NATIONAL HURRICANE CENTER TROPICAL CYCLONE REPORT

TROPICAL STORM OMAR

(AL152020)

31 August–5 September 2020

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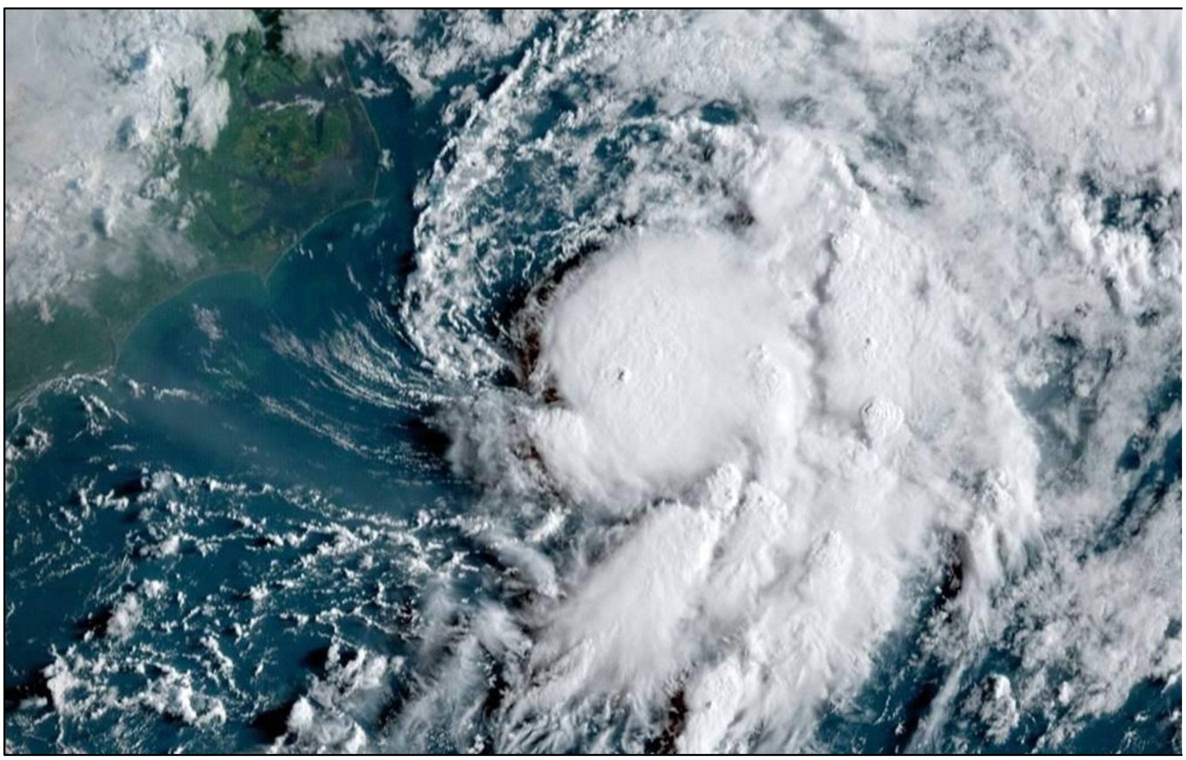

GOES-16 TRUE COLOR VISIBLE SATELLITE IMAGE OF OMAR WHEN IT BECAME A TROPICAL STORM OFF OF THE SOUTHEAST U.S. COAST AT 1200 UTC 1 SEPTEMBER 2020. IMAGE COURTESY NOAA/NESDIS/STAR.

Omar was a short-lived tropical storm that formed from a non-tropical disturbance over the western Atlantic Ocean waters offshore the southeastern United States. Omar passed between the Carolinas and Bermuda, and did not directly affect any land areas before dissipating over the open North Atlantic. Omar was the earliest 15th-named storm on record, besting the previous mark held by Hurricane Ophelia of 2005.

