



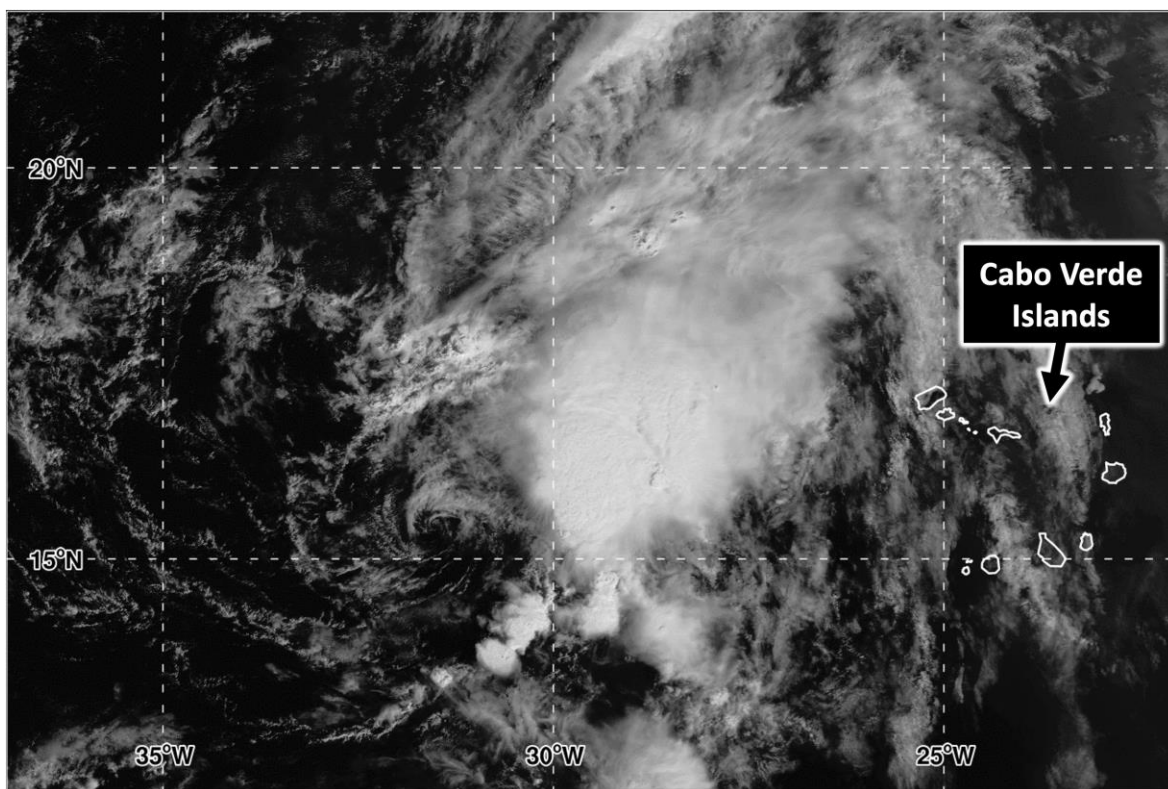
# NATIONAL HURRICANE CENTER TROPICAL CYCLONE REPORT

## TROPICAL DEPRESSION TWELVE

(AL122022)

4–6 October 2022

Philippe P. Papin  
National Hurricane Center  
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GOES-16 VISIBLE SATELLITE IMAGE AT 1130 UTC 5 OCTOBER 2022 SHOWING THE EXPOSED CENTER OF TROPICAL DEPRESSION TWELVE. DATA USED TO CREATE THIS IMAGE COURTESY OF THE NOAA BIG DATA PROJECT.

Tropical Depression Twelve was a short-lived tropical cyclone that remained several hundred miles west of the Cabo Verde Islands.

# Tropical Depression Twelve

4–6 OCTOBER 2022

## SYNOPTIC HISTORY

The origins of Tropical Depression Twelve can be traced back to a tropical wave that emerged off the west coast of Africa on 29 September. This wave was initially associated with diurnal convective activity that waned over the next few days as the wave axis moved westward, passing several hundred miles to the south of the Cabo Verde Islands. However, on 3 October, an eastward-propagating convectively coupled Kelvin Wave (Fig. 1) contributed to a significant increase in shower and thunderstorm activity along the wave axis, where an area of low pressure began to develop. This convective activity became more concentrated and better organized during the early morning hours of 4 October, and scatterometer imagery suggested that a well-defined center formed around 1200 UTC that day, marking the formation of a tropical depression about 390 n mi to the west-southwest of the Cabo Verde Islands. The “best track” chart of the depression’s path is given in Fig. 2, with the wind and pressure histories shown in Figs. 3 and 4, respectively. The best track positions and intensities are listed in Table 1<sup>1</sup>.

