NATIONAL HURRICANE CENTER TROPICAL CYCLONE REPORT

TROPICAL STORM JOSEPHINE

(AL112020)

11–16 August 2020

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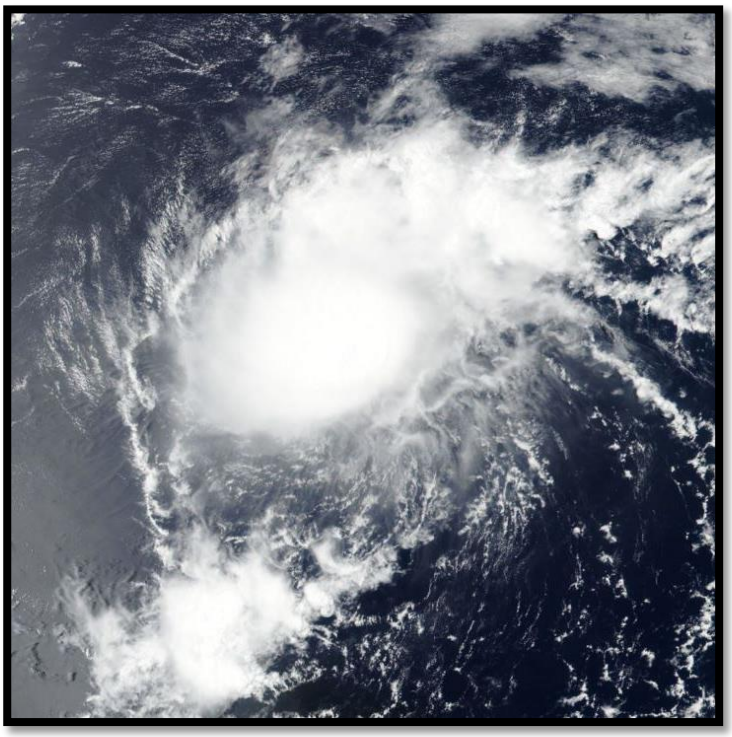

SUOMI NPP/VISIBLE INFRARED IMAGING RADIOMETER SUITE (VIIRS) IMAGERY OF TROPICAL STORM JOSEPHINE AT 1644 UTC 13 AUGUST 2020. IMAGE COURTESY OF NASA EOSDIS WORLDVIEW.

Josephine was a tropical storm that formed over the central tropical Atlantic Ocean and passed north of the Leeward Islands. Josephine became the earliest tenth-named storm on record in the Atlantic basin, a mark previously held by Tropical Storm Jose, which formed on 22 August 2005.

Tropical Storm Josephine

11–16 AUGUST 2020

SYNOPTIC HISTORY

Josephine originated from a convectively active tropical wave that moved off the west coast of Africa late on 7 August. Showers and thunderstorms increased near the wave axis over the next couple of days as the wave moved westward at 15 to 20 kt over the tropical eastern Atlantic. A mid-level cyclonic circulation became evident in satellite imagery near the wave axis on 9 August, but scatterometer data indicated the low-level circulation was elongated and poorly organized. Disorganized showers and thunderstorms continued near the wave axis early on 10 August, and a scatterometer pass later that day revealed that a closed low-pressure system had formed over 600 n mi west-southwest of the Cabo Verde Islands. A burst of deep convection occurred near the low center shortly thereafter, and despite moderate easterly vertical wind shear, the associated convection began showing signs of organization early on 11 August. A tropical depression is estimated to have formed by 0600 UTC that day about 800 n mi west-southwest of the Cabo Verde Islands. 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 moved westward on 11–12 August as it was steered by a deep-layer subtropical ridge over the central Atlantic. The cyclone failed to intensify during this period, as it struggled to sustain deep convection due to entrainment of dry mid-level air from the surrounding environment and modest southeasterly vertical wind shear. The shear diminished early on 13 August, and deep convection developed and became increasingly organized near the cyclone's center. A couple of scatterometer passes around this time revealed an area of 35–40 kt winds to the northwest of the elongated low-level circulation, and the cyclone became Tropical Storm Josephine with a peak intensity of 40 kt at 1200 UTC 13 August when it was located almost 900 n mi east-southeast of the northern Leeward Islands (cover photo). Josephine turned west-northwestward at a slightly faster forward speed on 13–14 August as a weakness developed in the subtropical ridge. Despite light deep-layer shear and warm sea surface temperatures, Josephine failed to intensify and actually slightly weakened early on 14 August. This was likely due to the presence of some mid-level shear, which prevented the cyclone from becoming vertically aligned and introduced dry air into the circulation that disrupted the convective organization. Later that day, a strong convective burst enabled the cyclone to once again reach an intensity of 40 kt at 1800 UTC 14 August when it was centered over 400 n mi east of the northern Leeward Islands.

