NATIONAL HURRICANE CENTER TROPICAL CYCLONE REPORT

TROPICAL DEPRESSION TEN-E

(EP102020)

13–16 August 2020

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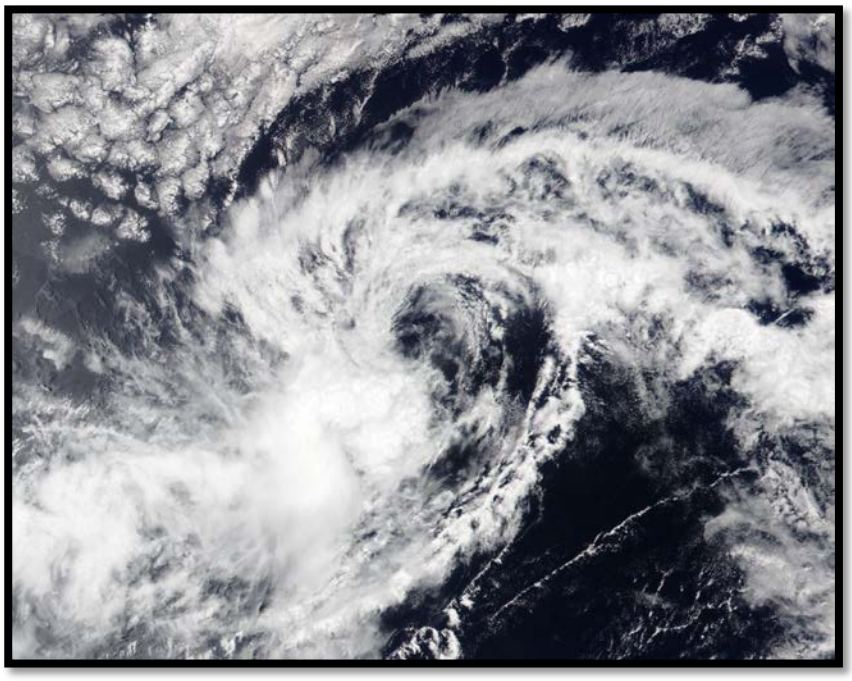

NOAA-20/VISIBLE INFRARED IMAGING RADIOMETER SUITE (VIIRS) IMAGERY OF TROPICAL DEPRESSION TEN-E AT 2220 UTC 14 AUGUST 2020. IMAGE COURTESY OF NASA EOSDIS WORLDVIEW.

Tropical Depression Ten-E developed over the western part of the eastern North Pacific basin along the monsoon trough and remained over open waters during its life cycle.

Tropical Depression Ten-E

13–16 AUGUST 2020

SYNOPTIC HISTORY

Tropical Depression Ten-E originated from an area of disturbed weather that developed along the eastern North Pacific monsoon trough on 11 August, over 1000 n mi southwest of the southern tip of the Baja California peninsula. As the disturbance propagated westward, bursts of deep convection led to the formation of an area of low pressure on 12 August. A small band of convection developed to the southwest of the low-pressure system late on 12 August, and then deepened and became better organized around the low early on 13 August. Around this time, scatterometer surface wind data revealed a well-defined, closed low-level circulation with 25 to 30 kt winds. Therefore, a tropical depression is estimated to have formed at 0600 UTC 13 August over 1400 n mi west-southwest of the southern tip of the Baja California peninsula. 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[1].

The depression's development was disrupted by moderate to strong northeasterly vertical wind shear throughout its life. Despite adequate oceanic heat content with sea surface temperatures of 27–28°C along its track, strengthening was inhibited as the sheared tropical cyclone contended with dry mid-level air in its surrounding environment and struggled to sustain organized, deep convection near and over its center (cover image). The depression initially moved west-northwestward to westward along the southern periphery of a low- to mid-level ridge. The cyclone turned slowly toward the west-southwest on 14 August as the weakening ridge shifted to the northwest of the depression, and then the cyclone became nearly stationary on 15 August as the low-level steering currents collapsed. Later that day, the low-level center of the depression was completely exposed as the remaining convection was displaced to the south-southwest by strong northeasterly wind shear. A final burst of deep convection occurred to the south of the cyclone early on 16 August but weakened shortly thereafter, and the depression became a post-tropical cyclone by 1200 UTC that day. The remnant low briefly moved north-northwestward, and then it accelerated westward as it was steered by a high-pressure ridge building well to its north. A small burst of convection occurred near the low early on 17 August, but it was not enough for the system to regain tropical cyclone status. Scatterometer data indicated that the remnant low opened up into a trough just after 1800 UTC 17 August, when it was located about 1100 n mi east-southeast of the island of Hawaii.

