NATIONAL HURRICANE CENTER TROPICAL CYCLONE REPORT

HURRICANE PABLO

(AL182019)

25–28 October 2019

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National Hurricane Center
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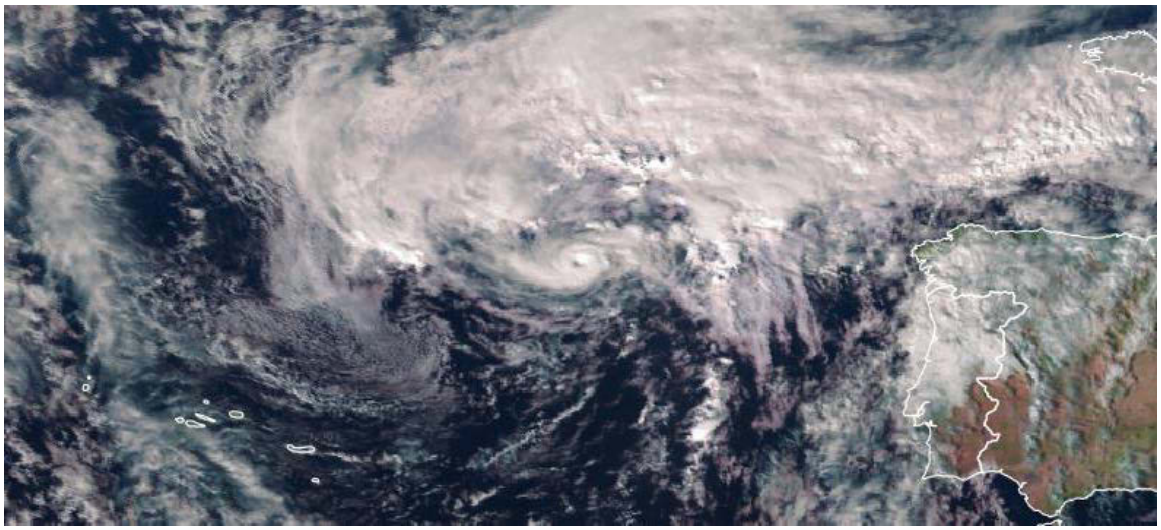

METEOSAT NATURAL COLOR IMAGE OF PABLO AT 1400 UTC 27 OCTOBER 2019. IMAGE COURTESY OF EUMETSAT.

Pablo was a category 1 hurricane on the Saffir-Simpson Hurricane Wind Scale that formed from a non-tropical low over the northern Atlantic and passed near the eastern Azores.

Hurricane Pablo

25–28 OCTOBER 2019

SYNOPTIC HISTORY

Pablo had a non-tropical origin at high latitudes. A baroclinic low formed over the central North Atlantic on 22 October and quickly developed gale-force winds to the northwest of the center. By the next day, the cyclone had an elongated circulation with multiple associated vorticity centers. The eastern-most of these centers formed around 1800 UTC 23 October and soon thereafter the low developed storm-force winds and a relatively small radius of maximum winds. Initially nearly stationary, the small-scale low began a southwestward motion early on 24 October around the northwestern side of the larger eastward-moving baroclinic low. This motion was followed by a turn toward the southeast and eventually toward the east around the south side of the larger low. Convection near the center of the low increased by 0000 UTC 25 October, although at this time it lacked the anticyclonic outflow at upper levels characteristic of a tropical cyclone. Based on this structure, it is estimated that a subtropical storm with 45-kt winds formed around that time about 350 n mi west-southwest of the western Azores. The "best track" chart of the 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 subtropical storm moved east-northeastward during the next 12 h, followed by an east-southeastward motion that lasted into 26 October. While the cyclone remained embedded in the large baroclinic low during this time, satellite imagery indicated that the cyclone transitioned into a tropical storm by 1800 UTC 25 October with the formation of a central dense overcast, developing anticyclonic outflow, and occasional hints of eye formation. However, scatterometer data suggested that the maximum winds slowly decreased despite the transition. On 26 October, Pablo turned east-northeastward, with the center passing to the southeast of the eastern Azores by 0000 UTC 27 October. After that time, Pablo turned northeastward and intensified, with convection increasing near the center and a small eye becoming more apparent in infrared and visible satellite imagery. It is estimated that Pablo became a hurricane at 1200 UTC 27 October (cover photo) and 6 h later reached an estimated peak intensity of 70 kt. The hurricane then approached a large frontal zone on the northeast side of the baroclinic low and moved northward over decreasing sea surface temperatures. These factors caused the cyclone to quickly weaken. After weakening to a tropical storm, Pablo merged with the front to again become an extratropical cyclone near 1200 UTC 28 October about 625 n mi north-northeast of the eastern Azores. The system then moved east-northeastward along the frontal boundary for another 12 h or so before dissipating completely.