After formation, the depression moved generally northwestward, moving into a weakness within a mid-level ridge that was produced by a deep-layer trough dropping southward from the mid-latitudes to the north of the depression. In addition to steering the depression poleward, the trough also contributed to southwesterly 200–850 mb vertical wind shear (>20 kt) as the system also moved into relatively low environmental mid-level relative humidity (<60%). The deep convection then sheared away from the center overnight on 4 October, with the low-level circulation becoming fully exposed in first-light visible satellite imagery on 5 October (cover photo). While convective bursts continued to occasionally pulse near and northeast of the center over the next 24 h, briefly tugging the center of the depression more poleward on the afternoon of 5 October, this activity gradually became less organized as the low-level circulation became elongated and more diffuse. The vertical wind shear increased to over 30 kt on 6 October. After one final nocturnal convective burst that morning, the low-level center fully separated from the convection and turned west-northwestward, becoming more steered by the low-level flow. Scatterometer data indicated that the low-level circulation opened up into a surface trough axis by 0000 UTC 7 October about 650 n mi to the west-northwest of the Cabo Verde Islands. The remnant trough axis would completely lose its identity as it drifted westward over the next day or so.

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<sup>1</sup> 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 *bt* directory, while previous years’ data are located in the *archive* directory.

## METEOROLOGICAL STATISTICS

Observations in Tropical Depression Twelve (Figs. 3 and 4) 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 the depression.

### *Winds and Pressure*

The 30-kt estimated peak intensity of the depression is based on a blend of scatterometer data in addition to subjective Dvorak estimates from TAFB and SAB (Fig. 3). At the time the system became a tropical depression, the peak wind retrieval by ASCAT-B at 1114 UTC 4 October was only 25 kt, but a peak 33-kt wind retrieval was observed by ASCAT-C at 1206 UTC 4 October. The TAFB Dvorak classification was also at T2.0 (30 kt), supporting a peak intensity between the scatterometer values. A blend of scatterometer and subjective satellite intensity estimates continued to indicate winds of around 30 kt between 5–6 October, even shortly before the system degenerated into a trough axis. The depression's minimum pressure of 1007 mb is based on the Knaff-Zehr-Courtney pressure-wind relationship (Fig. 4).

## CASUALTY AND DAMAGE STATISTICS

There were no reports of damage or casualties associated with Tropical Depression Twelve.

## FORECAST AND WARNING CRITIQUE

The genesis of Tropical Depression Twelve was well anticipated (Table 2). The wave from which the depression developed was first introduced in the Tropical Weather Outlook (TWO) with a low (<40%) chance of formation 114 h prior to development. The 5-day formation chance was increased to the medium category (40–60%) 108 h and then the high category (>60%) 84 h before the depression formed. For the 2-day outlook, a low formation chance was added to the TWO 102 h before development, increased to medium at 30 h, and then high 12 h before formation. In addition to good lead time, the location of genesis was also well forecast, with each 5-day outlook area (Fig. 5) capturing the correct location of genesis, albeit covering a relatively large area in several of the high outlooks (Fig. 5d).

A verification of NHC official track forecasts for Tropical Depression Twelve is given in Table 3a. Official track forecast errors were greater than the mean official errors for the previous 5-yr period from 12 to 48 h, albeit for a relatively low number of forecasts. These higher-than-normal track errors were partially related to a somewhat slower and more poleward motion of the depression than anticipated by the official forecasts (not shown). A homogeneous comparison of the official track errors with selected guidance models is given in Table 3b. Of the deterministic guidance, the GFS (GFSI) performed well, beating the official track forecast at all lead times. A blend of both the ECMWF and GFS (GFXI) also outperformed the track forecast at all lead times. Interestingly, the track forecast errors of the higher-resolution guidance (HWFI, HMNI, CTCI) did not perform as well, generally having higher track errors than the official forecast.

A verification of NHC official intensity forecasts for Tropical Depression Twelve is given in Table 4a. In contrast to the track forecast, the official intensity forecast errors were lower than the mean official errors for the previous 5-yr period, remaining under 5 kt at all forecast lead times. In general, the official intensity forecasts correctly anticipated that the depression would not intensify significantly during its lifespan. A homogeneous comparison of the official intensity errors with selected guidance models is given in Table 4b. In general, the intensity guidance also had low intensity errors, although no one model, either deterministic or consensus, was able to vastly outperform or beat the official intensity forecast at all lead times.