[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.

Increasing west-southwesterly wind shear associated with a tropical upper-tropospheric trough (TUTT) induced a weakening trend on 15 August. Josephine assumed a sheared appearance on satellite imagery, and the cyclone's low-level center became completely exposed early on 16 August as it was displaced more than 60 n mi west of the remaining deep convection. The shallow cyclone resumed a westward motion to the south of a low-level ridge axis, and Josephine weakened to a tropical depression by 0600 UTC 16 August. Shortly after 1200 UTC that day, scatterometer data indicated that the circulation center had opened up into a trough of low pressure, marking the dissipation of the system about 150 n mi northeast of San Juan, Puerto Rico.

METEOROLOGICAL STATISTICS

Observations in Tropical Storm Josephine (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. Observations also include flight-level and stepped frequency microwave radiometer (SFMR) wind observations from three flights of the 53rd Weather Reconnaissance Squadron of the U.S. Air Force Reserve Command. A total of five center fixes were provided by reconnaissance aircraft during these missions. 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 Josephine.

Josephine first reached an estimated peak intensity of 40 kt from 1200 UTC to 1800 UTC 13 August. ASCAT-B and -C passes at 1235 UTC and 1328 UTC 13 August, respectively, showed peak winds between 35–40 kt associated with an area of organized convection in the northwest quadrant of Josephine. The cyclone's intensity peaked at 40 kt again from 1800 UTC 14 August to 0600 UTC 15 August. The first Air Force Reserve Hurricane Hunter reconnaissance flight into Josephine found SFMR winds of 37 kt at 1843 UTC 14 August, and an ASCAT-A pass just before 0000 UTC 15 August showed 35–40 kt winds in the northern semicircle of the cyclone. Note that the various objective satellite intensity estimates during this period ranged from 32–50 kt, and an average of these values also supports an intensity of 40 kt.

The estimated minimum central pressure of 1004 mb at 1800 UTC 14 August is based on the extrapolated minimum sea level pressure reported by Hurricane Hunter aircraft from a 1919 UTC 14 August center fix.

There were no reliable ship reports or observations from land stations of tropical-storm-force winds associated with Josephine. NOAA buoy 41044, located about 330 n mi northeast of Saint Martin, measured a peak 1-minute wind speed of 31 kt at 1854 UTC 15 August with a gust to 36 kt when the center of Josephine passed about 175 n mi southwest of the buoy.

CASUALTY AND DAMAGE STATISTICS

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

FORECAST AND WARNING CRITIQUE

The genesis of Josephine was somewhat anticipated, although the tropical cyclone developed sooner than expected (Table 2). The tropical wave from which Josephine formed was introduced in the low (<40%) category of the 2-day and 5-day Tropical Weather Outlook (TWO) 60 h before genesis. The 2-day and 5-day genesis probabilities were increased to the medium (40–60%) category 36 h before formation. The probabilities did not reach the high (>60%) category of the TWO before genesis occurred. Genesis did not appear likely until the vertical wind shear diminished, but convection was able to become organized enough for a tropical depression to form early on 11 August despite the moderate easterly shear that the system was experiencing.

