# NATIONAL HURRICANE CENTER
# TROPICAL CYCLONE REPORT

# TROPICAL DEPRESSION TWENTY-ONE-E

(EP212019)

16–18 November 2019

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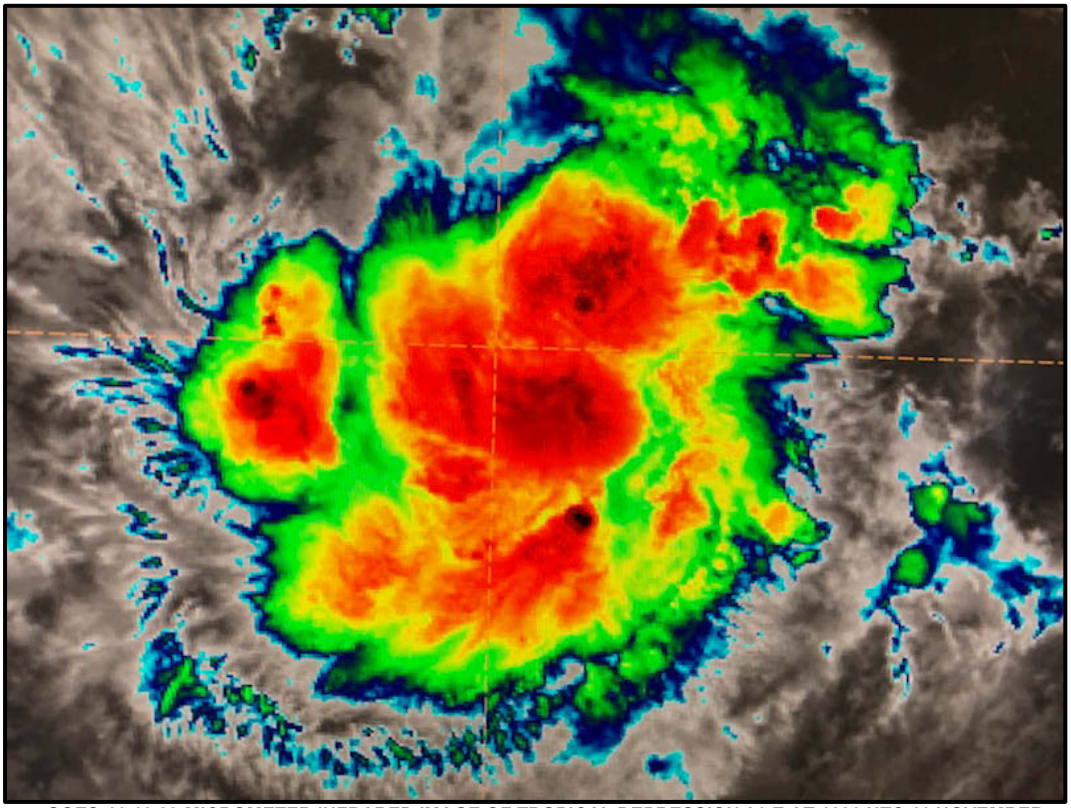

GOES-16 10.33-MICROMETER INFRARED IMAGE OF TROPICAL DEPRESSION 21-E AT 1030 UTC 16 NOVEMBER.

Tropical Depression Twenty-One-E developed well south of the southern coast of Mexico and moved westward to west-northwestward for a couple of days before dissipating.

# Tropical Depression Twenty-One-E

**16–18 NOVEMBER 2019**

## SYNOPTIC HISTORY

Tropical Depression Twenty-One-E's precursor disturbance was a tropical wave that moved off the west coast of Africa around 2 November. The wave generated some deep convection as it moved westward over the tropical Atlantic Ocean over the next several days. This thunderstorm activity remained disorganized, as strong upper-level winds were unfavorable for tropical cyclone development. The wave crossed the Caribbean Sea from 8–11 November, helping to enhance convection over the northern portion of South America, and it emerged over the eastern Pacific basin on 12 November. By early on 13 November, a broad area of low pressure formed near the wave's axis. The disturbance's low-level circulation remained ill-defined as it passed to the south of the Gulf of Tehuantepec during a strong gap wind event. Deep convection increased and became more persistent to the north of the low on 15 November, while scatterometer data (not shown) revealed that the low-level circulation was becoming better-defined. Late that day, convection became more concentrated near the center of the low, and the system became a tropical depression around 0000 UTC 16 November while it was located about 470 n mi south-southeast of Acapulco, Mexico. 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 cyclone initially remained embedded within the monsoon trough as a mid-level ridge to its north steered the depression generally westward. However, the depression never got significantly better organized after the time of genesis and it is possible that the low-level center reformed once or twice to the north of its previous location where bursts of deep convection were occurring. These center re-formations likely contributed to the northerly component of movement after 16 November. Despite being in a low-shear environment over warm waters, dry air intrusions caused the deep convection to pulse for the ensuing couple of days. This lack of persistent deep convection caused the depression to gradually weaken. A scatterometer pass (Fig. 4) on 18 November indicated that the cyclone had degenerated to a surface trough, and it dissipated around 1200 UTC that day while located about 400 n mi southwest of Acapulco, Mexico.