[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.

METEOROLOGICAL STATISTICS

Observations in Tropical Depression Ten-E (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 of Tropical Depression Ten-E.

The maximum intensity of Ten-E is estimated to be 30 kt, primarily based on scatterometer data as well as Dvorak intensity estimates from TAFB and SAB. Note that the T3.0/45 kt subjective Dvorak intensity estimates shown in Fig. 2 at 1800 UTC 13 August and 0000 UTC 14 August were deemed too high and likely unrepresentative of the cyclone's intensity at that time. These estimates were determined using the Dvorak technique's shear pattern, which is highly dependent on the placement of the center and is often not clear cut for weaker systems. The other Dvorak classifications and objective satellite intensity estimates during this period were between 30–33 kt. In addition, ASCAT-A and -B passes at 0532 UTC 13 August and 0626 UTC 14 August, respectively, showed peak winds around 30 kt. Therefore, the final best track intensity is set at 30 kt based on the preponderance of the data.

The estimated minimum central pressure of 1004 mb is based on the Knaff-Zehr-Courtney pressure wind relationship.

CASUALTY AND DAMAGE STATISTICS

There were no reports of damage or casualties associated with Tropical Depression Ten-E.

FORECAST AND WARNING CRITIQUE

The genesis of Tropical Depression Ten-E was well forecast. Table 2 provides the number of hours in advance of formation with the first NHC Tropical Weather Outlook (TWO) forecast in each likelihood category. There was a consistent signal for genesis in the global models well before the incipient perturbation developed, and the potential formation of Ten-E was introduced in the low (<40%) category of the 5-day Tropical Weather Outlook (TWO) 96 h before genesis. The 5-day genesis probabilities were increased to the medium (40–60%) and high (>60%) categories 84 h and 54 h before Ten-E formed, respectively. A low genesis probability was introduced in the 2-day TWO 60 h before genesis. The 2-day genesis probabilities were increased to the medium and high categories 36 h and 18 h before formation, respectively.

A verification of NHC official track forecasts for Tropical Depression Ten-E is given in Table 3a. Official forecast track errors (OFCL) were lower than the mean official errors for the previous 5-yr period at all available forecast lead times; however, there were no verifying forecasts at 96 or 120 h. The climatology and persistence errors (OCD5) were well above their 5-yr means, which suggest that the track of Ten-E was more challenging-than-average to forecast. A homogeneous comparison of the official track errors with selected guidance models is given in Table 3b. Overall, the NHC official forecast performed well compared to the guidance. The Global Forecast System (GFSI) was the best-performing global model and slightly outperformed OFCL at most verifying forecast times.

A verification of NHC official intensity forecasts for Tropical Depression Ten-E is given in Table 4a. Similar to the track forecast, OFCL intensity errors were much lower than the mean official errors for the previous 5-yr period at all available forecast times. A homogeneous comparison of the official intensity errors with selected guidance models is given in Table 4b. The ECMWF model (EMXI) was one of the better performing intensity models for Ten-E, along with the intensity variable consensus aid (IVCN). Early NHC forecasts called for Ten-E to strengthen into a minimal tropical storm, but the depression was unable to overcome the persistent vertical wind shear and, thus, never intensified.

No coastal watches and warnings were issued in association with Tropical Depression Ten-E.

Table 1. Best track for Tropical Depression Ten-E, 13–16 August 2020.

