NATIONAL HURRICANE CENTER TROPICAL CYCLONE REPORT

HURRICANE HILDA

(EP082021)

30 July–6 August 2021

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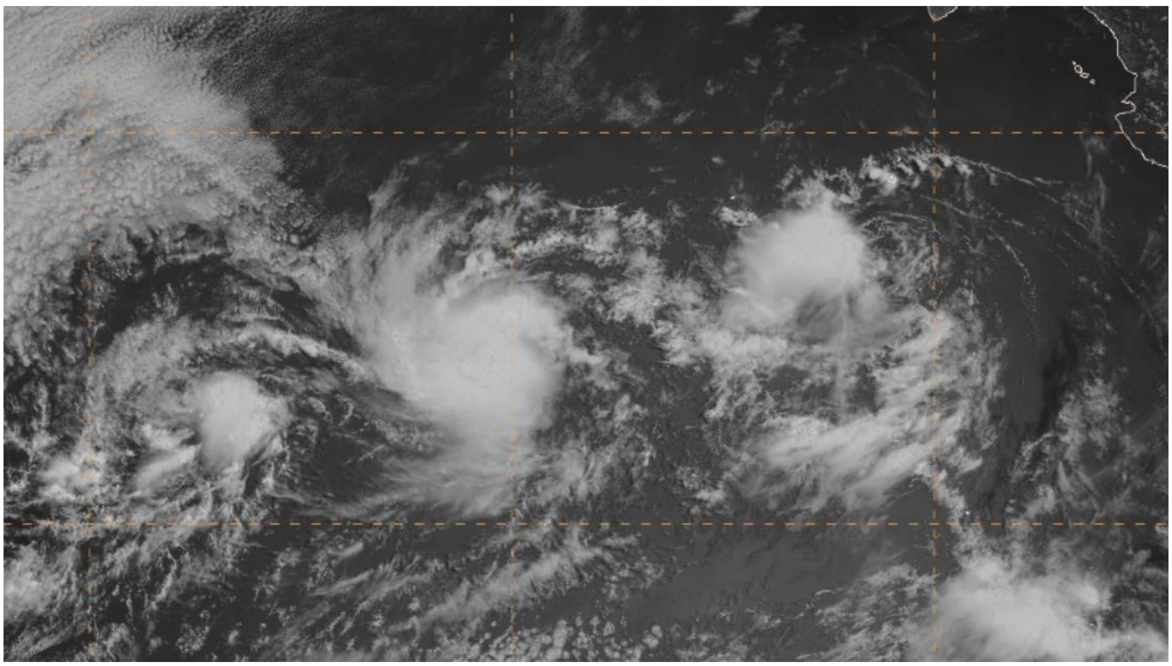

GOES-17 VISIBLE IMAGE OF HURRICANE HILDA AT 1800 UTC 1 AUGUST 2021 (CENTER) NEAR PEAK INTENSITY, WITH THE REMNANTS OF TD 9-E (LATER TROPICAL STORM JIMENA, LEFT) AND DEVELOPING TROPICAL STORM IGNACIO (RIGHT)

Hilda rapidly intensified into a hurricane well offshore of southwestern Mexico before easterly shear and cooler waters gradually caused the system to weaken while it moved farther away from land.

Hurricane Hilda

30 JULY–6 AUGUST 2021

SYNOPTIC HISTORY

Hilda formed from a westward-moving low-latitude tropical wave that was first evident over northern South America on 21 July. The wave had a large increase in convection while it moved across Central America, emerging into the eastern Pacific on 24 July. Sporadic bursts of convection occurred for the next couple of days until a larger convective burst formed on 27 July. This thunderstorm activity left behind broad low- and mid-level circulations early the next day, several hundred miles south of Manzanillo, Mexico. While deep convection periodically formed near the center between 28–29 July, helping to generate a stronger wind field, scatterometer data on 29 July indicated that the low-level circulation was elongated and lacked a well-defined center. Outflow boundaries on satellite imagery (not shown) also suggested dry mid-level air in the northern portion of the circulation was inhibiting development of the system during this period. However, the surface low became better organized overnight with a burst of convection near the broad center, and since the low already had gale-force winds, this convection also led to the formation of a tropical storm near 1200 UTC 30 July about 675 n mi south of the southern tip of the Baja California peninsula. The "best track" chart of Hilda'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[1].