There were no coastal watches or warnings issued in association with Tropical Depression Twelve.



Table 1. Best track for Tropical Depression Twelve, 4–6 October 2022.

Date/Time (UTC)	Latitude (°N)	Longitude (°W)	Pressure (mb)	Wind Speed (kt)	Stage
04 / 1200	13.6	29.5	1007	30	tropical depression
04 / 1800	14.2	30.2	1007	30	"
05 / 0000	14.6	30.5	1007	30	"
05 / 0600	15.0	30.9	1007	30	"
05 / 1200	15.3	31.5	1007	30	"
05 / 1800	16.0	31.9	1007	30	"
06 / 0000	17.0	32.1	1007	30	"
06 / 0600	17.7	32.8	1007	30	"
06 / 1200	18.1	33.9	1008	30	"
06 / 1800	18.7	35.0	1009	30	"
07 / 0000					dissipated
04 / 1200	13.6	29.5	1007	30	maximum wind 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%)	102	114
Medium (40%-60%)	30	108
High (>60%)	12	84



Table 3a. NHC official (OFCL) and climatology-persistence skill baseline (OCD5) track forecast errors (n mi) for Tropical Depression Twelve, 4–6 October 2022. 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	51.1	67.6	59.0	109.3				
OCD5	58.7	63.9	66.3	90.7				
Forecasts	7	5	3	1				
OFCL (2017-21)	23.6	35.5	47.6	61.4	78.2	91.3	125.6	172.1
OCD5 (2017-21)	45.5	98.3	156.7	213.7	252.4	316.9	403.6	484.6



Table 3b. Homogeneous comparison of selected track forecast guidance models (in n mi) for Tropical Depression Twelve, 4–6 October 2022. Errors smaller than the NHC official forecast are shown in boldface type.

Model ID	Forecast Period (h)							
	12	24	36	48	60	72	96	120
OFCL	51.1	67.6	59.0	109.3				
OCD5	58.7	<b>63.9</b>	66.3	<b>90.7</b>				
GFSI	<b>50.4</b>	<b>53.9</b>	<b>45.8</b>	<b>60.3</b>				
EMXI	<b>43.8</b>	<b>54.1</b>	80.3	129.8				
NVGI	53.9	<b>63.1</b>	59.9	<b>107.6</b>				
CMCI	57.0	106.5	114.6	157.9				
HWFI	<b>39.6</b>	78.1	107.4	243.5				
HMNI	58.6	112.9	148.2	177.8				
CTCI	52.7	69.1	64.2	<b>101.8</b>				
HCCA	<b>43.2</b>	<b>58.5</b>	69.8	138.0				
AEMI	<b>48.1</b>	74.4	68.1	<b>80.1</b>				
GFEX	<b>47.3</b>	<b>49.5</b>	<b>58.7</b>	<b>96.2</b>				
TVCA	<b>45.0</b>	<b>57.8</b>	64.0	126.5				
TVCX	<b>44.6</b>	<b>57.3</b>	65.3	126.1				
TVDG	<b>46.1</b>	<b>54.8</b>	62.1	114.1				
TABS	65.9	102.5	160.5	165.8				
TABM	62.8	83.4	137.9	177.3				
TABD	78.8	158.9	288.0	399.0				
Forecasts	7	5	3	1				





Table 4a. NHC official (OFCL) and climatology-persistence skill baseline (OCD5) intensity forecast errors (kt) for Tropical Depression Twelve, 4–6 October 2022. 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	<b>0.7</b>	<b>2.0</b>	<b>3.3</b>	<b>0.0</b>				
OCD5	2.9	7.0	10.3	16.0				
Forecasts	7	5	3	1				
OFCL (2017-21)	5.4	8.0	9.5	10.9	11.0	12.1	13.1	14.7
OCD5 (2017-21)	7.0	11.1	14.5	17.1	18.0	20.2	21.9	22.1

Table 4b. Homogeneous comparison of selected intensity forecast guidance models (in kt) for Tropical Depression Twelve, 4–6 October 2022. Errors smaller than the NHC official forecast are shown in boldface type.