Tropical Storm Omar

31 AUGUST–5 SEPTEMBER 2020

SYNOPTIC HISTORY

Omar originated from a non-tropical, mid-tropospheric disturbance that moved out of the central U.S. Plains and into the southeastern United States on 29 August. The vigorous mid- to upper-level shortwave trough passed to the south of the remnant low of former Hurricane Laura, which was moving over the Ohio Valley region at the time and interacted with a broad surface trough – the remnants of a dissipated frontal system – that was oriented east-to-west near the Florida-Georgia border. By late on 30 August, the shortwave trough had induced the development of a small low-pressure system along the surface trough near the coast of northeastern Florida. Over the course of the next 24 h, deep convection developed and steadily increased in both areal coverage and organization, and weak upper-level anticyclonic outflow formed – a classic signature of a warm-core tropical low. While the system moved slowly northeastward just offshore of and parallel to the southeastern U.S. coast early on 31 August, convection began to organize into small curved bands and a 1437 UTC scatterometer surface wind data indicated that a well-defined low pressure system had already formed. Therefore, it is estimated that a tropical depression had formed around 1200 UTC that day about 130 n mi south-southeast of Wilmington, North Carolina. Subsequent buoy observations and data from an Air Force Reserve reconnaissance aircraft verified the earlier scatterometer wind data, indicating that the system was a closed low and possessed winds of at least 30 kt. 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 small depression continued its northeastward motion away from the United States for the next few days, occasionally ingesting dry mid-level air while encountering strong westerly to west-northwesterly deep-layer vertical wind shear. The combination of those two negative factors offset the above-average sea-surface temperatures (SST), resulting in intermittent bursts of deep convection confined to the eastern semicircle of the circulation, which significantly inhibited the intensification process. By 1200 UTC 1 September, however, a burst of strong convection developed over and to the east of the well-defined low-level center, and the system reached tropical storm status when it was located about 100 n mi southeast of Cape Hatteras, North Carolina. Omar became the earliest 15th-named storm on record, besting the previous mark by about a week held by Hurricane Ophelia of 2005. However, seven hurricanes had already formed prior to the 15th-named storm in 2005 compared to only four hurricanes prior to the formation of Tropical Storm Omar during the 2020 hurricane season.

[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.

Omar moved east-northeastward to eastward over the open Atlantic Ocean for the next couple of days and struggled to maintain deep convection near the center due to hostile west-northwesterly vertical wind shear in excess of 30 kt. Omar weakened to a tropical depression by 0000 UTC 3 September when the small cyclone was located about 230 n mi north of Bermuda. Omar moved eastward to east-southeastward at 10–15 kt for the next 24 h, then slowed down to around 5 kt on 4 September when the cyclone entered a region of weak steering flow. During the period 3–4 September, Omar produced periodic bursts of deep convection near the center, which were sufficient for the system to maintain tropical cyclone status longer than expected. Early on 5 September, under the influence of increasing southerly flow ahead of a deep-layer trough, Omar turned sharply northward and began to accelerate. However, the strong flow shear ahead of the approaching trough also increased the southerly vertical wind shear across the small cyclone. By 1800 UTC 5 September, all associated convection had dissipated and Omar degenerated into a remnant low pressure system about 500 n mi northeast of Bermuda. The post-tropical cyclone moved quickly northward to north-northeastward over the cold waters of the North Atlantic and was absorbed by a frontal system by 1200 UTC 6 September when it was located about 250 n mi south of Cape Race, Newfoundland.

METEOROLOGICAL STATISTICS

Observations in Omar (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) observations from one flight conducted by the 53rd Weather Reconnaissance Squadron of the U.S. Air Force Reserve Command. 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 Omar.

There were no ship or buoy reports of tropical-storm-force winds associated with Omar. However, NOAA buoy 41001, located about 150 n mi east of Cape Hatteras, measure a 1-minute sustained wind speed of 29 kt at 3.8 m elevation at 0911 UTC 1 September, and that value converts to an approximate 1-minute wind speed of 32 kt at 10-m elevation. That data was sued to upgrade Omar to tropical storm status at 1200 UTC 1 September.

Winds and Pressure

The estimated peak intensity of 35 kt from 1200 UTC 1 September to 1200 UTC 2 September is based on an average of subjective satellite intensity estimates of T2.5/35 kt from TAFB and SAB, objective intensity estimates of 35 kt from UW-CIMSS ADT and 35-40 kt from SATCON, 33-kt scatterometer wind data, and the aforementioned 32-kt surface wind observation from buoy 41001. The estimated minimum pressure of 1003 mb is based on the KZC pressure-wind relationship.