Over marginally warm waters and within light vertical shear conditions, Hilda rapidly intensified that night, becoming a hurricane the next day and reaching a peak intensity of 75 kt on 1 August. This conducive environment did not last long, however, with increasing northeasterly shear (partially from developing Tropical Storm Ignacio to the east – cover image) causing the low- and mid-level circulations to be become somewhat displaced that day. The hurricane moved toward the west-northwest or northwest after genesis due to a ridge of high pressure to the north, and that ridge steered Hilda on that general course throughout its lifetime. Hilda generally maintained its strength on 2 August in the marginal environment, but more substantial weakening started on 3 August due to the cyclone moving over cooler waters, with the cyclone becoming a tropical storm again early on 3 August. The vertical wind shear became light again on 4 August, allowing Hilda's weakening trend to pause that day. A combination of increasing shear and cooler waters forced further decay on 5 August, and Hilda became a tropical depression by the end of the day. Deep convection ceased by 0600 UTC 6 August, marking the transition of Hilda into a remnant low about 1250 n mi west of the southern tip of the Baja California peninsula. The low

[1] 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.

turned westward within the low-level trade winds and degenerated into a trough of low pressure early the next day.

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) and the Satellite Analysis Branch (SAB), objective Advanced Dvorak Technique (ADT) estimates, and Satellite Consensus (SATCON) 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.

The 75-kt peak intensity of Hilda is based on satellite estimates of about 75 kt from SAB and SATCON. While higher estimates were received from TAFB and ADT, microwave data did not show a well-organized cyclone, and the low- and mid-level centers were not well aligned near peak intensity. Consequently, the peak winds of Hilda have been analyzed on the lower side of the satellite intensity estimates.

There were no ship reports of winds of tropical storm force in association with Hilda.

CASUALTY AND DAMAGE STATISTICS

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

FORECAST AND WARNING CRITIQUE

The genesis of Hilda was well anticipated at long range, but not as well at short range (Table 2). The potential for tropical cyclone formation was first mentioned in the Tropical Weather Outlook 132 h prior to formation, with the system raised to the medium (40–60%) category 108 h prior to genesis. However, the system was first given non-zero 2-day probabilities only 36 h before formation, and the 2-day probabilities were raised to the high (>60%) category 18 h before genesis occurred. The GFS model (which NHC leaned toward) had a poor set of genesis forecasts a few days before Hilda formed (after initially showing genesis at long range), although the ECMWF and CMC models were more consistent in showing the potential for tropical cyclone formation.

A verification of NHC official track forecasts for Hilda is given in Table 3a. Official track forecast errors were lower than the mean official errors for the previous 5-year period at all verifying times through 72 h, then somewhat above the 5-year mean thereafter (for a small sample at long-range). A homogeneous comparison of the official track errors with selected guidance models is given in Table 3b. The official track forecasts (OFCL) were better than much of the single-model deterministic forecast guidance, with only the ECMWF model (EMXI) somewhat better at long range. The consensus models GFEX and TVCX were the best available guidance, outperforming the official forecast at some time ranges, while the regional hurricane models HWRF (HWFI) and HMON (HMNI) had relatively poor track forecasts.

A verification of NHC official intensity forecasts for Hilda is given in Table 4a. Official intensity errors were lower or much lower than the previous 5-year average error at all time ranges. This is impressive given the initial rapid intensification phase and the high climatology/persistence errors (OCD5) at long range, suggesting substantial forecast skill. A homogeneous comparison of the official intensity errors with selected guidance models is given in Table 4b. Despite the very low OFCL errors, many of the consensus aids and even some of the single-model deterministic guidance bested OFCL beyond 12 h. This seems to be due to OFCL slightly over-forecasting the peak intensity and being too slow to bring down the wind speeds at long range (high bias). The HMON model had a very good set of forecasts for Hilda, while the Decay-SHIPS (DSHP) model struggled with this hurricane.

