huge waves. Air filled with foam and spray. Sea completely white with driving spray. Visibility very greatly reduced.	Massive and widespread damage to structures.

Another aspect of the Beaufort scale is that it clumps all winds velocities of force 12 or higher to be considered hurricane force. For our analyses the use of force 12 implies a wind of approximately 70 knots (Landsea et al, 2004). However, where hurricanes are noted as 'severe', 'violent', 'terrific' or 'great hurricane' then an estimate of 90 kt is chosen (Landsea et al, 2004). Other observational errors can arise from instrument errors and incorrect or uncalibrated barometers and anemometers. Errors such as described above can originate from many sources but can be corrected through the reanalysis process.

In addition to the many errors found in the database, the original location, time, and intensity may not have been accurately estimated. This is problematic because HURDAT is utilized to suggest various trends in tropical cyclone activity (active and non-active periods). However, the question remains whether these trends are accurate. The inherent errors within HURDAT are potentially corrected through a reanalysis of the original hurricane database. Additionally, by reanalyzing the hurricane database, future studies will more accurately portray climatic trends within the HURDAT climate record.

Limitations in the Original Hurricane Record

One limitation noted by Jarvinen et al (1984) is the time at which the original HURDAT position and intensity estimates were taken. Only one time estimate was originally used before 1931 at 1200 Greenwich Mean Time (GMT) (Jarvinen et al, 1984). The three intermediate positions (0000 GMT, 0600 GMT, and 1800 GMT) were then interpolated from two day's 1200 GMT locations. As time progressed, it was recognized

that only estimating the position and intensity once a day for the database was not enough. The period of 1931 to 1956 began the era of recording two position estimates (Jarvinen et al, 1984). Four of the years within this research (1916, 1918, 1927, and 1928) occur in the period where only one position estimate was recorded. Currently, analyses and records within HURDAT are done at four 6-hour intervals of 0000 GMT, 0600 GMT, 1200 GMT, and 1800 GMT.

In reanalyzing the track of original HURDAT, analyses were first conducted using the 1200 GMT observations. This is because most ships reported observations at 1200 GMT, but only sporadically provided data at other times of the day. U.S. Weather Bureau stations typically reported observations twice a day at 0000 and 1200 GMT. The 1200 GMT analyses were used to interpolate the positions of the intermediate time periods at 0000 GMT, 0600 GMT, and 1800 GMT. Individual analysis of intermediate time intervals was done usually in areas of dense shipping traffic, if available data permitted, and normally near the United States coast. Typically, tropical cyclones that made landfall in the United States contained more available data for the reassessment of position and intensity. This also often allowed the analysis of the intermediate time intervals instead of interpolation.

Without in situ data from the most violent part of the storm, near the eye, accurate estimates of the intensity almost never occurred (Landsea et al, 2004). It should be noted that the inner core of hurricanes where winds are strongest is mesoscale in size, only measuring five to fifty kilometers in radius from the center of the eye. When ships happened to intercept a hurricane at sea they would notify all other ships in its proximity

which unfortunately lessened the chance of a ship to sample the maximum winds. This was especially the case after about 1910, as ship-based radios became more commonly utilized.

The observation and detection of tropical cyclones in the early half of the Twentieth Century depend greatly on the location. Tropical cyclones could have occurred in the open ocean (eastern and central Atlantic) without being noticed by ships or coastal stations, and at this time they will remain undocumented (Jarvinen et al, 1984; Landsea et al, 2004). This possibility is due to the lack of observing systems such as aircraft reconnaissance, radar, and geostationary/polar orbiting satellites during the study period. Table 2 describes the chronological order of available observational networks that have been established across the North Atlantic Basin since the early 1800's (Fitzpatrick, 1999 and Neumann et al., 1999).

Table 2: The observation network chronology for the North Atlantic Basin.

Year	Observation Network
1800s	Ship Logs
1845	First telegraph line complete from Washington to Boston
1846	The invention of the cup anemometer by Robinson
1870	Smithsonian Institute volunteer weather observer network started in the U.S.
1875	First hurricane prediction system started by Benito Vines in Cuba
1890	U.S. weather service transferred to civilian agency - U.S. Weather Bureau
1898	U.S. Weather Bureau established observation stations throughout Caribbean
1905	First use of the radio to transmit weather observations from shipping vessels
1944	Beginning of regular aircraft reconnaissance for tropical cyclone observation
1962	Satellite observations used for tropical cyclone detection and observation

With the invention of the radio in 1902, ships were able to send their weather observations to coastal stations of the U.S. Weather Bureau. Ships that did not have radio

transmission capability sent their written accounts once moored at port. These ship reports provided crucial data for historical reconstruction of past hurricanes in such publications as Ludlum (1963), Ho (1989), Tucker (1995), and others.

Overview of ENSO and AMO

El Nino-Southern Oscillation (ENSO) is defined as a fluctuation of the coupled atmosphere-ocean conditions throughout the tropical Pacific Ocean (Glickman, 2000). Different phases of ENSO are discerned by sea-surface temperature (SST) anomalies in the central and eastern equatorial Pacific Ocean with El Nino (La Nina) events considered as warming (cooling) periods of SST (Landsea, 2000). The phases of ENSO can alternate as briefly as two years or as long as seven. Warm eastern and central Pacific SST's correlate to a strong subtropical jet that typically stretches across the southern portions of the United States and translates to higher shear values in the tropical Atlantic. A high shear environment for the tropical Atlantic Ocean is not conducive for tropical cyclones and thus the warm phase (El Nino) is considered as a tropical activity inhibitor. The Southern Oscillation index (SOI) is defined as the observed sea level pressure difference between Tahiti and Darwin, Australia (Glickman, 2000). High (low) pressures at Tahiti and low (high) pressures at Darwin indicate a La Nina (El Nino) pattern (Landsea, 2000). The phases of ENSO and amount of tropical activity for this study period will be compared to confirm the teleconnection's link to tropical cyclone activity in the North Atlantic Basin.

An ENSO cool or La Nina event occurred in 1916 (Mestas-Nunez and Enfield, 2001). This would indicate an environment that is conducive for tropical cyclones. According to the original HURDAT, a very active hurricane season occurred in 1916 with 14 tropical cyclones. An ENSO warm or El Nino event occurred in 1918, suggesting that tropical cyclone activity should be below normal for the year (Mestas-Nunez and Enfield, 2001). Original HURDAT indicates that six tropical cyclones occurred during the 1918 hurricane season. Both original HURDAT records for 1916 and 1918 corroborate the teleconnections effect on tropical activity for the North Atlantic Basin. Mestas-Nunez and Enfield (2001) also note that the rest of the study period (1927, 1928, and 1935) saw relatively neutral ENSO conditions, indicating that variations in the track and intensity of tropical cyclones are dependent upon basin specific phenonena (i.e. warm ocean temps, atmospheric pressure anomalies).

The second teleconnection is known as the Atlantic Multidecadal Oscillation (AMO). The AMO is a 65-80 year climate cycle of the North Atlantic Ocean (0-70°N) sea surface temperatures (Kerr, 2000). The warm phases occurred from approximately 1870 to 1902, 1925 to 1970, and 1995 to date while the cool phases occurred during 1903 to 1925 and 1971 to 1994 (Goldenberg et al., 2001). The phases of the AMO indicate various trends in tropical cyclone activity and are compared to the study period for corroboration. Two of the five years of this project (1916 and 1918) occurred during a cool phase and three (1927, 1928, and 1935) occurred during a warm phase. How the tropical cyclone activity compares to the AMO will be discussed further in the results section.

Both teleconnections of ENSO and AMO have been shown to positively correlate with North Atlantic basin tropical activity (Landsea et al., 1999 and Kerr, 2000). El Nino years and cool phases of the AMO suggest less than normal tropical cyclone activity, while La Nina events and warm AMO phases indicate marked increases in activity. The alterations to original HURDAT will create a more complete and accurate climate record for the study period, thereby increasing the reliability of the teleconnection from these records.

ACCUMMULATED CYCLONE ENERGY (ACE)

As mentioned earlier, HURDAT is used in this study to assess the amount of accumulated energy of tropical cyclones. The ACE index (Bell et al., 2000) is a modified version of the hurricane destruction potential (HDP) previously devised by Dr. Gray at Colorado State University. HDP calculates an index value by summing the squares of the estimated 6-hour maximum sustained wind speed (V_{\max}^2) from HURDAT's maximum winds for the duration in which a tropical cyclone is a hurricane (Bell et al, 2000). HDP accounts for mature tropical cyclones categorized as a hurricane but leaves out the energy accumulated by tropical storms. ACE provides a more complete index by calculating 6-hour (V_{\max}^2) for both tropical storms and hurricanes. For example the summation for September 1st, 1935, of storm number three's ACE would look similar to: $\sum [(55 \text{ kt})^2 + (60 \text{ kt})^2 + (65 \text{ kt})^2 + (75 \text{ kt})^2] = 16475 \text{ kt}^2$.

The ACE index is considered a physically meaningful and statistically reasonable measurement of overall tropical cyclone activity during a given hurricane season (Bell et

al, 2000). It should be noted that although the term ‘hurricane season’ is used, meaning June 1 to November 30, any tropical cyclone that is deemed tropical storm or hurricane strength is used in determining the ACE index, independent of time of year. Because ACE calculations are dependent on HURDAT, any revisions to the known intensity record will affect estimates of ACE, especially with the discovery of new tropical systems or large alterations in existing intensity records.

An example of the original and revised ACE index values for the 1935 hurricane season is $9.4 \times 10^5 \text{ kt}^2$ and $10.9 \times 10^5 \text{ kt}^2$, respectively. This increase in tropical cyclone activity is more indicative of the actual amount of tropical cyclone activity that occurred in 1935. The period of 1950 to present is considered most accurate due to the advent of aircraft reconnaissance (1944) and scientists rely on this period for comparison of previous tropical cyclone activity. The National Oceanic and Atmospheric Association (NOAA) states that the period from 1951 to 2000 had an average hurricane season ACE index value of $6.5 \times 10^5 \text{ kt}^2$ (Bell et al, 2004). The period 1911 – 1940 had an average ACE index of $7.3 \times 10^5 \text{ kt}^2$. By reanalyzing the early 20th century intensity estimates, researchers can better understand climate cycles using the ACE index.

Hurricane Climatology

The global number of tropical cyclones annually is fairly constant with eighty to ninety tropical cyclones reaching tropical storm intensity per year (McBride, 1995). Fluctuations in tropical cyclone activity are more noticeable at the individual basin scale (e.g. West Pacific Basin, North Atlantic Basin, etc.). The North Atlantic Basin (Gulf of

Mexico, Caribbean Sea, and the North Atlantic Ocean) normally experiences 9.6 named storms (tropical storms or hurricanes), 5.9 hurricanes, and 2.3 major hurricanes per annum for the period of 1950-2000 (Klotzbach and Gray, 2004). The climatology of hurricanes for the 1910's, 1920's and 1930's is substantially less partially because of tropical storms/hurricanes that were not observed. For 1911 to 1940, the average number of named storms, hurricanes, and major hurricanes is 6.9, 4.0, and 1.5, respectively.

Currently, hurricanes are classified using the Saffir-Simpson scale, which analyzes the potential destruction of a hurricane based on their intensity on a scale from one to five, one being the weakest and five being the strongest and most destructive (Table 3). Created by Dr. Robert Simpson in 1974, the scale is a way to categorize the destructive potential of a hurricane using observed wind speed (Simpson, 1974).

Hurricane summaries for the years in this study also have a corresponding Saffir-Simpson category for each tropical cyclone reaching at least 65 knots (74 mph).

Table 3: The Saffir-Simpson scale of potential hurricane damage

Category	Pressure (mb)	Wind (mph)	Damage
ONE	> 980	74 – 85	Minimal
TWO	979 – 965	86 – 110	Moderate
THREE	964 – 945	111 – 130	Extensive
FOUR	944 – 920	131 – 155	Extreme
FIVE	< 920	> 155	Catastrophic

1916 Hurricane Season

Tropical cyclone activity previously documented in the National Hurricane Center's hurricane database for 1916 indicates a very active hurricane season occurred (Figure 1). Eleven hurricanes and three tropical storms were observed, of which six were major hurricanes possessing Category 3 hurricane intensity (100 knots or greater). Tropical cyclone activity began in late June and continued until middle November. Of the fourteen total storms, nine struck the United States from Texas to New England (Figure 1). Also, five of the nine systems that made landfall in the U.S. directly affected Florida.

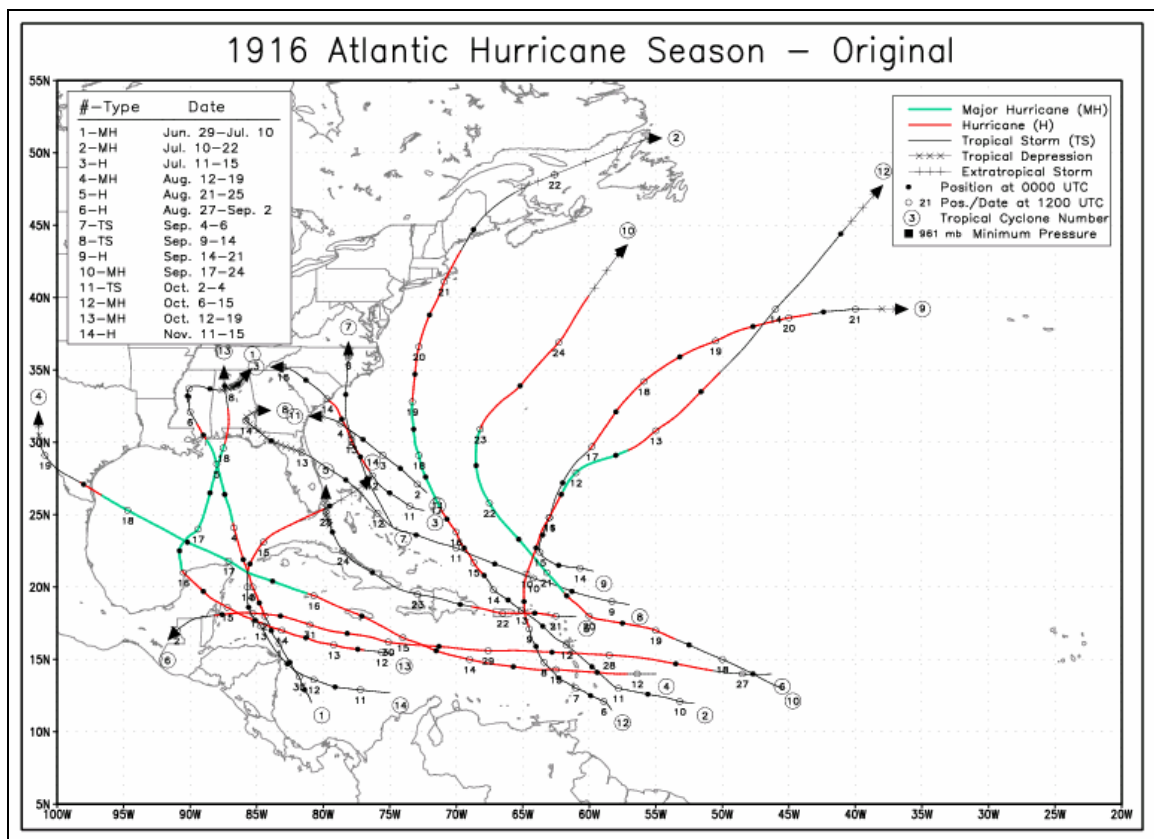


Figure 1: The original Atlantic hurricane season map of 1916.

Storm 1 struck the Mississippi coast in early July as a Category 3 hurricane. Storm 2 paralleled the East Coast during the middle of July before making landfall in Massachusetts as a Category 1 hurricane. The 3rd storm of the season was a short-tracked hurricane that struck near Charleston, South Carolina, in mid August as a minimal Category 1 hurricane. Storm 4 was a long-lived hurricane that traveled the length of the Caribbean Sea before crossing into the Gulf of Mexico and making landfall north of Brownsville, Texas, as a Category 3 hurricane.

The 5th storm of the year took an unusual course as it made landfall in Puerto Rico, Hispanola, and eastern Cuba before dissipating just off the southeast coast of Florida in late August. Storm 6 traversed the Caribbean Sea and made landfall in northern Belize in early September as Category 1 hurricane. Storms 7 and 8 made landfall in the U.S. as tropical storms in southeast North Carolina and northern Florida, respectively. The 9th, 10th, and 12th storms finally gave the U.S. a break as they recurved well away from U.S. soil. Storm 11 was found to be a minimal tropical storm as it made landfall in northern Georgia. Storms 13 and 14 made landfall in Florida in October and November. Storm 13 was a Category 3 hurricane at landfall while storm 14 was only a Category 1 storm.

The strongest hurricane that made U.S. landfall was of Category 3 strength and occurred three different times in the Gulf of Mexico. The lowest pressure in HURDAT is 970 mb with storm number 12 which originated in the northeast Caribbean and traversed on a north to northeast track fortunately not affecting the U.S. mainland. Amazingly enough, two major hurricanes (storms number 1 and 13) made landfall within about 100

miles of each other near the middle gulf region between Mississippi and the panhandle of Florida. This hurricane season is on record as one of the busiest seasons. 1916 holds the record for most landfalling hurricanes and tropical storms at 8 (Landsea and Goldenberg, 2004). 1916 ties 1886 and 1985 as possessing the most U.S. landfalling hurricanes at 6 (Landsea and Goldenberg, 2004).

1918 Hurricane Season

1918 proved to be a below normal hurricane season as five total storms occurred. Three hurricanes and two tropical storms were observed with two of the systems striking the United States (Figure 2). North Carolina experienced a minor tropical storm in late August. Tropical cyclone activity was highest during the months of August and September with no other storms being found outside of those two months. The season's strongest hurricane, with a minimum pressure of 960 mb, made landfall in extreme southwest Louisiana in early August as a Category 3 hurricane.

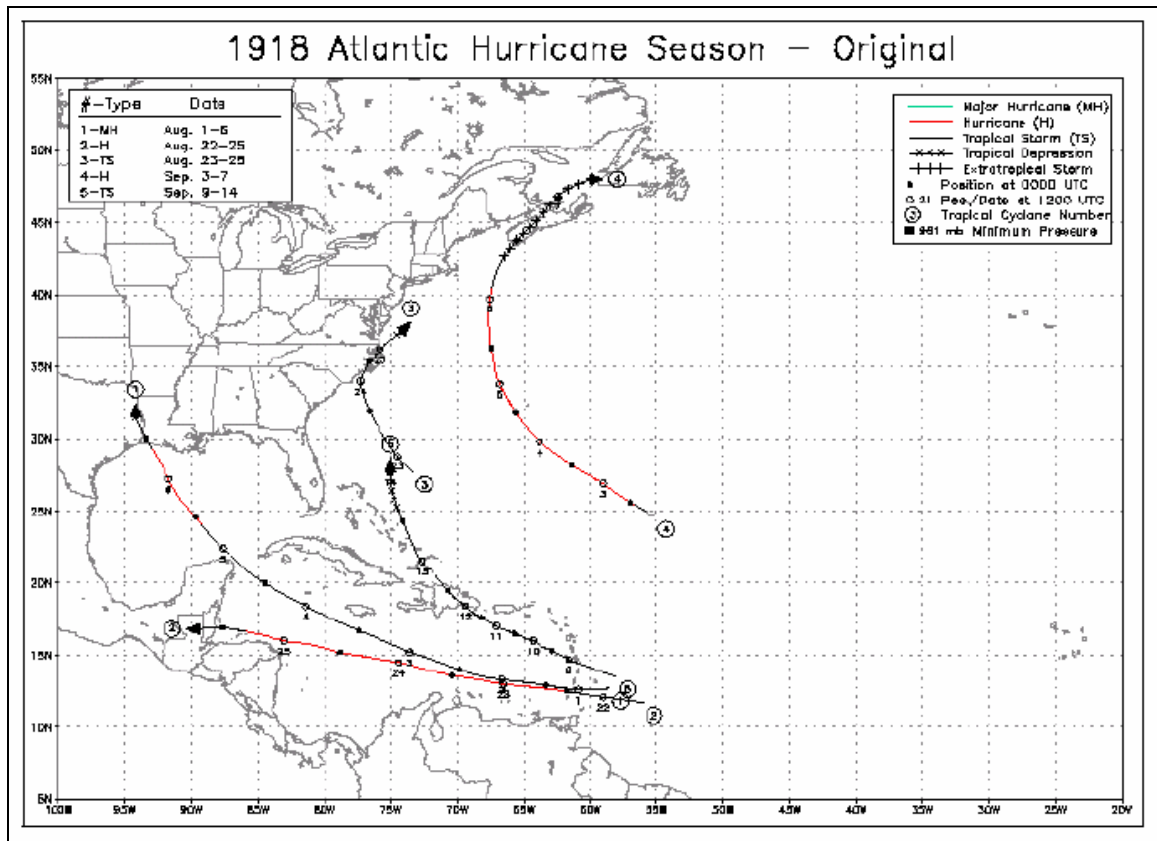


Figure 2: The original Atlantic hurricane season map of 1918.

1927 Hurricane Season

The hurricane season of 1927 was near normal with four hurricanes and three tropical storms occurring (Figure 3). A tropical storm with maximum intensity of 50 knots struck southern South Carolina, near Beaufort, in early October. Tropical cyclone activity was below normal with seven total systems occurring between August and November. The Bahamas experienced tropical storm force winds (40-50 knots) as storms number five, six, and seven traversed the region.

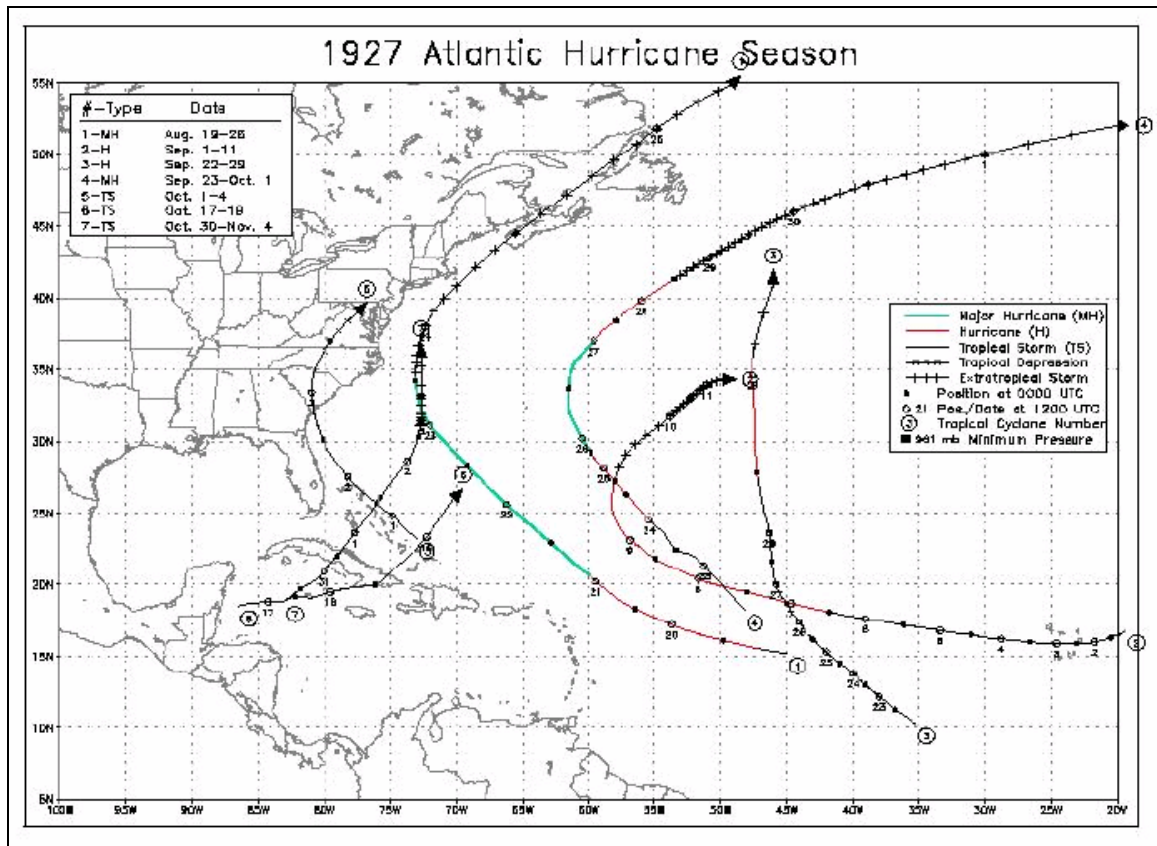


Figure 3: The original Atlantic hurricane season map of 1927.

1928 Hurricane Season

HURDAT indicates the 1928 hurricane season was near normal as six total storms were observed (Figure 4). Four hurricanes and two tropical storms occurred with an abnormal amount of tropical cyclone activity experienced in Florida. A Category 2 hurricane in early August and a tropical storm in mid-August were followed by one of the worst hurricanes in Florida's history (Barnes, 1998a). A Category 4 hurricane struck the southeastern coast of Florida in middle September with sustained winds of 130 knots. Storm 4 struck Mexico just south of Brownsville, Texas. Storm number 5 and 6 recurved in the central Atlantic with storm 6 reaching hurricane intensity.

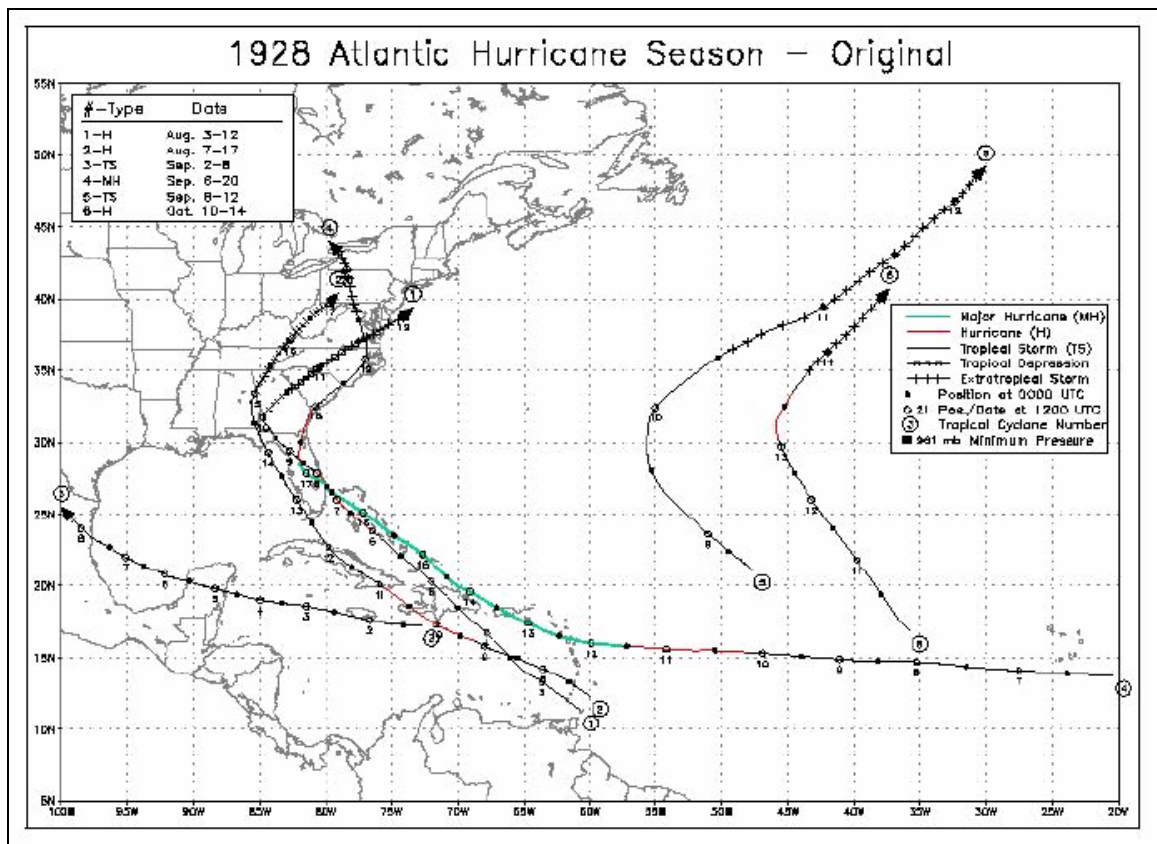


Figure 4: The original Atlantic hurricane season map of 1928.

1935 Hurricane Season

The 1935 hurricane season was classified as normal with six tropical cyclones. Only one tropical storm was observed but five hurricanes (three major hurricanes) occurred (Figure 5). Two hurricanes made landfall in extreme south Florida. Around Labor Day of 1935 a tiny but very powerful hurricane struck the Florida Keys as a devastating Category 5 hurricane (one of three that struck the United States during the entire Twentieth Century). Hurricanes before the 1950's were not given names unless their unusual character and intensity warranted a name. Thus, this storm became known

as the infamous Labor Day Hurricane of 1935. Several books have been written from the personal accounts of the hurricane from Ernest Hemingway to a more recent William Drye. Drye (2002) dubbed the hurricane as the *Storm of the Century* and in his book he mentioned the need for an established warning service since most residence of the Keys had little or no warning that the incredible storm was headed in their direction. After making landfall in the Florida Keys the Labor Day hurricane recurved making its second landfall just northwest of Tampa, Florida. The hurricane then raced up the East Coast and eventually reemerged off the Virginia Coast. The hurricane cost several million dollars and killed over 500 people (Drye, 2002).

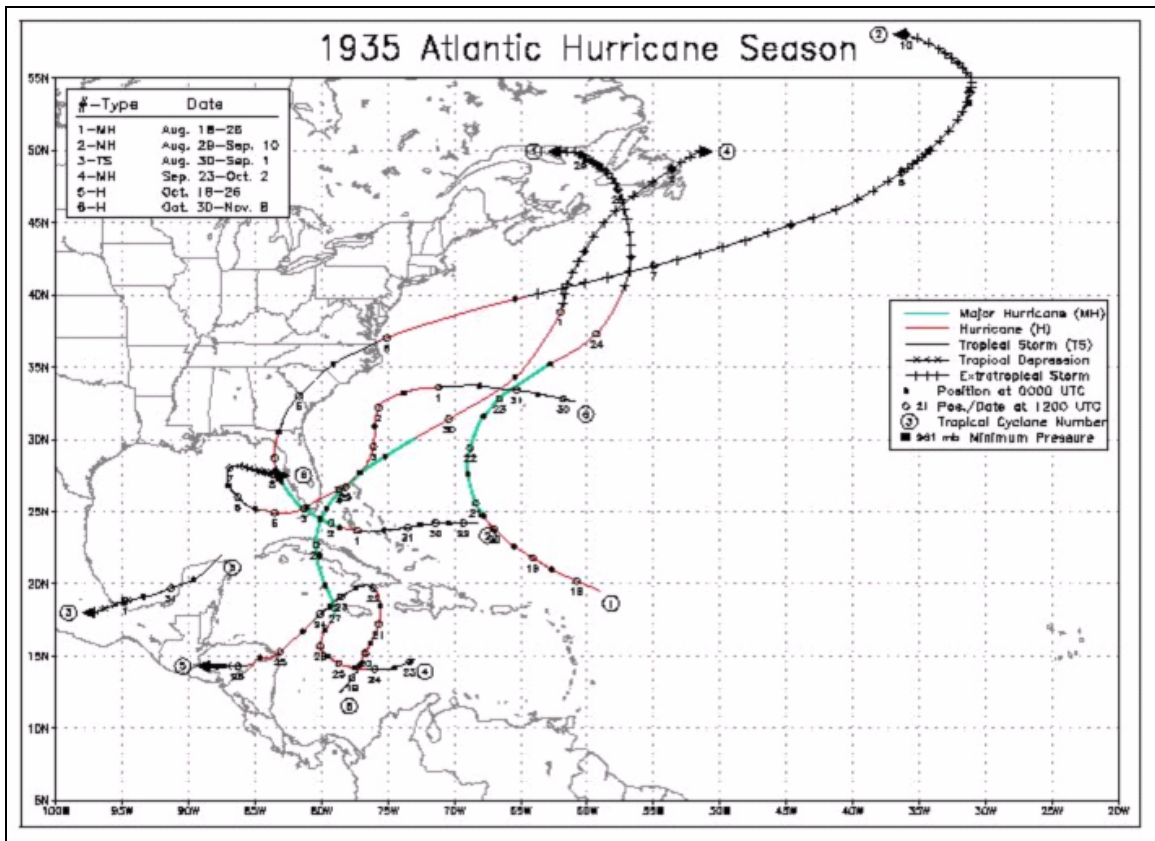


Figure 5: The original Atlantic hurricane season map of 1935.

The rest of the 1935 hurricane season was fairly quiet for U.S. residents as only two storms threatened the coast of southern Florida. Storm number four originated in the Caribbean Sea and propagated north over Cuba before making a close brush with the extreme southeastern tip of Florida. The last storm of the year had an unusual origin east of Bermuda. The storm traveled south, nearly parallel to the East Coast before making its final landfall in Miami, Florida, as a Category 1 hurricane. Its atypical track and origin gave it the nickname “Yankee Hurricane” by Floridian residents since its path was similar to the migration of Northerners to the coasts of Florida. Although the 1935

hurricane season is classified as slightly below normal, it produced the strongest hurricane on record in the Labor Day Hurricane.

Background Summary

The original HURDAT ACE calculations for the study period indicate an extremely active year (1916), three average years (1927, 1928, and 1935), and one below average year (1918) of tropical activity. These values also correlate to the phases of the AMO. A warm AMO began in 1925 and lasted until 1970 which agrees with normal tropical activity for 1927, 1928, and 1935. A cool AMO phase occurred prior to 1925 which would suggest that 1916 and 1918 would have suppressed tropical cyclone activity. 1918 did in fact have well below normal amounts of tropical cyclone activity. 1916 is the outlier in that it occurred during the cool AMO phase with 14 tropical cyclones. The significance of this may be that the high amount of tropical activity experienced in 1916 was a result of a very conducive tropical atmosphere (i.e. the La Nina 'prime' environment for tropical cyclone development).

ENSO during the study period correlated with the original HURDAT. 1916 is characterized as a cool ENSO (La Nina) phase meaning that tropical cyclones in the North Atlantic Basin should increase from average amounts (greater than 6.9 named storms and 4 hurricanes). 1918 saw only five named systems which correlate with the warm ENSO (El Nino) phase. The rest of the study period (1927, 1928, and 1935) occurred during relatively neutral ENSO events, indicating that no global inhibitors or accelerators were necessarily present and that internannual variation in tropical cyclone activity were determined on a basin scale (i.e. sea level pressure anomalies).

The question remains, will the revised HURDAT indicate any differences in the teleconnections link and ACE patterns established in the original HURDAT? The results section will answer this question and explain in detail the implications of revising HURDAT.

CHAPTER III

METHODOLOGY

Throughout the early 20th century, ship and coastal observations around North America and the Caribbean were supplied to forecasters at least once and sometimes twice per day. Synoptic charts using the limited ocean and coastal surface observations were then constructed to aid the forecaster with the synoptic scenario surrounding a hurricane. When hurricanes occurred near shipping lanes, these reports became invaluable in determining the intensity and location of tropical systems. However, not all ships had the ability to report their conditions to the United States Weather Bureau. These ships often continued to their predetermined port where their meteorological observations were sent to the Weather Bureau well after the storm passage. The data were used in post-analysis of hurricanes that struck the U.S., but a large portion of the data has not yet been used to corroborate HURDAT.

There are several sources that are utilized to reanalyze HURDAT, many of which have recently become available. The sections below describe the databases and data sources that were used to reassess HURDAT for the study period.

Data Sources

There are many sources of data that contribute to the successful reanalysis of a tropical cyclone in HURDAT. Ship observations are crucial to the reanalysis of storms at

sea while station observations are important for the reanalysis of tropical cyclones near or over land. The sources of data for this project are listed and explained below.

The most crucial of all raw data are ship observations/records provided by the Comprehensive Ocean-Atmospheric Data Set (COADS) (Woodruff et al, 1987). COADS is a dataset originally compiled for sea-surface temperature analyses but has been adapted for the reanalysis of tropical cyclones. COADS includes a large number of variables but only the following variables are relevant for the reanalysis of storms in HURDAT: date, synoptic time, pressure, wind speed, wind direction, air temperature, sea-surface temperature, platform type, and ship identification tag (Figure 6). The COADS data used in the reanalysis process were made available through the Hurricane Research Division.

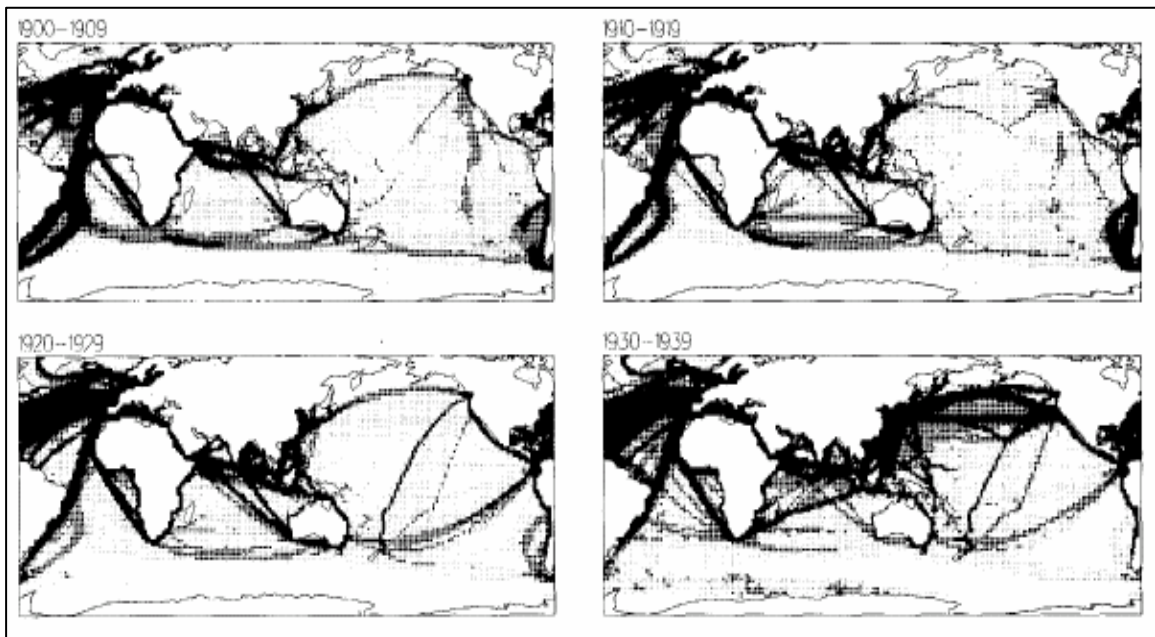


Figure 6: COADS shipping lane traffic for the period 1900-1939 (Woodruff et al, 1987).

The development of the COADS has encompassed the task of digitizing every marine observation (i.e. merchant ship logs and shipping fleet reports) into a single database (Woodruff, 1987). This database is utilized in the reanalysis of hurricanes by helping corroborate storm locations and intensities, as well as offering new data points for more accurate analysis. Also, COADS will be important in determining the existence of previously undiscovered tropical cyclones.

Other sources of historical weather data include the Original Monthly Station Records (OMR) and data published in the Monthly Weather Review (MWR). Marine weather observations are important for open ocean regions, but near land, station observations become the most reliable data. Monthly logs (Figure 7) of individual weather stations (OMR) from the National Climate Data Center for large coastal cities, such as Miami, New Orleans, Savannah, Cape Hatteras, Charleston, and many others were combined with COADS to reanalyze HURDAT. The original observations are scanned into an Adobe Acrobat format making viewing easy and accessible. Meteorological measurements of wind speed, wind direction, and barometric pressure were extracted from OMR for each day of each storm in HURDAT.

(Page 10 of 12)

ORIGINAL MONTHLY RECORD OF OBSERVATIONS at Miami, Fla., for the Month of August, 1916.
 Number of Station barometer, 138; sum of corrections, -0.23 inch.

TIME		BAROMETER					SPECIAL OBSERVATIONS										DATE							
Date	7th Mer.	Local (G.M.T. -5)	Altimeter	Observed reading	Foot correction	Station (Observed reading plus total cor.)	Reduced to sea level	Thermometers		Psychrometers		WIND		CLOUDS			STATE OF WEATHER	SPECIAL PHENOMENA	INITIALS OF OBSERVER	DATE				
								Dry	Wet	Wet point	Wet point (with psychrometer)	Wet point (with psychrometer)	Direction	Force	Dir.	Kind					Dir.			
16	2 57	1 57	86.5	30.087	-181	29.976	30.01	85.7	78.8	76	10	73	87.0	E	18	18	E	0	5	5	5	Cloudy	J.S.	16
22	2 57	1 57	85.0	30.105	-176	29.929	29.96	85.3	76.0	72	13	65	86.0	SE	9	10	SE	0.14	3	3	3	Clear	PRE	22
23	2 57	1 57	85.0	30.033	-176	29.857	29.89	84.0	76.3	73	11	70	84.8	E	8	9	E	0	4	4	4	Partly Cloudy	PRE	23
23	4 50	3 50	85.0	30.012	-176	29.836	29.87	84.1	77.7	75	9	75	84.8	E	8	9	E	0	3	3	3	Partly Cloudy	PRE	23
24	2 57	1 57	86.0	30.008	-178	29.830	29.86	85.7	77.8	75	10	70	86.8	E	8	10	E	0	2	2	2	Clear	J.S.	24
24	6 50	5 50	85.0	29.970	-176	29.794	29.82	83.1	76.6	74	9	74	86.8	NE	16	18	E	0	4	4	4	Cloudy	PRE	24
25	12 50	11 50	84.0	29.941	-173	29.768	29.80	81.2	77.4	75	6	84	82.3	N	6	16	S	0.03	4	4	4	Cloudy	J.S.	25
25	2 57	1 57	82.5	29.958	-169	29.789	29.82	74.9	74.9	75	0	100	82.3	S	36	40	S	2.6	10	10	10	Heavy Rain	J.S.	25
25	4 50	3 50	82.5	29.998	-169	29.826	29.86	75.9	75.8	76	0	100	82.3	S	26	39	S	4.96	10	10	10	Lt. Rain	PRE	25
11	11 50	10 50				30.230	30.26	84																
25	5 50	4 50				29.743	29.77	81																

If additional space is required, run a sheet similar to this, and paste to this margin. † By dial when self-register is out of order. †† † indicates trace of precipitation.

(10)

Figure 7: An example of the Original Monthly Record for the month of August, 1916.

Data from the Monthly Weather Review (MWR) provides written accounts from U.S. Weather Bureau observers as well as a select number of ship logs and monthly weather accounts from around the globe (Figure 8). COADS and MWR often mirror one another since the observations of ship logs in MWR are also found in COADS. Observations of wind speed, wind direction, air temperature, sea surface temperature, and barometric pressure were extracted from MWR for each storm occurrence in HURDAT. Similarly, information from MWR publications, including weather service observations and monthly and seasonal weather summaries, were also utilized during the reassessment process.

OCEAN GALES AND STORMS, SEPTEMBER, 1927

Vessel	Voyage		Position at time of lowest barometer		Gale began	Time of lowest barometer	Gale ended	Lowest barometer	Direction of wind when gale began	Direction and force of wind at time of lowest barometer	Direction of wind when gale ended	Highest force of wind and direction	Shifts of wind near time of lowest barometer
	From—	To—	Latitude	Longitude									
NORTH ATLANTIC OCEAN													
Bolivar, Belg. S. S.	Antwerp	New York	50 37 N.	27 44 W.	Sept. 1.	11 p., 1	Sept. 3.	29.62	SW	WSW, 8	NW	W, 9	W.-NW.
Minnesota, Br. S. S.	New York	Boulogne	41 11 N.	54 12 W.	5	1 p., 6	8	29.47	SW	SW, 11	NW	W, 12	SW.-W.-NW.
Eastier, Belg. S. S.	do.	Antwerp	46 35 N.	35 45 W.	7	2 p., 7	7	29.47	NE	NE, 8	NNW	NE, 9	NE.-N.
Merier, Belg. S. S.	Antwerp	New York	50 29 N.	26 07 W.	7	Mdt., 7	8	29.51	SW	SW, 8	NW	NW, 10	
Bohamban, Fr. S. S.	do.	Havre	42 45 N.	50 39 W.	9	7 a., 9	10	29.57	W	W, 7	NW	W, 8	S.-SW.
Ingworth, Br. S. S.	River Tyne	Galveston	31 20 N.	51 10 W.	10	8 p., 10	10	29.82	S	S, 7	SW	S, 8	S.-SW.-W.
Tynfield, Br. M. S.	London	do.	33 05 N.	59 56 W.	11	1 a., 12	12	29.70	Var.	S, 7	W	Var., 8	S.-SW.-W.
Previdence, Fr. S. S.	Boston	Lisbon	40 45 N.	53 30 W.	11	8 p., 12	13	29.49	S	SSE, 7	WSW	SSE, 9	W.-NW.-N.-NNE.
Arkansas, Dan. S. S.	Baltimore	Rotterdam	49 15 N.	9 44 W.	14	4 p., 14	15	29.50	WSW	NNW, 9	N	NNW, 9	SW.-W.
Dresden, Ger. S. S.	Bremerhaven	New York	43 23 N.	46 44 W.	16	9 p., 16	17	29.53	SW	SW, 8	WNW	SW, 9	
Matino O, Ital. S. S.	Naples	Beaumont	35 00 N.	28 40 W.	20	10 p., 20	21	28.95	SW	NW, 10	NW	—, 10	
Tata, Am. S. S.	Rotterdam	Savannah	52 10 N.	3 50 E.	22	1 p., 22	25	28.82	S	S	NW	SW, 12	
New York City, Br.S.S.	Cardiff	Philadelphia	50 30 N.	21 27 W.	23	Mdt., 23	24	29.28	NW	NW, 9	NNW	N, 9	NW.-N.
S. Anthony, Am. S. S.	Santos	Boston	27 32 N.	55 49 W.	23	—, 24	27	29.46	NE	ESE, 10	N	NE, 11	NE.-ESE.
Sagorack, Am. S. S.	New York	Copenhagen	59 21 N.	7 55 W.	24	4 p., 24	26	29.22	NNE	NNE, 9	NNE	NNE, 9	Steady.
Corness Peak, Am. S. S.	Rotterdam	Galveston	31 23 N.	60 16 W.	25	4 a., 25	26	28.67	SE	SE, 8	NW	E, 12	
Wigrecht, Du. S. S.	Seville	New Orleans	31 08 N.	61 00 W.	26	7 a., 26	26	29.06	NE	N, 12	NW	N, 12	NE.-N.-NW.
Intinous, Am. S. S.	Mobile	London	39 43 N.	59 47 W.	27	Noon, 27	29	29.40	ENE	ENE, 11	NNW	ENE, 11	ENE.-N.-NNW.
Esarnand, Du. S. S.	Antwerp	Habana	37 37 N.	60 43 W.	27	10 a., 27	27	29.35	ENE	N, 10	NNW	N, 10	ENE.-N.-NNW.
Giuseppe Verdi, Ital.S.S.	Lisbon	New York	37 50 N.	59 03 W.	27	11 p., 27	28	29.02	S	WNW, 12	NW	NW, 12	S.-SW.-W.
Union de Larrinaga, R. S. S.	Manchester	Galveston	55 00 N.	18 30 W.	27	10 p., 27	27	29.33	SW	WSW, 8	WSW	WSW, 9	WSW.-W.-WNW.
Bolivia, Br. S. S.	London	New York	42 44 N.	52 48 W.	28	6 p., 28	30	28.98	NE	NE, 7	NNW	NNW, 12	SSE.-NE.-NNW.
Narragansett, Br. M. S.	Hull	Baton Rouge	34 56 N.	46 00 W.	29	7 a., 29	29	29.53	SSE	S, 11	SW	S, 11	
Pres. Harding, Am. S. S.	New York	Cherbourg	43 05 N.	52 15 W.	27	4 p., 29	29	29.18	SE	NE, 7	—	—, 10	SE.-E.-N.
Dresden, Ger. S. S.	New York	Bremerhaven	41 31 N.	54 46 W.	28	4 p., 29	Oct. 1.	29.73	NNE	NNW, 11	NW	NNW, 11	NNE.-NNW.
Gov. John Lind, Am.S.S.	San Juan	Baltimore	25 39 N.	69 48 W.	30	2 p., 30	1	29.78	E	ENE, 8	E	E, 8	
De Grasse, Fr. S. S.	New York	Havre	47 45 N.	34 35 W.	30	11 a., 30	Sept. 30	29.09	SSE	WSW, 11	NW	SSE, 12	WSW.-NW.
United States, Dan. S. S.	New York	Christiansand	58 34 N.	8 33 W.	26	1 p., 30	30	29.39	SW	WSW, 7	SW	WNW, 10	
NORTH PACIFIC OCEAN													

Figure 8: An example of the Monthly Weather Review data from September, 1927.

Tropical cyclone reanalysis involves a careful assessment of COADS, OMR, and MWR observations pertaining to a storm. Other useful information about a storm's occurrence or its effect on people and property can be found from hurricane climatology reports from coastal states, especially North Carolina and Florida (Barnes, 1998a and 1998b). National hurricane climatology reports are also available from Bermuda (Tucker, 1982) and Cuba (Perez-Suarez et al., 2000) that were not available for original post-season analysis. Older, but still very valuable, publications (Tannehill, 1938; Connor, 1956; Dunn and Miller, 1960) have proven reliable when reassessing past tropical cyclones. Additional documents pertaining to hurricane climatology (Hebert and McAdie, 1997; Jarrell et al., 1992) are very important to the reanalysis process as well. Every available meteorological observation mentioned in these texts is crucial to the successful reanalysis of a given storm.

Historical weather maps (HWM) that were previously plotted during the years of 1910-1939 are used as the background synoptic setting for plotting COADS, MWR, OMR, or any other additional observations (Figure 9). These maps are made available through the National Hurricane Center's library in Miami, Florida. From these documents, estimates of wind speed, wind direction, air temperature, sea surface temperature, and barometric pressure were extracted for each day for each storm in HURDAT. All available raw data were hand-plotted on the HWM's during the data aggregation process in preparation for the reanalysis procedure.

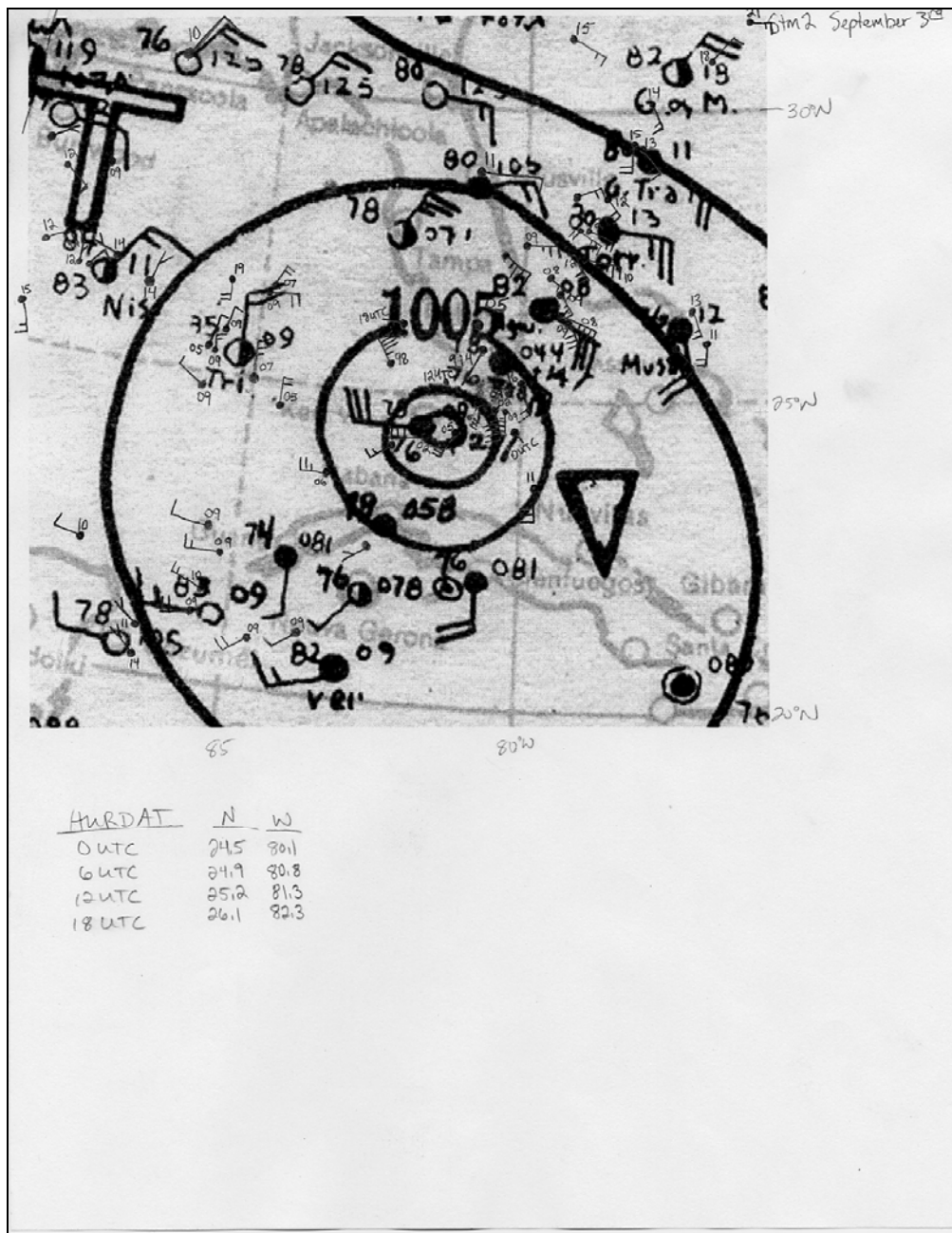


Figure 9: An example of an annotated Historical Weather Map (HWM) for storm two of 1935.

Data Aggregation and Conversions

The most important step in the overall success of reanalyzing a tropical cyclone is to aggregate all the available raw observations such as ship records, land station observations, and historical accounts into an easily viewable database (Figure 10). The observations from COADS, OMR, MWR, HWM, and historical documents, are aggregated into a single database for each storm.

Day	OBS	PRES	WIND	DIR	TEMP	SST	Location	Lat	Lon	Source	SHIP ID
1935 Storm 3 (August - September), previously storm 2											
2-Sep	12Z	1011	15	SSW	83	84	SHIP	193	804	COA	US116880
2-Sep	12Z	1014	15	E	84	83	SHIP	156	770	COA	US107726
2-Sep	12Z	1013	20	NE	84	80	SHIP	163	759	COA	NL011407
2-Sep	12Z	1007	5	W	85		Cienfuegos, Cuba	222	757	HWM	
2-Sep	12Z	1008	30	NNE	82		SHIP	267	798	HWM	
2-Sep	12Z	1009	20	NE	82	74	SHIP	258	804	HWM	
2-Sep	13Z	1012	15	NNW	86	84	SHIP	278	879	COA	US117268
2-Sep	13Z	1013	10	NNW	84	88	SHIP	271	872	COA	US117302
2-Sep	13Z	1009	30	NE	84	84	SHIP	277	825	COA	US118688
2-Sep	13Z	1007	30	NNE	84	85	SHIP	245	815	COA	7040650
2-Sep	13Z		10	SE	79	81	SHIP	295	805	COA	7036607
2-Sep	13Z	1015	10	ENE	84	84	SHIP	285	795	COA	
2-Sep	13Z	1010	10	ENE	84	85	SHIP	166	877	COA	US121778
2-Sep	14Z	1014		ENE	85	84	SHIP	275	895	COA	7038747
2-Sep	14Z	1011	10	NE	85	84	SHIP	245	835	COA	
2-Sep	15Z	1008	15	NNE	83	86	SHIP	230	836	COA	PM002064
2-Sep	16Z	1007	15	NNE	87	87	SHIP	273	803	COA	US118688
2-Sep	17Z	1011	20	NE	88	86	SHIP	266	824	COA	435290
2-Sep	17Z	1008	20	N	79	83	SHIP	245	815	COA	7040650
2-Sep	17Z		15	SE	79	81	SHIP	285	805	COA	7036607
2-Sep	18Z	1013	10	E	86	86	SHIP	268	868	COA	US117268
2-Sep	18Z	1012	10	NNE	82	85	SHIP	209	853	COA	PM001926
2-Sep	18Z	1013	20	ESE	84	85	SHIP	276	790	COA	US117288
2-Sep	18Z	1008	30	SE	81		SHIP	255	775	COA	13007952
2-Sep	18Z	1010	5	SE	82	85	SHIP	184	870	COA	US119093
2-Sep	18Z	1011	15	SW	83	84	SHIP	197	815	COA	US116880
2-Sep	18Z		25	N,NNE			Long Key Island	248	807	MWR	
2-Sep	19Z			N			Long Key Island	248	807	MWR	
2-Sep	19Z	1012	15	NNE	87	86	SHIP	252	849	COA	US118273
2-Sep	19Z	997	30	N	80	84	SHIP	247	806	COA	US118688
2-Sep	20Z	1004	27	NE	82		Miami			OMR	
2-Sep	20Z	1004	17	N	84		Key West			OMR	
2-Sep	20Z	991	45	NNE	80	87	SHIP	248	804	COA	US118688
2-Sep	20Z		45	N	79		Long Key Island	248	807	MWR	
2-Sep	21Z	924	5	Var			SHIP	~250	~805	MWR	Dixie
2-Sep	21Z		70	N			Long Key Island	248	807	MWR	
2-Sep	21Z	1005	25	N	86	84	SHIP	245	825	COA	7040650
2-Sep	21Z		15	ESE	80	81	SHIP	285	805	COA	7036607
2-Sep	21Z	1010	20	E	82	82	SHIP	162	756	COA	435273
2-Sep	22Z	996	50	NW			SHIP	244	809	MWR	Reaper
2-Sep	22Z	950	70	N			Long Key Island	248	807	MWR	
2-Sep	22Z	1006	20	NNW	85	84	SHIP	231	828	COA	US118219
2-Sep	22Z	996	35	ENE	75	83	SHIP	276	827	COA	US116404
Day	OBS	PRES	WIND	DIR	TEMP	SST	LOCATION	LAT	LON	SOURCE	SHIP ID
HWM = Historical Weather Map											
MWR = Monthly Weather Review											
COA = COADS Data Set											
OMR = Original Monthly Records from NCDC											

Figure 10: An example of the Microsoft Excel database. The single database contains all pertinent and relevant data for the reanalysis process.

Several formatting issues and conversions are to be completed before input into the database. Units of wind speed from all data sources were converted to knots in order to be consistent with current analyses. Likewise, all wind direction measurements from the different sources are converted to cardinal direction (NNE, NE, ENE, E, etc.).

Barometric pressure is converted from inches of mercury (as in OMR, MWR, and some historical accounts) to millibars (COADS, HWM). The overall goal is to create a uniform database for each day of a storm's life span. The analysis follows the observations within the spreadsheet.

Track Determination

The first step in reassessing a storm within the original HURDAT record is to define the track. Intensity changes are done second, once an understanding of the storm's position is determined. The storm's center is where the area of maximum winds and lowest pressures reside. The ideal process for finding the center of a tropical cyclone is to use the direction of the observed wind direction and assume a cyclonic 20° inflow angle (Figure 11, Landsea et al, 2004).

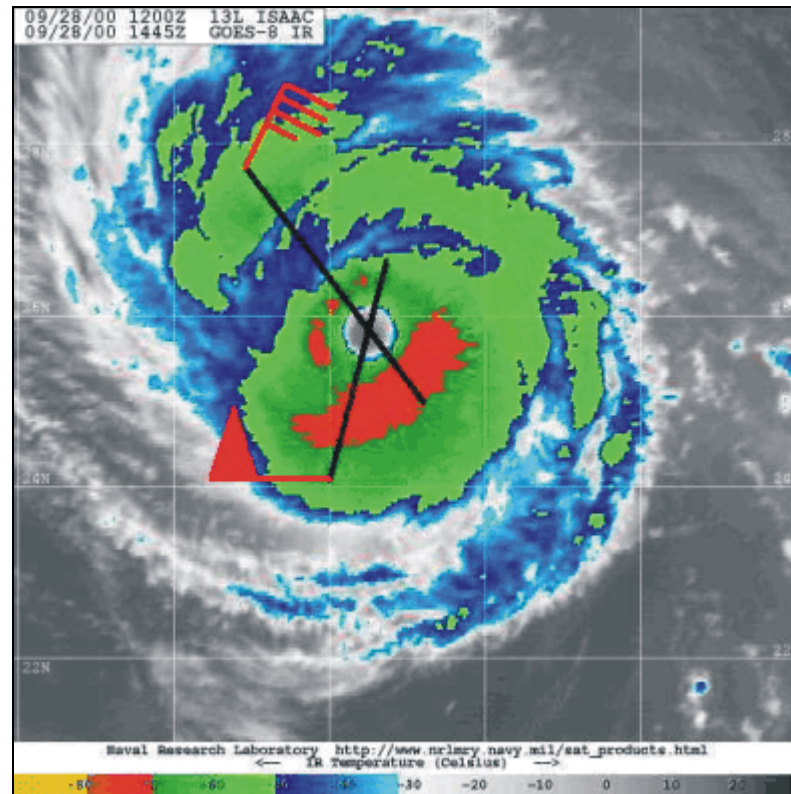


Figure 11: The process for defining the center of a tropical cyclone from observed winds. Two ship observations (indicated by the red wind barbs) roughly indicate the tropical cyclone center (where the two black lines cross) assuming cyclonic flow with a 20° inflow angle (Landsea et al, 2004).

Discrepancies between the original HURDAT record and the newly annotated HWM are noted and used in determining the amount of change needed to alter the original HURDAT track. By comparing the available data with the original track, it is possible to define new cyclone centers as the location closest to the most dependable wind/pressure observations. Central track latitude and longitude coordinates are determined for the 12 GMT time frames for each day and then the overall track (00 GMT, 06 GMT, and 18 GMT) positions are a blend of two consecutive days' 12 GMT points. This procedure is repeated for the duration of a tropical cyclone in HURDAT.