Date/Time (UTC)	Latitude (°N)	Longitude (°W)	Pressure (mb)	Wind Speed (kt)	Stage
12 / 1800	13.1	127.1	1006	25	low
13 / 0000	13.3	127.9	1005	25	"
13 / 0600	13.5	128.8	1004	30	tropical depression
13 / 1200	13.7	129.5	1004	30	"
13 / 1800	14.0	130.3	1004	30	"
14 / 0000	14.1	130.9	1004	30	"
14 / 0600	14.0	131.4	1004	30	"
14 / 1200	13.8	131.9	1004	30	"
14 / 1800	13.6	132.5	1004	30	"
15 / 0000	13.4	133.0	1004	30	"
15 / 0600	13.3	133.3	1004	30	"
15 / 1200	13.2	133.5	1004	30	"
15 / 1800	13.1	133.7	1004	30	"
16 / 0000	13.1	133.8	1005	30	"
16 / 0600	13.3	133.8	1006	30	"
16 / 1200	13.6	133.9	1007	25	low
16 / 1800	14.1	134.0	1007	25	"
17 / 0000	14.5	134.1	1007	25	"
17 / 0600	14.8	134.6	1007	25	"
17 / 1200	14.9	135.4	1008	20	"
17 / 1800	15.0	136.2	1009	20	"
18 / 0000					dissipated
13 / 0600	13.5	128.8	1004	30	maximum wind and minimum pressure

Table 2. Number of hours in advance of formation of Ten-E 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%)	60	96
Medium (40%–60%)	36	84
High (>60%)	18	54

Table 3a. NHC official (OFCL) and climatology-persistence skill baseline (OCD5) track forecast errors (n mi) for Tropical Depression Ten-E, 13–16 August 2020. 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	**18.2**	**21.3**	**26.8**	**32.6**	**38.5**	**50.7**		
OCD5	35.6	83.9	139.6	214.2	277.2	334.6		
Forecasts	11	9	7	5	3	1		
OFCL (2015-19)	21.8	34.0	44.9	55.3	66.2	77.1		
OCD5 (2015-19)	34.3	69.9	108.7	146.8	181.4	216.0		

Table 3b. Homogeneous comparison of selected track forecast guidance models (in n mi) for Tropical Depression Ten-E, 13–16 August 2020. 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	18.9	23.9	31.4	31.7	32.2	50.7		
OCD5	37.7	86.1	138.2	218.3	277.4	334.6		
GFSI	**18.0**	**23.1**	**26.2**	**25.1**	33.4	**44.7**		
HMNI	**17.4**	28.9	42.9	54.9	93.2	105.8		
HWFI	21.1	34.3	40.4	44.0	45.3	62.9		
EGRI	21.9	41.1	63.7	87.2	96.2	129.6		
EMXI	19.2	27.0	**30.4**	37.5	56.0	123.6		
CMCI	48.1	112.0	196.2	223.2	207.1	144.2		
NVGI	51.6	94.0	118.2	133.5	150.1	167.1		
AEMI	24.6	50.8	87.6	110.0	82.0	**41.3**		
HCCA	**17.3**	27.9	39.8	42.3	**20.8**	**29.7**		
TVCX	**16.7**	26.3	32.2	31.9	**29.6**	50.7		
GFEX	**16.5**	**22.4**	**24.1**	**25.4**	39.0	71.9		
TVCE	**16.6**	25.3	31.8	35.6	**18.9**	**16.7**		
TVDG	**17.4**	26.0	34.6	36.6	**31.5**	57.7		
TABD	45.7	99.8	163.8	256.5	344.7	435.2		
TABM	27.8	47.5	68.7	116.3	163.9	194.3		
TABS	20.7	40.5	65.9	78.9	114.1	141.9		
Forecasts	9	7	5	4	2	1		

Table 4a. NHC official (OFCL) and climatology-persistence skill baseline (OCD5) intensity forecast errors (kt) for Tropical Depression Ten-E, 13–16 August 2020. 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	**0.9**	**1.7**	**2.1**	**3.0**	**1.7**	**5.0**		
OCD5	4.3	6.7	10.1	12.8	23.3	27.0		
Forecasts	11	9	7	5	3	1		
OFCL (2015-19)	6.0	9.9	12.1	13.5	14.5	15.4		
OCD5 (2015-19)	7.8	13.0	16.6	18.9	20.2	21.4		

Table 4b. Homogeneous comparison of selected intensity forecast guidance models (in kt) for Tropical Depression Ten-E, 13–16 August 2020. 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	1.0	1.9	2.5	3.0	1.7	5.0		
OCD5	4.3	6.8	10.3	12.8	23.3	27.0		
HMNI	3.0	2.1	3.2	5.0	7.7	6.0		
HWFI	1.4	2.5	3.7	5.8	5.3	7.0		
HCCA	2.0	2.8	**1.8**	**1.2**	2.0	**3.0**		
GFSI	1.9	2.2	**1.5**	3.4	6.0	6.0		
EMXI	1.9	**1.4**	**1.0**	**2.2**	3.0	**4.0**		
DSHP	1.4	**1.6**	**2.3**	3.2	4.7	7.0		
LGEM	1.5	2.6	**2.3**	**2.6**	3.0	**4.0**		
IVCN	1.2	**1.1**	**1.0**	**1.6**	2.3	**2.0**		
Forecasts	10	8	6	5	3	1		

