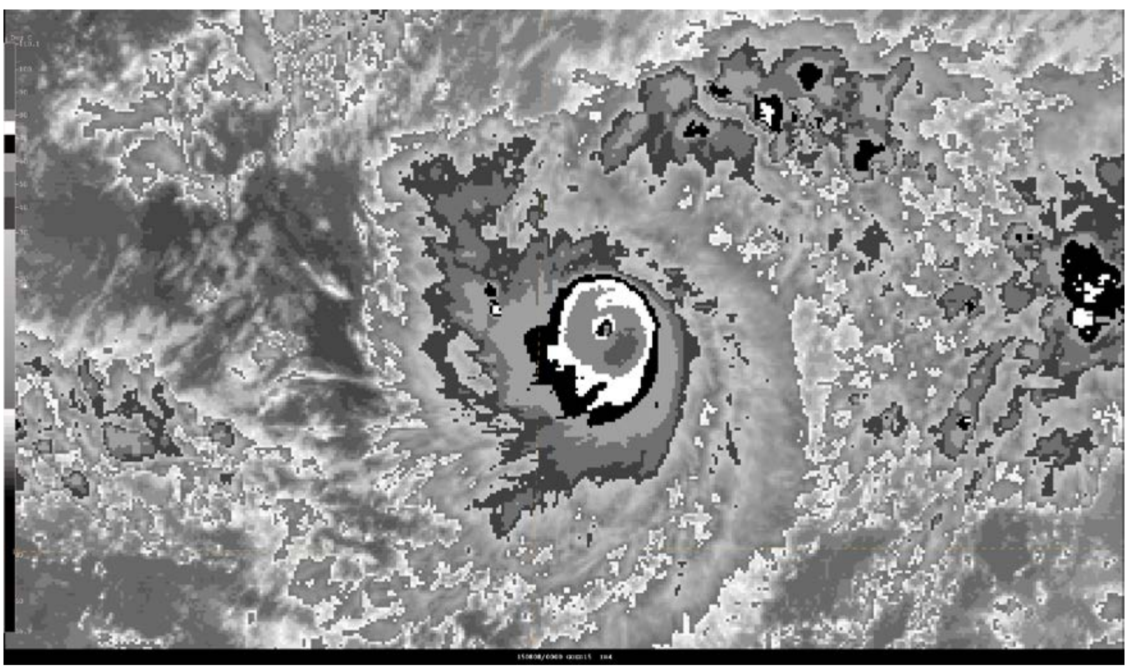
NATIONAL HURRICANE CENTER TROPICAL CYCLONE REPORT

HURRICANE HILDA

(EP102015)

6 – 13 August 2015

Eric S. Blake
National Hurricane Center
Jon Jelsema
Central Pacific Hurricane Center
6 September 2016[1]



NOAA GOES-15 INFARED SATELLITE IMAGE OF HURRICANE HILDA AT 0000 UTC 8 AUGUST 2015.

Hilda formed in the southwestern portion of the eastern North Pacific basin and became a category 3 hurricane before moving into the central Pacific basin, where it stayed south of Hawaii.

[1] Original report date 29 October 2015. Updated 29 February 2016 to include CPHC analysis. Updated 6 September to include final verification data from CPHC.

Hurricane Hilda

6 – 13 AUGUST 2015

SYNOPTIC HISTORY

The wave that spawned Hilda left the west African coast on 19 July with a large area of associated showers and thunderstorms. The convection decreased while the wave moved westward across the eastern Atlantic, and only a small area of thunderstorms accompanied the wave during the next several days within the Intertropical Convergence Zone. The wave crossed the Lesser Antilles on 25 July and moved into the eastern North Pacific on 28 July. Convection flared for the next several days, and a weak low was noted on 2 August while the system was located several hundred miles south of Cabo San Lucas, Mexico. Although the associated thunderstorm activity became more organized in a low-shear environment, the low-level circulation remained ill-defined for the next few days while the wave was moving into the southwestern portion of the eastern Pacific. A burst of convection late on 5 August led to the formation of a small well-defined low, marking the formation of a tropical depression by 0000 UTC 6 August about 1300 n mi west-southwest of Cabo San Lucas. The "best track" chart of the tropical cyclone's path is given in Fig. 1, with the wind and pressure histories shown in Figs. 2 and 3, respectively. The best track positions and intensities are listed in Table 1[2].

Twelve hours later, the depression became a tropical storm. Hilda gradually strengthened on 6 August within an environment of light-to-moderate northeasterly shear and warm water. Microwave images that day indicated the storm had a very small inner core, with hints of a mid-level eye. On the next day, perhaps as a result of diminishing wind shear, rapid intensification began with a small central dense overcast forming with cold cloud-top temperatures, and an eye appeared on visible images. Satellite estimates indicate that Hilda became a hurricane early on 7 August, and a major hurricane early on 8 August just before moving westward into the central Pacific basin around 0600 UTC 8 August.