Pressure-Wind Relationship

Track position is dependent upon observed wind directions and, in the absence of observed winds, inferred from barometric pressure readings. In determining intensity it is important to locate the nearest lowest barometric pressure or highest observed wind speed (near the perceived center). The highest observed winds provide a lower bound of what the intensity may be, but seldom do ships (or land-based weather stations) experience the exact strongest winds in a hurricane. Even if an early Twentieth Century ship did encounter the worst part of the storm, none had anemometers to measure the wind and thus typically only indicated Beaufort 12 (70 knots) peak winds.

Atmospheric sea level pressure measurements (central or peripheral) can be used to provide estimates of the maximum sustained wind speeds in a tropical cyclone. Schloemer (1954) derived an equation to estimate the central pressure of a hurricane, given a peripheral pressure reading and roughly knowing the size of the radius of maximum winds (eyewall). One can then convert the central pressure observations or estimates to a maximum sustained surface wind with a pressure-wind relationship (Kraft, 1961; Dvorak, 1975). The formula used for calculating the central pressure is as follows:

$$\frac{P_R - P_o}{P_n - P_o} = e^{(-RMW/R)}$$

P_R is the sea level pressure at radius R , RMW is the radius of maximum winds, P_o is the central pressure at sea level, and P_n is the environmental sea level pressure at the outer limit of a tropical cyclone where the cyclonic circulation ends. Regional pressure-

wind relationships (Table 4) vary depending upon latitude (Landsea et al., 2004), thus pressure values are calculated separately for each of the four main regions: the Gulf of Mexico (GMEX), southern latitudes (south of 25°N), subtropical latitudes (25°N to 35°N), and northern latitudes (35°N to 45°N). Although this is a useful tool when observations are absent, pressure-wind calculations should not supercede the use of actual wind observations in a tropical cyclone when available (Landsea et al, 2004). Table 4 below contains the general summary of the pressure-wind relationships in tropical cyclones. The full length pressure-wind relationship table can be found in Appendix A.

Table 4: The North Atlantic Basin pressure-wind relationship.

P(MB)	GMEX (kt)	<25N (kt)	25-35N (kt)	35-45N (kt)	KRAFT (kt)	DVORAK (kt)
1000	45	47	48	49	50	45
990	62	64	63	63	67	61
980	76	78	75	73	80	76
970	89	89	85	82	92	90
960	100	100	94	90	102	102
950	110	110	103	97	111	113
940	119	119	110	103	120	122
930	128	127	117	---	128	132
920	137	135	124	---	135	141
910	145	143	---	---	142	151
900	153	150	---	---	149	161
890	---	157	---	---	---	170

Radius of Maximum Winds

The radius of maximum winds (RMW), or radius of hurricane force winds, can have an effect on the pressure-wind relationship. A smaller-sized RMW will produce stronger winds than a large RMW for a given tropical cyclone with the same central pressure (Landsea et al., 2004). This is due to the tighter pressure gradient, and thus wind speeds, within the smaller vortex. Vickery et al. (2000) derived an equation for the radius of maximum winds (RMW) of north Atlantic tropical cyclones expressed in terms of central pressure (P_o), environmental pressure (P_n), and latitude (L):

$$\ln(\text{RWM}) = 2.363 - 0.00005086 * (P_o - P_n)^2 + 0.0394899 * (L).$$

In the reanalysis process, tropical cyclones that were found to have abnormally small RMW (observed or estimated) had their wind speeds adjusted accordingly. Landsea et al (2004) notes that storms possessing a RWM of 25 to 50 percent smaller than climatology were increased by about five knots while systems that had extremely smaller RMW (greater than 50 percent) were adjusted by 10 knots. Moreover, hurricanes with a RMW larger than expected by climatology are assessed a wind speed somewhat lower than that suggested by the pressure-wind relationship.

Inland Wind Decay Processes in Tropical Cyclones

Tropical cyclones that make landfall undergo a tremendous amount of weakening due to the lack of warm ocean water to sustain development. The well known MEOW (Maximum Envelope Of Winds) graphics, available on the Nation Hurricane Center's

website, are derived from an inland wind decay model by Kaplan and DeMaria (1995). Again, models are useful tools but they are not meant to supercede in situ observations. In the absence of observed winds the Kaplan and DeMaria model provides guidance for determining wind speeds after landfall. The model calculates the degree of decay with respect to intensity and forward speed, given that the cyclone makes landfall in the Gulf or East Coast. The model is designed mainly for the southeastern United States since nearly all of the coastal regions are less than 650 feet elevation up to 150 km from the coast (Kaplan and DeMaria, 1995). The model is less applicable for higher elevations across the Caribbean and Central America.

Another model used in determining the rate of decay with tropical cyclone landfall was developed in 1987 by Ho et al. Their findings indicate that landfalling cyclones in the Gulf Coast region increase in central pressure by nearly half in the first ten hours over land (Ho et al., 1987). Other relationships were also defined in Ho et al. (1987) and used throughout the reanalysis process to determine central pressure estimates. Notation of which model was used for the reassessment is listed in the metadata documentation.

Reanalysis Process

The process of reassessing tropical cyclone activity involves a careful examination of all available observations of barometric pressure, wind direction, wind speed, and damage records from COADS, OMR, MWR, and historical documents. The steps defined below will describe the process in detail and explain how the reanalysis project works. Data collection is the first and most crucial step because the reassessment

is entirely based on evidence suggested by the data available. Analysis of the data, based on current knowledge and techniques utilized by the National Hurricane Center is the next step (e.g. symmetric surface wind structure, 20 degree inflow angle, pressure-wind relationship). The final step is to document all revisions of HURDAT into a metadata file. The metadata document explains what evidence is present to change the track and intensity of HURDAT.

Once data are aggregated into a single database, by hand-plotting all available observations of pressure, wind speed, and wind direction, from 10-14 GMT onto a copied HWM. This allows ± 2 hour interval to maximize the available data around the 12 GMT synoptic time. The goal is to reassess the 12 GMT position and intensity first, then determine the other three synoptic-time parameters.

Determination of the track for a full day is done by first deriving the 12 GMT center then determining the other three synoptic times through an interpolation of two days' 12 GMT points. When reanalyzing a major landfalling hurricane it is important to locate the lowest pressure or highest observed wind for the area affected. If necessary, a time-series low pressure map of the hurricane's track and intensity is created to aid the analyst in deriving the approximate central path traveled by the storm (Figure 12). The central path would be expected to follow the lowest pressure or highest wind speed observations.

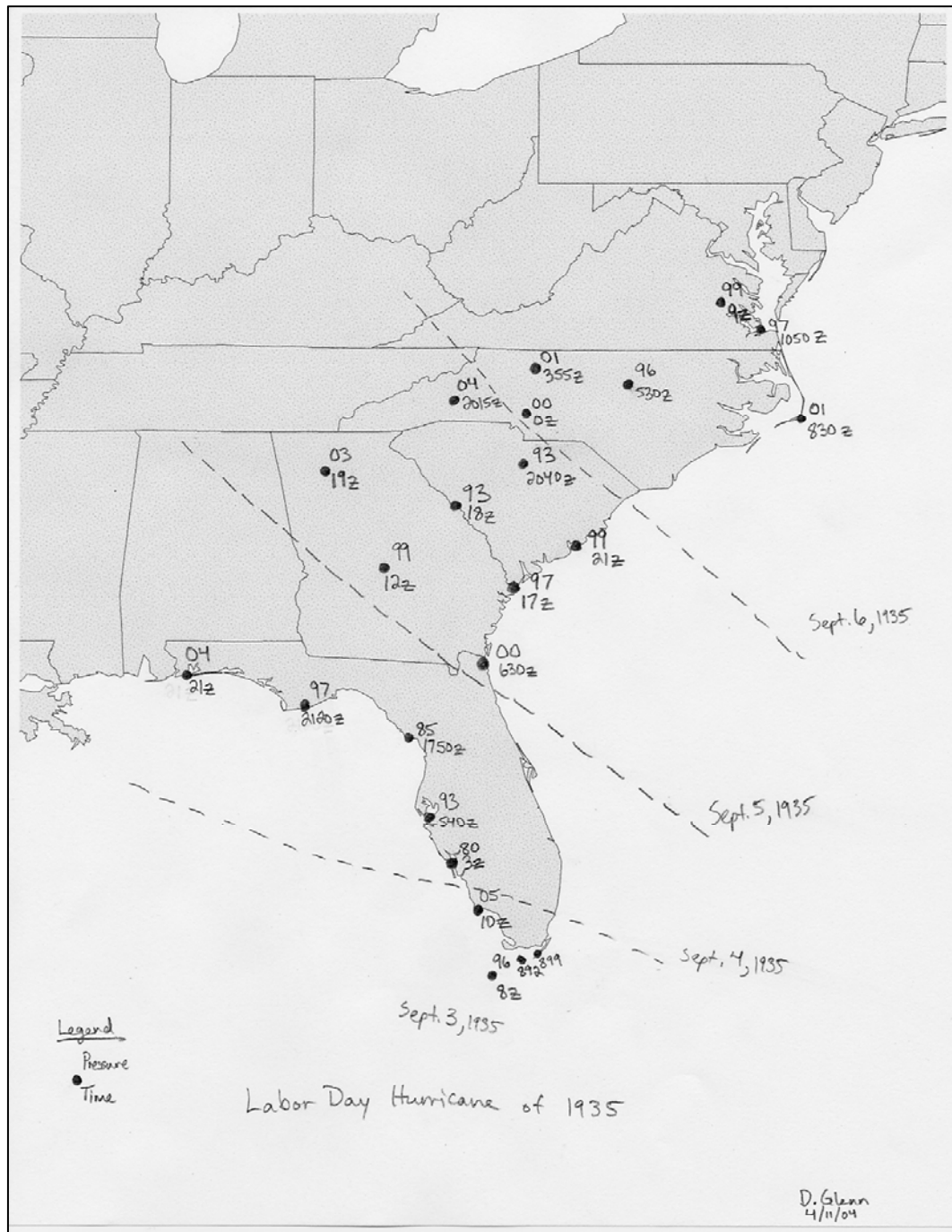


Figure 12: Time-series lowest pressure map for the Labor Day Hurricane of 1935. Time-series low-pressure charts aid the analyst by indicating the day's lowest pressure and the time at which the lowest pressure occurred. Knowing this is crucial in determining the location of the cyclone's center once over land.

Determination of the intensity for tropical cyclones is dependent on observed winds or from estimates utilizing the pressure-wind relationship. These data should be compared positionally with the original HURDAT track location and then utilized to either verify or adjust the original intensity for a storm. If a low pressure or high wind data point appears too distant from the known center, even though it may be the lowest observation, it would be considered suspect without other collaborating low pressures (i.e. nearby ships should have similar observations).

Changes to the original HURDAT database are typically adjustments of intensity and track. Somewhat less typical changes to HURDAT are storm deletion and storm addition. All changes must have sufficient evidence (corroborated by multiple sources) to indicate that a change to the current record is appropriate. Previously unrecorded tropical storms or hurricanes will be added where new raw observations warrant. Where evidence suggests that a system was previously overestimated, as in the case of a weak tropical storm that was actually a tropical depression, HURDAT would be revised to represent the true intensity of the system by removing it. The HURDAT track and intensity record of tropical storms and hurricanes does not include tropical cyclones that peaked at tropical depression intensity.

Best Track Files

After the reanalysis process is complete the revisions to HURDAT are listed in an updated best track file. The best track file contains the most important information about the storm such as storm number, date, synoptic time, latitude, longitude, observed central pressure (when available), and intensity estimate. There are two formats for viewing the

best track file given to the public at (www.aoml.noaa.gov/hrd/hurdat). The easy-to-read format shows the information in a neat, easily readable, list of each day's track and intensity estimates. The second format uses an 80 character format that is designed for quick computer analysis with programs such as FORTRAN, SPSS, SAS, and others. U.S. landfall indicator and location descriptors are also used in the 80 character format. An extensive explanation of both formats can also be found on the reanalysis website or in Jarvinen et al (1984).

Documentation of Revisions

The final step of reassessing a year's worth of tropical cyclone activity is to document all of the suggested changes for individual tropical systems and include new landfall attribute information (eye diameter, radius of maximum winds, environmental pressure, and radius of the outer closed isobar) into a metadata file. The format of the metadata file is in four parts. The first part of the metadata is the original and revised best track file in the 80 character format. The best track file is followed by a short introductory paragraph describing the storm number within the year's activity and also a classification of whether the suggested alterations to HURDAT are minor or major. Changes of greater than 1.5° latitude or longitude and intensity changes greater than fifteen knots are considered major. Minor alterations are defined as changes less than major classification, but with at least some alterations to HURDAT. The opening paragraph is followed by day-to-day records of available data including the original and annotated HWM analysis and highlights of the day's lowest pressures and highest

observed winds. The final piece of the metadata write-up is the summary paragraphs where all the data are synthesized and changes to HURDAT are thoroughly discussed.

The metadata file is a written explanation of changes in HURDAT and what evidence indicated that the changes be made. It is also a concise account of each day's events for every tropical storm and hurricane in HURDAT. Metadata explanations are sometimes very arduous, in that it can take several days to a week to complete one storm. Tropical depressions are not included in HURDAT but where evidence suggests that a tropical depression might have been more intense (tropical storm) then it is noted in the metadata file as an additional note in case future archived data becomes uncovered.

The above mentioned methodology is used to reassess tropical cyclones in HURDAT. Although sometimes very small, changes to the track and intensity are inevitable due to the many observations that were not available to researchers in previous analyses. Once an updated and improved hurricane season is reanalyzed it can then be used in various climate studies.

CHAPTER IV

RESULTS OF REANALYSIS

The reanalysis of each individual year took several months to complete because each day of each storm for each of the five years had to be reanalyzed. The detailed changes to HURDAT (metadata files) are included in Appendix B. Appendix B also contains a detailed description of the alterations for each storm (each day of the storm) for each of the years. Appendix B also represents the bulk of the work of this thesis.

This Results section, though, will summarize the most significant changes to previous HURDAT. The major and minor changes are as follows: major intensity change indicates a fifteen knot increase or decrease in intensity and a major track change indicates a positional alteration of 1.5 degrees or greater.

The hurricane time frame from 1911 to 1940 is considered to be the baseline for hurricane activity. During that period the North Atlantic Basin (Gulf of Mexico, Caribbean Sea, and the North Atlantic Ocean) experienced 6.9 named storms (tropical storms or hurricanes), 4 hurricanes, and 1.5 major hurricanes per annum. The 1916, 1918, 1927, 1928, and 1935 hurricane seasons are compared with the 1911-1940 average for determining below normal, normal, and above normal activity.

Databases Provided in the Reanalysis

As part of this project, three new files have been made available. First and foremost is the revised Atlantic HURDAT “best-track” file which contains the four 6-hourly intensity and position estimates of all known tropical storms and hurricanes (Appendix B). When available, central pressure estimates are also included in the database. The second database is the HURDAT metadata file which is a documentation file that details each change in the revised HURDAT (Appendix B). It also includes the original HURDAT values, the reasoning for revisions to HURDAT, and the revised HURDAT values. The third file is a United States landfalling hurricane and tropical storm database. Each tropical cyclone that traversed U.S. soil, or made a close brush but did not make landfall, is included. The database lists such information as the exact landfall time, location, intensity, radius of maximum winds, environmental sea-level pressure, and the radius of the outer closed isobar for landfalling systems.

1916 Revised HURDAT

The 1916 original HURDAT reveals above normal tropical cyclone activity with 14 tropical cyclones occurring (Figure 13). Through the reanalysis process it has been determined that HURDAT overestimated the frequency and intensity of tropical cyclones in 1916 (Table 5).

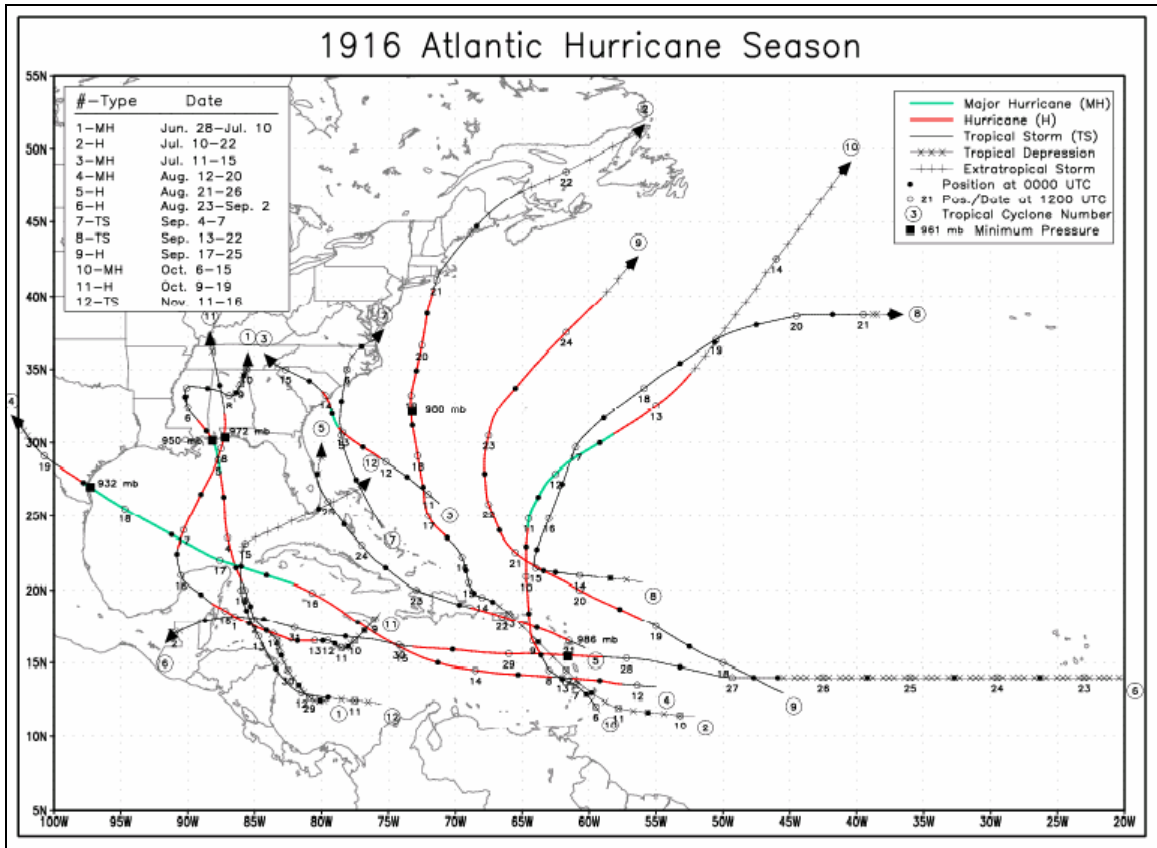


Figure 13: The revised HURDAT track map for 1916.

Table 5: Revisions for the 1916 hurricane season.

Storm	Previous Storm Number	Date	Orig. Peak Intensity (kt)	Revised Peak Intensity (kt)	Major/Minor Track Change	Major/Minor Intensity Change	Genesis/Decay Change
1	1	6/29 - 7/10	105	105	Minor	Minor	Genesis 12 hr Earlier
2	2	7/10 - 22	105	75	Minor	Major -30	None
3	3	7/11 - 15	85	100	Minor	Major +15	Decay 6 hr Later
4	4	8/12 - 19	110	120	Minor	Minor +10	Decay 6 hr Later
5	5	8/21 - 25	85	95	Minor	Minor +10	Decay 12 hr Later
6	6	8/27 - 9/2	85	70	Minor	Major -15	None
7	7	9/4 - 6	35	35	Minor	Minor	Decay 12 hr Later
--	8	9/9 - 14	45	--	--	--	Removed Tropical Wave
8	9	9/14 - 21	90	60	Minor	Major -30	Gen. 12 hr Earlier, Dec 6 hr Later
9	10	9/17 - 25	105	95	Major	Major -10	None
--	11	10/2 - 4	40	--	--	--	Removed Extratropical
10	12	10/6 - 15	105	100	Minor	Minor -5	Decay 12 hr Earlier
11	13	10/12 - 19	105	90	Minor	Major -15	Genesis 3 Days Earlier
12	14	11/11 - 16	70	60	Minor	Minor -10	None

Table 5 indicates that two tropical storms were deleted from the original HURDAT. Storm number 8 was deleted due to an absence of a closed circulation and gale force winds (35 kt or greater) for the duration of the storm, indicating that storm 8 is

actually a tropical wave that did not become a tropical depression (Appendix B). Storm number 11 was found to be extra-tropical in nature, possessing a significant temperature gradient and an asymmetric wind structure (Appendix B). Storm 8 was originally classified as a minimal tropical storm with 45 kt maximum winds while storm 11 was classified as a minimal tropical storm with 40 kt maximum winds. The removal of storm 8 and 11 reduces the total number of tropical cyclones from 14 to 12, but 1916 still remains one of the more active hurricane seasons in HURDAT for the era.

Originally, HURDAT listed storm number 2 as a major hurricane at 105 kt, but available observations indicated only a minimal hurricane at 75 kt. Storm 3 was originally listed in HURDAT as a Category 2 hurricane at 85 kt but available observations indicate the system was actually a Category 3 hurricane at 100 kt. Storm 4 was determined to be 120 kt, 10 kt more intense than original HURDAT's 110 kt, which reclassifies the system as a Category 4 hurricane. HURDAT underestimated the intensity of storm 5 at 85 kt. Available observations surrounding storm 5 indicate its peak winds were 95 kt. The 10 kt upgrade did not, however, change the Saffir-Simpson classification of Category 2 status. Storm 6 was originally estimated to be a Category 2 hurricane at 85 kt but available observations indicate the systems peak intensity was only 70 kt, Category 1 strength.

Storm 9 was originally estimated as a Category 2 hurricane at 90 kt, but available observations indicate the storm was actually 60 kt, suggesting that the system did not attain hurricane intensity. The 10th storm of the season was listed as a 105 kt Category 3 hurricane in original HURDAT. Available observations suggest a downgrade to a 95 kt

Category 2 hurricane. Storm 12 was originally listed as a 105 kt hurricane and was revised down to 100 kt based on available observations. Original HURDAT lists storm 13 as a 105 kt Category 3 hurricane but available observations indicate the system's peak winds were actually 90 kt, Category 2 intensity. Storm 14 was decreased from a 70 kt Category 1 hurricane to a 60 kt tropical storm, a downgrade from original HURDAT.

Original HURDAT listed the 1916 hurricane season as having 14 tropical cyclones, with 11 being hurricanes (six major hurricanes) and three tropical storms (Jarvinen et al, 1984). Revised HURDAT decreases the total number of hurricanes from 11 to nine and reduces the number of major hurricanes from six to four. Also, original HURDAT suggested that the six major hurricanes were all Category 3 intensity. Revised HURDAT indicates four major hurricanes occurred with three being classified as Category 3 and one as a Category 4 hurricane.

Intensity estimates were overestimated during the 1916 hurricane season (Table 5). The 30 kt overestimation of storm 2 and 9 were the greatest for 1916. Seven of the 12 tropical cyclones in HURDAT were classified as having major intensity changes (Table 5). An average difference between the original and revised HURDAT intensity estimates indicates an overall decrease of approximately seven knots for the 12 retained storms in HURDAT.

1918 Revised HURDAT

The 1918 hurricane season was distinctly less active than 1916 with five tropical cyclones occurring (Figure 14). The total number of storms did not change for 1918; however, one storm was added and one storm was deleted (Table 6). A new tropical

storm, storm 4, was added possessing 60 kt maximum winds. Storm number 5 of the original HURDAT record contained winds less than gale force (35 kt) which reclassifies the system as a tropical depression and indicates removal from HURDAT. Storm 5 previously had peak winds of 40 kt. Only minor revisions were indicated for the track of tropical cyclones in 1918.

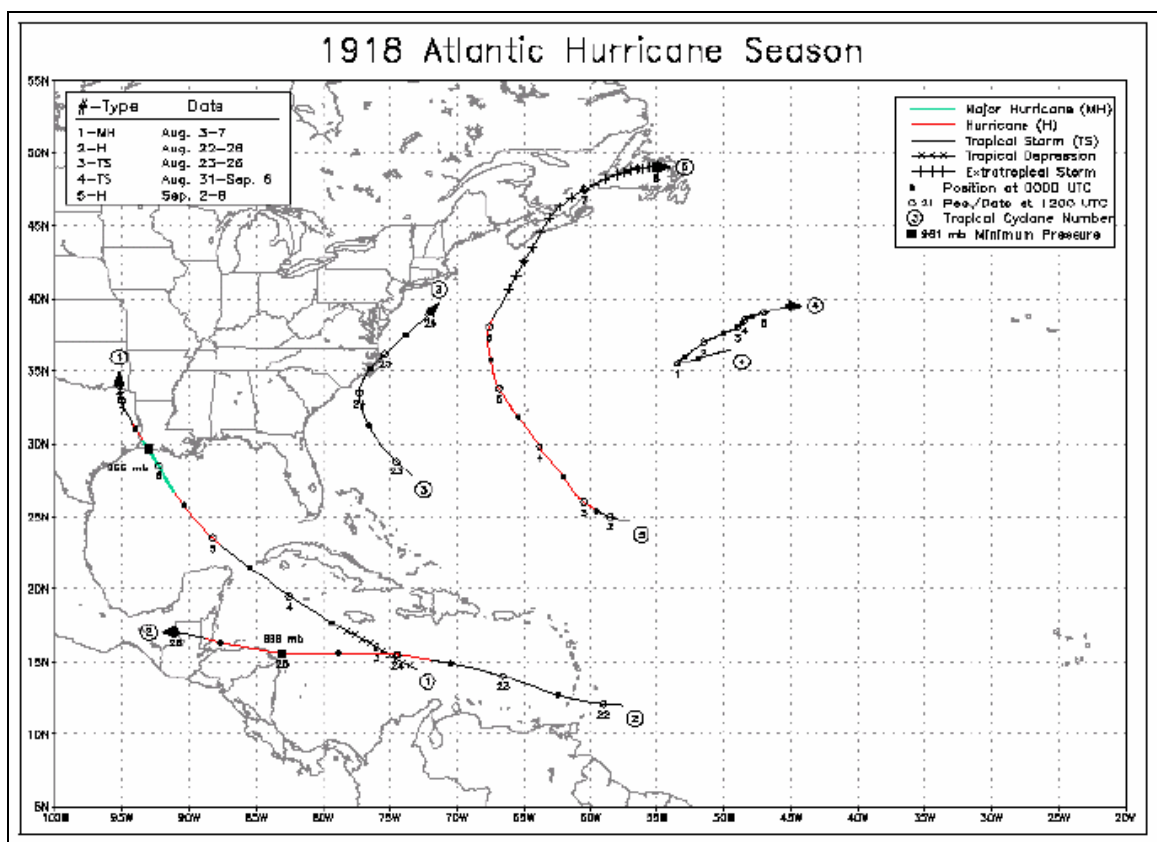


Figure 14: The revised HURDAT track map for 1918.

Table 6: Revisions for the 1918 hurricane season

Storm	Prev. Storm Number	Date	Orig. Peak Intensity (kt)	Revised Peak Intensity (kt)	Major/Minor Track Change	Major/Minor Intensity Change	Genesis/Decay Change
1	1	8/3 – 7	90	110	Minor	Major +20	Gen. 2 Days Later, Decay 12 hr Later
2	2	8/22 -26	70	90	Minor	Major +20	Decay 6 hr Later
3	3	8/23 - 26	50	60	Minor	Minor +10	Decay 12 hr Later
4	--	8/31 - 9/6	--	60	--	--	New Storm
5	4	9/2 – 8	85	85	Minor	None*	Gen. 18 hr Earlier, Decay 18 hr Later
--	5	9/9 – 14	40	--	--	--	Removed Tropical Depression

*Storm 5 (originally storm 4) was the only storm in the study period that received no intensity alterations.

Intensity was significantly underestimated for three of the tropical cyclones in 1918 with an average underestimation of over 15 knots. Storm number 1 was originally in HURDAT as a 90 kt Category 2 hurricane. Available observations indicate the system was underestimated by 20 kt at its peak intensity. This upgrades storm number 1 to a Category 3 hurricane (Table 6, Appendix B). Storm number 2 was underestimated by 20 kt at its peak intensity, increasing it from a minimal hurricane (70 kt) to a Category 2 hurricane at 90 kt (Table 6, Appendix B). Storm number 3 was increased to a 60 kt tropical storm from 50 kt originally. Storm 5 is maintained as an 85 kt Category 2 hurricane.

The four retained systems observed alterations in genesis and in decay time/date. Storm 1 originated two days later and decayed 12 hours later than originally suggested in

HURDAT. Storms 2 and 3 decayed later than original HURDAT by six and 12 hours, respectively. Storm 5, originally number 4, began 18 hours earlier and decayed 18 hours later than suggested in the original HURDAT record.

1927 Revised HURDAT

The hurricane season of 1927 was below normal with seven total storms occurring (Figure 15). Original HURDAT suggests seven tropical cyclones occurred: four hurricanes (two major hurricanes) and three tropical storms (Table 7). Revised HURDAT indicates that seven tropical cyclones did occur but that there were actually three hurricanes (one major hurricane) and four tropical storms. Only one system, storm number 5, made landfall in the United States as a 35 kt tropical storm. Overall, minor revisions were indicated for the track of tropical cyclones during the 1927 hurricane season.

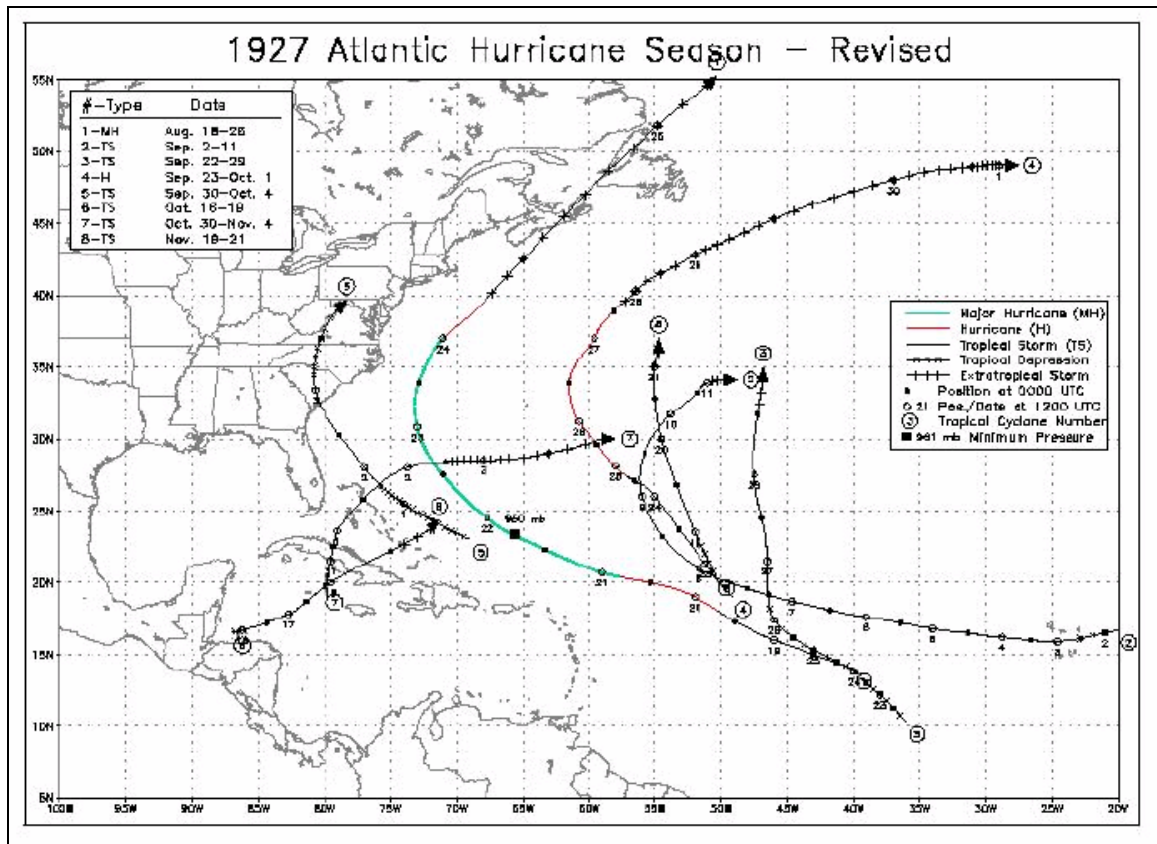


Figure 15: The revised HURDAT track map for 1927.

Table 7: Revisions for the 1927 hurricane season

Storm	Prev. Storm Number	Date	Orig. Peak Intensity (kt)	Revised Peak Intensity (kt)	Major/Minor Track Change	Major/Minor Intensity Change	Genesis/Decay Change
1	1	8/19 - 26	105	110	Major	Minor +5	Genesis 1 Day Earlier
2	2	9/1 - 11	90	60	Major	Major -30	Decay 6 hr Earlier
3	3	9/22 - 29	70	70	Major	Minor -10	None
4	4	9/23 - 10/1	105	90	Minor	Major -15	None
5	5	10/1 - 4	50	40	Minor	Minor -10	None
6	6	10/17 - 19	40	40	Minor	Minor	Gen. 1 Day Earlier Decay 12 hr Earlier
7	7	10/30 - 11/1	40	40	Major	Minor	Genesis 6 hr Earlier
8	--	11/19 - 21	--	50	--	--	New Storm

HURDAT originally listed the peak intensity of storm number 1 as a Category 3 hurricane at 105 kt. Storm 1 was upgraded to 110 kt, maintaining the Category 3 status. The original HURDAT peak intensity of storm number 2 was overestimated at 90 kt as available observations indicate that storm number 2 did not reach hurricane strength. Storm 2 is revised to a 60 kt tropical storm, making it the largest decrease in intensity for the 1927 hurricane season. Storm 4 was originally listed in HURDAT as having a peak intensity of 105 kt but available observations indicate only a 90 kt hurricane. This reduces the original Saffir-Simpson classification for storm 4 from a Category 3 hurricane to a Category 2 hurricane. The peak intensity of storms 3, 6 and 7 remain unchanged although minor alterations were conducted for daily intensity estimations.

1928 Revised HURDAT

Original HURDAT lists the hurricane season of 1928 as below normal with six total storms (Figure 16). HURDAT originally suggests that four hurricanes (one major hurricane) and two tropical storms occurred (Table 8). No change was found in the frequency of tropical cyclones. Minor revisions were indicated for the track of tropical cyclones during the 1928 hurricane season. Also, no tropical cyclones were deleted or added to the hurricane database.

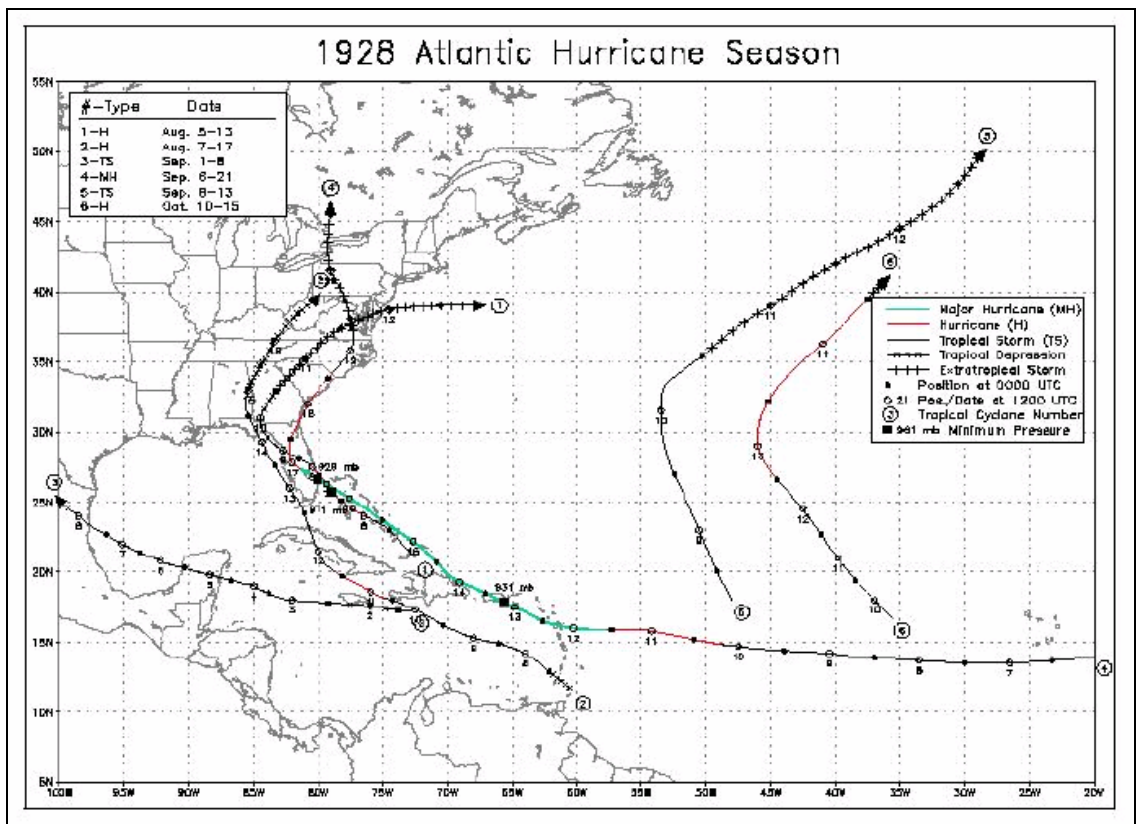


Figure 16: The revised HURDAT track map for 1928.

Table 8: Revisions for the 1928 hurricane season

Storm	Prev. Storm Number	Date	Orig. Peak Intensity (kt)	Revised Peak Intensity (kt)	Major/Minor Track Change	Major/Minor Intensity Change	Genesis/Decay Change
1	1	8/5 – 12	85	85	Minor	Minor	Genesis 2 Days Later
2	2	8/7 – 17	70	70	Minor	Minor	Decay 6 hr Earlier
3	3	9/1 – 8	50	50	Minor	Minor	None
4	4	9/6 – 9/20	140	130	Minor	Minor -10	None
5	5	9/8 – 12	50	50	Major	Minor	None
6	6	10/8 – 10/15	65	80	Minor	Major +15	Genesis 2 Days Earlier

Intensity estimates of the original HURDAT record were fairly accurate with only two systems needing revisions in peak intensity. Peak intensity of storm 4 was originally 140 kt Category 5 hurricane but available observations indicate that storm 4 was actually 130 kt. However, the 10 kt decrease in peak intensity brings storm 4 to a Category 4 hurricane. The peak intensity of storm 6 was originally 65 kt but available observations indicate the system was actually an 80 kt hurricane. The increase in peak intensity of 15 kt for storm 6 maintained its Saffir-Simpson Category 1 classification.

The peak intensity of storms 1, 2, 3, and 5 remain unchanged however minor alterations were introduced for daily intensity estimations. Genesis was found to have occurred two days prior to the original HURDAT for storms 1 and 6. The timing of decay in HURDAT was changed for storm 2 as it was found to have diminished six hours prior to the original HURDAT record.

1935 Revised HURDAT

One of the most infamous hurricane seasons on record for the North Atlantic Basin occurred in 1935 (Figure 17). Original HURDAT suggests a below average hurricane season with six systems occurring: five hurricanes (three major hurricanes) and one tropical storm (Jarvinen et al, 1984). Through a careful reanalysis, eight total tropical cyclones were found to have occurred with five hurricanes (two major hurricanes) and three tropical storms (Table 9.) Two systems were added to the original HURDAT for 1935, storm number 1 and storm number 8. Storm number one was a 50 kt tropical storm that occurred in May and storm 8 was a 45 kt tropical storm that occurred in November.

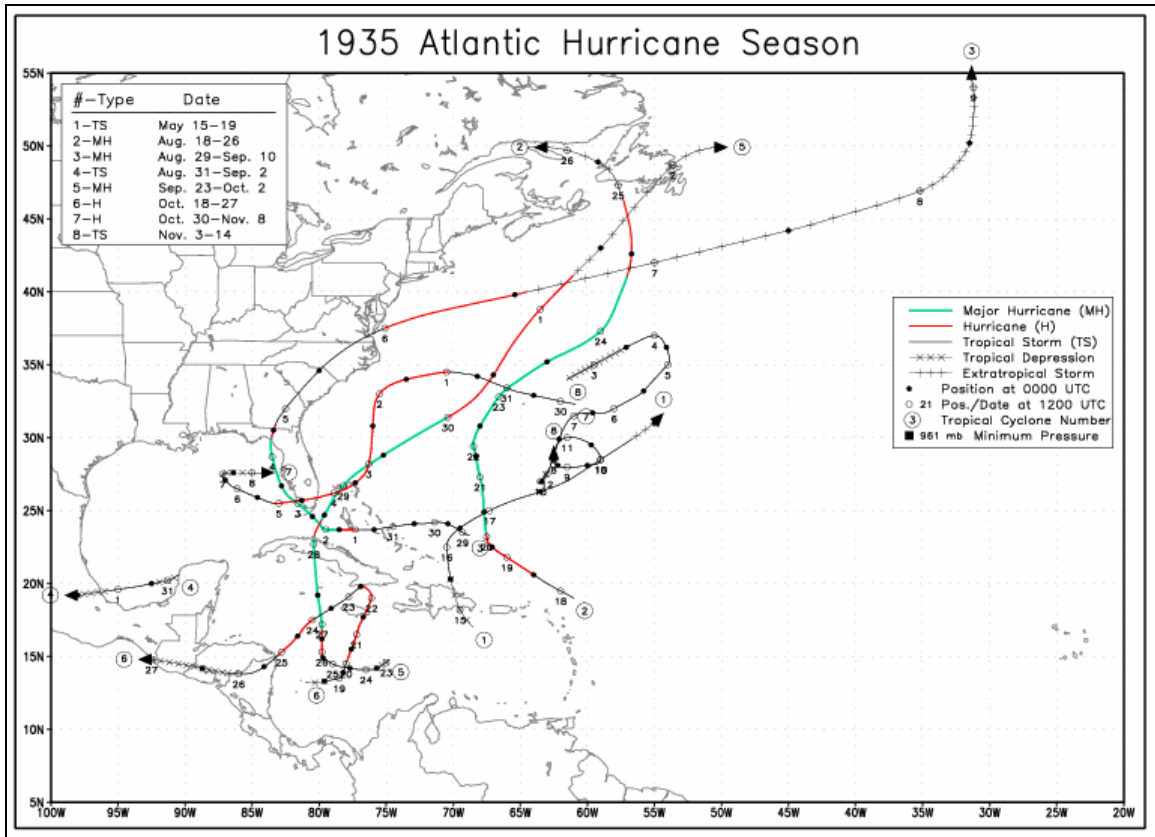


Figure 17: The revised HURDAT track map for 1935.

Table 9: Revisions for the 1935 hurricane season

Storm	Prev. Storm Number	Date	Orig. Peak Intensity (kt)	Revised Peak Intensity (kt)	Major/Minor Track Change	Major/Minor Intensity Change	Genesis/Decay Change
1	--	5/15 - 19	--	50	--	--	New Storm
2	1	8/18 - 26	105	110	Minor	Minor +5	None
3	2	8/29 - 9/10	140	160	Minor	Major +20	None
4	3	8/31 - 9/1	40	35	Major	Minor -5	Genesis 12 hr Later, Decay 6 hr Later
5	4	9/23 - 10/2	105	115	Major	Minor +10	None
6	5	10/18 - 27	75	75	Minor	None	Genesis 12 hr Earlier, Decay 6 hr Later
7	6	10/30 - 11/8	70	90	Minor	Major +20	None
8	--	11/2 - 14	--	45	--	--	New Storm

Intensity estimates were underestimated by an average of nearly 10 knots for systems previously in HURDAT. Storm's number 2 and 7 were classified as major intensity changes as they were increased by 20 kt through the reanalysis process (Table 9). Storm 4 was an 105 kt Category 3 hurricane originally but available observations indicate Storm 4 was actually a 115 kt Category 4 hurricane (Table 9). Revisions to the tracks of tropical cyclones in original HURDAT were typically minor, except for two storms (number 4 and 5) classified as having major track changes.

Storm number 2 is known as the Labor Day Hurricane (LDH) of 1935. Originally HURDAT had the Labor Day Hurricane's peak winds at 140 kt, but through the reanalysis process the peak winds were increased to 160 kt, maintaining the Category 5

hurricane status (Appendix B). The cause of this is a better understanding of the pressure-wind relationship and the effects of a smaller radius of maximum winds on the intensity of a hurricane. The LDH had an observed central pressure of 892 mb, which correlates to maximum sustained winds of 155 kt from the southern pressure-wind relationship. The radius of maximum winds with the LDH were approximately 6 nautical miles, smaller than the 9-10 nautical mile climatology by Vickery et al (2000). The 5 kt boost from 155 kt to 160 kt is due to the very small radius of maximum winds. The LDH holds two records: the lowest observed pressure by a landfalling tropical cyclone at 892 mb and the strongest hurricane on record at 160 kt Category 5 hurricane.

U.S. Landfalling Tropical Cyclones

One of the databases produced through the reanalysis process is an updated record for tropical cyclones that affect the United States. The results of the reanalyzed HURDAT record for tropical cyclone landfall are located in Table 10.

Table 10: Tropical cyclones that affected the United States for 1916, 1918, 1927, 1928, and 1935.

Date/Storm #	Landfall Time	Location	Landfall Intensity	Central Pressure	OCI	RMW
7/5/1916 – Storm 1	2000 Z	Pascagoula, MS	105 kt	950 mb	1008 mb	26 nmi.
7/21/1916 – Storm 2	1200 Z	Block Island, RI	60 kt	993 mb	--	30 nmi.
7/14/1916 – Storm 3	0800 Z	Bulls Bay, SC	90 kt	970 mb	1013 mb	20 nmi.
8/16/1916 – Storm 4	2100 Z	Baffin Bay, TX	120 kt	932 mb	1012 mb	25 nmi.
8/25/1916 – Storm 5	1800 Z	Miami, FL	35 kt	--	--	--
9/6/1916 – Storm 7	0600 Z	Wilmington, NC	35 kt	--	--	--
10/18/1916 - Storm 11	1430 Z	Pensacola, FL	90 kt	972 mb	1010 mb	19 nmi.
8/6/1918 – Storm 1	1730 Z	Cameron, LA	110 kt	955 mb	1012 mb	12 nmi.
8/25/1918 – Storm 3	0000 Z	New Bern, NC	60 kt	--	--	--
10/3/1927 – Storm 5	1100 Z	Beaufort, SC	35 kt	--	--	--
8/8/1928 – Storm 1	0900 Z	Vero Beach, FL	85 kt	977 mb	1014 mb	10 nmi.
8/13/1928 – Storm 2	0300 Z	Key West, FL	60 kt	--	--	--
8/14/1928 – Storm 2	1300 Z	Apalachicola, FL	45 kt	--	--	--
9/17/1928 – Storm 4	0000 Z	Fort Pierce, FL	125 kt	929 mb	1009 mb	28 nmi.
9/3/1935 – Storm 3	0200 Z	Craig Key, FL	160 kt	892 mb	1010 mb	6 nmi.
9/4/1935 – Storm 3	1800 Z	Cedar Key, FL	100 kt	960 mb	1010 mb	21 nmi.
9/29/1935 – Storm 5	0400 Z		105 kt	947 mb	1006 mb	--
11/4/1935 – Storm 8	1800 Z	Miami, FL	90 kt	973 mb	1012 mb	10 nmi.

A total of 17 tropical storms and hurricane made landfall, or a very close brush, with the U.S. coastline. 1916 had the most landfalling tropical cyclones with eight while the other four hurricane seasons had three systems or less that affected the U.S. The most intense hurricane at landfall was the Labor Day Hurricane of 1935 (storm 3). The Category 5 hurricane possessed 160 kt winds across the middle Florida Keys. The second strongest hurricane to make landfall was storm 4 of 1928. Storm 4 was classified as a Category 4 hurricane sustaining winds of 130 kt at landfall.

The new U.S. landfalling hurricane table contains many new storm variables such as observed outermost closed isobar, radius of maximum winds, and environmental sea level pressure measurements. The smallest radius of maximum winds noted in the table is six nautical miles observed with the Labor Day Hurricane. Another significant table of

interest summarizes the changes of U.S. landfalling hurricanes (Table 11). The new table gives the original HURDAT and revised HURDAT assessments along with any alterations of landmass impacted by hurricanes for the study period.

Table 11: Changes to U.S. landfalling hurricanes for 1916, 1918, 1927, 1928, and 1935.

Date/Storm Number	Original HURDAT	Revised HURDAT	Category/State Changes
07/05/1916 – Storm 1	MS3 AL3	MS3 AL2 AFL2	No change, downgraded by a category, add in NW Florida
07/21/1916 – Storm 2	MA1	TS	Downgraded by a category
07/14/1916 – Storm 3	SC1	SC2	Upgraded by a category
08/16/1916 – Storm 4	TX3	TX4	Upgraded by a category
10/18/1916 – Storm 5	AFL2 AL2	AFL2 AL1	No change in FL, downgraded by a category
11/15/1916 – Storm 12	BFL1	TS	Downgraded by a Category
08/06/1918 – Storm 1	LA3	LA3CTX1	No change, add in North Texas
08/08/1928 – Storm 1	CFL2	CFL2	No change
09/17/1928 – Storm 4	CFL4DFL2 GA1 SC1	CFL4 BFL3 DFL1 AFL1GA1 SC1	No change, add in SW and NW Florida, Downgraded by a category in NE Florida
09/03/1935 – Storm 3	BFL5AFL2	CFL5BFL5 AFL3 GA1	No change, add in SE Florida, upgrade a category in NW Florida, add in Georgia
11/04/1935 – Storm 8	CFL2	CFL2BFL1	No change, add SW Florida

Table notes: The impact of a hurricane upon individual U.S. states by Saffir-Simpson Scale. ATX-South Texas, BTX-Central Texas, CTX-North Texas, LA-Louisiana, MS-Mississippi, AL-Alabama, AFL-Northwest Florida, BFL-Southwest Florida, CFL-Southeast Florida, DFL-Northeast Florida, GA-Georgia, SC-South Carolina, NC-North Carolina, VA-Virginia, MA-Massachusetts, TS-Tropical Storm.

Reanalysis Conclusions

In general, track estimates during the 1910's, 1920's, and 1930's needed minor revisions, though a couple per year did require major changes. Intensity estimates for the period saw the greatest change with the single largest change of 30 knots occurring in 1916 and 1927 (Appendix B). The addition of four tropical storms to the original HURDAT record was offset by the deletion of three tropical storms, creating a new total number of storms for the period at 39 (Appendix B). No major changes were found for systems that made landfall in the United States. A new database for tropical cyclones that affected the United States was also completed allowing future HURDAT users to obtain more information about such tropical cyclones.

The phases of the El Nino Southern Oscillation (ENSO) and the Atlantic Multidecadal Oscillation (AMO) somewhat corroborated with the amount of tropical cyclone activity for the study period. 1916 and 1918 were in the cool (quite) AMO phase; however this fact neither aided nor inhibited tropical activity. La Nina (El Nino) conditions prevailed for 1916 (1918) which produced two diametrically opposite years of tropical activity. 1927, 1928, and 1935 were considered ENSO neutral conditions which, along with the warm phase of the AMO, produced near normal amounts of tropical activity. The AMO indicates periods of warm/cool phases implying active/inactive periods within hurricane climatology, but the more useful indicator of tropical activity lies in the different ENSO phases. This data in this research indicates that future predictions utilizing the ENSO teleconnection can be used with increased confidence. The phase of the AMO is still important in assessing long term trends between active and

inactive periods but, as the 1916 hurricane season illustrates, a cool AMO does not always mean suppressed tropical cyclone activity.

CHAPTER V

RESULTS OF ACE

The accumulated cyclone energy (ACE) index is utilized to determine the amount of tropical cyclone activity. NOAA defines near normal seasonal activity when total ACE index values range between 6.5 and $10.3 \times 10^5 \text{ kt}^2$ (Bell et al, 2004b). For the period of 1911-1940, the average ACE index value of $7.3 \times 10^5 \text{ kt}^2$ has been calculated for comparison with the revised HURDAT record. The data tables containing the best-track intensities utilized in calculating ACE can be found in Appendix C. The figure below shows the original and revised HURDAT ACE values (Figure 18).

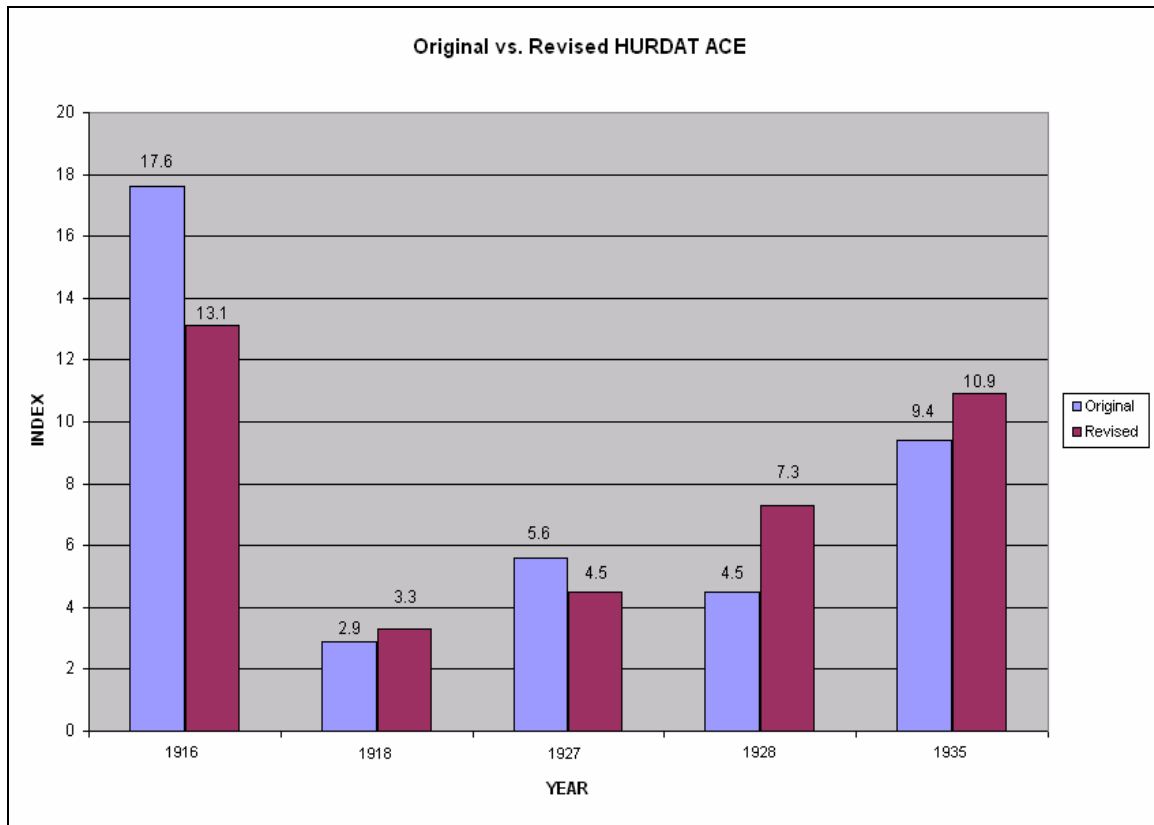


Figure 18: Original vs. Revised HURDAT ACE

ACE index values for original HURDAT contained one year of above normal tropical activity, one year of normal activity, and three years of below normal tropical activity. 1916 was the above normal year with the highest ACE value of $17.6 \times 10^5 \text{ kt}^2$, 200% higher than the 1951-2000 median of $8.75 \times 10^5 \text{ kt}^2$ (Bell et al, 2000). 1935 tropical activity was classified as normal with the second highest ACE index of $9.4 \times 10^5 \text{ kt}^2$. 1918 is noted as below normal for both the original and revised HURDAT's. 1927 and 1928 were near normal with values of 4.5 and $5.6 \times 10^5 \text{ kt}^2$, respectively.

The comparison of the original and revised HURDAT ACE index values for 1916 are intriguing at first glance. The revised HURDAT ACE values for 1916 decreased

dramatically from $17.6 \times 10^5 \text{ kt}^2$ to $13.1 \times 10^5 \text{ kt}^2$. This is a reduction of over 34 percent from the original HURDAT values. The reduction in the amount of tropical activity is partly due to the removal of two tropical storms but the main cause for such a dramatic decrease is because seven systems received a reduction in their peak winds. Two of the hurricanes in 1916 were reduced by 30 kt which also leads to a much diminished ACE index. However, the revised ACE index of $13.1 \times 10^5 \text{ kt}^2$ maintains the original classification of above normal tropical activity.

Original HURDAT ACE index values for 1918 indicate below normal tropical activity at $2.9 \times 10^5 \text{ kt}^2$. The revised HURDAT ACE index value changed to $3.3 \times 10^5 \text{ kt}^2$, a 14 percent increase. The cause for the increase in tropical activity is due to the upgrade of the intensity for three hurricanes by an average of 15 knots. Also, a 40 kt tropical storm was deleted while a new 60 kt tropical storm was added to the HURDAT record for 1918. The added tropical storm was more intense than the deleted tropical storm which had an effect on the index calculation.

The original HURDAT ACE index value for 1927 is $5.6 \times 10^5 \text{ kt}^2$, indicative of a nearly normal ($7.3 \times 10^5 \text{ kt}^2$) tropical season. Revised HURDAT reveals an ACE index value of $4.5 \times 10^5 \text{ kt}^2$, a 24 percent decrease, which drops 1927 to slightly below normal. The decrease in the ACE index is due to the overall reduction in the intensity of tropical cyclones by an average of six knots. Storm number 2 was originally a 90 kt hurricane but after careful reanalysis the system was found to be only 60 kt. A 30 kt decrease will noticeably change the amount of tropical activity, especially when HURDAT only contained seven systems originally.

The original HURDAT ACE index value for 1928 is $4.5 \times 10^5 \text{ kt}^2$, slightly below normal tropical activity. Revised HURDAT increases the ACE index value by 62 percent to $7.3 \times 10^5 \text{ kt}^2$, which upgrades the 1928 season to normal status. This also marks the largest ACE index increase for the study period. The cause of such a large increase in activity is mainly due to the increased intensity over a longer duration for tropical cyclones in HURDAT. A secondary cause is the increase in the intensity of storm 6 from a 60 kt tropical storm to an 80 kt hurricane. Storm 1 was shortened by 2 days while storm 6 was lengthened by two days, both during minimal tropical storm strength, which had little effect on the ACE calculation. Storm 2 retained its peak intensity of 70 kt but other time intervals saw an increase in intensity which caused a greater ACE value.

The original HURDAT ACE index value for 1935 is $9.4 \times 10^5 \text{ kt}^2$, indicating normal tropical activity. Revised HURDAT increases the ACE index value by 16 percent to $10.9 \times 10^5 \text{ kt}^2$, also indicative of a normal hurricane season. The increase in activity is due to the addition of two tropical storms with 50 kt and 45 kt intensity, respectively. Tropical cyclones in revised HURDAT increased in intensity by an average of eight knots, which also lead to a greater ACE index value. The peak intensity of the Labor Day Hurricane (storm 3) increased by 20 kt, from 140 to 160 kt, and the intensity of storm 7 increased by 20 kt, from 70 to 90 kt. The upgrades in peak intensity for storms 3 and 7 also effected the ACE index calculation for 1935.

A comparison of the five year period (1916, 1918, 1927, 1928, and 1935) gives an original ACE index value of $40 \times 10^5 \text{ kt}^2$ and revised ACE index value of $39.1 \times 10^5 \text{ kt}^2$. This indicates a decrease in accumulated tropical cyclone energy of only 2.5%. 1916 and

1927 revised HURDAT ACE values have the largest effect on the total decrease since they were originally either near normal (1927) or well above normal (1916). The other three years saw 14 to 62 percent increases but the increases were only significant because the original values were so low (i.e. 2.9 increased to 3.3 and 4.5 increased to 7.3). It is not as useful to analyze the entire period since changes in tropical cyclone activity are best assessed through annual comparisons.

CHAPTER VI

DISCUSSION

Scant data in the first half of the Twentieth Century lead to significant errors in the estimation of track and intensity of hurricanes (Landsea et al, 2004). The reanalysis process corrects, when needed, the track and intensity of tropical cyclones in the North Atlantic basin by carefully analyzing the collective data from ship logs, coastal stations, and historical documents. Recalculating the ACE index shows that the overall accumulated tropical cyclone activity remained nearly the same after revising HURDAT.

Through the reanalysis process four new tropical storms were added to HURDAT. It appears that these storms were absent from the original record because they occurred in the central Atlantic Ocean away from land and dense shipping traffic. Moreover, researchers during the early Twentieth Century did not have satellite or reconnaissance aircraft to track storms far from land which often meant storms that occurred in the open ocean were absent from the hurricane database. Three tropical storms were removed from HURDAT due to the increased amount of available observations from COADS, MWR, OMR, and other historical documents. Two of the systems were found to be only tropical depression strength (less than 35 knots in intensity) while one was found to be extratropical in nature (substantial temperature gradient). It is interesting to note that all three removed systems occurred near land.

The analyses present within this research are only as accurate as the amount of available data. Limitations in the reanalysis process still exist due to the lack of data from countries across the Caribbean Sea and in Mexico. Meteorological records from these areas may potentially change the track and intensity of tropical cyclones that crossed the Yucatan Peninsula or made landfall along Central America. Future efforts should be made to obtain these data to gain more observations surrounding tropical cyclones in this region. As stated before, the reanalysis process is not final since the discovery of previously unused archived data may alter the current record of tropical cyclones in the database.

Surprisingly, as the reanalysis process progressed from 1916 to 1935, no natural improvement in the original hurricane record was found. The amount of available data increased substantially between the 1910's and 1930's; however, the increase in data did not indicate a more accurate original hurricane database. Differences between the original and revised HURDAT record depend on the storm track and year in discussion.

Tropical cyclones that made landfall along the United States coastline had minor track alterations which indicates that previous landfall statistics computed utilizing the original HURDAT are still considered reliable. New landfalling statistics pertaining to intensity will see the greatest improvement from the original HURDAT.

The results of this project can have a tremendous effect on model guidance using tropical cyclone climatology. A newly developed model designed to help predict tropical cyclogenesis was recently created by Mark DeMaria at the Cooperative Institute for Research in the Atmosphere (www.cira.colostate.edu/ramm/gparm/genesis.asp, 2004).