[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 Twenty-One E (Figs. 2 and 3) include subjective satellite-based Dvorak technique estimates from the Tropical Analysis and Forecast Branch (TAFB) and the Satellite Analysis Branch (SAB), and objective Advanced Dvorak Technique (ADT) estimates and Satellite Consensus (SATCON) estimates from the Cooperative Institute for Meteorological Satellite Studies/University of Wisconsin-Madison (UW-CIMSS). 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.

The depression's estimated maximum intensity of 30 kt from 0000 UTC 16 to 0000 UTC 17 November is based on a combination of scatterometer data and Dvorak estimates. A pair of scatterometer passes over the cyclone at 0330 and 0355 UTC 16 November showed a few tropical-storm-force wind vectors within a larger area of 25–30 kt winds. However, these strongest winds were co-located with an area of intense convection and presumably high rain rates, and most of the vectors were flagged as potentially rain contaminated. Since the quality of the ASCAT data was questionable, and no other intensity estimates at that time supported more than 30 kt, the peak intensity is estimated to be 30 kt. However, it is worth noting that the ASCAT data cannot be dismissed with complete certainty, and it is possible that the system produced tropical-storm-force winds for a brief period of time.

There were no ship reports of tropical storm force winds associated with the depression.

# CASUALTY AND DAMAGE STATISTICS

There were no reports of damage or casualties associated with the depression.

# FORECAST AND WARNING CRITIQUE

The genesis of Tropical Depression Twenty-One-E (Table 2) was not well-anticipated, which is not surprising due to the weak nature of the cyclone and the marginal environment. The global forecast models were not suggesting much in the way of tropical cyclone development, and those that did close off a low correctly indicated that little strengthening would occur. The incipient disturbance was first introduced into the Tropical Weather Outlook with a low chance (<40%) for development during both the 48-h and 120-h forecast periods only 18 h before genesis occurred. At the time genesis occurred, the 48-h and 120-h probabilities were 30% and 40%, respectively.

A verification of NHC official track forecasts for Tropical Depression Twenty-One-E is given in Table 3a. Official track forecast errors were much higher than the previous 5-yr mean official errors at all available time periods, with the errors more than double the 5-yr means beyond 12 h. Additionally, the official forecast errors were larger than those of climatology-persistence (OCD5) at 24 h and beyond, indicated that the official track forecasts lacked skill. A homogeneous comparison of the official track errors with selected guidance models is given in Table 3b. The official NHC track errors were close to or slightly better than the majority of the guidance at 12 h, but worse than most of the guidance beyond 12 h. The AEMI, GFSI, and TABD were the best performing track guidance, beating the official NHC track at all time periods. The regional models HWFI and HMNI had the largest overall track errors. Most of the guidance as well as the official NHC forecasts had fairly large track errors beyond 12 h due to a left-of-track bias (Fig. 5), as it was not anticipated that center reformations would contribute to a northerly component of motion. Due to the relatively short existence of the depression, there were no verifying forecasts beyond 36 h.

A verification of NHC official intensity forecasts for Tropical Depression Twenty-One-E is given in Table 4a. The official intensity forecasts had average errors lower than the mean official errors for the previous 5-yr period at all available time periods. A homogeneous comparison of the official intensity errors with selected guidance models is given in Table 4b. The official forecast was better than the majority of guidance at 12 h, but worse than all of the guidance from 24–36 h. The early official NHC intensity forecasts were higher than all of the guidance, anticipating that some strengthening would occur. Although the official NHC errors were higher than the guidance after 24 h, both the NHC and model forecasts all correctly anticipated that significant strengthening was unlikely.

No coastal watches or warnings were issued in association with Tropical Depression Twenty-One-E.