A verification of NHC official track forecasts for Josephine 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 times except at 12 h. A homogeneous comparison of the official track errors with selected guidance models is given in Table 3b. The HFIP corrected consensus approach (HCCA) outperformed OFCL at all verifying forecast times, and overall the Global Ensemble Forecast System (AEMI) performed better than the rest of the global track models.

A verification of NHC official intensity forecasts for Josephine is given in Table 4a. Official forecast intensity errors were 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. Several intensity models outperformed OFCL between 24–96 h, including the statistical Logistic Growth Equation Model (LGEM), the HWRF (HWFI), the Naval Research Laboratory COAMPS-TC (CTCI), and the IVDR consensus aid. Unlike for track, HCCA forecast Josephine's intensity poorly. Early NHC forecasts trended closer to HCCA and called for the cyclone to strengthen into a 50-kt tropical storm (Fig. 4). Since Josephine struggled to remain organized and intensify due to bouts of dry air entrainment and vertical wind shear, the official intensity forecast exhibited a high bias, particularly between 48–96 h.

No coastal watches or warnings were issued in association with Josephine.

Table 1. Best track for Tropical Storm Josephine, 11–16 August 2020.

Date/Time (UTC)	Latitude (°N)	Longitude (°W)	Pressure (mb)	Wind Speed (kt)	Stage
10 / 1800	11.1	34.2	1009	25	low
11 / 0000	11.3	35.4	1008	30	"
11 / 0600	11.4	36.8	1008	30	tropical depression
11 / 1200	11.5	38.2	1008	30	"
11 / 1800	11.7	39.6	1008	30	"
12 / 0000	11.9	41.0	1008	30	"
12 / 0600	12.0	42.3	1008	30	"
12 / 1200	12.1	43.7	1007	30	"
12 / 1800	12.2	44.9	1007	30	"
13 / 0000	12.4	46.1	1007	30	"
13 / 0600	12.7	47.3	1007	30	"
13 / 1200	13.4	48.6	1005	40	tropical storm
13 / 1800	14.0	50.0	1005	40	"
14 / 0000	14.5	51.3	1005	35	"
14 / 0600	15.1	52.8	1005	35	"
14 / 1200	16.2	54.2	1005	35	"
14 / 1800	17.4	55.6	1004	40	"
15 / 0000	18.0	56.9	1004	40	"
15 / 0600	18.4	58.3	1005	40	"
15 / 1200	18.8	59.7	1007	35	"
15 / 1800	19.6	60.9	1009	35	"
16 / 0000	19.8	62.1	1009	35	"
16 / 0600	20.0	63.4	1010	30	tropical depression
16 / 1200	20.2	64.5	1010	30	"
16 / 1800					dissipated
14 / 1800	17.4	55.6	1004	40	maximum wind & minimum pressure

Table 2. Number of hours in advance of formation of Josephine 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	60
Medium (40%–60%)	36	36
High (>60%)	-	-

Table 3a. NHC official (OFCL) and climatology-persistence skill baseline (OCD5) track forecast errors (n mi) for Josephine. 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	29.4	**33.8**	**41.2**	**43.5**	**65.3**	**78.0**	**93.0**	
OCD5	36.5	56.7	83.2	94.9	128.6	148.8	110.7	
Forecasts	18	16	14	12	10	8	4	
OFCL (2015-19)	24.1	36.9	49.6	65.1	80.7	96.3	133.2	
OCD5 (2015-19)	44.7	96.1	156.3	217.4	273.9	330.3	431.5	