The sole latitudinal and longitudinal predictor of tropical origin in the model comes from the National Hurricane Center's best track file from 1949 to present. The reanalysis process creates a much more accurate database for the genesis time and location of tropical cyclones in HURDAT. Once the reanalysis project has reached this time period the model will become more efficient and reliable in its predictions if the revised HURDAT origin locations are added.

CHAPTER VII

CONCLUSION

In concluding this research, it is significant to note that the suggested changes to the hurricane database are currently being reviewed by hurricane specialists and researchers at the National Hurricane Center. 1916, 1918, 1927, 1928, and 1935 were very interesting years to reanalyze from the Category 3 hurricane that struck Mississippi in 1916 to the catastrophic Category 5 Labor Day Hurricane that struck the Florida Keys in 1935.

The outcome of this project is that the hurricane climatology for the study period is now more accurate and reliable. Future studies using this data will therefore be more accurate as well. Moreover, the methodology used to derive the revised HURDAT can be utilized in other tropical basins (e.g. Northwest Pacific Ocean, North Indian Ocean). By reanalyzing other tropical basins, a more complete and accurate global hurricane climatology can be created. The next step is to continue reanalyzing HURDAT until the entire Twentieth Century is completed. Research should then be attempt to extending back in time the database prior to 1851.

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APPENDIX A
THE ATLANTIC PRESSURE-WIND RELATIONSHIP

Table A.1: The Atlantic Pressure-Wind Relationship

ATLANTIC PRESSURE/WIND RELATIONSHIP								
Winds (knots) computed from regional P/W relationships								
P(MB)/P(IN)	GLFMEX	<25N	25-35N	35-45N	KRAFT	P(MB)		
1008/29.77	26	28	31	32	31	1008		
1007/29.74	29	31	33	35	34	1007		
1006/29.71	32	34	36	37	37	1006		
1005/29.68	34	36	38	40	40	1005		
1004/29.65	37	39	40	42	42	1004		
1003/29.62	39	41	43	44	44	1003		
1002/29.59	41	43	45	45	46	1002		
1001/29.56	43	45	46	47	48	1001		
1000/29.53	45	47	48	49	50	1000		
999/29.50	47	49	50	50	52	999		
998/29.47	49	51	52	52	54	998		
997/29.44	51	53	53	53	56	997		
996/29.41	53	55	55	55	58	996		
995/29.38	54	56	56	56	59	995		
994/29.35	56	58	58	58	61	994		
993/29.32	58	59	59	59	63	993		
992/29.30	59	61	61	60	64	992		
991/29.27	61	63	62	61	66	991		
990/29.24	62	64	63	63	67	990		
989/29.21	64	66	65	64	69	989		
988/29.18	65	67	66	65	70	988		
987/29.15	67	68	67	66	71	987		
986/29.12	68	70	68	67	73	986		
985/29.09	70	71	70	68	74	985		
984/29.06	71	72	71	69	75	984		
983/29.03	72	74	72	70	77	983		
982/29.00	74	75	73	71	78	982		
981/28.97	75	76	74	72	79	981		
980/28.94	76	78	75	73	80	980		
979/28.91	78	79	76	74	82	979		
978/28.88	79	80	77	75	83	978		
977/28.85	80	81	79	76	84	977		
976/28.82	81	83	80	77	85	976		
975/28.79	83	84	81	78	86	975		
974/28.76	84	85	82	79	87	974		
973/28.73	85	86	83	80	89	973		
972/28.70	86	87	84	80	90	972		
971/28.68	87	88	85	81	91	971		
970/28.65	89	89	85	82	92	970		
969/28.62	90	91	86	83	93	969		

Table A.1 (continued)

968/28.59	91	92	87	84	94	968
967/28.56	92	93	88	85	95	967
966/28.53	93	94	89	85	96	966
965/28.50	94	95	90	86	97	965
964/28.47	95	96	91	87	98	964
963/28.44	97	97	92	88	99	963
962/28.41	98	98	93	88	100	962
961/28.38	99	99	94	89	101	961
960/28.35	100	100	94	90	102	960
959/28.32	101	101	95	91	103	959
958/28.29	102	102	96	91	104	958
957/28.26	103	103	97	92	105	957
956/28.23	104	104	98	93	106	956
955/28.20	105	105	99	93	107	955
954/28.17	106	106	99	94	108	954
953/28.14	107	107	100	95	108	953
952/28.11	108	108	101	96	109	952
951/28.08	109	109	102	96	110	951
950/28.05	110	110	103	97	111	950
949/28.03	111	111	103	98	112	949
948/28.00	112	112	104	98	113	948
947/27.97	113	112	105	99	114	947
946/27.94	114	113	106	99	115	946
945/27.91	115	114	106	100	115	945
944/27.88	116	115	107	101	116	944
943/27.85	117	116	108	101	117	943
942/27.82	118	117	109	102	118	942
941/27.79	119	118	109	103	119	941
940/27.76	119	119	110	103	120	940
939/27.73	120	120	111	104	120	939
938/27.70	121	120	112	---	121	938
937/27.67	122	121	112	---	122	937
936/27.64	123	122	113	---	123	936
935/27.61	124	123	114	---	124	935
934/27.58	125	124	114	---	124	934
933/27.55	126	125	115	---	125	933
932/27.52	127	125	116	---	126	932
931/27.49	128	126	116	---	127	931
930/27.46	128	127	117	---	128	930
929/27.43	129	128	118	---	128	929
928/27.41	130	129	118	---	129	928
927/27.38	131	129	119	---	130	927
926/27.35	132	130	120	---	131	926
925/27.32	133	131	120	---	131	925

Table A.1 (continued)

924/27.29	134	132	121	---	132	924
923/27.26	134	133	122	---	133	923
922/27.23	135	133	122	---	134	922
921/27.20	136	134	123	---	134	921
920/27.17	137	135	124	---	135	920
919/27.14	138	136	---	---	136	919
918/27.11	139	137	---	---	136	918
917/27.08	139	137	---	---	137	917
916/27.05	140	138	---	---	138	916
915/27.02	141	139	---	---	139	915
914/26.99	142	140	---	---	139	914
913/26.96	143	140	---	---	140	913
912/26.93	143	141	---	---	141	912
911/26.90	144	142	---	---	141	911
910/26.87	145	143	---	---	142	910
909/26.84	146	143	---	---	143	909
908/26.81	147	144	---	---	143	908
907/26.79	147	145	---	---	144	907
906/26.76	148	146	---	---	145	906
905/26.73	149	146	---	---	145	905
904/26.70	150	147	---	---	146	904
903/26.67	151	148	---	---	147	903
902/26.64	151	148	---	---	147	902
901/26.61	152	149	---	---	148	901
900/26.58	153	150	---	---	149	900
899/26.55	154	151	---	---	149	899
898/26.52	---	151	---	---	150	898
897/26.49	---	152	---	---	151	897
896/26.46	---	153	---	---	151	896
895/26.43	---	153	---	---	152	895
894/26.40	---	154	---	---	153	894
893/26.37	---	155	---	---	---	893
892/26.34	---	155	---	---	---	892
891/26.31	---	156	---	---	---	891
890/26.28	---	157	---	---	---	890
889/26.25	---	157	---	---	---	889
888/26.22	---	158	---	---	---	888
P(MB)/P(IN)	GLFMEX	<25N	25-35N	35-45N	KRAFT	P(MB)

Table notes: Tabular wind values are based on following regression equations (Landsea et al, 2004):

- 1) For GLFMEX: Wind (knots) = $10.627 \cdot (1013 - p)^{0.5640}$ Sample size = 664; $r = 0.991$
- 2) For <25N Wind (knots) = $12.016 \cdot (1013 - p)^{0.5337}$ Sample size = 1033; $r = 0.994$
- 3) For 25-35N Wind (knots) = $14.172 \cdot (1013 - p)^{0.4778}$ Sample size = 922; $r = 0.996$
- 4) For 35-45N Wind (knots) = $16.086 \cdot (1013 - p)^{0.4333}$ Sample size = 492; $r = 0.974$
- 5) For Kraft Wind (knots) = $14.000 \cdot (1013 - p)^{0.5000}$ Sample size = 13; $r = ??$
- 6) Dashes indicate pressure is lower than that included in developmental data
- 7) Developmental data excludes all overland data. Data for <25N zone is from longitude 62W westward. Data for 25-35N zone is from 57.5W westward. Data for 35-45N is for 51W and westward. Gulf of Mexico includes all over water data west of a line from northeastern Yucatan to 25N, 80W. Kraft equation, developed from limited Gulf of Mexico data, is discussed in the Mariners Weather Log, September, 1971, p 157.
- 8) Wind and pressure data are from the HURDAT file, 1970-1997.
- 9) To avoid over-weighting the higher pressures, winds were averaged for each class, interval of pressure (1010-1006; 1005-1001, etc.). Each set of data were counted as one case and the midpoint of the class interval was taken as the pressure (1008, 1003, etc.). Because this method reduces the standard deviation of the sample, the correlation coefficients are inflated. Also, the sample size is reduced considerably.

APPENDIX B.1
METADATA RESULTS FOR 1916

Storm 1, 1916

21020 06/29/1916 M=12 1 SNBR= 476 NOT NAMED XING=1 SSS=3
 21020 06/28/1916 M=13 1 SNBR= 476 NOT NAMED XING=1 SSS=3

(The 28th is new to HURDAT.)

21025 06/28* 0 0 0 0* 0 0 0 0*125 795 25 0*125 798 25 0
*** ** *** **

21025 06/29* 0 0 0 0* 0 0 0 0*120 809 35 0*125 811 35 0
 21025 06/29*125 801 25 0*125 805 25 0*127 809 25 0*130 813 25 0
*** ** *** ** *** ** *** **

21030 06/30*129 814 35 0*133 816 35 0*138 818 35 0*143 822 40 0
 21030 06/30*135 817 30 0*140 821 30 0*145 825 30 0*150 828 30 0
*** ** *** ** *** ** *** **

21035 07/01*148 825 40 0*154 829 45 0*161 833 50 0*166 837 55 0
 21035 07/01*155 830 30 0*160 831 30 0*165 833 30 0*169 837 30 0
*** ** *** ** *** ** *** **

21040 07/02*170 839 55 0*175 841 60 0*180 844 65 0*185 846 70 0
 21040 07/02*172 841 35 0*176 846 35 0*180 850 40 0*185 852 45 0
*** ** *** ** *** ** *** **

21045 07/03*189 848 70 0*194 850 75 0*200 853 80 0*209 856 85 0
 21045 07/03*189 853 50 0*194 855 55 0*200 857 60 0*207 860 65 0
*** ** *** ** *** ** *** **

21050 07/04*219 860 90 0*231 864 95 0*241 867 95 0*253 870 100 0
 21050 07/04*215 864 70 0*224 867 75 0*235 870 80 0*248 872 85 0
*** ** *** ** *** ** *** **

21055 07/05*264 874 100 0*275 877 105 0*285 880 105 0*296 884 105 0
 21055 07/05*263 873 90 0*276 875 95 0*288 877 100 0*299 880 105 950
*** ** *** ** *** ** *** ** *** **

21060 07/06*305 890 90 979*313 895 60 0*321 900 50 0*327 901 40 0
 21060 07/06*308 886 80 0*317 894 55 0*324 900 45 994*328 901 40 0
*** ** *** ** *** ** *** **

21065 07/07*332 902 40 0*335 902 40 0*337 901 40 0*339 894 40 0
 21065 07/07*331 902 40 0*334 902 40 0*337 901 40 0*338 894 40 0
*** *** ***

21070 07/08*337 885 40 0*336 876 30 0*338 869 30 0*339 866 30 0
 21070 07/08*337 885 40 0*335 876 40 0*332 869 35 0*332 866 35 0
*** ** *** ** *** ** *** **