Another burst of intensification ensued later on 8 August in an environment characterized by low vertical wind shear and sea surface temperatures (SSTs) in excess of 28°C, about 1-1.5°C above normal. Hilda reached its maximum strength around 1800 UTC 8 August, as a category 4 hurricane with maximum sustained winds of 125 knots and a minimum central pressure of 937 mb. Although weak vertical wind shear remained in place through 9 August, the combination of slightly cooler SSTs and the entrainment of drier mid-level air led to weakening while Hilda moved west-northwestward, and Hilda dropped below major hurricane strength at 1800 UTC 9 August.

---

[2] A digital record of the complete best track, including wind radii, can be found on line at ftp://ftp.nhc.noaa.gov/atcf. Data for the current year's storms are located in the *btk* directory, while previous years' data are located in the *archive* directory.

Over the next couple of days, Hilda turned toward the northwest with a decrease in forward speed as it rounded the southwestern periphery of a large subtropical ridge. The system also began to feel the influence of increasing upper-level westerly winds associated with a subtropical jet stream over Hawaii, and some slight additional weakening occurred on 10 August

Hilda underwent rapid weakening on 11 August due to vertical wind shear from the strong subtropical jet stream over Hawaii. The wind shear, in combination with increased entrainment of dry mid-level air, caused the low-level circulation center of Hilda to become partially exposed and the system dropped below hurricane strength by 0000 UTC 12 August. Hilda remained nearly stationary and slowly weakened on 12 August as it was in a region of ill-defined steering resulting from strong upper-level westerly winds and low-level easterly trades. The battle between these two atmospheric steering currents finally caused a loss of deep convection near the center of Hilda on 13 August. The shallow system then picked up speed as it moved to the west-southwest, and weakened to a tropical depression at 1800 UTC 13 August. At that time, Hilda made its closest approach to the state of Hawaii, passing 165 n mi south-southeast of South Point on the Big Island of Hawaii. Hilda lost all tropical characteristics by 0000 UTC 14 August and became a remnant low.

METEOROLOGICAL STATISTICS

Observations in Hilda (Figs. 2 and 3) include subjective satellite-based Dvorak technique intensity estimates from the Tropical Analysis and Forecast Branch (TAFB), the Satellite Analysis Branch (SAB), the Central Pacific Hurricane Center (CPHC), the Joint Typhoon Warning Center (JTWC) and objective Advanced Dvorak Technique (ADT) estimates from the Cooperative Institute for Meteorological Satellite Studies/University of Wisconsin-Madison. Data and imagery from NOAA polar-orbiting satellites including the Advanced Microwave Sounding Unit (AMSU), the NASA Global Precipitation Mission (GPM), the European Space Agency's Advanced Scatterometer (ASCAT), and Defense Meteorological Satellite Program (DMSP) satellites, among others, were also useful in constructing the best track of the hurricane. The operational best track west of 140˚ W includes flight-level, stepped frequency microwave radiometer (SFMR), and dropwindsonde observations from flights of the 53rd Weather Reconnaissance Squadron of the U. S. Air Force Reserve Command.

The estimated 100-kt peak intensity of Hilda in the eastern Pacific is based on Dvorak satellite intensity estimates from TAFB and SAB. The ADT was unable to resolve the small eye of Hilda and is not representative of the peak intensity in this instance.

Hilda's estimated peak intensity of 125 knots at 1800 UTC 8 August, is based on a blend of Dvorak satellite intensity estimates from CPHC, SAB and JTWC. The minimum central pressure of 937 mb at 1800 UTC 8 August is based on the Knaff-Zehr-Courtney (KZC) pressure-wind relationship for an intensity of 125 knots.

The US Air Force Reserve 53rd Weather Reconnaissance Squadron conducted 7 reconnaissance missions which included flight levels of 700 mb and 850 mb when the cyclone was located to the east and southeast of the Hawaiian Islands. The first 4 missions were conducted at 700 mb on 10 and 11 August, while the fifth through seventh missions were conducted at 850 mb on 12 and 13 August. The strongest maximum flight-level winds of 96 kt were observed at 0348 UTC 10 August during the 1st mission into the cyclone. The strongest Stepped Frequency Microwave Radiometer (SFMR) winds of 85 knots were observed at 1608 UTC 10 August during the 2nd mission into Hilda.

The lowest pressure measured in the eye of Hilda by a dropwindsonde was 974 mb at 0345 UTC 10 August. However, the dropwindsonde also reported a surface wind of 12 kt, so the minimum central pressure at that time is estimated to be 973 mb.