There were no land-based watches or warnings issued for Hilda.

Table 1. Best track for Hurricane Hilda, 30 July–6 August 2021.

Date/Time (UTC)	Latitude (°N)	Longitude (°W)	Pressure (mb)	Wind Speed (kt)	Stage
30 / 1200	11.9	111.8	1004	35	tropical storm
30 / 1800	12.3	113.0	1003	40	"
31 / 0000	12.7	114.1	1002	45	"
31 / 0600	13.2	115.2	1000	50	"
31 / 1200	13.6	116.3	997	55	"
31 / 1800	14.0	117.4	991	65	hurricane
01 / 0000	14.2	118.3	985	75	"
01 / 0600	14.4	119.0	985	75	"
01 / 1200	14.5	119.7	985	75	"
01 / 1800	14.6	120.4	985	75	"
02 / 0000	14.8	121.1	988	70	"
02 / 0600	15.0	121.7	988	70	"
02 / 1200	15.3	122.2	988	70	"
02 / 1800	15.7	122.7	988	70	"
03 / 0000	16.2	123.2	991	65	"
03 / 0600	16.7	123.7	994	60	tropical storm
03 / 1200	17.2	124.3	997	55	"
03 / 1800	17.6	124.8	1000	50	"
04 / 0000	18.1	125.5	1002	45	"
04 / 0600	18.5	126.2	1004	40	"
04 / 1200	18.9	126.9	1004	40	"
04 / 1800	19.2	127.6	1004	40	"

Date/Time (UTC)	Latitude (°N)	Longitude (°W)	Pressure (mb)	Wind Speed (kt)	Stage
05 / 0000	19.5	128.2	1004	40	"
05 / 0600	20.0	128.8	1004	40	"
05 / 1200	20.6	129.7	1005	35	"
05 / 1800	21.3	130.7	1005	35	"
06 / 0000	22.0	131.7	1006	30	tropical depression
06 / 0600	22.5	132.8	1006	30	low
06 / 1200	22.8	133.6	1008	25	"
06 / 1800	22.8	134.3	1008	25	"
07 / 0000	22.6	134.7	1008	25	"
07 / 0600					dissipated
01 / 0000	14.2	118.3	985	75	maximum winds and minimum pressure

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%)	36	132
Medium (40%-60%)	30	108
High (>60%)	18	30

Table 3a. NHC official (OFCL) and climatology-persistence skill baseline (OCD5) track forecast errors (n mi) for Hurricane Hilda, 30 July–6 August 2021. 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	60	72	96	120
OFCL	**20.7**	**31.1**	**36.4**	**41.5**	**48.9**	**57.5**	98.0	160.1
OCD5	29.6	57.1	85.4	119.0	155.4	202.0	283.1	357.9
Forecasts	24	22	20	18	16	14	10	6
OFCL (2016-20)	21.3	33.1	44.0	54.6	78.4	76.0	95.9	116.6
OCD5 (2016-20)	33.1	69.4	107.8	147.0	186.4	219.7	280.2	342.0