Table 1. Best track for Tropical Depression Twenty-One-E, 16–18 November 2019.

| Date/Time (UTC) | Latitude (°N) | Longitude (°W) | Pressure (mb) | Wind Speed (kt) | Stage |
|---|---|---|---|---|---|
| 15 / 1200 | 9.0 | 95.7 | 1008 | 25 | low |
| 15 / 1800 | 9.1 | 96.7 | 1008 | 25 | " |
| 16 / 0000 | 9.1 | 97.7 | 1006 | 30 | tropical depression |
| 16 / 0600 | 9.2 | 98.7 | 1006 | 30 | " |
| 16 / 1200 | 9.2 | 99.7 | 1006 | 30 | " |
| 16 / 1800 | 9.4 | 100.7 | 1006 | 30 | " |
| 17 / 0000 | 9.6 | 101.5 | 1006 | 30 | " |
| 17 / 0600 | 10.0 | 102.2 | 1007 | 25 | " |
| 17 / 1200 | 10.4 | 102.9 | 1007 | 25 | " |
| 17 / 1800 | 11.0 | 103.6 | 1007 | 25 | " |
| 18 / 0000 | 11.7 | 104.2 | 1007 | 25 | " |
| 18 / 0600 | 12.2 | 104.8 | 1007 | 25 | " |
| 18 / 1200 | | | | | dissipated |
| 16 / 0000 | 9.1 | 97.7 | 1006 | 30 | minimum pressure and maximum wind speed |

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%) | 18 | 18 |
| Medium (40%-60%) | - | 0 |
| High (>60%) | - | - |

Table 3a. NHC official (OFCL) and climatology-persistence skill baseline (OCD5) track forecast errors (n mi) for Tropical Depression Twenty-One-E, 16–18 November 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 | 41.3 | 75.3 | 122.4 | 174.5 | | | |
| OCD5 | 42.2 | 72.7 | 90.0 | 21.3 | | | |
| Forecasts | 7 | 5 | 3 | 1 | | | |
| OFCL (2014-18) | 21.1 | 32.2 | 41.8 | 51.8 | 75.7 | 101.1 | 133.7 |
| OCD5 (2014-18) | 34.0 | 69.7 | 109.0 | 148.4 | 223.5 | 285.5 | 356.7 |

Table 3b. Homogeneous comparison of selected track forecast guidance models (in n mi) for Tropical Depression Twenty-One E, 16–18 November 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 | 44.1 | 77.6 | 121.8 | | | | |
| OCD5 | 45.7 | 85.5 | 130.8 | | | | |
| TABS | 49.6 | 90.2 | 135.3 | | | | |
| TABM | 45.2 | **70.9** | **85.7** | | | | |
| TABD | **39.8** | **56.3** | **53.4** | | | | |
| TVDG | 46.3 | **70.3** | **109.6** | | | | |
| TVCE | 48.4 | **76.5** | 121.9 | | | | |
| TVCX | 51.2 | 79.3 | 122.2 | | | | |
| HCCA | 50.5 | **76.1** | **108.4** | | | | |
| AEMI | **42.8** | **56.6** | **70.6** | | | | |
| NVGI | 50.1 | **50.1** | **44.4** | | | | |
| HWFI | 52.7 | 101.9 | 169.7 | | | | |
| HMNI | 50.2 | 87.3 | 147.2 | | | | |
| GFSI | **42.0** | **59.5** | **89.5** | | | | |
| Forecasts | 6 | 4 | 2 | | | | |

Table 4a. NHC official (OFCL) and climatology-persistence skill baseline (OCD5) intensity forecast errors (kt) for Tropical Depression Twenty-One-E, 16–18 November 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 | **2.9** | **8.0** | **10.0** | **10.0** | | | |
| OCD5 | 7.1 | 19.6 | 33.7 | 41.0 | | | |
| Forecasts | 7 | 5 | 3 | 1 | | | |
| OFCL (2014-18) | 6.1 | 10.0 | 12.2 | 13.7 | 15.5 | 15.4 | 15.7 |
| OCD5 (2014-18) | 7.9 | 13.1 | 16.7 | 19.2 | 21.8 | 22.9 | 22.1 |

