

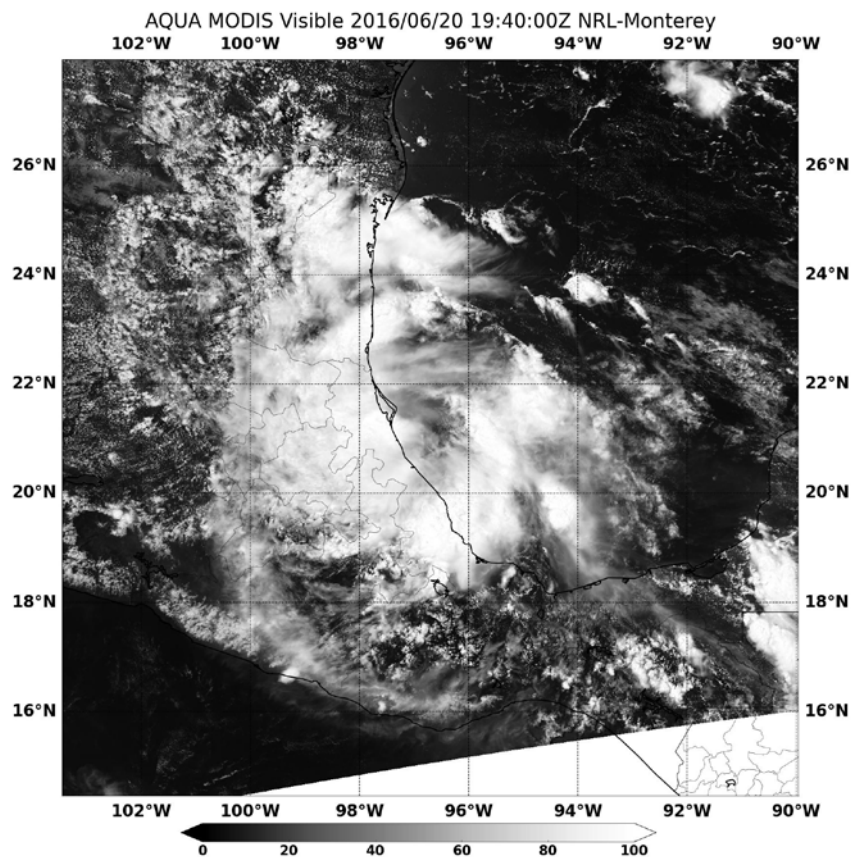


# NATIONAL HURRICANE CENTER TROPICAL CYCLONE REPORT

## TROPICAL STORM DANIELLE (AL042016)

19 – 21 June 2016

John L. Beven II  
National Hurricane Center  
8 September 2016



MODIS IMAGE OF DANIELLE TAKEN BY THE AQUA SATELLITE AT 1940 UTC 20 JUNE 2016. IMAGE COURTESY OF NRL MONTEREY AND NASA

Danielle was a short-lived tropical storm over the Bay of Campeche that made landfall in eastern mainland Mexico.

# Tropical Storm Danielle

19 – 21 JUNE 2016

## SYNOPTIC HISTORY

The formation of Danielle was associated with a tropical wave that emerged from the coast of Africa on 8 June, moved westward across the tropical Atlantic south of 10°N, and reached northern South America on 13 June. The associated shower activity increased on 15 June when the wave moved over the southwestern Caribbean Sea. Subsequently, the area of convection moved northwestward and was located over the Yucatan peninsula of Mexico on 17 June.

Development of the disturbance began the next day when it reached the Bay of Campeche, and a low pressure area formed a short distance north of Ciudad del Carmen, Mexico. The low moved west-northwestward to westward with increasing organization of the shower activity, and by 1200 UTC 19 June its convection and circulation had sufficient organization for the system to be considered a tropical depression. At that time, it was centered about 125 n mi east-northeast of Veracruz, 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<sup>1</sup>.