There were no ship reports or surface observations with winds of tropical storm force associated with Hilda. There was one buoy near the path of Hilda, the National Data Buoy Center (NDBC) buoy 51004, located 205 n mi southeast of Hilo, HI. The buoy observed sustained surface winds of 37 kt with a peak wind gust of 45 kt at 0420 UTC 13 August. The buoy also observed seas of 12 to 13 ft between 0400 and 0500 UTC when the peak wind was observed.

High surf in excess of 16 feet affected east-facing shores of Maui and the Big Island of Hawaii, with minor coastal inundation reported.

CASUALTY AND DAMAGE STATISTICS

There were no reports of damage or casualties associated with Hilda.

FORECAST AND WARNING CRITIQUE

Hilda's genesis was well forecast overall (Table 2). The system that became Hilda was introduced into the Tropical Weather Outlook (TWO) with a low (< 40%) probability during the next 5 days 84 h before genesis, and it was included in the 48-h TWO 72 h before formation. The probability reached the high category (> 60% chance of formation) 60 h before genesis in the 5-day TWO and 24 h before formation in the 48-h TWO.

A verification of NHC official track forecasts for Hilda is given in Table 3a. Official forecast track errors were higher than the mean official errors for the previous 5-yr period except at 12 h. A homogeneous comparison of the official track errors with selected guidance models is given in Table 3b. Model guidance, in general, struggled with forecasting Hilda, with notable northeastward forecast biases in most of the models. Some of the simpler guidance, such as the LBAR and BAMD, outperformed the GFS and other global models for the first 72 hours of the forecasts, which is a fairly rare event. The ECMWF model was generally the best overall guidance at day 3 and beyond.

A verification of NHC official intensity forecasts for Hilda is given in Table 4a. Official forecast intensity errors were much higher the mean official errors for the previous 5-yr period except at 120 h. A homogeneous comparison of the official intensity errors with selected guidance models is given in Table 4b. The rapid intensification of Hilda proved especially difficult to forecast, with all models having substantial low biases for the first few days. While the official forecast outperformed all guidance through 72 h, the errors were still large.

There were no watches or warnings on land associated with Hilda east of 140°W.

A verification of CPHC official track forecasts for Hilda is given in Table 5a. Official forecast track errors were lower than the mean official errors for the previous 5-yr period except at 36 and 48 h. A homogeneous comparison of the official track errors with selected guidance models is given in Table 5b. The models, in general, struggled in handling the recurvature of Hilda to the south of the Hawaiian Islands, with many models showing a notable northeastward bias. The consensus guidance, in general, outperformed the statistical and dynamical guidance, with the GFEX (GFS and ECMWF) consensus performing particularly well. The GFEX was slightly better than the official forecast at each forecast lead time, while the HWRF was the top performing model beyond day 3.

A verification of CPHC official intensity forecasts for Hilda is given in Table 6a. Official forecast intensity errors were lower than the mean official errors for the previous 5-yr period except at 12 h. A homogeneous comparison of the official intensity errors with selected guidance models is given in Table 5b. The rapid intensification of Hilda and subsequent weakening during 8 and 9 August was handled relatively well by the models given the large changes in intensity during this stretch, but led to slightly higher errors in the official intensity forecasts during the first 24 h. Official intensity errors beyond 24 h were quite low, averaging around 5 kt at each forecast period through 120 h. While the intensity errors overall were quite low for most of the model guidance, the intensity consensus IVCN and the official forecast OFCL were clearly the top performers.

The forecast issued at 1500 UTC on 11 August indicated that Hilda would pass over or near the southern section of the Big Island of Hawaii, and as a result a tropical storm watch was issued for this island. Hilda weakened as it approached and passed by to the south of the Big Island of Hawaii, however, and tropical storm conditions did not occur anywhere within the watch area. All tropical storm watches were discontinued at 0300 UTC 13 August. Given the proximity of Hilda's track to the Big Island of Hawaii, along with the uncertainty in the track forecast advertised by the models, the tropical storm watch appeared warranted. Once conditions were no longer a threat, the tropical storm watch was cancelled.

Table 1. Best track for Hilda, 6-13 August 2015.