[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 Pablo (Figs. 2 and 3) include subjective satellite-based intensity estimates from the Dvorak and Hebert-Poteat techniques provided by the Tropical Analysis and Forecast Branch (TAFB), 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 Pablo.

There were no reports of tropical-storm-force or greater winds during the subtropical and tropical cyclone phases of Pablo from either the Azores or from ships. However, there were many reports of gale- to storm-force winds associated with the baroclinic low that spawned the hurricane, with the strongest reported wind being 50 kt from the *Norwegian Pearl* (call sign C6VG7) at 0400 UTC 24 October.

The estimated maximum intensity of 70 kt is based on a blend of subjective and objective satellite intensity estimates.

While there are uncertainties in the historical record, as of this writing Pablo is the farthest north and east hurricane formation of record in the North Atlantic basin.

CASUALTY AND DAMAGE STATISTICS

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

FORECAST AND WARNING CRITIQUE

The genesis of Pablo was essentially unforecast (Table 2). The system that became Pablo was not mentioned in the Tropical Weather Outlook (TWO) until after it became a subtropical storm in the best track, and it was introduced into the TWO only 6 h before the system became a tropical storm. While the global models accurately forecast the development of the baroclinic low, they did not produce consistent forecasts indicating that the system would evolve into a subtropical or tropical cyclone.

A verification of NHC official track forecasts for Pablo is given in Table 3a. Official forecast track errors were much greater than the mean official errors for the previous 5-yr period, although the number of forecasts is small. A homogeneous comparison of the official track errors with selected guidance models is given in Table 3b, and this indicates that several of the track guidance aids outperformed the official forecasts. Examination of the individual forecasts (not

shown) indicates that while the NHC track forecasts correctly called for a northward turn on the eastern side of the baroclinic low, the turn was later, more gradual, and farther from the eastern Azores than forecast. The forecast forward speeds were also somewhat slower than the storm's actual forward motion. It should be noted that while the official forecast errors were large, the climatology-persistence errors were very large, indicating that the official forecasts were skillful.

A verification of NHC official intensity forecasts for Pablo is given in Table 4a. Official forecast intensity errors were much greater than the mean official errors for the previous 5-yr period. They were also greater than the climatology-persistence forecasts (OCD5) at 24–48 h, indicating that these intensity forecasts had no skill at those forecast lead times. A homogeneous comparison of the official intensity errors with selected guidance models is given in Table 4b, which shows that the vast majority of the intensity guidance had lower forecast errors than the official forecasts. Examination of the individual forecasts (Fig. 4) shows a significant low bias, with none of the NHC forecasts indicating more than 5 kt of strengthening while Pablo's intensity increased from 45 kt to 70 kt as a tropical cyclone.

There were no coastal tropical cyclone watches or warnings issued for Pablo. The baroclinic low that contained Pablo was the primary cause of weather impacts in the Azores, and based on this the Portuguese Institute for Sea and Atmosphere issued non-tropical-cyclone watches and warnings for those islands.

Table 1. Best track for Hurricane Pablo, 25–28 October 2019.