Model ID	Forecast Period (h)							
	12	24	36	48	60	72	96	120
OFCL	0.7	2.0	3.3	0.0				
OCD5	2.9	7.0	10.3	16.0				
HWFI	4.1	3.4	4.3	12.0				
HMNI	1.6	<b>1.2</b>	<b>2.7</b>	7.0				
CTCI	1.3	<b>1.8</b>	4.7	4.0				
DSHP	2.0	3.6	<b>2.3</b>	1.0				
LGEM	2.1	4.0	3.3	3.0				
ICON	1.9	2.0	<b>1.7</b>	1.0				
IVCN	1.9	<b>1.6</b>	<b>1.3</b>	2.0				
IVDR	1.7	<b>1.2</b>	<b>2.0</b>	2.0				
HCCA	2.3	3.4	3.7	4.0				
GFSI	0.9	2.0	<b>3.0</b>	3.0				
EMXI	1.3	2.6	5.0	7.0				
NVGI	<b>0.4</b>	<b>1.2</b>	<b>1.0</b>	1.0				
CMCI	2.1	3.2	<b>2.0</b>	5.0				
Forecasts	7	5	3	1				

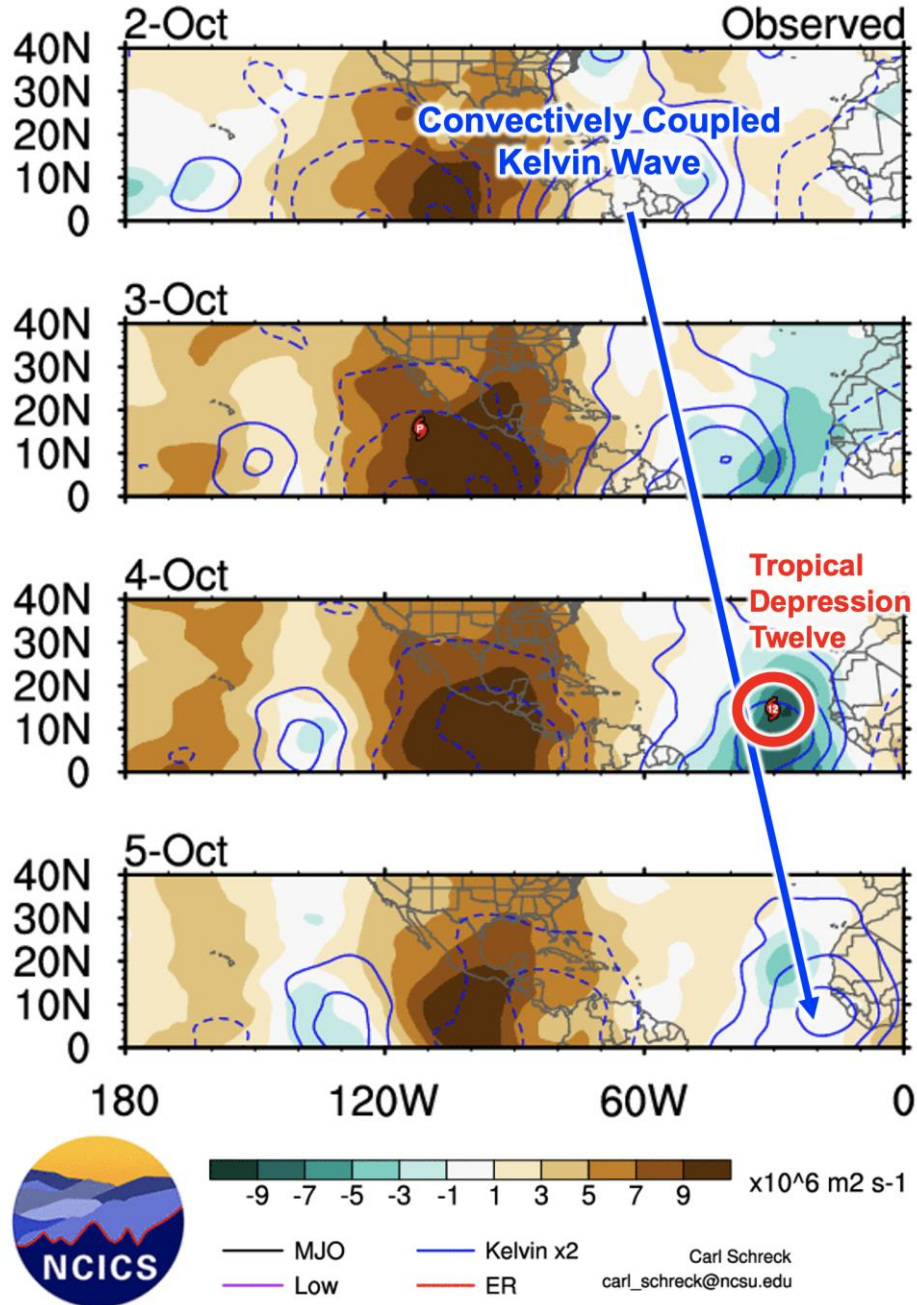


Figure 1. Observed unfiltered Velocity Potential Anomalies at 200 mb (shaded,  $\times 10^6 \text{ m}^2 \text{ s}^{-1}$ ) over the western hemisphere covering the