CASUALTY AND DAMAGE STATISTICS

There were no reports of damage or casualties associated with Tropical Storm Omar.

FORECAST AND WARNING CRITIQUE

The genesis of Tropical Storm Omar wasn't forecast particularly well, which isn't that unusual for system's originate from mid-tropospheric disturbances that exist overland less than 24 h prior to tropical cyclone formation. The disturbance from which Omar developed was first introduced in the Tropical Weather Outlook in the low (<40%) and categories 24 h and 30 h in the 48- and 120-h periods, respectively, prior to genesis (Table 2). Probabilities were raised to the medium category (40%–60%) for both the 2- and 5-day periods 18 h before genesis occurred. The 5-day probability was increased to the high category (>60%) just 12 h before Omar formed, while the 2-day probability never reached the high category. It is not unusual for the global models the NHC to have relatively short lead-time genesis forecasts associated with non-tropical incipient disturbances, especially those that propagate off of land.

A verification of NHC official track forecasts for Omar is given in Table 3a. Official forecast (OFCL) track errors were lower than the mean official errors for the previous 5-yr period at the 12-, 24-, and 36-h forecast times, but only by a small margin. In contrast, OFCL track errors were greater than the 5-yr mean errors at 48, 60, 72, and 96 h. In fact, the 96-h OFCL errors were almost 90% worse than average. By comparison, the OCD5 climatology track errors were more than 10% better than average, an indication that the four 96-h OFCL track forecasts were not skillful. A homogeneous comparison of the official track errors with selected guidance models is given in Table 3b. OCL track forecasts outperformed the majority of the model guidance at all forecast times except at 96 h. However, there was only one homogenous forecast available for verification at the time, making that forecast verification statistically insignificant. The best NHC forecast aid for Omar was the EMXI (interpolated-ECMWF) model, which outperformed OFCL at forecast times. However, the EMXI model was not the best overall model at 72 and 96 hours, and was bested by several models at those two time periods, especially the simple consensus models TVCA and GFEX (GFS-ECMWF model average).

A verification of NHC official intensity forecasts for Omar is given in Table 4a. In contrast to the track errors, official forecast intensity errors were much lower than the mean official errors for the previous 5-yr period at all forecast times, more than 2 to 3 times better than average at 48-96 hours. A homogeneous comparison of the official intensity errors with selected guidance models is given in Table 4b. OFCL intensity errors generally were generally lower than all intensity guidance, with the exception of the simple-consensus models, ICON and IVCN, and the corrected-consensus model HCCA.

No coastal watches and warnings were required with Omar.

Table 1. Best track for Tropical Storm Omar, 31 August–5 September 2020.

Date/Time (UTC)	Latitude (°N)	Longitude (°W)	Pressure (mb)	Wind Speed (kt)	Stage
30 / 1800	30.2	80.7	1011	25	low
31 / 0000	30.2	79.4	1010	25	"
31 / 0600	30.6	78.2	1009	30	tropical depression
31 / 1200	31.5	77.4	1009	30	"
31 / 1800	32.2	76.9	1008	30	"
01 / 0000	32.9	76.2	1007	30	"
01 / 0600	33.8	75.0	1005	30	"
01 / 1200	34.6	73.7	1003	35	tropical storm
01 / 1800	35.2	72.2	1003	35	"
02 / 0000	35.8	70.7	1003	35	"
02 / 0600	36.1	69.3	1003	35	"
02 / 1200	36.2	68.0	1003	35	"
02 / 1800	36.2	66.4	1004	35	"
03 / 0000	36.2	64.8	1005	30	tropical depression
03 / 0600	36.1	63.0	1005	30	"
03 / 1200	36.1	61.7	1005	30	"
03 / 1800	35.6	60.5	1005	30	"
04 / 0000	35.3	59.5	1006	30	"
04 / 0600	35.3	58.8	1006	30	"
04 / 1200	35.3	58.0	1006	30	"
04 / 1800	35.3	57.5	1006	30	"
05 / 0000	35.5	57.3	1007	30	"
05 / 0600	36.0	57.3	1008	30	"
05 / 1200	36.8	57.3	1009	30	"
05 / 1800	37.7	57.1	1010	30	low
06 / 0000	38.8	56.8	1011	30	"
06 / 0600	40.4	55.6	1012	30	"
06 / 1200					absorbed by frontal system
01 / 1200	34.6	73.7	1003	35	minimum pressure