Table 3b. Homogeneous comparison of selected track forecast guidance models (in n mi) for Hurricane Hilda, 30 July–6 August 2021. 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	60	72	96	120
OFCL	21.6	30.0	35.5	42.1	53.0	59.3	105.4	156.1
OCD5	33.9	60.9	94.0	135.9	174.4	210.4	301.1	387.6
EGRI	23.5	40.5	62.4	97.4	150.0	187.2	269.6	**88.1**
HMNI	25.2	38.0	61.5	97.8	124.1	157.8	292.1	447.3
HWFI	**21.5**	37.3	53.4	74.9	108.2	135.9	292.2	411.2
GFSI	23.6	38.5	52.4	57.2	68.7	78.6	142.4	242.5
GFEX	21.7	34.2	43.3	45.3	**48.4**	**49.4**	**68.0**	**155.5**
EMXI	21.9	34.5	52.3	59.4	61.5	71.8	**78.5**	**138.8**
CMCI	27.2	47.9	70.7	97.1	112.2	154.3	272.8	327.5
CTCI	25.1	35.8	52.8	78.4	94.0	131.5	137.8	208.0
AEMI	23.1	35.7	46.4	54.5	61.8	65.8	113.3	182.1
FSSE	**19.9**	32.5	40.7	47.4	55.5	61.1	**81.9**	170.6
HCCA	**20.1**	**29.2**	37.8	44.6	54.0	60.8	135.0	195.6
TVCN	**20.7**	31.3	37.6	45.3	56.1	65.7	116.8	170.4
TVCE	**20.7**	32.0	37.6	51.6	64.7	77.7	140.8	205.8
TVCX	**21.1**	**29.7**	36.8	42.9	**51.6**	**59.2**	**101.3**	**154.8**
TVDG	**21.4**	31.9	37.3	44.5	57.3	68.1	115.3	**140.2**
TABS	25.2	48.6	70.4	81.3	90.8	112.4	204.7	330.6
TABM	26.3	49.9	74.4	86.0	94.2	123.4	218.6	311.7
TABD	31.0	61.0	80.1	97.5	119.8	138.6	210.5	256.5
Forecasts	16	15	15	13	11	11	7	3

Table 4. NHC official (OFCL) and climatology-persistence skill baseline (OCD5) intensity forecast errors (kt) for Hurricane Hilda, 30 July–6 August 2021. 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	60	72	96	120
OFCL	**4.8**	**7.0**	**7.0**	**6.1**	**7.5**	**8.2**	**9.5**	**9.2**
OCD5	6.0	8.9	10.8	12.6	17.6	19.5	21.9	17.5
Forecasts	24	22	20	18	16	14	10	6
OFCL (2016-20)	5.6	9.0	10.9	12.6	15.2	15.3	16.0	16.7
OCD5 (2016-20)	7.2	12.0	15.3	17.6	17.9	20.4	21.2	20.8

Table 4b. Homogeneous comparison of selected intensity forecast guidance models (in kt) for Hurricane Hilda, 30 July–6 August 2021. 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	60	72	96	120
OFCL	4.4	7.0	8.0	6.5	8.6	9.1	10.0	9.0
OCD5	6.2	8.8	10.9	13.7	19.3	20.5	21.1	18.6
HCCA	5.2	**5.3**	**5.9**	**5.5**	**9.4**	9.5	**9.0**	**6.6**
FSSE	4.6	**4.8**	**5.2**	**6.4**	10.0	11.5	11.4	10.6
IVCN	5.1	**5.5**	**4.9**	**3.8**	**6.2**	**7.3**	**9.7**	**8.2**
DSHP	6.2	8.2	10.5	11.2	12.8	14.5	18.3	16.2
LGEM	6.6	9.2	10.1	9.8	9.7	**8.7**	10.7	9.4
HWFI	6.4	**5.5**	**4.1**	**5.8**	9.6	12.0	15.9	10.6
HMNI	5.2	**3.3**	**3.7**	**4.4**	**4.6**	**6.5**	**8.1**	**3.4**
IVDR	5.1	**5.0**	**3.8**	**3.2**	**6.1**	**6.8**	**8.9**	**6.6**
CTCI	5.4	**6.3**	**6.7**	7.3	9.6	11.5	10.1	10.2
GFSI	6.2	7.1	**7.5**	8.1	**7.0**	**6.2**	**7.3**	**4.6**
EMXI	6.4	9.1	11.3	15.2	15.5	13.5	**9.3**	**7.0**
Forecasts	16	15	15	13	11	11	7	5