Date/Time (UTC)	Latitude (°N)	Longitude (°W)	Pressure (mb)	Wind Speed (kt)	Stage
23 / 1800	40.0	38.3	1000	40	extratropical
24 / 0000	40.2	38.4	998	50	"
24 / 0600	39.0	39.9	995	50	"
24 / 1200	36.9	39.3	990	50	"
24 / 1800	35.8	36.9	988	45	"
25 / 0000	35.9	35.1	988	45	subtropical storm
25 / 0600	36.3	34.0	988	45	"
25 / 1200	36.4	33.2	989	40	"
25 / 1800	35.9	32.7	990	40	tropical storm
26 / 0000	35.5	31.8	990	40	"
26 / 0600	35.2	30.7	990	40	"
26 / 1200	35.1	29.1	989	45	"
26 / 1800	35.6	26.6	987	50	"
27 / 0000	37.0	23.8	985	55	"
27 / 0600	39.5	20.7	983	60	"
27 / 1200	41.9	18.8	980	65	hurricane
27 / 1800	44.1	17.3	977	70	"
28 / 0000	45.5	17.0	982	60	tropical storm
28 / 0600	46.3	17.6	990	45	"
28 / 1200	46.5	17.9	995	35	extratropical
28 / 1800	46.6	17.6	995	35	"
29 / 0000	46.8	16.4	995	30	"
29 / 0600					dissipated
27 / 1800	44.1	17.3	977	70	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%)	n/a	n/a
Medium (40%-60%)	n/a	n/a
High (>60%)	n/a	n/a

Table 3a. NHC official (OFCL) and climatology-persistence skill baseline (OCD5) track forecast errors (n mi) for Hurricane Pablo, 25–28 October 2019. 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	46.4	103.2	166.1	185.6			
OCD5	139.3	338.1	550.2	698.2			
Forecasts	9	7	5	3			
OFCL (2014-18)	23.6	35.5	47.0	61.8	96.0	136.0	179.6
OCD5 (2014-18)	44.8	97.6	157.4	220.1	340.7	446.6	536.6

Table 3b. Homogeneous comparison of selected track forecast guidance models (in n mi) for Hurricane Pablo, 25–28 October 2019. 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	51.4	113.2	174.5	181.3			
OCD5	149.7	366.3	586.9	750.8			
GFSI	**34.7**	**76.7**	**132.1**	**132.5**			
AEMI	68.7	145.9	211.7	212.3			
HWFI	**30.9**	**76.9**	**152.4**	181.7			
HMNI	**34.6**	**77.2**	**119.0**	**149.1**			
TVCA	**45.9**	**92.3**	**157.4**	**179.9**			
HCCA	**40.5**	**81.9**	**141.1**	**153.0**			
FSSE	**39.1**	**89.6**	**164.5**	195.0			
TABS	72.4	155.8	238.2	252.4			
TABM	68.6	124.9	**168.1**	**141.6**			
TABD	65.6	**105.2**	**102.0**	**56.8**			
Forecasts	8	6	4	2			

Table 4a. NHC official (OFCL) and climatology-persistence skill baseline (OCD5) intensity forecast errors (kt) for Hurricane Pablo, 25–28 October 2019, dates. 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	8.3	13.6	19.0	18.3			
OCD5	9.2	12.1	13.8	6.7			
Forecasts	9	7	5	3			
OFCL (2014-18)	5.3	7.9	9.9	11.2	13.3	14.4	14.2
OCD5 (2014-18)	6.9	10.9	14.3	17.4	20.9	22.0	22.8

Table 4b. Homogeneous comparison of selected intensity forecast guidance models (in kt) for Hurricane Pablo, 25–28 October 2019. 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	8.8	15.0	20.0	12.5			
OCD5	9.2	**13.7**	**16.8**	**6.0**			
HWFI	11.1	16.3	**19.5**	13.5			
HMNI	**7.2**	**8.3**	**8.0**	**5.5**			
DSHP	**7.2**	**10.7**	**13.2**	**8.0**			
LGEM	**7.1**	**12.2**	**15.0**	**6.5**			
ICON	**7.8**	**11.5**	**12.5**	**7.0**			
IVCN	**8.2**	**11.5**	**12.2**	**7.0**			
GFSI	10.0	16.0	**18.8**	**11.0**			
HCCA	**7.4**	**10.5**	**10.8**	**7.5**			
FSSE	**7.4**	**11.0**	**12.2**	**8.0**			
Forecasts	8	6	4	2			