Table 2. Number of hours in advance of formation of Omar 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%)	24	30
Medium (40%-60%)	18	18
High (>60%)	--	12

Table 3a. NHC official (OFCL) and climatology-persistence skill baseline (OCD5) track forecast errors (n mi) for Tropical Storm Omar, 31 August–5 September 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	**19.2**	**32.5**	**49.3**	72.4	86.1	121.4	249.0	
OCD5	44.1	103.6	175.5	253.6	313.6	383.0	381.8	
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	171.6
OCD5 (2015-19)	44.7	96.1	156.3	217.4	273.9	330.3	431.5	511.9

Table 3b. Homogeneous comparison of selected track forecast guidance models (in n mi) for Tropical Storm Omar, 31 August–5 September 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	19.2	33.7	54.2	82.4	96.7	88.9	278.5	
OCD5	50.9	111.2	182.3	264.8	321.8	379.6	383.5	
GFSI	35.0	70.9	113.1	153.1	183.4	121.6	**166.1**	
EMXI	**18.2**	**29.1**	**48.6**	**69.9**	**81.5**	**88.3**	**252.5**	
NVGI	22.1	49.5	87.7	125.7	173.3	263.2	463.9	
CMCI	33.6	71.5	117.6	179.4	284.1	325.4	872.4	
AEMI	25.0	41.4	68.7	99.0	109.3	138.0	**38.5**	
HWFI	27.4	42.6	63.8	85.5	**92.2**	89.9	**269.9**	
HMNI	23.1	37.1	**37.1**	**43.4**	**70.7**	95.1	278.8	
CTCI	23.1	35.3	**47.4**	**62.6**	**63.4**	95.4	**204.8**	
TVCA	22.9	38.4	62.6	93.4	108.3	**86.2**	**168.0**	
GFEX	23.8	46.9	74.3	106.3	125.3	**79.0**	**45.2**	
TVCX	22.2	37.4	60.4	87.3	99.9	**78.8**	**161.6**	
HCCA	21.4	33.8	**53.0**	**78.8**	**83.6**	92.4	**245.4**	
TABS	38.3	81.5	131.9	178.1	186.7	192.0	**108.9**	
TABM	25.4	39.6	59.0	84.7	141.5	188.4	359.4	
TABD	51.2	126.0	220.3	339.7	513.5	741.6	1177.2	
Forecasts	12	10	9	8	6	2	1	

Table 4a. NHC official (OFCL) and climatology-persistence skill baseline (OCD5) intensity forecast errors (kt) for Tropical Storm Omar, 31 August–5 September 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	**1.7**	**4.1**	**2.9**	**5.4**	**4.5**	**5.0**	**3.8**	
OCD5	3.8	7.7	14.8	22.1	28.2	33.2	35.8	
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	15.5
OCD5 (2015-19)	6.8	10.8	14.1	17.0	18.8	20.6	22.5	24.6

Table 4b. Homogeneous comparison of selected intensity forecast guidance models (in kt) for Tropical Storm Omar, 31 August–5 September 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	1.2	3.6	3.0	5.6	4.2	0.0		
OCD5	3.7	8.0	14.5	22.4	29.7	34.0		
HWFI	2.5	**2.8**	4.1	5.9	7.0	1.0		
HMNI	2.8	4.9	6.8	9.6	8.2	11.0		
DSHP	2.8	**3.1**	**2.3**	**5.4**	10.5	15.0		
LGEM	3.3	5.3	7.4	8.4	9.5	11.0		
ICON	2.4	**2.4**	**2.2**	**2.2**	**2.7**	3.0		
IVCN	2.2	**2.2**	**2.2**	**2.3**	**2.2**	2.0		
CTCI	2.7	**3.5**	4.3	**5.2**	7.2	4.0		
GFSI	4.4	6.3	7.3	7.4	10.2	7.0		
EMXI	3.3	4.9	4.4	**3.2**	4.7	1.0		
HCCA	2.2	**2.0**	**2.6**	**4.8**	5.7	4.0		
Forecasts	13	11	10	9	6	1		