Date/Time (UTC)	Latitude (°N)	Longitude (°W)	Pressure (mb)	Wind Speed (kt)	Stage
06 / 0000	12.4	129.2	1006	30	tropical depression
06 / 0600	12.5	130.3	1006	30	"
06 / 1200	12.6	131.5	1004	35	tropical storm
06 / 1800	12.6	132.8	1001	45	"
07 / 0000	12.6	133.9	999	50	"
07 / 0600	12.6	135.0	997	55	"
07 / 1200	12.5	136.3	994	60	"
07 / 1800	12.6	137.6	987	75	hurricane
08 / 0000	12.8	139.0	967	100	"
08 / 0600	13.1	140.3	966	100	"
08 / 1200	13.3	141.5	953	110	"
08 / 1800	13.6	142.8	937	125	"
09 / 0000	13.9	144.0	946	120	"
09 / 0600	14.2	145.2	950	115	"
09 / 1200	14.5	146.2	963	100	"
09 / 1800	14.8	147.1	964	95	"
10 / 0000	15.1	147.9	970	90	"
10 / 0600	15.5	148.7	974	85	"
10 / 1200	15.9	149.4	974	85	"
10 / 1800	16.2	150.0	976	80	"
11 / 0000	16.6	150.5	978	80	"
11 / 0600	16.8	150.8	981	80	"
11 / 1200	17.0	151.1	985	75	"
11 / 1800	17.0	151.4	989	65	"
12 / 0000	17.1	151.5	992	55	tropical storm
12 / 0600	17.2	151.5	994	50	"
12 / 1200	17.4	151.7	998	45	"
12 / 1800	17.3	151.8	1002	40	"

13 / 0000	17.3	152.2	1003	40	"
13 / 0600	17.2	152.4	1003	40	"
13 / 1200	16.9	153.3	1005	35	"
13 / 1800	16.5	154.2	1007	30	tropical depression
14 / 0000	16.0	155.3	1008	25	low
14 / 0600	15.7	156.2	1008	25	"
14 / 1200	15.5	157.7	1008	25	"
14 / 1800	15.2	159.0	1008	20	"
15 / 0000					dissipated
08 / 1800	13.6	142.8	937	125	minimum pressure and maximum wind

Table 2. Number of hours in advance of formation associated with the first NHC Tropical Weather Outlook forecast in the indicated likelihood category. Note that the timings for the "Low" category do not include forecasts of a 0% chance of genesis.

	Hours Before Genesis	
	48-Hour Outlook	**120-Hour Outlook**
Low (<40%)	72	84
Medium (40%-60%)	48	72
High (>60%)	24	60

Table 3a. NHC official (OFCL) and climatology-persistence skill baseline (OCD5) track forecast errors (n mi) for Hilda. Mean errors for the previous 5-yr period are shown for comparison. Official errors that are smaller than the 5-yr means are shown in boldface type.

	Forecast Period (h)						
	12	24	36	48	72	96	120
OFCL	**21.2**	41.9	70.3	96.4	124.6	158.5	196.2
OCD5	21.0	41.1	61.3	76.5	104.1	151.6	245.3
Forecasts	9	9	9	9	9	9	9
OFCL (2010-14)	23.4	36.4	47.2	59.4	89.0	123.6	159.5
OCD5 (2010-14)	36.6	74.2	116.5	159.7	245.6	331.1	427.4

Table 3b. Homogeneous comparison of selected track forecast guidance models (in n mi) for Hilda. Errors smaller than the NHC official forecast are shown in boldface type. The number of official forecasts shown here will generally be smaller than that shown in Table 3a due to the homogeneity requirement.

Model ID	Forecast Period (h)						
	12	24	36	48	72	96	120
OFCL	21.5	41.3	69.6	92.4	113.2	146.1	181.7
OCD5	22.9	41.8	**60.3**	**74.0**	**99.4**	155.6	271.3
GFSI	22.4	49.5	78.8	101.2	132.9	159.6	**175.4**
EMXI	22.3	44.2	**68.0**	**74.4**	**66.5**	**85.7**	**179.3**
GHMI	28.5	52.3	84.8	121.1	213.2	358.0	498.8
HWFI	22.5	**35.8**	**64.7**	**90.2**	138.8	169.5	**160.8**
EGRI	**20.4**	**34.1**	**52.6**	**77.8**	123.7	181.0	217.6
NVGI	34.9	62.7	82.0	99.4	133.4	201.2	291.2
AEMI	27.8	58.1	89.4	110.8	137.8	163.1	**165.7**
TVCN	**19.7**	**39.8**	**65.2**	**87.1**	119.8	170.7	213.5
LBAR	**15.5**	**32.3**	**40.5**	**45.5**	**62.8**	149.3	284.3
BAMD	**20.8**	**34.7**	**45.0**	**48.5**	**87.2**	225.3	443.3
BAMM	23.2	**39.1**	**50.9**	**64.8**	**100.2**	179.2	286.6
BAMS	46.7	84.8	117.1	138.0	159.9	182.5	224.3
Forecasts	8	8	8	8	8	8	8

Table 4a. NHC official (OFCL) and climatology-persistence skill baseline (OCD5) intensity forecast errors (kt) for Hilda. Mean errors for the previous 5-yr period are shown for comparison. Official errors that are smaller than the 5-yr means are shown in boldface type.