21075 07/09*340 864 25 0*342 862 25 0*345 860 20 0*348 859 20 0
 21075 07/09*334 864 30 0*337 862 30 0*340 860 25 0*343 859 25 0

```

***   **   ***   **   ***   **   ***   **
21080 07/10*351 858 20 0*354 857 20 0*358 856 20 0*362 858 20 0
21080 07/10*346 858 20 0*348 857 20 0*350 856 20 0*352 855 20 0
***           ***           ***           *** ***

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21085 HR MS3 AL3
21085 HR MS3 AL2AFL2
*****

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Minor changes to the track and major alterations to the intensity shown in Neumann et al. (1999). Evidence for these alterations comes from the Historical Weather Map series, the COADS ship database, Monthly Weather Review, the Original Monthly Records, Connor (1956), Dunn and Miller (1960), Schwerdt et al. (1979), Ho et al. (1987), and Jarrell et al. (1992).

June 28: HWM analyzed no significant features in the western Caribbean. Available observations from HWM and COADS suggest a center near 12.5N, 79.5W at 12 UTC. No gale force winds (or equivalent in pressure) were observed.

June 29: HWM indicates an open wave near of 11N, 83W. HURDAT listed this as a tropical storm at 12N, 80.9W at 12 UTC. Available observations from HWM and COADS suggest a center near 12.7N, 80.9W at 12 UTC. No gale force winds (or equivalent in pressure) were observed.

June 30: HWM analyzed a closed low of at most 1010 mb near 15N, 83.5W. HURDAT listed this as a tropical storm at 13.8N, 81.8W at 12 UTC. Available observations from HWM and COADS suggest a center near 14.5N, 82.5W at 12 UTC. No gale force winds (or equivalent in pressure) were observed.

July 1: HWM indicates a closed low of at most 1010 mb near 16N, 84W. HURDAT listed this as a tropical storm at 13N, 57.8W at 12 UTC. The MWR seasonal hurricane chart suggests a center near 16.2N, 83.8W at 12 UTC. MWR notes the track of the "Middle Gulf Storm" to be near 17.3N, 84.3W at 18 UTC. Available observations from HWM and COADS suggest a center near 16.1N, 83.3W at 12 UTC. No gale force winds (or equivalent in pressure) were observed. "The first definite indications of this disturbance were noted on the morning of July 1 at Swan Island ..., when after a day or two of unsettled weather the barometer had fallen to 29.78 inches [1009 mb]" (MWR).

July 2: HWM analyzed a closed low of at most 1010 mb near 17N, 85W. HURDAT listed this as a Category 1 hurricane at 18N, 84.4W at 12 UTC. The MWR seasonal hurricane chart suggests a center near 17.7N, 84.6W at 12 UTC. MWR notes the track of the "Middle Gulf Storm" to be near 18.2N, 84.5W at 12 UTC. Available observations from HWM and COADS suggest a center near 18N, 85W at 12 UTC. No gale force winds (or equivalent in pressure) were observed. "On the morning of the 2d it was clearly evident that the disturbance was well defined with a northward movement" (MWR).

July 3: HWM indicates a closed low of at most 1000 mb near 20N, 85.5W. HURDAT listed this as a Category 1 hurricane at 20N, 85.3W at 12 UTC. The MWR Tracks of

Lows indicate the center near 20N, 85W at 8 a.m. The MWR seasonal hurricane chart suggests a center near 20.3N, 85.5W at 12 UTC. MWR notes the track of the "Middle Gulf Storm" to be near 20N, 85.2W at 12 UTC. Available observations from HWM and COADS suggest a center near 20N, 85.7W at 12 UTC. Ship highlights: 35 kt E at 21.5N, 84.7W at ~18 UTC (MWR). "One the morning of the 3d the storm center was estimated to be about latitude 20N., longitude 85W., but the absence of radio reports prevented a more precise location ... Thus far the storm was apparently of not much intensity ... The United States Coast Guard cutter Itasca had encountered a severe disturbance on the afternoon of July 3 about 25 miles south of Cape San Antonio with a whole gale [35 kt] from the east"(MWR).

July 4: HWM analyzed a closed low of at most 995 mb near 14N, 61.5W. HURDAT listed this as a Category 2 hurricane at 24.1N, 86.7W at 12 UTC. The MWR Tracks of Lows indicate the center near 23.5N, 87W at 8 a.m. The MWR seasonal hurricane chart suggests a center near 24N, 87W at 12 UTC. MWR notes the track of the "Middle Gulf Storm" to be near 23.8N, 86.7W at 12 UTC. Available observations from HWM and COADS suggest a center near 23.5N, 87W at 12 UTC. Ship highlights: 45 kt ENE and 996 mb at 22.7N, 85.9W at 04 UTC (MWR); 55 kt E and 999 mb at 23N, 86W at ~06 UTC (MWR); 35 kt SE and 996 mb at 22.7N, 85.9W at 06 UTC (MWR). Station highlights: 49 kt (no direction) at Havana at 16 UTC (MWR); 50 kt and 1006 mb at Burrwood, Louisiana at 19 UTC (MWR). "The storm passed through the Yucatan Channel during the early night of the 3d and apparently had attained only moderate intensity until just before that channel was reached, after which there was a marked increase in its activity" (MWR).

July 5: HWM indicates a closed low of 975 mb near 28N, 87W. HURDAT listed this as a Category 3 hurricane at 28.5N, 88W at 12 UTC. The MWR Tracks of Lows indicates a low pressure of 1001 mb with a center near 28N, 89W at 8 a.m. The MWR seasonal hurricane chart suggests a center near 28.7N, 88W at 12 UTC. MWR notes the track of the "Middle Gulf Storm" to be near 28.8N, 88.5W at 12 UTC. Available observations from HWM and COADS suggest a center near 28.8N, 87.7W at 12 UTC. Ship highlights: 25 kt NE and 1002 mb at 29.7N, 90.1W at 12 UTC (COA); 5 kt ENE and 1005 mb at 22.7N, 95.2W at 12 UTC (COA). Station highlights: 90 kt SE at Pensacola at 30N, 87.6W at 1832 UTC (MWR); 961 mb (peripheral pressure) at Fort Morgan (Mobile) at 20 UTC (MWR); 93 kt at Mobile at 20 UTC (OMR). "On the morning of the 5th ... the storm center had moved across the Gulf with unusual rapidity and was near to and approaching the middle Gulf coast, and apparently somewhere between Mobile Bay and the mouth of the Mississippi River" (MWR).

July 6: HWM analyzed a closed low of at most 1005 mb near 32.5N, 90W. HURDAT listed this as a tropical storm at 32.1N, 90W at 12 UTC. The MWR Tracks of Lows indicates a low pressure of 1000 mb with a center near 33.5N, 90W at 8 a.m. The MWR seasonal hurricane chart suggests a center near 32N, 90W at 12 UTC. MWR notes the track of the "Middle Gulf Storm" to be near 33N, 90W at 12 UTC. Available observations from HWM and COADS suggest a center near 32.4N, 90W at 12 UTC. Station highlights: 85 kt SE and 984 mb at Pensacola at 00 UTC (OMR); 987 mb at Pass Christian, Mississippi at 0030 UTC (MWR); 994 mb with a N wind at Jackson,

Mississippi at 12 UTC (OMR). "Unfortunately, several lives were lost along the middle Gulf coast, mainly persons in small boats. Marine casualties were of a minor character but the aggregate losses amounted to several millions of dollars, distributed principally between the cities of Pensacola and Mobile and the agricultural sections of southeastern Mississippi and southwestern Alabama. The high tides were responsible for the major portion of the coast damage. At Mobile the tide was somewhat more than 2 feet above the previous highest tide of 9.87 feet above mean tide in September, 1906, and the entire business district was inundated. At Pensacola the tide was 5 feet above normal high tide, or 3 ½ feet lower than the highest reached during the storm of September, 1906" (MWR). July 7: HWM indicates a closed low of at most 1005 mb near 33N, 89.5W. HURDAT listed this as a tropical storm at 33.7N, 90.1W at 12 UTC. The MWR Tracks of Lows indicate the center near 31N, 89.5W at 8 a.m. The MWR seasonal hurricane chart suggests a center near 33.5N, 89.5W at 12 UTC. MWR notes the track of the "Middle Gulf Storm" to be near 33.7N, 89.7W at 18 UTC. Available observations from HWM and COADS agree with the original HURDAT analysis of 33.7N, 90.1W at 12 UTC. Station highlights: 38 kt S at Pensacola at 14 UTC (OMR); 1003 mb with a SW wind at Jackson 00 UTC (OMR). "After the morning of the 6th the storm hovered over Mississippi and Alabama for three days with steadily decreasing intensity, but with torrential rains that caused great floods and enormous damage to growing crops ... After the storm center passed inland torrential rains set in over the east Gulf State, and western Georgia and continued in the form of heavy showers for about a week. These rains of course caused enormous losses of staple crops and caused great floods in the rivers of eastern Mississippi, Alabama, and western Georgia" (MWR).

July 8: HWM analyzed a closed low of at most 1005 mb near 33N, 87W. HURDAT listed this as a tropical depression at 33.8N, 86.9W at 12 UTC. The MWR seasonal hurricane chart suggests a center near 33N, 87W at 12 UTC. MWR notes the track of the "Middle Gulf Storm" to be near 33.3N, 87W at 12 UTC. Available observations from HWM and COADS suggests a center near 33.2N, 86.9W at 12 UTC. Station highlights: 45 kt SW at Pensacola at 12 UTC (MWR); 10 kt S and 1006 mb at Birmingham at 12 UTC (OMR).

July 9: HWM indicates a closed low of at most 1005 mb near 34N, 85.5W with a weakening cold front north of the low. HURDAT listed this as a tropical depression at 34.5N, 86W at 12 UTC. The MWR seasonal hurricane chart suggests a center near 34.5N, 86.8W at 12 UTC. MWR notes the track of the "Middle Gulf Storm" to be near 34.5N, 86.5W at 12 UTC. Available observations from HWM and COADS suggest a center near 34N, 86W at 12 UTC. Station highlights: 1004 mb at Birmingham at 08 UTC (OMR); 1005 mb at Montgomery at 08 UTC (OMR); 1005 mb and a W wind at Florence, Alabama at 12 UTC (OMR).

July 10: HWM analyzed a closed low of at most 1010 mb near 35N, 85W with no significant frontal boundaries in the vicinity. HURDAT listed this as a tropical depression at 35.8N, 85.6W at 12 UTC. The MWR seasonal hurricane chart suggests a center near 36N, 86.3W at 12 UTC. MWR notes the track of the "Middle Gulf Storm" to be near 36.3N, 87W at 12 UTC. Available observations from HWM and COADS suggest a

center near 35N, 85.6W at 12 UTC. Station highlights: 10 kt W and 1006 mb at Montgomery at 00 UTC (OMR).

Genesis for storm 1 began at 12 UTC on June 28th, 24 hours earlier than previous HURDAT, in the southwest Caribbean Sea. Intensity at first occurrence is determined as a tropical depression rather than a tropical storm. The system progressed on a general northwest to north-northwest track until landfall in extreme southeast Mississippi on the 5th. Available observations suggest the system intensified slower than first indicated by HURDAT. No gale force winds or low pressures were observed until July 3rd, when the storm began to pass through the Yucatan Channel. A 35 kt wind was observed southwest of Pinar del Rio, Cuba, on the afternoon of the 3rd (MWR). 60 kt is chosen for HURDAT at 12 UTC, 20 kt less than previous HURDAT. On the 4th the hurricane emerged in the Gulf of Mexico as a Category 1 hurricane. Highest winds on the 4th were 55 kt. 80 kt is chosen for HURDAT at 12 UTC on the 4th, down 15 kt from original HURDAT. The hurricane continued to intensify on the 5th before making landfall near Pascagoula, Mississippi at 20 UTC. Lowest pressure at landfall was 961 mb (peripheral pressure) observed at Fort Morgan (Mobile), Alabama around 20 UTC. Highest observed winds were 93 kt from Mobile around 20 UTC. This wind reduces to 76 kt true after accounting for the high bias of the instrument of the era (Fergusson and Covert 1924) and adjusting to a 1 min wind (Powell et al. 1996). Connor (1956) estimated the lowest sea level pressure for this hurricane to be 28.00" [948 mb], which likely was that at the US landfall. Dunn and Miller (1960) note the occurrence as a major hurricane for Florida, Mississippi and Alabama. Ho et al (1987) noted this hurricane as possessing a 950 mb central pressure, 26 nmi radius of maximum winds (RWM), 25 kt forward speed, and a landfall point of 30.4N, 88.3W. Schwerdt et al. (1979) suggested a 94 kt maximum 1 min surface wind and environmental pressure of 1007 mb. Jarrell et al (1992) suggests a Category 3 hurricane for Mississippi and Alabama and a central pressure of 948 mb (no doubt originally from Connor). 950 mb implies winds of 110 kt from the Gulf of Mexico pressure-wind relationship. An RMW of 26 nmi is moderately larger than that expected from climatology for this latitude and central pressure (20 nmi - Vickery et al. 2000). Thus the slightly weaker value of 105 kt is retained for HURDAT at 18 UTC on the 5th and is estimated to have occurred at landfall around 21 UTC. The 950 mb central pressure at landfall is also added to HURDAT for 18 UTC on the 5th. Application of the Schwerdt et al. parametric wind model gives Category 2 wind impact in both Alabama and northwest Florida and only tropical storm conditions in Louisiana.

After landfall the system meandered over Mississippi and Alabama from the 6th through the 9th. Peak observed winds after landfall were the following: 00 UTC 6th – 85 kt (69 kt true), 06 UTC – 70 kt (57 kt true), 12 UTC – 50 kt (42 kt true), and 18 UTC – 42 kt (35 kt true). Application of the Kaplan and DeMaria (1995) model suggests winds of 79, 56, 41, and 32 kt, accordingly. Winds for revised HURDAT are reduced from 90 down to 80 kt at 00 UTC on the 6th and maintained at 60 kt at 06 UTC. A possible central pressure observation on the 6th of 994 mb at 12 UTC in Jackson, Mississippi implies winds of 56 kt. 45 kt is chosen for HURDAT at 12 UTC as the storm was well inland, a 5 kt reduction

to original HURDAT. Pensacola observed 38 kt (33 kt true) winds on the 7th, thus HURDAT is maintained at 40 kt. The system continued to produce gale force winds at Pensacola on the 8th and Birmingham observed pressures around 1006 mb. 35 kt is chosen for HURDAT, 5 kt higher than previous HURDAT. Moderately low pressures were found in Alabama as the system finally weakened to a tropical depression on the 9th. The season's first tropical cyclone was certainly an unexpected event. The unusual early-season Category 3 hurricane caused several million dollars of damage in Alabama, Florida, and Mississippi.

Storm 2, 1916

21090 07/10/1916 M=13 2 SNBR= 477 NOT NAMED XING=1 SSS=1

21090 07/10/1916 M=13 2 SNBR= 477 NOT NAMED XING=1 SSS=0

21095 07/10* 0 0 0 0*120 521 35 0*121 532 35 0*124 544 35 0

21095 07/10* 0 0 0 0*115 521 30 0*115 532 30 0*116 544 30 0
 *** ** *** ** *** **

21100 07/11*126 556 35 0*128 567 35 0*130 578 35 0*136 587 35 0

21100 07/11*117 556 30 0*118 567 30 0*120 578 30 0*124 588 30 0
 *** ** *** ** *** ** *** ** **

21105 07/12*145 598 35 0*153 608 35 0*160 617 35 0*165 626 35 0

21105 07/12*130 598 30 0*137 608 30 0*145 617 30 0*154 627 30 0
 *** ** *** ** *** ** *** ** **

21110 07/13*173 635 35 0*179 643 40 0*184 651 45 0*188 657 45 0

21110 07/13*164 638 30 0*175 650 30 0*184 660 30 0*189 667 30 0
 *** ** ** *** ** ** *** ** *** ** **

21115 07/14*191 661 50 0*194 666 50 0*198 672 55 0*203 675 60 0

21115 07/14*192 672 35 0*194 676 35 0*195 680 40 0*196 683 40 0
 *** ** ** *** ** *** ** ** *** ** **

21120 07/15*208 679 65 0*212 683 70 0*217 687 75 0*222 690 75 0

21120 07/15*198 686 45 0*201 688 45 0*205 690 50 0*209 691 50 0
 *** ** ** *** ** ** *** ** ** *** ** **

21125 07/16*227 694 80 0*231 697 85 0*238 700 90 0*243 704 90 0

21125 07/16*213 692 55 0*217 693 55 0*222 695 60 0*228 699 60 0
 *** ** ** *** ** ** *** ** ** *** ** **

21130 07/17*247 707 95 0*253 711 95 0*260 715 100 0*268 719 100 0

21130 07/17*235 706 65 0*242 714 65 0*250 720 70 0*260 723 70 0
 *** ** ** *** ** ** *** ** *** *** **

21135 07/18*276 723 105 0*283 726 105 0*291 728 105 0*300 731 105 0

21135 07/18*270 724 75 0*280 726 75 0*291 728 75 0*302 730 75 0

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21140 07/19*309 732 100 0*318 733 100 0*328 733 95 0*338 732 95 0
21140 07/19*312 732 75 0*322 733 75 980*332 733 75 0*341 731 75 0
*** ** *
*** ** *
*** ** *
*** ** *

21145 07/20*347 731 90 0*356 730 90 0*366 728 90 0*376 725 85 0
21145 07/20*349 729 75 0*357 727 75 0*366 725 75 0*376 723 75 0
*** ** *
*** ** *
*** ** *
*** ** *

21150 07/21*388 720 85 0*399 714 80 0*411 709 75 0*425 701 65 0
21150 07/21*388 721 70 0*399 718 65 0*411 714 60 993*430 704 45 1001
*** ** *
*** ** *
*** ** *
*** ** *

21155 07/22*447 687 55 0*469 662 45 0E485 626 35 0E510 555 30 0
21155 07/22*447 684 40 0*469 655 35 0E485 617 30 0E510 565 30 0
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*** ** *
*** ** *
*** ** *

21160 HR MA1
21160 HR
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Minor changes to the track and major alterations to the intensity shown in Neumann et al. (1999). Evidence for these alterations comes from the Historical Weather Maps series, the COADS ship database, Original Monthly Records, Monthly Weather Review, Dunn and Miller (1960), Roth and Cobb (2001), and Boose et al. (2001).

July 10: HWM analyzed no significant features near the Lesser Antilles. HURDAT listed this as a tropical storm at 12.1N, 53.2W at 12 UTC. Available observations from HWM and COADS suggest a center near 11.5N, 53.2W at 12 UTC. No gale force winds (or equivalent in pressure) were observed.

July 11: HWM indicates a closed low of at most 1012.5 mb near 11N, 57.5W. HURDAT listed this as a tropical storm at 13.0N, 57.8W at 12 UTC. Available observations from HWM and COADS suggest a center near 12N, 57.8W at 12 UTC. No gale force winds (or equivalent in pressure) were observed.

July 12: HWM analyzed a closed low of at most 1012.5 mb near 14N, 61.5W. HURDAT listed this as a tropical storm at 16.0N, 61.7W at 12 UTC. The MWR seasonal hurricane chart suggests a center near 14.8N, 61.2W at 12 UTC. Available observations from HWM and COADS suggest a center near 14.5N, 61.7W at 12 UTC. No gale force winds (or equivalent in pressure) were observed.

July 13: HWM indicates a closed low of at most 1010 mb near 18N, 65W. HURDAT listed this as a tropical storm at 18.4N, 65.1W at 12 UTC. The MWR seasonal hurricane chart suggests a center near 17.8N, 65W at 12 UTC. Available observations from HWM and COADS suggest a center near 18.4N, 66W at 12 UTC. No gale force winds (or equivalent in pressure) were observed.

July 14: HWM analyzed a closed low of at most 1010 mb near 20N, 67.5W. HURDAT listed this as a tropical storm at 19.8N, 67.2W at 12 UTC. The MWR Tracks of Lows

indicate the center near 19.5N, 67.5W at 8 a.m. The MWR seasonal hurricane chart suggests a center near 19.5N, 67.3W at 12 UTC. Available observations from HWM and COADS suggest a center near 19.5N, 68W at 12 UTC. Ship highlights: 35 kt ESE and 1021 mb at 27.1N, 67.0W at 12 UTC (COA).

July 15: HWM indicates a closed low of at most 1000 mb near 20N, 68.5W. HURDAT listed this as a Category 1 hurricane at 21.7N, 68.7W at 12 UTC. The MWR Tracks of Lows indicate the center near 21N, 69W at 8 a.m. The MWR seasonal hurricane chart suggests a center near 20.6N, 68.5W at 12 UTC. Available observations from HWM and COADS suggest a center near 20.5N, 69W at 12 UTC. Ship highlights: 50 kt E and 1015 mb at 25.9N, 66.5W at 12 UTC (COA); 45 kt SE and 1016 mb at 24.5N, 64.5W at 12 UTC (COA).

July 16: HWM analyzed a closed low of at most 995 mb near 21.5N, 69W. HURDAT listed this as a Category 2 hurricane at 23.8N, 70W at 12 UTC. The MWR Tracks of Lows indicate the center near 23.5N, 70W at 8 a.m. The MWR seasonal hurricane chart suggests a center near 21.7N, 69.5W at 12 UTC. Available observations from HWM and COADS suggest a center near 22.2N, 69.5W at 12 UTC. Ship highlights: 30 kt SW and 1002 mb at 21.8N, 67.4W at 16 UTC (COA); 50 kt ENE and 1010 mb at 25.3N, 66.2W at 16 UTC (COA).

July 17: HWM indicates a closed low of 990 mb near 24N, 70.5W. HURDAT listed this as a Category 3 hurricane at 26.0N, 71.5W at 12 UTC. The MWR Tracks of Lows indicate the center near 25N, 72W at 8 a.m. The MWR seasonal hurricane chart suggests a center near 24N, 71.5W at 12 UTC. Available observations from HWM and COADS suggest a center near 25N, 72W at 12 UTC. Ship highlights: 45 kt ESE and 1006 mb at 27.5N, 67.5W at 08 UTC (COA); 35 kt N and 995 mb at 24.3N, 74.3W at 12 UTC (COA); 45 kt SE and 1012 mb at 24.9N, 66.1W at 12 UTC (COA). “On the morning of the 17th it was central at approximately 23N, 73W with a northward tendency” (MWR).

July 18: HWM analyzed a closed low of 985 mb near 30N, 73W. HURDAT listed this as a Category 3 hurricane at 29.1N, 72.8W at 12 UTC. The MWR Tracks of Lows indicate the center near 29N, 74W at 8 a.m. The MWR seasonal hurricane chart suggests a center near 29.2N, 73W at 12 UTC. Available observations from HWM and COADS agree with the HURDAT analysis of 29.1N, 72.8W at 12 UTC. Ship highlights: 35 kt ENE and 1000 mb at 31.6N, 74.7W at 12 UTC (COA); 45 kt SE and 1008 mb at 31.2N, 71.2W at 12 UTC (COA); 55 kt ENE and 1000 mb at 31.0N, 73.0W at 20 UTC (MWR). “The evening of the 18th, the storm center was about at 30N, 74W with a northward movement” (MWR).

July 19: HWM indicates a closed low of 980 mb near 24N, 75W. HURDAT listed this as a Category 2 hurricane at 32.8N, 73.3W at 12 UTC. The MWR Tracks of Lows indicate the center near 33.5N, 75W at 8 a.m. The MWR seasonal hurricane chart suggests a center near 33.4N, 73W at 12 UTC. Available observations from HWM and COADS suggest a center near 33.2N, 73.3W at 12 UTC. Ship highlights: 70 kt ESE and 991 mb at ~32.5N, ~73.0W at 04 UTC (MWR); 980 mb (central pressure) at ~32.5N, ~73.0W at 06 UTC (MWR); 45 kt SW at 32.3N, 73.0W at 12 UTC (COA). When the ship the *S.S. Ausable* intercepted the hurricane around 06 UTC, “the wind continued east-southeasterly

until the ship was in the center of the hurricane, when the barometer read 28.94 inches [980 mb]" (MWR).

July 20: HWM analyzed a closed low of 985 mb near 36.5N, 71.5W. HURDAT listed this as a Category 2 hurricane at 36.6N, 72.8W at 12 UTC. The MWR Tracks of Lows indicate the center near 37N, 74.5W at 8 a.m. The MWR seasonal hurricane chart suggests a center near 37N, 72.8W at 12 UTC. Available observations from HWM and COADS suggest a center near 36.6N, 72.5W at 12 UTC. Ship highlights: 35 kt W and 997 mb at 34.3N, 74.1W at 01 UTC (COA); 35 kt NW and 1001 mb at 35.1N, 74.1W at 11 UTC (COA); 35 kt W and 1005 mb at 34.5N, 74.4W at 12 UTC (COA). Station highlights: 42 kt at Norfolk (Roth and Cobb). "On the morning of the 20th the storm was apparently central at 37N, 74W with a tendency toward a slight recurve to the northeastward" (MWR).

July 21: HWM indicates an approaching frontal system from the west while the system retained a closed low of 995 mb near of 41N, 72W. HURDAT listed this as a Category 1 hurricane at 41.1N, 70.9W at 12 UTC. The MWR Tracks of Lows indicate the center near 41.5N, 72W at 8 a.m. Available observations from HWM and COADS suggests a center near 41.1N, 71.4W at 12 UTC. Ship highlights: 20 kt E and 998 mb at 41.5N, 71.3W at 12 UTC (COA). Station highlights: 40 kt E at Block Island at 09 UTC (OMR); 20 kt N and 995 mb (peripheral pressure) at Block Island at 12 UTC (OMR); 43 kt SW at Nantucket, Massachusetts at 15 UTC (OMR); 11 kt N and 1001 mb (central pressure) at Portland at 20 UTC (OMR). "On the morning of the 21st the storm was central south of and very near the New England coast, the barometer reading this day of 29.38 inches [995 mb] at Block Island, R.I ... striking the southern New England coast with diminished intensity" (MWR).

July 22: HWM analyzed a frontal boundary paralleling the U.S. northeast coastline and the Canadian Maritime Provinces. HURDAT listed this as an extra-tropical storm at 48.5N, 62.6W at 12 UTC. The MWR Tracks of Lows indicate the center near 47.5N, 62W at 8 a.m. Available observations from HWM and COADS suggest a center near 48.5N, 61.7W at 12 UTC. Ship highlights: 15 kt W and 1003 mb at 12 UTC (COA). Station highlights: 5 kt SW and 1005 mb at Portland, Massachusetts at 00 UTC (OMR); 10 kt SW and 1006 mb at Boston, Massachusetts at 00 UTC (OMR). "The storm continued northeastward with diminishing intensity and without strong winds north of Massachusetts. By the morning of the 22nd this storm had passed into Newfoundland" (MWR).

Genesis for storm 2 is retained at 06 UTC on July 10th. The storm's intensity is initially analyzed as a tropical depression rather than a tropical storm. A rather weak vortex for the first few days of its existence is supported by MWR's assertion that the system had its origins over the central Lesser Antilles around the 12th. The storm originated southeast of Barbados on the 10th and progressed on a general west-northwest to northwest track through the eastern Caribbean Sea. The first gale force observations near the storm occurred on July 15th as a ship observed 50 kt winds. 50 kt is chosen for HURDAT at 12 UTC on the 15th, 25 kt less than originally. On the 16th, a wind of 50 kt was again observed by ship with an additional peripheral pressure observation of 1002 mb. 1002 mb

implies winds of at least 43 kt from the southern pressure-wind relationship. 60 kt is chosen for HURDAT at 12 UTC on the 16th, 30 kt less than previously in HURDAT. The storm became a hurricane on the 17th as it began to progress on more of a north-northwest track. A peripheral pressure of 995 mb was observed on the 17th, implying winds of at least 56 kt from the southern pressure-wind relationship. 70 kt is chosen for HURDAT at 12 UTC, 30 kt less than previous HURDAT. Peak wind observations on the 18th were 55 kt. 75 kt is chosen for HURDAT at 12 UTC, 30 kt less than originally. A central pressure of 980 mb was observed on the 19th at 06 UTC (and added to the HURDAT record), implying winds of 75 kt from the subtropical pressure-wind relationship. 75 kt is chosen for HURDAT at 06 UTC on the 19th, a 25 kt downgrade. On the 20th, a peripheral pressure of 997 mb was observed around 00 UTC, implying winds of at least 53 kt from the northern and subtropical pressure-wind relationships. For continuity, 75 kt is chosen for HURDAT at 00 and 12 UTC, 15 kt less than previously. The storm made landfall near 41.4N, 71.2W around 12 UTC on July 21st. Peak observations at landfall were 43 kt SW winds at Nantucket at 14 UTC on the 21st and 995 mb at Block Island at 11-12 UTC. The low pressure at Block Island was accompanied by 20 kt N winds making it a peripheral pressure. The central pressure at landfall was likely around 993 mb, which would imply winds of 59 kt from the northern pressure-wind relationship (central pressure also added to HURDAT). Boose et al. analyzed the radius of maximum winds (RMW) to be around 27 nmi, moderately smaller than climatology of 36 nmi (Vickery et al., 2000). Environmental pressures at landfall were quite low – around 1007 mb outer closed isobar – as a moderately strength cold front was approaching the storm during the landfall. Thus given the storm's moderately small RWM but in a low environmental pressure, 60 kt is chosen for HURDAT at 12 UTC on the 21st, a 15 kt downgrade. This reduces the intensity at landfall to tropical storm strength and removes the Category 1 hurricane impact for Massachusetts from HURDAT. This agrees with the rather minimal impacts that this system caused at landfall, the weak winds observed and also Dunn and Miller's characterization of the system's intensity at landfall in the Rhode Island and Cape Cod area as "Minor" (meaning less than hurricane intensity). A downgrade to tropical storm intensity at landfall also is in agreement with the recommendations by Boose et al. and E. Boose (personal communication), based upon the observed wind impact on structures in New England. The system weakened rapidly as it raced off towards the northern latitudes on the 21st and 22nd. Portland observed a pressure of 1001 mb and winds of 11 kt N at 20 UTC on the 21st, which may have been a central pressure (and is added into HURDAT). 1001 mb central pressure suggests winds of 47 kt from the northern pressure-wind relationship. 45 kt is chosen for HURDAT at 18 UTC on the 21st. The system transitioned to an extratropical storm by 12 UTC. Overall, the storm is analyzed to be significantly weaker than original HURDAT; however, the system did attain Category 1 hurricane intensity from the 17th to the 21st.

Storm 3, 1916

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21165 07/11/1916 M= 5 3 SNBR= 478 NOT NAMED XING=1 SSS=1
21165 07/11/1916 M= 5 3 SNBR= 478 NOT NAMED XING=1 SSS=2

21170 07/11* 0 0 0 0*253 724 40 0*256 735 40 0*261 743 45 0
21170 07/11* 0 0 0 0*259 712 40 0*265 720 40 0*271 728 45 0
                *** ***                *** ***                *** ***

21175 07/12*265 750 50 0*270 757 60 0*277 763 60 0*284 768 70 0
21175 07/12*277 736 50 0*282 744 60 0*287 752 60 0*292 760 70 0
                *** ***                *** ***                *** ***

21180 07/13*290 772 75 0*296 776 80 0*302 779 85 0*309 782 85 0
21180 07/13*297 769 75 0*302 777 80 0*307 784 90 0*313 789 100 0
                *** ***                *** ***                *** *** **                *** *** **

21185 07/14*316 786 85 0*324 790 75 0*330 797 60 983*336 803 55 0
21185 07/14*320 792 100 0*326 794 85 973*332 797 65 0*337 802 55 0
                *** *** **                *** *** **                *** *** **                *** *** **

21190 07/15*343 813 50 0*348 820 45 0*352 830 30 0* 0 0 0 0
21190 07/15*342 809 50 0*346 818 45 0*350 827 35 0*354 836 30 0
                *** ***                *** ***                *** *** **                *** *** **

21195 HR SC1
21195 HR SC2
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Minor changes to the track and the intensity shown in Neumann et al. (1999). Evidence for these alterations comes from the Historical Weather Maps series, the COADS ship database, Original Monthly Records, Monthly Weather Review, Dunn and Miller (1960), Ho et al. (1987), and Jarrell et al. (1992).

July 11: HWM analyzed a closed low of at most 1015 mb near 27N, 72W. HURDAT listed this as a tropical storm at 25.6N, 73.5W at 12 UTC. The MWR seasonal hurricane chart suggests a center near 24.5N, 74.2W at 12 UTC. Available observations from HWM and COADS suggest a center near 26.5N, 72W at 12 UTC. No gale force winds (or equivalent in pressure) were observed.

July 12: HWM indicates a closed low of 995 mb near 29.5N, 76W. HURDAT listed this as a tropical storm at 27.7N, 76.3W at 12 UTC. The MWR Tracks of Lows indicates a low pressure of 1009 mb near 29N, 76.5W at 12 UTC. The MWR seasonal hurricane chart suggests a center near 26.3N, 76W at 12 UTC. Available observations from HWM and COADS suggest a center near 28.7N, 75.2W at 12 UTC. Ship highlights: 35 kt SW and 1009 mb at 28.4N, 74.7W at 12 UTC (COA); 35 kt NE and 1016 mb approximately 50 miles south of Charleston at 16 UTC (MWR). "On July 12 a vessel radio report from about 27N, 72.5W gave the first notice of this disturbance" (MWR).

July 13: HWM analyzed a closed low of 960 mb near 31N, 84W. HURDAT listed this as a Category 2 hurricane at 30.2N, 76.3W at 12 UTC. The MWR Tracks of Lows indicate the center near 31N, 78W at 12 UTC. The MWR seasonal hurricane chart suggests a center near 29.2N, 78.2W at 12 UTC. Available observations from HWM and COADS suggest a center near 30.7N, 78.4W at 12 UTC. Ship highlights: 55 kt NNE and 1011 mb approximately 50 miles south of Charleston at 12 UTC (MWR); 70 kt NE and 971 mb at 31.7N, 78.9W at 18 UTC (MWR); 70 kt ENE and 961 mb at 31.8N, 78.9W at 1930 UTC (MWR). Station highlights: 38 kt N at Savannah at 18 UTC (OMR); 45 kt NE at Charleston at 18 UTC (MWR); 56 kt at Charleston at 21 UTC (OMR). “The U.S.S. Hector reported a barometer reading (aneroid) of 28.37 inches [961 mb] which, upon subsequent comparison of the instrument, is thought to be reasonably accurate” (MWR).

July 14: HWM indicates a closed low of 990 mb just inland over South Carolina near 33N, 80.5W. HURDAT listed this as a tropical storm at 33N, 79.7W at 12 UTC. The MWR Tracks of Lows indicate a low pressure of 996 mb near 33.5N, 80W at 12 UTC. The MWR seasonal hurricane chart suggests a center near 33N, 80W at 12 UTC. Available observations from HWM and COADS suggest a center near 33.2N, 79.7W at 12 UTC. Ship highlights: 70 kt E and 971 mb at 31.8N, 78.8W at 00 UTC (MWR); 70 kt SE and 976 mb at 31.9N, 78.8W at 02 UTC (MWR); 70 kt S and 985 mb at 32N, 78.8W at 04 UTC (MWR). Station highlights: 987 mb at Georgetown, South Carolina, at 07 UTC (MWR); 55 kt NW and 983 mb at Charleston at 08 UTC (OMR); 997 mb at Columbia at 2045 UTC (OMR). “This storm passed inland over or very near Charleston about 4 a.m. of the 14th, with a lowest barometer reading of 29.02 inches [983 mb] ... It was of unusual severity, though its path of destructiveness was comparatively narrow ... The material damage locally was not great. Most houses suffered minor damage to roofs and consequent water damage. Some signs were blown down and a few valuable plate-glass windows were broken. No large vessels suffered material injury, though a number of small boats were sunk at their wharves, and a few of them were crushed, though most of them suffered only minor damage ... One of the most lamentable results of the storm from a community point of view was the damage to shade trees, the soaking rain and the shifting winds combining to uproot many of them. There were two lives lost in Charleston and vicinity ... The damage south of Charleston to North Edisto River seems to have been confined almost wholly to crop injury. To the northward the destruction was much greater. Large tracks of cultivated land in McClellanville section were inundated Friday morning, causing a total loss of crops. Water stood 4 or 5 feet deep in the town and left a heavy deposit of sea sledge covering dead animals and fowls. The tide is said to have been higher than in 1893 or 1911 ... The crop damage from about 15 to 20 miles northeast of Charleston on to McClellanville and the Santee River is estimated by the competent to judge at from 75 to 90 per cent. Almost all the trees in McClellanville were uprooted. Numerous houses were blown down, but they were of flimsy construction. Loss of live stock was rather heavy from wrecking of barns, and some hogs and other small animals were drowned. Notwithstanding the great material damage there was no loss of human life. In Georgetown the damage was apparently little worse than in Charleston, except that the tide rose higher and is said to have damaged some goods in stores on the water front ... North of Georgetown the storm was less

severe, though the tide was very high at Pawleys Island and Murrels Inlet. No damage of consequence occurred there, however, or at Myrtle Beach, farther up the coast. The hurricane is believed to have been one of the most severe that has visited this coast since the Weather Bureau was established, but its destructive effects were confined to unusually narrow limits. This is due partly at least to the fact that its course was practically normal to the coast line. Its center is thought to have passed inland over Bulls Bay, about 25 miles northeast of Charleston and some 10 miles southwest of McClellanville ...It is practically impossible at this time to estimate with any degree of accuracy the total losses occasioned by the hurricane ...It will certainly run high into the millions if the floods which resulted from the storm's inland progress be taken into account" (MWR).

July 15: HWM analyzed a closed low of at most 1010 mb inland over Alabama near 34N, 87W. HURDAT listed this as a tropical depression at 35.2N, 83W at 12 UTC. The MWR Tracks of Lows indicate the center near 35N, 86.5W at 12 UTC. The MWR seasonal hurricane chart suggests a center near 35.2N, 82W at 12 UTC. Available observations from HWM and COADS suggest a center near 35N, 82.7W at 12 UTC. Station highlights: 47 kt E and 1008 mb at Charlotte at 00 UTC (OMR); 49 kt at Charlotte at 03 UTC (OMR); 52 kt E at Charlotte at 04 UTC (OMR). "On the morning of the 15th the remnants of the storm were lost in the mountains of western North Carolina" (MWR).

Genesis for storm number 3 is retained at 06 UTC on July 11th as a minimal tropical storm in the western Atlantic Ocean. The system originated just northeast of the Bahamas and progressed on a northwestward track throughout its lifetime. Gale force winds were first observed on the 12th as a ship recorded 35 kt winds. 60 kt is retained for HURDAT at 12 UTC on the 12th because of the hurricane intensity reports on the following day. The storm deepened rapidly on the 12th and 13th. A peripheral pressure of 961 mb was observed late on the 13th, implying winds of at least 94 kt from the subtropical pressure-wind relationship. 100 kt is chosen for HURDAT at 18 UTC, a 15 kt upgrade from original HURDAT. A peripheral pressure of 971 mb along with hurricane force winds was observed early on the 14th implying winds of at least 85 kt from the subtropical pressure-wind relationship. The hurricane made landfall near Bulls Bay, South Carolina, around 08 UTC on the 14th. This reading was taken about eight hours before landfall. A value of 983 mb was included originally in HURDAT for 12 UTC on the 14th. This pressure reading was likely that of Charleston at 08 UTC on the 14th, which as it was accompanied by 55 kt NW wind indicates that it was a peripheral pressure measurement, not a central pressure. Thus 983 mb is removed from HURDAT. It is of note that Ho et al. did not analyze this US landfalling hurricane – implying that it was of central pressure higher than 982 mb (possibly because of this 983 mb observation). Dunn and Miller list this as a "minimal" (Category 1 or 2) hurricane causing severe flooding in South Carolina. Jarrell et al. analyzed a 980 mb central pressure at landfall. However, because of the 971 mb peripheral pressure/hurricane force wind readings eight hours before landfall and the 983 mb/55 kt wind readings from Charleston, a slightly lower central pressure is estimated for landfall: 973 mb. 973 mb suggests winds of 83 kt from the subtropical pressure-wind relationship. The system is described as "small in area" (which

could increase the pressure gradient and winds), but was also moving slowly at landfall (which would decrease the winds on the strong semicircle), so 85 kt is chosen for HURDAT at 06 UTC and also at landfall a couple hours later. This is a 10 kt increase from the original HURDAT and it does upgrade the system from a Category 1 to Category 2 hurricane impact for South Carolina. Peak observed winds after landfall were the following: 12 UTC 14th – 60 kt (ship), 18 UTC – 45 kt (ship), 00 UTC 15th – 47kt, 06 UTC – 52 kt. These last two values reduce down to 40 and 43 kt, respectively, after for correcting for the high bias of the anemometers of the era (Fergusson and Covert 1924) and adjusting from 5 to 1 min winds (Powell et al. 1996.) Application of the Kaplan and DeMaria (1995) model suggests winds of 66, 49, 34, and 24 kt, accordingly. Winds for HURDAT after landfall were analyzed to be 65 kt (5 kt increase), 55 kt (no change), 50 kt (no change), and 45 kt (no change), respectively. MWR notes this storm as, “moderately severe in intensity and of small area”.

Storm 4, 1916

21200 08/12/1916 M= 8 4 SNBR= 479 NOT NAMED XING=1 SSS=3
21200 08/12/1916 M= 9 4 SNBR= 479 NOT NAMED XING=1 SSS=4

21205 08/12* 0 0 0 0*140 550 60 0*140 564 60 0*140 579 70 0
21205 08/12* 0 0 0 0*134 550 35 0*135 564 40 0*136 578 40 0
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21210 08/13*141 594 75 0*142 610 75 0*143 625 80 0*143 641 80 0
21210 08/13*138 592 45 0*139 606 45 0*140 620 50 0*141 636 50 0
*** ** ** *** ** ** *** ** ** *** ** **

21215 08/14*145 657 85 0*147 674 85 0*150 690 85 0*153 704 85 0
21215 08/14*142 653 55 0*143 669 60 0*145 685 60 0*147 700 60 0
*** ** ** *** ** ** *** ** ** *** ** **

21220 08/15*156 715 85 0*161 728 85 0*165 740 90 0*173 756 90 0
21220 08/15*150 713 65 0*154 726 65 0*160 740 70 0*168 756 70 0
*** ** ** *** ** ** *** ** ** *** ** **

21225 08/16*180 771 95 0*187 790 95 0*194 807 95 0*199 823 100 0
21225 08/16*178 773 75 0*189 790 75 0*198 807 80 0*205 824 85 0
*** ** ** *** ** ** *** ** ** *** ** **

21230 08/17*204 838 100 0*209 854 105 0*218 871 105 0*225 887 105 0
21230 08/17*210 841 90 0*215 858 95 0*220 876 105 0*228 894 110 0
*** ** ** *** ** ** *** ** ** *** ** **

21235 08/18*231 902 110 0*240 920 110 0*253 947 110 948*262 964 100 0
21235 08/18*237 912 115 0*246 930 120 0*255 947 120 0*264 963 120 932
*** ** ** *** ** ** *** ** ** *** ** **

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21240 08/19*271 980 65 0*279 996 50 0*2911009 35 0*3121014 30 0
21240 08/19*273 978 95 948*282 993 65 0*2911007 40 0*3011017 30 0
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(The 20th is new to HURDAT.)

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21242 08/20*3121025 25 0* 0 0 0 0* 0 0 0 0* 0 0 0 0

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21245 HRATX3

21245 HRATX4

Minor changes to the track and major alterations to the intensity shown in Neumann et al. (1999). Evidence for these alterations comes from the Historical Weather Maps series, the COADS ship database, Original Monthly Records, Monthly Weather Review, Connor (1956), Dunn and Miller (1960), Schwerdt et al (1979), Ho et al (1987), Ellis (1988), and Jarrell et al. (1992).

August 12: HWM analyzed an inverted trough near 13N, 56W. HURDAT listed this as a tropical storm at 14N, 56.4W at 12 UTC. The MWR seasonal hurricane chart suggests a center near 14N, 56.5W at 12 UTC. Available observations from HWM and COADS suggest a center near 13.5N, 56.4W at 12 UTC. Ship highlights: 35 kt NE and 1015 mb at 15.8N, 56.5W at 12 UTC (COA). "...first observed on the morning of the 12th in the vicinity of Barbados" (MWR).

August 13: HWM indicates a closed low of at most 1010 mb near 13.5N, 62W. HURDAT listed this as a Category 1 hurricane at 14.3N, 62.5W at 12 UTC. The MWR seasonal hurricane chart suggests a center near 14.5N, 62W at 12 UTC. Available observations from HWM and COADS suggest a center near 14N, 62W at 12 UTC. No gale force winds (or equivalent in pressure) were observed.

August 14: HWM analyzed a closed low of at most 1005 mb near 15N, 68W. HURDAT listed this as a Category 2 hurricane at 15N, 69W at 12 UTC. The MWR seasonal hurricane chart suggests a center near 15.3N, 68.2W at 12 UTC. Available observations from HWM and COADS suggest a center near 14.5N, 68.5W at 12 UTC. No gale force winds (or equivalent in pressure) were observed.

August 15: HWM indicates a closed low of at most 1000 mb near 15.5N, 74W. HURDAT listed this as a Category 2 hurricane at 16.5N, 74W at 12 UTC. The MWR seasonal hurricane chart suggests a center near 16.5N, 74.6W at 12 UTC. Available observations from HWM and COADS suggest a center near 16N, 74W at 12 UTC. Ship highlights: 25 kt NE and 1005 mb at 17.9N, 75.2W at 12 UTC (COA); 30 kt NE and 1006 mb at 18.9N, 76W at 17 UTC (COA); 35 kt E and 1004 mb at 19.5N, 76W at 23 UTC (COA). Station highlights: 15 kt N and 1006 mb at Jamaica at 12 UTC (HWM). MWR notes the storm as, "passed westward a short distance south of Jamaica on the 15th and into the Gulf of Mexico by way of the Yucatan Channel on the night of the 16th".

August 16: HWM analyzed a closed low of 990 mb near 19N, 81W. HURDAT listed this as a Category 2 hurricane at 19.4N, 80.7W at 12 UTC. The MWR seasonal hurricane chart suggests a center near 18.8N, 81W at 12 UTC. Available observations from HWM

and COADS suggest a center near 19.8N, 80.7W at 12 UTC. Ship highlights: 30 kt W and 998 mb at 19.3N, 83.7W at 20 UTC (COA); 35 kt WSW and 1000 mb at 19.3N, 83.7W at 23 UTC (COA).

August 17: HWM indicates a closed low of 975 mb near 22N, 88.5W just north of the Yucatan of Mexico. HURDAT listed this as a Category 3 hurricane at 21.8N, 87.1W at 12 UTC. The MWR Tracks of Lows indicate the center near 22N, 87.5W at 12 UTC. The MWR seasonal hurricane chart suggests a center near 22.3N, 87.5W at 12 UTC.

Available observations from HWM and COADS suggest a center near 22N, 87.6W at 12 UTC. Ship highlights: 35 kt E and 1014 mb at 25.5N, 85.8W at 12 UTC (COA); 30 kt S and 1006 mb at 21.7N, 89.7W at 23 UTC (COA).

August 18: HWM analyzed a closed low of 950 mb near 25.5N, 94W. HURDAT listed this as a Category 3 hurricane at 25.3N, 94.7W at 12 UTC. The MWR Tracks of Lows indicate the center near 26N, 95W at 12 UTC. The MWR seasonal hurricane chart suggests a center near 25.5N, 94W at 12 UTC. Available observations from HWM and COADS suggest a center near 25.5N, 94.7W at 12 UTC. Station highlights: 15 kt N and 1006 mb at Brownsville at 12 UTC (OMR); 984 mb at Corpus Christi at 2315 UTC (MWR); 78 kt E at Corpus Christi at 2250 UTC (MWR). "It was approaching the south Texas coast on the morning of the 18th, and passed inland between Corpus Christi and Brownsville the afternoon and evening of the 18th" (MWR).

August 19: HWM indicates a closed low of 975 mb near 28.5N, 101W inland over northeast Mexico. HURDAT listed this as a tropical storm at 34N, 100.9W at 12 UTC. The MWR Tracks of Lows indicate the center near 29N, 102W at 12 UTC. Available observations from HWM and COADS suggest a center near 29.1N, 100.7W at 12 UTC. Station highlights: 948 mb (a likely central pressure) at Kingsville, Texas, at 0115 UTC (MWR); 40 kt SE and 1003 mb at San Antonio at 06 UTC (OMR); 971 mb (peripheral pressure) at Del Rio, Texas, at 1130 UTC (MWR). "At the office of the Santa Gertrudis ranch at Kingsville, 14 miles north of Riviera, the aneroid barometer was carefully watched by Mr. J.B. Wright, the manager of the ranch, and he took the lowest reading of 28.00 [948 mb] inches at 8:15 p.m. [0115 UTC on the 19th] ... Six lives were lost by the foundering of the coastwise steamer Pilot Boy off Port Aransas, Tex.; three additional lives were lost by drowning along the coast near Corpus Christi, Tex., and six at various interior points, as a result of hurricane winds in the lower Rio Grande Valley. Newspaper reports place the damage sustained in southwest Texas at \$1,800,000. The damage, while largely confined to coast regions, was more or less general over a wide area. In the interior, crops were badly damaged by wind and rain and windmills, fences, and barns were blown down....The cities of Bishop, Kingsville, and Corpus Christi being the largest sufferers. In Corpus Christi it was the water front that sustained the heaviest damage. All the wharves and most of the buildings on the wharves were destroyed; even the solid timber head of the municipal wharf was unfloored, taking down the storm-warning display tower. Hardly a property in Corpus Christi escaped without damage of some kind, and vegetation where not destroyed suffered heavily ... there can be no question but that the storm was a fully developed hurricane with a central pressure at least 1 inch lower [950 mb] than that observed at Corpus Christi [984 mb]. The relatively low property losses along the coast must be ascribed to the rapidity with which the storm

advanced and passed. Because of this rapidity of movement its chance of creating a big tidal wave were greatly diminished. Also it must be borne in mind that the whole length of the Texas coast is protected by sand islands stretching from the mouth of the Rio Grande to Galveston, with few inlets and sparsely settled ... After passing inland a short distance wouth of Corpus Christi, the cyclone continued to move in a west-northwest direction, reaching Del Rio, Tex., at about 7:30 a. m. local mean time August 19, with a minimum pressure of 28.69 inches [971 mb]. Since it passed Corpus Christi, 200 miles distant, 12 hours earlier, we may assign it a movement of about 17 miles per hour. The recovery of the pressure after the passage of the center of the storm was extremely rapid ... The next observing station in the path of the storm is El Paso, Tex., distant about 300 miles. The barograph at that and other stations in that vicinity do not show any trace of the storm in question; we must therefore consider that it dissipated over southwest Texas during the daylight hours of the 19th" (MWR).

August 20: HWM shows an open trough along the Texas-New Mexico border. Thus it is analyzed that the system had dissipated by 12 UTC. Available observations from HWM, COADS, and OMR suggest a center near 31.2N, 102.5W at 00 UTC. No gale force winds (or equivalent in pressure) were observed.

Genesis is retained for storm 4 at 06 UTC on August 12th as a tropical storm just west of the Lesser Antilles. Peak observed winds on the 12th were noted as 35 kt. 40 kt is chosen for HURDAT at 12 UTC, 20 kt less than previous HURDAT. No gale force winds or low pressures were again observed until late on the 15th, when the system was centered near Jamaica. A gradual increase in intensity is maintained for the storm during the 13th through the 16th, although substantially weaker than original HURDAT based upon available observations from HWM and COADS. The hurricane entered the Gulf of Mexico through the Yucatan Channel during the morning of the 17th. Peak observed winds on the 17th were only 35 kt but available data near the center were scarce on this date. 105 kt is retained for HURDAT at 12 UTC on the 17th. On the 18th, the hurricane quickly traveled across the Gulf of Mexico before making landfall near Baffin Bay, Texas, around 22 UTC. Dunn and Miller classified this hurricane for the lower coast of Texas as "Extreme" (Category 4 or 5). Schwerdt et al. analyzed the hurricane to have 103 kt estimated maximum sustained surface winds at landfall (converted to 1 min) and with a 1010 mb environmental pressure. Ho et al listed the hurricane on August 18th as possessing 948 mb central pressure at landfall, 25 nmi radius of maximum winds (RWM), and a landfall point of 26.8N, 97.4W. Connor analyzed the lowest central pressure for the lifetime of this system (in this case at landfall in Texas) of "28.00 inches [948 mb] or less". Jarrell et al. utilized the Connor and Ho et al. central pressure estimates in their assessment of a 948 mb Category 3 hurricane for southern Texas. However, the 948 mb measurement was well-inland (30 nmi) after the hurricane was over land for about two hours. An application of the Ho et al. pressure-decay model indicates a central pressure at landfall of about 932 mb This landfall pressure suggests winds of 127 kt from the Gulf of Mexico pressure-wind relationship. RMW were noted to be moderately larger (25 nmi) than climatology of 16 nmi (Vickery et al., 2001), which suggests a slight decrease in the hurricanes intensity. Intensity at landfall is estimated at

120 kt, a 10 kt upgrade from original HURDAT. This upgrade changes the impact for south Texas from Category 3 to Category 4. MWR notes the hurricane as, "severe and moderate to large in extent". The revised landfall location in Texas is near 27.0N, 97.4W, somewhat north of the Ho et al and HURDAT estimates. On the 19th and 20th the hurricane quickly diminished in intensity as it continued on its west-northwest to northwest progression over the southern United States. Peak observed winds after landfall were the following: 00 UTC 19th – 70 kt, 06 UTC – 45 kt, 12 UTC – 50 kt, 18 UTC – less than gale force. These first three values reduce down to 57, 38, and 42 kt, respectively, after for correcting for the high bias of the anemometers of the era (Fergusson and Covert 1924) and adjusting from 5 to 1 min winds (Powell et al. 1996.) Application of the Kaplan and DeMaria (1995) model suggests winds of 94, 64, 42, and 35 kt, accordingly. The 948 mb central pressure inland at 0115 UTC on the 19th suggests winds of 112 kt from the Gulf of Mexico pressure-wind relationship. Winds after landfall are chosen to be 95 kt (increased by 30 kt), 65 kt (increased by 15 kt), 40 kt (increased by 5 kt), and 30 kt (no change), respectively, because of the sparse data coverage after landfall. The system is extended an additional six hours to a position as a decaying tropical depression on 00 UTC on the 20th. Dunn and Miller listed this as an extreme hurricane for the lower Texas coast on August 18th with 20 fatalities and \$1.8 million in damage. Storm surge associated with the passage of this hurricane were noted by Ellis and Conner as 9.2 feet in Corpus Christi, 4 feet in Galveston, and 2.4 feet in Fort Point. Intensity for this system was overestimated by 15-20 kt early on and underestimated by 10 kt at landfall in Texas. August 8th through the 11th were analyzed to determine if the system could have originated closer to Africa but due to the limited amount of available ship observations the current genesis position is maintained at 06 UTC on the 12th.

Storm 5, 1916

21250 08/21/1916 M= 5 5 SNBR= 480 NOT NAMED XING=0 SSS=0
 21250 08/21/1916 M= 6 5 SNBR= 480 NOT NAMED XING=1 SSS=0

21255 08/21* 0 0 0 0*180 610 55 0*180 625 65 0*181 632 75 0
 21255 08/21* 0 0 0 0*160 603 55 0*165 615 65 0*170 627 75 0
 *** ** *** ** *** **

21260 08/22*182 641 85 988*182 653 80 0*182 665 70 0*185 680 65 0
 21260 08/22*174 639 85 0*178 652 95 0*182 665 75 0*186 680 65 0
 *** ** *** ** ** ***

21265 08/23*188 697 60 0*192 712 55 0*195 729 45 0*200 746 45 0
 21265 08/23*190 697 60 0*195 714 55 0*200 729 45 0*207 741 45 0
 *** *** ** *** *** **

21270 08/24*210 763 40 0*217 776 40 0*225 785 35 0*232 790 35 0
 21270 08/24*215 752 40 0*222 762 40 0*230 770 35 0*237 777 35 0
 *** ** *** ** *** ** *** **

21275 08/25*238 793 35 0*245 796 30 0*252 798 30 0*261 798 30 0
 21275 08/25*244 783 35 0*252 789 35 0*260 795 35 0*269 801 35 0
 *** ** *** ** *** ** *** **

(The 26th is new to HURDAT.)

21277 08/26*279 803 30 0*290 800 30 0* 0 0 0 0* 0 0 0 0

21280 HR

Minor changes to the track and intensity shown in Neumann et al. (1999). Evidence for these alterations comes from the Historical Weather Maps series, the COADS ship database, Monthly Weather Review, Perez (1971), and Boose et al. (2004).

August 21: HWM analyzed a closed low of at most 1012.5 mb near 15.5N, 63.5W. HURDAT listed this as a Category 1 hurricane at 18.0N, 62.5W at 12 UTC. Available observations from HWM and COADS suggest a center near 16.5N, 61.5W at 12 UTC. No gale force winds (or equivalent in pressure) were observed.

August 22: HWM indicates a closed low of at most 1000 mb near 18N, 68W. HURDAT listed this as a Category 1 hurricane at 18.2N, 66.5W at 12 UTC. The MWR Tracks of Lows indicates a low pressure of 1008 mb near 18N, 68W at 8 a.m. Available observations from HWM and COADS agree with the original HURDAT analysis of 18.2N, 66.5W at 12 UTC. Ship highlights: 35 kt SW and 1005 mb at 20.8N, 84.5W at 22 UTC (COA); 45 kt E and 1012 mb at 22.7N, 84.4W at 23 UTC (COA). Station highlights: 80 kt at San Juan at ~12 UTC (MWR); 997 mb at San Juan at 11 UTC (Perez). "Hurricane of comparatively small diameter passed over Porto Rico this forenoon, vortex entering the island at about Naguabo and leaving between Arecibo and Isabelia. Wind velocity at San Juan 90 miles per hour for about 45 minutes. Highest 10-minute period about 92 miles per hour. Much damage was done throughout the island, a million dollars being a conservative estimate of the money loss. Area of destruction was probably 45 or 50 miles wide and time of passing about two and a quarter hours" (MWR).

August 23: HWM analyzed a closed low of at most 1005 mb near 20N, 74W. HURDAT listed this as a tropical storm at 19.5N, 72.9W at 12 UTC. The MWR Tracks of Lows indicates a low pressure of 1007 mb near 21N, 74W at 8 a.m. Available observations from HWM and COADS suggests a center near 20N, 72.9W at 12 UTC. No gale force winds (or equivalent in pressure) were observed.

August 24: HWM indicates a closed low of at most 1005 mb near 21.5N, 78W. HURDAT listed this as a tropical storm at 22.5N, 78.5W at 12 UTC. The MWR Tracks of Lows indicate the center near 23N, 77.5W at 8 a.m. Available observations from HWM and COADS suggests a center near 23N, 77W at 12 UTC. Ship highlights: 35 kt SW and 1005 mb at 20.8N, 84.5W at 22 UTC (COA); 45 kt E and 1012 mb at 22.7N, 84.4W at 23 UTC (COA). "The center of the storm did not approach any of the meteorological stations in the Bahamas or Cuba" (MWR).

August 25: HWM analyzed a closed low of at most 1010 mb near 25N, 79W. HURDAT listed this as a tropical depression at 25.2N, 79.8W at 12 UTC. The MWR Tracks of Lows indicates a low pressure of 1008 mb near 24.5N, 79.5W at 8 a.m. Available observations from HWM and COADS suggests a center near 26N, 79.5W at 12 UTC. Station highlights: 35 kt S at Miami at 17 UTC (OMR). MWR notes the location of the system as, "a feeble disturbance east of the Florida peninsula on the 25th and 26th. August 26: HWM indicates an open wave near 30N, 75W. Available observations from HWM and COADS suggests a center near 29N, 80W at 06 UTC. No gale force winds (or equivalent in pressure) were observed.

Storm 5 originated as a tropical storm in the eastern Caribbean Sea at 06 UTC on August 21st though it is possible that the system began east of the Lesser Antilles. The system progressed west-northwestward on the 21st and 22nd as it neared the Greater Antilles. On the 22nd the hurricane made landfall at Naguabo, Puerto Rico around 11 UTC (Perez). Peak observed winds on the 22nd were 80 kt around 12 UTC at San Juan, Puerto Rico (MWR). This converts to 69 kt after accounting for the high bias of the instrument (Fergusson and Covert 1924) as well as converting from a peak 10 min to a peak 1 min wind (Powell et al. 1996). Boose et al. analyzed peak structural damage as F2, which roughly corresponds to Category 2 hurricane intensity. Boose et al. also suggest boosting the landfall intensity to 95 kt to best take into account the spatial distribution and the peak of the structural damage observed. Thus, a 95 kt Category 2 hurricane is chosen for HURDAT at 06 UTC, up 15kt from original HURDAT. The hurricane decreased in intensity late on the 22nd after the storm made landfall in Hispanola. No gale force winds or low pressures were observed on the 23rd and thus HURDAT is maintained at 45 kt at 12 UTC as data coverage was sparse near Hispanola. The storm paralleled Cuba's northern coastline on the 24th and began to turn north just northeast of Santa Clara, Cuba, late in the day. No gale force winds or low pressures were found on the 24th and therefore the original HURDAT is maintained at 35 kt at 12 UTC on the 24th. The storm tracked very near the southeastern tip of Florida on the 25th as Miami observed 35 kt southerly winds. 35 kt is chosen for HURDAT at 12 UTC on the 25th, 5 kt higher than original HURDAT. Storm 5 dissipated by 12 UTC on the 26th, 12 hours later than that in HURDAT originally.

Storm 6, 1916

21285 08/27/1916 M= 7 6 SNBR= 481 NOT NAMED XING=0 SSS=0
 21285 08/27/1916 M= 7 6 SNBR= 481 NOT NAMED XING=0 SSS=0

(The 23rd to the 26th are new to HURDAT)

21286 08/23*140 200 30 0*140 215 30 0*140 230 30 0*140 246 30 0
 21287 08/24*140 263 30 0*140 279 30 0*140 295 30 0*140 311 30 0
 21288 08/25*140 327 30 0*140 344 30 0*140 360 30 0*140 376 30 0
 21289 08/26*140 392 30 0*140 408 30 0*140 425 30 0*140 442 30 0

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21290 08/27* 0 0 0 0*140 463 60 0*140 485 60 0*143 512 65 0
21290 08/27*140 459 35 0*140 476 35 0*140 493 40 0*143 512 45 0
          *** ** *          *** **          *** **          *** **

21295 08/28*147 535 65 0*151 560 70 0*153 585 75 0*154 605 75 0
21295 08/28*147 533 50 0*151 552 55 0*153 572 60 0*154 594 65 0
          *** **          *** **          *** **          *** **

21300 08/29*155 628 80 989*156 651 85 0*156 676 85 0*157 692 85 0
21300 08/29*155 616 70 986*156 638 70 0*156 660 70 0*157 681 70 0
          *** ** ***          *** **          *** **          *** **

21305 08/30*159 713 85 0*160 731 85 0*162 751 85 0*166 767 85 0
21305 08/30*159 702 70 0*160 722 65 0*162 742 60 0*166 762 55 0
          *** **          *** **          *** **          *** **

21310 08/31*168 782 85 0*170 796 85 0*174 810 80 0*177 820 80 0
21310 08/31*168 782 50 0*170 801 45 0*174 820 40 0*177 832 40 0
          **          *** **          *** **          *** **

21315 09/01*180 832 75 0*181 841 75 0*182 853 70 0*182 864 70 0
21315 09/01*180 843 40 0*181 854 45 0*182 865 50 0*181 876 50 0
          *** **          *** **          *** **          *** ** **

21320 09/02*181 876 65 0*179 893 55 0*170 910 30 0* 0 0 0 0
21320 09/02*179 887 40 0*175 898 35 0*170 910 30 0* 0 0 0 0
          *** ** *          *** ** **          *** ** **

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21325 HR

Minor changes to the track and major changes to the intensity shown in Neumann et al. (1999). Evidence for these alterations comes from the Historical Weather Maps series, the COADS ship database, Original Monthly Records, Monthly Weather Review, and Tannehill (1938).

August 23: HWM analyzed a closed low of at most 1010 mb at 15.5N, 21.5W.

Available observations suggest that the center is near 14N, 23W. No gale force winds (or equivalent in pressure) were observed.

August 24: HWM indicates an open trough around 25W. Available observations suggest that the center is near 14N, 29.5W though data are sparse. No gale force winds (or equivalent in pressure) were observed.

August 25: HWM analyzed no significant features in the eastern tropical North Atlantic. As data are sparse, a center is interpolated to be near 14N, 36W. No gale force winds (or equivalent in pressure) were observed.

August 26: HWM indicates no significant features in the eastern tropical North Atlantic. A center is estimated to be near 14N, 42.5W, though data are sparse. No gale force winds (or equivalent in pressure) were observed.

August 27: HWM analyzed no significant features east of the Lesser Antilles Islands. HURDAT listed this as a tropical storm at 14N, 48.5W at 12 UTC. Available observations from HWM and COADS suggest a center near 14N, 49.3W at 12 UTC. No gale force winds (or equivalent in pressure) were observed. "The exact origin of the disturbance is unknown, but was undoubtedly some distance to the east of the island of Dominica" (MWR).

August 28: HWM indicates an inverted trough near 13N, 58W. HURDAT listed this as a Category 1 hurricane at 15.3N, 58.5W at 12 UTC. The MWR seasonal hurricane chart suggests a center near 15.1N, 58.5W at 12 UTC. Available observations from HWM and COADS suggest a center near 15.3N, 57.2W at 12 UTC. Station highlights: 986 mb (possible central pressure) at Roseau, Dominica, at 2330 UTC (MWR). "An intense storm passed over Dominica during the afternoon and evening of the 28th. The hurricane advanced over the island with but little warning; a number of lives were lost and much property was destroyed on the northern and eastern sides ... It was evidently of small diameter and great intensity while passing over Dominica" (MWR).

August 29: HWM analyzed a closed low of at most 1010 mb near 14.5N, 66W. HURDAT listed this as a Category 2 hurricane at 15.6N, 67.6W at 12 UTC. The MWR seasonal hurricane chart suggests a center near 16.2N, 66W at 12 UTC. Available observations from HWM and COADS suggest a center near 15.6N, 66W at 12 UTC. No gale force winds (or equivalent in pressure) were observed.

August 30: HWM indicates a closed low of at most 1005 mb near 16.5N, 74.5W. HURDAT listed this as a Category 2 hurricane at 16.2N, 75.1W at 12 UTC. The MWR seasonal hurricane chart suggests a center near 17.5N, 72.5W at 12 UTC. Available observations from HWM and COADS suggest a center near 16.2N, 74.2W at 12 UTC. No gale force winds (or equivalent in pressure) were observed. "It moved thence westward and passed immediately north of the island of Jamaica, with greatly decreased intensity" (MWR).

August 31: HWM analyzed a closed low of at most 1005 mb near 17N, 81.5W. HURDAT listed this as a Category 1 hurricane at 17.4N, 81W at 12 UTC. The MWR seasonal hurricane chart suggests a center near 18.5N, 79.5W at 12 UTC. Available observations from HWM and COADS suggest a center near 17.4N, 82W at 12 UTC. No gale force winds (or equivalent in pressure) were observed.

September 1: HWM indicates a closed low of at most 1000 mb near 18N, 86W. HURDAT listed this as a Category 1 hurricane at 18.2N, 85.3W at 12 UTC. The MWR seasonal hurricane chart suggests a center near 18.7N, 85.2W at 12 UTC. Available observations from HWM and COADS suggest a center near 18.2N, 86.5W at 12 UTC. No gale force winds (or equivalent in pressure) were observed. "...to a position to the northwest of Swam Island, in which vicinity it lost intensity" (MWR).

September 2: HWM analyzed a closed low of at most 1005 mb near 17N, 91W. HURDAT listed this as a tropical depression at 17N, 91W at 12 UTC. Available observations from HWM and COADS suggest a center near 17N, 91W at 12 UTC. No gale force winds (or equivalent in pressure) were observed.

September 3: HWM analyzed a closed low of at most 1010 mb near 14.5N, 94W. However, available observations do not support this analysis and it appears that the system had dissipated by this date.

Genesis is begun four days earlier than originally in HURDAT near the Cape Verde Islands. No gale force winds or low pressures were observed until it made landfall in Dominica late on the 28th. Available observations suggest the system was substantially weaker on the 27th and 28th. 40 kt is chosen for 12 UTC on the 27th, 20 kt less than original HURDAT. A possible central pressure of 986 mb at Dominica was observed at 2330 UTC (28th) which implies winds of 70 kt from the southern pressure-wind relationship. (986 mb replaced 989 mb in HURDAT for the 00 UTC 29th entry.) 70 kt is chosen for 00 UTC on the 29th, 10 kt less than previous HURDAT. The storm was centered southeast of Jamaica on the 30th. This intensity (Category 1 hurricane at 70 kt) appears to have been the maximum intensity for the system's lifetime. MWR notes the storm's intensity on the 30th as, "greatly decreased intensity". No gale force winds or low pressures were observed on the 30th. 60 kt is chosen for HURDAT at 12 UTC, down from 85 kt, in agreement with MWR's assessment of the intensity trend of the system. Barometric pressure increased despite the system's approach to Swan Island on the 31st, indicating the storm continued to weaken. Based upon available observations, 40 kt is chosen for HURDAT at 12 UTC on the 31st, a 40 kt decrease from original HURDAT. On September 1st the storm passed north of Swan Island before making its second landfall near the Belize/Mexico border around 2100 UTC on the 1st. No gale force winds or low pressures were observed on the 1st despite fair data coverage, suggesting the storm was weaker than originally suggested in HURDAT. The system is analyzed to have made landfall in Central America as a 50 kt tropical storm, weaker than the 65 kt Category 1 hurricane originally in HURDAT. The system appears to have dissipated over land by 18 UTC on the 2nd.

Storm 7, 1916

21330 09/04/1916 M= 3 7 SNBR= 482 NOT NAMED XING=1 SSS=0

21330 09/04/1916 M= 4 7 SNBR= 482 NOT NAMED XING=1 SSS=0

21335 09/04* 0 0 0 0* 0 0 0 0*242 748 35 0*259 758 35 0

21335 09/04* 0 0 0 0* 0 0 0 0*242 755 35 0*259 765 35 0

21340 09/05*275 767 35 0*290 773 35 0*305 779 35 0*319 783 35 0

21340 09/05*275 774 35 0*290 781 35 0*305 785 35 0*317 786 35 0

*** **

21345 09/06*333 783 35 0*347 782 35 0*360 781 25 0* 0 0 0 0

21345 09/06*328 785 35 0*339 783 35 0*350 781 30 0*359 777 30 0

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(The 7th is new to HURDAT.)

21347 09/07*365 770 25 0*370 760 25 0* 0 0 0 0* 0 0 0 0

21350 TS

Minor changes to the track and the intensity shown in Neumann et al. (1999). Evidence for these alterations comes from the Historical Weather Maps series, the COADS ship database, and Monthly Weather Review.

September 4: HWM analyzed an inverted trough near 23N, 76W. HURDAT listed this as a tropical storm at 24.2N, 74.8W at 12 UTC. The MWR Tracks of Lows indicate the center near 23.5N, 76W at 8 a.m. Available observations from HWM and COADS suggests a center near 24.2N, 75.5W at 12 UTC. No gale force winds (or equivalent in pressure) were observed.

September 5: HWM indicates a closed low of at most 1015 mb near 31N, 79W. HURDAT listed this as a tropical storm at 30.5N, 77.9W at 12 UTC. The MWR Tracks of Lows indicate the center near 29N, 79W at 8 a.m. Available observations from HWM and COADS suggests a center near 30.5N, 78.5W at 12 UTC. Ship highlights: 35 kt S and 1017 mb at 31.7N, 76W at 22 UTC (COA).

September 6: HWM analyzed a closed low of at most 1015 mb near 35N, 78W over North Carolina. HURDAT listed this as a tropical depression at 36N, 78.1W at 12 UTC. The MWR Tracks of Lows indicate the center near 35N, 78W at 8 a.m. Available observations from HWM and COADS suggests a center near 35N, 78.1W at 12 UTC. No gale force winds (or equivalent in pressure) were observed.

September 7: HWM indicates the system to have dissipated before 12 UTC near the North Carolina/Virginia border. The MWR Tracks of Lows indicate the center near 39N, 75W at 8 a.m. Available observations from HWM and COADS suggests a center near 37N, 67W at 06 UTC. No gale force winds (or equivalent in pressure) were observed.

Genesis is retained for storm 7 at 12 UTC on September 4th as a tropical storm just northeast of the central Bahamas. The storm progressed north-northwestward and eventually north before striking the southeast tip of North Carolina early on the 6th. Gale force winds of 35 kt were first observed by ship on the 5th as the storm neared the U.S. East Coast. 35 kt is chosen for HURDAT at 12 UTC on the 5th. Storm 7 made landfall in southeast North Carolina early on the 6th. No gale force winds or low pressures were observed by coastal stations for the duration of the storm. Peak observations with this storm were 35 kt on the 5th. The system made landfall around 06 UTC on the 6th as a 35 kt tropical storm, which is unchanged in intensity from that originally shown in HURDAT. The lifetime of the storm was extended 18 hours from original HURDAT to account for weakening and eventual dissipation on the 7th at 06 UTC.

Removed Storm 8, 1918

(Remove from HURDAT.)

21355 09/09/1916 M= 6 8 SNBR= 483 NOT NAMED XING=1 SSS=0

21360 09/09* 0 0 0 0*188 570 35 0*190 583 35 0*193 598 35 0
 21365 09/10*197 613 35 0*202 627 35 0*206 642 35 0*212 659 35 0
 21370 09/11*216 671 40 0*221 685 40 0*227 700 45 0*231 715 45 0
 21375 09/12*236 730 45 0*240 745 45 0*251 759 45 0*263 770 45 0
 21380 09/13*274 783 40 0*283 798 40 0*293 816 30 0*297 828 30 0
 21385 09/14*301 839 25 0*308 849 20 0*315 858 20 0*322 849 20 0
 21390 TS

This storm, originally storm number 8 originally in Neumann et al. (1999), is removed from HURDAT because it only reached tropical depression intensity. Evidence for this comes from the Historical Weather Maps series, the COADS ship database, and Monthly Weather Review.

September 9: HWM analyzed no significant features in the proximity. HURDAT listed this as a tropical storm at 19N, 58.3W at 12 UTC. Available observations from HWM and COADS suggest the system is closed, near 18N, 59W. No gale force winds (or equivalent in pressure) were observed.

September 10: HWM indicates no significant features in the proximity. HURDAT listed this as a tropical storm at 20.6N, 64.2W at 12 UTC. Available observations from HWM and COADS suggest the system is closed, near the HURDAT position. No gale force winds (or equivalent in pressure) were observed.

September 11: HWM analyzed a closed low of at most 1010 mb at 25N, 71W. HURDAT listed this as a tropical storm at 22.7N, 70W at 12 UTC. The MWR Tracks of Lows indicate the center near 24.7N, 74W at 8 p.m. Available observations from HWM and COADS suggest that a center may be near 23.5N, 71W. No gale force winds (or equivalent in pressure) were observed.

September 12: HWM indicates a closed low of at most 1010 mb at 26N, 78W. HURDAT listed this as a tropical storm at 25.1N, 75.9W at 12 UTC. The MWR Tracks of Lows indicates a low pressure of 1007 mb near 26N, 75.7W at 8 a.m. However, available observations from HWM and COADS suggest the system has weakened to an open wave and no longer has a defined center. No gale force winds (or equivalent in pressure) were observed.

September 13: HWM analyzed a closed low of at most 1010 mb at 27.5N, 84.5W. HURDAT listed this as a tropical depression at 29.3N, 81.6W at 12 UTC. The MWR Tracks of Lows indicates a low pressure of 1011 mb near 30N, 82.5W at 8 a.m. However, available observations from HWM and COADS suggest the system has an open NE-SW oriented trough and thus a center cannot be defined on this date. No gale force winds (or equivalent in pressure) were observed.

September 14: HWM indicates an inverted trough in the vicinity of southern Georgia (31N, 83W). HURDAT listed this as a tropical depression at 31.5N, 85.8W at 12 UTC. The MWR Tracks of Lows indicates a low pressure of 1012 mb near 31.5N, 85.5W at 8 a.m. Available observations from HWM and COADS suggest the system has an ill-defined center near 30.5N, 85W. No gale force winds (or equivalent in pressure) were observed.

Genesis for this system began at 06 UTC on September 9th as a tropical depression east of the northern Lesser Antilles. A peak observation of 1013 mb and 15 kt indicates the system had not yet attained tropical storm status on the 9th (HWM). On the 10th it again appears that the system was not of tropical storm intensity as previously suggested by HURDAT. Peak observations on the 10th were 1014 mb and 15 kt (COA). The system continued on a west-northwestward track on the 10th and 11th as depression approached the eastern edge of the Bahamas. Peak observations on the 11th were 1013 mb and 10 kt at Turks Islands (HWM). Available observations suggests the system lacked a closed surface circulation on the 12th and 13th. Peak observations on the 12th as the system traverses the central Bahamas were 1009 mb and 15 kt (HWM). MWR notes this system as, "originating east of the northern Bahamas and moved northwest, passing to the coast near and south of Jacksonville, FL". As the system moved over central Florida on the 13th peak observations of 1012 mb and 15 kt were found at Pensacola. "It was of slight energy and extent" as indicated by MWR.

The absence of a closed surface circulation prevailed on the 12th and 13th and was only weakly present on other days in its lifetime. The tropical system was near land and close to numerous ship observations on the 11th-14th and as noted above, no gale force winds or low pressures were observed on these days. Therefore, due to evidence that the peak intensity of the system was less than gale force wind from substantial ship and coastal data, this indicates storm number 8 should be downgraded to a tropical depression, thereby removing it from HURDAT. Notice that this is consistent with MWR's assessment that the system was of "slight energy and extent".

Storm 8 (originally 9), 1916

21395 09/14/1916 M= 8 9 SNBR= 484 NOT NAMED XING=0 SSS=0
 21395 09/13/1916 M=10 8 SNBR= 484 NOT NAMED XING=0 SSS=0
 ** *

(The 13th is new to HURDAT.)

21400 09/13* 0 0 0 0* 0 0 0 0*205 560 30 0*207 572 30 0

21400 09/14* 0 0 0 0*211 597 35 0*213 607 35 0*214 616 35 0
 21400 09/14*208 584 30 0*209 596 35 0*210 607 35 0*211 616 35 0
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21405 09/15*215 623 35 0*218 630 40 0*224 637 40 0*231 637 45 0
 21405 09/15*212 625 35 0*213 634 40 0*215 640 40 0*220 641 40 0
 *** ** * ** * ** * ** * ** *

21410 09/16*236 635 45 0*241 633 50 0*248 630 55 0*260 626 55 0
 21410 09/16*227 639 40 0*237 635 40 0*248 630 40 0*260 625 40 0

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*** ** *      *** ** *      **      *** **
21415 09/17*272 620 60 0*285 611 60 0*297 598 65 0*309 589 70 0
21415 09/17*272 620 45 0*285 615 45 0*297 610 50 0*307 601 50 0
      **      *** **      *** **      *** ** **
21420 09/18*321 580 75 0*331 571 80 0*342 559 85 0*351 546 90 0
21420 09/18*317 589 55 0*327 574 55 0*337 559 60 0*346 546 60 0
      *** ** *      *** ** *      *** **      *** **
21425 09/19*359 532 90 0*365 519 85 0*370 505 80 0*376 491 70 0
21425 09/19*354 532 60 0*362 519 60 0*370 505 60 0*376 490 60 0
      *** **      *** **      *** **      *** **
21430 09/20*380 477 70 0*383 464 70 0*386 450 65 0*388 437 65 0
21430 09/20*380 475 60 0*383 460 55 0*386 445 50 0*387 431 45 0
      *** **      *** **      *** **      *** ** **
21435 09/21*390 424 55 0*391 412 45 0*392 400 35 0*392 370 25 0
21435 09/21*387 418 40 0*387 406 35 0*387 395 35 0*387 385 30 0
      *** ** *      *** ** *      *** **      *** ** **

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(The 22nd is new to HURDAT.)

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21437 09/22E387 375 25 0* 0 0 0 0* 0 0 0 0* 0 0 0 0
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21440 HR

21440 TS

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Minor changes to the track and major changes to the intensity shown in Neumann et al. (1999), originally storm 9. Evidence for these alterations comes from the Historical Weather Maps series, the COADS ship database, and Monthly Weather Review.

September 13: HWM analyzed an open wave well northeast of the Lesser Antilles Islands. Available observations from HWM and COADS suggest a center near 20.5N, 56W at 12 UTC. No gale force winds (or equivalent in pressure) were observed.

September 14: HWM indicates an open wave north of the Lesser Antilles. HURDAT listed this as a tropical storm at 21.3N, 60.7W at 12 UTC. Available observations from HWM and COADS suggest a center near 21N, 60.7W at 12 UTC. No gale force winds (or equivalent in pressure) were observed.

September 15: HWM analyzed a closed low of at most 1012.5 mb near 21N, 64W. HURDAT listed this as a tropical storm at 22.4N, 63.7W at 12 UTC. Available observations from HWM and COADS suggest a center near 21.5N, 64W at 12 UTC. No gale force winds (or equivalent in pressure) were observed.

September 16: HWM indicates a closed low of at most 1010 mb near 24.5N, 63W. HURDAT listed this as a tropical storm at 24.8N, 63W at 12 UTC. Available observations from HWM and COADS suggest a center near 24.8N, 63W at 12 UTC. No gale force winds (or equivalent in pressure) were observed.

September 17: HWM analyzed a closed low of at most 1005 mb near 29.3N, 60W. HURDAT listed this as a Category 1 hurricane at 29.7N, 59.8W at 12 UTC. Available observations from HWM and COADS suggest a center near 29.7N, 61W at 12 UTC. No gale force winds (or equivalent in pressure) were observed.

September 18: HWM indicates a closed low of at most 1000 mb near 34N, 56W. HURDAT listed this as a Category 2 hurricane at 34.2N, 55.9W at 12 UTC. Available observations from HWM and COADS suggest a center near 33.7N, 55.9W at 12 UTC. Ship highlights: 35 kt WSW and 1015 mb at 31.2N, 54.3W at 12 UTC (COA).

September 19: HWM analyzed a closed low of at most 1000 mb near 36.5N, 51.5W. HURDAT listed this as a Category 2 hurricane at 37N, 50.5W at 12 UTC. Available observations from HWM and COADS suggest a center near 18N, 85W at 12 UTC. No gale force winds (or equivalent in pressure) were observed.

September 20: HWM indicates a closed low of at most 1005 mb near 39N, 45W. HURDAT listed this as a Category 1 hurricane at 38.6N, 45W at 12 UTC. Available observations from HWM and COADS suggest a center near 38.6N, 44.5W at 12 UTC. Ship highlights: 45 kt SSW and 1011 mb at 37.4N, 42.4W at 12 UTC (COA).

September 21: HWM analyzed a closed low of at most 1005 mb near 38.5N, 39.5W with a cold front approaching from the northwest. HURDAT listed this as a tropical storm 39.2N, 38.7W at 12 UTC. Available observations from HWM and COADS suggest a center near 38.7N, 39.5W at 12 UTC. No gale force winds (or equivalent in pressure) were observed.

September 22: HWM indicates that the system has been absorbed by an approaching cold front by 12 UTC. Available observations from HWM and COADS suggest a center near 38.7N, 37.5W at 00 UTC. No gale force winds (or equivalent in pressure) were observed.

Genesis is begun for storm number 8 at 12 UTC on September 13th as a tropical depression, 18 hours earlier than previously in HURDAT. Storm 8 kept as attaining tropical storm intensity on the 14th as the system traversed on a westward course north of the Lesser Antilles Islands though sparse observations make this somewhat uncertain. The system recurved on the 15th and 16th taking a northeastward path well southeast of Bermuda. The system is analyzed as having substantially weaker intensity from the 16th through the 20th based upon available ship observations from HWM and COADS. Highest observations with this system were only 45 kt, significantly less than the previous HURDAT peak intensity of 90 kt. Revised peak analyzed intensity of storm 8 is 60 kt on the 18th and 19th, 30 kt less than originally in HURDAT. Thus it is analyzed that the system never attained hurricane status during its lifetime. The storm continued on an eastward progression as it began to weaken on the 21st and 22nd. The storm transitioned to extratropical status as it was absorbed by a frontal boundary at 00 UTC on the 22nd and dissipated quickly thereafter.

Storm 9 (Originally 10), 1916

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21445 09/17/1916 M= 9 10 SNBR= 485 NOT NAMED  XING=0 SSS=0
21445 09/17/1916 M= 9 9 SNBR= 544 NOT NAMED  XING=0 SSS=0
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21450 09/17* 0 0 0 0* 0 0 0 0*130 455 35 0*135 467 35 0
21450 09/17* 0 0 0 0* 0 0 0 0*130 455 35 0*135 467 35 0

21455 09/18*140 477 40 0*145 488 45 0*150 500 50 0*155 513 50 0
21455 09/18*140 477 40 0*145 488 45 0*150 500 50 0*155 513 50 0

21460 09/19*160 525 60 0*165 538 65 0*170 550 75 0*173 563 80 0
21460 09/19*161 525 55 0*168 538 55 0*175 550 60 0*181 563 65 0
      *** ** *** ** *** ** *** **

21465 09/20*175 575 85 0*177 588 90 0*180 600 95 0*187 608 95 0
21465 09/20*187 577 70 0*193 592 75 0*200 607 80 0*207 621 80 0
      *** ** * *** ** * *** ** * *** ** *

21470 09/21*194 617 95 0*202 624 100 0*210 632 100 0*221 642 105 0
21470 09/21*213 634 85 0*219 646 85 0*225 655 90 0*232 662 90 0
      *** ** * *** ** * *** ** * *** ** *

21475 09/22*233 653 105 0*245 665 105 0*258 675 105 0*271 682 105 0
21475 09/22*240 667 95 0*249 671 95 0*258 675 95 0*268 677 95 0
      *** ** * *** ** * *** ** * *** ** *

21480 09/23*284 685 100 0*297 685 100 0*309 682 95 0*325 670 95 0
21480 09/23*279 678 95 0*291 678 95 0*305 675 95 0*320 670 95 0
      *** ** * *** ** * *** ** * ***

21485 09/24*339 652 90 0*354 638 90 0*369 623 85 0*395 605 85 0
21485 09/24*337 655 90 0*355 638 90 0*375 617 85 0*395 595 75 0
      *** ** * *** ** * *** ** * *** **

21490 09/25E430 578 80 0* 0 0 0 0* 0 0 0 0* 0 0 0 0
21490 09/25E420 570 60 0* 0 0 0 0* 0 0 0 0* 0 0 0 0
      *** ** *

21495 HR

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Major changes to the track and minor alterations to the intensity of storm number 10 originally shown in Neumann et al. (1999). Evidence for these alterations comes from the Historical Weather Maps series, the COADS ship database, individual ship and station data from NCDC, Tucker (1995), and Monthly Weather Review.

September 17: HWM analyzed a closed low of at most 1005 mb near 13N, 45.5W. HURDAT listed this as a tropical storm at 13N, 45.5W at 12 UTC. Available observations from HWM and COADS suggest are quite sparse. No gale force winds (or equivalent in pressure) were observed.

September 18: HWM indicates a closed low of at most 1000 mb near 15.3N, 50W.

HURDAT listed this as a tropical storm at 15N, 50W at 12 UTC. Available observations from HWM and COADS suggest a center near the HURDAT position. No gale force winds (or equivalent in pressure) were observed.

September 19: HWM analyzed a closed low of at most 995 mb near 18N, 55W.

HURDAT listed this as a Category 1 hurricane at 17N, 55W at 12 UTC. Available observations from HWM and COADS suggest a center near 17.5N, 55W at 12 UTC. No gale force winds (or equivalent in pressure) were observed.

September 20: HWM indicates a closed low of at most 990 mb near 20N, 61W.

HURDAT listed this as a Category 2 hurricane at 18N, 60W at 12 UTC. The MWR seasonal hurricane chart suggests a center near 17.3N, 61.5W at 12 UTC. Available observations from HWM and COADS suggest a center near 20N, 60.7W at 12 UTC. Ship highlights: 60 kt NW and 999 mb at 20N, 61.7W at 12 UTC (COA).

September 21: HWM analyzed a closed low of at most 985 mb near 23N, 65.5W.

HURDAT listed this as a Category 3 hurricane at 21N, 63.2W at 12 UTC. The MWR seasonal hurricane chart suggests a center near 21.8N, 65.3W at 12 UTC. Available observations from HWM and COADS suggest a center near 22.5N, 65.5W at 12 UTC. Ship highlights: 20 kt ESE and 1006 mb at 25.2N, 57.2W at 12 UTC (COA).

September 22: HWM indicates a closed low of at most 975 mb near 25.8N, 67W.

HURDAT listed this as a Category 3 hurricane at 25.8N, 67.5W at 12 UTC. The MWR seasonal hurricane chart suggests a center near 26N, 67W at 12 UTC. The MWR Tracks of Lows suggests a center near 25N, 66.5W at 8 a.m. Available observations from HWM and COADS suggests a center near 25.8N, 67.5W at 12 UTC. No gale force winds (or equivalent in pressure) were observed.

September 23: HWM analyzed a closed low of at most 980 mb near 30N, 67W.

HURDAT listed this as a Category 2 hurricane at 30.9N, 68.2W at 12 UTC. The MWR seasonal hurricane chart suggests a center near 30.5N, 67W at 12 UTC. The MWR Tracks of Lows suggests a center near 31N, 69.5W at 8 a.m. Available observations from HWM and COADS suggests a center near 30.5N, 67.5W at 12 UTC. Station highlights: 50 kt SE at Bermuda at 18 UTC (Tucker); 60 kt SE at Bermuda at 20 UTC (Tucker); 70 kt SSE at Bermuda at 2045-2300 UTC (Tucker); 73 kt at Bermuda (Tucker). "A really terrible hurricane struck Bermuda on this date, with raging winds of 84 mph, and greater losses occasioned than in that of 1899" (Tucker).

September 24: HWM indicates a closed low of at most 980 mb near 38N, 61W with a cold frontal boundary approaching the system from the northwest. HURDAT listed this as a Category 2 hurricane at 36.9N, 62.3W at 12 UTC. Available observations from HWM and COADS suggest a center near 37.5N, 61.7W at 12 UTC. Ship highlights: 70 kt S and 981 mb at 37.4N, 61.4W at 12 UTC (COA); 50 kt NW at 36.7N, 62.5W at 12 UTC (HWM); 35 kt S and 1009 mb at 42N, 53.7W at 12 UTC (COA).

September 25: HWM analyzed the system as being absorbed by an extratropical storm.

HURDAT listed this as an extratropical storm at 43N, 57.8W at 00 UTC. Available observations from HWM and COADS suggest a center near 42N, 57W at 00 UTC. No gale force winds (or equivalent in pressure) were observed.

Genesis for storm 9, originally 10, is retained at 12 UTC on September 17th as a tropical storm east of the Lesser Antilles, though there is little data available near the system until the 19th. Storm 9 progressed on a west-northwestward track from the 17th through the 19th, before recurving towards Bermuda on the 22nd and 23rd. The first gale force wind of 60 kt was observed on the 20th. 80 kt is chosen for HURDAT at 12 UTC on the 20th, 15 kt less than original HURDAT. The hurricane passed very close by Bermuda late on the 23rd. Bermuda experienced south-southeasterly hurricane force winds and greater losses than the Hurricane of 1899 (Tucker). Gale force winds were not observed by ship again until the 24th where two different ships measured 35 kt and 70 kt winds, respectively. One ship also had a low pressure of 981 mb, implying winds of at least 72 kt from the northern pressure-wind relationship. 85 kt is retained for HURDAT at 12 UTC on the 24th. The system began to weaken on the 24th due to an approaching cold front. Storm 9 began extratropical transition late on the 24th and available observations indicate the storm to have dissipated at 06 UTC on the 25th.

September 13th through 16th were analyzed to determine if the system could have originated closer to Africa but due to the limited amount of available ship observations the current genesis position is maintained at 12 UTC on the 17th. MWR noted this storm as, "originating near Antigua, whence it passed northwestward as far as can be ascertained from a limited number of vessel reports and recurved to the west of Bermuda". Peak observations with this hurricane were 73 kt in Bermuda as the storm passed close by on the 23rd. "It was of only moderate extent and slight to moderate intensity" (MWR). The revised peak intensity of 95 kt, down 10 kt from original HURDAT, reduces storm 9 from major hurricane status to Category 2 intensity.

Removed Storm 11, 1916

(Remove storm #11 from HURDAT)

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21500 10/02/1916 M= 3 11 SNBR= 486 NOT NAMED XING=0 SSS=0
21505 10/02* 0 0 0 0*265 722 40 0*271 729 40 0*276 735 40 0
21510 10/03*282 742 40 0*286 748 40 0*291 755 40 0*296 762 40 0
21515 10/04*302 770 40 0*307 778 40 0*313 787 40 0*318 801 30 0
21520 TS
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This system, originally storm 11 in Neumann et al. (1999), is removed from HURDAT since it was an extratropical cyclone throughout its lifecycle. Evidence for this comes from the Historical Weather Maps series, the COADS ship database, and Monthly Weather Review.

October 2: HWM analyzed a stationary front extending east-northeast from the southern Bahamas to south of Bermuda. HURDAT listed this as a tropical storm at 27.1N, 72.9W at 12 UTC. The MWR Tracks of Lows and does not indicate this system on this date suggesting that it was not yet a closed circulation. Available observations from HWM

and COADS indicate the system was an open wave; therefore a center cannot be defined on this date. No gale force winds (or equivalent in pressure) were observed.

October 3: HWM indicated an extratropical storm centered near 27N, 73W with a significant temperature gradient existing to the north and northwest of the system. HURDAT listed this as a tropical storm at 29.1N, 75.5W at 12 UTC. The MWR Tracks of Lows indicates a low pressure of 1006 mb near 29N, 75W at 8 a.m. Available observations from HWM and COADS suggests a center roughly near 30N, 76.5W. Ship highlights: 45 kt NNE and 1008 mb at 33.3N, 77.7W at 12 UTC (COA); 35 kt NNE and 1016 mb at 33.6N, 75.8W at 12 UTC (COA); 35 kt and 1006 mb at 30.9N, 79.7W at 12 UTC (COA).

October 4: HWM analyzed an extratropical storm centered near 31N, 78W. HURDAT listed this as a tropical storm at 31.3N, 78.7W at 12 UTC. The MWR Tracks of Lows indicates a low pressure of 1003 mb centered near 32.5N, 79.5W at 8 a.m. Available observations from HWM and COADS suggest a substantial temperature gradient was associated with this system, around a center near 32N, 78.5W. Ship highlights: 35 kt N and 1003 mb at 32.2N, 78.9W at 11 UTC (COA); 45 kt E and 1014 mb at 33.9N, 74.2W at 17 UTC (COA); 35 kt and 1020 mb at 35.1N, 74.2W at 23 UTC (COA). "During the 4th, moderate northeast gales were reported on the SC and GA coasts. By 8 p.m. the storm had passed inland to northern FL with greatly diminished energy" (MWR).

Storm 11 is originally in HURDAT as a minimal tropical storm with peak intensity of 40 kt. No closed center was found on the 2nd, nor were there any gale force winds observed that day. By the date (3rd) that the system had developed, a substantial temperature gradient and asymmetric wind structure prevailed. This was also the case for the duration of this system, suggesting that the system was not tropical in nature. Numerous gale force winds were observed on the 3rd and 4th well removed from the storm's approximate center. MWR noted Storm 11 as having "small extent and energy". HURDAT originally listed this system as a tropical storm but evidence from HWM, COADS, and MWR indicate the system was extratropical in nature, and therefore should be removed from HURDAT.

Storm 10 (Originally 12), 1916

21525 10/06/1916 M=10 12 SNBR= 487 NOT NAMED XING=0 SSS=0

21525 10/06/1916 M=10 10 SNBR= 567 NOT NAMED XING=0 SSS=0

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21530 10/06* 0 0 0 0*115 583 35 0*121 589 35 0*123 594 35 0

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21530 10/06* 0 0 0 0*117 592 30 0*121 595 30 0*125 598 30 0
          *** ** *
21535 10/07*125 599 35 0*128 604 35 0*130 610 35 0*134 617 35 0
21535 10/07*129 602 30 0*132 606 30 0*135 610 35 0*137 615 40 0
          *** ** *
21540 10/08*137 623 35 0*142 628 40 0*148 634 45 0*154 638 45 0
21540 10/08*139 620 45 0*142 625 50 0*145 630 55 0*150 633 60 0
          *** ** *
21545 10/09*159 640 50 0*164 643 55 0*171 645 60 0*180 648 85 970
21545 10/09*155 636 65 0*160 639 75 0*165 642 85 0*173 644 95 963
          *** ** *
21550 10/10*190 649 90 0*199 649 90 0*209 647 85 0*219 643 85 0
21550 10/10*184 645 95 0*197 646 95 0*209 647 95 0*219 647 95 0
          *** ** *
21555 10/11*227 640 85 0*238 636 90 0*248 630 90 0*257 625 95 0
21555 10/11*229 647 95 0*239 646 95 0*248 645 100 0*256 642 100 0
          *** ** *
21560 10/12*264 621 95 0*271 617 100 0*279 610 105 0*285 600 105 0
21560 10/12*263 638 100 0*271 633 100 0*279 625 100 0*289 612 100 0
          *** ** *
21565 10/13*291 580 100 0*299 562 90 0*308 550 80 0*321 531 75 0
21565 10/13*300 592 100 0*312 571 90 0*325 550 80 0*343 528 75 0
          *** ** *
21570 10/14*335 516 65 0*361 488 60 0*392 460 55 0*417 435 50 0
21570 10/14E368 506 65 0E396 483 60 0E425 460 55 0E455 435 50 0
          **** ** *
21575 10/15*444 411 45 0E471 386 45 0E500 356 40 0* 0 0 0 0
21575 10/15E485 411 45 0* 0 0 0 0* 0 0 0 0* 0 0 0 0
          **** ** *

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21580 HR

Major changes to the track and minor changes to the intensity shown in Neumann et al. (1999). Evidence for these alterations comes from the Historical Weather Maps series, the COADS ship database, and Monthly Weather Review.

October 6: HWM analyzed no significant features near the Lesser Antilles Islands.

HURDAT listed this as a tropical storm at 12.1N, 58.9W at 12 UTC. Available observations from HWM and COADS suggest a center near 12.1N, 59.5W at 12 UTC. No gale force winds (or equivalent in pressure) were observed.

October 7: HWM indicates a closed low of at most 1010 mb near 14N, 63W. HURDAT listed this as a tropical storm at 13N, 61W at 12 UTC. The MWR seasonal hurricane

chart suggests a center near 14.7N, 62.5W at 12 UTC. Available observations from HWM and COADS suggest a center near 13.5N, 61W at 12 UTC. No gale force winds (or equivalent in pressure) were observed. "On the afternoon of the 7th there were some indications of a disturbance near and slightly west of Martinique" (MWR).

October 8: HWM analyzed a closed low of at most 1005 mb near 15.5N, 64.5W. HURDAT listed this as a tropical storm at 14.8N, 63.4W at 12 UTC. The MWR seasonal hurricane chart suggests a center near 16N, 63.3W at 12 UTC. Available observations from HWM and COADS suggest a center near 14.5N, 63W at 12 UTC. No gale force winds (or equivalent in pressure) were observed.

October 9: HWM indicates a closed low of at most 1000 mb near 16.5N, 66W. HURDAT listed this as a tropical storm at 17.1N, 64.5W at 12 UTC. The MWR seasonal hurricane chart suggests a center near 17.3N, 64W at 12 UTC. Available observations from HWM and COADS suggest a center near 16.5N, 64W at 12 UTC. Station highlights: 963 mb (possible central pressure) at St. Croix at 23 UTC (MWR); 991 mb at St. Thomas at 22 UTC (MWR); 996 mb at Tortola, Virgin Islands, at 2330 UTC (MWR). "The lowest reading at St. Croix was 28.45 inches [963 mb] during the night of the 9th-10th. The disturbance evidently passed nearly over and a little to the south of St. Thomas" (MWR).

October 10: HWM analyzed a closed low of at most 995 mb near 21N, 66.5W. HURDAT listed this as a Category 2 hurricane at 20.9N, 64.7W at 12 UTC. The MWR seasonal hurricane chart suggests a center near 20.5N, 67W at 12 UTC. Available observations from HWM and COADS suggest a center near 20.9N, 64.7W at 12 UTC. Ship highlights: 35 kt SSE and 1004 mb at 15.2N, 63W at 12 UTC (HWM). Station highlights: 975 mb at Tortola, Virgin Islands, at 0050 UTC (MWR); 991 mb at St. Thomas at 04 UTC (MWR). "By the morning of the 10th the storm had recurved slightly and had passed to the northeast of Puerto Rico" (MWR).

October 11: HWM indicates a closed low of at most 985 mb near 23.5N, 66W with a decaying stationary front to the northwest of the system. HURDAT listed this as a Category 2 hurricane at 24.8N, 63W at 12 UTC. The MWR seasonal hurricane chart suggests a center near 24.5N, 67W at 12 UTC. Available observations from HWM and COADS suggest a center near 24.8N, 64.5W at 12 UTC. Ship highlights: 45 kt SSW at 24.7N, 64W at 12 UTC (HWM); 70 kt SW and 966 mb at 25.3N, 63.2W at 20 UTC (MWR).

October 12: HWM analyzed a closed low of at most 1000 mb near 27N, 60W with a cold frontal boundary well north of the system. HURDAT listed this as a Category 3 hurricane at 27.9N, 61W at 12 UTC. The MWR seasonal hurricane chart suggests a center near 27.3N, 63.7W at 12 UTC. Available observations from HWM and COADS suggest a center near 27.9N, 62.5W at 12 UTC. Ship highlights: 30 kt NNE and 1006 mb at 30.6N, 63.7W at 12 UTC (COA). "The ship Bellas reported a severe hurricane with southeast to southwest gales on October 12 in latitude 27.6N, 62.3W" (MWR).

October 13: HWM indicates a closed low of at most 1005 mb near 29.5N, 55W. HURDAT listed this as a Category 1 hurricane at 30.8N, 55W at 12 UTC. Available observations from HWM and COADS suggest a center near 32.5N, 55W at 12 UTC, though data are somewhat sparse. No gale force winds (or equivalent in pressure) were observed.

October 14: HWM analyzed a closed low of at most 1005 mb near 41N, 47W. HURDAT listed this as a Category 1 hurricane at 39.2N, 46W at 12 UTC. Available observations from HWM and COADS suggest a center near 42.5N, 46W at 12 UTC. Observations also indicate that the system had transformed into an extratropical cyclone with significant temperature gradients occurring near the system's center. Ship highlights: 20 kt WNW and 1000 mb at 42.7N, 47.1W at 12 UTC (COA).

October 15: HWM indicates the system has been absorbed by a very large extratropical cyclone near 45N, 45W. HURDAT listed this as an extra-tropical cyclone at 44.4N, 41.1W at 00 UTC. Available observations from HWM and COADS suggest a center near 48.5N, 41.1W at 00 UTC. Ship highlights: 45 kt SSW and 1021 mb at 52.1N, 31W at 12 UTC (COA); 45 kt SSW and 1006 mb at 49.1N, 40.1W at 12 UTC (COA); 20 kt WSW and 1000 mb at 52.7N, 37W at 12 UTC (COA).

Genesis for storm 10, originally 12, is retained at 06 UTC on October 6th. The system originated a short distance southeast of Barbados and progressed on a northwestward track from the 7th to the 9th through the northeastern Caribbean Sea before recurving well south of Bermuda by October 12th. Gale force winds or low pressures were not observed as the storm traversed the southern Lesser Antilles and development into a tropical storm is delayed until the 7th. The system made landfall in the U.S. Virgin Islands late on the 9th apparently much increased in intensity as a possible central pressure of 963 mb was observed at 23 UTC at St. Croix. 963 mb implies winds of at 97 kt from the southern pressure-wind relationship. 95 kt is chosen for HURDAT at 18 UTC on the 9th, a 10 kt upgrade from original HURDAT. On the 10th the Category 2 hurricane progressed on a northward track through the Virgin Islands. A peripheral pressure of 966 mb was observed on the 11th as the hurricane began to recurve, implying winds of at least 94 and 89 kt, respectively, from the southern and subtropical pressure-wind relationship. 100 kt is chosen for HURDAT at 18 UTC on the 11th, 5 kt higher than previous HURDAT. MWR noted that a ship observed a 'severe hurricane' (90 kt) on October 12th. 100 kt is chosen for HURDAT, down 5 kt from previous HURDAT. The hurricane continued northeastward on the 13th, 14th, and 15th as the system began to weaken and transition to extratropical storm status. Available observations indicate the hurricane transitioned to an extratropical storm by 00 UTC on the 14th. The system had a last position at 00 UTC on the 15th, 12 hours earlier than original HURDAT, as it was being absorbed by a very large extratropical cyclone.

MWR noted the hurricane as, "of small area and of great intensity" (MWR). Peak intensity with storm 10 is 100 kt on the 12th, 5 kt less than originally in HURDAT, maintaining the previous Category 3 hurricane classification. September 30th through October 5th were analyzed to determine if the storm's origin could have occurred closer to the African coast. Unfortunately, due to sparse data coverage a center position cannot be defined before the original HURDAT genesis of 06 UTC on October 6th.

Storm 11 (Originally 13), 1916

21585 10/12/1916 M= 8 13 SNBR= 488 NOT NAMED XING=1 SSS=2
 21585 10/09/1916 M=11 11 SNBR= 488 NOT NAMED XING=1 SSS=2
 ** **

(The 9th, 10th, and 11th are new to HURDAT.)

21586 10/09* 0 0 0 0*185 756 25 0*180 760 25 0*176 764 25 0
 21587 10/10*172 768 30 0*168 772 30 0*165 775 30 0*163 778 30 0
 21588 10/11*161 780 30 0*160 782 30 0*160 785 30 0*161 788 30 0

21590 10/12* 0 0 0 0*154 747 60 0*155 756 60 0*156 765 60 0
 21590 10/12*163 790 35 0*164 792 40 0*165 795 45 0*165 797 50 0
 *** ** ** ** ** ** ** ** ** ** **

21595 10/13*157 774 70 0*158 783 75 0*160 792 85 0*162 804 90 0
 21595 10/13*165 799 55 0*165 801 60 0*165 805 65 0*165 811 70 0
 *** ** ** ** * * * * *

21600 10/14*165 813 90 0*167 822 95 0*170 831 95 0*173 841 95 0
 21600 10/14*165 818 75 0*167 827 80 0*170 836 85 0*173 845 85 0
 *** ** ** * * * * *

21605 10/15*177 851 95 0*181 862 90 0*186 872 85 0*191 882 85 0
 21605 10/15*177 854 85 0*181 863 85 0*186 872 85 0*191 882 60 0
 *** ** ** * * * * *

21610 10/16*197 890 85 0*203 897 90 0*210 905 95 0*217 907 100 0
 21610 10/16*197 890 45 0*203 899 40 0*210 905 40 0*217 907 50 0
 ** * * * * *

21615 10/17*225 908 100 0*235 901 105 0*240 894 105 0*252 889 105 0
 21615 10/17*224 908 60 0*232 906 70 0*240 903 80 0*252 897 85 0
 *** ** ** * * * * *

21620 10/18*265 885 105 0*279 881 105 0*296 875 100 974*316 871 65 0
 21620 10/18*265 890 90 0*279 882 90 0*296 875 90 972*316 872 65 0
 *** ** ** * * * * *

21625 10/19*339 874 55 0*366 876 50 0E395 860 45 0* 0 0 0 0
 21625 10/19*339 876 45 0*362 882 30 0E385 890 25 0* 0 0 0 0
 *** ** ** * * * * *

21630 HRAL2AFL2
 21630 HRAFL2 AL1

Minor changes to the track and major changes to the intensity of storm 11, originally 13, shown in Neumann et al (1999). Evidence for these alterations comes from the Historical Weather Maps series, the COADS ship database, Original Monthly Records, Monthly

Weather Review, Ho et al (1989), Dunn and Miller (1960), Barnes (1998), and Connor (1956).

October 9: HWM analyzed a low pressure of at most 1000 mb near 17.5N, 66W pertaining to storm 12. No significant features were analyzed for the central or western Caribbean Sea. Available observations from HWM and COADS suggest a center near 18N, 76W at 12 UTC. No gale force winds (or equivalent in pressure) were observed.

October 10: HWM indicates a low pressure of at most 995 mb near 21N, 67W pertaining to storm 12. No significant features were analyzed for the central or western Caribbean Sea. Available observations from HWM and COADS suggest a center near 16.5N, 77.5W at 12 UTC. No gale force winds (or equivalent in pressure) were observed.

October 11: HWM analyzed a closed low of at most 1005 mb near 16N, 78.5W. Available observations from HWM and COADS suggest a center near 16N, 78.5W at 12 UTC. Station highlights: 5 kt NE and 1006 mb at Kingston at 12 UTC (HWM). "...on the morning of the 11th the first evidences of distinct cyclonic circulation with a center apparently a short distance south of Jamaica" (MWR).

October 12: HWM indicates a broad closed low of at most 1010 mb in the western Caribbean Sea. HURDAT listed this as a tropical storm at 15.5N, 75.6W at 12 UTC. The MWR seasonal hurricane chart suggests a center near 16.2N, 77W at 12 UTC. Available observations from HWM and COADS suggest a center near 16.5N, 79.5W at 12 UTC. Station highlights: 5 kt N and 1006 mb at Kingston at 12 UTC (HWM).

October 13: HWM analyzed a closed low of at most 1000 mb near 16.7N, 79.5W. HURDAT listed this as a Category 1 hurricane at 16N, 79.2W at 12 UTC. The MWR seasonal hurricane chart suggests a center near 16.4N, 80W at 12 UTC. Available observations from HWM and COADS suggest a center near 16.5N, 80.5W at 12 UTC. Ship highlights: 35 kt NE and 1014 mb at 20.8N, 85.8W at 12 UTC (COA).

October 14: HWM indicates a closed low of at most 980 mb near 17.5N, 83W. HURDAT listed this as a Category 2 hurricane at 17N, 83.1W at 12 UTC. The MWR seasonal hurricane chart suggests a center near 16.7N, 82.7W at 12 UTC. Available observations from HWM and COADS suggest a center near 17N, 83.6W at 12 UTC. Ship highlights: 35 kt NE and 1004 mb at 18.8N, 84.9W at 12 UTC (HWM); 40 kt NE and 1009 mb at 20N, 85.5W at 12 UTC (HWM); 45 kt NE and 1007 mb at 20.2N, 85.7W at 14 UTC (COA). Station highlights: 70 kt N and 980 mb at Swan Island at 1530 UTC (MWR). "During the succeeding 24 hours (on the 24th) the storm appeared to greatly increase in intensity and at 11:30 a.m. passed very close to Swan Island , the barometer reading 28.94 inches [980 mb] with hurricane force from the north" (MWR).

October 15: HWM analyzed a closed low of at most 980 mb near 19N, 87.5W. HURDAT listed this as a Category 2 hurricane at 18.6N, 87.2W at 12 UTC. The MWR seasonal hurricane chart suggests a center near 17.2N, 86W at 12 UTC. Available observations from HWM and COADS suggest a center near 18.6N, 87.2W at 12 UTC. Ship highlights: 50 kt ESE and 996 mb at 20.5N, 86.5W at 12 UTC (HWM); 70 kt ESE and 997 mb at 20.3N, 86.8W at 14 UTC (COA). Station highlights: 35 kt SE and 1007 mb at Swan Island at 12 UTC (MWR).

October 16: HWM indicates a closed low of at most 990 mb near 21N, 90.5W. HURDAT listed this as a Category 3 hurricane at 21N, 90.5W at 12 UTC. The MWR Tracks of Lows indicates a center near 22N, 88.7W at 8 p.m. The MWR seasonal hurricane chart suggests a center near 19.6N, 90.3W at 12 UTC. Available observations from HWM and COADS suggest a center near 21N, 90.5W at 12 UTC. No gale force winds (or equivalent in pressure) were observed. “On the morning of the 16th the storm center was apparently crossing the northern Yucatan Peninsula , moving northwestward or northward” (MWR).

October 17: HWM analyzed a closed low of at most 995 mb near 24N, 90.5W. HURDAT listed this as a Category 3 hurricane at 24N, 89.4W at 12 UTC. The MWR Tracks of Lows indicates a low pressure of 1000 mb with a center near 25.5N, 89W at 8 p.m. The MWR seasonal hurricane chart suggests a center near 23.5N, 90.5W at 12 UTC. Available observations from HWM and COADS suggest a center near 24N, 90.3W at 12 UTC. Ship highlights: 35 kt ESE and 1004 mb at 27.2N, 88.8W at 12 UTC (HWM); 35 kt NW and 1000 mb at 23.5N, 92W at 12 UTC (HWM).

October 18: HWM indicates a closed low of at most 1000 mb near 29N, 88W. HURDAT listed this as a Category 3 hurricane at 29.6N, 87.5W at 12 UTC. The MWR Tracks of Lows indicates a low pressure of 968 mb with a center near 27N, 89W at 1 a.m. The MWR seasonal hurricane chart suggests a center near 29.3N, 87.8W at 12 UTC. Available observations from HWM and COADS suggest a center near 29.6N, 87.5W at 12 UTC. Ship highlights: 55 kt E and 981 mb near 27N, 89W at 05 UTC (MWR); 30 kt W and 1006 mb at 27.5N, 93.8W at 12 UTC (HWM); 35 kt SSW and 1011 mb at 26.6N, 85.8W at 16 UTC (COA). Station highlights: 110 kt E at Mobile at 1230 UTC (MWR); 105 kt SE at Pensacola at 1413 UTC (MWR); 40 kt SE and 974 mb at Pensacola at 1430 UTC (MWR); 104 kt W and 978 mb at Pensacola at 15 UTC (OMR). “The center passed almost directly over the city of Pensacola, Florida, at 10:30 a.m., when the barometer read 28.76 inches [974 mb] with a wind of 48 miles an hour from the southeast. After the lull attending the passage of the storms center the wind again increased from the west. After 11 a.m. the wind subsided to less than a gale” (MWR). “Pensacola experienced both the easterly and westerly gales of this hurricane, and a distinct lull in the wind when the center of the storm passed” (Pensacola OMR).

October 19: HWM analyzed the low as merged with an approaching frontal system near southern Illinois (~38.5N, ~89W). HURDAT listed this as an extra-tropical storm at 39.5N, 86W at 12 UTC. The MWR Tracks of Lows indicates a low pressure of 1002 mb with a center near 39N, 87.5W at 8 a.m. Available observations from HWM and COADS suggests a center near 38.5N, 89W at 12 UTC. Station highlights: 5 kt ENE and 1003 mb at Fort Wayne, Indiana, at 12 UTC (HWM); 5 kt S and 1004 mb at Nashville at 12 UTC (HWM); 10 kt ENE and 1005 mb at Chicago at 12 UTC (HWM). “On the morning of the 19th the storm was central over Indiana, with a lowest reported pressure of 29.58 inches [1002 mb]” (MWR).

Genesis is begun for storm 11, originally storm 13, on October 9th at 06 UTC as a 25 kt tropical depression southeast of Jamaica, approximately three days earlier than previously in HURDAT. No gale force winds or low pressures were observed on the 9th through the

11th as the system progressed southwestward towards the western Caribbean Sea. On the 12th a peripheral pressure of 1006 mb was observed at Jamaica, implying winds of at least 34 kt from the southern pressure-wind relationship. 45 kt is chosen for HURDAT at 12 UTC, 15 kt less than previous HURDAT. A peak wind of 35 kt was observed on the 13th. 65 kt is chosen for HURDAT at 12 UTC on the 13th, 20 kt less than originally in HURDAT. On the 14th the hurricane passed very close to Swan Island. A peripheral pressure of 980 mb was observed at Swan Island, implying winds of at least 78 kt from the southern pressure-wind relationship. 85 kt is chosen for HURDAT at 12 UTC on the 14th, a 10 kt downgrade from previous HURDAT. The hurricane progressed west-northwestward from the 12th through the 15th before making landfall just north of the Belize/Mexico border. The storm's intensity at landfall is maintained at 85 kt for HURDAT at 12 UTC on the 15th, partially due to the absence of observations from Mexico and sparse data coverage near the storm. Intensity estimates while the hurricane traversed the Yucatan Peninsula utilized the Kaplan and DeMaria (1995) inland wind decay model, creating a more realistic decrease in intensity for HURDAT while the storm is over land on the 15th and 16th.

The storm emerged in the lower Gulf of Mexico around 12 UTC on the 16th. 40 kt is chosen for HURDAT at 12 UTC on the 16th, a 55 kt downgrade from original HURDAT. On the 17th, the storm began to recurve towards the central Gulf region. A peak wind of 35 kt was observed by ship on the 17th however available data near the storm was sparse on this date. 80 kt is chosen for HURDAT at 12 UTC on the 17th, a 25 kt downgrade from previous HURDAT. The hurricane's northward motion increased on the 17th and 18th before making landfall near Pensacola, Florida, on the 18th. The radius of maximum winds associated with this hurricane is noted by Ho et al as 19 nmi., slightly smaller than climatology of 23 nmi. Pensacola observed a central pressure of 974 mb at 1430 UTC implying winds of 83 kt from the Gulf of Mexico pressure-wind relationship. The storm's forward motion is noted by Ho et al as 21 kt. A fast moving system along with smaller than climatology RMW suggests a slight boost in the intensity at landfall. Thus 90 kt is chosen for HURDAT at 12 UTC on the 18th. The boost in intensity to 90 kt also corresponds to a slightly lower central pressure to around 972 mb (972 mb replaces 974 mb for the 12 UTC estimate in HURDAT). Peak intensity with this hurricane was found to be 90 kt on the 18th, 15 kt less original HURDAT. Dunn and Miller (1960) indicate a major impact in Pensacola on October 18th. The location of landfall is noted by Ho et al as 30.3N, 87.5W. After careful reanalysis it appears that the center made landfall near 30.4N, 87.3W at 1430 UTC. Storm surge is noted by Connor, OMR, and MWR as four feet above normal in Mobile and three feet above normal in Pensacola. The hurricane diminished rapidly after landfall and merged with a low near the Great Lakes by 12 UTC on the 19th. Damage estimates associated with the passage of this storm were approximately \$100,000, mainly in Florida and Alabama (Barnes, 1998).

Storm 12 (Originally 14), 1916


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21635 11/11/1916 M= 6 14 SNBR= 489 NOT NAMED XING=1 SSS=1
21635 11/11/1916 M= 6 12 SNBR= 489 NOT NAMED XING=0 SSS=0
      **

21640 11/11*127 750 35 0*128 763 35 0*129 772 35 0*130 783 35 0
21640 11/11*123 755 30 0*124 765 30 0*125 775 30 0*126 785 30 0
      *** ** *      *** ** *      *** ** *      *** ** *

21645 11/12*131 791 35 0*133 798 35 0*136 807 40 0*140 817 40 0
21645 11/12*127 795 35 0*128 805 35 0*130 815 40 0*136 825 40 0
      *** ** *      *** ** *      *** ** *      *** ** *

21650 11/13*147 827 45 0*159 838 45 0*173 847 50 0*180 853 50 0
21650 11/13*146 834 45 0*157 841 45 0*168 847 50 0*177 852 50 0
      *** ** *      *** ** *      *** ** *      *** ** *

21655 11/14*186 856 55 0*193 857 60 0*200 857 60 0*208 857 60 0
21655 11/14*186 856 55 0*193 859 60 0*200 860 60 0*208 860 60 0
      *** ** *      *** ** *      *** ** *      *** ** *

21660 11/15*216 855 70 0*223 851 70 0*231 845 70 0*245 820 70 0
21660 11/15*216 860 60 0*223 859 60 0E231 857 55 0E242 832 55 1006
      *** ** *      *** ** *      *      *** ** *      **** ** *

21665 11/16*256 795 60 0E270 770 55 0* 0 0 0 0* 0 0 0 0
21665 11/16E255 802 50 0E270 770 45 0* 0 0 0 0* 0 0 0 0
      **** ** *      **

21670 HRBFL1
21670 TS
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Minor changes to the track and intensity shown in Neumann et al. (1999), originally storm number 14. Evidence for these alterations comes from the Historical Weather Maps series, the COADS ship database, Original Monthly Records, and Monthly Weather Review.

November 11: HWM analyzed an open wave near the west central Caribbean. HURDAT listed this as a tropical storm at 12.9N, 77.2W at 12 UTC. Available observations from HWM and COADS suggest a center near 12.5N, 77.5W at 12 UTC. No gale force winds (or equivalent in pressure) were observed.

November 12: HWM indicates a closed low of at most 1005 mb near 13N, 82.5W. HURDAT listed this as a tropical storm at 13.6N, 80.7W at 12 UTC. The MWR seasonal hurricane chart suggests a center near 12N, 81.5W at 12 UTC. Available observations from HWM and COADS suggest a center near 13N, 81.5W at 12 UTC. Ship highlights: 15 kt ENE and 1004 mb at 14.2N, 81.5W at 12 UTC (HWM). "The disturbance originated in approximately 12N, 81W" (MWR).

November 13: HWM analyzed a closed low of at most 1005 mb near 17N, 86W. HURDAT listed this as a tropical storm at 17.3N, 84.7W at 12 UTC. The MWR seasonal hurricane chart suggests a center near 15.5N, 85W at 12 UTC. Available observations from HWM and COADS suggest a center near 16.8N, 84.7W at 12 UTC. Ship highlights: 35 kt NE and 1009 mb at 22N, 86.5W at 12 UTC (HWM). Station highlights: 5 kt E wind and 1002 mb at Swan Island at 12 UTC (OMR).

November 14: HWM indicates a closed low of at most 1005 mb near 19N, 86W with a cold front advancing from the northwest. HURDAT listed this as a tropical storm at 20N, 85.7W at 12 UTC. The MWR seasonal hurricane chart suggests a center near 19.3N, 87.2W at 12 UTC. Available observations from HWM and COADS suggest a center near 19.5N, 86W at 12 UTC. Ship highlights: 25 kt S and 1005 mb at 16.8N, 82.5W at 12 UTC (COA). Station highlights: 5 kt SE and 1004 mb at Swan Island at 12 UTC (HWM). "This disturbance was evidently of marked intensity in the lower latitudes, for according to press reports considerable damage was caused to property along the coast of Spanish Honduras and in Yucatan" (MWR).

November 15: HWM analyzed an asymmetric closed low of at most 1010 mb near 25N, 82W with a frontal boundary extending NE-SW through the system. HURDAT listed this as a Category 1 hurricane at 23.1N, 84.5W at 12 UTC. The MWR seasonal hurricane chart suggests a center near 23.2N, 85.7W at 12 UTC. The MWR Tracks of Lows suggests a closed low of 1002 mb near 24N, 83.7W at 8 a.m. Available observations from HWM and COADS suggests a center near 23.1N, 85.7W at 12 UTC. Ship highlights: 35 kt NW and 1002 mb at 21.8N, 85.8W at 12 UTC (COA). Station highlights: 62 kt N at Sand Key, Florida (MWR); 57 kt at Havana (MWR); 1006 mb (central pressure) and 10 kt SE at Key West at 20 UTC (OMR); 45 kt N at Key West at 21 and 22 UTC (OMR). MWR notes the system as, "advanced rapidly east-northeastward over extreme southern Florida during the 15th".

November 16: HWM indicates a frontal system situated across the eastern Bahamas, stretching from southwest to northeast. HURDAT listed this as an extratropical storm at 27N, 77W at 06 UTC, but that it had likely dissipated by 12 UTC. The MWR Track of Lows suggests a center near 39.7N, 60W at 8 a.m. Available observations from HWM and COADS suggests a center near 27N, 77W at 06 UTC. No gale force winds (or equivalent in pressure) were observed.

Genesis is retained for storm 12 at 00 UTC on November 11th, but as a tropical depression rather than a tropical storm in the central Caribbean Sea. The system became a tropical storm on the 12th as a low pressure of 1004 mb was observed, implying winds of at least 39 kt from the southern pressure-wind relationship. 40 kt is retained for HURDAT at 12 UTC on the 12th. The tropical storm progressed northeastward clipping the eastern tip of Honduras before tracking just west of Swan Island on the 13th. The lowest pressure on the 13th was observed at Swan Island as 1002 mb, implying winds of at least 43 kt from the southern pressure-wind relationship. 50 kt is retained for HURDAT on the 13th at 12 UTC. The storm tracked nearly due north on the 14th and passed through the Yucatan channel on the 15th. HWM indicates the system became elongated northeast to southwest with an asymmetric wind field by 12 UTC on the 15th.

Available observations suggest the system transitioned to an extratropical storm by 12 UTC on the 15th, 18 hours earlier than originally suggested in HURDAT. A central pressure of 1006 mb was observed at Key West implying winds of at least 32 kt and 34 kt from the Gulf of Mexico and southern pressure-wind relationships. However, peak observed winds (corrected to 1-min wind [Fergusson and Covert 1924 and Powell et al 1996]) with this tropical storm are 51 kt at Sand Key and 46 kt at Havana, which occurred primarily in association with the strong cold frontal boundary late on the 15th. 55 kt at 21 UTC on the 15th is analyzed for the intensity of the now extratropical system, down from 70 kt.

The system has been downgraded from a Category 1 hurricane on the 15th to a tropical storm before the extratropical transition. Neumann et al listed storm 12 (originally 14) to be a Category 1 hurricane in southwest Florida, while Schwerdt et al and Ho et al did not list the system indicating that the storm had a central of at least 982 mb. Dunn and Miller (1960) listed this as a "minimal" system that affected the Straits of Florida. Available observations indicate the system acquired peak intensity of 60 kt on the 15th before transitioning to extratropical status.

1916 Additional Notes

1) Historical Weather Maps and COADS indicate that a tropical cyclone developed on 3 October near 17N, 81W from a broad area of low pressure that had persisted in the southwestern Caribbean Sea since the 1st. The system drifted to the northwest while gaining little strength. There were no gales reported in the vicinity of the storm, although a few cases of 25-30 knot winds were reported in the southeastern Gulf of Mexico, along with pressures around 1007 mb. By 6 October, the storm began to lose its closed circulation; the pressure rose to around 1015 mb, and is estimated to have dissipated later that day. Based on the lack of sufficient wind observations, this system is estimated to have stayed as a tropical depression, and is not added to HURDAT.

DAY	LAT	LON	STATUS
Oct 3	17N	81W	Tropical Depression
Oct 4	17N	82W	Tropical Depression
Oct 5	19N	85W	Tropical Depression
Oct 6	20N	85W	Dissipated

2) Historical Weather Maps and COADS indicate that a tropical cyclone developed from the tail end of a decaying frontal boundary near 15N, 76W on 24 October. The low meandered in the central Caribbean Sea for the next several days, peaking in intensity on the 25th. Thereafter, it slowly weakened while drifting northwest. As it approached the western side of Jamaica, it began to get entangled within another frontal boundary, and on the 31st, it became absorbed. Only one gale was reported from COADS on the 25th;

Monthly Weather Review cites the same ship report of SE 50 knot winds just north of Cuba (October, 1917). The lowest observed pressures were 1006 mb. Because only one gale was observed, the system is being kept as a tropical depression, thus it is not being added to HURDAT. It is possible that it may have been a weak tropical storm at some point on the 25th based on the numerous near-gale observations, but sufficient evidence for upgrading is lacking.

DAY	LAT	LON	STATUS
Oct 24	15N	76W	Tropical Depression
Oct 25	16N	76W	Tropical Depression
Oct 26	17N	78W	Tropical Depression
Oct 27	19N	80W	Tropical Depression
Oct 28	20N	80W	Tropical Depression
Oct 29	20N	80W	Tropical Depression
Oct 30	22N	79W	Tropical Depression
Oct 31	-----	-----	Absorbed by front

3) Historical Weather Maps and COADS indicate that a closed low pressure area developed along a frontal boundary around 35N on 4 August. The system moved to the northeast fairly rapidly until becoming absorbed into a larger extratropical system on the 7th. Two separate ships recorded gale force winds on the 5th, and minimum pressures were around 1015 mb. The lack of cold air funneling on the west side of the system suggests that the system may have had some tropical characteristics, but the temperature gradient along the front was over 10 degrees in most cases. South of 40N the temperatures ranged from 70-78 while north of 40N, the temperatures were in the low-mid 60's. Thus, the low is analyzed to have been baroclinic, and is not added to HURDAT.

DAY	LAT	LON	STATUS
Aug 4	37N	69W	Extratropical
Aug 5	39N	65W	Extratropical
Aug 6	44N	60W	Extratropical
Aug 7	-----	-----	Absorbed by larger extratropical system

4) Historical Weather Maps and COADS indicate that a low pressure area closed off along a stationary frontal boundary around 37N on 17 August. Initially, the system moved southeast until the 19th, when it became nearly stationary. On the 21st, it began a slow northwesterly movement toward Long Island. The system was baroclinic in structure until the 19th when temperatures on the backside of the front started to moderate. A minimum pressure of 995 mb was reported by a ship on that day; however, there appeared to have been a 5 mb downward bias with that ship, so the actual pressure is adjusted to 1000 mb, which correlates to a 50 kt storm. Though the storm was no longer baroclinic, gale force winds were reported just off of Cape Hatteras, 250 miles from the center, so it is assumed to have been a non tropical gale center at this point. The

wind field never consolidated, and on the 21st the system started to weaken. Gales were no longer being reported, and the system appears to have dissipated on the 22nd.

DAY	LAT	LON	STATUS
Aug 17	37N	68W	Extratropical
Aug 18	36N	66W	Extratropical
Aug 19	34N	69W	Non-tropical gale center
Aug 20	36N	69W	Non-tropical gale center
Aug 21	37N	70W	Non-tropical gale center
Aug 22	-----	-----	Dissipated

APPENDIX B.2
METADATA RESULTS FOR 1918

Storm 1, 1918

21815 08/01/1918 M= 7 1 SNBR= 493 NOT NAMED XING=1 SSS=3
 21815 08/03/1918 M= 5 1 SNBR= 493 NOT NAMED XING=1 SSS=3

21820 08/01*127 585 35 0*126 599 35 0*126 609 35 0*127 619 35 0*
 21825 08/02*129 633 35 0*131 648 40 0*133 666 40 0*135 681 40 0*
 (The 1st and 2nd are removed from HURDAT).

21830 08/03*140 698 45 0*146 716 45 0*152 736 45 0*159 753 50 0*
 21830 08/03*145 730 25 0*152 745 25 0*160 760 30 0*168 776 30 0
 *** ** * ** * ** * ** * ** * ** * ** * ** * ** * ** * ** *

21835 08/04*167 774 50 0*175 794 50 0*184 814 55 0*191 828 55 0*
 21835 08/04*177 793 35 0*186 809 40 0*195 825 45 0*205 840 50 0
 *** ** * ** * ** * ** * ** * ** * ** * ** * ** * ** * ** *

21840 08/05*200 845 55 0*210 860 60 0*224 876 60 0*235 888 60 0*
 21840 08/05*215 855 55 0*225 869 60 0*235 883 70 0*246 894 80 0
 *** ** * ** * ** * ** * ** * ** * ** * ** * ** * ** * ** *

21845 08/06*246 897 70 0*259 909 80 0*272 917 90 0*286 925 85 960*
 21845 08/06*258 904 90 0*271 914 100 0*285 923 110 0*298 932 110 955
 *** ** * ** * ** * ** * ** * ** * ** * ** * ** * ** * ** *

21850 08/07*300 934 40 0*315 942 30 0* 0 0 0 0* 0 0 0 0*
 21850 08/07*310 940 70 0*320 946 40 0*330 950 30 0*340 952 25 0
 *** ** * ** * ** * ** * ** * ** * ** * ** * ** * ** * ** *

21855 HR LA3
 21855 HR LA3CTX1

Major changes to the track and the intensity shown in Neumann et al (1999). Evidence for these alterations comes from the Historical Weather Maps series, the COADS ship database, individual ship and station data from NCDC, and Monthly Weather Review.

August 3: HWM analyzed an inverted trough in the vicinity of 15N, 73.5W. HURDAT listed this as a tropical storm at 15.2N, 73.6W at 12 UTC. Available observations from HWM and COADS suggest a center near 16N, 76W at 12 UTC.

August 4: HWM indicates an inverted trough near 18N, 83W. HURDAT listed this as a tropical storm at 18.4N, 81.4W at 12 UTC. Available observations from HWM and COADS suggest a center near 19.5N, 82.5W at 12 UTC. Ship highlights: 35 kt SW and 1005 mb at 20.8N, 84.5W at 22 UTC (COA); 45 kt E and 1012 mb at 22.7N, 84.4W at 23 UTC (COA).

August 5: HWM analyzed a closed low of at most 1010 mb near 22N, 88W. HURDAT listed this as a tropical storm at 22.4N, 87.6W at 12 UTC. The MWR Tracks of Cyclones

indicate the center near 22N, 87W at 8 a.m. Available observations from HWM and COADS suggests a center near 23.5N, 88.3W at 12 UTC. Ship highlights: 35 kt SSW at 21.1N, 86.7W (COA).

August 6: HWM indicates a closed low of at most 1010 mb near 26.5N, 92.5W.

HURDAT listed this as a Category 2 hurricane at 27.2N, 91.7W at 12 UTC. The MWR Tracks of Cyclones indicate the center near 29N, 93.5W at 8 a.m. Available observations from HWM and COADS suggests a center near 28.5N, 92.3W at 12 UTC. Station highlights: calm winds and 960 mb at Sulphur at 19 UTC (MWR); 78 kt at Lake Charles (LA) at 19 UTC (MWR). Damage estimates in MWR are, "...roughly estimated at \$5,000,000".

August 7: HWM analyzed a closed low of at most 1010 mb near 19N, 61W. HURDAT listed this as dissipated at 31.5N, 94.2W by 06 UTC. Available observations from HWM and COADS suggest a center near 33N, 95W at 12 UTC.

Genesis is begun at 00 UTC August 3rd, 2 days later and significantly farther west (2.6 degrees) than previously suggested in HURDAT. The system originated southwest of Haiti as a tropical depression and progressed west-northwestward towards the Yucatan Peninsula. Gale force winds were observed late on the 4th and evidence indicates the tropical storm became a hurricane around 12 UTC on the 5th just north of the Yucatan, 12 hours earlier than originally suggested in HURDAT. Available observations estimate landfall to have occurred at 1730 UTC on the 6th near Cameron, Louisiana (29.8N, 93.2W). A central intensity of 955 mb at landfall has been estimated using the Ho et al inland pressure decay model from an inland central pressure observation at Sulphur, Louisiana [960 mb] indicating at least 110 kt from the Gulf of Mexico pressure-wind relationship. 110 kt is chosen for HURDAT at 18 UTC on the 6th, upgraded from 85 kt previously. This increases storm 1 from a Category 2 hurricane to a Category 3, making it the only major hurricane of 1918. Regarding the probably radius of maximum winds (RMW): "The area in which considerable destruction occurred was about 25 miles wide" (MWR). RMW observations of 12-13 nmi is considerably smaller than climatology (21 nmi) (source). Regarding the storm surge at landfall, "...Johnsons Bayou, 10 miles east of the Sabine Pass, reported the tide was 2.5 feet above normal... At Morgan City the tide rose 3 feet" (MWR).

The hurricane progressed on a north-northwest track as it made landfall, nearly paralleling the Texas/Louisiana border. A pressure of 960 mb at Sulphur (LA) at 19 UTC on the 6th, 2.5 hours after landfall, implies winds of at least 95 kt from the subtropical pressure-wind relationship. At 5 UTC on the 7th an observed wind of 30 kt was reported in Shreveport (LA), approximately 11 hours after landfall. These observations were utilized in the Kaplan and DeMaria inland wind decay model to determine a revised dissipation time of 18 UTC on the 7th, 12 hours later than previously suggesting in HURDAT.

Jarrell et al (1992) lists this storm as the 29th most deadly hurricane with 34 fatalities and indicates it was of Category 3 intensity in southwest Louisiana. Dunn and Miller (1960) notes an extreme hurricane in southwest Louisiana with a death toll of 34 persons and a

damage estimate of \$5,000,000. Although storm 1 has been boosted from Category 2 to Category 3 intensity, it should be noted that storm 1 possibly reached Category 4 strength due to the speed of the storm and climatologically small radius of maximum winds. North Texas is added as having Category 1 impact from storm number 1 by Utilizing the Schwerdt et al (year) wind model. The revised Category 3 assessment at landfall from 110 kt does corroborate with previous studies by Jarrell et al (1992) and Neumann et al (1999).

Storm 2, 1918

21860 08/22/1918 M= 5 2 SNBR= 494 NOT NAMED XING=0 SSS=0

21865 08/22* 0 0 0 0*117 560 60 0*121 590 60 0*123 606 60 0
 21865 08/22* 0 0 0 0*120 575 40 0*121 590 45 0*123 606 45 0
 *** ** ** ** **

21870 08/23*125 618 65 0*127 636 70 0*130 665 70 0*133 684 70 0
 21870 08/23*127 624 50 0*133 644 50 0*140 665 55 0*145 684 55 0
 *** ** ** *** ** ** *** ** **

21875 08/24*136 704 70 0*140 723 70 0*145 744 70 0*148 764 70 0
 21875 08/24*149 704 60 0*152 723 65 0*155 744 70 0*156 764 75 0
 *** ** ** *** ** ** *** ** **

21880 08/25*152 788 70 0*157 809 70 0*160 830 70 0*165 852 65 0
 21880 08/25*156 788 80 0*156 809 85 0*156 830 90 968*159 852 80 0
 *** ** ** *** ** ** *** ** ** *** ** **

21885 08/26*169 876 55 0*168 894 30 0* 0 0 0 0* 0 0 0 0
 21885 08/26*163 876 70 0*167 894 45 0*170 910 30 0* 0 0 0 0
 *** ** ** *** ** ** *** ** **

21890 HR

Minor changes to the track and the intensity shown in Neumann et al. (1999). Evidence for these alterations comes from the Historical Weather Maps series, the COADS ship database, individual ship data from NCDC, and Monthly Weather Review.

August 22: HWM indicates an open wave near 14N, 60W. HURDAT listed this as a tropical storm at 12.1N, 59W at 12 UTC. Available observations from HWM and COADS suggest a center near 12.1N, 59W at 12 UTC. Station highlights: 42 kt SE and 1010 mb at Bridgetown, Barbados at ~18 UTC (MWR).

August 23: HWM analyzed an open wave near 15N, 65W. HURDAT listed this as a Category 1 hurricane at 13N, 66.5W at 12 UTC. Available observations from HWM and COADS suggest a center near 14N, 66.5W at 12 UTC. Ship highlights: 50 kt SE and 1003 mb at 14.3N, 66.2W at 11 UTC (NCDC).

August 24: HWM indicates a broad inverted trough near 18N, 76W. HURDAT listed this as a Category 1 hurricane at 14.5N, 74.4W at 12 UTC. Available observations from HWM and COADS suggest a center near 15.5N, 74.4W at 12 UTC. No gale force winds (or equivalent in pressure) were observed. "Center passed south of Jamaica moving west (MWR)."

August 25: HWM analyzed an inverted trough near 16.5N, 82W. HURDAT listed this as a Category 1 hurricane at 16N, 83W at 12 UTC. Available observations from HWM and COADS suggest a center near 15.6N, 83W at 12 UTC. Ship highlights: 70 kt NW and 972 mb at 15.6N, 82W at 08 UTC (NCDC); calm winds and 968 mb at 16N, 83W at 09 UTC (NCDC); "the disturbance, much diminished in intensity, passed inland over Honduras Sunday night [25th] and dissipated over that region during the next 48 hours (MWR)."

August 26: HWM indicates an inverted trough near 12.5N, 87W. HURDAT listed this as dissipated at 16.8N, 89.4W by 06 UTC. Available observations from HWM and COADS suggest a center near 17N, 91W at 12 UTC. No gale force winds (or equivalent in pressure) were observed.

Genesis for this tropical system is kept at 06 UTC on August 22nd. First reports of this tropical storm occurred at 18 UTC on the 22nd at Barbados where gale force winds [42 kt] and moderately low pressure [1010 mb] were observed. 45 kt is chosen for HURDAT at 12 UTC on the 22nd, a reduction down from 60 kt based upon available observations. Evidence suggests the tropical storm passed just south of Barbados on the 22nd. Tropical storm force winds [50 kt] were reported throughout the morning hours of the 23rd by the ship S.S. Mohegan as the storm progressed westward across the eastern Caribbean Sea. 55 kt is chosen for HURDAT at 12 UTC on the 23rd, a reduction down from 70 kt. Gale force winds or low pressures were not observed again until the early morning of the 25th where the ship S.S. Kaeo Samud measured a central pressure of 968 mb at 09 UTC at 15.6N, 82W (NCDC). A central pressure of 968 mb indicates winds of 92 kt from the southern pressure-wind relationship. 90 kt is chosen for 12 UTC on the 25th, increased from 70 kt originally. Evidence indicates the hurricane made landfall in northern Honduras late on the 25th and continued a westward track into southern Belize by the 26th, but due to the lack of land observations, the exact location of such landfall is uncertain. However, it is apparent that the hurricane was greatly diminished in intensity after landfall since no gale force winds or low pressures were observed by either land or ship stations on the 26th. Available observations indicate the storm dissipated by 12 UTC on the 26th, 6 hours later than suggested in HURDAT. The ship observation on the 23rd led to an increase in the peak intensity for storm 2 from Category 1 [70 kt] to Category 2 [90 kt]. Major alterations are suggested for the duration of storm 2.

Storm 3, 1918

21895 08/23/1918 M= 4 3 SNBR= 495 NOT NAMED XING=1 SSS=0

21900 08/23* 0 0 0 0*277 733 35 0*288 745 35 0*304 757 40 0

21900 08/23* 0 0 0 0*277 733 35 0*288 745 35 0*300 757 40 0

21905 08/24*319 766 40 0*332 771 45 0*340 773 50 0*347 770 50 0

21905 08/24*312 766 40 0*324 771 45 0*335 773 50 0*344 770 55 0
*** **

21910 08/25*354 766 50 0*358 762 45 0*362 758 40 0*367 752 35 0

21910 08/25*351 765 60 0*357 759 60 0*362 753 60 0*368 746 55 0
*** **

21915 08/26*374 742 30 0* 0 0 0 0* 0 0 0 0* 0 0 0 0

21915 08/26*375 738 45 0*382 729 35 0E390 720 30 0* 0 0 0 0
*** **

21920 TS

Minor changes to the track and the intensity shown in Neumann et al. (1999). Evidence for these alterations comes from the Historical Weather Maps series, individual station observations from NCDC, and the COADS ship database.

August 23: HWM analyzed a closed low of at most 1010 mb near 29N, 75W. HURDAT listed this as a tropical storm at 28.8N, 74.5W by 12 UTC. The MWR Tracks of Cyclones indicate the center near 29N, 75W at 8 p.m. Available observations from HWM and COADS suggests a center near 28.8N, 74.5W at 12 UTC. No gale force winds (or equivalent in pressure) were observed.

August 24: HWM indicates a closed low of at most 1005 mb near 34N, 77.5W. HURDAT listed this as a tropical storm at 34N, 77.3W at 12 UTC. The MWR Tracks of Cyclones indicate the center near 34N, 78W at 8 a.m. Available observations from HWM and COADS suggests a center near 33.5N, 77.3W at 12 UTC. Ship highlights: 35 kt S and 1004 mb at 32.8N, 78.3W at 11 UTC (COA). Station highlights: 30 kt N and 1006 mb at Wilmington (NC) at 12 UTC (HWM); 15 kt NW and 1002 mb at Wilmington at 16 UTC (OMR). Wind observations from Wilmington were "a maximum velocity of 38 miles from the northwest at 12:10 pm (16Z)" (OMR).

August 25: HWM analyzed a closed low of at most 1005 mb near 36N, 75W. HURDAT listed this as a tropical storm at 36.2N, 75.8W by 12 UTC. The MWR Tracks of Cyclones indicate the center near 37N, 74W at 8 a.m. Available observations from HWM and COADS suggests a center near 36.2N, 75.3W at 12 UTC. Ship highlights: 60 kt SSE and 999 mb at 36.1N, 75.1W at 12 UTC (COA). Station highlights: 55 kt at Cape Henry at ~18 UTC (OMR); 35 kt SW and 1008 mb at Cape Hatteras at 12 UTC (OMR).

August 26: HWM indicates the cyclone is merging with a frontal system. HURDAT listed this as a tropical depression at 37.4N, 74.2W by 00 UTC for its last position. Available observations from HWM and COADS suggest a center near 39N, 72W at 12 UTC. No gale force winds (or equivalent in pressure) were observed.

Minor alterations are suggested to the track and intensity of storm number 3. Genesis for this tropical system is kept at 06 UTC on the 23rd. Gale force winds were first observed on the 24th [35 kt] with a peripheral pressure of 1004 mb suggesting at least 40 kt from the subtropical pressure-wind relationship. 50 kt is retained for HURDAT at 12 UTC on the 24th. A peripheral pressure observation of 1002 mb at Wilmington, North Carolina, at 16 UTC on the 24th suggests winds of at least 45 kt from the subtropical pressure-wind relationship. 55 kt is chosen for HURDAT at 18 UTC, up slightly (5 kt) from HURDAT originally. The tropical storm made landfall northeast of New Bern, North Carolina, near 00 UTC on the 25th with peak peripheral observations of 1008 mb and 25 kt winds at Cape Hatteras. A wind of 60 kt was observed at 12 UTC on the 25th, indicating the tropical storm was stronger than originally suggested by HURDAT. A peripheral pressure of 999 mb was observed at 12 UTC on the 25th suggesting winds of at least 50 kt from the northern pressure-wind relationship. 60 kt is chosen for HURDAT at 12 UTC, a 20 kt upgrade from original HURDAT. The storm stayed over land for ~ 18 hours, moving back over the Atlantic Ocean around 18 UTC on the 25th. It is possible that the system achieved hurricane status as well, but no direct evidence could be found. The storm passed just east of Virginia on the 25th where Cape Henry observed 55 kt winds. Dissipation occurred by 12 UTC on the 26th, 12 hours later than suggested by HURDAT, as the tropical storm merged with an approaching frontal boundary. Maximum observations with this storm were 60 kt and 999 mb at 12 UTC on the 25th. Damage associated with this tropical storm was minor, "probably not exceeding \$15,000" (OMR).

Storm 4, 1918

(This storm is new to HURDAT.)

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21921 08/31/1918 M= 7 4 SNBR= 496 NOT NAMED XING=0 SSS=0
21922 08/31* 0 0 0 0* 0 0 0 0*365 495 35 0*362 508 35 0
21923 09/01*359 520 35 0*356 530 35 0*355 535 35 0*357 535 35 0
21924 09/02*360 530 40 0*365 523 40 0*370 515 45 0*373 507 45 0
21924 09/03*376 500 50 0*378 494 50 0*380 490 55 0*382 488 55 0
21924 09/04*383 487 60 0*384 486 60 0*385 485 60 0*386 483 60 0
21924 09/05*387 480 55 0*388 476 50 0*390 470 45 0*392 462 40 0
21924 09/06*395 452 35 0* 0 0 0 0* 0 0 0 0* 0 0 0 0
21924 TS
```