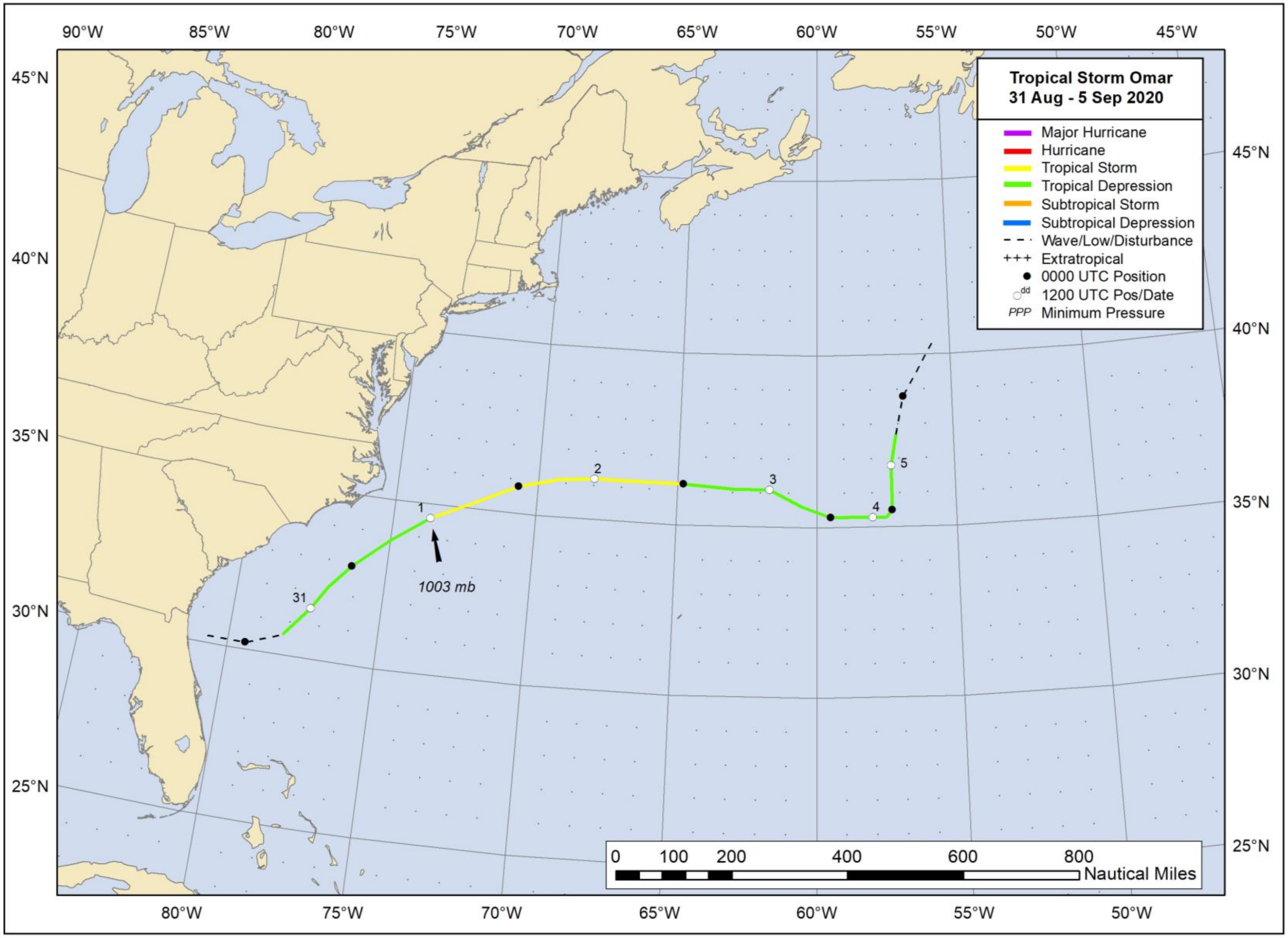

Figure 1. Best track positions for Tropical Storm Omar, 31 August–5 September 2020. Post-tropical cyclone positions are based partly on analyses from the NOAA Ocean Prediction Center.