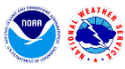
A mid-level ridge over the southern United States provided an east-southeast to west-northwest steering flow, and the cyclone moved in that general direction during its short lifetime. However, superimposed on top of that motion were changes in direction that might have been due to either a reformation of the center or propagation of the center along a northwest-southeast oriented trough that existed within the cyclone’s circulation. The first of these changes occurred early on 20 June when the previously westward-moving center turned northwestward. During this period, the depression strengthened to a tropical storm and reached a peak intensity of 40 kt at about 1200 UTC that day. Later on 20 June, Danielle turned west-southwestward and weakened, making landfall near Tamiahua, Mexico (in the state of Veracruz about 70 n mi south-southeast of Tampico) around 2200 UTC with a landfall intensity estimated at 35 kt. After landfall, Danielle rapidly weakened as it continued west-southwestward, and the cyclone dissipated early on 21 June over the mountains of eastern Mexico.

## METEOROLOGICAL STATISTICS

Observations in Danielle (Figs. 2 and 3) include subjective satellite-based Dvorak technique intensity estimates from the Tropical Analysis and Forecast Branch (TAFB) and the

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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*k directory, while previous years’ data are located in the *archive* directory.



Satellite Analysis Branch (SAB), and objective Advanced Dvorak Technique (ADT) estimates from the Cooperative Institute for Meteorological Satellite Studies/University of Wisconsin-Madison. Observations also include flight-level, stepped frequency microwave radiometer (SFMR), and dropwindsonde observations from two flights of the 53<sup>rd</sup> 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 Danielle.

### ***Winds and Pressure***

There were no surface observations of sustained tropical-storm-force winds associated with Danielle. The highest land station wind report was from Tampico, Mexico, which reported 30 kt sustained winds with a gust to 40 kt at 2353 UTC 20 June. At sea, NOAA buoy 42055 reported a 1-min wind of 33 kt and a peak gust of 38 kt at 0541 UTC 19 June at an elevation of 5 m.

The estimated peak intensity of 40 kt is based on 850-mb flight-level winds of 52 kt measured by the Air Force Reserve Hurricane Hunter aircraft at 1047 UTC 20 June. On several occasions, the SFMR on the aircraft estimated winds greater than 40 kt, although these were recorded in areas of heavy rain and their reliability is suspect. The minimum pressure reported during the storm was 1007 mb from a Hurricane Hunter aircraft at 0909 UTC 20 June.

### ***Rainfall and Flooding***

Danielle caused locally heavy rains across portions of eastern Mexico, particularly in the states of Veracruz and Tamaulipas. While storm total rainfalls are not currently available, 24-h amounts for 20-21 June were generally 3-6 inches with a maximum amount of 6.22 inches at Cosautlán de Carvajal (Table 3). These rains caused flash flooding across portions of eastern Mexico.

### ***Tornadoes***

No tornadoes were reported from Danielle.

## CASUALTY AND DAMAGE STATISTICS

Media reports indicate that one death was directly<sup>2</sup> associated with Danielle - a man in the municipality of Ciudad Madero, Tamaulipas who drowned in a flash flood. Other media reports indicate that 1,200 homes were damaged by flooding in the municipality of Pueblo Viejo, Veracruz. No monetary damage figures are available at this time.

## FORECAST AND WARNING CRITIQUE

The genesis forecasts for Danielle showed a mix of positive and negative results. On the plus side, the potential for genesis was first given a low probability of occurrence (<40% chance) 108 h before genesis for the medium range (48-120 h) forecast and 42 hours before genesis for the short range (0-48 h) forecast as shown in Table 2. On the other hand, the probabilities were not raised into the medium category (40-60% chance) until 30 h before genesis for the medium range and 24 h before genesis for the short range. The probabilities did not reach the high category (>60% chance) in either the medium or the short range forecasts until 6 h before genesis. One factor working against an earlier increase in probabilities was that the various global dynamical models forecast a broad low pressure area over the Bay of Campeche that did not appear to be a developing tropical cyclone.

A verification of NHC official track forecasts for Danielle is given in Table 4. Official forecast track errors were greater than the mean official errors for the previous 5-yr period, although the number of forecasts was very small. Examination of the individual forecasts (Fig. 4) indicates they did not predict the two track changes that occurred on 20 June.

A verification of NHC official intensity forecasts for Danielle is given in Table 5. Official forecast intensity errors were near or lower than the mean official errors for the previous 5-yr period. Once again, the number of forecasts was very small.