Table 3b. Homogeneous comparison of selected track forecast guidance models (in n mi) for Josephine. 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	32.8	33.9	44.1	50.7	72.6	75.1	88.3	
OCD5	41.0	59.6	90.7	120.4	161.6	158.8	117.6	
GFSI	33.7	34.9	47.3	56.8	82.8	99.5	110.5	
HMNI	34.4	39.6	52.2	69.4	101.4	120.1	167.5	
HWFI	33.0	41.4	57.8	**44.5**	**56.6**	**63.0**	**35.8**	
EMXI	**32.0**	40.7	51.2	67.4	89.9	87.7	130.6	
CMCI	33.6	38.7	**43.5**	58.8	73.8	78.9	**87.5**	
NVGI	42.8	73.6	102.8	159.5	220.8	267.6	375.3	
CTCI	38.7	41.6	59.6	83.0	98.1	92.1	92.0	
AEMI	**32.3**	**30.2**	**41.4**	**46.1**	**57.4**	**55.5**	100.2	
HCCA	**30.1**	**29.7**	**41.7**	**46.5**	**62.6**	**51.6**	**61.4**	
TVCX	**31.3**	35.5	45.8	55.1	75.3	80.5	**83.9**	
GFEX	**32.0**	36.7	46.5	55.3	81.6	89.2	116.7	
TVCA	**32.0**	35.2	46.3	54.1	76.3	78.9	**75.9**	
TVDG	**31.8**	35.4	45.8	55.2	78.9	86.0	**85.0**	
TABD	56.1	107.8	164.3	173.4	233.2	306.4	465.3	
TABM	41.3	69.5	109.5	125.2	155.2	197.8	297.2	
TABS	35.5	41.1	51.2	**41.8**	**27.0**	**38.6**	90.4	
Forecasts	14	12	10	6	5	4	2	

Table 4a. NHC official (OFCL) and climatology-persistence skill baseline (OCD5) intensity forecast errors (kt) for Josephine. 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	**4.4**	**5.9**	**7.1**	**9.2**	**11.0**	**8.8**	**7.5**	
OCD5	6.9	8.4	9.4	12.2	17.2	17.4	26.5	
Forecasts	18	16	14	12	10	8	4	
OFCL (2015-19)	5.2	7.7	9.4	10.7	11.9	13.0	14.4	
OCD5 (2015-19)	6.8	10.8	14.1	17.0	18.8	20.6	22.5	

Table 4b. Homogeneous comparison of selected intensity forecast guidance models (in kt) for Josephine. 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	4.3	5.4	7.5	10.0	10.0	10.0	10.0	
OCD5	6.8	7.3	8.2	**8.2**	10.0	14.8	28.5	
HMNI	**4.1**	5.5	**6.8**	12.0	13.4	13.0	13.0	
HWFI	4.4	**4.5**	**6.2**	**4.3**	**4.6**	**4.8**	**3.0**	
GFSI	5.6	6.4	**4.6**	**2.7**	**4.6**	**3.8**	**4.0**	
EMXI	4.9	6.2	**6.5**	**8.7**	**9.4**	**7.2**	**6.0**	
CTCI	5.1	**4.5**	**4.2**	**5.8**	**5.2**	**4.5**	**7.0**	
HCCA	4.8	**4.5**	**5.1**	10.7	11.0	10.2	**9.0**	
DSHP	5.8	**4.2**	**3.3**	**7.3**	10.0	14.2	21.0	
LGEM	5.7	**4.5**	**3.7**	**2.8**	**1.6**	**2.8**	**7.5**	
IVCN	4.7	**4.2**	**4.2**	**6.2**	**6.0**	**7.2**	10.0	
IVDR	4.4	**4.1**	**4.2**	**5.7**	**5.2**	**6.0**	**7.5**	
Forecasts	14	12	10	6	5	4	2	