	Forecast Period (h)						
	12	24	36	48	72	96	120
OFCL	11.1	21.7	30.0	32.8	23.9	17.8	**13.3**
OCD5	14.9	25.7	37.8	44.1	29.8	19.3	15.6
Forecasts	9	9	9	9	9	9	9
OFCL (2010-14)	5.9	9.8	12.5	14.0	15.5	16.3	14.9
OCD5 (2010-14)	7.7	12.8	16.4	18.8	21.1	20.9	19.7

Table 4b. Homogeneous comparison of selected intensity forecast guidance models (in kt) for Hilda. Errors smaller than the NHC official forecast are shown in boldface type. The number of official forecasts shown here will generally be smaller than that shown in Table 4a due to the homogeneity requirement.

Model ID	Forecast Period (h)						
	12	24	36	48	72	96	120
OFCL	11.1	21.7	30.0	32.8	23.9	17.8	13.3
OCD5	14.9	25.7	37.8	44.1	29.8	19.3	15.6
IVCN	13.8	26.1	34.4	38.1	25.7	**16.3**	**8.7**
HWFI	14.3	28.9	39.0	45.1	30.6	24.3	17.9
GHMI	16.4	31.8	41.0	43.0	29.2	**14.9**	**8.2**
LGEM	15.6	24.4	34.0	37.2	25.6	18.6	**11.9**
DSHP	14.4	23.3	31.1	34.6	23.9	**16.3**	**9.8**
GFSI	19.3	35.2	46.3	51.4	38.7	26.9	22.7
Forecasts	9	9	9	9	9	9	9

Table 5a. CPHC official (OFCL) and climatology-persistence skill baseline (OCD5) track forecast errors (n mi) for Hilda. Mean OFCL errors for the previous 5-yr period are shown for comparison. Official errors that are smaller than the 5-yr mean are shown in boldface type.

	Forecast Period (h)						
	12	24	36	48	72	96	120
OFCL	**23.4**	**39.6**	59.6	83.6	**113.0**	**164.2**	**244.0**
OCD5	33.2	70.7	118.9	189.8	358.8	527.5	664.9
Forecasts	20	19	17	15	11	7	3
(CP) OFCL (2010-14)	27.9	44.1	56.7	73.9	132.3	183.7	258.9

Table 5b. Homogeneous comparison of selected track forecast guidance models (in n mi) for Hilda. Errors smaller than the CPHC official forecast are shown in boldface type. The number of official forecasts shown here will generally be smaller than that shown in Table 5a due to the homogeneity requirement.

Model ID	Forecast Period (h)						
	12	24	36	48	72	96	120
OFCL	24.3	40.4	60.7	77.0	114.4	165.5	238.4
OCD5	34.3	71.6	120.0	189.5	358.4	517.1	646.3
BAMD	56.6	118.2	181.7	213.8	428.4	682.7	891.1
BAMM	37.3	63.0	81.4	82.5	136.2	246.5	400.9
BAMS	52.3	96.4	136.5	158.1	212.5	225.1	250.1
HWFI	**23.0**	40.7	71.0	100.5	117.8	**107.8**	**99.5**
GHMI	26.5	52.8	94.7	140.2	262.4	455.7	616.7
AVNI	26.5	46.4	67.1	85.8	125.0	**155.4**	**194.9**
AEMI	25.8	40.4	**58.8**	**67.8**	**84.3**	**111.6**	**162.4**
EGRI	31.9	52.4	63.7	**64.1**	**101.4**	**146.2**	**211.2**
NGXI	26.9	55.1	85.9	124.3	220.2	307.7	279.6
CMCI	47.8	72.5	100.7	149.4	247.1	338.0	402.0
EMXI	31.3	49.5	**59.3**	**68.1**	115.9	168.8	**233.1**
TVCN	**19.4**	**37.3**	**58.5**	77.4	**114.3**	168.0	**234.5**
GFEX	**19.7**	**33.2**	**43.2**	**55.2**	**96.5**	**147.1**	**213.4**
Forecasts	19	18	16	12	10	6	2

Table 6a. CPHC official (OFCL) and climatology-persistence skill baseline (OCD5) intensity forecast errors (kt) for Hilda. Mean OFCL errors for the previous 5-yr period are shown for comparison. Official errors that are smaller than the 5-yr mean are shown in boldface type.