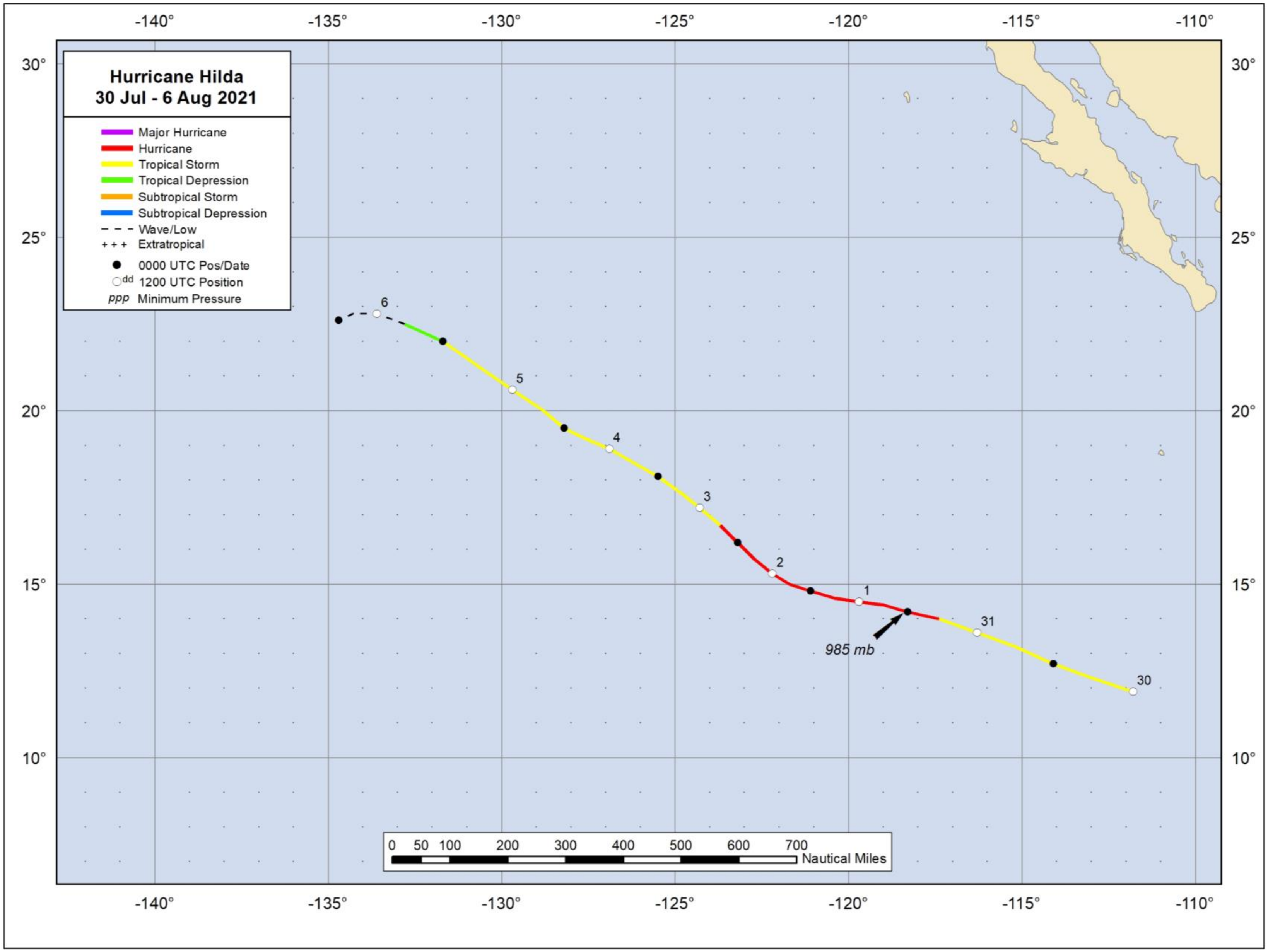

Figure 1. Best track positions for Hurricane Hilda, 30 July–6 August 2021.