It should be noted that no verification of the guidance models was done for Danielle due to the small number of forecasts.

Watches and warnings associated with Danielle are given in Table 6.

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<sup>2</sup> Deaths occurring as a direct result of the forces of the tropical cyclone are referred to as “direct” deaths. These would include those persons who drowned in storm surge, rough seas, rip currents, and freshwater floods. Direct deaths also include casualties resulting from lightning and wind-related events (e.g., collapsing structures). Deaths occurring from such factors as heart attacks, house fires, electrocutions from downed power lines, vehicle accidents on wet roads, etc., are considered “indirect” deaths.



Table 1. Best track for Tropical Storm Danielle, 19 - 21 June 2016.

Date/Time (UTC)	Latitude (°N)	Longitude (°W)	Pressure (mb)	Wind Speed (kt)	Stage
18 / 1800	19.4	91.6	1010	25	low
19 / 0000	19.7	92.3	1009	25	"
19 / 0600	19.9	93.2	1009	25	"
19 / 1200	19.9	94.1	1008	30	tropical depression
19 / 1800	19.8	94.6	1009	30	"
20 / 0000	19.8	95.1	1008	30	"
20 / 0600	20.0	95.5	1008	35	tropical storm
20 / 1200	20.7	96.1	1007	40	"
20 / 1800	21.3	96.8	1008	35	"
20 / 2200	21.2	97.4	1009	35	landfall near Tamiahua, Mexico
21 / 0000	21.1	97.8	1010	30	tropical depression
21 / 0600	20.8	98.7	1013	20	low
21 / 1200					dissipated
20 / 2200	21.2	97.4	1009	35	landfall near Tamiahua, Mexico
20 / 1200	20.7	96.1	1007	40	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%)	42	108
Medium (40%-60%)	24	30
High (>60%)	6	6

Table 3. Selected 24-h rainfall totals for 20-21 June 2016 associated with Tropical Storm Danielle. All stations are in the Mexican state of Veracruz, and these data are courtesy of the Meteorological Service of Mexico.

Municipality/Station	Rainfall (in)
Acajete/La Joya	3.32
Actopan	4.85
Calchualco	3.88
Carrillo Puerto/Mexcala	3.57
Cosautlán de Carvajal	6.22
Cuituláhuac/Puente de la Autopista	4.24
Emiliano Zapata/Rinconada	3.35
Huatusco	2.84
Huayacocotla	5.16
La Antigua/Cardel	3.31
Omealca	3.58
Pánuco/Pánuco	3.14
Pánuco/Paso de Piedras	2.81
Puente Nacional/Tamarindo	3.54
San Andrés Tuxtla/Sihuapan	3.08
Tepatlaxco/OCGC	4.25
Tlacolulan	3.87
Totutla	3.98
Zongolica/Chicomapa	3.69



Table 4. NHC official (OFCL) and climatology-persistence skill baseline (OCD5) track forecast errors (n mi) for Tropical Storm Danielle, 19 - 21 June 2016. 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	36.5	55.4					
OCD5	42.6	51.6					
Forecasts	4	2					
OFCL (2011-15)	28.4	45.0					
OCD5 (2011-15)	48.3	101.5					

Table 5. NHC official (OFCL) and climatology-persistence skill baseline (OCD5) intensity forecast errors (kt) for Tropical Storm Danielle, 19 - 21 June 2016. 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	<b>3.8</b>	2.5					
OCD5	6.3	2.5					
Forecasts	4	2					
OFCL (2011-15)	6.2	9.4					
OCD5 (2011-15)	7.3	10.8					





Table 6. Watch and warning summary for Tropical Storm Danielle, 19 – 21 June 2016.