Table 4b. Homogeneous comparison of selected intensity forecast guidance models (in kt) for Tropical Depression Twenty-One-E, 16–18 November 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 | 2.5 | 6.2 | 7.5 | | | | |
| OCD5 | 6.7 | 17.8 | 31.0 | | | | |
| IVDR | **2.2** | **2.5** | **1.5** | | | | |
| IVCN | **2.0** | **3.5** | **2.5** | | | | |
| ICON | **2.2** | **3.2** | **3.0** | | | | |
| LGEM | 2.7 | **4.5** | **3.0** | | | | |
| DSHP | 3.7 | **5.8** | **7.0** | | | | |
| HCCA | 2.5 | **4.0** | **3.5** | | | | |
| AEMI | **2.2** | **3.2** | **4.0** | | | | |
| NVGI | **1.8** | **1.8** | **1.0** | | | | |
| HWFI | **2.0** | **2.0** | **4.0** | | | | |
| HMNI | 3.0 | **2.5** | **2.5** | | | | |
| GFSI | 3.0 | **2.8** | **3.5** | | | | |
| Forecasts | 6 | 4 | 2 | | | | |

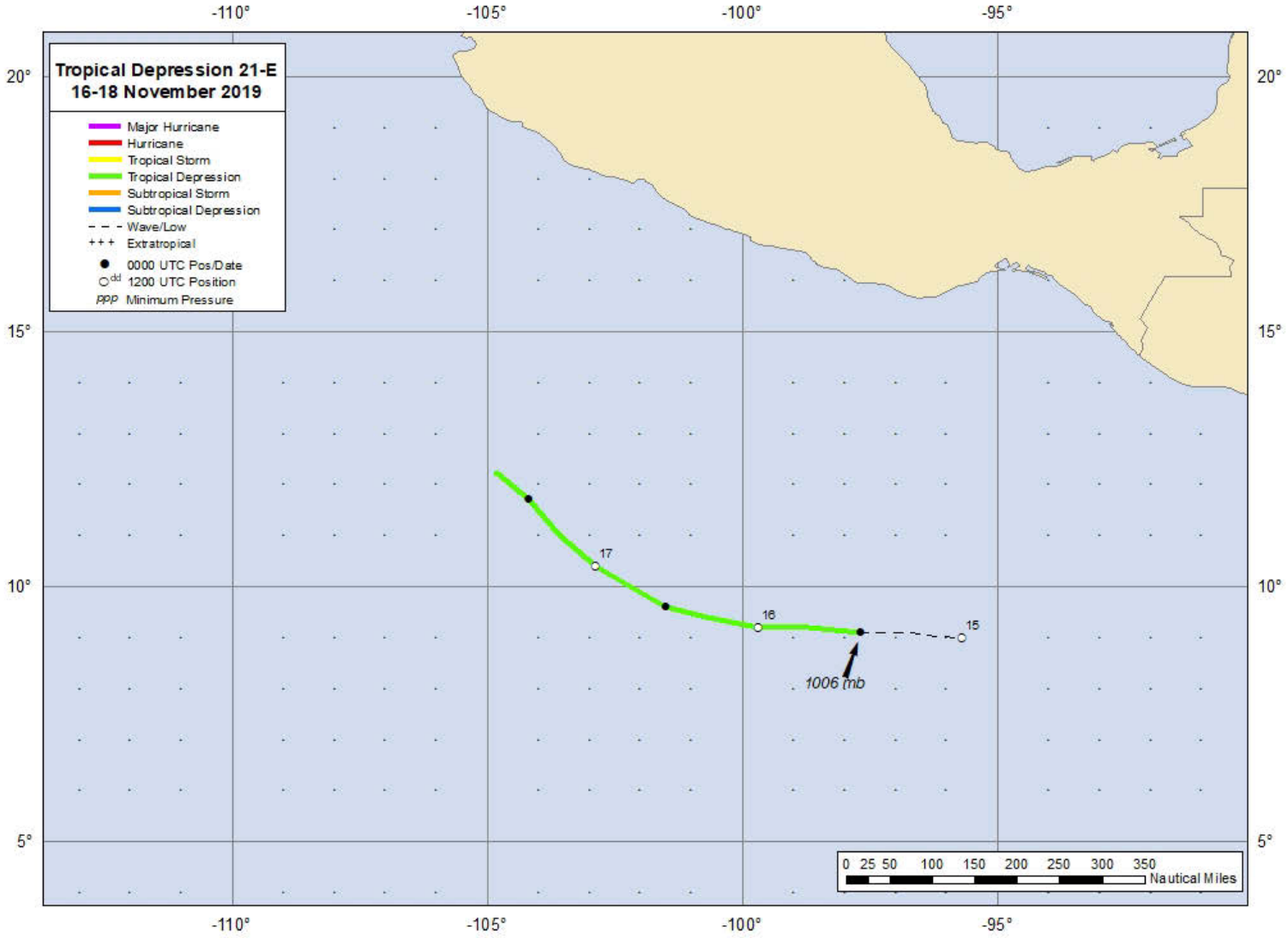


Figure 1. Best track positions for Tropical Depression Twenty-One-E, 16–18 November, 2019.