This is a new tropical storm not previously recorded in HURDAT. Evidence for this system comes from the Historical Weather Map series and the COADS ship database.

August 31: HWM indicates a closed low of at most 1015 mb near 35N, 49W. Available observations from HWM and COADS suggest a center near 36.5N, 49.5W at 12 UTC.

Ship highlights: 35 kt NE and 1022 mb at 38N, 50.1W at 12 UTC (COA).

September 1: HWM analyzed a closed low of at most 1010 mb near 33N, 52W. Available observations from HWM and COADS suggest a center near 35.5N, 53.5W at 12 UTC.

No gale force winds (or equivalent in pressure) were observed.

September 2: HWM indicates a closed low of at most 1010 mb near 34N, 50W. Available observations from HWM and COADS suggest a center near 37N, 51.5W at 12 UTC. No

gale force winds (or equivalent in pressure) were observed.

September 3: HWM analyzed a closed low of at most 1010 mb near 36N, 50W. Available observations from HWM and COADS suggest a center near 38N, 49W at 12 UTC. Ship highlights: 50 kt E at 39.1N, 56W at 12 UTC (COA).

September 4: HWM indicates a closed low of at most 1005 mb near 40N, 50W. Available observations from HWM and COADS suggest a center near 38.5N, 48.5W at 12 UTC.

Ship highlights: 35 kt NW and 996 mb at 37.9N, 48.6W at 07 UTC (COA); 30 kt NW and 993 mb at 38.1N, 48.3W at 09 UTC (COA); 30 kt SSW and 992 mb at 38.3N, 47.9W at 11 UTC (COA).

September 5: HWM analyzed a closed low of at most 1015 mb near 39N, 48W. Available observations from HWM and COADS suggest a center near 39N, 47W at 12 UTC. No gale force winds (or equivalent in pressure) were observed.

September 6: HWM indicates a closed low of at most 1010 mb near N, W. Available observations from HWM and COADS suggests a center near 39.5N, 45.2W at 00 UTC.

No gale force winds (or equivalent in pressure) were observed.

Genesis for this tropical storm began around 12 UTC on August 31st where evidence first indicates a closed circulation. Gale force winds [35 kt] were observed on 31st at 12 UTC northeast of Bermuda. 35 kt is chosen for HURDAT at 12 UTC. Gale force winds were not observed on September 1st or 2nd although HURDAT is maintained at minimal tropical storm strength. A 50 kt wind was observed at 12 UTC on the 3rd. 55 kt is chosen for HURDAT at 12 UTC. A peripheral pressure of 992 mb at 11 UTC on the 4th suggests winds of at least 60 kt from the northern pressure-wind relationship. Therefore 60 kt is chosen for HURDAT at 12 UTC. Peak observations with this tropical storm were 50 kts on the 3rd and 992 mb on the 4th. Maximum winds chosen for HURDAT are 60 kt based on both observed winds and pressure, although it is possible that this system reached minimal hurricane status. Dissipation occurred on the 6th as the system became absorbed by a frontal boundary. Storm 4 meandered east and northeast of Bermuda for the duration of its existence.

Storm 5 (originally 4), 1918

21925 09/02/1918 M= 6 4 SNBR= 496 NOT NAMED XING=0 SSS=0

21925 09/02/1918 M= 7 5 SNBR= 496 NOT NAMED XING=0 SSS=0

* *

21930 09/02* 0 0 0 0* 0 0 0 0* 0 0 0 0*246 551 60 0

21930 09/02*246 570 40 0*248 578 45 0*250 585 50 0*252 590 60 0

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

21935 09/03*256 570 65 0*262 580 70 0*269 590 70 0*275 602 75 0

21935 09/03*254 595 65 0*257 600 70 0*260 605 70 0*266 612 75 0

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

21940 09/04*282 614 75 0*290 626 80 0*298 638 80 0*308 648 85 0

21940 09/04*277 620 75 0*288 629 80 0*298 638 80 0*308 646 85 0

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

21945 09/05*318 656 85 0*328 662 85 0*338 668 85 0*353 672 80 0

21945 09/05*318 654 85 0*328 661 85 0*338 668 85 0*348 672 80 0

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

21950 09/06*363 674 75 0*380 676 65 0*397 675 65 0*420 668 55 0

21950 09/06*358 674 75 0*368 676 65 0*380 675 65 0*497 666 55 0

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

21955 09/07E438 655 50 0E451 641 45 0E468 624 40 0E480 600 40 0

21955 09/07E425 650 50 0E455 630 45 0E475 605 40 0E485 580 40 0

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(The 8th is new to HURDAT.)

21957 09/08E489 565 40 0E490 655 35 0E490 550 30 0* 0 0 0 0

21960 HR

Major changes to the track and no changes to the intensity shown in Neumann et al. (1999), originally storm number 4. Evidence for these alterations comes from the Historical Weather Maps series, the COADS ship database, individual ship and station data from NCDC, and Monthly Weather Review.

September 2: HWM indicates a closed low of at most 1010 mb near 35N, 50W.

HURDAT listed this as a tropical storm at 24.6N, 55.1W at 18 UTC at its first listing.

Available observations from HWM and COADS suggest a center near 25N, 58.5W at 12 UTC. Ship highlights: 45 kt NE at 26.5N, 60.6W at 12 UTC (COA).

September 3: HWM analyzed a closed low of at most 1010 mb near 25N, 62W.

HURDAT listed this as a Category 1 hurricane at 26.9N, 59.0W at 12 UTC. Available observations from HWM and COADS suggest a center near 26N, 60.5W at 12 UTC. Ship highlights: 70 kt S at 25.7N, 59.7W at 12 UTC (COA). "The earliest report of the

existence of this storm came from the Swedish S.S. Texas on September 3, the vessel being some distance southeast of Bermuda..." (MWR).

September 4: HWM indicates a closed low of at most 1005 mb near 25.5N, 65.5W.

HURDAT listed this as a Category 1 hurricane at 29.8N, 63.8W at 12 UTC. The MWR Tracks of Cyclones indicate the center near 23.5N, 64W at 8 a.m. Available observations from HWM and COADS suggests a center near 29.8N, 63.8W at 12 UTC. Station highlights: 35 kt NE and 1006 mb at Bermuda at 12 UTC (HWM). "The lowest reported pressure for this storm was 28.88 inches [978 mb], at Hamilton, Bermuda, on the 4th" (MWR).

September 5: HWM analyzed a closed low of at most 1005 mb near 33N, 70W.

HURDAT listed this as a Category 2 hurricane at 33.8N, 66.8W at 12 UTC. The MWR Tracks of Cyclones indicate the center near 34N, 66W at 8 a.m. Available observations from HWM and COADS suggests a center near 33.8N, 66.8W at 12 UTC. Station highlights: 978 mb at Bermuda at 00 UTC (MWR). "...the storm advanced northwestward, passing to the west of Bermuda on the night of the 4th-5th" (MWR).

September 6: HWM indicates a closed low of at most 1000 mb near 38N, 69W.

HURDAT listed this as a Category 1 hurricane at 39.7N, 67.5W at 12 UTC. The MWR Tracks of Cyclones indicate the center near 39N, 67W at 8 a.m. Available observations from HWM and COADS suggests a center near 38N, 67.5W. Ship highlights: 35 kt N and 991 mb at 39.5N, 68.4W at 15 UTC (COA); 35 kt WNW and 1002 mb at 39.6N, 69.2W at 19 UTC (COA).

September 7: HWM analyzed a closed low of at most 995 mb near 47.5N, 60.5W.

HURDAT listed this as an extra-tropical storm at 46.8N, 62.4W at 12 UTC. The MWR Tracks of Cyclones indicate the center near 48.5N, 61W at 8 a.m. Available observations from HWM and COADS suggests a center near 47.5N, 60.5W at 12 UTC. Ship highlights: 997 mb at 47.1N, 65.3W at 15 UTC (COA). Station highlights: 20 kt N and 1005 mb at St. Pierre at 12 UTC (HWM); 35 kt W and 998 mb at Glace Bay at 12 UTC (HWM). "The storm recurved some distance out to sea from the coast of the United States, but crossed Nova Scotia on the night of the 6th-7th, much diminished in intensity" (MWR).

September 8: HWM indicates a closed low of at most 1010 mb near 50N, 54W. Available observations from HWM and COADS suggest a center near 49N, 55W. No gale force winds (or equivalent in pressure) were observed.

This tropical system originated east of Bermuda early on the 2nd as a tropical storm as indicated by available wind observations, 18 hours earlier than originally in HURDAT. A wind observation of 70 kt at 12 UTC on the 3rd confirms the system attained hurricane intensity. 70 kt is maintained for HURDAT at 06 UTC on the 3rd. As the hurricane traversed near Bermuda, a peripheral pressure observation of 978 mb at 00 UTC on the 5th suggests winds of at least 77 kt from the subtropical pressure-wind relationship. 85 kt is maintained for 00 UTC on the 5th. A peripheral pressure observation of 991 mb at 15 UTC on the 6th suggests winds of at least 61 kt from the northern pressure-wind relationship. 65 kt is retained for HURDAT at 12 UTC. The Category 2 hurricane paralleled the United States east coast on the 5th and 6th until landfall in Nova Scotia as a

weaker extratropical storm early on the 7th. The storm dissipated as an extratropical storm on the 8th at 12 UTC, 18 hours later than indicated in HURDAT. Minor alterations are suggests for the track of this storm.

Originally Storm 5, 1918

(This storm is to be removed from HURDAT.)

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21965 09/09/1918 M= 6 5 SNBR= 497 NOT NAMED XING=0 SSS=0
21970 09/09*135 580 35 0*143 605 35 0*147 616 35 0*150 622 35 0
21975 09/10*153 629 35 0*156 636 35 0*160 643 35 0*162 650 35 0
21980 09/11*165 657 35 0*167 663 40 0*170 670 40 0*173 676 40 0
21985 09/12*176 682 40 0*179 688 40 0*184 694 40 0*189 701 35 0
21990 09/13*195 707 35 0*204 715 35 0*215 727 35 0*227 734 35 0
21995 09/14*243 741 35 0*258 747 30 0*277 750 25 0* 0 0 0 0
22000 TS
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Major changes to the track and the intensity shown in Neumann et al. (1999), originally storm number 5. Evidence for these alterations comes from the Historical Weather Maps series, the COADS ship database, and Monthly Weather Review.

September 9: HWM analyzed an open wave near the Lesser Antilles. HURDAT listed this as a tropical storm at 14.7N, 61.6W at 12 UTC. Available observations from HWM and COADS suggest the system is not closed and therefore a center cannot be determined on this date. No gale force winds (or equivalent in pressure) were observed. "It was first noted on the 9th near Barbados Island, and thence a track toward the northwest, across the eastern end of the Caribbean Sea, was taken" (MWR).

September 10: HWM indicates an open wave located near the northeastern Caribbean Sea. HURDAT listed this as a tropical storm at 16N, 64.3W at 12 UTC. Available observations from HWM and COADS indicate the system is not closed and thus a center cannot be determined on this date. No gale force winds (or equivalent in pressure) were observed.

September 11: HWM analyzed an inverted trough near 17N, 67W. HURDAT listed this as a tropical storm at 17N, 67W at 12 UTC. Available observations from HWM and COADS suggest the system is not closed and therefore a center cannot be determined on this date. No gale force winds (or equivalent in pressure) were observed.

September 12: HWM indicates a broad area of low pressure in the central Caribbean Sea near 15N, 74W. HURDAT listed this as a tropical storm at 18.4N, 69.4W at 12 UTC. The MWR Tracks of Cyclones indicates a low pressure of 1009 mb near 19N, 73.5W at 8 p.m. Available observations from HWM and COADS indicates the system is not closed and thus a center cannot be determined on this date. No gale force winds (or equivalent in pressure) were observed. "After crossing Haiti on the 12th, the path inclined to a more nearly northerly direction" (MWR).

September 13: HWM analyzed as a closed low of at most 1010 mb near 15.5N, 81W.

HURDAT listed this as a tropical storm at 21.5N, 72.7W at 12 UTC. The MWR Tracks of Cyclones indicate the center near 21N, 74W at 8 p.m. Available observations from HWM and COADS suggest the system is not closed and therefore a center cannot be determined on this date. No gale force winds (or equivalent in pressure) were observed. September 14: HWM indicates an inverted trough in the north-central Caribbean Sea near Cuba with an approaching frontal system moving into the Bahamas. HURDAT listed this as a tropical storm at 27.7N, 75W at 12 UTC. The MWR Tracks of Cyclones indicate the center near 27N, 75W at 8 a.m. Available observations from HWM and COADS indicate the system is not closed and thus a center cannot be determined on this date. No gale force winds (or equivalent in pressure) were observed. "...the storm disappeared on the 14th near the Great Abaco Island" (MWR).

Genesis for this system began at 00 UTC on the 9th as a minimal tropical depression east of the Lesser Antillies. A peak observation of 1011 mb and 20 kt at 12 UTC on the 9th at Barbados indicates the system had not yet attained tropical storm status (HWM). Available winds also suggest that the system was not closed on the 9th as the prevailing winds were from the east throughout the day. On the 10th it again appears that the system was not of tropical storm intensity as previously suggested by HURDAT. Peak observations on the 10th were 1013 mb and 20 kt at 12 UTC at San Juan, Puerto Rico (HWM). The system began progressing on a more northwestward track on the 11th. No gale force winds or low pressures were observed on the 11th although HURDAT suggests a 40 kt tropical storm existed at 12 UTC on the 11th. Peak observations on the 11th were 1012 mb and 15 kt at St. Thomas Island (HWM). HURDAT indicates a 40 kt tropical storm on the 12th but available observations suggests the system continues to remain a tropical depression, lacking a westerly wind component and possessing no gale force observed or implied winds. Peak observations on the 12th were 1012 mb and 15 kt at Turks Islands at 12 UTC (HWM). The 13th brought about the first westerly wind observation (10 kt SW) near Guantanamo Bay, Cuba at 12 UTC (HWM). Peak observations for the 13th were 1011 mb and 15 at Baracoa, Cuba at 12 (HWM). HURDAT maintains that the system was of minimal tropical storm intensity through 00 UTC on the 14th. Peak observations near the original HURDAT track were 1015 mb and 20 kt just off the coast of Miami at 12 UTC on the 14th (COA).

The absences of westerly winds prevailed from the 9th through the 12th indicating that the system was not closed. The tropical system was near land on the 9th, 12th, and 13th and as noted above, no gale force winds or low pressures were observed on these days. Therefore, lacking sufficient evidence of a closed surface circulation or gale force winds indicates that storm number 5 should be downgraded to a tropical depression, thereby removing it from HURDAT.

1918 Additional Notes

1) Historical Weather Maps and COADS indicate a cyclonic system developed in the Gulf of Mexico at the tail end of a frontal boundary, became a tropical depression, moved across south Florida and merged with a frontal boundary. Highest winds with this system were 15 kt (a few days) and lowest pressure of 1008 mb (on the 23rd - COA). Thus no gales or pressures supporting gale force were observed. While it is possible that this system did attain tropical storm force, this system is considered a tropical depression and not added to HURDAT.

DAY LAT LON STATUS

Jun 18 --- --- Trough in the eastern Gulf of Mexico
 Jun 19 25N 90W Possible Tropical Depression
 Jun 20 26N 87W Tropical Depression
 Jun 21 26N 86W Tropical Depression
 Jun 22 25N 81W Tropical Depression (over south Florida)
 Jun 23 29N 79W Extratropical - merging with front

2) Historical Weather Maps and COADS indicate a well-developed tropical wave left the coast of West Africa, became a tropical depression soon thereafter, traveled west for two days, and then was lost in the data void of the eastern tropical North Atlantic. Peak observed winds were 25 kt on the 14th (HWM) and sea level pressures dropped 5 mb at Praia, Cape

Verde Islands (down to 1010 mb) in one day as the tropical depression passed through. No gales or pressures supporting gale force were observed. While it is possible that this system did attain tropical storm force, this system is considered a tropical depression and not added to HURDAT.

DAY LAT LON STATUS

Sep 13 15N 19W Tropical Depression
 Sep 15 15N 24W Tropical Depression
 Sep 16 15N 29W Tropical Depression
 Sep 17 --- --- System lost over open ocean

3) Historical Weather Maps, COADS and Monthly Weather Review indicate that a tropical depression formed in the northwestern Caribbean Sea on the 25th of September, moved north over the next two days with no change in intensity, became extratropical on the 28th in the eastern Gulf of Mexico and dissipated in place on the 30th. Peak observations as a tropical cyclone were 30 kt ship (COA) and 1007 mb (Belize City and ship, HWM and COA) on the 25th and 33 kt at Sand Key, FL on the 27th (MWR). (The 33 kt at Sand Key corrects to 29 kt after accounting for the high bias of instrumentation of the era and converting from maximum 5 min to 1 min winds [Fergusson and Covert 1924 and Powell et al. 1996].) Higher winds were observed (36 kt at Pensacola - 32 kt

after adjustment) after the system transitioned to an extratropical storm on the 28th. It is possible that this system did obtain tropical storm intensity, but without supporting evidence this system is considered a tropical depression and not added to HURDAT.

DAY LAT LON STATUS

Sep 24 --- --- Open trough over Central America
 Sep 25 18N 87W Tropical Depression
 Sep 26 20N 87W Tropical Depression
 Sep 27 23N 88W Tropical Depression
 Sep 28 28N 84W Extratropical Storm
 Sep 29 28N 85W Extratropical Storm
 Sep 30 27N 85W Extratropical Storm - dissipating

4) Historical Weather Maps, COADS and Monthly Weather Review indicate that a tropical depression formed in the southern Gulf of Mexico on the 14th of October, moved slowly northwestward over the next three days without significant change in intensity, made landfall in Louisiana late on the 17th, and dissipated over Arkansas on the 19th. Peak observations were 37 kt at Sand Key, FL on the 15th (MWR) and 38 kt at Pensacola, FL on the 16th (MWR). (These correct to 32 and 33 kt, respectively, after accounting for the high bias of instrumentation of the era and converting from maximum 5 min to 1 min winds [Fergusson and Covert 1924 and Powell et al. 1996].) No pressures were reported lower than 1006 mb throughout the lifetime of the system. It is possible that this system did obtain tropical storm intensity, but without supporting evidence this system is considered a tropical depression and not added to HURDAT.

DAY LAT LON STATUS

Oct 14 22N 85W Tropical Depression
 Oct 15 24N 88W Tropical Depression
 Oct 16 26N 91W Tropical Depression
 Oct 17 29N 92W Tropical Depression
 Oct 18 31N 93W Tropical Depression - over land
 Oct 19 33N 94W Tropical Depression - over land, dissipating

APPENDIX B.3
METADATA RESULTS FOR 1927

Storm 1, 1927

24285 08/19/1927 M= 8 1 SNBR= 543 NOT NAMED XING=0 SSS=0

24285 08/18/1927 M= 9 1 SNBR= 543 NOT NAMED XING=0 SSS=0

*

(The 18th is new to HURDAT.)

24287 08/18* 0 0 0 0* 0 0 0 0*140 400 35 0*145 415 35 0

24290 08/19* 0 0 0 0* 0 0 0 0*152 450 60 0*156 475 65 0

24290 08/19*150 430 40 0*155 445 45 0*160 460 50 0*166 475 55 0

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

24295 08/20*161 498 70 0*166 519 75 0*172 537 80 0*178 552 85 0

24295 08/20*173 490 60 0*182 515 65 0*190 520 70 0*196 536 75 0

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

24300 08/21*183 565 90 0*191 579 90 0*202 594 95 0*215 611 100 0

24300 08/21*200 553 85 0*203 571 95 0*207 590 100 0*214 611 105 0

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

24305 08/22*229 628 100 0*242 645 100 0*256 662 105 0*270 678 105 0

24305 08/22*223 633 105 0*233 657 110 950*245 677 110 0*259 695 110 0

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

24310 08/23*283 692 105 0*297 706 105 0*311 720 105 0*326 728 100 0

24310 08/23*275 710 110 0*291 723 110 0*308 730 110 0*324 732 110 0

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

24315 08/24*342 731 100 0E360 730 95 0E380 724 95 0E408 700 90 0

24315 08/24*339 729 105 0*354 722 100 0*370 710 95 0*390 685 85 0

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

24320 08/25E445 655 90 0E485 597 90 0E518 548 90 0E544 502 90 0

24320 08/25E425 650 75 0E470 603 70 0E518 548 70 0E558 490 65 0

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

24325 08/26E568 442 90 0E586 390 85 0E610 323 80 0* 0 0 0 0

24325 08/26E583 435 65 0E598 380 60 0E610 323 60 0* 0 0 0 0

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24330 HR

Minor changes to the track and intensity shown in Neumann et al. (1999). Evidence for these alterations comes from the Historical Weather Maps series, the COADS ship database, Original Monthly Records, and Monthly Weather Review.

August 18: HWM analyzed an open wave near 12N, 41W. HURDAT listed this as a Category 1 hurricane at 20.2N, 60.8W at 12 UTC. The MWR Tracks of Cyclones indicate the center near 21N, 61W at 8 a.m. Available observations from HWM and

COADS suggest a center near 19.5N, 62W. No gale force winds (or equivalent in pressure) were observed.

August 19: HWM indicates a closed low of at most 1010 mb near 12N, 46.5W. HURDAT listed this as a tropical storm at 15.2N, 45W at 12 UTC. Available observations from HWM and COADS suggest a center near 16N, 46W. Ship highlights: 45 kt NNE at 17.5N, 48.5W at 19 UTC (COA).

August 20: HWM analyzed a closed low of at most 1010 mb near 17.5N, 50W. HURDAT listed this as a Category 1 hurricane at 17.2N, 53.7W at 12 UTC. Available observations from HWM and COADS suggest a center near 19N, 52W. Ship highlights: 45 kt E and 1021 mb at 21.5N, 51.5W at 23 UTC (COA).

August 21: HWM indicates a closed low of at most 1005 mb near 19N, 59.5W. HURDAT listed this as a Category 2 hurricane at 20.2N, 59.4W at 12 UTC. The MWR Tracks of Cyclones indicate the center near 22N, 64.8W at 8 a.m. Available observations from HWM and COADS suggest a center near 20.7N, 59W. Ship highlights: 70 kt NE and 961 mb at 22.7N, 63W at 2140 UTC (MWR). "The first tropical disturbance of the season made its appearance on the morning of the 21st, about 300 miles northeast of St. Kitts. At that time it was of considerable intensity, as indicated by the heavy northeast swells reported by the S.S. Inanda in approximately 19N, 60W" (MWR).

August 22: HWM analyzed a closed low of 980 mb near 24.7N, 67.5W. HURDAT listed this as a Category 3 hurricane at 25.6N, 66.2W at 12 UTC. The MWR Tracks of Cyclones indicate the center near 25N, 68W at 8 a.m. Available observations from HWM and COADS suggest a center near 24.5N, 67.7W. Ship highlights: 70 kt N at 25N, 65.8W at 05 UTC (MWR); calm winds and 950 mb central pressure at 22.8N, 65.8W at 05 UTC (MWR); 70 kt E at 27N, 68W at 20 UTC (COA). "A delayed report from the S. S. Maraval at 1 a.m., August 22, in 22.8N, 65.8W, gives lowest barometer 28.06 inches [950 mb] and wind calm" (MWR).

August 23: HWM indicates a closed low of at most 985 mb near 30.5N, 73.5W. HURDAT listed this as a Category 3 hurricane at 31.1N, 72W at 12 UTC. The MWR Tracks of Cyclones indicate the center near 30N, 72W at 8 a.m. Available observations from HWM and COADS suggest a center near 30.8N, 73W. Ship highlights: 70 kt ESE at 00 UTC at 27N, 69W (COA); 60 kt ESE and 1004 mb at 01 UTC at 28.5N, 68.5W (COA); 50 kt NE and 983 mb at 12 UTC at 30N, 69.5W (COA); 25 kt E and 970 mb at 20 UTC at 36.3N, 72.7W (COA). "On the morning of the 23rd its center was at 31.5N, 73W. During the preceding 12 hours it had begun to recurve to the northward. By the evening of the 23rd it was central about 100 miles east of Cape Hatteras, being attended by winds of hurricane force near its center" (MWR).

August 24: HWM analyzed a closed low of 980 mb near 38N, 70.5W. HURDAT listed this as an extratropical storm at 38N, 72.4W at 12 UTC. The MWR Tracks of Cyclones indicate the center near 38.5N, 71.5W at 8 a.m. Available observations from HWM and COADS suggest a center near 37N, 71W. Ship highlights: 70 kt SE and 996 mb at 00 UTC at 34N, 70.5W (COA); 60 kt NW and 976 mb at 12 UTC at 36.7N, 71.3W (COA); 70 kt ENE and 981 mb at 14 UTC at 40.2N, 70.5W (MWR); north wind and 966 mb at 20 UTC at 42.3N, 67.5W (MWR). "It continued to move north-northeast, passing 100

miles or less to the east of Nantucket during the daylight hours of the 24th to the Straits of Belle Isle” (MWR).

August 25: HWM indicates an extratropical storm centered near 52N, 55W. HURDAT listed this as an extratropical storm at 51.8N, 54.8W at 12 UTC. The MWR Tracks of Cyclones indicate the center near 52N, 56W at 8 a.m. Available observations from HWM and COADS suggest a center near HURDAT to be most accurate. Ship highlights: 70 kt S and 976 mb at 02 UTC at 44.3N, 63.3W (MWR); 70 kt W at 08 UTC at 47.5N, 59.5W (COA). “...by the morning of the 25th, [the storm] attended by gales over the Canadian Maritime Provinces approximately hurricane force near the center” (MWR). August 26: HWM analyzed an extratropical storm centered near 60N, 30W. HURDAT listed this as an extratropical storm at 61 N, 32.3W at 12 UTC. Available observations from HWM and COADS suggest a center near HURDAT to be most accurate. No gale force winds (or equivalent in pressure) were observed. “It then moved rapidly northeast, being central over Iceland on the morning of the 27th with air pressure 28.44 inches [963 mb] and attended by gales” (MWR).

Genesis for storm 1 began on August 18th at 12 UTC as a 35 kt tropical storm, one day and 25 kt less than original HURDAT. On the 19th, a peak wind of 45 kt was observed on the northwest side of the storm. 50 kt is chosen for HURDAT at 12 UTC, a 20 kt downgrade from previous HURDAT. The storm progressed on a west-northwestward track from the 20th through the 22nd. Late on the 21st, the ship S.S. Seekonk observed a minimum pressure of 961 mb implying winds of at least 99 kt from the southern pressure-wind relationship. 100 kt is chosen for HURDAT at 12 UTC on the 21st, a 5 kt upgrade from previous HURDAT. Early on the 22nd, a central pressure of 950 mb was observed implying winds of 110 kt and 103 kt from the southern and subtropical pressure-wind relationships, respectively. 110 kt is chosen for HURDAT at 12 UTC, a 5 kt increase from original HURDAT. A new central pressure of 950 mb was also added to HURDAT at 06 UTC. A peripheral pressure of 970 mb was observed late on the 23rd, implying winds of at least 85 kt from the subtropical pressure-wind relationship. 110 kt is chosen for HURDAT at 12 UTC, a 5 kt upgrade from previous HURDAT. Original HURDAT suggests storm 1 to have transitioned to extratropical status by 06 UTC on the 24th. Available observations indicate the system did not transition to an extratropical cyclone until 00 UTC on the 25th. A peripheral pressure of 966 mb was observed late on the 24th, implying winds of at least 85 kt from the northern pressure-wind relationship. The hurricane transitioned to an extratropical cyclone early on the 25th as it raced off towards the northern Atlantic Ocean. Storm 1 dissipated by 12 UTC on the 26th. Peak observations with storm 1 maintain its original classification as a Category 3 hurricane.