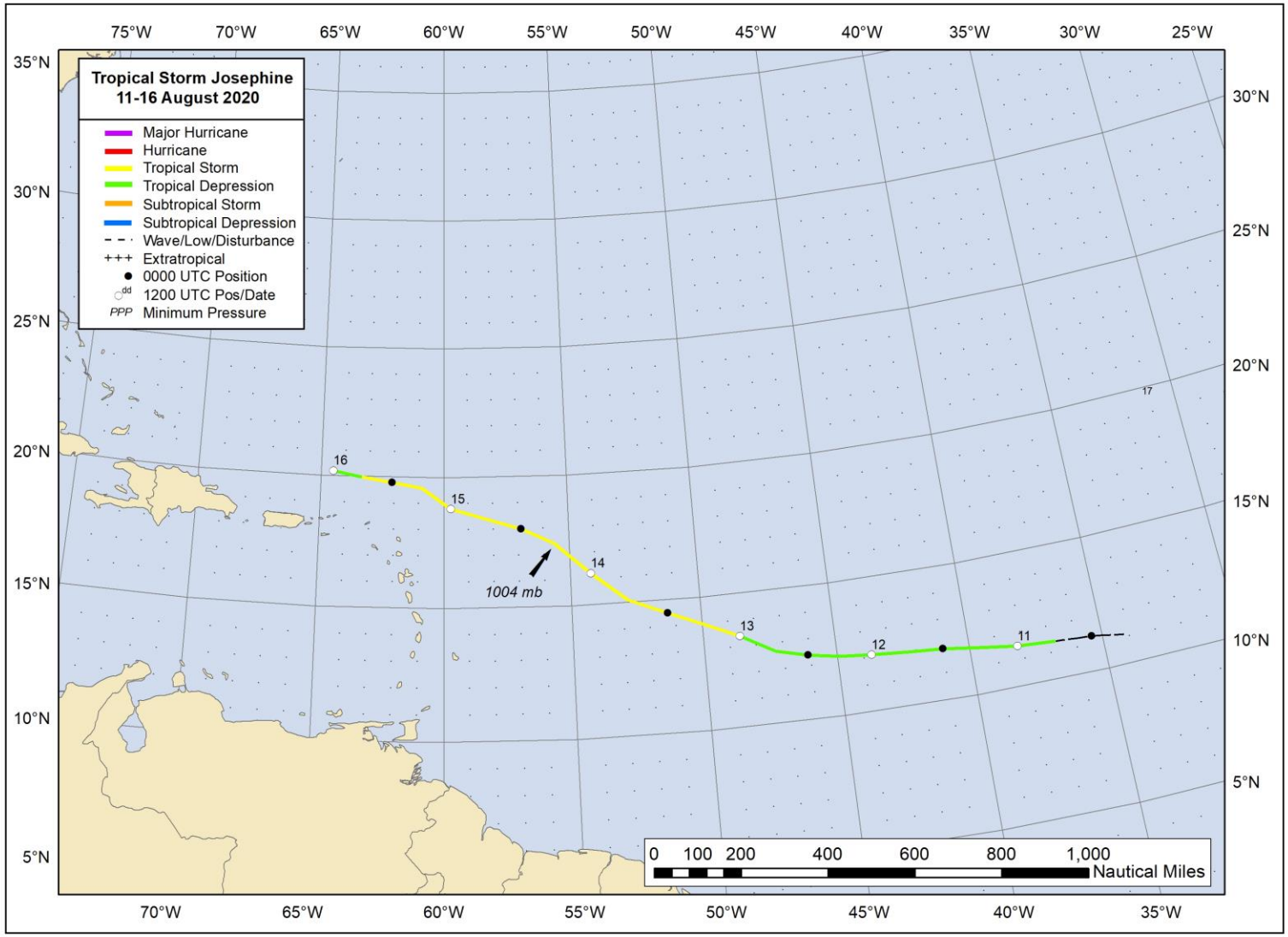

Figure 1. Best track positions for Tropical Storm Josephine, 11–16 August 2020.