Atlantic basin from 2–5 October 2022, where green (brown) shading shows areas of upward (downward) motion favored by the upper-level velocity potential field. Blue solid (dashed) contours indicate where the velocity potential has been filtered for upward (downward) motion associated with Kelvin Waves, with the annotations highlighting where a convectively coupled Kelvin Wave moved eastward and enhanced upward vertical motion prior to the development of Tropical Depression Twelve. Image has been adapted from Carl Schreck and the North Carolina Institute for Climate Studies, accessible at <https://ncics.org/portfolio/monitor/mjo/>.

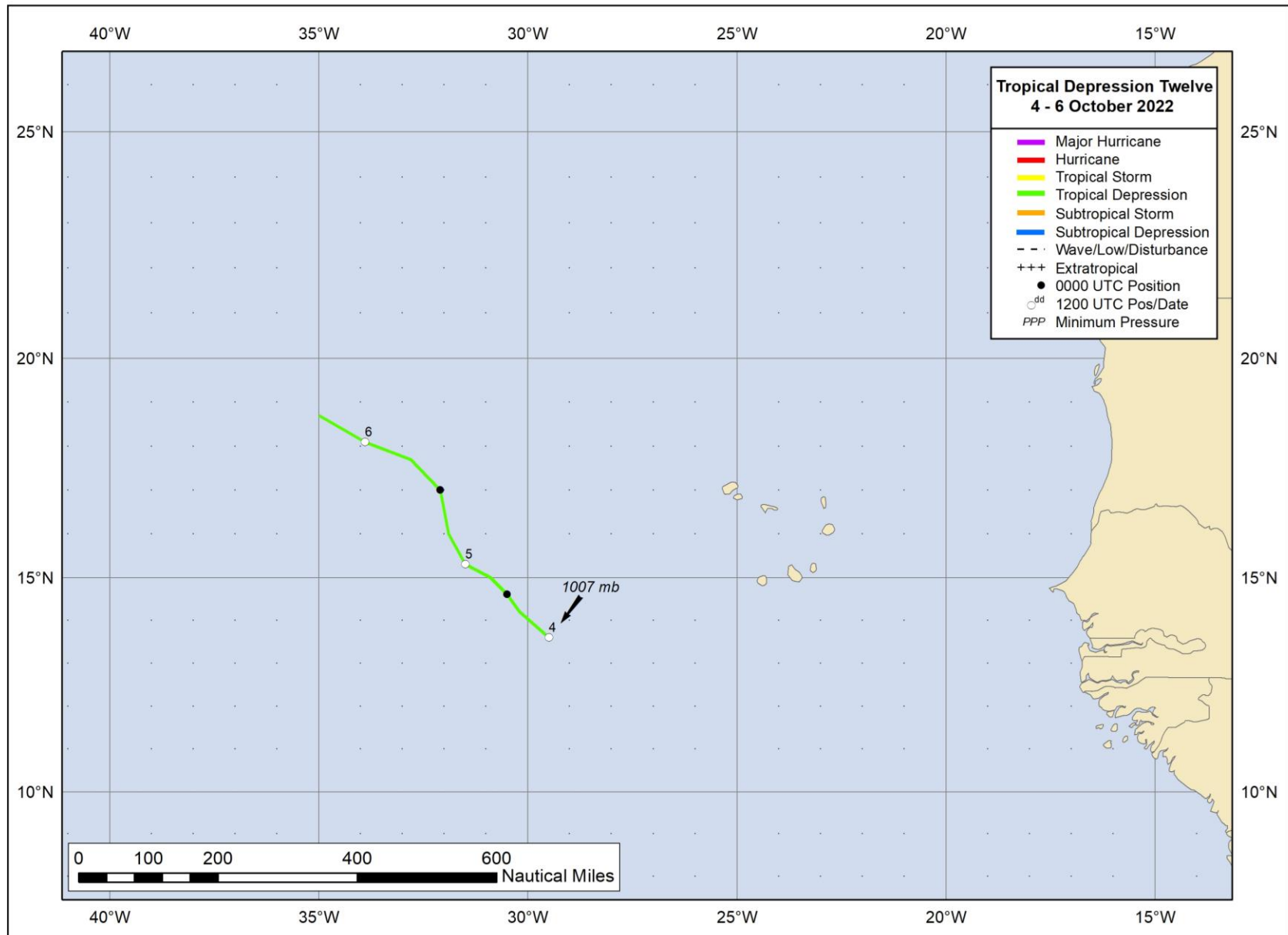


Figure 2. Best track positions for Tropical Depression Twelve, 4–6 October 2022.