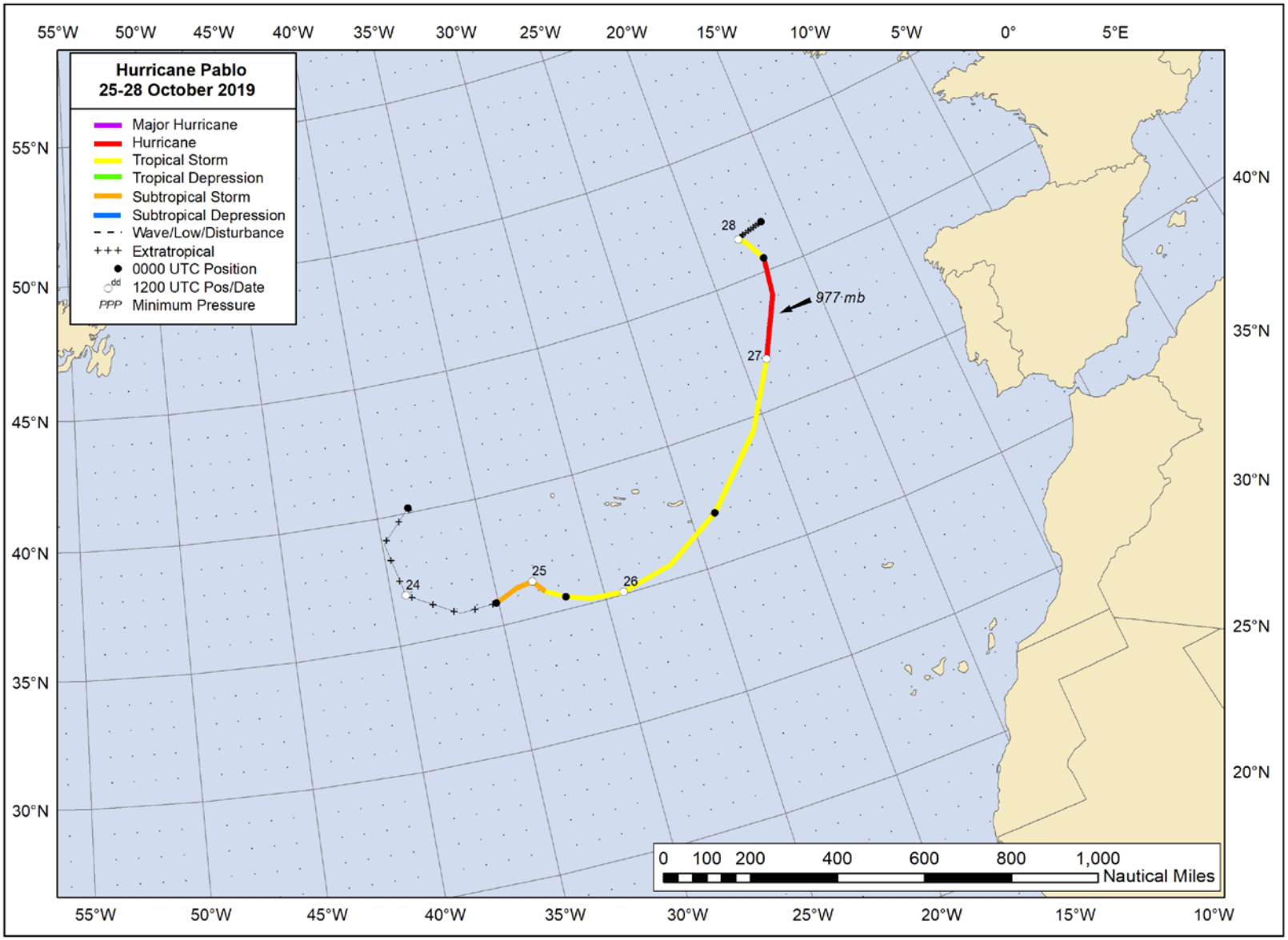

Figure 1. Best track positions for Hurricane Pablo, 25–28 October 2019. Tracks during the extratropical stage are partially based on analyses from the NOAA Ocean Prediction Center.