	Forecast Period (h)						
	12	24	36	48	72	96	120
OFCL	8.0	**8.4**	**7.6**	**4.3**	**5.5**	**3.6**	**6.7**
OCD5	9.4	11.6	12.6	13.7	6.5	10.6	20.3
Forecasts	20	19	17	15	11	7	3
(CP) OFCL (2010-14)	4.8	8.6	11.6	13.8	18.5	19.3	20.4

Table 6b. Homogeneous comparison of selected intensity forecast guidance models (in kt) for Hilda. Errors smaller than the CPHC official forecast are shown in boldface type. The number of official forecasts shown here will generally be smaller than that shown in Table 6a due to the homogeneity requirement.

Model ID	Forecast Period (h)						
	12	24	36	48	72	96	120
OFCL	7.9	7.8	7.2	4.3	6.1	3.8	5.0
OCD5	9.3	10.6	11.3	12.5	**5.8**	8.5	15.0
HWFI	**7.4**	7.9	**6.9**	5.1	9.7	8.8	10.0
GHMI	9.4	9.4	7.8	6.1	14.6	12.0	22.0
AVNI	8.6	8.7	9.4	12.4	18.9	29.0	19.0
EMXI	9.8	14.3	19.9	28.0	43.6	61.3	54.0
IVCN	**7.7**	7.9	**6.1**	4.5	**5.1**	5.3	**4.0**
SHIP	9.3	10.7	10.7	10.9	15.3	16.3	17.0
DSHIP	9.3	10.7	10.7	10.9	15.3	16.3	17.0
LGEM	8.7	9.7	9.2	9.1	9.1	9.0	11.0
Forecasts	19	18	16	14	9	4	1

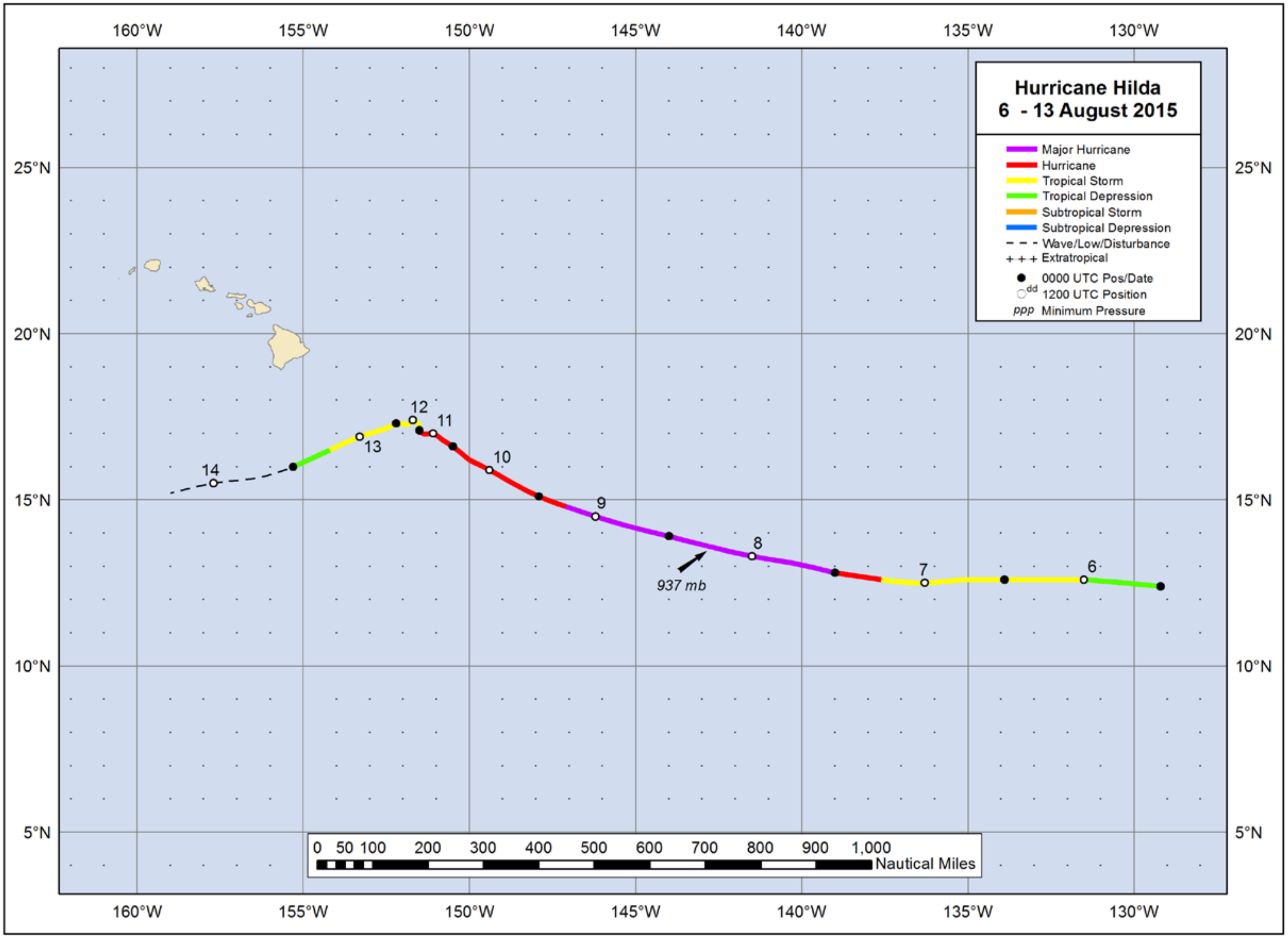


Figure 1. Best track positions for Hurricane Hilda, 6-13 August 2015.