Storm 2, 1927

24335 09/01/1927 M=11 2 SNBR= 544 NOT NAMED XING=0 SSS=0
24335 09/02/1927 M=10 2 SNBR= 544 NOT NAMED XING=0 SSS=0

**

(The 1st is removed from HURDAT.)

24340 09/01* 0 0 0 0* 0 0 0 0*168 193 35 0*165 199 35 0

24345 09/02*163 205 35 0*161 211 35 0*160 217 35 0*159 223 35 0

24345 09/02* 0 0 0 0*167 200 30 0*165 210 30 0*163 219 30 0

*** **

24350 09/03*159 230 35 0*159 238 35 0*159 246 35 0*159 256 35 0

24350 09/03*161 228 30 0*160 237 35 0*159 246 35 0*159 256 35 0

*** **

24355 09/04*160 266 35 0*161 277 35 0*162 288 40 0*163 299 40 0

24355 09/04*160 266 35 0*161 277 35 0*162 288 40 0*163 300 40 0

24360 09/05*165 310 40 0*166 321 45 0*168 334 45 0*170 348 50 0

24360 09/05*165 313 40 0*166 326 45 0*168 340 45 0*170 353 50 0

*** **

24365 09/06*172 362 50 0*174 376 55 0*176 390 55 0*178 404 60 0

24365 09/06*172 365 50 0*174 377 55 0*176 390 55 0*178 404 55 0

*** **

24370 09/07*181 418 65 0*184 433 65 0*187 447 70 0*191 463 70 0

24370 09/07*181 418 60 0*184 432 60 0*187 447 60 0*191 463 60 0

** *** **

24375 09/08*195 481 75 0*199 499 75 0*204 517 80 0*212 536 85 0

24375 09/08*196 481 60 0*202 500 60 0*210 517 60 0*220 532 60 0

*** **

24380 09/09*218 549 85 0*225 560 90 0*231 569 90 0*247 580 90 0

24380 09/09*232 544 60 0*245 553 55 0*260 560 55 0*275 562 55 0

*** **

24385 09/10*272 580 85 0E298 565 80 0E317 538 70 0E324 531 60 0

24385 09/10*290 558 50 0*304 550 50 0*317 538 45 0*326 526 45 0

*** **

24390 09/11E330 523 50 0E335 517 45 0E339 510 40 0E343 498 35 0

24390 09/11*332 518 40 0*336 515 40 0*339 510 35 0E341 498 30 0

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24395 HR

24395 TS

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Minor changes to the track and intensity shown in Neumann et al. (1999). Evidence for these alterations comes from the Historical Weather Maps series, the COADS ship database, and Monthly Weather Review.

September 2: HWM isobaric analysis indicates a closed low of at most 1012.5 mb near 16.5N, 23W. HURDAT listed this as a tropical storm at 16N, 21.7W at 12 UTC. Available observations from HWM and COADS suggest a center near 16.5N, 21W. No gale force winds (or equivalent in pressure) were observed.

September 3: HWM indicates a closed low of at most 1010 mb near 17N, 24W. HURDAT listed this as a tropical storm at 15.9N, 24.6W at 12 UTC. Available observations from HWM and COADS suggest a center near HURDAT to be most accurate. Ship highlights: 35 kt SW and 1015 mb at 12 UTC at 15N, 23.3W (HWM).

September 4: HWM analyzed no significant features in the eastern Atlantic Ocean. HURDAT listed this as a tropical storm at 16.2N, 28.8W at 12 UTC. Available observations from HWM and COADS suggest a center near HURDAT to be most accurate. No gale force winds (or equivalent in pressure) were observed.

September 5: HWM indicates no significant features in the central Atlantic Ocean. HURDAT listed this as a tropical storm at 16.8N, 33.4W at 12 UTC. Available observations from HWM and COADS suggest a center near 16.8N, 34W. No gale force winds (or equivalent in pressure) were observed.

September 6: HWM analyzed no significant features in the central Atlantic Ocean. HURDAT listed this as a tropical storm at 17.6N, 39W at 12 UTC. Available observations from HWM and COADS suggest a center near HURDAT to be most accurate. No gale force winds (or equivalent in pressure) were observed.

September 7: HWM indicates no significant features in the central Atlantic Ocean. HURDAT listed this as a Category 1 hurricane at 18.7N, 44.7W at 12 UTC. Available observations from HWM and COADS suggest a center near HURDAT to be most accurate. No gale force winds (or equivalent in pressure) were observed.

September 8: HWM analyzed no significant features in the central Atlantic Ocean. HURDAT listed this as a Category 1 hurricane at 20.4N, 51.7W at 12 UTC. Available observations from HWM and COADS suggest a center near 21N, 51.7W. Ship highlights: 50 kt SE and 1007 mb at 12 UTC at 21.7N, 51W (MWR). "The S.S. Matador received a radiogram from the British S.S. Socrates stating that on the morning of the 8th, in 21.6N, 51W, the barometer reading 29.73 inches [1007 mb] and falling, with winds SE force 10 [50 kt]. Storm center moving toward the NW" (MWR).

September 9: HWM indicates an inverted trough near 25N, 57W with a stationary front stretching southwest to northeast across Bermuda. HURDAT listed this as a Category 2 hurricane at 23.1N, 56.9W at 12 UTC. Available observations from HWM and COADS suggest a center near 26.5N, 56W. Ship highlights: 35 kt SW and 1014 mb at 12 UTC at 25.5N, 55.5W (COA).

September 10: HWM analyzed a closed low of at most 1010 mb embedded within a cold front near 31.5N, 53W. HURDAT listed this as an extratropical storm at 31.7N, 53.8W at 12 UTC. Available observations from HWM and COADS suggest a center near HURDAT to be most accurate. No gale force winds (or equivalent in pressure) were observed

September 11: HWM indicates a closed low of at most 1010 mb near 19N, 61W. HURDAT listed this as an extratropical storm at 20.2N, 60.8W at 12 UTC. Available

observations from HWM and COADS suggest a center near HURDAT to be most accurate. No gale force winds (or equivalent in pressure) were observed.

Storm number 2 began as a tropical depression rather than a tropical storm on September 2nd, 18 hours later than suggested in original HURDAT. The storm originated near the Cape Verde islands on the 2nd and progressed westward until the 8th. A peak wind of 35 kt was observed on the 3rd indicating the system had attained tropical storm strength. 35 kt is chosen for HURDAT at 12 UTC on the 3rd. From September 4th through 7th no gale force winds or low pressures were observed, mainly due to scant weather observations. For continuity, intensity estimates for the 4th-7th have been estimated at 40, 45, 55, and 60 kt, respectively. Peak observations with this system were 50 kt observed on the 8th. 60 kt is chosen for HURDAT at 12 UTC, 20 kt less than original HURDAT. The storm began to recurve on the 9th well east of Bermuda. A peak wind of 35 kt was observed on the 9th. 55 kt is chosen for HURDAT at 12 UTC, a 35 kt downgrade from original HURDAT. Gale force winds were no longer observed after the 9th and thus a moderate decrease in intensity is suggested for the 10th and 11th. Available observations indicate the storm transitioned to extratropical status at 18 UTC on the 11th, 36 hours later than previously indicated in HURDAT. Original HURDAT suggested storm 2 was a 90 kt Category 2 hurricane at peak intensity, however peak observations indicate that the system only attained tropical storm strength (50 kt).

Storm 3, 1927

24400 09/22/1927 M= 8 3 SNBR= 545 NOT NAMED XING=0 SSS=0

24405 09/22* 0 0 0 0* 0 0 0 0*103 352 35 0*108 360 35 0

24405 09/22* 0 0 0 0* 0 0 0 0*103 360 30 0*108 360 30 0
 *** ** **

24410 09/23*113 368 35 0*118 374 35 0*122 380 35 0*126 385 35 0

24410 09/23*113 368 30 0*118 374 30 0*122 380 30 0*126 385 30 0
 ** ** ** ** **

24415 09/24*130 390 35 0*134 395 35 0*138 400 35 0*142 405 35 0

24415 09/24*130 390 30 0*134 395 30 0*138 400 30 0*142 405 30 0
 ** ** ** *

24420 09/25*145 410 35 0*149 415 35 0*153 420 35 0*157 425 35 0

24420 09/25*145 410 30 0*149 415 30 0*153 430 30 0*157 425 30 0
 ** ** ** *

24425 09/26*162 430 35 0*168 436 35 0*174 441 35 0*180 446 35 0

24425 09/26*162 430 30 0*168 436 30 0*174 460 30 0*182 446 30 0
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24430 09/27*187 450 35 0*193 455 40 0*200 458 45 0*207 460 45 0

24430 09/27*192 450 35 0*203 455 40 0*215 465 45 0*207 460 45 0
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24435 09/28*216 461 50 0*225 462 55 0*236 463 60 0*252 467 60 0
 24435 09/28*216 461 50 0*225 462 55 0*275 475 60 0*252 467 60 0
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24440 09/29*278 472 65 0*310 473 70 0*346 476 70 0E410 460 70 0
 24440 09/29*278 472 55 0E310 473 45 0* 0 0 0 0* 0 0 0 0
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24445 HR

24445 TS

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Minor changes to the track and intensity shown in Neumann et al. (1999). Evidence for these alterations comes from the Historical Weather Maps series, the COADS ship database, and Monthly Weather Review.

September 22: HWM analyzed no significant features in the central Atlantic Ocean. HURDAT listed this as a tropical storm at 10.3N, 35.2W at 12 UTC. Available observations from HWM and COADS suggest a center near 10.3N, 36W. No gale force winds (or equivalent in pressure) were observed.

September 23: HWM indicates a closed low of at most 1010 mb near 12.5N, 37W. HURDAT listed this as a tropical storm at 12.2N, 38W at 12 UTC. Available observations from HWM and COADS suggest a center near HURDAT to be most accurate. No gale force winds (or equivalent in pressure) were observed.

September 24: HWM analyzed a closed low of at most 1010 mb near 13N, 38W. HURDAT listed this as a tropical storm at 13.8N, 40W at 12 UTC. Available observations from HWM and COADS suggest a center near HURDAT to be most accurate. Ship highlights: 20 kt ENE and 1005 mb at 12 UTC at 14.3N, 40.4W (COA).

September 25: HWM indicates a closed low of at most 1010 mb near 16N, 43W. HURDAT listed this as a tropical storm at 15.3N, 42W at 12 UTC. Available observations from HWM and COADS suggest a center near 15.3N, 43W. No gale force winds (or equivalent in pressure) were observed.

September 26: HWM analyzed a closed low of at most 1010 mb near 16N, 46W. HURDAT listed this as a tropical storm at 17.4N, 44.1W at 12 UTC. Available observations from HWM and COADS suggest a center near 17.4N, 46W. No gale force winds (or equivalent in pressure) were observed.

September 27: HWM indicates no significant features in the central Atlantic Ocean. HURDAT listed this as a tropical storm at 20N, 45.8W at 12 UTC. Available observations from HWM and COADS suggest a center near 21.5N, 46.5W. No gale force winds (or equivalent in pressure) were observed.

September 28: HWM analyzed no significant features in the central Atlantic Ocean. HURDAT listed this as a tropical storm at 23.6N, 46.3W at 12 UTC. Available observations from HWM and COADS suggest a center near 27.5N, 47.5W. Ship highlights: 60 kt SSW at 15 UTC at 28.5N, 47.5W (COA).

September 29: HWM indicates no significant features in the central Atlantic Ocean. HURDAT listed this as a Category 1 hurricane at 34.6N, 47.6W at 12 UTC. Available observations from HWM and COADS suggest a center near 19.5N, 62W. Ship highlights: 50 kt S at 12 UTC at 34.9N, 46.2W (COA); 45 kt S and 1016 mb at 12 UTC at 36.2N, 43.5W (COA); 15 kt W and 1005 mb at 15 UTC at 37N, 49.7W (COA).

Genesis for storm 3 is retained at 12 UTC on September 22nd as a tropical depression rather than a tropical storm. The storm progressed on a northwestward track through the 26th before recurving on the 28th. Gale force observations were not observed from the 22nd through the 27th due to a lack of available data near the system. A peak wind of 60 kt was observed on the 28th; however, indicating the system did attained tropical storm strength. Storm 3 was eventually absorbed by storm 4 around 06 UTC on the 29th. Peak intensity for storm 3 was original listed in HURDAT as a minimal Category 1 hurricane but available observations indicate the peak intensity to be tropical storm strength at 60 kt.

Storm 4, 1927

24450 09/23/1927 M= 9 4 SNBR= 546 NOT NAMED XING=0 SSS=0

24455 09/23*182 482 35	0*199 498 40	0*213 512 45	0*221 523 50	0
24455 09/23*190 492 35	0*201 502 40	0*213 512 45	0*225 522 45	0
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24460 09/24*224 534 55	0*237 544 60	0*245 554 65	0*254 563 70	0
24460 09/24*237 532 50	0*249 541 50	0*260 550 55	0*267 558 55	0
*** ** *	*** ** *	*** ** *	*** ** *	
24465 09/25*263 572 75	0*272 580 80	0*281 588 85	0*287 594 90	0
24465 09/25*271 566 60	0*275 573 65	0*281 580 70	0*288 587 75	0
*** ** *	*** ** *	*** **	*** ** *	
24470 09/26*292 598 95	0*297 602 100	0*302 605 105	0*316 613 105	0
24470 09/26*296 594 80	0*304 601 85	0*312 608 90	0*324 613 90	0
*** ** *	*** ** **	*** ** **	*** **	***
24475 09/27*337 615 105	0*357 609 100	0*370 596 95	0*377 589 90	0
24475 09/27*339 615 90	0*354 609 85	0*370 596 80	0*381 589 80	0
*** ** *	*** **	*** **	*** **	**
24480 09/28*384 579 90	0*391 571 85	0*398 560 85	0*405 548 80	0
24480 09/28*389 581 80	0E396 573 75	0E403 565 75	0E410 556 75	0
*** ** *	**** ** *	**** ** *	**** ** **	
24485 09/29*413 535 80	0E421 521 80	0E428 508 75	0E436 494 70	0
24485 09/29E415 546 75	981E420 535 75	0E428 520 75	0E439 494 70	0

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24490 09/30E444 479 65 0E452 463 60 0E460 445 55 0E469 421 50 0
24490 09/30E453 460 70 0E468 415 70 0E480 370 70 0E487 335 65 0
      *** ** *      *** ** *      *** ** *      *** ** *
24495 10/01E479 388 50 0E489 346 45 0E500 300 40 0E520 200 40 0
24495 10/01E489 310 60 0E490 298 55 0E490 290 50 0E490 285 40 0
      *** ** *      *** ** *      *** ** *      *** ** *

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24500 HR

Minor changes to the track and intensity shown in Neumann et al. (1999). Evidence for these alterations comes from the Historical Weather Maps series, the COADS ship database, and Monthly Weather Review.

September 23: HWM analyzed a closed low of at most 1010 mb near 20N, 51.5W. HURDAT listed this as a tropical storm at 21.3N, 51.2W at 12 UTC. Available observations from HWM and COADS agree with the original HURDAT position at 12 UTC. No gale force winds (or equivalent in pressure) were observed.

September 24: HWM indicates a closed low of at most 1010 mb near 22N, 55W. HURDAT listed this as a Category 1 hurricane at 24.5N, 55.4W at 12 UTC. Available observations from HWM and COADS suggest a center near 26N, 55W. Ship highlights: 50 kt NE at 27.4N, 56W at 12 UTC (COA); 35 kt NNE and 999 mb at 26.5N, 55.5W at 12 UTC (COA). “The center on that date (24th) was in approximately latitude 25N, longitude 54 W, with a direction of movement almost due northwest” (MWR).

September 25: HWM analyzed a closed low of at most 1005 mb near 28N, 60W. HURDAT listed this as a Category 2 hurricane at 28.1N, 58.8W at 12 UTC. Available observations from HWM and COADS suggest a center near 28.1N, 58W. Ship highlights: 35 kt ESE and 1006 mb at 27.5N, 54.5W at 00 UTC (COA); 50 kt ESE and 998 mb at 27.5N, 55.9W at 04 UTC (MWR). “The system began to recurve on the 25th with the westernmost point of its path being the 61st meridian, reached midday on the 26th” (MWR).

September 26: HWM indicates a closed low of at most 1000 mb near 30N, 61W. HURDAT listed this as a Category 3 hurricane at 30.2N, 60.5W at 12 UTC. Available observations from HWM and COADS suggest a center near 31.2N, 60.8W. Ship highlights: 35 kt SE and 971 mb at 31.5N, 60.3W at 08 UTC (MWR); 70 kt N and 984 mb 31.1N, 61W at 11 UTC (MWR); 70 kt ENE and 985 mb at 31.5N, 60 W at 12 UTC (COA).

September 27: HWM analyzed a closed low of at most 1000 mb near 37N, 60W. HURDAT listed this as a Category 2 hurricane at 37N, 59.6W at 12 UTC. Available observations from HWM and COADS agree with the original HURDAT position at 12 UTC. Ship highlights: 50 kt NE at 39.3N, 61.9W at 12 UTC (COA); 50 kt N and 994 mb at 37.6N, 60.7W at 14 UTC (MWR); 60 kt ENE and 996 mb at 16 UTC (MWR). MWR notes the storms track as, “completing the recurve on the 27th, as the storm moved in a nearly northeasterly direction”.

September 28: HWM indicates a closed low of at most 1010 mb near 39N, 61W with a warm front extending east-northeast from the center. HURDAT listed this as a Category 2 hurricane at 39.8N, 56W at 12 UTC. Available observations from HWM and COADS suggest a center near 40.3N, 56.5W. Ship highlights: 70 kt WNW and 983 mb at 37.8N, 59W at 03 UTC (MWR); 70 kt NE at 40N, 58W at 12 UTC (COA); 30 kt NE and 981 mb at 42.7N, 52.8W at 22 UTC (MWR).

September 29: HWM analyzed an extratropical cyclone with a low of at most 995 mb near 43N, 50W. HURDAT listed this as an extratropical storm at 42.8N, 50.8W at 12 UTC. Available observations from HWM and COADS suggest a center near 42.8N, 52W. Ship highlights: 70 kt NE and 976 mb at 42.5N, 54.5W at 08 UTC (COA); 70 kt NNE and 984 mb at 42.5N, 54.5W at 12 UTC (COA); 70 kt N and 1000 mb at 43.5N, 55.5W at 16 UTC (COA).

September 30: HWM indicates an extra tropical cyclone near 46N, 43W. HURDAT listed this as an extratropical storm at 46N, 44.5W at 12 UTC. Available observation from HWM and COADS suggests a center near 48N, 37W. Ship highlights: 40 kt SW and 989 mb at 47.4N, 35.2W at 12 UTC (HWM); 15 kt SE and 994 mb at 45.4N, 44.3W at 12 UTC (COA); 60 kt WSW and 985 mb at 47.7N, 34.6W at 15 UTC (MWR); 70 kt SSE at 47.7N, 34.6W (MWR).

October 1: HWM analyzed an occluded low near 50N, 30W. HURDAT listed this as an extratropical storm at 50N, 30W at 12 UTC. Available observations from HWM and COADS suggest a center near 49N, 29W. Ship highlights: 25 kt SW and 993 mb at 47.5N, 34.5W at 10 UTC (COA); 45 kt SW at 45.9N, 28.4W at 12 UTC (COA); 45 kt N and 996 mb at 49N, 27W at 18 UTC (COA).

Genesis is retained for storm 4 at 00 UTC on September 23rd as a minimal tropical storm. The storm progressed northwestward before recurving just east of Bermuda on the 26th. No gale force winds or low pressures were observed on the 23rd. A peak wind of 50 kt was observed on the 24th, indicating the system was not yet a hurricane. 55 kt is chosen for HURDAT at 12 UTC on the 24th, 10 kt less than previous HURDAT. A peripheral pressure of 971 mb was observed early on the 26th, implying winds of at least 85 kt from the subtropical pressure-wind relationship. 90 kt is chosen for HURDAT at 12 UTC on the 26th, 15 kt less than originally found in HURDAT. A peak wind of 60 kt was observed on the 27th, indicating the system was weakening. 80 kt is chosen for HURDAT at 12 UTC on the 27th, a 15 kt downgrade from previous HURDAT. Available observations on the 28th indicate an asymmetric wind field suggesting the system transitioned to an extratropical cyclone. Peak winds on the 28th were 70 kt. 75 kt is chosen for HURDAT at 12 UTC, a 10 kt downgrade. On the 29th, a peripheral pressure of 976 mb was observed, implying winds of at least 77 kt from the northern pressure-wind relationship. Given that the system is baroclinic, the pressure-wind relationship can be utilized with slightly weaker winds. Therefore, 75 kt is maintained for HURDAT at 12 UTC on the 29th. It should also be noted that Storm 4 absorbed storm number 3 on the 29th. A peak wind of 70 kt was observed on the 30th. 70 kt is chosen for HURDAT at 12 UTC on the 30th, 15 kt greater than previous HURDAT. Available observations on October 1st indicate an occluded low with peak winds of 45 kt. 50 kt is chosen for

HURDAT at 12 UTC on the 1st, a 10 kt upgrade and also the last record for storm 4 in HURDAT. Available observations indicate the peak intensity with this hurricane to be 90 kt, 15 kt less than originally suggested in HURDAT. This reclassifies storm 4 from a Category 3 down to a Category 2 hurricane.

Storm 5, 1927

24505 10/01/1927 M= 4 5 SNBR= 547 NOT NAMED XING=1 SSS=0

24505 09/30/1927 M= 5 5 SNBR= 547 NOT NAMED XING=1 SSS=0

*

(The 30th is new to HURDAT.)

24507 09/30* 0 0 0 0* 0 0 0 0*230 690 30 0*236 704 30 0

24510 10/01*232 730 35 0*240 740 35 0*248 748 35 0*252 754 35 0

24510 10/01*243 718 30 0*249 730 30 0*255 740 30 0*261 749 30 0

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

24515 10/02*257 761 35 0*265 772 40 0*275 782 45 0*287 792 50 0

24515 10/02*267 757 35 0*273 764 35 0*280 770 35 0*290 778 35 0

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

24520 10/03*301 801 50 0*316 807 50 0*334 810 40 0*350 807 35 0

24520 10/03*303 789 40 0*318 800 40 0*334 807 35 0*350 808 30 0

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

24525 10/04*370 795 30 0*390 775 25 0* 0 0 0 0* 0 0 0 0

24525 10/04*370 803 30 0*390 790 25 0* 0 0 0 0* 0 0 0 0

*** ** * ** *

24530 TS

Minor changes to the track and intensity shown in Neumann et al. (1999). Evidence for these alterations comes from the Historical Weather Maps series, the COADS ship database, and Monthly Weather Review.

September 30: HWM analyzed a closed low of at most 1010 mb near 23N, 69W.

Available observations from HWM and COADS suggest a center near 23N, 69W. No gale force winds (or equivalent in pressure) were observed.

October 1: HWM indicates a closed low of at most 1010 mb near 24N, 76W. HURDAT listed this as a tropical storm at 24.8N, 74.8W at 12 UTC. The MWR Tracks of Cyclones indicate the center near 23N, 72W at 8 a.m. Available observations from HWM and COADS suggest a center near 25.5N, 74W. No gale force winds (or equivalent in pressure) were observed.

October 2: HWM analyzed a closed low of at most 1010 mb near 29N, 77W. HURDAT listed this as a tropical storm at 27.5N, 78.2W at 12 UTC. The MWR Tracks of Cyclones

indicate the center near 27.5N, 77.5W at 8 a.m. Available observations from HWM and COADS suggest a center near 28N, 77W. Ship highlights: 35 kt ENE and 1016 mb at 12 UTC at 29N, 73W (HWM).

October 3: HWM indicates a closed low of at most 1010 mb near 33N, 80W, with a cold front approaching from the west. HURDAT listed this as a tropical storm at 33.4N, 81W at 12 UTC. The MWR Tracks of Cyclones indicate the center near 33.7N, 81W at 8 a.m. Available observations from HWM and COADS suggest a center near 33.4N, 80.7W. Ship highlights: 35 kt and 1008 mb at 04 UTC at 32.3N, 79W (MWR). Station highlights: 43 kt at Charleston at 09 UTC (OMR); 38 kt at Wilmington (MWR); 37 kt at Raleigh (MWR).

October 4: HWM analyzed a cold front nearly paralleling the United States East Coast. HURDAT listed this as a tropical storm at 39N, 77.5W at 12 UTC. The MWR Tracks of Cyclones indicate the center near 43.5N, 71W at 8 a.m. Available observations from HWM and COADS suggest a center near 39N, 79W. No gale force winds (or equivalent in pressure) were observed.

Genesis for storm 5 began at 12 UTC on September 30th as a tropical depression rather than a tropical storm, 12 hours earlier than previously suggested in HURDAT. First gales were observed on October 2nd as the system progressed northwestward towards the United States East Coast. A peak wind of 35 kt on the 2nd indicates that the system did attain tropical storm intensity. 35 kt is chosen for HURDAT at 12 UTC, 10 kt less than original HURDAT. The tropical storm made landfall around 10-11 UTC on the 3rd just southwest of Charleston, South Carolina. Peak observations at landfall occurred at Charleston where maximum winds were 43 kt. This reduces down to 37 kt after correcting for the high bias of the anemometers of the era (Fergusson and Covert 1924) and adjusting from 5 to 1 min winds (Powell et al. 1996). 35 kt is chosen for HURDAT at 12 UTC on the 3rd, a 5 kt downgrade from original HURDAT. Once over land the system quickly diminished in intensity and became absorbed by an approaching frontal boundary by 12 UTC on the 4th. "The storm was of very small extent and short duration..." (MWR).

Storm 6, 1927

24535 10/17/1927 M= 3 6 SNBR= 548 NOT NAMED XING=0 SSS=0

24535 10/16/1927 M= 4 6 SNBR= 548 NOT NAMED XING=0 SSS=0

*

(The 16th is new to HURDAT.)

24538 10/16*165 870 30 0*166 867 30 0*167 862 30 0*169 854 35 0

24540 10/17*185 865 40 0*187 855 40 0*188 843 40 0*188 833 40 0


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24540 10/17*172 844 40 0*175 835 40 0*178 827 40 0*182 820 40 0
      *** **          *** **          *** **          *** **

24545 10/18*192 822 40 0*191 809 40 0*195 795 40 0*198 779 40 0
24545 10/18*187 814 40 0*193 806 40 0*200 795 40 0*210 777 40 0
      *** **          *** **          ***          *** **

24550 10/19*200 762 35 0*214 743 35 0*233 723 35 0*260 702 35 0
24550 10/19*222 750 40 0E237 720 35 0* 0 0 0 0* 0 0 0 0
      *** ** **      *****          *** ** **      *** ** **

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24555 TS

Minor changes to the track and intensity shown in Neumann et al. (1999). Evidence for these alterations comes from the Historical Weather Maps series, the COADS ship database, and Monthly Weather Review.

October 16: HWM analyzed a broad area of low pressure in the western Caribbean Sea. Available observations from HWM and COADS suggest a center near 16.7N, 86.2W. No gale force winds (or equivalent in pressure) were observed.

October 17: HWM indicates a broad closed low of at most 1005 mb in the western Caribbean Sea. HURDAT listed this as a tropical storm at 18.8N, 84.3W at 12 UTC. Available observations from HWM and COADS suggest a center near 17.8N, 82.7W. Ship highlights: 30 kt NW and 1000 mb at 17.3N, 83.2W at 12 UTC (COA).

October 18: HWM analyzed a closed low of at most 1005 mb near 21.5N, 80W. HURDAT listed this as a tropical storm at 19.5N, 79.5W at 12 UTC. The MWR Tracks of Cyclones indicate the center near 19.5N, 80W at 8 a.m. Available observations from HWM and COADS suggest a center near 20N, 80W. Ship highlights: 15 kt NW and 1004 mb at 19.5N, 80.7W at 11 UTC (COA).

October 19: HWM indicates a cold front stretching northeast from the eastern Bahamas to Bermuda. HURDAT listed this as a tropical storm at 23.3N, 72.3W at 12 UTC. The MWR Tracks of Cyclones indicate the center near 22N, 72.5W at 8 a.m. Available observations from HWM and COADS suggest a center near 23.7N, 72W at 06 UTC. Ship highlights: 25 kt S and 999mb at 22N, 74.3W at 00 UTC (COA).

Genesis for storm 6 began on October 16th at 00 UTC as a tropical depression rather than a tropical storm in the western Caribbean Sea, one day earlier than original HURDAT. On the 17th, a peripheral pressure of 1000 mb was observed implying winds of at least 47 kt from the southern pressure-wind relationship. Environmental pressures were apparently low suggesting a slight decrease in the pressure-wind intensity estimates. Thus, 40 kt is chosen for HURDAT at 12 UTC on the 17th. The storm progressed east-northeastward throughout its duration. On the 18th a peripheral pressure of 1004 mb was observed implying winds of at least 39 kt from the southern pressure-wind relationship. 40 kt is chosen for HURDAT at 12 UTC on the 18th. Available observations indicate the system became absorbed by a frontal boundary by 12 UTC on the 19th, 12 hours earlier than original HURDAT. Peak intensity with this tropical storm is maintained at 40 kt.

“The disturbance was of small extent but of moderate intensity causing some destruction to crops as it passed northeast over extreme eastern Cuba during the night of the 18th” (MWR).

Storm 7, 1927

24560 10/30/1927 M= 6 7 SNBR= 549 NOT NAMED XING=0 SSS=0

24565 10/30* 0 0 0 0* 0 0 0 0* 0 0 0 0*188 830 35 0

24565 10/30* 0 0 0 0* 0 0 0 0*195 800 30 0*200 799 35 0
 *** **

24570 10/31*197 818 35 0*204 806 40 0*209 800 40 0*214 796 40 0

24570 10/31*205 797 35 0*220 796 40 0*215 795 40 0*220 794 40 0
 *** **

24575 11/01*220 790 35 0*227 784 35 0*236 777 35 0*247 768 35 0

24575 11/01*225 793 35 0*230 792 35 0*236 790 35 0*245 783 35 0
 *** **

24580 11/02*261 757 35 0*275 746 35 0*286 737 35 0*295 732 35 0

24580 11/02*258 771 35 0*271 755 35 0*280 737 35 0*283 722 35 0
 *** **

24585 11/03*303 729 35 0*309 728 35 0E314 727 30 0E321 727 30 0

24585 11/03*284 708 35 0E285 695 40 0E285 680 45 0E286 660 50 0
 *** **

24590 11/04E332 727 30 0E359 727 30 0* 0 0 0 0* 0 0 0 0

24590 11/04E290 630 50 0E300 590 45 0* 0 0 0 0* 0 0 0 0
 *** **

24595 TS

Minor changes to the track and intensity shown in Neumann et al. (1999). Evidence for these alterations comes from the Historical Weather Maps series, the COADS ship database, and Monthly Weather Review.

October 30: HWM analyzed a closed low of at most 1010 mb near 19N, 61W. HURDAT listed this as a Category 1 hurricane at 20.2N, 60.8W at 12 UTC. The MWR Tracks of Cyclones indicate the center near 21N, 61W at 8 a.m. Available observations from HWM and COADS suggest a center near 19.5N, 62W. No gale force winds (or equivalent in pressure) were observed.

October 31: HWM indicates a closed low of at most 1010 mb near 26N, 81W. HURDAT listed this as a tropical storm at 20.9N, 80W at 12 UTC. Available observations from

HWM and COADS suggest a center near 21.5N, 79.5W. No gale force winds (or equivalent in pressure) were observed.

November 1: HWM analyzed a closed low of at most 1010 mb centered over central Cuba. HURDAT listed this as a tropical storm at 23.6N, 77.7W at 12 UTC. Available observations from HWM and COADS suggest a center near 23.6N, 79W. No gale force winds (or equivalent in pressure) were observed.

November 2: HWM indicates a closed low of at most 1010 mb near 25N, 75W.

HURDAT listed this as a tropical storm at 28.6N, 73.7W at 12 UTC. The MWR Tracks of Cyclones indicate the center near 25N, 74W at 8 a.m. Available observations from HWM and COADS suggest a center near 28N, 73.7W. Ship highlights: 35 kt ESE and 1018 mb at 30.3N, 72.3W at 13 UTC (MWR).

November 3: HWM analyzed an elongated northwest to southeast closed low of at most 1000 mb near 28N, 68W. HURDAT listed this as a tropical storm at 31.4N, 72.7W at 12 UTC. The MWR Tracks of Cyclones indicate the center near 30.5N, 72.5W at 8 a.m. Available observations from HWM and COADS suggest a center near 28.5N, 68W. Ship highlights: 30 kt S and 999 mb at 28.5N, 65.5W at 12 UTC (COA); 20 kt W and 999 mb at 26N, 68.5W at 12 UTC (HWM).

November 4: HWM indicates an extratropical cyclone near 30N, 60W. HURDAT listed this as an extratropical storm at 35.9N, 72.7W at 06 UTC. Available observations from HWM and COADS suggest a center near 30N, 59W. No gale force winds (or equivalent in pressure) were observed.

Genesis for storm 7 began on October 30th as a tropical depression in the northwestern Caribbean Sea. The storm propagated northeast from the 30th through November 2nd as the system crossed over Cuba into the western Atlantic Ocean. HURDAT intensity estimates on October 31st and November 1st are retained due to the lack of available data near the system on these dates. On the 2nd, a peak wind of 35 kt was observed well north of the center. 35 kt is retained for HURDAT at 12 UTC. On the 3rd, a peripheral pressure of 999 mb was observed, implying winds of at least 50 kt from the subtropical pressure-wind relationship. Available observations on the 3rd show a northwest to east-southeast elongated low pressure with an asymmetric wind field, indicating that the system became baroclinic before 12 UTC. The southern pressure-wind relationship can be utilized with a slight decrease since the system was baroclinic on the 3rd. 45 kt is chosen for HURDAT at 12 UTC on the 3rd, 15 kt greater than original HURDAT. The new storm track for the 3rd and 4th indicates a much different track than original HURDAT. Instead of the system merging with an approaching mid-latitude cyclone off the Carolinas, available observations indicate that the extratropical cyclone progressed eastward into the central Atlantic, well south of Bermuda.

New Storm 8, 1927

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24596 11/19/1927 M= 3 8 SNBR= 550 NOT NAMED XING=0 SSS=0
24597 11/19*205 504 30 0*220 512 30 0*235 520 35 0*251 527 40 0
24598 11/20*268 534 45 0*284 540 50 0*300 545 50 0*315 548 50 0
24599 11/21*328 550 50 0*339 551 45 0E350 550 40 0E360 547 35 0
24599 TS

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Storm 8 is added to the original hurricane record shown in Neumann et al. (1999). Evidence for the addition comes from the Historical Weather Maps series and the COADS ship database.

November 16: HWM isobaric analysis indicated a closed low of no more than 1007.5 mb located near 17N, 52W, but ship data from COADS suggest that no closed low existed and was just a tropical wave.

November 17: HWM isobaric analysis indicated a closed low of no more than 1005 mb located near 18N, 45W, but there is no direct evidence that such a closed low existed.

Thus, the system was still a tropical wave.

November 18: HWM isobaric analysis continued to indicate a closed low of no more than 1005 mb located near 19N, 50W. Based on ship data to the northwest of the center, it appears that a trough existed, rather than a closed low.

November 19: HWM isobaric analysis continued to indicate a closed low of no more than 1005 mb located near 21.5N, 54.5W. Ship data from COADS now supports the idea of a closed low, but the only gale reported was about 500 miles from the center. Winds near the center averaged 15-20 kt. Thus, the system is classified as a 35 kt non-tropical gale located near 23.5N, 52W at this time. Ship highlights: 40 kt SE and 1012 mb at 27.5N, 50.5W (COA).

November 20: HWM isobaric analysis indicated a very large closed low of no more than 1005 mb located roughly near 26N, 57.5W. Ship data from COADS suggest that the center is much farther to the north. Numerous reports of gale force winds were found near the center, so the system is upgraded to a tropical cyclone. A cold front is analyzed about 10 degrees to the northwest of the system, with a low along it near 35N, 65W. Based on a time series of ship 17496, the center is positioned near 30N, 54.5W with 50 kt winds near the center. Ship highlights: 45 kt SSE and 999 mb at 29.5N, 53.5W at 12 UTC (COA).

November 21: HWM isobaric analysis indicated an elongated closed low of no more than 1005 mb located at the tail end of the cold front near 24N, 59W. Ship data from COADS suggest that the center is farther to the north along the front, near 35N, 55W. Since the low has been absorbed by the front, it is no longer being classified as tropical at this point. Although no gale force winds were reported near the center, the low is analyzed to be 40 kt based partially on continuity and partially on gale force wind reports farther away from the center.

1927 - Additional Notes

1) Historical Weather Maps and COADS indicate that a tropical cyclone developed on 17 October in the Northern Bahamas near 26N, 78W. It appears that the cyclone originated from a northern piece of the precursor disturbance to Storm #6. It moved rather quickly to the north immediately after it formed in response to an approaching frontal boundary. No gale force winds were reported while the system was presumed to be tropical, but the pressure was about 1004 mb. The highest winds reported were 25 kt. The system continued to deepen after it merged with the front, and several reports of gales were noted, along with a minimum pressure of 996 mb. Due to the lack of gale force winds during its brief period as a tropical cyclone, the system is not being added to HURDAT.

DAY	LAT	LON	STATUS
Oct 16	-----	-----	Not closed
Oct 17	26N	78W	Tropical Depression
Oct 18	35N	74W	Absorbed by front

2) Historical Weather Maps and COADS indicate that a weak low formed along a weakening frontal boundary on 13 August. The low began to take shape on the 12th along a still-intact front, near 23N, 77W. The next day it moved moderately northeastward as the front dissipated in the vicinity of the low. Winds near the center did not exceed 20 kt, so the system is not being added to HURDAT. Afterwards, the low moved very rapidly to the east-northeast and became absorbed in the remaining frontal boundary.

DAY	LAT	LON	STATUS
Aug 12	33N	77W	Not closed
Aug 13	35N	70W	Tropical Depression
Aug 14	36N	56W	Extratropical

APPENDIX B.4
METADATA RESULTS FOR 1928

Storm 1, 1928

24600 08/03/1928 M=10 1 SNBR= 550 NOT NAMED XING=1 SSS=2

24600 08/05/1928 M= 9 1 SNBR= 550 NOT NAMED XING=1 SSS=2

**

(The 3rd and 4th are removed from HURDAT.)

24605 08/03*113 607 35 0*123 621 35 0*133 636 35 0*142 652 35 0

24610 08/04*150 660 35 0*160 670 35 0*167 678 35 0*176 690 40 0

24615 08/05*185 700 40 0*194 709 40 0*203 720 35 0*212 731 40 0

24615 08/05* 0 0 0 0* 0 0 0 0*210 725 35 0*220 735 40 0

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

24620 08/06*221 743 45 0*230 754 55 0*238 765 65 0*245 774 70 0

24620 08/06*230 745 45 0*236 755 55 0*240 765 65 0*245 774 70 0

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

24625 08/07*251 781 80 0*255 786 80 0*260 791 85 0*265 795 85 0

24625 08/07*251 782 80 0*258 789 85 971*263 793 85 0*266 796 85 0

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

24630 08/08*269 799 85 0*274 803 80 977*278 807 70 0*282 812 50 0

24630 08/08*269 799 85 0*272 802 85 977*275 805 70 0*278 809 50 0

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

24635 08/09*286 817 40 0*290 822 40 0*294 827 35 0*298 832 35 0

24635 08/09*281 815 45 0*284 821 40 0*287 827 40 0*291 833 40 0

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

24640 08/10*303 838 35 0*309 843 35 0*317 848 35 0*326 840 30 0

24640 08/10*296 839 35 0*302 844 35 0*310 845 35 0*319 840 30 0

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

24645 08/11*335 829 30 0E343 817 30 0E352 805 30 0E361 790 30 0

24645 08/11*329 832 30 0E340 822 30 0E352 810 30 0E364 797 30 0

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

24650 08/12E370 775 30 0E378 759 30 0E387 741 30 0* 0 0 0 0

24650 08/12E374 782 30 0E382 762 30 0E387 745 30 0E389 726 0 0

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

(The 13th is new to HURDAT.)

24652 08/13E390 705 30 0E390 680 30 0* 0 0 0 0 0* 0 0 0 0

24655 HRCFL2

Minor changes to the track and intensity shown in Neumann et al. (1999). Evidence for these alterations comes from the Historical Weather Maps series, the COADS ship database, and Monthly Weather Review.

August 5: HWM analyzed a closed low of at most 1010 mb near 20N, 72.5W. HURDAT listed this as a tropical storm at 20.3N, 72W at 12 UTC. The MWR Tracks of Lows suggests a center near 22N, 73W at 8 a.m. Available observations from HWM and COADS suggest a center near 21N, 72.5W at 12 UTC. Ship highlights: 35 kt W and 1008 mb at 22.9N, 74.3W at 20 UTC (MWR); 35 kt SW and 1008 mb at 22.3N, 74.4W at 12 UTC (COA). “The first was in the vicinity of Turks Island on the morning of the 5th and following the usual northwesterly path, struck the southeast coast of Florida on the 7th” (MWR).

August 6: HWM indicates a closed low of at most 1010 mb near 23.5N, 78W. HURDAT listed this as a Category 1 hurricane at 23.8N, 76.5W at 12 UTC. The MWR Tracks of Lows suggests a center near 24N, 76.5W at 8 a.m. Available observations from HWM and COADS suggest a center near 24N, 76.5W at 12 UTC. No gale force winds (or equivalent in pressure) were observed.

August 7: HWM analyzed a closed low of at most 1005 mb near 25N, 80W. HURDAT listed this as a Category 2 hurricane at 26N, 79.1W at 12 UTC. The MWR Tracks of Lows suggests a center near 26N, 79W at 8 a.m. Available observations from HWM and COADS suggest a center near 26.3N, 79.3W at 12 UTC. Ship highlights: 60 kt NNW and 999 mb at 26.4N, 79.9W at 07 UTC (COA); 10 kt W and a central pressure of 971 mb at 26N, 79.8W at 07 UTC (MWR); 50 kt N and 1010 mb at 26.2N, 79.7W at 12 UTC (COA).

August 8: HWM indicates a closed low 1005 mb near 28.2N, 80.5W, just off the coast of Cape Canaveral. HURDAT listed this as a Category 1 hurricane at 27.8N, 80.7W at 12 UTC. The MWR Tracks of Lows suggests a center near 27.8N, 81W at 8 a.m. Available observations from HWM and COADS suggest a center near 27.5N, 80.5W at 12 UTC. Ship highlights: 50 kt W and 1001 mb at 26N, 80W at 00 UTC (COA); 70 kt SW and 997 mb at 26.5N, 79.8W at 00 UTC (COA); 45 kt SSE and 1002 mb at 27.2N, 79.6W at 09 UTC (COA). Station highlights: E wind with 1002 mb at Titusville, Florida, at 20 UTC (OMR).

August 9: HWM analyzed a closed low of 1000 mb near 29N, 83W. HURDAT listed this as a tropical storm at 29.4N, 82.7W at 12 UTC. The MWR Tracks of Lows suggests a center near 30N, 83W at 8 a.m. Available observations from HWM and COADS suggest a center near 28.7N, 82.7W at 12 UTC. Ship highlights: 15 kt NW and 1003 mb at 27.8N, 87.7W at 12 UTC (COA). Station highlights: 14 kt W and 1004 mb at Tampa at 00 UTC (OMR); 1001 mb at Tampa at 06 UTC (OMR); 13 kt SW and 1003 mb at Tampa at 12 UTC (OMR). “The disturbance continued on its northwestward course until near the thirtieth parallel and eighty-third meridian on the 9th, when it began to recurve and move over land” (MWR).

August 10: HWM indicates a closed low of at most 1010 mb near 31N, 84W. HURDAT listed this as a tropical storm at 31.7N, 84.8W at 12 UTC. The MWR Tracks of Lows suggests a center near 32N, 83.5W at 8 a.m. Available observations from HWM and

COADS suggest a center near 31N, 84.5W at 12 UTC. Station highlights: 1000 mb at Apalachicola, Florida, at 12 UTC (HWM); 19 kt N and 997 mb at Macon, Georgia, at 20 UTC (OMR); 26 kt S and 1004 mb at Savannah at 20 UTC (OMR).

August 11: HWM analyzed a broad extratropical cyclone centered near Charlotte, North Carolina. HURDAT listed this as an extratropical storm at 35.2N, 80.5W at 12 UTC. The MWR Tracks of Lows suggests a center near 35N, 81W at 8 a.m. Available observations from HWM and COADS suggest a center near 35.2N, 81W at 12 UTC. Station highlights: 16 kt NW and 999 mb at Macon, Georgia, at 00 UTC (OMR); 997 mb at Augusta, Georgia, at 03 UTC (OMR).

August 12: HWM indicates an extratropical cyclone just east of the Chesapeake Bay. HURDAT listed this as an extratropical storm at 38.7N, 74.1W at 12 UTC. The MWR Tracks of Lows suggests a center near 38.5N, 74W at 12 UTC. Available observations from HWM and COADS suggest a center near 38.7N, 74.5W at 12 UTC. Ship highlights: 35 kt SW and 1006 mb at 37.2N, 74.7W at 12 UTC (COA); 25 kt SW and 1004 mb at 37.7N, 74.6W at 12 UTC (COA); 35 W at 37.5N, 74.5W at 21 UTC (COA). "...passed out to sea near the Virginia Capes on the morning of the 12th, with moderate to strong gales along the coast between Hatteras and New York" (MWR).

August 13: HWM analyzed an extratropical cyclone near 40N, 70W. Original HURDAT did not list this system on this date. Available observations from HWM and COADS suggest a center near 39N, 68W at 06 UTC. No gale force winds (or equivalent in pressure) were observed.

Genesis for storm 1 is begun as a tropical storm at 12 UTC on August 5th, two and a half days later that suggested in original HURDAT. The storm originated north of Haiti on the 5th and progressed northwestward until landfall in central Florida on the 8th. Peak winds on the 5th were reported at 35 kt. 35 kt is retained for HURDAT at 12 UTC on the 5th. No gale force winds or low pressures were observed on the 6th as the storm paralleled Cuba's southeastern coast. On the 7th, a central pressure of 971 mb was observed, implying winds of 88 and 85 kt from the southern and subtropical pressure-wind relationships, respectively. 85 kt is retained for HURDAT at 12 UTC on the 7th. A new central pressure measurement has also been added to HURDAT at 06 UTC on the 7th. The Category 2 hurricane made landfall in central Florida around 09 UTC, near Cape Canaveral, on the 8th. The radius of maximum winds (RMW) for this hurricane at landfall was approximately 10 nmi, significantly smaller than climatology (20 nmi – Vickery et al, 2000). Barnes (1998) listed storm 1 as possessing barometric pressure of 28.84 inches [977 mb] at landfall just north of Fort Pierce. A central pressure of 977 mb implies winds of 81 and 79 kt from the southern and subtropical pressure-wind relationships, respectively. Due to the small RWM, 85 kt is chosen for HURDAT at 06 UTC, a 5 kt increase from original HURDAT. However, this does not change the Saffir-Simpson Category 2 hurricane classification at landfall. Peak observed winds after landfall were the following: 12 UTC 8th – 45 kt, 18 UTC – 30 kt, 00 UTC 9th – 25 kt, and 06 UTC – no wind speed record. Application of the Kaplan and DeMaria (1995) model suggests winds of 67, 52, 41, and 38 kt, accordingly. Winds for revised HURDAT are retained at 70 kt at 12 UTC and 50 kt at 18 UTC. On the 9th winds for revised HURDAT are increased to 45

kt at 00 UTC and maintained at 40 kt at 06 UTC. Gale force winds were not observed on the 9th but a peripheral pressure of 1003 mb was observed, implying winds of at least 43 kt from the subtropical pressure-wind relationship. 40 kt is chosen for HURDAT at 12 UTC, a 5 kt upgrade from previous HURDAT. On the 10th, a peripheral pressure of 997 mb was observed implying winds of at least 53 kt from the subtropical pressure-wind relationship. Given that the storm is over land, a significant reduction to the implied winds is necessary. Thus, 35 kt is retained for HURDAT at 12 UTC on the 10th. Available observations indicate that the storm transitioned to an extratropical storm by 06 UTC on the 11th. Peak winds on the 11th were 25 kt. 30 kt is maintained for HURDAT at 12 UTC. On the 12th the system reemerged into the Atlantic Ocean off the Virginia coast. Peak winds on the 12th were 30 kt. 30 kt is retained for HURDAT at 12 UTC. Available observations indicate the system dissipated by 12 UTC on the 13th, 18 hours later than indicated in original HURDAT, in the North Atlantic Ocean.

Storm 2, 1928

24660 08/07/1928 M=11 2 SNBR= 551 NOT NAMED XING=1 SSS=0
 24660 08/07/1928 M=11 2 SNBR= 551 NOT NAMED XING=1 SSS=0

24665 08/07* 0 0 0 0* 0 0 0 0*123 600 35 0*128 608 35 0
 24665 08/07* 0 0 0 0* 0 0 0 0*115 603 30 0*122 612 30 0
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24670 08/08*133 616 35 0*138 625 40 0*142 635 40 0*146 646 45 0
 24670 08/08*129 621 35 0*136 630 35 0*142 640 35 0*146 650 35 0
 *** ** * *** ** * *** ** * *** ** *

24675 08/09*150 655 50 0*154 669 55 0*158 680 60 0*162 689 65 0
 24675 08/09*149 660 40 0*151 670 40 0*153 680 40 0*157 691 40 0
 *** ** * *** ** * *** ** * *** ** *

24680 08/10*165 698 70 0*169 707 70 0*173 716 70 0*179 727 70 0
 24680 08/10*162 703 45 0*168 714 45 0*173 725 50 0*177 734 55 0
 *** ** * *** ** * *** ** * *** ** *

24685 08/11*186 737 70 0*194 748 70 0*201 759 60 0*207 770 60 0
 24685 08/11*180 742 60 0*182 750 65 0*186 759 70 0*191 769 70 0
 *** ** * *** ** * *** ** * *** ** *

24690 08/12*213 780 50 0*220 790 45 0*227 798 45 0*235 805 45 0
 24690 08/12*197 781 65 0*204 792 60 0*215 800 55 0*228 806 50 0
 *** ** * *** ** * *** ** * *** ** *

24695 08/13*244 811 45 0*252 816 50 0*260 822 50 0*268 828 55 0
 24695 08/13*242 811 60 0*252 816 60 0*260 822 55 0*268 828 55 0
 *** ** * *** ** * *** ** *

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24700 08/14*276 833 50 0*285 839 50 0*293 844 45 0*302 849 40 0
24700 08/14*276 833 50 0*284 839 50 0*293 844 45 0*302 849 40 0
***

24705 08/15*313 854 40 0*324 856 35 0*334 854 35 0*344 848 30 0
24705 08/15*311 854 35 0*320 856 35 0*330 854 30 0*339 850 30 0
*** ** *** ** *** **

24710 08/16*353 842 30 0*362 835 30 0*371 827 25 0*379 820 25 0
24710 08/16*347 845 30 0*355 839 30 0*365 833 25 0*375 825 25 0
*** *** *** *** *** ***

24715 08/17*386 812 25 0*392 805 20 0*397 797 20 0* 0 0 0 0
24715 08/17*384 816 25 0*392 805 20 0* 0 0 0 0* 0 0 0 0
*** *** *** *** **

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24720 HR

Minor changes to the track and intensity shown in Neumann et al. (1999). Evidence for these alterations comes from the Historical Weather Maps series, the COADS ship database, Original Monthly Records, and Monthly Weather Review.

August 7: HWM analyzed no significant features in the eastern Caribbean Sea. HURDAT listed this as a tropical storm at 12.3N, 60W at 12 UTC. Available observations from HWM and COADS suggest a center near 11.5N, 60.3W at 12 UTC. No gale force winds (or equivalent in pressure) were observed.

August 8: HWM indicates a closed low of at most 1005 mb near 14N, 65W. HURDAT listed this as a tropical storm at 14.2N, 63.5W at 12 UTC. Available observations from HWM and COADS suggest a center near 14.2N, 64W at 12 UTC. No gale force winds (or equivalent in pressure) were observed.

August 9: HWM analyzed a closed low of at most 1005 mb near 15.5N, 68W. HURDAT listed this as a tropical storm at 15.8N, 68W at 12 UTC. Available observations from HWM and COADS suggest a center near 15.3N, 68W at 12 UTC. No gale force winds (or equivalent in pressure) were observed.

August 10: HWM indicates a closed low of at most 1005 mb near 16.5N, 71W. HURDAT listed this as a tropical storm at 17.3N, 71.6W at 12 UTC. Available observations from HWM and COADS suggest a center near 17.3N, 72.5W at 12 UTC. Ship highlights: 20 kt ESE and 1005 mb at 13.8N, 69.2W at 12 UTC (HWM).

August 11: HWM analyzed a closed low of at most 1005 mb near 20N, 76.5W. HURDAT listed this as a tropical storm at 20.1N, 75.9W at 12 UTC. The MWR Tracks of Lows suggests a center near 19.8N, 75.8W at 8 a.m. Available observations from HWM and COADS suggest a center near 18.6N, 75.9W at 12 UTC. Ship highlights: 45 kt E and 1012 mb at 19.3N, 75W at 11 UTC (MWR); 60 kt E at 19.3N, 75W (MWR); 45 kt E at 19.3N, 75.1W at 12 UTC (COA). "The second disturbance was central near Jamaica on the 11th, and on that day strong easterly gales were encountered in the northerly quadrants" (MWR).

August 12: HWM indicates a closed low of at most 1000 mb near 22N, 81.5W. HURDAT listed this as a tropical storm at 22.7N, 79.8W at 12 UTC. The MWR seasonal hurricane chart suggests a center near 23N, 79.5W at 12 UTC. Available observations from HWM and COADS suggest a center near 21N, 79.5W at 12 UTC. Ship highlights: 70 kt S and 1019 mb at 27.8N, 78.9W at 00 UTC (COA); 10 kt E and 998 mb at 24.3N, 82.8W at 12 UTC (COA); 45 kt SE and 1014 mb at 25.2N, 80.2W at 18 UTC (COA).

August 13: HWM analyzed a closed low of 1000 mb near 26N, 82W, just west of Fort Myers, Florida. HURDAT listed this as a tropical storm at 26N, 82.2W at 12 UTC. The MWR Tracks of Lows suggests a center near 25.8N, 82.5W at 8 a.m. Available observations from HWM and COADS suggest a center near HURDAT to be most accurate. Ship highlights: 70 kt S at 24.6N, 80.9W (MWR); 30 kt S and 993 mb at 24.5N, 80.5W at 00 UTC (COA); 45 kt SE and 1008 mb at 24.6N, 80.8W at 07 UTC (MWR). Station highlights: 24 kt E and 1004 mb at Tampa at 22 UTC (OMR). "On the 13th the center was off the southwest coast of Florida" (MWR)

August 14: HWM indicates a closed low of 1000 mb near 29N, 84.5W. HURDAT listed this as a tropical storm at 29.3N, 84.4W at 12 UTC. The MWR Tracks of Lows suggests a center near 29.8N, 84.3W at 8 a.m. Available observations from HWM and COADS suggest a center near HURDAT to be most accurate. Ship highlights: 15 kt SE and 1003 mb at 29.9N, 79.7W at 00 UTC (COA). Station highlights: 26 kt S and 1005 mb at Tampa at 00 UTC (OMR); 21 kt NW and 1004 mb at Apalachicola at 12 UTC (OMR); 1003 mb at Apalachicola at 13 UTC (OMR). "On the 14th [the storm was] near Apalachicola. From this point it began to recurve slightly toward the east and gradually filled in as it moved over the land" (MWR).

August 15: HWM analyzed a very broad closed low of at most 1015 mb centered near Montgomery, Alabama. HURDAT listed this as a tropical storm at 33.4N, 85.4W at 12 UTC. The MWR Tracks of Lows suggests a center near 33N, 85.3W at 8 a.m. Available observations from HWM and COADS suggest a center near 33N, 85.4W at 12 UTC. No gale force winds (or equivalent in pressure) were observed.

August 16: HWM indicates a closed low of at most 1015 mb centered near the lower Appalachian Mountains. HURDAT listed this as a tropical depression at 37.1N, 82.7W at 12 UTC. The MWR Tracks of Lows suggests a center near 37N, 84W at 8 a.m. Available observations from HWM and COADS suggest a center near 36.5N, 83.3W at 12 UTC. No gale force winds (or equivalent in pressure) were observed.

August 17: HWM analyzed a trough centered over Virginia and North Carolina. HURDAT listed this as a tropical depression at 39.2N, 80.5W at 06 UTC. The MWR Tracks of Lows suggests a center near 38.3N, 80W at 8 a.m. Available observations from HWM and COADS suggest a center near HURDAT to be most accurate at 06 UTC. No gale force winds (or equivalent in pressure) were observed.

Genesis for storm 2 began at 12 UTC on August 7th near the Lesser Antilles as a tropical depression rather than a tropical storm. The storm progressed northwestward, eventually making landfall in southeast Cuba and recurving to make a second landfall near Apalachicola on the 14th of August. Gale force winds or low pressure were not observed until the 10th when a peripheral pressure of 1005 mb was reported, implying winds of at

least 36 kt from the southern pressure-wind relationship. 50 kt is chosen for HURDAT at 12 UTC, a 20 kt reduction from previous HURDAT. Peak winds on the 11th were 60 kt. 70 kt is chosen for HURDAT at 12 UTC, a 10 kt increase from original HURDAT. On the 12th, a peripheral pressure of 998 mb was observed, implying winds of at least 51 kt from the southern pressure-wind relationship. 55 kt is chosen for HURDAT at 12 UTC on the 12th, an upgrade of 10 kt. A peripheral pressure of 993 mb was observed at 00 UTC on the 13th which implies winds of at least 58 and 59 kt from the Gulf of Mexico and southern pressure-wind relationships, respectively. 60 kt is chosen for HURDAT at 00 UTC, a 15 kt increase from original HURDAT. The storm paralleled Florida's west coast on the 13th before making landfall around 13 UTC in Apalachicola on the 14th. Peak observations before landfall on the 14th, indicates a peripheral pressure report of 1003 mb. 1003 mb implies 39 kt from the Gulf of Mexico pressure-wind relationship. 45 kt is retained for HURDAT at 12 UTC. Once over land, the tropical storm quickly diminished in intensity. The storm progressed on a north to northeast track on the 15th and 16th and eventually dissipated over the Virginia by 12 UTC on the 17th.

Storm 3, 1928

24725 09/01/1928 M= 8 3 SNBR= 552 NOT NAMED XING=0 SSS=0
 24725 09/01/1928 M= 8 3 SNBR= 552 NOT NAMED XING=0 SSS=0

24730 09/01* 0 0 0 0* 0 0 0 0* 0 0 0 0*172 728 35 0
 24730 09/01* 0 0 0 0* 0 0 0 0* 0 0 0 0*172 728 25 0
 **

24735 09/02*173 741 35 0*174 754 35 0*176 767 35 0*179 780 35 0
 24735 09/02*173 738 30 0*174 748 30 0*176 760 30 0*177 775 30 0
 *** ** *** ** *** ** *** **

24740 09/03*182 793 35 0*184 805 40 0*186 815 40 0*187 824 45 0
 24740 09/03*178 792 35 0*179 807 40 0*180 820 40 0*182 830 45 0
 *** *** *** *** *** *** *** ***

24745 09/04*188 833 50 0*189 841 50 0*190 850 50 0*192 858 50 0
 24745 09/04*185 838 50 0*187 844 50 0*190 850 50 0*192 858 50 0
 *** *** *** ***

24750 09/05*194 867 50 0*196 875 50 0*198 884 40 0*200 893 35 0
 24750 09/05*194 867 50 0*196 875 50 0*198 884 40 0*200 893 35 0

24755 09/06*203 903 35 0*205 913 40 0*208 922 40 0*211 930 45 0
 24755 09/06*203 903 35 0*205 913 40 0*208 922 40 0*211 930 45 0

24760 09/07*214 938 45 0*217 945 45 0*220 951 45 0*223 957 45 0
 24760 09/07*214 938 45 0*217 945 45 0*220 951 45 0*223 957 45 0

24765 09/08*227 964 45 0*231 973 40 0*240 985 35 0*248 993 30 0
 24765 09/08*227 964 45 0*231 973 40 0*240 985 35 0*248 997 30 0

24770 TS

Minor changes to the track and intensity shown in Neumann et al. (1999). Evidence for these alterations comes from the Historical Weather Maps series, the COADS ship database, and Monthly Weather Review.

September 1: HWM analyzed no significant features across the Caribbean Sea. HURDAT listed this as a tropical storm at 17.2N, 72.8W at 18 UTC. Available observations from HWM and COADS suggest a center near 17.2N, 72.8W at 18 UTC. No gale force winds (or equivalent in pressure) were observed.

September 2: HWM indicates no significant features across the Caribbean Sea. HURDAT listed this as a tropical storm at 17.6N, 76.7W at 12 UTC. Available observations from HWM and COADS suggest a center near 17.6N, 76W at 12 UTC. No gale force winds (or equivalent in pressure) were observed. "From the 2nd until the 5th a tropical disturbance of moderate intensity moved slowly westward over the Caribbean Sea" (MWR).

September 3: HWM analyzed a closed low of at most 1010 mb near 16N, 84W, just northeast of Honduras. HURDAT listed this as a tropical storm at 18.6N, 81.5W at 12 UTC. Available observations from HWM and COADS suggest a center near 17.8N, 82W at 12 UTC. No gale force winds (or equivalent in pressure) were observed.

September 4: HWM indicates a closed low of at most 1010 mb near 17N, 85W. HURDAT listed this as a tropical storm at 19N, 85W at 12 UTC. Available observations from HWM and COADS suggest a center near HURDAT to be most accurate. Ship highlights: 35 kt ESE at 24N, 80W at 02 UTC (COA); 50 kt ESE at 20.5N, 81.1W at 04 UTC (MWR); 45 kt SE at 19.7N, 83.4W at 12 UTC (COA). "The American S.S. Norma in 20.5N, 81.1W, near midnight of the 3rd, encountered a heavy ESE to SE squall of force 8 to 10 [35 to 50 kt], with a rough cross sea" (MWR).

September 5: HWM analyzed an inverted trough near 15.5N, 64.5W. HURDAT listed this as a tropical storm at 19.8N, 88.4W at 12 UTC. Available observations from HWM and COADS suggest a center near HURDAT to be most accurate. No gale force winds (or equivalent in pressure) were observed.