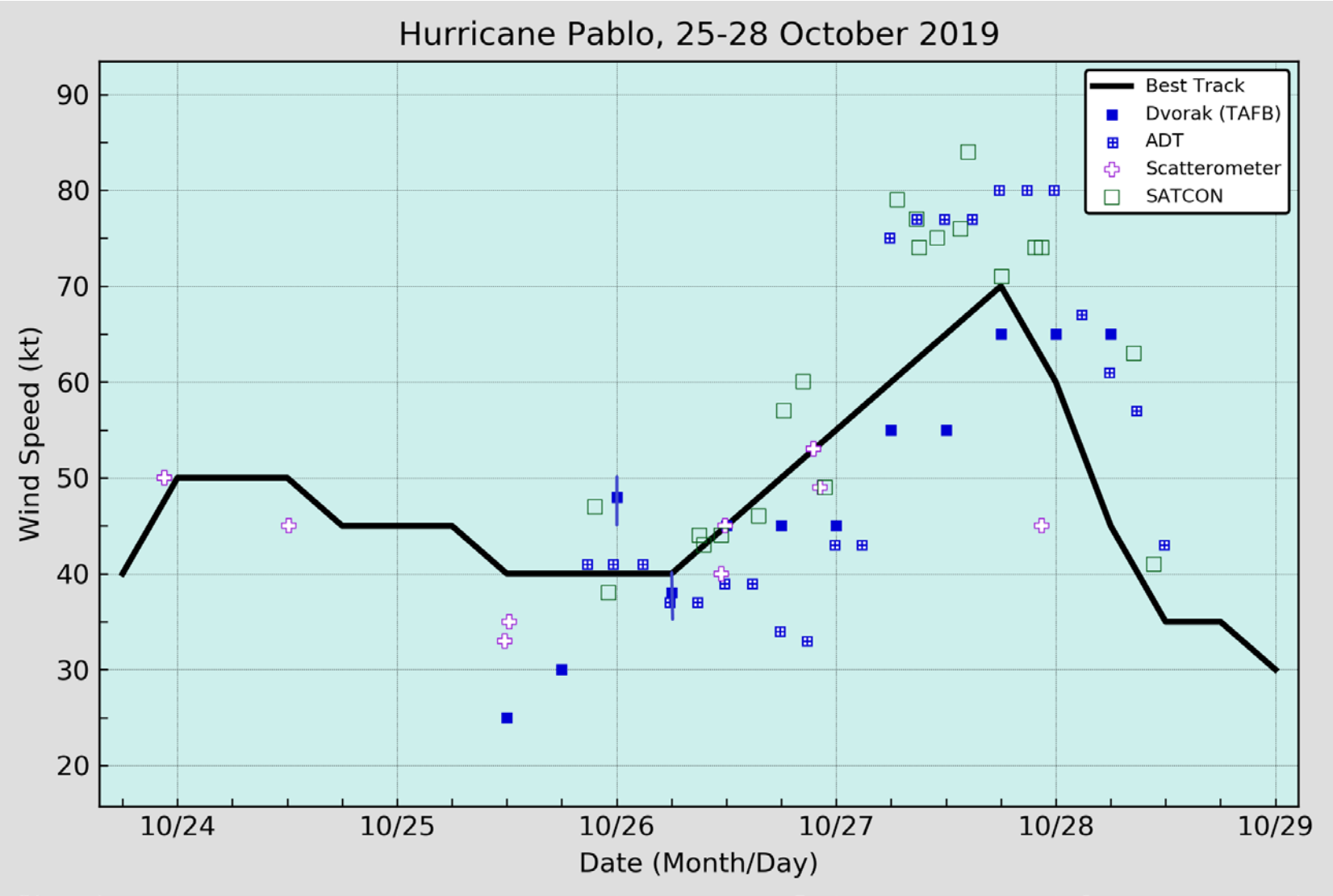

Figure 2. Selected wind observations and best track maximum sustained surface wind speed curve for Hurricane Pablo, 25–28 October 2019. TAFB estimates with the vertical line represent estimates from the Hebert-Poteat Technique for subtropical cyclones. Advanced Dvorak Technique estimates represent the 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.