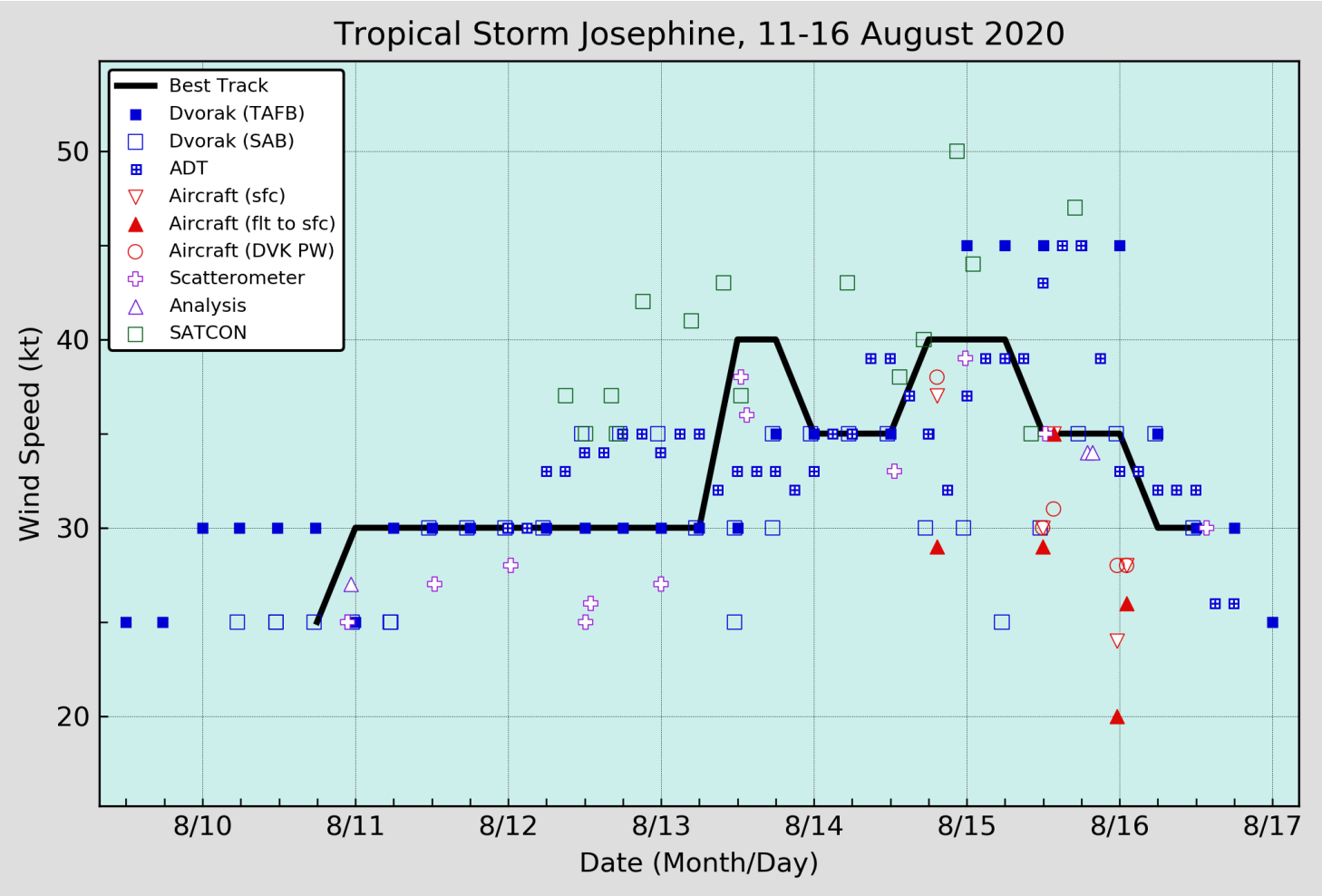

Figure 2. Selected wind observations and best track maximum sustained surface wind speed curve for Tropical Storm Josephine, 11–16 2020. Aircraft observations have been adjusted for elevation using a 75% adjustment factor for observations from 925 mb. Advanced Dvorak Technique estimates represent the 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.