September 6: HWM indicates no significant features across the western Caribbean Sea or southern Gulf of Mexico. HURDAT listed this as a tropical storm at 20.8N, 92.2W at 12 UTC. Available observations from HWM and COADS suggest a center near HURDAT to be most accurate. No gale force winds (or equivalent in pressure) were observed.

September 7: HWM analyzed no significant features across the southern Gulf of Mexico. HURDAT listed this as a tropical storm at 22N, 95.1W at 12 UTC. Available observations from HWM and COADS suggest a center near HURDAT to be most accurate. No gale force winds (or equivalent in pressure) were observed.

September 8: HWM indicates no significant features across the southern Gulf of Mexico. HURDAT listed this as a tropical storm at 24N, 98.5W at 12 UTC. Available

observations from HWM and COADS suggest a center near HURDAT to be most accurate. No gale force winds (or equivalent in pressure) were observed.

Genesis for storm 3 is retained at 18 UTC on September 1st, but as a tropical depression rather than a tropical storm. The system originated in the central Caribbean Sea and propagated westward for the storm's entire duration, making landfall in the Yucatan Peninsula and eastern Mexico. Gale force winds were not observed until early on the 4th, when the ship S.S. Norma reported 50 kt winds (MWR). 50 kt is retained for HURDAT at 12 UTC on the 4th. This observation corroborated with two other COADS ships as the only reported gales for this storm. The system made landfall in the Yucatan around 06 UTC on the 5th as a 50 kt tropical storm. The storm reemerged in the southern Gulf of Mexico early on the 6th and eventually made final landfall early on the 8th well south of the United States/Mexico border. Scant data coverage prevailed for the 5th through the 8th. Thus, the majority of HURDAT track and intensity estimates were retained. Peak intensity with this tropical storm remains at 50 kt on the 4th.

Storm 4, 1928

Storm 4 was complete by another researcher at the Hurricane Research Division; therefore the additional daily data and storm summary are not included with this particular storm. However, the best track file is listed for verification with the ACE index calculations and major/minor revision classification.

24775 09/06/1928 M=15 4 SNBR= 553 NOT NAMED XING=1 SSS=4

24775 09/06/1928 M=16 4 SNBR= 553 NOT NAMED XING=1 SSS=4

**

24780 09/06* 0 0 0 0* 0 0 0 0*137 204 35 0*138 221 35 0

24780 09/06*142 170 30 0*141 185 30 0*140 200 35 0*138 216 35 0

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

24785 09/07*139 239 35 0*140 257 35 0*141 275 35 0*142 294 35 0

24785 09/07*137 232 40 0*136 248 45 0*135 265 50 0*135 282 50 0

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

24790 09/08*144 315 35 0*146 335 40 0*147 352 40 0*148 367 40 0

24790 09/08*135 300 50 0*136 317 50 0*137 335 50 0*138 352 50 0

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

24795 09/09*148 382 45 0*148 396 50 0*149 411 50 0*150 426 55 0

24795 09/09*139 370 50 0*140 387 50 0*142 405 50 0*143 422 55 0

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

24800 09/10*151 440 55 0*152 454 60 0*153 469 60 0*154 486 65 0

24800 09/10*144 440 55 0*145 457 60 0*147 475 60 0*149 492 65 0

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***          *** ***          *** ***          *** ***
24805 09/11*155 505 70 0*155 525 75 0*156 542 80 0*157 557 85 0
24805 09/11*152 509 70 0*155 526 75 0*158 542 80 0*159 558 85 0
          *** ***          ***          ***          *** ***
24810 09/12*158 572 95 0*159 586 100 0*160 599 105 0*162 611 110 940
24810 09/12*159 573 95 0*159 588 100 0*160 603 110 0*162 615 120 940
          *** ***          ***          *** ***          *** ***
24815 09/13*165 623 115 0*169 635 120 0*174 647 135 0*179 658 140 931
24815 09/13*165 626 130 0*170 636 135 0*175 648 140 931*180 660 140 0
          *** ***          *** *** ***          *** *** ***          ***
24820 09/14*185 670 140 0*190 680 135 0*196 691 135 0*200 700 135 0
24820 09/14*185 670 120 941*189 680 120 0*193 691 120 0*199 700 120 0
          *** *** ***          ***          ***          ***          ***
24825 09/15*206 708 135 0*213 716 135 0*222 727 135 0*228 736 135 0
24825 09/15*207 708 120 0*215 717 120 0*222 727 120 0*229 738 120 941
          ***          ***          *** *** ***          ***          *** *** ***
24830 09/16*235 748 135 0*243 760 135 0*251 772 135 0*258 783 130 0
24830 09/16*237 750 120 0*245 763 120 0*253 776 125 0*260 788 125 0
          *** *** ***          *** *** ***          *** *** ***          *** *** ***
24835 09/17*265 795 130 929*271 801 115 0*278 815 110 955*288 820 90 0
24835 09/17*267 800 125 929*272 811 100 0*278 820 85 0*286 822 75 0
          *** *** ***          *** *** ***          *** ***          *** *** ***
24840 09/18*300 819 80 974*313 815 75 0*325 808 60 978*331 800 60 0
24840 09/18*295 821 70 0*307 815 70 979*320 808 80 0*330 800 70 0
          *** *** ** *** ***          ** *** ***          ** *** ***          **
24845 09/19*341 786 50 981*349 777 45 0*358 770 40 989*370 770 40 0
24845 09/19*338 792 65 0*348 783 60 0*358 775 60 0*368 773 50 0
          *** *** ** *** *** ***          *** ***          *** *** ***
24850 09/20*385 775 40 100E402 780 40 0E420 784 35 1008E433 790 35 0
24850 09/20E380 775 40 0E397 780 35 0E415 790 30 1008E435 792 30 0
          ****          **** ***          **          **** ***          **** ***

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(The 21st is new to HURDAT.)
24850 09/21E455 790 25 1002* 0 0 0 0* 0 0 0 0* 0 0 0 0

24855 HRCFL4DFL2 GA1 SC1
24855 HRCFL4BFL3AFL1DFL1 GA1 SC1

Storm 5, 1928

24860 09/08/1928 M= 5 5 SNBR= 554 NOT NAMED XING=0 SSS=0

24860 09/08/1928 M= 6 5 SNBR= 554 NOT NAMED XING=0 SSS=0

*

24865 09/08* 0 0 0 0* 0 0 0 0*211 477 35 0*218 486 35 0

24865 09/08* 0 0 0 0* 0 0 0 0*180 480 35 0*190 486 35 0

*** **

24870 09/09*224 495 35 0*230 502 35 0*236 510 40 0*257 535 40 0

24870 09/09*201 492 35 0*214 498 35 0*230 505 40 0*249 514 40 0

*** **

24875 09/10*280 553 40 0*304 556 45 0*324 550 45 0*341 530 45 0

24875 09/10*270 525 40 0*293 533 45 0*315 535 45 0*335 530 45 0

*** **

24880 09/11*359 503 50 0E375 470 50 0E394 423 50 0E412 397 50 0

24880 09/11*354 503 50 0E372 480 50 0E390 450 55 0E406 425 60 0

*** **

24885 09/12E431 369 50 0E449 347 50 0E468 324 50 0E485 307 50 0

24885 09/12E420 400 60 0E432 375 60 0E445 350 60 0E460 325 55 0

*** **

(The 13th is new to HURDAT.)

24887 09/13E477 305 50 0E495 290 45 0* 0 0 0 0* 0 0 0 0

24890 TS

Minor changes to the track and intensity shown in Neumann et al. (1999). Evidence for these alterations comes from the Historical Weather Maps series, the COADS ship database, and Monthly Weather Review.

September 8: HWM analyzed no significant features in the central Atlantic Ocean. HURDAT listed this as a tropical storm at 21.1N, 47.7W at 12 UTC. Available observations from HWM and COADS suggest a center near 18N, 47W at 12 UTC. No gale force winds (or equivalent in pressure) were observed.

September 9: HWM indicates no significant features in the central Atlantic Ocean. HURDAT listed this as a tropical storm at 23.6N, 51W at 12 UTC. Available observations from HWM and COADS suggest a center near 23N, 50.5W at 12 UTC. Ship highlights: 35 kt SSE and 1014 mb at 24.5N, 49.5W at 1014 mb (COA). "On the evening of the 9th a moderate depression was central near 27N, 51W, that moved slowly north accompanied by moderate winds until the morning of the 11th." (MWR).

September 10: HWM analyzed an extratropical cyclone just east of Bermuda. HURDAT listed this as a tropical storm at 32.4N, 55W at 12 UTC. Available observations from HWM and COADS suggest a center near 31.5N, 53.5W at 12 UTC. Ship highlights: 60

kt ESE and 1015 mb at 28.5N, 53.5W at 00 UTC (COA); 35 kt SSW and 1015 mb at 28.5N, 53.5W at 04 UTC (COA); 35 kt SSW and 1014 mb at 34N, 50.6W at 20 UTC (MWR).

September 11: HWM indicates an extratropical cyclone well southeast of Cape Race. HURDAT listed this as an extratropical storm at 39.4N, 42.3W at 12 UTC. Available observations from HWM and COADS suggest a center near 39N, 45W at 12 UTC. Ship highlights: 10 kt ESE and 985 mb at 40.3N, 43.3W at 18 UTC (MWR); 45 kt NNE at 40.3N, 43.3W (MWR). "By that date [11th] this low was near 40N, 45W, and had deepened considerably, with winds of force 7 [30 kt] near the center at the time of observation" (MWR).

September 12: HWM analyzed an extratropical cyclone in the northern Atlantic Ocean. HURDAT listed this as an extratropical storm at 46.8N, 32.4W at 12 UTC. Available observations from HWM and COADS suggest a center near 44.5N, 35W at 12 UTC. Ship highlights: 60 kt W and 993 mb at 41.3N, 36W at 10 UTC (MWR); 60 kt W at 42N, 35.3W at 12 UTC (COA); 45 kt SSW and 1002 mb at 43.5N, 29.5W at 18 UTC (COA).

September 13: HWM indicates an extratropical cyclone southeast of Iceland. Available observations from HWM and COADS suggest a center near 49.5N, 29W at 12 UTC. No gale force winds (or equivalent in pressure) were observed.

Genesis is retained for storm 5 at 12 UTC on September 8th as a minimal tropical storm. The storm progressed on a northwestward track and recurved east of Bermuda. A peak wind of 35 kt was observed on the 9th. 40 kt is retained for HURDAT at 12 UTC on the 9th. HWM analysis of an extratropical storm on the 10th appears to be inconsistent with available data that suggests the system is still barotropic on this date. A peak wind of 60 kt was observed on the 10th. 45 kt is retained for HURDAT at 12 UTC on the 10th. Available observations do agree with original HURDAT's analysis of an extratropical storm near 40N on the 11th. A peripheral pressure of 985 mb was observed on the 11th, implying winds of at least 68 kt from the northern pressure-wind relationship. Given that the system is no longer barotropic, the pressure-wind relationship can be utilized with a slight downgrade from the implied 68 kt. 55 kt is chosen for HURDAT at 12 UTC, a 5 kt upgrade from original HURDAT. On the 12th a peak wind of 60 kt was observed. 60 kt is chosen for HURDAT, 10 kt more than previous HURDAT. The system became absorbed by a large extratropical cyclone late on the 12th and dissipated by 12 UTC on the 13th.

Storm 6, 1928

24895 10/10/1928 M= 6 6 SNBR= 555 NOT NAMED XING=0 SSS=0
24895 10/10/1928 M= 6 6 SNBR= 555 NOT NAMED XING=0 SSS=0

24900 10/10* 0 0 0 0* 0 0 0 0*168 358 35 0*180 369 35 0
24900 10/10*167 356 35 0*173 363 40 0*180 370 45 0*187 377 50 0
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24905 10/11*194 379 35 0*206 388 35 0*218 398 35 0*229 407 35 0
24905 10/11*194 384 55 0*202 391 55 0*210 398 55 0*218 405 55 0
      *** **      *** ** **      *** **      *** ** **
24910 10/12*240 416 35 0*250 424 40 0*260 432 45 0*270 439 50 0
24910 10/12*227 411 55 0*236 418 55 0*245 425 55 0*255 434 60 0
      *** ** **      *** ** **      *** ** **      *** ** **
24915 10/13*278 445 55 0*287 450 60 0*297 455 60 0*309 459 70 0
24915 10/13*266 445 65 0*277 454 70 0*290 460 70 0*305 459 75 0
      *** **      *** ** **      *** ** **      *** ** **
24920 10/14*325 453 65 0*343 440 60 0E363 420 60 0E380 400 60 0
24920 10/14*322 452 80 0*342 435 80 0*363 410 80 0*380 390 75 0
      *** ** **      *** ** **      *   *** **      *   *** **
24925 10/15E400 380 60 0* 0 0 0 0* 0 0 0 0* 0 0 0 0
24925 10/15*395 375 65 0E405 365 50 0* 0 0 0 0* 0 0 0 0
      **** ** **      ***** ** **

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24930 HR

Minor changes to the track and intensity shown in Neumann et al. (1999). Evidence for these alterations comes from the Historical Weather Maps series, the COADS ship database, and Monthly Weather Review.

October 10: HWM analyzed no significant features in the central Atlantic Ocean. HURDAT listed this as a tropical storm at 16.8N, 35.8W at 12 UTC. Available observations from HWM and COADS suggest a center near 18N, 37W at 12 UTC. Ship highlights: 45 kt ESE and 1011 mb at 20.5N, 37.5W at 22 UTC (COA); 35 kt E and 1013 mb at 20.5N, 37.5W at 18 UTC (COA). “On the 10th a disturbance of tropical origin was somewhere in the vicinity of 22N, 37W, as indicated by the storm report from the Dutch S.S. Prins Frederik Hendrik” (MWR).

October 11: HWM indicates a warm front extending east-southeast from 35N, 44W to 29N, 34W. HURDAT listed this as a tropical storm at 21.8N, 39.8W at 12 UTC. Available observations from HWM and COADS suggest a center near 21N, 39.8W at 12 UTC. Ship highlights: 55 kt E and 1015 mb at 20.7N, 37.5W at 00 UTC (MWR); 35 kt SSE and 1015 mb at 21.5N, 37.5W at 02 UTC (COA); 35 kt SSE and 1013 mb at 21.5N, 37.5W at 06 UTC (COA).

October 12: HWM analyzed a cold front extending southwest from 40N, 35W to 27N, 50W. HURDAT listed this as a tropical storm at 26N, 43.2W at 12 UTC. Available observations from HWM and COADS suggest a center near 24.5N, 42.5W at 12 UTC. No gale force winds (or equivalent in pressure) were observed.

October 13: HWM indicates an extratropical cyclone near 28N, 47W. HURDAT listed this as a tropical storm at 29.7N, 45.5W at 12 UTC. Available observations from HWM and COADS suggest a center near 29N, 46W at 12 UTC. Ship highlights: 35 kt N and 1004 mb at 29.9N, 47.2W at 20 UTC (MWR); 35 kt NNE at 29.9N, 47.2W (MWR); 45

kt SSE and 1014 mb at 31.4N, 41.4W at 22 UTC (COA). “Unfortunately, this is an unfrequented part of the ocean and so few reports have been received that it has been difficult to trace its track accurately until the 14th” (MWR).

October 14: HWM analyzed a large extratropical cyclone near 38N, 41W. HURDAT listed this as a tropical storm at 36.3N, 42W at 12 UTC. Available observations from HWM and COADS suggest a center near 36.3N, 41W at 12 UTC. Ship highlights: 70 kt SW and 990 mb at 35.5N, 41.3W at 12 UTC (COA); 70 kt SW and 980 mb at 35.5N, 41W at 14 UTC (MWR); 70 kt SSE and 984 mb at 37.9N, 39.1W at 18 UTC (MWR). “It was on the 14th that the American tanker David C. Reid foundered, her approximate position being given in an SOS as 37N, 38W, apparently not far from the center of the disturbance” (MWR).

October 15: HWM indicates a large extratropical cyclone near 55N, 30W, in the process of absorbing a smaller extratropical system near 44N, 32W. HURDAT listed this as an extratropical storm at 40N, 38W at 00 UTC. Available observations from HWM and COADS suggest a center near 39.5N, 37.5W at 12 UTC. No gale force winds (or equivalent in pressure) were observed.

Genesis for storm 6 is begun at 00 UTC on October 10th as a tropical storm, 12 hours earlier than original HURDAT. The tropical storm progressed northwestward through October 13th before recurving well away from any landmass. On the 10th a peak wind of 45 kt was observed around 20 UTC. 50 kt is chosen for HURDAT at 18 UTC on the 10th, a 15 kt upgrade from previous HURDAT. As mentioned by MWR, the Dutch ship S.S. Prins Frederik Hendrik observed peak winds of 55 kt on the 11th around 00 UTC. 55 kt is chosen for HURDAT at 00 UTC, a 20 kt increase from original HURDAT. Gale force winds were not observed again until late on the 13th when a peak wind of 45 kt was reported well removed from the storm's center. 70 kt is chosen for HURDAT at 12 UTC, 10 kt greater than original HURDAT. A peripheral pressure of 980 mb was observed on the 14th, implying winds of at least 73 kt from the pressure-wind relationship. 80 kt is chosen for HURDAT at 12 UTC, a 20 kt upgrade from previous HURDAT. HWM consistently analyzed an extratropical system on the 13th and 14th but no direct evidence exists indicating the system had transitioned to baroclinic status. It is apparent, however, that the system weakened and became absorbed by a large extratropical system on the 15th. Original HURDAT listed this as a Category 1 hurricane at peak intensity but available observations indicate this system attained Category 2 hurricane strength on the 14th.

APPENDIX B.5
METADATA RESULTS FOR 1935

Storm 1, 1935

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27736 05/15/1935 M= 5 1 SNBR= 613 NOT NAMED XING=0 SSS=0
27737 05/15*170 685 30 0*175 690 30 0*182 695 35 1006*192 699 35 0
27738 05/16*203 702 35 0*215 704 35 0*225 705 35 0*232 702 35 0
27739 05/17*238 695 40 0*244 685 40 0*250 673 45 0*256 658 50 0
27739 05/18*263 635 50 0*273 610 45 0*285 590 40 0*297 570 35 0
27739 05/19E310 550 30 0* 0 0 0 0* 0 0 0 0* 0 0 0 0
27739 TS

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This is a new tropical storm not previously recorded in HURDAT. Evidence for this system comes from the Historical Weather Map series, the COADS ship database and the Monthly Weather Review.

May 15: An area of low pressure resides over the eastern portion of Hispaniola (18.5N, 69.5W) with pressure of at most 1010 mb from HWM. Available observations from HWM and COADS indicate the storm system is barotropic. Ship highlights: 5 kt NE and 1006 mb at 18N, 69.5W at 12 UTC (HWM).

May 16: HWM indicates an approaching frontal system from the northwest. The system is presently a tropical storm with evidence from HWM and COADS of a low of at most 1010 mb near 22.5N, 70.5W. "And on the 17th a whole gale was met a considerable distance south of Bermuda. The low with which this latter gale was connected was noted near Haiti on the 16th" (MWR). No gale force winds (or equivalent in pressure) were observed.

May 17: The approaching cold front continues to interact with the tropical storm causing it to move toward the northeast. HWM and COADS indicate the tropical storm is near 25N, 67.3W. "...on the 17th a whole gale was met a considerable distance south of Bermuda." Ship highlights: 20 kt NE and 1003 mb at 26N, 68.4W at 12 UTC (COA).

May 18: HWM indicates that no closed low was present and that a moderate cold front was approaching the area where the tropical cyclone was previously. Ship highlights: 50 kt S and 1003 mb at 26.3N, 63W at 00 UTC (MWR).

May 19: HWM suggests that the system has been absorbed by a frontal boundary. From COADS and MWR, however, observations suggest that the center was near 28.5N, 59W. No gale force winds (or equivalent in pressure) were observed.

Genesis for this tropical system began on the early morning of May 15th where evidence shows a closed circulation. It appears that the system acquired tropical storm status at 12 UTC on the 15th. A possible central pressure of 1006 mb at 12 UTC on the 15th suggests winds of 34 kt from the southern wind-pressure relationship. Therefore 35 kt is chosen for HURDAT. Peak observations were 50 kt and 1003 mb late on the 17th and early on the 18th as evident from the Dutch ship Magdala (MWR). 1003 mb peripheral pressure would suggest at least 43 kt from the southern wind-pressure relationship. Thus 50 kt is chosen for HURDAT based on both observed winds and pressure. Dissipation occurred on the 18th as the system became absorbed by a frontal boundary on the 19th.

Storm 2 (originally 1), 1935

26610 08/18/1935 M= 9 1 SNBR= 587 NOT NAMED XING=0

27740 08/18/1935 M= 9 2 SNBR= 614 NOT NAMED XING=0 SSS=0

*

26615 08/18* 0 0 0 0*195 590 65 0*202 608 70 0*206 618 75 0*

27745 08/18* 0 0 0 0*190 610 50 0*195 620 55 0*200 630 60 0

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

26620 08/19*210 627 75 0*214 634 80 0*218 641 80 0*222 648 85 0*

27750 08/19*206 640 65 0*212 650 70 0*218 660 75 0*222 667 80 0

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

26625 08/20*226 655 90 0*232 663 90 0*238 670 95 0*243 675 95 0*

27755 08/20*225 671 85 0*228 674 90 0*232 675 95 0*239 676 100 0

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

26630 08/21*247 678 95 0*251 681 100 0*256 684 100 0*265 687 100 0*

27760 08/21*249 677 105 0*262 678 110 0*273 680 110 0*281 682 110 0

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

26635 08/22*276 690 100 0*285 690 105 0*294 688 105 0*305 684 105 0*

27765 08/22*287 683 110 0*291 684 110 0*294 685 110 0*300 684 110 0

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

26640 08/23*316 678 105 0*321 673 105 0*328 666 100 0*340 648 100 0*

27770 08/23*308 680 110 0*317 674 105 0*328 666 100 0*340 650 100 0

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

26645 08/24*352 628 95 0*361 610 90 0*373 593 85 0*397 576 80 0*

27775 08/24*352 630 100 0*361 610 100 0*373 590 100 0*397 576 100 0

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

26650 08/25E426 567 75 0E452 570 70 0E473 577 65 0E484 584 55 0*

27780 08/25*426 567 90 0*452 570 80 0E473 577 70 0E484 584 60 0

* ** * ** * ** **

26655 08/26E489 591 50 0E493 598 40 0E497 605 35 0E499 620 30 0*

27785 08/26E489 592 50 0E493 602 40 0E497 615 35 0E499 630 30 0

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

26660 HR

27790 HR

Minor changes to the track and the intensity shown in Neumann et al. (1999), originally storm number 1. Evidence for these alterations comes from the Historical Weather Maps

series, the COADS ship database, individual ship and station data from NCDC, and Monthly Weather Review.

August 18: HWM analyzed a closed low of at most 1010 mb near 19N, 61W. HURDAT listed this as a Category 1 hurricane at 20.2N, 60.8W at 12 UTC. The MWR Tracks of Cyclones indicate the center near 21N, 61W at 8 a.m. Available observations from HWM and COADS suggests a center near 19.5N, 62W. Ship highlights: 35 kt NE at ~12 UTC at 22N, 65W (MWR). Regarding the intensity, "The American tanker California Standard made the first definite contact with the developing storm center on the morning of the 18th, when a northeast gale was encountered near 22N, 65W" (MWR).

August 19: HWM indicates a closed low of at most 1005 mb near 22N, 66W. HURDAT listed this as a Category 1 hurricane at 21.8N, 64.1W. The MWR Tracks of Cyclones indicate the center near 22N, 65W at 8 a.m. Available observations suggest that a position close to HWM is most accurate. Ship highlights: 50 kt SE and 1011 mb at 22.3N, 64W at 12 UTC (COA).

August 20: HWM analyzed a closed low of at most 1005 mb near 23N, 68W. HURDAT listed this as a Category 2 hurricane at 23.8N, 67W at 12 UTC. The MWR Tracks of Cyclones indicate the center near 24N, 66W at 8 a.m. Available observations suggest that a position slightly southwest of HURDAT is most accurate. Ship highlights: 35 kt ESE and 1006 mb at 24N, 66.7W (HWM).

August 21: HWM indicates a closed low of at most 995 mb near 26N, 69W. HURDAT listed this as a Category 3 hurricane at 25.6N, 68.4W at 12 UTC. The MWR Tracks of Cyclones indicate a pressure of 955 mb centered near 26N, 68W at 8 a.m. Available observations suggest the center north of HURDAT is most accurate. Ship highlights: 70 kt N and 955 mb at 26.9N, 68.5W at 09 UTC (MWR); 45 kt W and 986 mb at 27N, 67W at 12 UTC (COA). Regarding the intensity, "...the American steamship Angelina passed very close to the center about 5 a.m. of the 21st near 27N, 68.5W where a barometer reading of 955 mb was observed, attended by hurricane winds shifting from the northeast through west to southwest, without a lull" (MWR).

August 22: HWM analyzed a closed low of at most 995 mb near 29.5N, 68.5W. HURDAT listed this as a Category 3 hurricane at 29.4N, 68.8W. The MWR Tracks of Cyclones indicate the center near 29N, 69W at 8 a.m. Available observations suggest the HURDAT location is most accurate. Ship Highlights: 60 kt W and 994 mb at 27.3N, 71.7W at 04 UTC (MWR); 35 kt S and 1010 mb at 28.3N, 66W at 12 UTC (COA).

August 23: HWM indicates a closed low of at most 985 mb near 32.5N, 67W. HURDAT listed this as a Category 3 hurricane at 32.8N, 66.6W. The MWR Tracks of Cyclones indicate the center near 33N, 67W at 8 a.m. Available observations indicate that the HURDAT position is most accurate. Station highlights: 35 kt S and 1005 mb at Bermuda at 12 UTC (HWM). Ship highlights: 45 kt SSW and 1013 mb at 28.5N, 65.5W at 04 UTC (COA); 35 WSW and 1009 mb at 29.3N, 65.6 W at 12 UTC (COA).

August 24: HWM analyzed a closed low of at most 975 mb near 37N, 59.5W. HURDAT listed this as a Category 2 hurricane at 37.3N, 59.3W. The MWR Tracks of Cyclones indicate a pressure of 972 mb centered near 36N, 59W at 8 a.m. Available observations suggest the HURDAT position to be most accurate. Ship highlights: 70 kt S and 972 mb

at 36.5N, 59.5W at 09 UTC (MWR); 70 kt WNW and 956 mb at 41.4N, 57W at 21 UTC (MWR). "The British steamer York City encountered the central region about 400 miles northeast of Bermuda, and there for 24 hours experienced storm conditions culminating about 5 a.m. in a south-to-west hurricane that lasted 4 hours causing considerable damage to the life boats and superstructure of the ship. The barometer fell to 973 mb at 36.5N, 59.5W at its lowest point as the winds changed from south-southeast through southwest to northwest" (MWR).

August 25: HWM analyzed a closed low of at most 995 mb near 46N, 57.5W. HURDAT listed this as an extratropical storm centered near 47.3N, 57.7W. The MWR Tracks of Cyclones indicate a pressure of 996 mb centered near 47N, 56W at 8 a.m. Available observations suggest the HURDAT position to be most accurate. Ship highlights: 35 kt NE and 977 mb at 45.4N, 58.2W at 03 UTC (MWR); 35 kt SW and 1000 mb at 46N, 53.2W at 12 UTC (HWM).

August 26: HWM indicates a large extratropical storm centered near 50N, 60W with a cold front extending to the southeast. HURDAT listed this as an extratropical storm centered near 29.4N, 68.8W. Ship highlight: 25 kt SE and 1001 mb at 51N, 60W at 12 UTC (HWM).

Minor track and intensity changes are introduced for the duration of this major hurricane. HURDAT suggests the tropical cyclone was of hurricane intensity on the 18th although available observations do not support this scenario. Winds and/or low pressures indicate the system was a tropical storm on the 18th and became a hurricane by 00 UTC of the 19th, a 12 hour delay to hurricane intensity from originally listed in HURDAT. 955 mb peripheral pressure on the 21st suggests winds of at least 105 kt from the southern pressure-wind relationship. 110 kt is chosen for the reanalysis and is the peak intensity of this system. HURDAT suggests moderate dissipation began on the 24th with a quick transition to extratropical by 00 UTC of the 25th. Available observations indicate the dissipation began on the 25th with the transition to extratropical at 12 UTC of the 25th.

Storm 3 (originally 2), 1935

26665 08/29/1935 M=13 2 SNBR= 588 NOT NAMED XING=1 SSS=5

27795 08/29/1935 M=13 3 SNBR= 615 NOT NAMED XING=1 SSS=5

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26670 08/29* 0 0 0 0*242 683 35 0*242 693 35 0*242 698 35 0*

27800 08/29* 0 0 0 0*233 688 35 0*235 693 35 0*238 698 35 0

*** **

26675 08/30*242 704 35 0*242 709 40 0*242 714 40 0*241 720 45 0*

27805 08/30*241 704 35 0*242 709 40 0*242 714 40 0*241 721 40 0

*** **

26680 08/31*241 726 45 0*240 730 50 0*239 735 55 0*238 743 55 0*

27810 08/31*241 729 45 0*240 737 45 0*239 745 45 0*238 752 50 0

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26685	09/01	*237 753	60	0*236 763	60	0*237 773	65	0*238 781	75	0*
27815	09/01	*237 759	55	0*237 766	60	0*237 773	65	0*237 779	75	0
		*** **		*** **				*** **		
26690	09/02	*239 786	90	0*240 790	105	0*242 793	120	0*243 797	130	0*
27820	09/02	*237 785	90	0*237 790	105	0*237 795	120	0*241 800	135	924
		*** **		*** **		*** **		*** **		
26695	09/03	*245 801	140	892*249 808	130	0*252 813	115	0*261 823	100	0*
27825	09/03	*246 805	150	892*251 811	150	0*255 816	140	0*259 822	130	0
		*** **		*** **		*** **		*** **		
26700	09/04	*271 830	95	0*279 834	85	0*287 835	80	0*295 835	75	0*
27830	09/04	*267 828	125	0*277 832	115	0*287 835	105	0*297 836	100	960
		*** **		*** **		*** **		*** **		
26705	09/05	*305 832	60	0*317 827	60	0*330 817	55	0*341 805	55	0*
27835	09/05	*305 834	75	0*312 831	60	0*320 825	55	0*331 815	55	0
		*** **		*** **		*** **		*** **		
26710	09/06	*352 791	55	0*361 772	60	0*370 751	65	0*383 709	75	0*
27840	09/06	*346 800	55	0*361 780	60	0*375 751	70	0*387 709	75	0
		*** **		*** **		*** **		*** **		
26715	09/07	*397 654	80	0E408 602	80	0E420 550	80	0E433 498	75	0*
27845	09/07	*398 654	80	0E409 602	80	0E420 550	80	0E431 500	75	0
		***		***				***		
26720	09/08	E448 447	75	0E466 396	70	0E485 363	65	0E493 351	60	0*
27850	09/08	E442 450	75	0E455 400	75	0E469 352	75	0E485 327	75	0
		*** **		*** **		*** **		*** **		
26725	09/09	E500 342	60	0E521 321	55	0E540 312	50	0E550 311	45	0*
27855	09/09	E502 315	70	0E520 312	70	0E540 312	70	0E555 320	65	0
		*** **		*** **		*** **		*** **		
26730	09/10	E560 321	40	0E570 335	35	0E580 360	35	0* 0 0 0	0*	
27860	09/10	E565 340	60	0E568 365	55	0E570 390	50	0* 0 0 0	0	
		*** **		*** **		*** **				
26735	HRBFL5AFL2									
27865	HRCFL5BFL5AFL3 GA1									
						160kt	04/0200Z			

Minor changes to the track and major changes to the intensity shown in Neumann et al. (1999), originally storm number 2. Evidence for these alterations comes from the Historical Weather Maps series, the COADS ship database, Monthly Weather Review, Barnes (1998), Dunn and Miller (1960), Ho et al (1987), Jarrell et al (1992), Schwerdt et al (1979), and Vickery et al (2000).

August 29: HWM indicates that a closed low did not yet exist. HURDAT listed this as a tropical storm at 24.2N, 69.3W. The MWR Tracks of Cyclones indicate the center near 24.5N, 68W at 8 a.m. Available observations suggests a position south of HURDAT is most accurate. No gale force winds (or equivalent in pressure) were observed.

August 30: HWM analyzed a closed low of at most 1010 mb near 22.5N, 72.5W. HURDAT listed this as a tropical storm at 24.2N, 71.4W. The MWR Tracks of Cyclones indicate the center near 24.5N, 71W at 8 a.m. Available observations indicate the HURDAT location to be most accurate. No gale force winds (or equivalent in pressure) were observed.

August 31: HWM analyzed a closed low of at most 1005 mb near 24N, 73.5W. HURDAT listed this as a tropical storm at 23.9N, 73.5W. The MWR Tracks of Cyclones indicate the center near 24N, 74W at 8 a.m. Available observations indicate a position west of HURDAT to be most accurate. No gale force winds (or equivalent in pressure) were observed. "...but it was not until August 31 that a definite depression appeared, near Long Island in the southeastern Bahamas, and deepened rapidly as it moved westward" (MWR).

September 1: HWM analyzed a closed low of at most 1000 mb near 23.7N, 77.3W. HURDAT listed this as a Category 1 hurricane at 23.7N, 77.3W. The MWR Tracks of Cyclones indicate the center near 23.5N, 77W at 8 a.m. Available observations suggest the HURDAT location to be most accurate. Ship highlights: 50 kt S and 1005 mb at 22.9N, 74.5W at 00 UTC (MWR). "Hurricane intensity was doubtless reached by the developing disturbance near the south end of Andros Island on September 1" (MWR).

September 2: HWM analyzed a closed low of at most 1000 mb near 23N, 80W. HURDAT listed this as a Category 4 hurricane at 24.2N, 79.3W. The MWR Tracks of Cyclones indicates a pressure of 914 mb inches near 24N, 79W at 8 a.m. Available observations suggest a position south of HURDAT to be most accurate. Station highlights: 70 kt N and 950 mb at Long Key at 22 UTC (MWR); 70 kt NW and 945 mb at Long Key at 2245 UTC (MWR). Ship highlights: 5 kt variable and 924 mb at ~25N, ~80.5W at 21 UTC (MWR); 50 kt NW and 996 mb at 24.4N, 80.9W at 22 UTC (MWR). Miami observed minimal winds for this hurricane, "Northeast to southeast gales occurred during the day, in connection with a tropical disturbance passing through the Florida Keys; the maximum velocity was 40 mph from the southeast at 11:51 p.m." (OMR). Regarding the track, "The vortex was at the stage of maximum violence, though still of small diameter, as it crossed the Florida Keys between Key West and Miami, September 2, moving northwestward" (MWR).

September 3: HWM analyzed a closed low of at most 995 mb near 24.5N, 81.5W. HURDAT listed this as a Category 4 hurricane at 25.2N, 81.3W. The MWR Tracks of Cyclones indicates a pressure around 914 mb near 26.5N, 82W at 8 a.m. Available observations suggest a position slightly northwest of HURDAT to be most accurate. Station highlights: calm winds and 899 mb at Upper Matecumbe Key at ~00 UTC (MWR); calm winds and 892 mb at Craig Key at ~00 UTC (MWR); extreme hurricane force winds SSW and 26.98 in. [914 mb] at Long Key at 0215 UTC (MWR). Ship highlights: 920 mb at Molasses Reef at ~02 UTC (MWR); 50 kt SSW and 997 mb at

24.4N, 81.3W at 07 UTC (MWR); 45 kt NNW and 998 mb at 27.5N, 80.5W at 13 UTC (COA). With regards to landfall, "...at Long Key the barometer was read throughout the passage of the storm by Mr. J.E. Duane, a cooperative observer for the Weather Bureau. 9:20 p.m.: Barometer 922 mb, wind abated but no flat calm. Lull lasted 55 minutes, 10:10 p.m.: Barometer now 915 mb. 10:15: The first blast from SSW, full force. The barometer now read 914 mb" (MWR). According to the Miami Weather Bureau office, "Southeast gales, shifting to south, continued throughout the day in connection with the hurricane passing through the Florida Keys. Minor damage to awnings, fruit trees and shrubbery, etc. The maximum velocity for a five minute was 41 mph from the southeast at 9:07 a.m." (OMR). The Keys experienced an extreme hurricane with a barometer reading of 892 mb and winds in excess of 200 mph (Dunn and Miller). "On the night of the 2nd-3rd a severe hurricane of small diameter passed northeast of the station [Key West], with the center about 50 miles distant...highest wind was but 46 mph and there was no damage of consequence in this vicinity" (OMR). Regarding intensity at landfall, "Captain Olson's boat weathered the storm by being fastened on the north side of the railroad embankment at Craig, near the north end of Long Key. The ships barometer was tested in Washington and showed it to be exceptionally responsive and reliable. It recorded a low pressure of 892 mb near 00 UTC" (MWR). "This adjusted reading [892 mb] set a new record as the lowest pressure ever measured in the Western Hemisphere..." (Barnes). Landfall position is noted in Ho et al at 24.8N, 80.8W with 892 mb central pressure and 6 nautical mile radius of maximum winds. Estimated maximum sustained surface winds were 151 kt from Schwerdt et al. Regarding the storm tide at Islamorada (8:35 p.m.), "Best estimates suggest that the tide was eighteen to twenty feet above normal," and, "...the [railroad] track was turned on its side like a fence and ten train cars were swept sideways almost 100 feet" (Barnes).

September 4: HWM analyzed a closed low of at most 990 mb near 28N, 83.5W. HURDAT listed this as a Category 1 hurricane at 28.7N, 83.5W. The MWR Tracks of Cyclones indicates a pressure around 948 mb near 29N, 84.5W at 8 a.m. Available observations suggest a position near HURDAT to be most accurate. Station highlights: 980 mb at Egmont Key at 03 UTC (MWR); 985 mb at Cedar Key at 1750 UTC (MWR). Ship highlights: 35 kt SSE and 941 mb at 26N, 79.3W at 00 UTC (COA); 70 kt SE and 979 mb at 27.6N, 82.7W at 03 UTC (MWR). "At Cedar Keys, three lives were lost and considerable damages were reported to docks, fishing vessels, and structures near the shore, the worst flooding since 1896" (Barnes). "Tampa winds were clocked at 75 mph, the barometer dropped to 29.31, tides were 5.3 feet above normal, and over 7.3 inches of rain fell" (Barnes). "Very few roofs escaped at least minor damage. Many were blown off entirely and others damaged badly. Trees, citrus, overhead wiring, and other properties were damaged considerably or destroyed" (Tampa OMR). A central pressure observation of 960 mb was computed from the pressure profile and adjusted to the coast along with a landfall position of 29.9N, 83.7W and a 21 nautical mile radius of maximum winds (Ho et al).

September 5: HWM analyzed a closed low of at most 995 mb near 28N, 83.5W. HURDAT listed this as a tropical storm at 33N, 81.7W. The MWR Tracks of Cyclones indicates a pressure of 992 mb near 33N, 82W at 8 a.m. Available observations suggest a

position southwest of HURDAT to be most accurate. Station highlights: 15 kt N and 993 mb at Augusta at 18 UTC (OMR); 993 mb at Columbia at 2040 UTC (OMR). Ship highlights: 70 kt SE and 1001 mb at ~30.5N, ~80.7W at 07 UTC (MWR); 15 kt N and 1004 mb at 33.5N, 84.3W at 12 UTC (HWM). Regarding the track across the southeast United States, "During September 5 the storm moved from Georgia across the Carolinas, attended by high winds and heavy rains that caused some damage to property and crops, especially in southern Georgia" (MWR). "Throughout sections of Georgia, South Carolina, and North Carolina minor hurricane conditions were experienced and 4 tornadoes were reported" (Dunn and Miller). Savannah observed, "Besides heavy rains the storm caused high winds on the 5th reaching a maximum of 49 mph from the south at 10:31 a.m." (OMR). "On the 5th the center of a tropical disturbance passed approximately 25 miles west of the station [Charleston]. Actual property damage was slight though a considerable number of trees were blown down, breaking power lines and telephone connections" (Charleston OMR). Columbia experienced, "...2.42 inches in 24 hours on the 4th-5th. The center of that tropical storm which killed several hundred people in the Florida Keys passed just east of the station at 4:40 p.m. on the 5th where only a 20 mph wind was observed" (OMR). Raleigh weather office also noted that "nearly half of the month's total precipitation occurred on the 5th" (OMR).

September 6: HWM analyzed a closed low of at most 995 mb near 36N, 75W. HURDAT listed this as a Category 1 hurricane at 37N, 75.1W. The MWR Tracks of Cyclones indicates a pressure of 985 mb near 37N, 75W at 8 a.m. Available observations suggest a position slightly north of HURDAT to be most accurate. Station highlights: 28 kt NW and 999 mb at Norfolk at 12 UTC (OMR); 993 mb at Cape Henry at ~12 UTC (MWR). Ship highlights: 70 kt NW and 985 mb at ~38.5N, ~74W (MWR); 50 NNE and 984 mb at 39.7N, 69W at 22 UTC (MWR). On re-entry into the Atlantic Ocean, "On the morning of September 6 the center of disturbance passed near Cape Henry, VA., where the lowest barometer was only 992 mb" (MWR). Norfolk observed, "thunderstorm conditions from early to late afternoon on the 6th where a tornado was also observed passing through western and northwestern sections of the city causing \$22,000 in property damage but no loss of life (Norfolk OMR).

September 7: HWM indicates a closed low of at most 985 mb near 43.5N, 55W, with a cold front analyzed extending from the center toward the north. HURDAT listed this as a strong extratropical storm at 42N, 55W. The MWR Tracks of Cyclones indicates a pressure of 964 mb near 43N, 54.5W at 8 a.m. Available observations suggest a position near HURDAT to be most accurate. Ship highlights: 60 kt N and 964 mb at 42N, 54W at ~12 UTC (MWR); 70 kt WSW and 979 mb at 41.1N, 54.3W at 17 UTC (MWR).

September 8: HWM indicates a closed low of at most 980 mb near 48.5N, 37.5 with a cold front extending toward the south. HURDAT listed this as an extratropical storm at 48.5N, 36.3W. The MWR Tracks of Cyclones indicates a pressure around 948 mb near 46.5N, 37.5W at 8 a.m. Available observations suggest a position significantly southeast of HURDAT to be most accurate. Ship highlights: 70 kt N and 954 mb at 46.4N, 37.4W at 15 UTC (MWR); 70 kt WNW and 959 mb at 46.9N, 34.8W at 15 UTC (MWR).

September 9: HWM analyzed a closed low of at most 970 mb near 54N, 34.5W. HURDAT listed this as an extratropical storm at 54N, 31.2W. The MWR Tracks of

Cyclones indicates a pressure of 28.73 inches near 54.5N, 32W at 8 a.m. Available observations suggest a position near HURDAT to be most accurate. Ship highlights: 70 kt SW and 973 mb at 50N, 28.5W at 03 UTC (MWR); 45 kt NW and 977 mb at 53.5N, 38.5W at 12 UTC (COA); 45 kt WNW and 972 mb at 53.5N, 36.5W at 17 UTC (COA). September 10: HWM analyzed a closed low of at most 985 mb near 57N, 39W. HURDAT listed this as an extratropical storm at 58N, 36W. The MWR Tracks of Cyclones indicate the center near 57.5N, 37W at 8 a.m. Available observations suggest a position significantly southwest of HURDAT to be most accurate. Ship highlights: 35 kt S and 975 mb at 55.5N, 37.5W at 12 UTC (COA); 35 kt S and 992 mb at 57.3N, 33.2W at 12 UTC (HWM). Regarding the absorption into an extratropical cyclone "... off southern Greenland, it [the system] was lost on September 10 by merging with a cyclone of extratropical origin..." (MWR).

Genesis is maintained for this system on the 29th where evidence shows a closed circulation. The system originated northeast of Hispanola as a tropical storm and moved west-northwest toward southern Florida. No gales or low pressures were observed for the first three days of its existence and winds were reduced some on the 31st based upon available observations of a weaker system. It is estimated that the storm became a hurricane on September 1st around 12 UTC just south of Andros Island in the Bahamas. Over the next 24 hours the system nearly doubled in intensity from 65 kt to 120 kt on the 2nd. A central pressure of 924 mb at 21 UTC of the 2nd implies winds of 132 kt from the southern pressure-wind relationship. 140 kt is chosen for 18 UTC HURDAT as later evidence suggests a smaller than usual radius of maximum winds (RMW) for this system. Available observations estimate landfall to have occurred near 02 UTC on the 3rd at Craig Key. Intensity at landfall has been estimated from pressure observations at Craig Key [892 mb] indicating 155 kt winds from the southern pressure-wind relationship or 140 kt from the subtropical pressure-wind relationship. An average of these two pressure-wind relationships (since the system was near the border of the two) suggests winds of around 148 kt. Regarding the probable RMW at landfall in the Keys, "it is estimated that the calm center was perhaps 8 miles in diameter" (MWR). Available observations suggest the RWM to be 6 nmi (Ho et al). RMW were also noted as 6 nmi from Schwerdt et al. 6 nmi RMW is smaller than what might be expected from climatology of this central pressure and landfall latitude (9-10nmi - Vickery et al). Thus this tiny RMW suggests a significant boost from the standard pressure-wind relationship and 150 kt is chosen for 00 UTC in HURDAT. Peak observations of lowest pressure (and implied highest winds) were observed at 02 UTC and therefore an addition to the normal HURDAT 6 hour time interval is suggested such as in the case with Hurricane Andrew (1992). 160 kt is chosen for 02 UTC in HURDAT. This maintains the hurricane's intensity as Category 5 but increases its previous peak intensity from 140 kt to 160 kt. After passing the Keys, the hurricane moved toward the northwest and eventually north on the 4th before making its second landfall in northwest Florida. An observed peripheral pressure of 941 mb early on the 4th suggests at least 119 kt winds from the Gulf of Mexico pressure-wind relationship. 125 kt is chosen for HURDAT at 00 UTC.

Second landfall occurred near 18 UTC on the 4th north of Cedar Key. Ho et al indicates the position at landfall to be 29.9N, 83.7W. Landfall position 29.7N, 83.6W is chosen for HURDAT. Intensity at landfall comes from a central pressure estimate of 960 mb late on the 4th implying 100 kt winds from the Gulf of Mexico pressure-wind relationship. The only account of computed RMW at second landfall comes from Ho et al which suggests a 21 mile diameter eye. 21 nmi estimate is close to that expected (22 nmi) from central pressure and landfall latitude climatology (Vickery et al), so no large change to the pressure-wind relationship is made. Landfall intensity in northwest Florida is analyzed to be 100 kt, Category 3 intensity. During the 5th the hurricane moved toward the northeast as it traversed over Georgia and South Carolina. Savannah observed 45 kt winds as the system passed to the west. 55 kt is chosen for HURDAT. Available observations indicate the system was centered just east of Columbia around 21 UTC. Gale force winds (or equivalent in pressure) were observed for much of Georgia early on the 5th but wind speeds diminished as the system moved further north. Re-entry back into the Atlantic occurred near 12 UTC on the 6th and it re-intensified back to a minimal Category 1 hurricane. The hurricane raced off towards the east-northeast and quickly lost its barotropic characteristics early on the 7th. The hurricane became extratropical by 00 UTC on the 7th and peaked at 80 kt later that day. Only minor changes in track were suggested for the 6th and 7th. HURDAT suggests the system began dissipating on the 8th and 9th but available observations indicate the storm maintained 75kt on the 8th and 70 kt on the 9th. HURDAT dissipates the system on the 10th at 12 UTC. Ship observations are in agreement with the dissipation time in HURDAT.

Jarrell et al lists this as a Category 5 hurricane in southwest Florida (Keys) and as a Category 2 hurricane in northwest Florida. HURDAT's winds suggested a landfalling hurricane as a Category 5 in the Keys and Category 1 in northwest Florida. Available observations conclude that it was indeed a Category 5 hurricane for the Florida Keys (for both southwest and southeast Florida, due to the new breakdown of Florida's four regions) but the hurricane has been upgraded to a Category 3 for northwest Florida. "Total property losses entailed by this hurricane are very difficult to estimate, but doubtless exceed \$6,000,000; practically all the loss was suffered in Florida and most of it over the Florida Keys" (MWR). "The loss of life on the Keys was very heavy. Three populous relief work camps inhabited by war veterans were destroyed. The best estimate of mortalities, furnished by the American Red Cross, places the total at 409, of which 244 are known dead and 165 missing" (MWR). The infamous "Labor Day Hurricane" was one of only three Category 5 hurricanes to hit the U.S. in the 20th century.

Storm 4 (originally 3), 1935

26740 08/30/1935 M= 3 3 SNBR= 589 NOT NAMED XING=0
 27870 08/31/1935 M= 3 4 SNBR= 616 NOT NAMED XING=0 SSS=0
 ***** *

(The 30th is to be removed from HURDAT.)

26745 08/30* 0 0 0 0* 0 0 0 0*220 875 40 0*210 886 35 0*

26750 08/31*203 896 35 0*200 904 35 0*197 913 35 0*193 924 35 0*

27880 08/31*206 904 25 0*204 908 30 0*202 913 30 0*201 919 35 0
 *** ** * ** * ** * ** * ** * ** * ** * ** * ** *

26755 09/01*191 934 35 0*189 941 35 0*188 948 30 0*180 970 25 0*

27885 09/01*200 925 35 0*198 935 35 0*196 950 35 0*194 965 30 0
 *** ** * ** * ** * ** * ** * ** * ** * ** * ** *

(The 2nd is new to HURDAT.)

27887 09/02*192 980 25 0* 0 0 0 0* 0 0 0 0* 0 0 0 0

26760 TS

27890 TS

Minor changes to the track and the intensity shown in Neumann et al. (1999), originally storm number 3. Evidence for these alterations comes from the Historical Weather Maps series, the COADS ship database, individual ship and station data from NCDC, and Monthly Weather Review.

August 30: HURDAT suggests that genesis for this storm began on the 30th. Evidence from HWM, COADS, and MWR indicate that a closed low did not yet exist. Thus 30 August 1935 should be removed from HURDAT.

August 31: HWM analyzed a closed low of at most 1010 mb near 19.5N, 91W. HURDAT listed this as a tropical storm at 19.7N, 91.3W. Available observations suggest a position slightly north of HURDAT to be most accurate. No gale force winds (or equivalent in pressure) were observed.

September 1: HWM analyzed a closed low of at most 1005 mb near 18.5N, 94.5W. HURDAT listed this as a tropical depression at 18.8N, 94.8W. Available observations suggest a position slightly north of HURDAT to be most accurate. Station highlights: 10 kt N and 1005 mb at Veracruz at 12 UTC (HWM).

September 2: HURDAT suggests this system dissipated on the 1st. However, available observations indicate the storm maintained tropical depression intensity through 00 UTC. No gale force winds (or equivalent in pressure) were observed.

Genesis is begun for this tropical storm at 00 UTC on the 31st, 12 hours later than originally listed in HURDAT. 1005 mb peripheral pressure on the 1st suggests winds of at least 34 kt from the Gulf of Mexico pressure-wind relationship. 35 kt is chosen for HURDAT and is the peak intensity of the system. Dissipation of this storm is suggested in HURDAT to occur on the 21st but available observations indicate that the system maintained tropical depression intensity until 00 UTC on the 2nd. Thus the 2nd is to be added to HURDAT.

Storm 5 (originally 4), 1935

26765 09/23/1935 M=10 4 SNBR= 590 NOT NAMED XING=0
27895 09/23/1935 M=10 5 SNBR= 617 NOT NAMED XING=0 SSS=0
*

26770 09/23* 0 0 0 0*148 730 35 0*146 734 40 0*144 739 45 0*
27900 09/23* 0 0 0 0*148 747 30 0*146 750 30 0*144 753 30 0
*** ** *** ** *** **

26775 09/24*142 745 50 0*141 753 55 0*141 760 60 0*141 768 65 0*
27905 09/24*142 757 35 0*141 761 35 0*141 765 40 0*141 770 40 0
*** ** *** ** *** ** *** **

26780 09/25*142 775 70 0*143 782 75 0*145 787 80 0*147 791 80 0*
27910 09/25*142 777 45 0*143 784 45 0*145 790 50 0*147 794 55 0
*** ** *** ** *** ** *** **

26785 09/26*150 795 85 0*153 799 90 0*157 801 90 0*162 800 90 0*
27915 09/26*149 797 50 0*151 798 70 0*153 798 80 0*157 798 85 0
*** ** *** ** *** ** *** **

26790 09/27*168 797 95 0*175 792 95 0*183 790 100 0*191 793 100 0*
27920 09/27*162 798 90 0*167 798 95 0*172 798 100 0*180 799 100 0
*** ** *** ** *** ** *** **

26795 09/28*199 797 105 0*212 802 105 0*227 804 100 0*240 802 100 0*
27925 09/28*192 801 100 0*212 803 100 0*227 804 100 959*237 802 90 0
*** ** *** ** *** ** *** **

26800 09/29*252 796 100 0*260 790 100 0*267 782 100 0*277 770 100 0*
27930 09/29*247 796 100 0*257 790 110 0*267 782 115 0*277 770 115 0
*** ** *** ** *** ** *** **

26805 09/30*288 752 100 0*301 729 95 0*314 704 95 0*327 679 90 0*
27935 09/30*288 752 110 0*301 729 105 0*314 704 95 0*327 684 90 0
*** ** *** ** *** **

26810 10/01*343 654 90 0*365 635 85 0*388 620 80 0E407 615 75 0*
27940 10/01*343 670 90 0*365 655 85 0*388 635 80 0*407 615 75 0
*** ** *** ** *** ** *

26815 10/02E430 602 65 0E458 579 60 0E487 536 50 0E499 515 50 0*
27945 10/02E430 590 65 0E458 565 60 0E487 536 60 0E499 505 55 0
*** ** *** ** ** *** **

26820 HR
27950 HR

Minor changes to the track and major changes in the intensity shown in Neumann et al. (1999), originally storm number 4. Evidence for these alterations comes from the Historical Weather Maps series, the COADS ship database, individual ship and station data from NCDC, Monthly Weather Review, and Perez et al (2000).

September 23: HWM analyzed a closed low of at most 1010 mb near 12.5N, 73W. HURDAT listed this as a tropical storm at 14.6N, 73.4W. Available observations suggest a position farther west of HURDAT. No gale force winds (or equivalent in pressure) were observed. "The first positive indication of a disturbance of sufficient vigor to be classed as a definite tropical cyclone was an observation of southwest wind, force 4, with rain and a confused sea, reported by the American S.S. San Gil, 7 p.m., when near 14N, 75W" (MWR).

September 24: HWM indicated a closed low of at most 1005 mb near 13.5N, 76.5W. HURDAT listed this as a tropical storm at 14.1N, 76W. Available observations suggest a position farther west of HURDAT. No gale force winds (or equivalent in pressure) were observed.

September 25: HWM analyzed a closed low of at most 1000 mb near 14.5N, 78W. HURDAT listed this as a Category 1 hurricane at 14.5N, 78.7W. Available observations suggest a position slightly west of HURDAT. Ship highlights: 15 kt S and 1006 mb at 14N, 80.5W at 12 UTC (COA); 25 kt SW and 1005 mb at 14.3N, 79.4W at 18 UTC (COA). "At 11 p.m. of the 25th, the American tanker A.C. Bedford experienced a minimum barometer of 29.13 inches [986 mb] attended by westnorthwest hurricane winds, her position being then very near 15N, 80W" (MWR).

September 26: HWM analyzed a closed low of at most 995 mb near 15N, 80W. HURDAT listed this as a Category 2 hurricane at 15.7N, 80.1W. Available observations suggest a position slightly southeast of HURDAT. Ship highlights: 70 kt WNW and 986 mb at 15N, 80W at 03 UTC (MWR); 50 kt W and 991 mb at 15N, 80W at 12 UTC (HWM); 45 kt W and 988 mb at 15.1N, 80.2W at 18 UTC (COA). "The disturbance seems to have progressed at a very slow rate during the 26th, and to have taken a recurving path toward the western end of Jamaica" (MWR).

September 27: HWM analyzed a closed low of at most 995 mb near 16.5N, 79.5W. HURDAT listed this as a Category 3 hurricane at 18.3N, 79W. The MWR Tracks of Cyclones indicate the center near 17N, 80W at 8 a.m. Available observations suggest a position slightly southwest of HURDAT. Ship highlights: 45 kt S and 1001 mb at 17.3N, 78.6W at 13 UTC (MWR); 45 kt S and 1000 mb at 17.3N, 78.7W at 15 UTC (COA). "Data from ships' reports and island stations are too meager to permit reconstruction of the full history of storm activities during the 27th... high winds and excessive rains in Jamaica, causing heavy damage to the banana crop" (MWR).

September 28: HWM analyzed a closed low of at most 995 mb near 22.5N, 80W. HURDAT listed this as a Category 3 hurricane at 22.7N, 80.4W. The MWR Tracks of Cyclones indicates a pressure of 958 mb near 22.5N, 80.5W at 8 a.m. Available observations suggest HURDAT to be most accurate. Station highlights: 959 mb at Cienfuegos, Cuba at 09 UTC (MWR); 21 kt N and 999 mb at Key West at 18 UTC (OMR). Ship highlights: 20 kt N and 1004 mb at 24.7N, 84.2W at 12 UTC (COA); 25 kt

E and 1000 mb 25N, 80.1W at 12 UTC (COA). "Early on the 28th, the city of Cienfuegos, Cuba, was seriously affected by passage of the hurricane center, with lowest barometer unofficially reported at 28.31 inches [959 mb]" (MWR). "The southeast coast of Florida experienced minimal hurricane conditions on the 28th, with Bimini's barometer reading 27.90 inches [945 mb] and winds estimated at 120 mph" (Dunn and Miller 1960). Cuba's summarized accounts for this storm are noted as, "a Category 3 hurricane affecting the central provinces with hurricane conditions and aptly named El Huracan de Cienfuegos" (Perez et al). "Fowey-Rock Lighthouse, 12 miles southwest of Miami, experienced hurricane winds from the north, estimated at maximum to have been about 85 mph, with a barometer reading of 29.24 inches [990 mb]" (MWR).

September 29: HWM analyzed a closed low of at most 995 mb near 26.5N, 78W. HURDAT listed this as a Category 3 hurricane at 26.7N, 78.2W. The MWR Tracks of Cyclones indicates a pressure of 951 mb near 27N, 78W at 8 a.m. Available observations suggest HURDAT to be most accurate. "...the hurricane moved into a broad recurve that carried the center over the island of Bimini, where at 12:20 a.m. of the 29th, the wind shifted from southeast to northwest. The last barometer reading to be received from Bimini was 27.90 inches [945 mb], at 11 p.m., more than an hour in advance of passage of the center which was doubtless marked by considerably lower minimum pressure. Highest wind was estimated at 120 miles per hour" (MWR). Station highlights: 70 kt N and 990 mb at Fowey Rock at 02 UTC (MWR); wind shift from SE to NW and 945 mb at Bimini at 03 UTC (MWR). Ship highlights: 45 kt SE and 992 mb at 27.5N, 76.1W at 15 UTC (COA); 70 kt SE and 951 mb at 27.2N, 76.5W at 17 UTC (MWR). "The American steamer La Perla was near the hurricane center at 1 p.m. of September 29, at 27 degrees 14 minutes north, 76 degrees and 28 minutes west, with a barometer reading of 28.08 inches [951 mb]. Later in the day (9 p.m.) the Japanese steamer Tokai maru, near 28.5N, 74W met the hurricane with winds veering from east-southeast to west-southwest, and a barometer of 28.24 inches [956 mb]" (MWR).

September 30: HWM analyzed a closed low of at most 990 mb near 31N, 70W. HURDAT listed this as a Category 2 hurricane at 31.4N, 70.4W. The MWR Tracks of Cyclones indicates a pressure of 975 mb near 24.5N, 71W at 8 a.m. Available observations suggest HURDAT to be most accurate. Ship highlights: 70 kt WNW and 956 mb at 28.5N, 74.0W at 01 UTC (MWR); 35 kt ENE and 990 mb at 30.5N, 71.7W at 08 UTC (MWR); 40 kt SW and 1004 mb at 27.3N, 78.3W at 12 UTC (HWM).

October 1: HWM analyzed a closed low of at most 1000 mb near 37.5N, 63W. The map also indicates the system is becoming elongated southwest to northeast. HURDAT listed this as a Category 1 hurricane at 38.8N, 62W. The MWR Tracks of Cyclones indicates a pressure of 981mb near 37.5N, 63W at 8 a.m. Available observations suggest a position west of HURDAT to be most accurate. Ship highlights: 45 kt ENE and 1003 mb at 39.5N, 64.5W at 12 UTC (COA); 70 kt NNW and 987 mb at ~39.1N, ~64.0W at 15 UTC (MWR); 70 kt WSW and 972 mb at 42.2N, 59.5W at 21 UTC.

October 2: HWM analyzed a closed low of at most 1005 mb near 48N, 52W with a westward pointing warm front indicated west of the center. HURDAT listed this as an extratropical storm at 48.7N, 53.6W. The MWR Tracks of Cyclones indicates a pressure of 1005 mb near 48N, 54W at 8 a.m. Available observations suggest HURDAT to be

most accurate. Ship highlights: 70 kt SSE and 987 mb at 44N, 57.2W at 03 UTC (MWR); 45 kt S and 1005 mb at 48.5N, 50.2W at 12 UTC (COA).

Genesis for this hurricane is begun on September 23rd as a tropical depression. HURDAT previously suggested the system was a tropical storm on the 23, however, available observations indicate no gales (or equivalent in pressure) were recorded. Thus, 30 kt is chosen for HURDAT. The system acquired tropical storm intensity on the 24th. Again, HURDAT suggested the storm was of 60 kt intensity although available observations indicate the storm was only a minimal tropical storm with no gales (or equivalent in pressure) being reported. 40 kt is chosen for HURDAT. On the 25th, peripheral pressures of 1006 mb and 1005 mb were observed implying at least 34 and 36 kt, respectively, from the southern wind-pressure relationship. 50 kt is chosen for HURDAT. A peripheral pressure of 986 mb was observed on the 26th which suggests at least 70 kt winds from the southern pressure-wind relationship. 80 kt is chosen for HURDAT. Large errors in the track of the system were noted for late on the 26th and throughout the 27th. "While the history of this disturbance is continuous from the afternoon of September 23 until October 2, there is a period of 36 hours, September 26 and 27, during which the characteristics and movement of the storm are obscure and apparently abnormal" (MWR). MWR and HURDAT insist the storm moved north-northeast on the 26th, brushing western Jamaica on the 27th, and then taking a more north-northwest track before landfall in Cienfuegos, Cuba. Available observations indicate a scenario such as this to be incorrect, suggesting the hurricane maintained a northward track on the 26th, 27th, and early on the 28th. Intensity estimates for the 27th are vague due to the lack of ships near the center. Thus the HURDAT estimate is maintained at 100 kt.