<b>Date/Time (UTC)</b>	<b>Action</b>	<b>Location</b>
19 / 2100	Tropical Storm Warning issued	Coast of Mexico from Laguna Verde to Rio Panuco
21 / 0300	Tropical Storm Warning discontinued	All

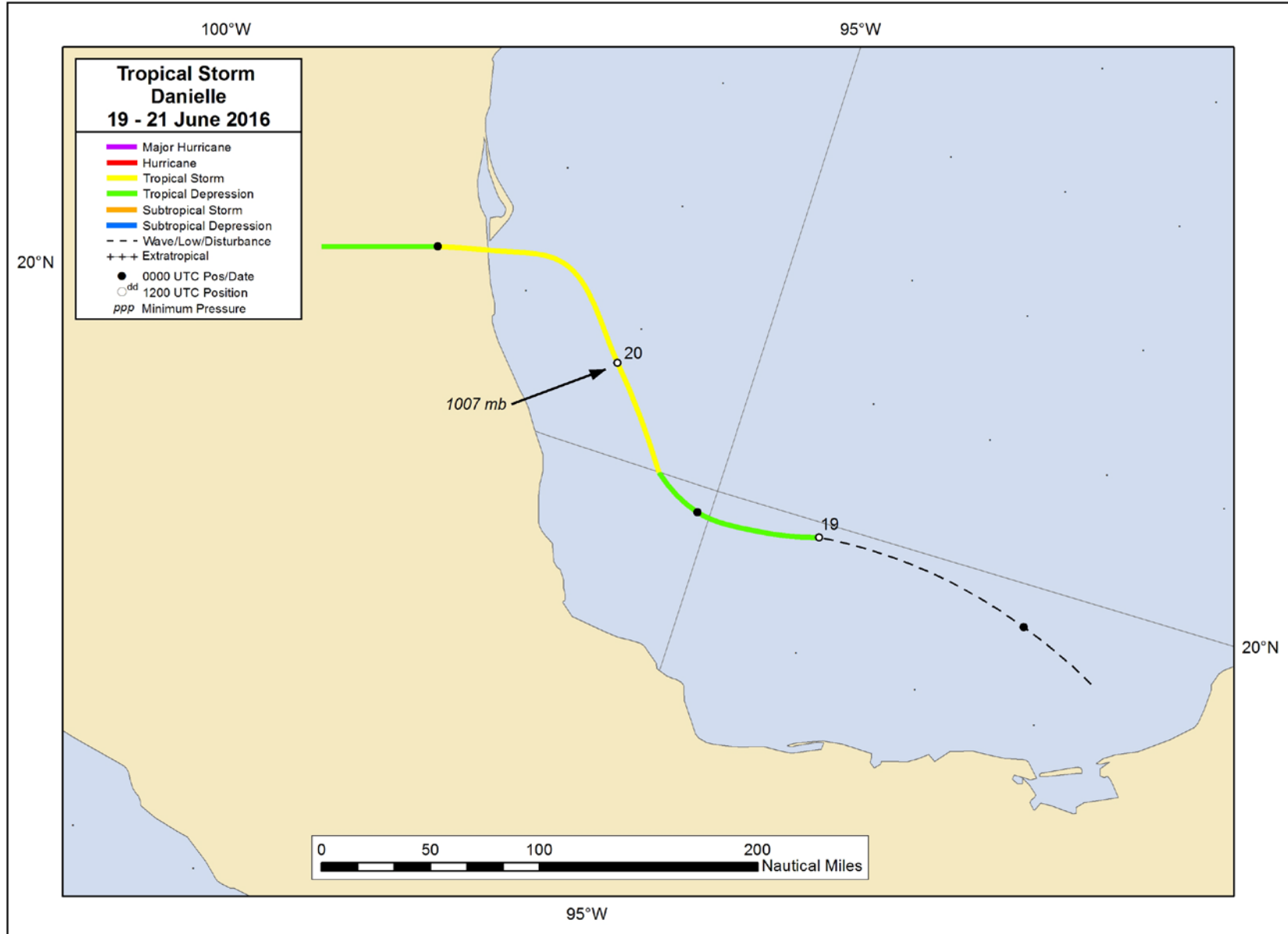


Figure 1. Best track positions for Tropical Storm Danielle, 19 – 21 June 2016.