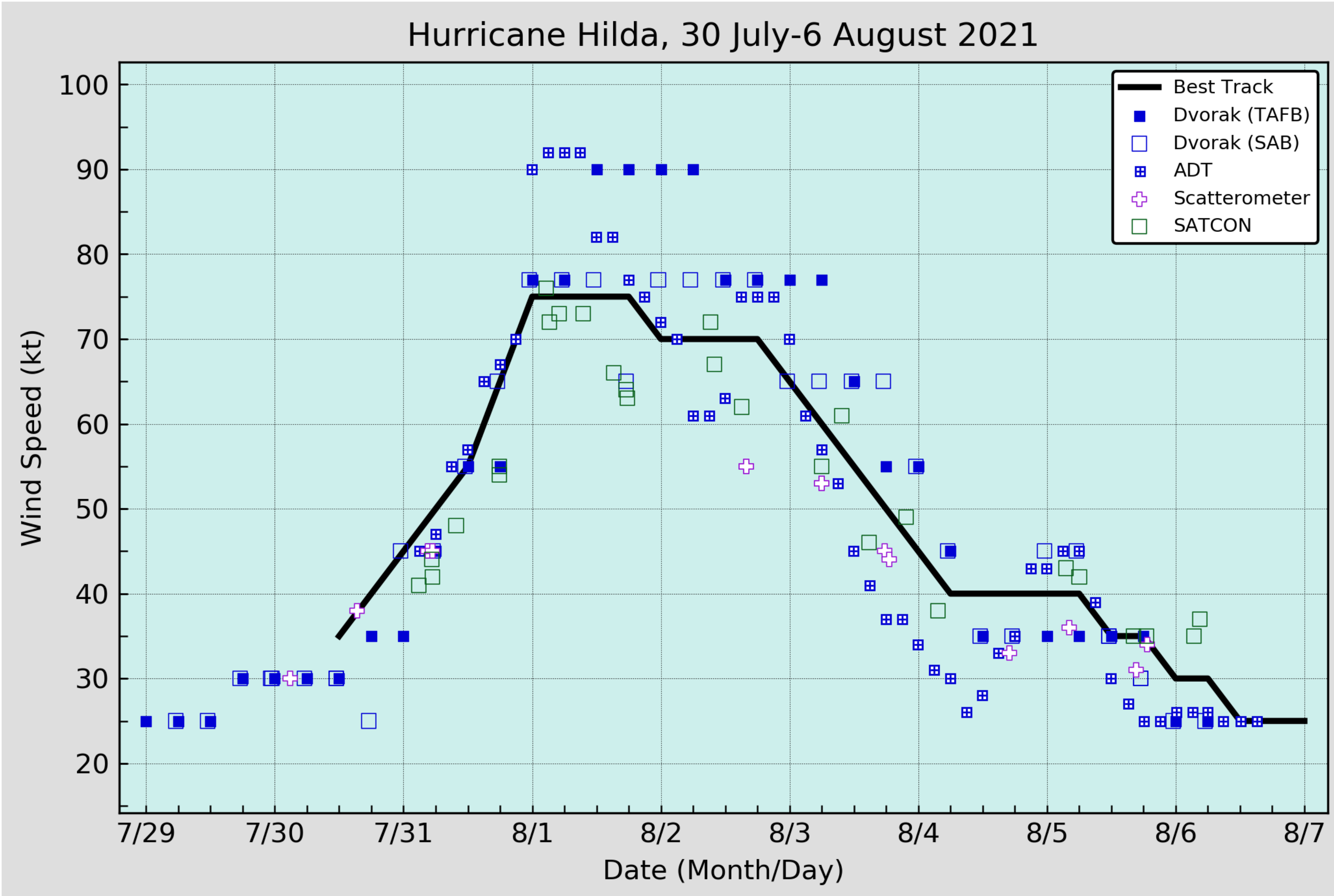

Figure 2. Selected wind observations and best track maximum sustained surface wind speed curve for Hurricane Hilda, 30 July–6 August 2021. Advanced Dvorak Technique estimates represent the Current Intensity at the nominal observation time. SATCON intensity estimates are from the Cooperative Institute for Meteorological Satellite Studies. Dashed vertical lines correspond to 0000 UTC.