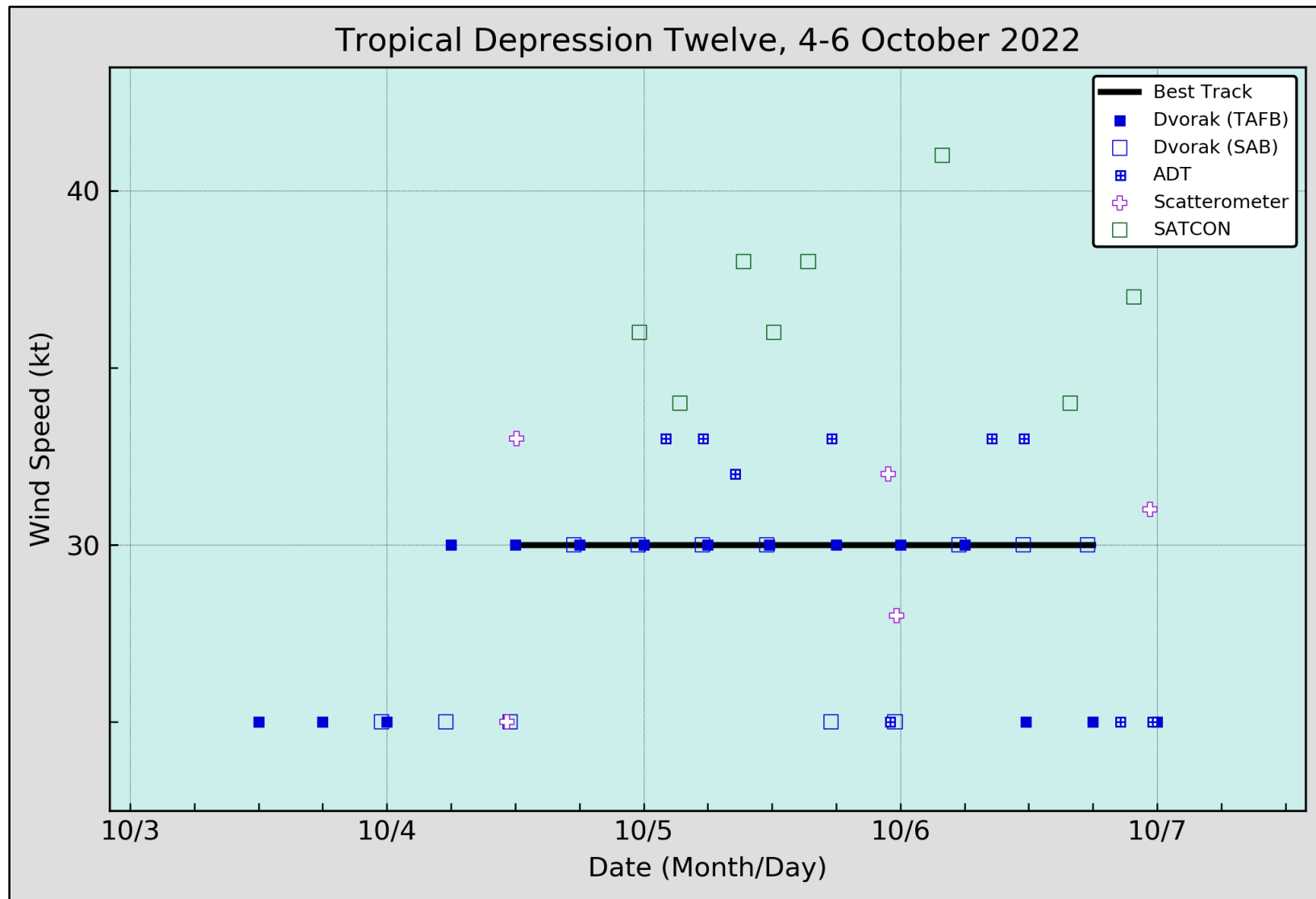


Figure 3. Selected wind observations and best track maximum sustained surface wind speed curve for Tropical Depression Twelve, 4–6 October 2022. Advanced Dvorak Technique estimates represent the Current Intensity at the nominal observation time. SATCON intensity estimates are from the Cooperative Institute for Meteorological Satellite Studies. Dashed vertical lines correspond to 0000 UTC.