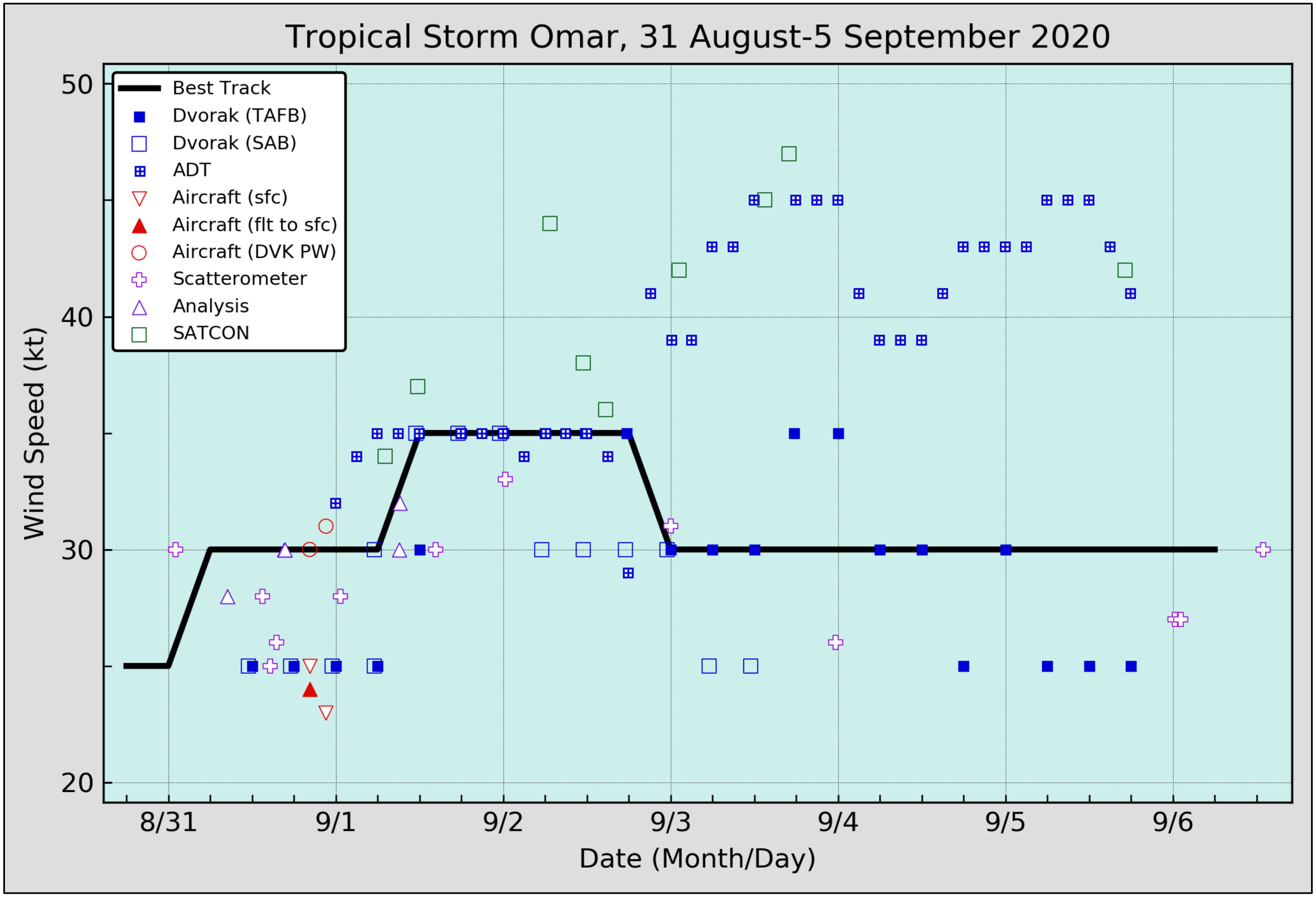

Figure 2. Selected wind observations and best track maximum sustained surface wind speed curve for Tropical Storm Omar, 31 August–5 September 2020. Aircraft observations have been adjusted for elevation using an 80% adjustment factor for observations at 1500 ft. Advanced Dvorak Technique estimates represent 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.