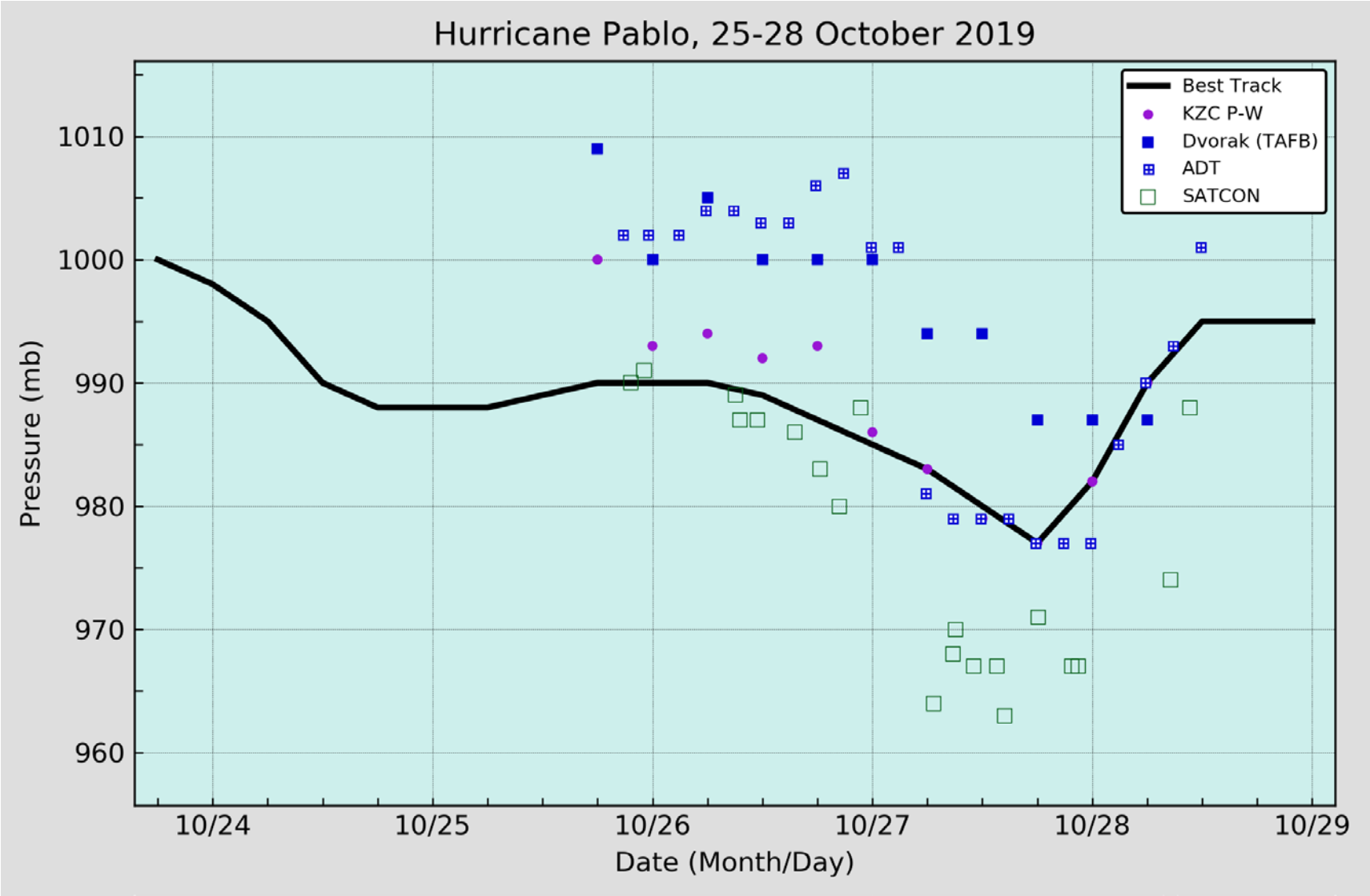

Figure 3. Selected pressure observations and best track minimum central pressure curve for Hurricane Pablo, 25–28, October 2019. Advanced Dvorak Technique estimates represent the Current Intensity at the nominal observation time. SATCON intensity estimates are from the Cooperative Institute for Meteorological Satellite Studies. KZC P-W refers to pressure estimates derived using the Knaff-Zehr-Courtney pressure-wind relationship.