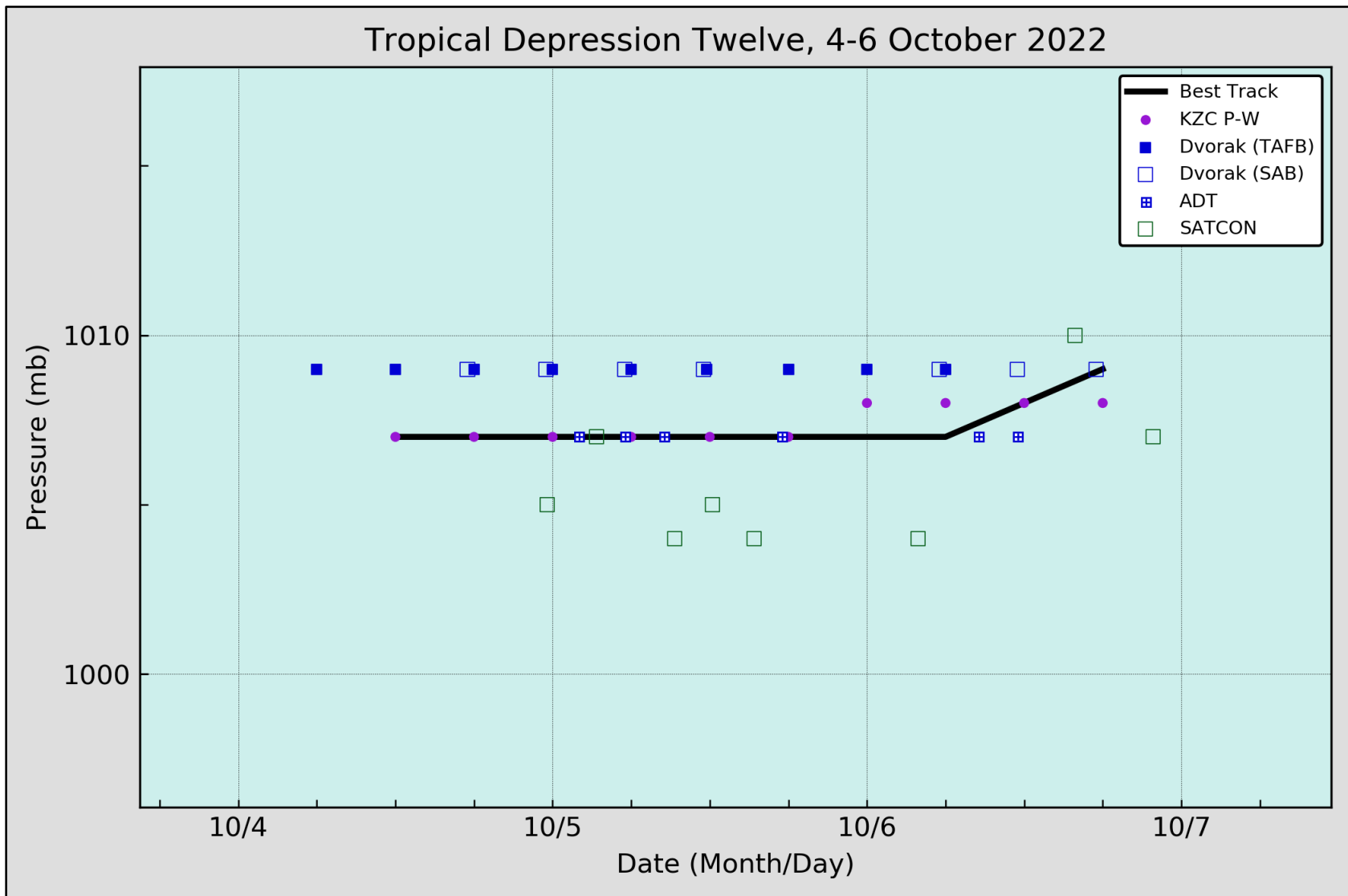


Figure 4. Selected pressure observations and best track minimum central pressure curve for Tropical Depression Twelve, 4–6 October 2022. Advanced Dvorak Technique estimates represent the Current Intensity at the nominal observation time. SATCON intensity estimates are from the Cooperative Institute for 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.