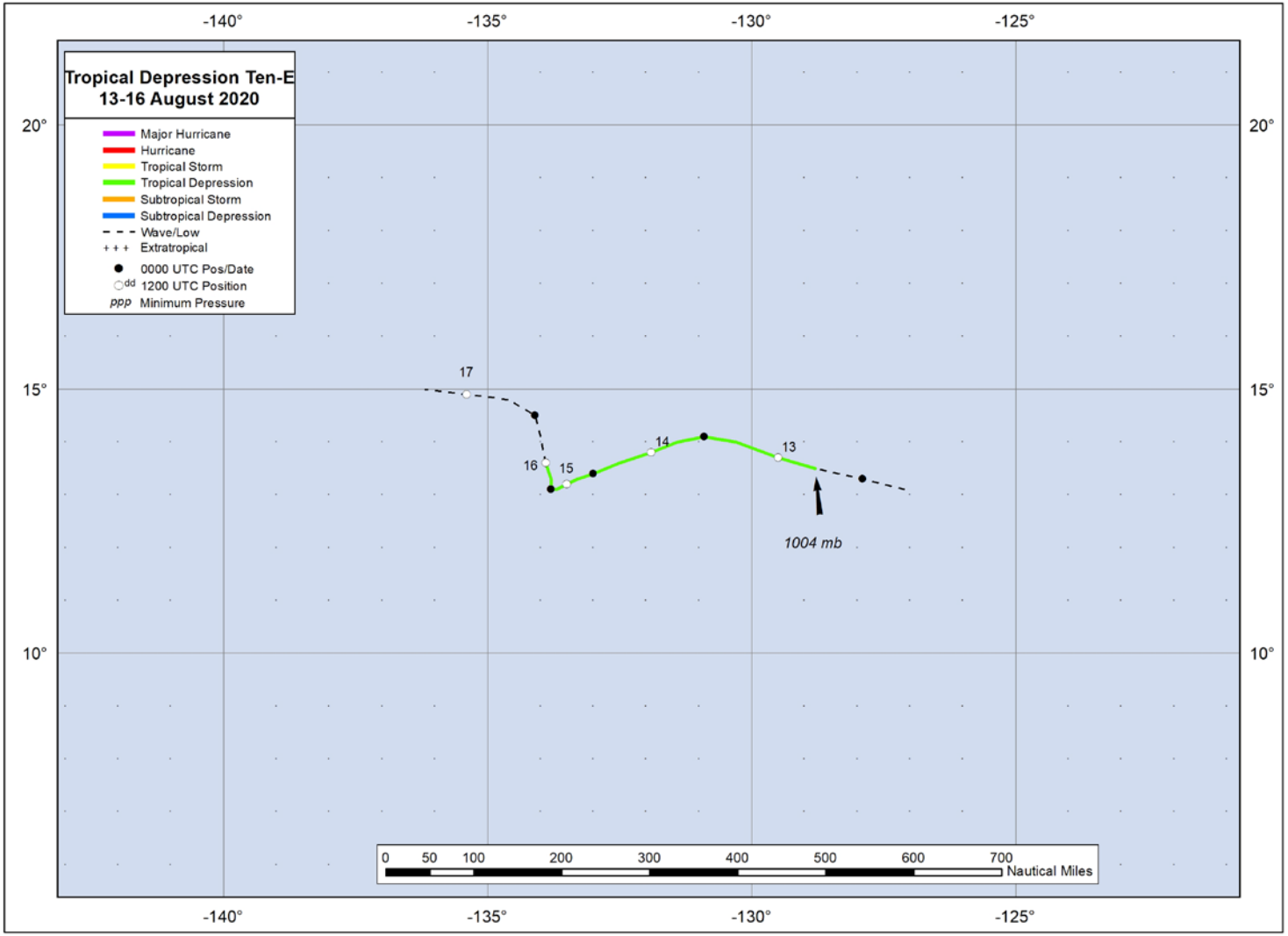

Figure 1. Best track positions for Tropical Depression Ten-E, 13–16 August 2020.