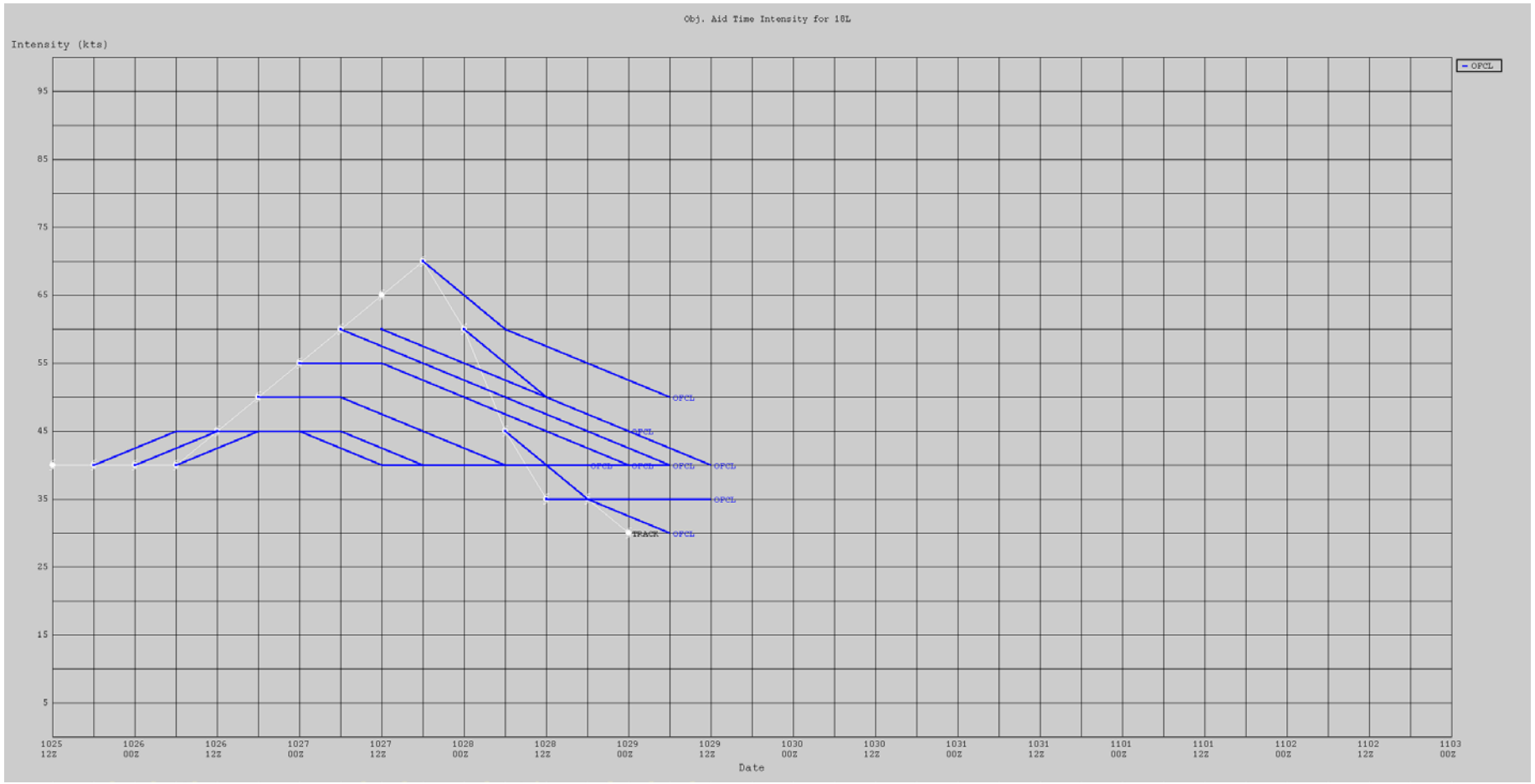

Figure 4. Selected official intensity forecasts (blue lines, kt) for Hurricane Pablo, 25–28 October 2019. The best track intensity (kt) is given by the white line at 6 h interval.