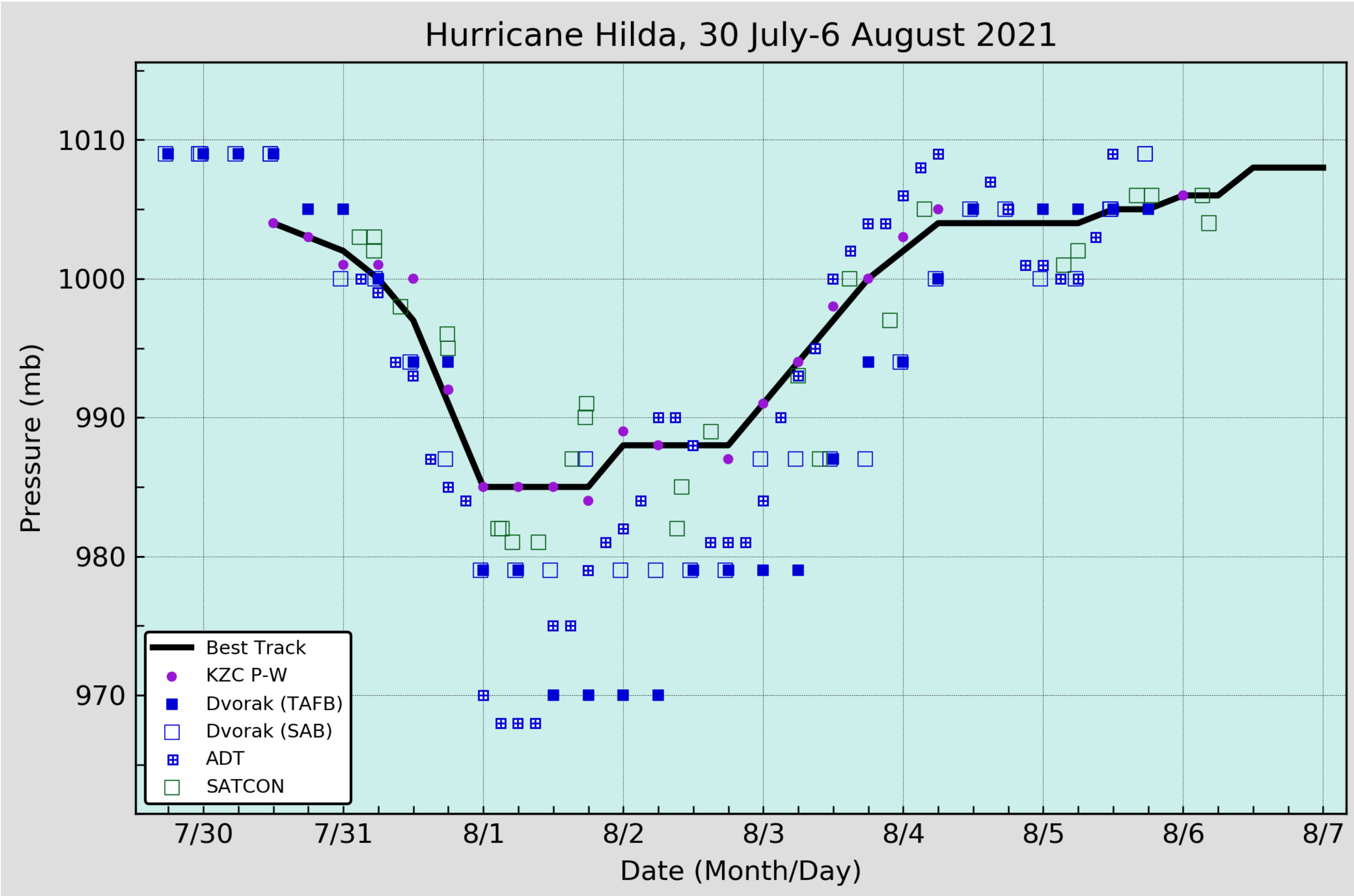

Figure 3. Selected pressure observations and best track minimum central pressure curve for Hurricane Hilda, 30 July–6 August 2021. Advanced Dvorak Technique estimates represent the Current Intensity at the nominal observation time. SATCON intensity estimates are from the Cooperative Institute for Meteorological Satellite Studies. KZC P-W refers to pressure estimates derived using the Knaff-Zehr-Courtney pressure-wind relationship. Dashed vertical lines correspond to 0000 UTC.