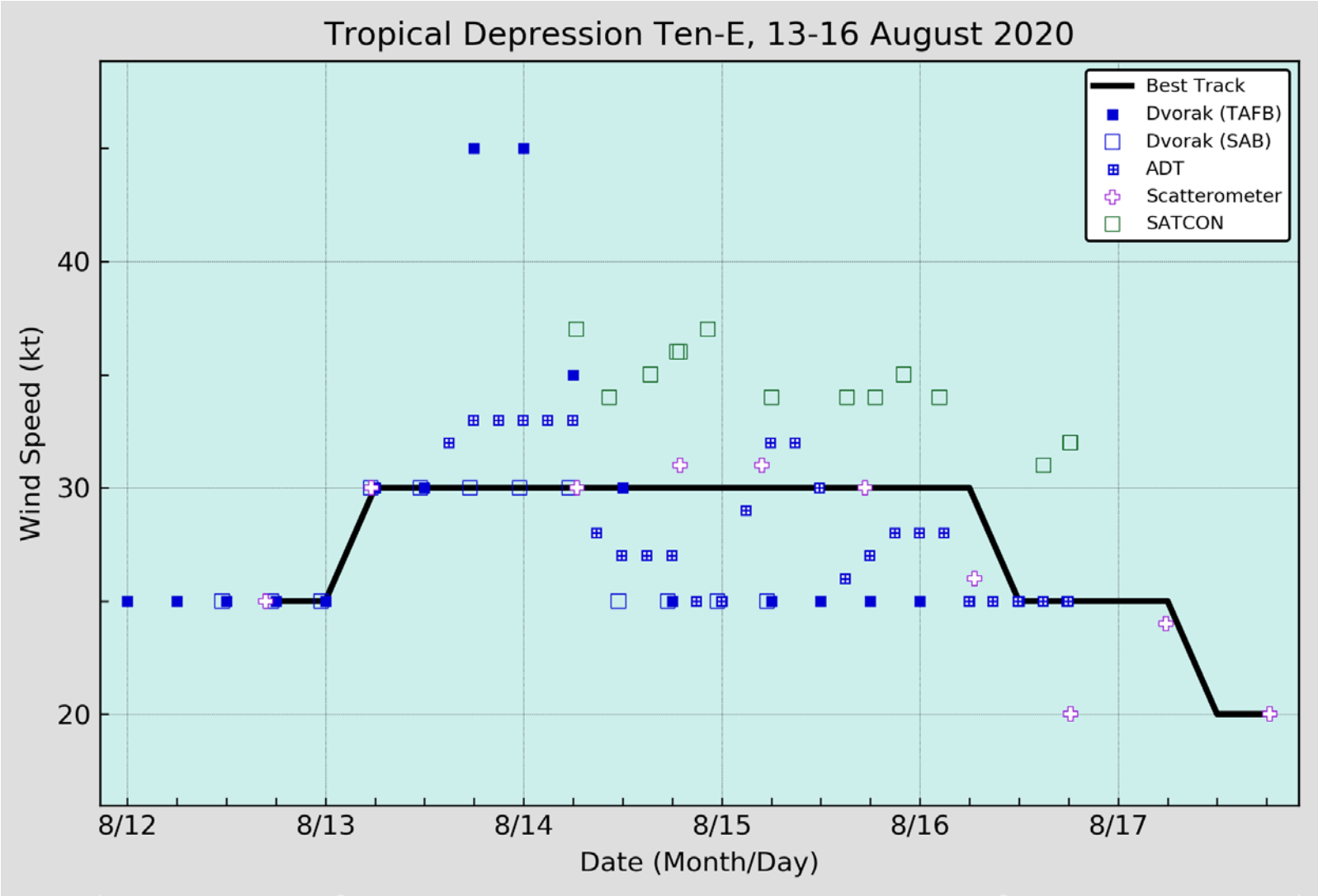

Figure 2. Selected wind observations and best track maximum sustained surface wind speed curve for Tropical Depression Ten-E, 13–16 August 2020. Advanced Dvorak Technique estimates represent the Current Intensity at the nominal observation time. SATCON intensity estimates are from the Cooperative Institute for Meteorological Satellite Studies. Dashed vertical lines correspond to 0000 UTC.