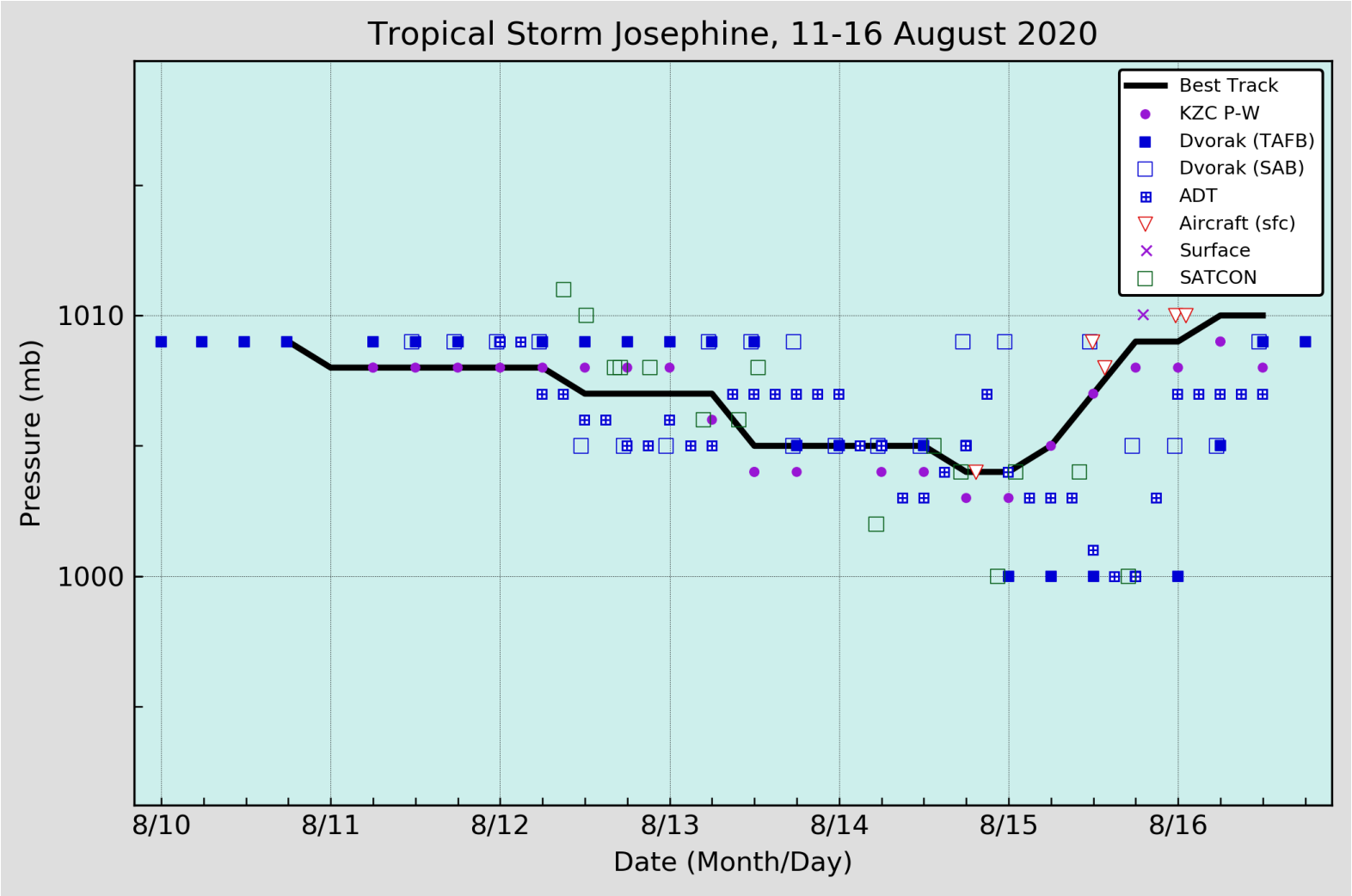

Figure 3. Selected pressure observations and best track minimum central pressure curve for Tropical Storm Josephine, 11–16 August 2020. Advanced Dvorak Technique estimates represent the Current Intensity at the nominal observation time. SATCON intensity estimates are from the Cooperative Institute for 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.