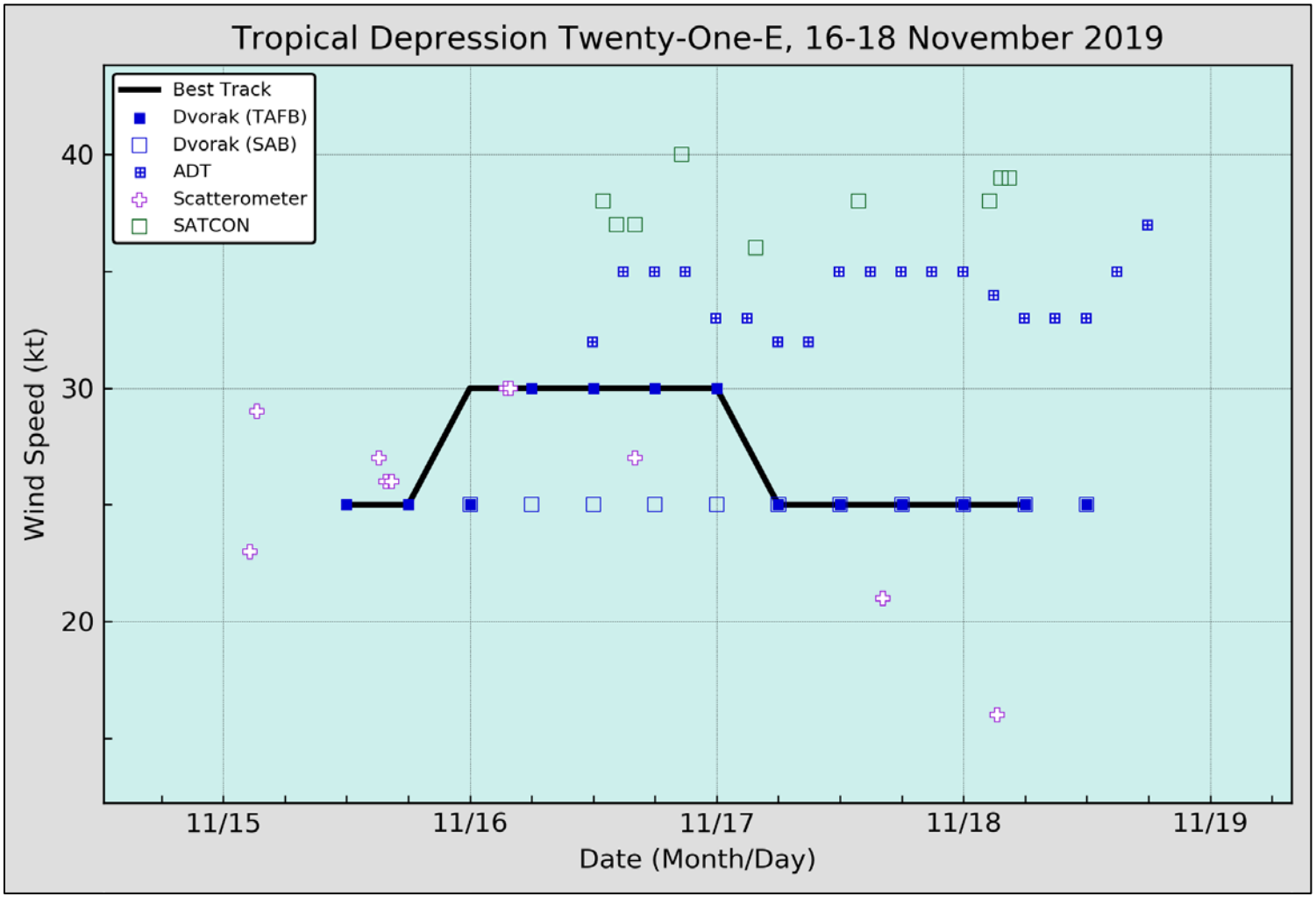


Figure 2. Selected wind observations and best track maximum sustained surface wind speed curve for Tropical Depression Twenty-One-E, 16–18 November 2019. Advanced Dvorak Technique estimates represent the Current Intensity at the nominal observation time. SATCON intensity estimates are from the Cooperative Institute for Meteorological Satellite Studies. Dashed vertical lines correspond to 0000 UTC.