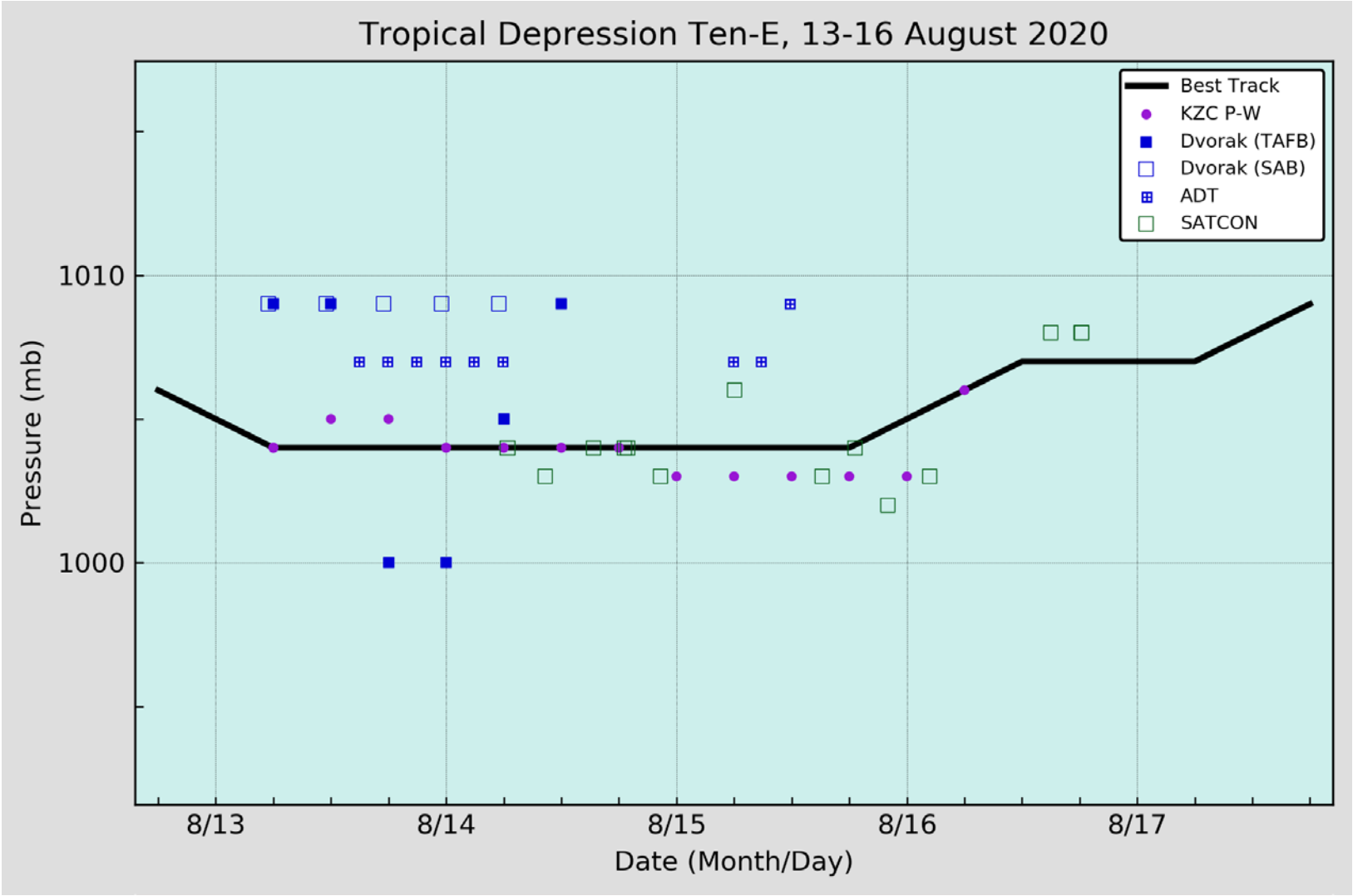

Figure 3. Selected pressure observations and best track minimum central pressure curve for Tropical Depression Ten-E, 13–16 August 2020. Advanced Dvorak Technique estimates represent the Current Intensity at the nominal observation time. SATCON intensity estimates are from the Cooperative Institute for 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.