### Twelve 5-day Tropical Weather Outlook Areas

From: 1800 UTC 29 Sep 2022 to 1200 UTC 4 Oct 2022

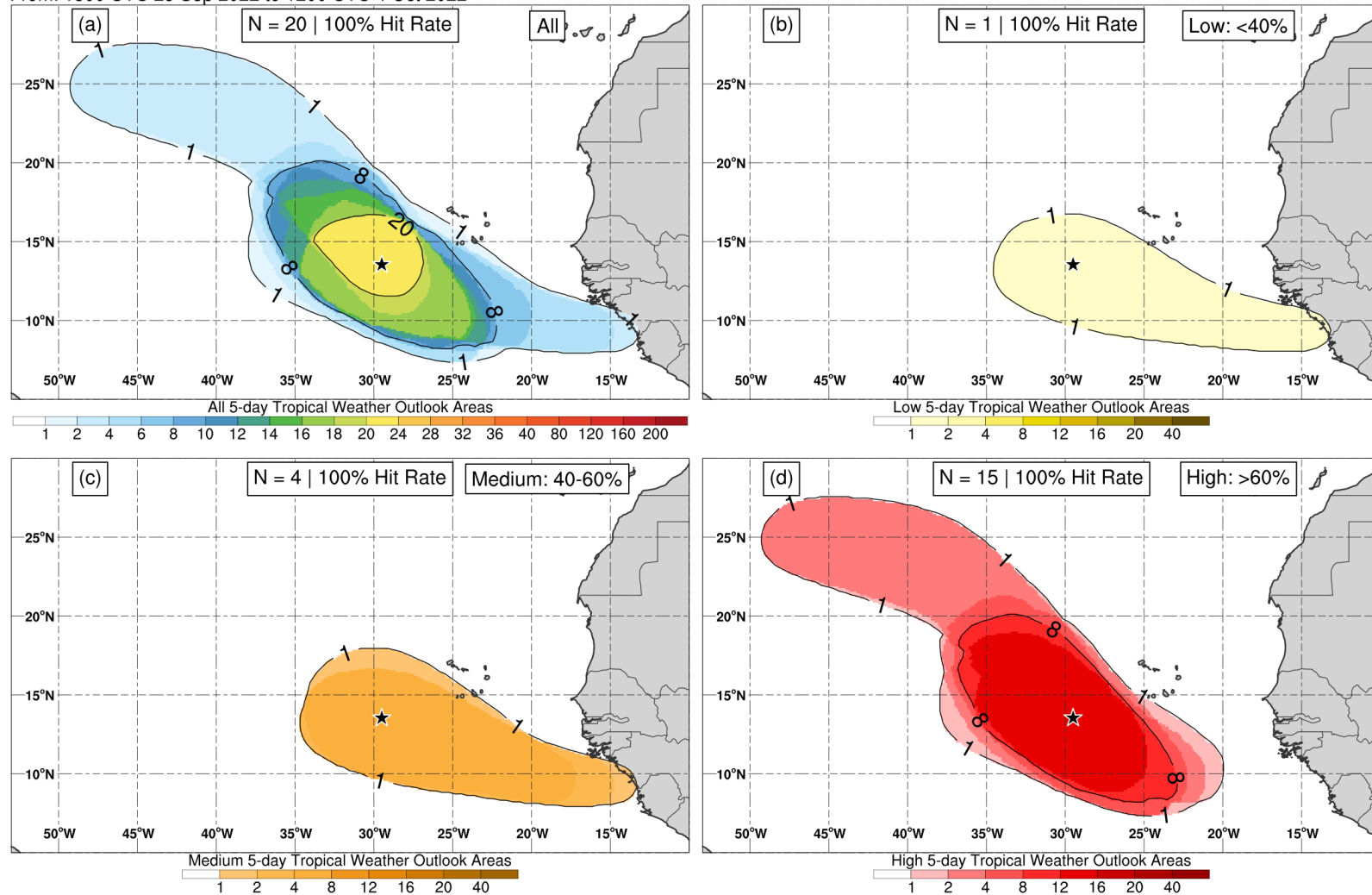


Figure 5. 5-day Tropical Weather Outlook genesis areas associated with the disturbance that developed into Tropical Depression Twelve for (a) all probability areas (10–100%, multi-color shading), (b) low probability areas (< 40%, yellow shading), (c) medium probability areas (40–60%, orange shading), and (d) high probability areas (> 60%, red shading). The black star in each panel indicates the genesis location of the depression. Hit rate indicates the percentage of outlook areas that the genesis location was captured within.