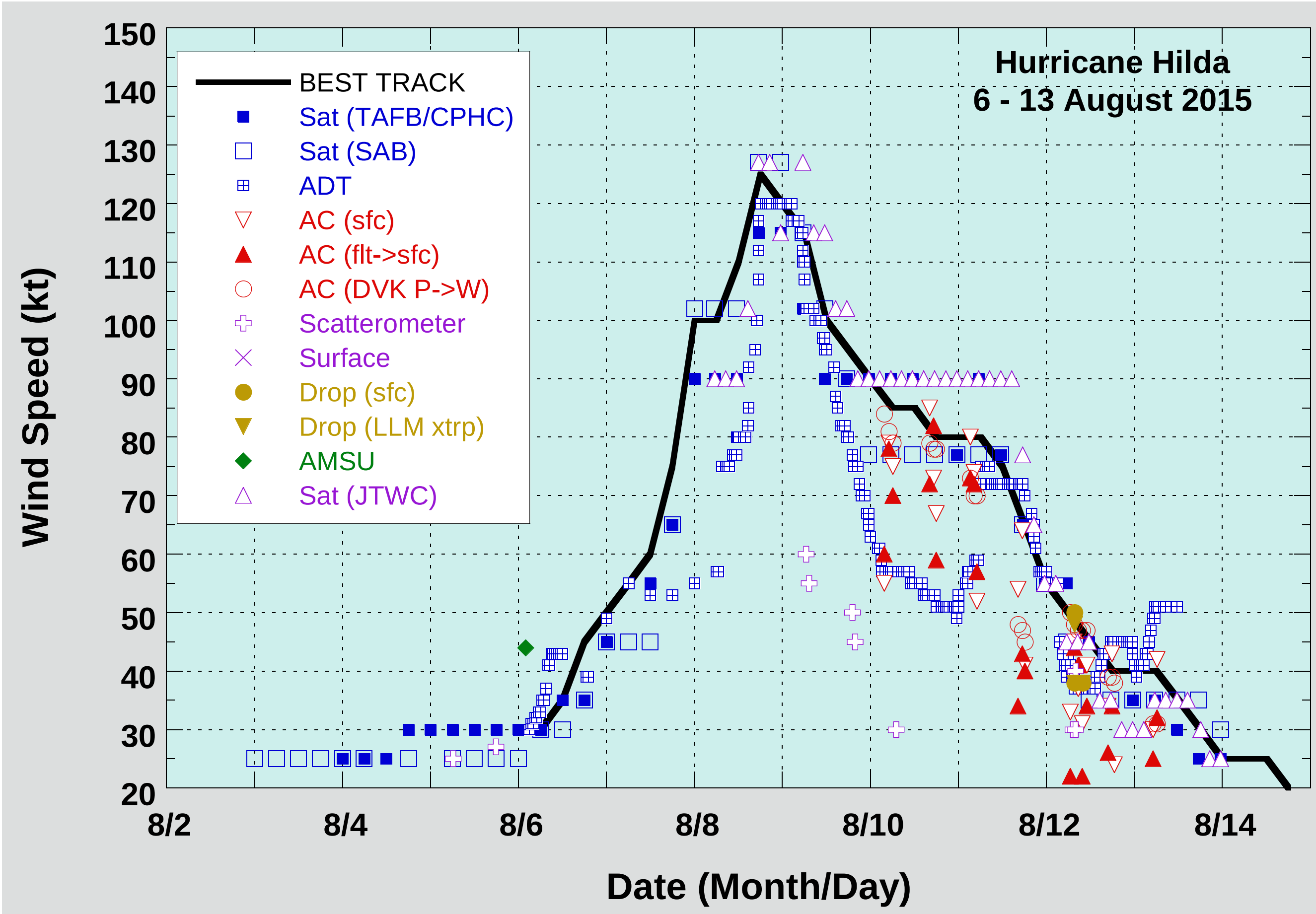


Figure 2. Selected wind observations and best track maximum sustained surface wind speed curve for Hilda. Advanced Dvorak Technique estimates represent the Current Intensity at the nominal observation time. AMSU intensity estimates are from the Cooperative Institute for Meteorological Satellite Studies technique. Aircraft observations have been adjusted for elevation using 90%, 80%, and 80% adjustment factors for observations from 700 mb, 850 mb, and 1500 ft, respectively. Dropwindsonde observations include actual 10 m winds (sfc), as well as surface estimates derived from the mean wind over the lowest 150 m of the wind sounding (LLM extrap).