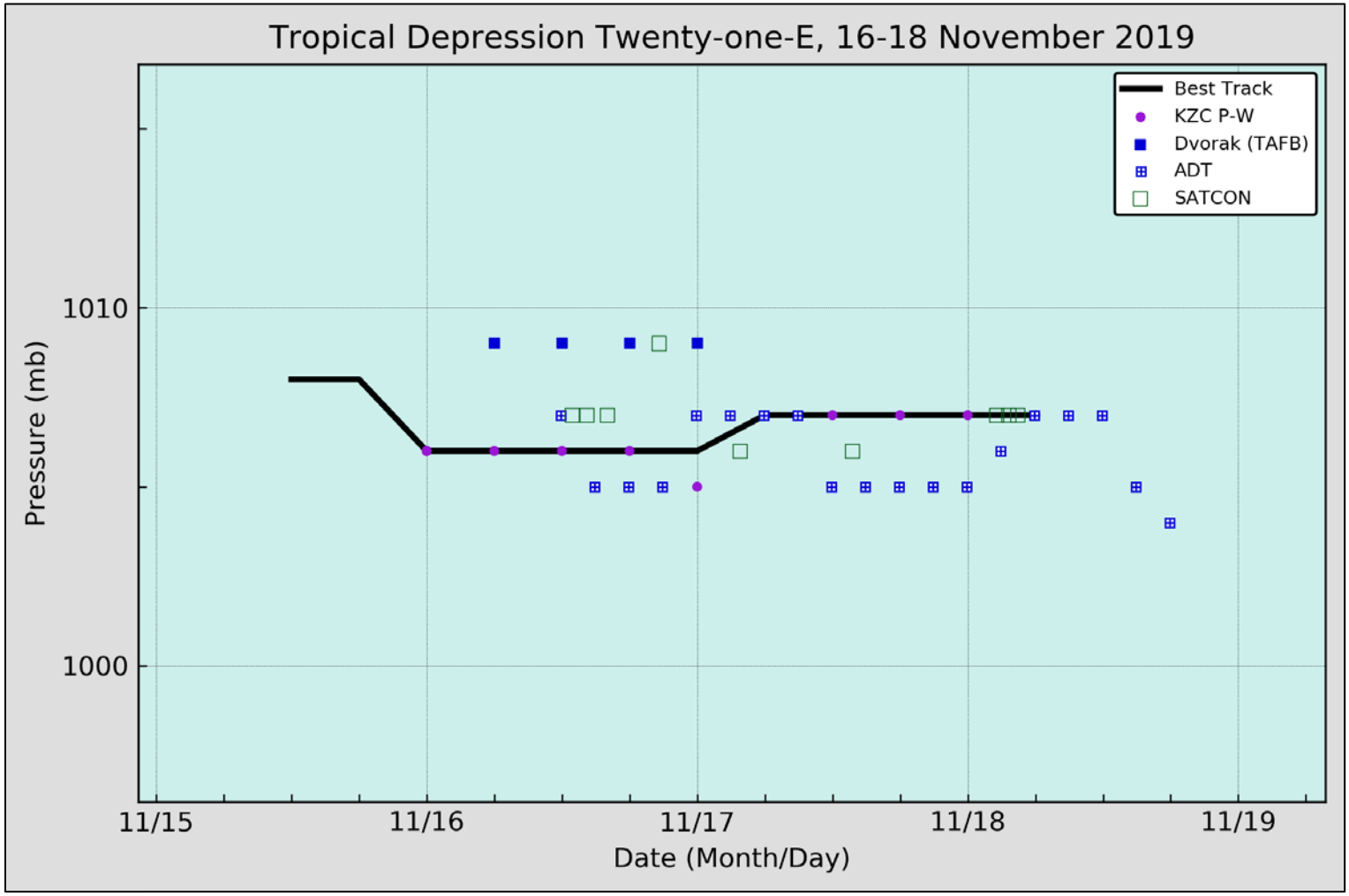


Figure 3. Selected pressure observations and best track minimum central pressure curve for Tropical Depression Twenty-One-E, 16–18 November 2019. Advanced Dvorak Technique estimates represent the Current Intensity at the nominal observation time. SATCON intensity estimates are from the Cooperative Institute for Meteorological Satellite Studies. KZC P-W refers to pressure estimates derived using the Knaff-Zehr-Courtney pressure-wind relationship. Dashed vertical lines correspond to 0000 UTC.