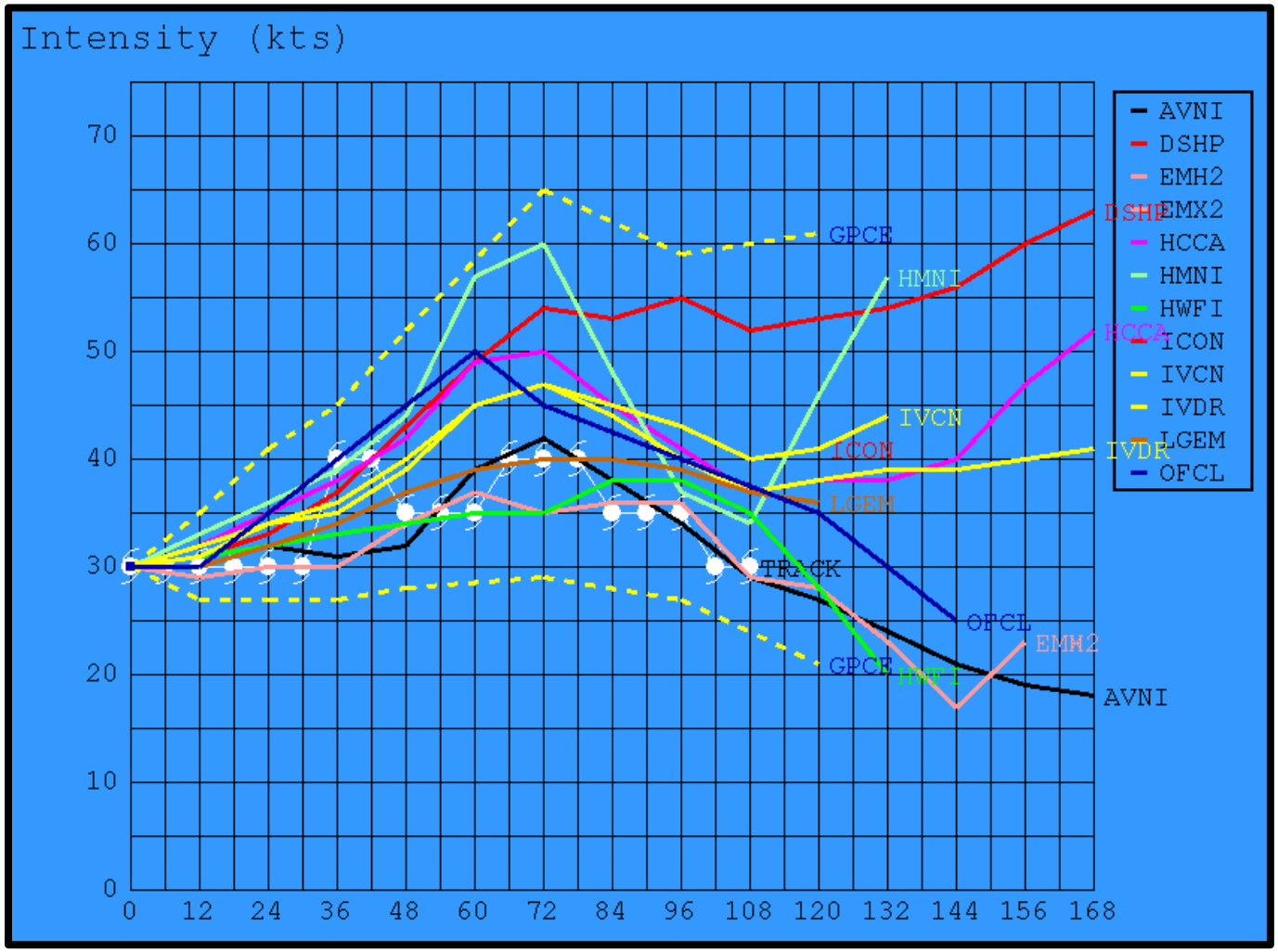

Figure 4. Selected intensity model forecasts (kt) for Josephine at 0000 UTC 12 August 2020. The NHC official intensity forecast is denoted by the solid dark blue line. The best track intensity (kt) is indicated by the solid white line, with intensity values marked with a cyclone symbol at 6 h intervals.