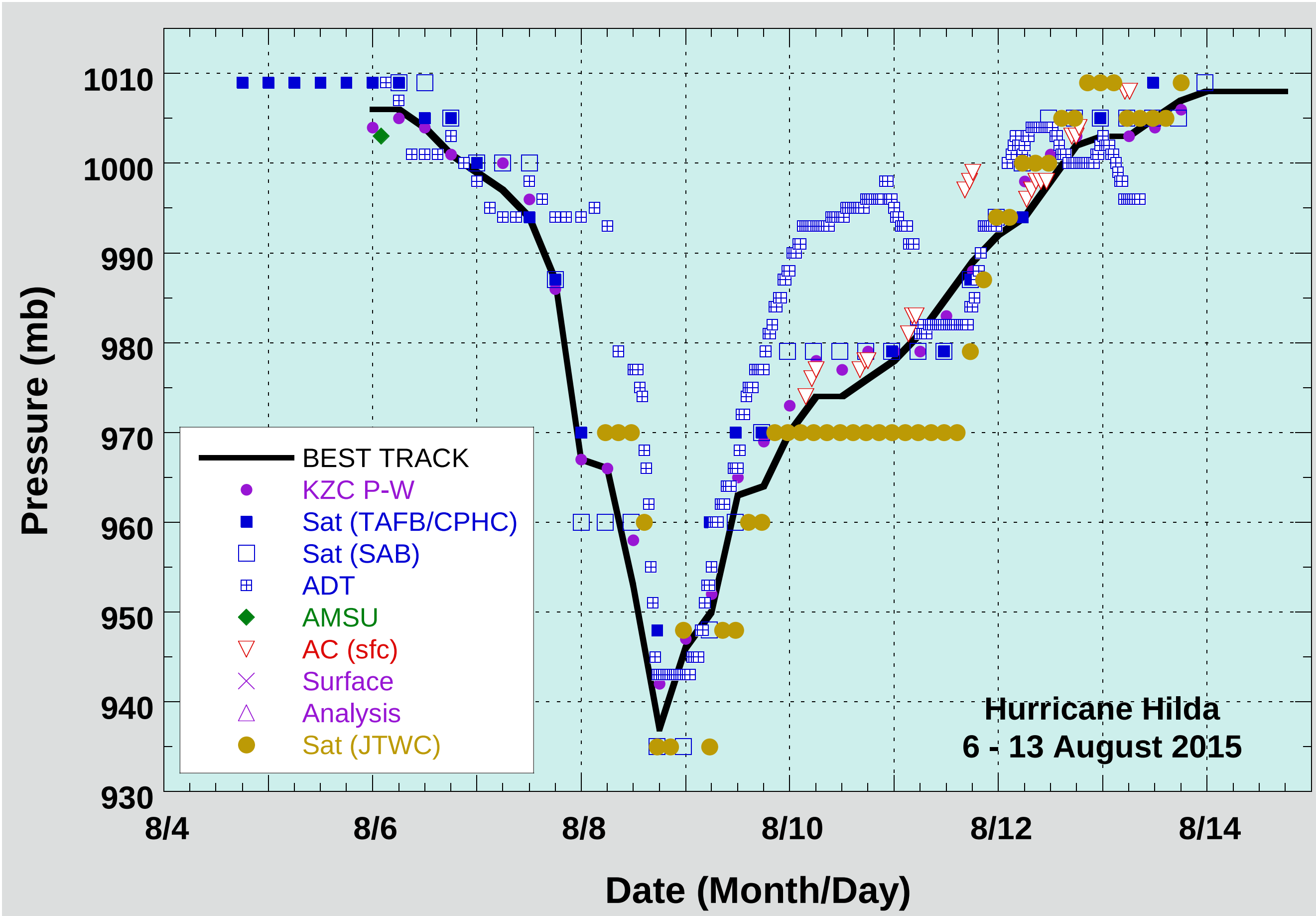


Figure 3. Selected pressure observations and best track minimum central pressure curve for Hilda. Advanced Dvorak Technique estimates represent the Current Intensity at the nominal observation time. AMSU intensity estimates are from the Cooperative Institute for Meteorological Satellite Studies technique. KZC P-W refers to pressure estimates derived using the Knaff-Zehr-Courtney pressure-wind relationship.