On the 28th, the hurricane made landfall in Cienfuegos, Cuba, around 09 UTC. A central pressure of 959 mb in Cienfuegos suggests 101 kt from the southern wind pressure relationship. 100 kt is chosen for HURDAT. "There was heavy property damage in Cienfuegos, Cumanayagua, and other Cuban localities, as the hurricane crossed the island, and the casualties in Cuba were estimated at 35 deaths and possibly 500 injured. Much damage was due to the floods that attended the passage of the storm" (MWR). Also on the 28th, the central region of Cuba is reported to have observed 105 kt winds causing 12 million dollars in damages and 43 deaths (Perez et al). The hurricane began to take a northeastward track after landfall and continued this path through the rest of its lifecycle. On the 29th the hurricane was centered just northeast of Bimini. Peripheral pressure observations on the 29th of 945 and 951 mb imply winds of at least 114 and 103 kt, respectively, from the southern pressure-wind relationship. 115 kt is chosen for HURDAT. The hurricane progressed more rapidly toward the northeast on the 30th and October 1st. A peripheral pressure of 956 mb on the 30th implies winds of at least 98 kt from the subtropical pressure-wind relationship. 95 kt is chosen for HURDAT. HURDAT suggests the hurricane transitions to extratropical on the 1st at 18 UTC but available observations indicate the transition did not occur until 00 UTC of the 2nd, 6 hours later than HURDAT. A peripheral pressure observation on the 1st of 972 mb indicates at least

80 kt from the northern pressure-wind relationship. 80 kt is chosen for HURDAT.
 Available observations indicate the hurricane became an extratropical storm on the 2nd at 00 UTC and dissipated by 18 UTC. Peak observations with this hurricane were 115 kt on the 29th, 15 kt higher than previously in HURDAT. This also brings storm number 5 to Category 4 intensity which is one category higher than previously in HURDAT.

Storm 6 (originally 5), 1935

26825 10/19/1935 M= 9 5 SNBR= 591 NOT NAMED XING=0
 27955 10/18/1935 M=10 6 SNBR= 618 NOT NAMED XING=0 SSS=0
 ** *

(The 18th is new to HURDAT.)

27957 10/18* 0 0 0 0* 0 0 0 0*132 810 30 0*132 803 30 0

26830 10/19*124 787 35 0*129 782 45 0*135 777 55 0*140 773 60 0*
 27960 10/19*133 796 35 0*134 790 40 0*135 785 45 0*137 783 45 0
 *** ** * ** * ** * ** * ** * ** * ** * ** *

26835 10/20*144 771 65 0*148 769 70 0*152 767 70 0*155 765 70 0*
 27965 10/20*139 782 50 0*142 781 55 0*145 780 60 0*150 778 70 0
 *** ** * ** * ** * ** * ** * ** * ** * ** *

26840 10/21*159 763 75 0*165 760 75 0*172 757 75 0*179 756 75 0*
 27970 10/21*155 776 75 0*160 774 75 0*165 772 75 0*171 770 75 0
 *** ** * ** * ** * ** * ** * ** * ** * ** *

26845 10/22*185 756 75 0*191 757 75 0*197 761 60 0*199 767 60 0*
 27975 10/22*177 767 75 0*183 764 75 0*190 761 75 0*197 765 75 0
 *** ** * ** * ** * ** * ** * ** * ** * ** *

26850 10/23*197 774 60 0*194 780 60 0*191 785 50 0*188 790 45 0*
 27980 10/23*198 769 65 0*195 773 55 0*191 778 50 0*187 784 50 0
 *** ** * ** * ** * ** * ** * ** * ** * ** *

26855 10/24*184 794 45 0*182 797 45 0*179 801 55 988*174 807 65 0*
 27985 10/24*183 791 55 0*179 798 60 0*175 805 65 988*170 811 65 0
 *** ** * ** * ** * ** * ** * ** * ** * ** *

26860 10/25*167 814 65 0*160 823 70 0*153 831 75 0*149 839 75 0*
 27990 10/25*164 816 65 0*158 822 65 0*153 828 65 0*148 834 55 0
 *** ** * ** * ** * ** * ** * ** * ** * ** *

26865 10/26*149 846 75 0*144 854 65 0*143 863 35 0*143 874 25 0*
 27995 10/26*143 841 45 0*139 849 40 0*138 860 35 0*139 872 30 0
 *** ** * ** * ** * ** * ** * ** * ** * ** *

26870 10/27*143 879 20 0*143 884 15 0* 0 0 0 0* 0 0 0 0*
 28000 10/27*142 887 30 0*145 905 25 0*148 925 30 0* 0 0 0 0

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

26875 HR
28005 HR

Minor changes to the track and the intensity shown in Neumann et al. (1999), originally storm number 5. Evidence for these alterations comes from the Historical Weather Maps series, the COADS ship database, Monthly Weather Review, Norton (1935), and Perez et al (2000).

October 18: HWM indicates a closed low of at most 1005 mb near 14N, 81W. HURDAT suggests the system originated on the 19th, however, available observations indicate the system began on the 18th as a tropical depression at 12 UTC. Ship highlights: 15 kt N and 1006 mb at 14.7N, 83.1W at 00 UTC (COA); 10 kt S and 1002 mb at 12.9N, 80.7W at 12 UTC (COA)." An area of relatively low pressure was noted over the southwestern Caribbean Sea on October the 17th, but it was not until the 18th that any evidence of a circulation appeared in this area" (Norton).

October 19: HWM indicates a closed low of at most 1005 mb near 13.5N, 80W. HURDAT listed this as a tropical storm at 13.5N, 77.7W. Available observations suggest a position west of HURDAT to be most accurate. Ship highlights: 40 kt SSW and 1004 mb at 13.5N, 77.8W at 20 UTC (MWR). "The development of this storm first became quite evident on the afternoon of October 19, when the American steamer Forbes Hauptmann experienced a south-southwest gale of force 9, with barometer 29.64 inches [1004 mb], near 13N, 79W" (MWR).

October 20: HWM indicates a closed low of at most 1005 mb near 14.5N, 80.5W. HURDAT listed this as a Category 1 hurricane at 15.2N, 76.7W. Available observations suggest that a position southwest of HURDAT is most accurate. Ship highlights: 30 kt SSE and 1005 mb at 15N, 77W at ~12 UTC (MWR); 20 kt NE and 1001 mb at 20N, 83.9W at 18 UTC (COA). "...the U.S.S. Chaumont, on the morning of the 20th, then near 15N, 77W, whence she reported south-southeast wind of force 7, and barometer reading 29.68 inches [1005 mb]" (MWR).

October 21: HWM indicates a closed low of at most 1005 mb near 15N, 78W. HURDAT listed this as a Category 1 hurricane at 17.2N, 75.7W. The MWR Tracks of Cyclones indicate the center near 18N, 75.5W at 8 a.m. Available observations suggest a position southwest of HURDAT to be most accurate. Ship highlights: 30 kt SE and 1006 mb at 18N, 75.9W at 13 UTC (COA); 35 kt NNE and 1003 mb at 18.7N, 77.2W at 19 UTC (COA). "The storm moved northeastward as forecast, and the center passed close to Navassa Island during the afternoon of October 21" (MWR).

October 22: HWM indicates a closed low of at most 1000 mb near 18.5N, 76W. HURDAT listed this as a tropical storm at 19.7N, 76.1W. The MWR Tracks of Cyclones indicate a pressure of 994 mb near 20N, 76W at 8 a.m. Available observations suggest that a position south of HURDAT is most accurate. Station highlights: 50 kt ENE and 999 mb at Nipe Bay, Cuba, at 1830 UTC (Grady Norton and G.E. Dunn). Ship highlights: 25 kt S and 1004 mb at 18.2N, 75.2W at 12 UTC (COA); 15 kt SE and 1004 mb at 20N,

75W at 12 UTC (HWM). The hurricane's occurrence in Cuba is noted as, "a Category 1 hurricane that affected eastern provinces causing minimal damage throughout the 22-23" (Perez et al). "...the center [became close] to the coast of Cuba near Santiago, on the early morning of October 22" (MWR).

October 23: HWM indicates a closed low of at most 1005 mb near 17N, 78W. HURDAT listed this as a tropical storm at 19.1N, 78.5W. The MWR Tracks of Cyclones indicate the center near 19N, 78.5W at 8 a.m. Available observations suggest a position slightly south of HURDAT to be most accurate. Ship highlights: 15 kt N and 1003 mb at 19.1N, 78.5W at 12 UTC (COA); 30 kt ESE and 1004 mb at 19.2N, 74.4W at 12 UTC (COA). "During October 22 and 23 the disturbance moved westward and then southwestward, and it started back again across the Caribbean Sea, to increase in intensity and resume full hurricane force before entering Honduras near Cape Gracias, on October 25" (MWR).

October 24: HWM indicates a closed low of at most 990 mb near 16.5N, 80.5W. HURDAT listed this as a tropical storm at 17.9N, 80.1W. The MWR Tracks of Cyclones indicate a pressure of 988 mb near 18N, 81.5W at 8 a.m. Available observations suggest that a position southwest of HURDAT is most accurate. Ship highlights: calm winds and 988 mb at 17.7N, 80.4W at 10 UTC (MWR); 35 kt N and 1004 mb at 19.2N, 81.6W at 12 UTC (HWM); 35 kt SE and 998 mb at 17.4N, 80.4W at 17 UTC (COA). "...the American steamer Afel, on the morning of October 24, had the lowest barometer so far reported in connection with this hurricane at 29.18 inches [988 mb], as the central calm passed over the vessel in 17 degrees 44 minutes north, 80 degrees 26 minutes west. The highest wind experienced there was only a strong gale (Beaufort 9) which came up from the southeast after the passage of the calm center" (MWR).

October 25: HWM indicates a closed low of at most 995 mb near 15.2N, 82W. HURDAT listed this as a Category 1 hurricane at 15.3N, 83.1W. Available observations suggest that a position just east of HURDAT to be most accurate. Ship highlights: 30 kt W and 999 mb at ~14.9N, ~83.3W at 08 UTC (MWR); 40 kt NNW and 995 mb at ~15.3N, ~83.4W at 08 UTC (MWR); 25 kt W and 1000 mb at 14.5N, 83.2W at 12 UTC (COA).

October 26: HWM indicates a closed low of at most 1000 mb near 13.5N, 84.5W. HURDAT listed this as a minimal tropical storm at 14.3N, 86.3W. Available observations suggest that a position southeast of HURDAT is most accurate. Station highlights: 5 kt SW and 1005 mb at Bluefields at 12 UTC (HWM). Ship highlights: 10 kt SSW and 1005 mb at 12.4N, 83W at 00 UTC (COA).

October 27: HWM indicates a closed low of at most 1005 mb near 15N, 92W. HURDAT listed this as a tropical depression at 14.3N, 88.4W at 06 UTC. Available observations suggest that a position significantly farther west of HURDAT to be most accurate. Station highlights: calm winds and 1005 mb at Tapachula, Mexico, at 12 UTC (HWM). Ship highlights: 25 kt NNW and 1004 mb at 14.4N, 93.5W at 12 UTC (COA).

Genesis is begun for this system at 12 UTC on October the 18th as a tropical depression, 12 hours earlier than previously recorded in HURDAT. Tropical storm intensity is attained for this system at 00 UTC on the 19th. Available observations indicated a peripheral pressure of 1004 mb suggesting at least winds of 39 kt from the southern pressure-wind relationship. Thus, 45 kt is chosen for HURDAT. On the 20th peripheral

pressures of 1005 and 1001 mb were reported which implies at least winds of 36 and 45 kt, respectively, from the southern pressure-wind relationship. 60 is chosen for HURDAT. Available observations suggest a slight decrease in the estimated intensity originally in HURDAT from 55 to 45 kt on the 19th and 70 to 60 kt on the 20th. Track changes of 1 degree or less are suggested as well for the 19th and 20th. The system became a minimal Category 1 hurricane at 00 UTC on the 21st. 75 kt is maintained for HURDAT for the 21st and 22nd, and is considered the storms peak intensity. A lack of observations near the storm on the 21st and 22nd make it hard to truly estimate the hurricanes intensity on the 21st and 22nd. Early on the 22nd the hurricane skirted the southwestern Haiti and southeast tip of Jamaica. "Torrential rains over extreme southwestern Haiti attended the storms passage, and press reports indicate a disastrous total of deaths, the actual number being uncertain but more than 1000 and possibly as many as 2000. There was much damage to crops and property in Jamaica, the estimates of monetary losses exceed \$2,000,000" (MWR). Available observations indicate landfall in Cuba occurred near Santiago between 18 UTC of the 22nd and 00 UTC of the 23rd.

This is later than suggested by HURDAT (12-18 UTC on the 22nd). "There was considerable damage in the vicinity of Santiago, Cuba, as the cyclone moved into that region and press reports indicate 4 lives were lost there. The wind exceeded 70 mph at Santiago, as measured by an anemometer on a Pan-American Airways hangar which was blown down after that velocity had been recorded" (MWR). A slow decrease in intensity was observed on the 23rd as the storm moved southwest back towards the Caribbean Sea. A peripheral pressure of 1003 mb was observed on the 23rd implying at least 41 kt from the southern pressure-wind relationship. 50 kt is chosen for HURDAT. A slight intensity increase was reported on the 24th as an eye pressure was measured at 988 mb indicating 67 kt from the southern pressure wind relationship. 65 kt is chosen for HURDAT. By October 25th, the hurricane was centered slightly east of the Honduras Nicaragua eastern most border as a minimal Category 1 hurricane. Two ships observed peripheral pressures of 995 and 999 mb implying at least winds of 56 and 49 kt, respectively, from the southern pressure-wind relationship. 65 kt is chosen for HURDAT. Second landfall is said to have occurred near 18 UTC on the 25th with dissipation beginning thereafter over Nicaragua. The system continued to progress southwest and eventually re-emerged in the eastern Pacific Ocean, but no further development occurred. HURDAT intensity is suggested to maintain as Category 1 hurricane with minor alterations in the track and timing of peak observations.

Storm 7 (originally 6), 1935

26880 10/30/1935 M=10 6 SNBR= 592 NOT NAMED XING=1 SSS=2

28010 10/30/1935 M=10 7 SNBR= 619 NOT NAMED XING=1 SSS=2

*

26885 10/30* 0 0 0 0*326 609 35 0*328 618 35 0*330 628 40 0*


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28015 10/30* 0 0 0 0*323 609 35 0*325 620 35 0*327 630 40 0
          ***          *** ***          *** ***

26890 10/31*331 637 40 0*333 645 45 0*334 653 50 0*335 666 55 0*
28020 10/31*329 640 40 0*331 650 45 0*334 660 50 0*338 671 55 0
          *** ***          *** ***          ***          *** ***

26895 11/01*337 681 60 0*337 697 60 0*336 712 65 0*335 726 70 0*
28025 11/01*342 682 60 0*344 693 60 0*345 705 65 0*343 719 70 0
          *** ***          *** ***          *** ***          *** ***

26900 11/02*332 738 70 0*328 750 70 980*322 757 70 0*316 759 70 0*
28030 11/02*340 735 70 0*336 747 75 980*330 755 75 0*320 759 70 0
          *** ***          *** *** **          *** *** **          ***

26905 11/03*309 760 70 0*302 760 70 0*295 761 70 0*286 764 65 0*
28035 11/03*308 760 70 0*294 761 80 0*282 763 90 973*274 767 90 0
          ***          *** *** **          *** *** **          *** *** **

26910 11/04*277 771 65 0*270 779 65 0*265 787 65 0*258 803 65 973*
28040 11/04*269 773 90 0*265 780 90 0*262 789 90 0*259 801 90 973
          *** *** **          *** *** **          *** *** **          *** *** **

26915 11/05*253 811 65 0*249 825 65 0*249 835 65 0*251 843 65 0*
28045 11/05*257 813 75 0*256 822 65 0*255 830 65 0*256 838 60 0
          *** *** **          *** ***          *** ***          *** *** **

26920 11/06*252 850 60 0*255 857 60 0*260 863 55 0*264 867 50 0*
28050 11/06*259 846 55 0*262 854 50 0*265 861 45 0*268 867 40 0
          *** *** **          *** *** **          *** *** **          *** **

26925 11/07*268 870 45 0*275 871 40 0*280 869 35 0*281 858 30 0*
28055 11/07*271 870 40 0*273 872 35 0*275 872 35 0*276 869 30 0
          *** **          *** *** **          *** ***          *** ***

26930 11/08*278 847 25 0*277 842 20 0*276 837 15 0*275 834 15 0*
28060 11/08*276 864 30 0*276 857 25 0E276 850 25 0E276 843 20 0
          *** *** **          *** *** **          *          *** **          *** *** **

26935 HRCFL2
28065 HRCFL2BFL1
          *****

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Minor changes to the track and the intensity shown in Neumann et al. (1999), originally storm number 6. Evidence for these alterations comes from the Historical Weather Maps series, the COADS ship database, Original Monthly Records from NCDC, Monthly Weather Review, Barnes (1998), Dunn (1935), Dunn and Miller (1960), Dyke (1935), Gil, Jarrell et al (1992), the USDA Weather Bureau (1935), and Vickery et al (2000).

October 30: HWM indicates a closed low of at most 1015 mb near 32, 62.5W. HURDAT listed this as a tropical storm at 32.8N, 61.8W. The MWR Tracks of Cyclones indicate the center near 33N, 62W at 8 a.m. Available observations suggest a position slightly southwest of HURDAT to be most accurate. No gale force winds (or equivalent in pressure) were observed. "This storm seemingly was of extratropical origin, since it first appeared as a small and weak depression central about 32 degrees north, some distance east of Bermuda, early on October 30" (MWR).

October 31: HWM indicates a closed low of at most 1015 mb near 33N, 67W. HURDAT listed this as a tropical storm at 33.4N, 65.3W. The MWR Tracks of Cyclones indicate the center near 34N, 65.5W at 8 a.m. Available observations suggest a position slightly west of HURDAT to be most accurate. Ship highlights: 35 kt WSW and 1000 mb at 33N, 65.2W at 05 UTC (MWR).

November 1: HWM indicates a closed low of at most 1005 mb near 33N, 71W. HURDAT listed this as a Category 1 hurricane at 33.6N, 71.2W. The MWR Tracks of Cyclones indicate the center near 34N, 70.5W at 8 a.m. Available observations suggest a position northeast of HURDAT to be most accurate. Station (peak) highlights: 35 kt N at Cape Hatteras (MWR); 45 kt N at Cape Henry(???). Ship highlights: 40 kt ESE and 1005 mb at 33.5N, 73.5W at 12 UTC (HWM); 60 kt E and 990 mb at 35.3N, 72.1W at 18 UTC (MWR); 60 kt SE and 996 mb at 35.1N, 71.8W at 20 UTC (COA). "Near midnight on October 31, the American steamship W.H. Libby at latitude 34 degrees 43 minutes north, longitude 69 degrees 16 minutes south, reporting southeast winds of force 8. The lowest barometer reading on this vessel was at 2 a.m. on November 1, when a corrected value of 29.58 inches [1002 mb] was indicated" (MWR).

November 2: HWM indicates a closed low of at most 995 mb near 32N, 75W. HURDAT listed this as a Category 1 hurricane at 32.2N, 75.7W. The MWR Tracks of Cyclones indicates a pressure of 980 mb near 23.5N, 76W at 8 a.m. Available observations suggest a position northeast of HURDAT to be most accurate. Ship highlights: calm winds and 980 mb central pressure at 33.5N, 74.7W at 06 UTC (MWR); 45 kt NNE and 992 mb at 33.5N, 74.7W at 09 UTC (COA); 35 kt W and 993 mb at 32.2N, 75W at 12 UTC (HWM). "Between the morning of November 1 and 2, and particularly during the night of the 1st, the storm center took a peculiar turn toward a more southerly course. The American steamship Iowan passed through the central calm area at about 2 a.m. on November 2, in 33 degrees 30 minutes north, 74 degrees 42 minutes west, and reported a barometer reading of 28.94 inches [980 mb]. Just before passage through the calm, the wind had attained force 12 from the north-northeast and thereafter switched to force 12 from the southwest" (MWR).

November 3: HWM indicates a closed low of at most 1005 mb near 28.5N, 77W. HURDAT listed this as a Category 1 hurricane at 29.5N, 76.1W. The MWR Tracks of Cyclones indicates a pressure of 964 mb near 29N, 76.5W at 8 a.m. Available observations suggest a position southwest of HURDAT to be most accurate. Ship highlights: 70 kt WSW at 27.7N, 76.5W at 12 UTC (MWR); 15 kt E and 964 mb at 27.7N, 76.5W at 1330 UTC (MWR); 60 kt WSW and 964 mb at 27.6N, 76.6W at 14 UTC (Dunn and Miller); 45 kt E and 993 mb at 27.6N, 76.6W at 16 UTC (Dunn). "At 9:30 a.m. [of the 3rd] the British steamship Queen of Bermuda, about 75 miles north-

northeast of Hopetown, Great Abaco Island, at 27 degrees 41 minutes north, 76 degrees 32 minutes west, was in the hurricane center, with a barometer reading of 28.46 inches [973 mb], the lowest reported for the storm" (MWR).

November 4: HWM indicates a closed low of at most 1000 mb near 26.5N, 78.5W.

HURDAT listed this as a Category 1 hurricane at 26.5N, 78.7W. The MWR Tracks of Cyclones indicates a pressure of 973 mb near 26N, 79W at 8 a.m. Available observations suggest a position southwest of HURDAT to be most accurate. Station highlights: 58 kt NW and 975 mb at Miami at 17 UTC (OMR); 60 kt WNW and 973 mb at Miami at 17 UTC (Dunn); calm winds and 973 mb at Miami at 1745 UTC (OMR); 65 kt SE at Miami at 18 UTC (Dunn); 70 kt E and 977 at 21 UTC (USDA). Ship highlights: 50 kt NNE at 26.7N, 78.8W at 12 UTC (HWM); north to northeast winds and 973 mb at 25.9N, 79.5W at 16 UTC (MWR); 50 kt SW and 1001 mb at 25.3N, 80.1W at 18 UTC (COA). "A report from the American steamship Arizpa, Mobile to London, caught in the hurricane of the southeast coast of Florida, states that the barometer stood at 28.72 inches [973 mb] (corrected) from 11 a.m. until noon of the 4th, at and close to 25 degrees 55 minutes north, 79 degrees 55 minutes west, while hurricane velocities from north and northeast were experienced between 10 a.m. and 1 p.m." (MWR).

November 5: HWM indicates a closed low of at most 1010 mb near 26N, 84W.

HURDAT listed this as a Category 1 hurricane at 24.9N, 83.5W. The MWR Tracks of Cyclones indicate the center near 26N, 84W at 8 a.m. Available observations suggest a position northeast of HURDAT to be most accurate. Station highlights: 29 kt W and 1005 mb at Key West at 00 UTC (OMR). Ship highlights: 35 kt NNW and 1004 mb at 24.9N, 84W at 10 UTC (MWR); 70 kt ENE and 1002 mb at 26.6N, 83.5W at 17 UTC (Dyke).

November 6: HWM analyzes an area of low environmental pressure, but not closed, near 25N, 85W with an approaching cold front from the northwest. Available observations disagree with this analysis and indicate that a circulation, however weak it appears (~1015 mb), is present around 25.5N, 75W. HURDAT listed this as a tropical storm at 26N, 86.3W. The MWR Tracks of Cyclones indicate the center near 26.5N, 85.5W at 8 a.m. Available observations suggest a position slightly northeast of HURDAT to be most accurate. Ship highlights: 45 kt N and 1008 mb at 25.8N, 85.7W at 09 UTC (MWR); 35 kt S and 1011 mb at 26.6N, 85.7W at 13 UTC (COA); 35 kt S and 1009 mb at 27N, 86.2W at 17 UTC (MWR).

November 7: HWM indicates a closed low of at most 1015 mb near 26N, 88W with a cold front propagating north of the circulation. HURDAT listed this as a tropical storm at 28N, 86.9W. The MWR Tracks of Cyclones indicate the center near 28N, 86.5W at 8 a.m. Available observations suggest a position slightly southwest of HURDAT to be most accurate. Ship highlights: 35 kt NE and 1012 mb at 27.9N, 87.2W at 00 UTC (COA).

November 8: HWM analyzed a cold front stretching from southwest to northeast such that no circulation exists and barotropic characteristics that where once present are no longer apparent. HURDAT listed this as a tropical depression at 27.6N, 83.7W. The MWR Tracks of Cyclones indicate the center near 27N, 85W at 8 a.m. Available observations suggest a position west of HURDAT to be most accurate. No gale force winds (or equivalent in pressure) were observed.

Genesis is maintained for this hurricane on October 30th at 06 UTC as a minimal tropical storm. Gale force winds were not reported until the 31st where a peripheral pressure observation of 1000 mb was indicated, implying 48 kt from the subtropical pressure-wind relationship. 50 kt is chosen for HURDAT. Hurricane intensity was reached on November 1st as indicated by an observed peripheral pressure of 990 mb which implies at least winds of 63 kt from the subtropical pressure-wind relationship. 65 kt is chosen for HURDAT. On the 2nd the storm's motion took an irregular path from west toward the Carolinas to south toward the Bahamas. A central pressure of 980 mb at 06 UTC was observed indicating winds of 75 kt from the subtropical pressure-wind relationship. 75 kt is chosen for HURDAT, 5 kt higher than previously recorded. The hurricane was located north of the Bahamas on the 3rd where several ship observations were available. A central pressure of 964 mb was reported shortly after 12 UTC, of the 3rd, which implies winds of 91 kt from the subtropical pressure-wind relationship. Additionally, peripheral winds of 60 and 70 kt were observed. 90 kt is chosen for HURDAT, 25 kt higher than the original estimate. Landfall for the Category 2 hurricane occurred around 18 UTC on the 4th in Miami, Florida. "The eye of the storm passed over the city [Miami] at about noon on the 4th before tracking across the Everglades and into the Gulf of Mexico" (Barnes). On the 4th, a central pressure of 973 mb was observed at 18 UTC in Miami indicating winds of 83 kt from the subtropical pressure-wind relationship and 86 kt from the southern pressure-wind relationship. 90 kt is chosen for HURDAT. This new wind estimate is considerably higher than before (65 kt) but does confirm the Category 2 classification listed in many additional accounts and in HURDAT. Dunn and Miller note the storm as "occurring in extreme south Florida on November 4th as a minimal hurricane with Miami's barometer reading 973 mb and winds of 75 mph." Gil indicates landfall at 18 UTC at 25.9N, 80.1W, with 90 kt winds (Category 2) and a 973 mb pressure observation. Jarrell et al also noted this hurricane as a "Category 2 hurricane in southeast Florida with a 973 mb pressure." Regarding the eye diameter, "...the width of the eye is estimated at 15 miles" (MWR) and is somewhat smaller than expected by climatology (20 nmi - Vickery et al). "The storm throughout its history was of comparatively small diameter, and its hurricane winds covered only a narrow band" (MWR). Ho et al lists this storm as, "having a RMW of 10 nmi, a central pressure of 973 mb, and a landfall location of 25.9N, 80.1W."

After landfall in Miami the hurricane decreased its intensity from 90 kt to 75 kt at 00 UTC on the 5th. Neumann suggests winds of 75 kt also at 00 UTC. Minimal gale force observations (35 kt) were seen for the 5th at Key West (00 UTC) although a peripheral wind of east-northeast at 70 kt was noted by the S.S. Horshell at 17 UTC (Dyke). 65 kt is chosen for HURDAT at 12 UTC. The system continued to diminish in intensity through the 5th, downgrading the hurricane to a tropical storm at 18 UTC. On the 6th, several ship observations contained gale force winds but relatively weak pressures (1008-1011 mb) with the highest wind of 45 kt at 09 UTC. 45 kt is chosen for HURDAT, 10 kt lower than previously estimated. A peripheral wind observation of 35 kt on the 7th indicates the storm is continuing to dissipate. The storm became a tropical depression at 18 UTC on the 7th and transitioned to extratropical at 12 UTC on the 8th.

"The total property loss in Miami and vicinity is estimated at \$5,500,000. The total loss of life in Florida and Great Abaco Island is placed at 19" (MWR). Storm 7 of the 1935 hurricane season is known as the 'Yankee Hurricane' due to its unusual southwest progression from east of Bermuda to Miami, Florida. Although previously classified in HURDAT as a Category 2 hurricane for southeast Florida, no winds in HURDAT were listed above 70 kt. Peak observations are 90 kt on the 3rd and 4th prior to landfall in Miami. Only minor alterations are suggested for the track of the Yankee Hurricane.

Storm 8, 1935

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28066 11/03/1935 M=12 8 SNBR= 620 NOT NAMED XING=0 SSS=0
28066 11/03*340 615 30 0*345 605 30 0*350 595 30 0*356 583 30 0
28066 11/04*362 571 35 0*367 560 40 0*370 550 45 0*367 544 45 0
28066 11/05*362 541 45 0*356 539 45 0*350 540 45 0*342 548 45 0
28066 11/06*332 558 40 0*325 570 40 0*320 580 40 0*317 588 40 0
28066 11/07*317 596 40 0*317 603 40 0*315 610 40 0*309 616 40 0
28066 11/08*299 621 40 0*290 624 40 0*285 625 40 0*282 624 40 0
28066 11/09*281 622 40 0*280 619 40 0*280 615 35 0*280 609 35 0
28066 11/10*281 600 35 0*282 593 35 0*285 590 35 0*290 592 40 0
28066 11/11*295 597 45 0*299 605 45 0*300 615 45 0*296 622 45 0
28066 11/12*287 626 40 0*279 628 40 0*275 630 40 0*272 632 40 0
28066 11/13*270 634 40 0*269 636 40 0*270 635 35 0*275 631 30 0
28066 11/14*285 625 25 0* 0 0 0 0* 0 0 0 0* 0 0 0 0
28066 TS

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This is a new tropical storm not previously recorded in HURDAT. Evidence for this system comes from the Historical Weather Map series, the COADS ship database, individual ship and station data from NCDC, and the Monthly Weather Review.

November 3: HWM indicates a closed low of at most 1005 mb near 36N, 60W with a frontal system to the northwest of the storm stretching from northeast to southwest. Available observations from HWM and COADS indicate the system is barotropic in structure. No gale force winds (or equivalent in pressure) were observed.

November 4: HWM analyzed a closed low of at most 1000 mb near 38N, 55W with the weak stationary front northwest of the system dissipating. Ship highlights: 25 kt S and 1001 mb at 37.2N, 54.5W at 12 UTC (COA); 10 kt SSW and 1005 mb at 40.1N, 53.6W at 13 UTC (COA).

November 5: HWM analyzed a closed low of at most 1010 mb near 34N, 54W. The previous frontal system to the northwest has dissipated as indicated by HWM. Ship highlights: 25 kt SSW and 1006 mb at 33.4N, 52.6W at 12 UTC (COA).

November 6: HWM analyzed a closed low of at most 1010 mb near 33.5N, 58W. No gale force winds (or equivalent in pressure) were observed.

November 7: HWM indicates a closed low of at most 1010 mb near 32.5N, 64W. A second frontal system is approaching from the northwest although not yet affecting the storm. No gale force winds (or equivalent in pressure) were observed.

November 8: HWM analyzed a closed low of at most 1010 mb near 27.5N, 63.5W. The system has become elongated northwest to southeast as indicated by HWM. Ship highlights: 25 kt W and 1006 mb at 27.5N, 62.5W at 12 UTC (COA).

November 9: HWM indicates a closed low of at most 1010 mb near 30N, 60W with a frontal system present to the north-northwest. No gale force winds (or equivalent in pressure) were observed.

November 10: HWM analyzed a closed low of at most 1010 mb near 28N, 58.5W. The frontal boundary analyzed for the several days preceding has lifted off to the north causing the storm to become elongated northeast to southwest. No gale force winds (or equivalent in pressure) were observed.

November 11: HWM indicates a closed low of at most 1005 mb near 30N, 62W. Ship highlights: 15 kt N and 1001 mb at 30N, 62.1W at 12 UTC (COA).

November 12: HWM analyzed a closed low of at most 1005 mb near 27N, 63W. Ship highlights: 5 WSW and 1006 mb at 23.5N, 63.5W at 08 UTC (COA).

November 13: HWM indicates a closed low of at most 1010 mb near 26.5N, 63.5W.

The system is weakening as the area of low pressure has becoming much broader than the previous days. Ship highlights: 20 kt N and 1006 mb at 24.8N, 67.5W at 00 UTC (COA).

November 14: HWM analyzed a closed low of at most 1010 mb near 31N, 61.5W which has become elongated northwest to southeast. HWM also indicates a third moderate frontal system is approaching from the north. Dissipation is said to occur by 00 UTC as no gale force winds (or equivalent in pressure) were observed.

Genesis for this tropical storm began on the early morning of November 3rd where evidence shows a closed circulation. It appears that the system became a tropical storm at 00 UTC on 4th. Peripheral pressures of 1001 and 1005 mb were observed on the 4th which suggests winds of at least 47 and 40 kt, respectively, from the northern pressure-wind relationship. 45 kt is chosen for the reanalysis and HURDAT on the 4th.

Observations on the 5th were limited but a peripheral pressure of 1006 mb was found which suggests winds of at least 37 kt from the northern pressure-wind relationship. 45 kt is chosen for HURDAT on the 5th. Through the 6th and 7th no gales were observed and HURDAT is maintained at 40 kt. The 8th provided a peripheral pressure observation of 1006 mb suggesting at least 36 kt from the subtropical pressure-wind relationship. 40 kt is chosen for HURDAT. No gales were again observed until the 11th where a peripheral pressure of 1001 mb was reported. Such pressures suggest winds of at least 46 kt from the subtropical pressure-wind relationship. 45 kt is chosen for HURDAT. The 12th and 13th contained a peripheral pressure observation of 1006 mb suggesting at least 36 kt from the subtropical pressure-wind relationship. 40 kt was chosen for the 12th and 35 kt for the 13th for HURDAT. After enduring its third frontal system late on the 13th and early on the 14th, the system finally dissipated near 06 UTC on the 14th.

APPENDIX C

THE ACCUMULATED CYCLONE ENERGY (ACE) INDEX CALCULATIONS

Table C.1: 1916 original HURDAT ACE index values with the computed tropical cyclone activity of 17.6×10^6 .

STM	00_UTC	06_UTC	12_UTC	18_UTC	V
6/29/16	0	0	35	35	2450
6/30/16	35	35	35	40	5275
7/1/16	40	45	50	55	9150
7/2/16	55	60	65	70	15750
7/3/16	70	75	80	85	24150
7/4/16	90	95	95	100	36150
7/5/16	100	105	105	105	43075
7/6/16	90	60	50	40	15800
7/7/16	40	40	40	40	6400
7/8/16	40	30	30	30	1600
7/9/16	25	25	20	20	0
7/10/16	20	20	20	20	0
STM 2					
7/10/16	0	35	35	35	3675
7/11/16	35	35	35	35	4900
7/12/16	35	35	35	35	4900
7/13/16	35	40	45	45	6875
7/14/16	50	50	55	60	11625
7/15/16	65	70	75	75	20375
7/16/16	80	85	90	90	29825
7/17/16	95	95	100	100	38050
7/18/16	105	105	105	105	44100
7/19/16	100	100	95	95	38050
7/20/16	90	90	90	85	31525
7/21/16	85	80	75	65	23475
7/22/16	55	45	35	30	5050
STM 3					
7/11/16	0	40	40	45	5225
7/12/16	50	60	60	70	14600
7/13/16	75	80	85	85	26475
7/14/16	85	75	60	55	19475
7/15/16	50	45	30	0	4525
STM 4					
8/12/16	0	60	60	70	12100
8/13/16	75	75	80	80	24050
8/14/16	85	85	85	85	28900
8/15/16	85	85	90	90	30650
8/16/16	95	95	95	100	37075
8/17/16	100	105	105	105	43075
8/18/16	110	110	110	100	46300

Table C.1 (continued)

8/19/16	65	50	35	30	7950
STM 5					
8/21/16	0	55	65	75	12875
8/22/16	85	80	70	65	22750
8/23/16	60	55	45	45	10675
8/24/16	40	40	35	35	5650
8/25/16	35	30	30	30	1225
STM 6					
8/27/16	0	60	60	65	11425
8/28/16	65	70	75	75	20375
8/29/16	80	85	85	85	28075
8/30/16	85	85	85	85	28900
8/31/16	85	85	80	80	27250
9/1/16	75	75	70	70	21050
9/2/16	65	55	30	0	7250
STM 7					
9/4/16	0	0	35	35	2450
9/5/16	35	35	35	35	4900
9/6/16	35	35	25	0	2450
STM 8					
9/9/16	0	35	35	35	3675
9/10/16	35	35	35	35	4900
9/11/16	40	40	45	45	7250
9/12/16	45	45	45	45	8100
9/13/16	40	40	30	30	3200
9/14/16	25	20	20	20	0
STM 9					
9/14/16	0	35	35	35	3675
9/15/16	35	40	40	45	6450
9/16/16	45	50	55	55	10575
9/17/16	60	60	65	70	16325
9/18/16	75	80	85	90	27350
9/19/16	90	85	80	70	26625
9/20/16	70	70	65	65	18250
9/21/16	55	45	35	25	6275
STM 10					
9/17/16	0	0	35	35	2450
9/18/16	40	45	50	50	8625
9/19/16	60	65	75	80	19850
9/20/16	85	90	95	95	33375
9/21/16	95	100	100	105	40050
9/22/16	105	105	105	105	44100
9/23/16	100	100	95	95	38050
9/24/16	90	90	85	85	30650

Table C.1 (continued)

9/25/16	80	0	0	0	0
STM 11					
10/2/16	0	40	40	40	4800
10/3/16	40	40	40	40	6400
10/4/16	40	40	40	30	4800
STM 12					
10/6/16	0	35	35	35	3675
10/7/16	35	35	35	35	4900
10/8/16	35	40	45	45	6875
10/9/16	50	55	60	85	16350
10/10/16	90	90	85	85	30650
10/11/16	85	90	90	95	32450
10/12/16	95	100	105	105	41075
10/13/16	100	90	80	75	30125
10/14/16	65	60	55	50	13350
10/15/16	45	45	40	0	2025
STM 13					
10/12/16	0	60	60	60	10800
10/13/16	70	75	85	90	25850
10/14/16	90	95	95	95	35175
10/15/16	95	90	85	85	31575
10/16/16	85	90	95	100	34350
10/17/16	100	105	105	105	43075
10/18/16	105	105	100	65	36275
10/19/16	55	50	45	0	5525
STM 14					
11/11/16	35	35	35	35	4900
11/12/16	35	35	40	40	5650
11/13/16	45	45	50	50	9050
11/14/16	55	60	60	60	13825
11/15/16	70	70	70	70	19600
11/16/16	60	55	0	0	60
			ACE Total:	17.6×10^5	1762910

Table C.2: 1916 revised HURDAT ACE index values with the computed tropical cyclone activity of 13.1×10^5 .

STM	00_UTC	06_UTC	12_UTC	18_UTC	V
6/28/16	0	0	25	25	0
6/29/16	25	25	25	25	0
6/30/16	30	30	30	30	0
7/1/16	30	30	30	30	0
7/2/16	35	35	40	45	6075
7/3/16	50	55	60	65	13350
7/4/16	70	75	80	85	24150
7/5/16	90	95	100	105	38150
7/6/16	80	55	45	40	13050
7/7/16	40	40	40	40	6400
7/8/16	40	40	35	35	5650
7/9/16	30	30	25	25	0
7/10/16	20	20	20	20	0
STM 2					
7/10/16	0	30	30	30	0
7/11/16	30	30	30	30	0
7/12/16	30	30	30	30	0
7/13/16	30	30	30	30	0
7/14/16	35	35	40	40	5650
7/15/16	45	45	50	50	9050
7/16/16	55	55	60	60	13250
7/17/16	65	65	70	70	18250
7/18/16	75	75	75	75	22500
7/19/16	75	75	75	75	22500
7/20/16	75	75	75	75	22500
7/21/16	70	65	60	50	15225
7/22/16	40	35	30	30	2825
STM 3					
7/11/16	0	40	40	45	5225
7/12/16	50	60	60	70	14600
7/13/16	75	80	90	100	30125
7/14/16	100	90	70	55	26025
7/15/16	50	45	35	30	5750
STM 4					
8/12/16	0	60	60	70	12100
8/13/16	75	75	80	80	24050
8/14/16	85	85	85	85	28900
8/15/16	85	85	90	90	30650
8/16/16	95	95	95	100	37075
8/17/16	100	105	105	110	44150
8/18/16	115	120	120	120	56425
8/19/16	95	65	40	30	14850

Table C.2 (continued)

8/20/16	25	0	0	0	0
STM 5					
8/21/16	0	55	65	75	12875
8/22/16	85	95	75	65	26100
8/23/16	60	55	45	45	10675
8/24/16	40	40	35	35	5650
8/25/16	35	35	35	35	4900
8/26/16	30	30	0	0	0
STM 6					
8/27/16	0	35	40	45	4850
8/28/16	50	55	60	65	13350
8/29/16	70	70	70	70	19600
8/30/16	70	65	60	55	15750
8/31/16	50	45	40	40	7725
9/1/16	40	45	50	50	8625
9/2/16	40	35	30	0	2825
STM 7					
9/4/16	0	0	35	35	2450
9/5/16	35	35	35	35	4900
9/6/16	35	35	30	30	2450
9/7/16	25	25	0	0	0
STM 8					
9/13/16	0	0	30	30	0
9/14/16	30	35	35	35	3675
9/15/16	35	40	40	40	6025
9/16/16	40	40	40	40	6400
9/17/16	45	45	50	50	9050
9/18/16	55	55	60	60	13250
9/19/16	60	60	60	60	14400
9/20/16	60	55	50	45	11150
9/21/16	40	35	35	30	4050
9/22/16	25	0	0	0	0
STM 9					
9/17/16	0	0	35	35	2450
9/18/16	40	45	50	50	8625
9/19/16	55	55	60	65	13875
9/20/16	70	75	80	80	23325
9/21/16	85	85	90	90	30650
9/22/16	95	95	95	95	36100
9/23/16	95	95	95	95	36100
9/24/16	90	90	85	75	29050
9/25/16	60	0	0	0	0
STM 10					
10/6/16	0	30	30	30	0

Table C.2 (continued)

10/7/16	30	30	35	40	2825
10/8/16	45	50	55	60	11150
10/9/16	65	75	85	95	26100
10/10/16	95	95	95	95	36100
10/11/16	95	95	100	100	38050
10/12/16	100	100	100	100	40000
10/13/16	100	90	80	75	30125
10/14/16	65	60	55	50	0
10/15/16	45	0	0	0	0
STM 11					
10/9/16	0	25	25	25	0
10/10/16	30	30	30	30	0
10/11/16	30	30	30	30	0
10/12/16	35	40	45	50	7350
10/13/16	55	60	65	70	15750
10/14/16	75	80	85	85	26475
10/15/16	85	85	85	60	25275
10/16/16	45	40	40	50	7725
10/17/16	60	70	80	85	22125
10/18/16	90	90	90	65	28525
10/19/16	45	30	25	0	2025
STM 12					
11/11/16	30	30	30	30	0
11/12/16	35	35	40	40	5650
11/13/16	45	45	50	50	9050
11/14/16	55	60	60	60	13825
11/15/16	60	60	55	55	7200
11/16/16	50	45	0	0	0
			ACE Total:	$13.1 \cdot 10^5$	1314725

Table C.3: 1918 original HURDAT ACE index values with the computed tropical cyclone activity of 2.9×10^5 .

STM	00 UTC	06 UTC	12 UTC	18 UTC	V
8/1/18	35	35	35	35	4900
8/2/18	35	40	40	40	6025
8/3/18	45	45	45	50	8575
8/4/18	50	50	55	55	11050
8/5/18	55	60	60	60	13825
8/6/18	70	80	90	85	26625
8/7/18	40	30	0	0	1600
STM 2					
8/22/18	0	60	60	60	10800
8/23/18	65	70	70	70	18925
8/24/18	70	70	70	70	19600
8/25/18	70	70	70	65	18925
8/26/18	55	30	0	0	3025
STM 3					
8/23/18	0	35	35	40	4050
8/24/18	40	45	50	50	8625
8/25/18	50	45	40	35	7350
8/26/18	30	0	0	0	0
STM 4					
9/2/18	0	0	0	60	3600
9/3/18	65	70	70	75	19650
9/4/18	75	80	80	85	25650
9/5/18	85	85	85	80	28075
9/6/18	75	65	65	55	17100
9/7/18	50	45	40	40	0
STM 5					
9/9/18	35	35	35	35	4900
9/10/18	35	35	35	35	4900
9/11/18	35	40	40	40	6025
9/12/18	40	40	40	35	6025
9/13/18	35	35	35	35	4900
9/14/18	35	30	25	0	1225
			ACE Total:	2.9×10^5	285950

Table C.4: 1918 revised HURDAT ACE index values with the computed tropical cyclone activity of 3.3×10^5 .

STM	00_UTC	06_UTC	12_UTC	18_UTC	V
8/3/18	25	25	30	30	0
8/4/18	35	40	45	50	7350
8/5/18	55	60	70	80	17925
8/6/18	90	100	110	110	42300
8/7/18	70	40	30	25	6500
STM 2					
8/22/18	0	40	45	45	5650
8/23/18	50	50	55	55	11050
8/24/18	60	65	70	75	18350
8/25/18	80	85	90	80	28125
8/26/18	70	45	30	0	6925
STM 3					
8/23/18	0	35	35	40	4050
8/24/18	40	45	50	55	9150
8/25/18	60	60	60	55	13825
8/26/18	45	35	30	0	3250
STM 4					
8/31/18	0	0	35	35	2450
9/1/18	35	35	35	35	4900
9/2/18	40	40	45	45	7250
9/3/18	50	50	55	55	11050
9/4/18	60	60	60	60	14400
9/5/18	55	50	45	40	9150
9/6/18	35	0	0	0	1225
STM 5					
9/2/18	40	45	50	60	9725
9/3/18	65	70	70	75	19650
9/4/18	75	80	80	85	25650
9/5/18	85	85	85	80	28075
9/6/18	75	65	65	55	17100
9/7/18	50	45	40	40	0
9/8/18	40	35	30	0	0
			ACE Total:	3.3×10^5	325075

Table C.5: 1927 original HURDAT ACE index values with the computed tropical cyclone activity of 5.6×10^5 .

STM	00_UTC	06_UTC	12_UTC	18_UTC	V
8/19/27	0	0	60	65	7825
8/20/27	70	75	80	85	24150
8/21/27	90	90	95	100	35225
8/22/27	100	100	105	105	42050
8/23/27	105	105	105	100	43075
8/24/27	100	95	95	90	10000
8/25/27	90	90	90	90	0
8/26/27	90	85	80	0	0
STM 2					
9/1/27	0	0	35	35	2450
9/2/27	35	35	35	35	4900
9/3/27	35	35	35	35	4900
9/4/27	35	35	40	40	5650
9/5/27	40	45	45	50	8150
9/6/27	50	55	55	60	12150
9/7/27	65	65	70	70	18250
9/8/27	75	75	80	85	24875
9/9/27	85	90	90	90	31525
9/10/27	85	80	70	60	7225
9/11/27	50	45	40	35	0
STM 3					
9/22/27	0	0	35	35	2450
9/23/27	35	35	35	35	4900
9/24/27	35	35	35	35	4900
9/25/27	35	35	35	35	4900
9/26/27	35	35	35	35	4900
9/27/27	35	40	45	45	6875
9/28/27	50	55	60	60	12725
9/29/27	65	70	70	70	14025
STM 4					
9/23/27	35	40	45	50	7350
9/24/27	55	60	65	70	15750
9/25/27	75	80	85	90	27350
9/26/27	95	100	105	105	41075
9/27/27	105	100	95	90	38150
9/28/27	90	85	85	80	28950
9/29/27	80	80	75	70	6400
9/30/27	65	60	55	50	0
10/1/27	50	45	40	40	0
STM 5					
10/1/27	35	35	35	35	4900
10/2/27	35	40	45	50	7350

Table C.5 (continued)

10/3/27	50	50	40	35	7825
10/4/27	30	25	0	0	0
STM 6					
10/17/27	40	40	40	40	6400
10/18/27	40	40	40	40	6400
10/19/27	35	35	35	35	4900
STM 7					
10/30/27	0	0	0	35	1225
10/31/27	35	40	40	40	6025
11/1/27	35	35	35	35	4900
11/2/27	35	35	35	35	4900
11/3/27	35	35	30	30	2450
11/4/27	30	30	0	0	0
			ACE Total:	$5.6 \cdot 10^5$	560375

Table C.6: 1927 revised HURDAT ACE index values with the computed tropical cyclone activity of 4.5×10^5 .

STM	00_UTC	06_UTC	12_UTC	18_UTC	V
8/19/27	0	0	60	60	7200
8/20/27	65	70	70	80	20425
8/21/27	85	90	100	105	36350
8/22/27	105	110	110	105	46250
8/23/27	105	105	105	100	43075
8/24/27	100	95	95	90	28050
8/25/27	85	80	70	70	0
8/26/27	65	65	60	55	0
STM 2					
9/1/27	0	0	25	25	0
9/2/27	25	25	25	25	0
9/3/27	30	30	35	35	2450
9/4/27	35	35	40	40	5650
9/5/27	40	45	45	50	8150
9/6/27	50	55	55	60	12150
9/7/27	65	65	60	60	15650
9/8/27	60	60	60	60	14400
9/9/27	60	55	55	55	12675
9/10/27	50	45	45	40	8150
9/11/27	40	35	35	30	4050
STM 3					
9/22/27	0	0	30	30	0
9/23/27	30	30	30	30	0
9/24/27	30	30	30	30	0
9/25/27	30	30	30	30	0
9/26/27	30	30	30	30	0
9/27/27	35	40	45	45	6875
9/28/27	50	55	60	60	12725
9/29/27	65	70	70	70	18925
STM 4					
9/23/27	35	40	45	45	6875
9/24/27	50	55	55	60	12150
9/25/27	60	65	70	75	18350
9/26/27	80	85	90	90	29825
9/27/27	90	85	80	80	28125
9/28/27	80	75	75	75	6400
9/29/27	75	75	75	75	0
9/30/27	75	70	70	65	0
10/1/27	60	55	50	0	0
STM 5					
10/1/27	30	30	30	30	0
10/2/27	30	35	35	40	4050

Table C.6 (continued)

10/3/27	40	40	35	35	5650
10/4/27	30	25	0	0	0
STM 6					
10/17/27	35	35	40	40	5650
10/18/27	40	40	40	40	6400
10/19/27	40	35	0	0	1600
STM 7					
10/30/27	0	0	30	35	1225
10/31/27	35	40	40	40	6025
11/1/27	35	35	35	35	4900
11/2/27	35	35	35	35	4900
11/3/27	35	35	45	45	1225
11/4/27	45	45	0	0	0
			ACE Total:	4.5*10 ⁵	446550

Table C.7: 1928 original HURDAT ACE index values with the computed tropical cyclone activity of 4.5×10^5 .

STM	00_UTC	06_UTC	12_UTC	18_UTC	V
8/3/28	35	35	35	35	3675
8/4/28	35	35	35	40	4050
8/5/28	40	40	35	40	4425
8/6/28	45	55	65	70	12150
8/7/28	80	80	85	85	20850
8/8/28	85	80	70	50	13800
8/9/28	40	40	35	35	4050
8/10/28	35	35	35	30	2450
8/11/28	30	30	30	30	0
8/12/28	30	30	30	0	0
STM 2					
8/7/28	0	0	35	35	2450
8/8/28	35	40	40	45	5225
8/9/28	50	55	60	65	10850
8/10/28	70	70	70	70	14700
8/11/28	70	70	60	60	12100
8/12/28	50	45	45	45	6075
8/13/28	45	50	50	55	8025
8/14/28	50	50	45	40	6125
8/15/28	40	35	35	30	2450
8/16/28	30	30	25	25	0
8/17/28	25	20	20	0	0
STM 3					
9/1/28	0	0	0	35	1225
9/2/28	35	35	35	35	3675
9/3/28	35	40	40	45	5225
9/4/28	50	50	50	50	7500
9/5/28	50	50	40	35	5325
9/6/28	35	40	45	45	5650
9/7/28	45	45	45	45	6075
9/8/28	45	40	35	30	2825
STM 4					
9/6/28	0	0	35	35	1225
9/7/28	35	35	35	35	2450
9/8/28	35	40	40	40	3200
9/9/28	45	50	50	55	5000
9/10/28	55	60	60	65	7200
9/11/28	70	75	80	85	12025
9/12/28	95	100	105	110	21025
9/13/28	115	120	135	140	32625
9/14/28	140	135	135	135	36450
9/15/28	135	135	135	135	36450

Table C.7 (continued)

9/16/28	135	135	135	130	36450
9/17/28	130	115	110	90	25325
9/18/28	80	75	60	60	9225
9/19/28	50	45	40	40	3625
9/20/28	40	40	35	35	2825
STM 5					
9/8/28	0	0	35	35	2450
9/9/28	35	35	40	40	4425
9/10/28	40	45	45	45	6075
9/11/28	50	50	50	50	2500
9/12/28	50	50	50	50	0
STM 6					
10/10/28	0	0	35	35	2450
10/11/28	35	35	35	35	3675
10/12/28	35	40	45	50	6125
10/13/28	55	60	60	70	12100
10/14/28	65	60	60	60	3600
10/15/28	60	0	0	0	0
			ACE Total:	4.5*10 ⁵	449450

Table C.8: 1928 revised HURDAT ACE index values with the computed tropical cyclone activity of 7.3×10^5 .

STM	00_UTC	06_UTC	12_UTC	18_UTC	V
8/5/28	30	35	35	40	4050
8/6/28	45	55	65	70	14175
8/7/28	80	80	85	85	27250
8/8/28	85	80	70	50	21025
8/9/28	40	40	40	40	6400
8/10/28	35	35	35	30	3675
8/11/28	30	30	30	30	0
8/12/28	30	30	30	0	0
STM 2					
8/7/28	0	0	25	25	0
8/8/28	30	35	35	35	3675
8/9/28	40	45	45	45	7675
8/10/28	45	50	50	55	10050
8/11/28	60	65	70	65	16950
8/12/28	60	55	55	60	13250
8/13/28	65	65	65	60	16275
8/14/28	50	50	45	40	8625
8/15/28	40	35	30	30	2825
8/16/28	30	30	25	25	0
8/17/28	25	20	0	0	0
STM 3					
9/1/28	0	0	0	20	0
9/2/28	25	25	25	30	0
9/3/28	30	35	40	45	4850
9/4/28	50	50	50	50	10000
9/5/28	50	50	40	35	7825
9/6/28	35	40	40	45	6450
9/7/28	45	45	45	45	8100
9/8/28	45	40	35	30	4850
STM 4					
9/6/28	0	0	35	35	2450
9/7/28	35	35	35	35	4900
9/8/28	35	40	40	40	6025
9/9/28	45	50	50	55	10050
9/10/28	55	60	60	65	14450
9/11/28	70	75	80	85	24150
9/12/28	95	100	115	120	46650
9/13/28	120	120	130	130	62600
9/14/28	130	125	125	125	63775
9/15/28	125	125	125	125	62500
9/16/28	125	125	125	130	63775
9/17/28	130	120	110	90	51500

Table C.8 (continued)

9/18/28	80	75	60	60	19225
9/19/28	50	45	40	40	7725
9/20/28	40	40	35	35	1600
STM 5					
9/8/28	0	0	35	35	2450
9/9/28	35	35	40	40	5650
9/10/28	40	45	45	45	7675
9/11/28	50	50	55	60	2500
9/12/28	50	50	60	60	0
STM 6					
10/8/28	20	20	25	25	0
10/9/28	30	30	35	35	2450
10/10/28	35	40	45	45	6875
10/11/28	50	50	55	55	11050
10/12/28	55	55	55	60	12675
10/13/28	65	65	70	70	18250
10/14/28	75	75	80	70	17650
10/15/28	60	0	0	0	0
			ACE Total:	7.3*10 ⁵	726575

Table C.9: 1935 original HURDAT ACE index values with the computed tropical cyclone activity of 9.4×10^5 .

STM	00_UTC	06_UTC	12_UTC	18_UTC	V
8/18/35	0	65	70	75	14750
8/19/35	65	70	75	80	21150
8/20/35	90	90	95	95	34250
8/21/35	95	100	100	100	39025
8/22/35	100	105	105	105	43075
8/23/35	105	105	100	100	42050
8/24/35	95	90	85	80	30750
8/25/35	75	70	65	55	0
8/26/35	50	40	35	30	0
STM 2					
8/29/35	0	35	35	35	3675
8/30/35	35	40	40	45	6450
8/31/35	45	50	55	55	10575
9/1/35	60	60	65	75	17050
9/2/35	90	105	120	130	50425
9/3/35	140	130	115	100	59725
9/4/35	95	85	80	75	28275
9/5/35	60	60	55	55	13250
9/6/35	55	60	65	75	16475
9/7/35	80	80	80	75	6400
9/8/35	75	70	65	60	0
9/9/35	60	55	50	45	0
9/10/35	40	35	35	0	0
STM 3					
8/30/35	0	0	40	35	2825
8/31/35	35	35	35	35	4900
9/1/35	35	35	30	25	2450
STM 4					
9/23/35	0	35	40	45	4850
9/24/35	50	55	60	65	13350
9/25/35	70	75	80	80	23325
9/26/35	85	90	90	90	31525
9/27/35	95	95	100	100	38050
9/28/35	105	105	100	100	42050
9/29/35	100	100	100	100	40000
9/30/35	100	95	95	90	36150
10/1/35	90	85	80	75	21725
10/2/35	65	60	60	55	0
STM 5					
10/19/35	35	45	55	60	9875
10/20/35	65	70	70	70	18925
10/21/35	75	75	75	75	22500

Table C.9 (continued)

10/22/35	75	75	60	60	18450
10/23/35	60	60	50	45	11725
10/24/35	45	45	55	65	11300
10/25/35	65	70	75	75	20375
10/26/35	75	65	35	25	11075
10/27/35	20	15	0	0	0
STM 6					
10/30/35	0	35	35	40	4050
10/31/35	40	45	50	55	9150
11/1/35	60	60	65	70	16325
11/2/35	70	70	70	70	19600
11/3/35	70	70	70	65	18925
11/4/35	65	65	65	65	16900
11/5/35	65	65	65	65	16900
11/6/35	60	60	55	50	12725
11/7/35	45	40	35	30	4850
11/8/35	25	20	15	15	0
			ACE Total:	9.4×10^5	942200

Table C.10: 1935 revised HURDAT ACE index values with the computed tropical cyclone activity of 10.9×10^5 .

STM	00 UTC	06 UTC	12 UTC	18 UTC	V
5/15/35	30	30	35	35	2450
5/16/35	35	35	35	35	4900
5/17/35	40	40	45	50	7725
5/18/35	50	45	40	35	7350
5/19/35	30	0	0	0	0
STM 2					
8/18/35	0	50	55	60	9125
8/19/35	65	70	75	80	21150
8/20/35	85	90	95	100	34350
8/21/35	105	110	110	110	47325
8/22/35	110	110	110	110	48400
8/23/35	110	105	100	100	43125
8/24/35	100	100	100	100	40000
8/25/35	90	80	70	60	14500
8/26/35	50	40	35	30	0
STM 3					
8/29/35	0	35	35	35	3675
8/30/35	35	40	40	40	6025
8/31/35	45	45	45	50	8575
9/1/35	55	60	65	75	16475
9/2/35	90	105	120	135	51750
9/3/35	150	150	140	130	81500
9/4/35	125	115	105	100	49875
9/5/35	75	60	55	55	15275
9/6/35	55	60	70	75	17150
9/7/35	80	80	80	75	6400
9/8/35	75	70	65	60	0
9/9/35	60	55	50	45	0
9/10/35	60	55	50	0	0
STM 4					
8/31/35	25	30	30	35	1225
9/1/35	35	35	30	25	2450
9/2/35	25	0	0	0	0
STM 5					
9/23/35	0	30	30	30	0
9/24/35	35	35	40	40	5650
9/25/35	45	45	50	55	9575
9/26/35	50	70	80	85	21025
9/27/35	90	95	100	100	37125
9/28/35	100	100	100	90	38100
9/29/35	100	110	115	115	48550
9/30/35	110	105	95	90	40250

Table C.10 (continued)

10/1/35	90	85	80	75	27350
10/2/35	65	60	60	55	0
STM 6					
10/18/35	0	0	30	30	0
10/19/35	35	40	45	45	6875
10/20/35	50	55	60	70	14025
10/21/35	75	75	75	75	22500
10/22/35	75	75	75	75	22500
10/23/35	65	55	50	50	12250
10/24/35	55	60	65	65	15075
10/25/35	65	65	65	55	15700
10/26/35	45	40	35	30	4850
10/27/35	30	25	20	0	0
STM 7					
10/30/35	0	35	35	40	4050
10/31/35	40	45	50	55	9150
11/1/35	60	60	65	70	16325
11/2/35	70	75	75	70	21050
11/3/35	70	80	90	90	27500
11/4/35	90	90	90	90	32400
11/5/35	75	65	65	60	17675
11/6/35	55	50	45	40	9150
11/7/35	40	35	35	30	4050
11/8/35	30	25	25	20	0
STM 8					
11/3/35	30	30	30	30	0
11/4/35	35	40	45	45	6875
11/5/35	45	45	45	45	8100
11/6/35	40	40	40	40	6400
11/7/35	40	40	40	40	6400
11/8/35	40	40	40	40	6400
11/9/35	40	40	35	35	5650
11/10/35	35	35	35	40	5275
11/11/35	45	45	45	45	8100
11/12/35	40	40	40	40	6400
11/13/35	40	40	35	30	4425
11/14/35	25	0	0	0	0
			ACE Total:	10.9×10^5	1087550