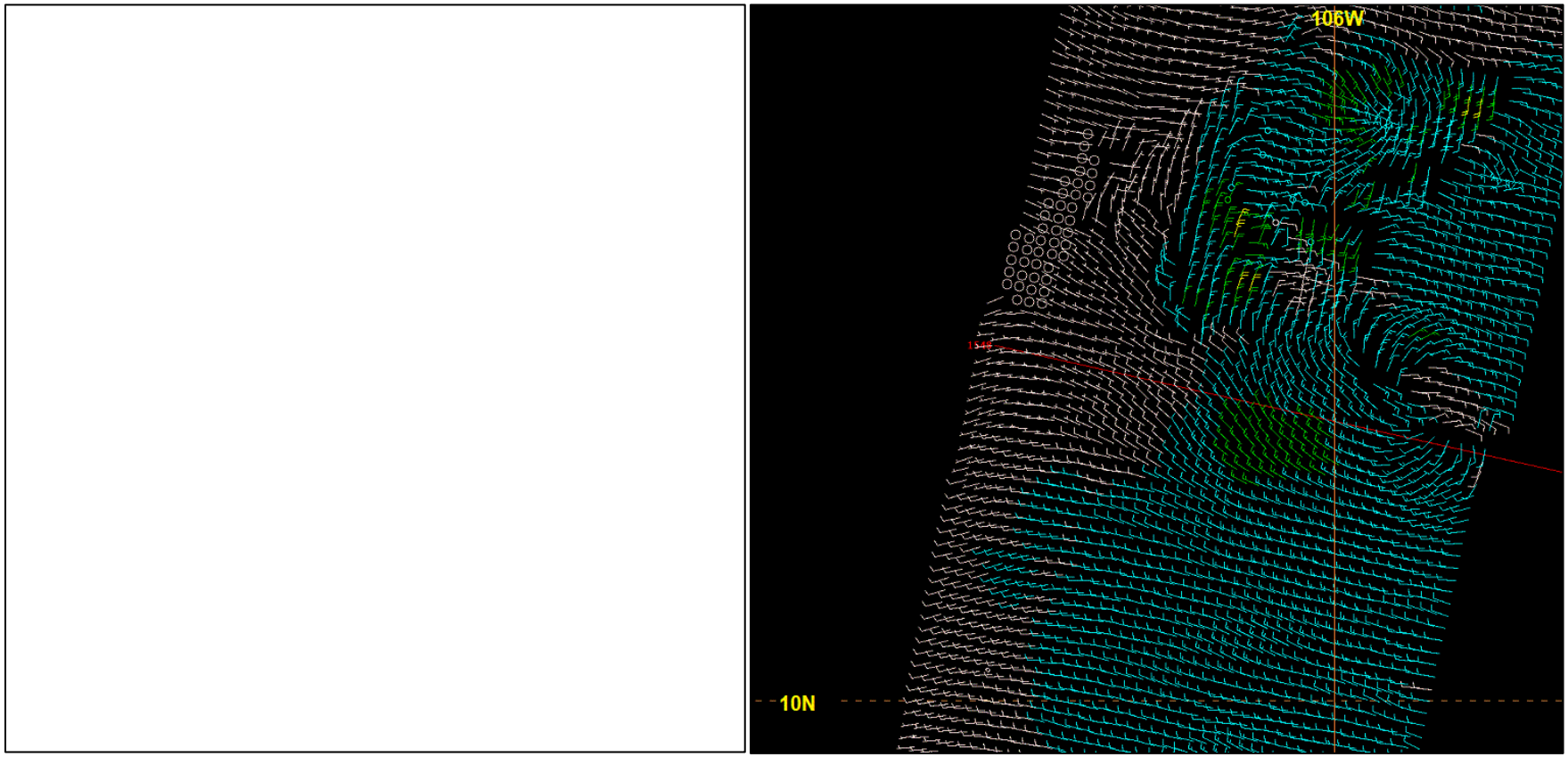


Figure 4. Scatterometer directional ambiguities (left) and winds (right) from the METOP-A ASCAT instrument at 1547 UTC 18 November, 2019, indicating that the depression had dissipated.