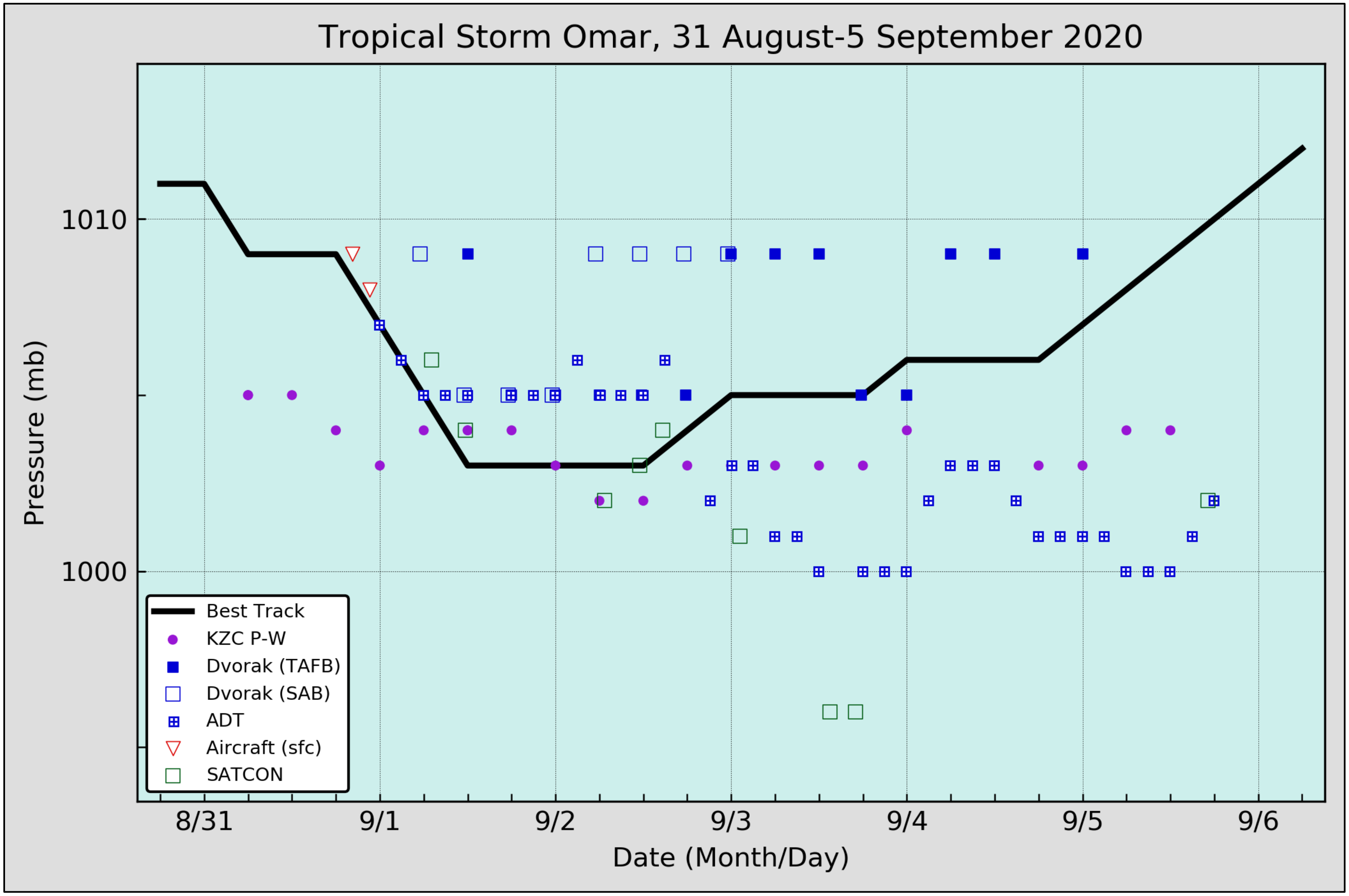

Figure 3. Selected pressure observations and best track minimum central pressure curve for Tropical Storm Omar, 31 August–5 September 2020. Advanced Dvorak Technique estimates represent the Current Intensity at the nominal observation time. SATCON intensity estimates are from the Cooperative Institute 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.