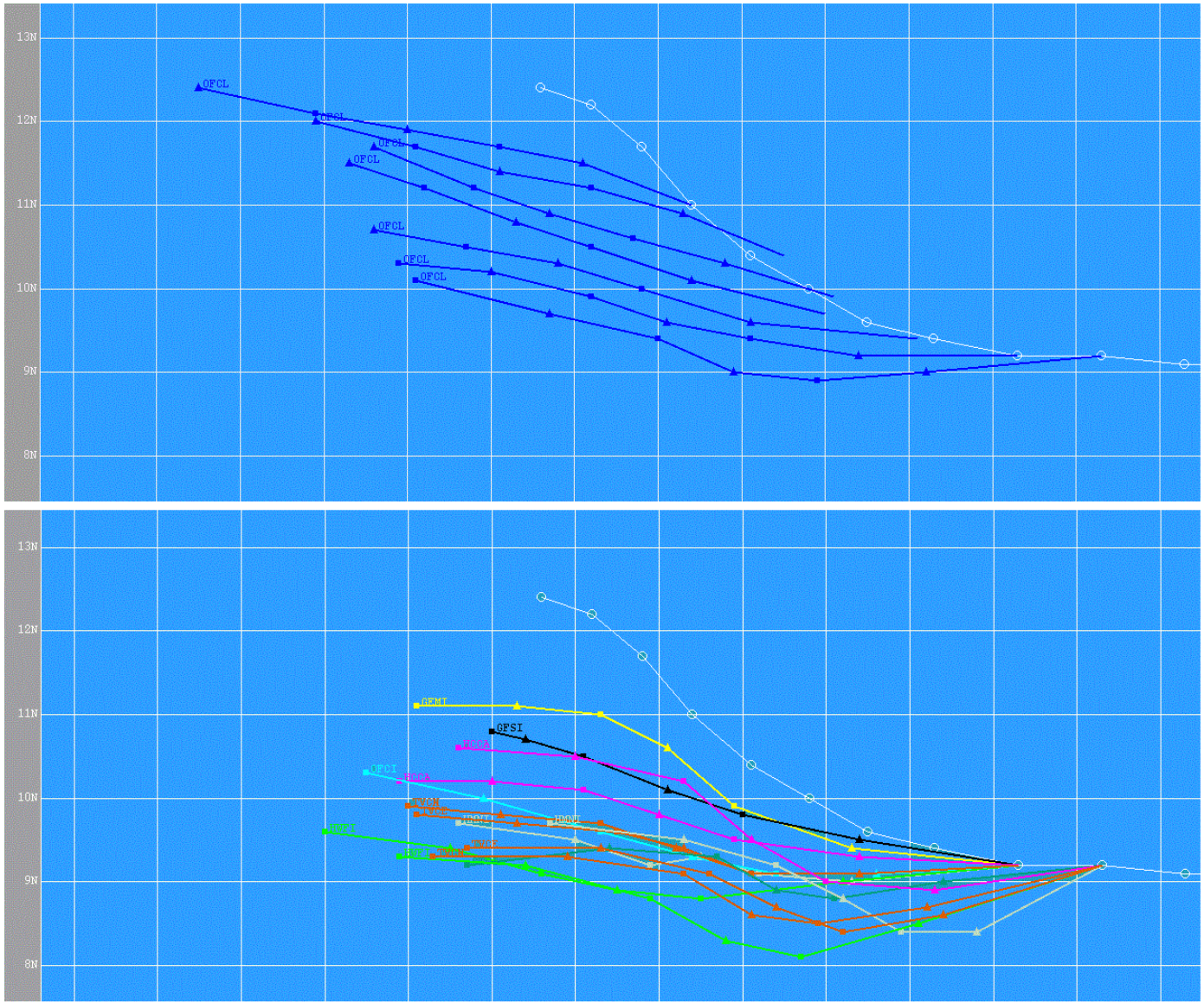


Figure 5. All NHC official three-day track forecasts (top) for Tropical Depression Twenty-One-E from 0600 UTC 16 November through 1800 UTC 17 November and three-day model track forecasts (bottom) for Tropical Depression Twenty-One-E from the 0600 and 1200 UTC 16 November forecast cycles. The depression's best track is indicated by the white line and symbols.