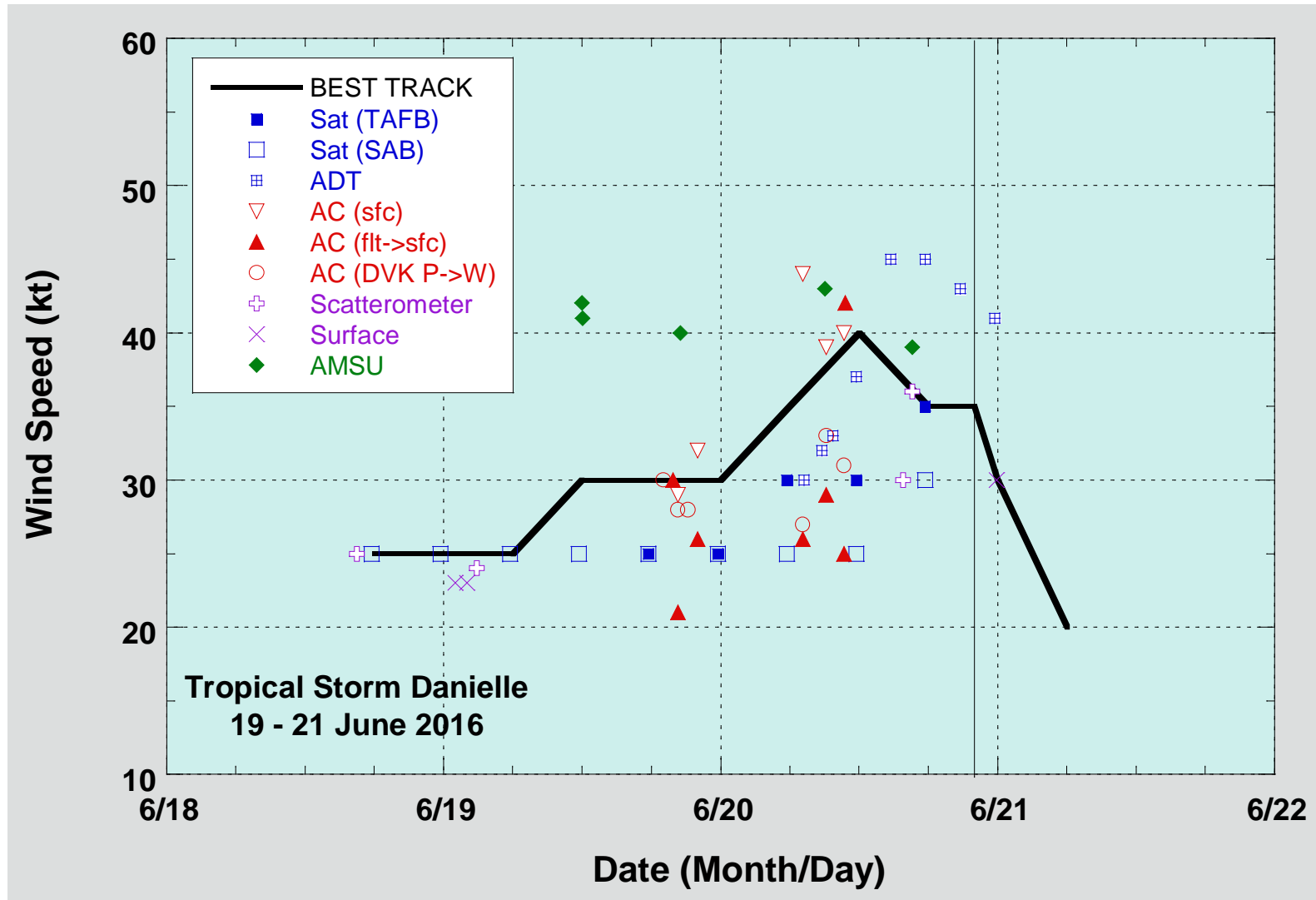


Figure 2. Selected wind observations and best track maximum sustained surface wind speed curve for Tropical Storm Danielle, 19 – 21 June 2016. Aircraft observations have been adjusted for elevation using 80% adjustment factors for observations from 850 mb and 1500 ft. Advanced Dvorak Technique estimates represent the Current Intensity at the nominal observation time. AMSU intensity estimates are from the Cooperative Institute for Meteorological Satellite Studies technique. Dashed vertical lines correspond to 0000 UTC, and the solid vertical line correspond to landfall.



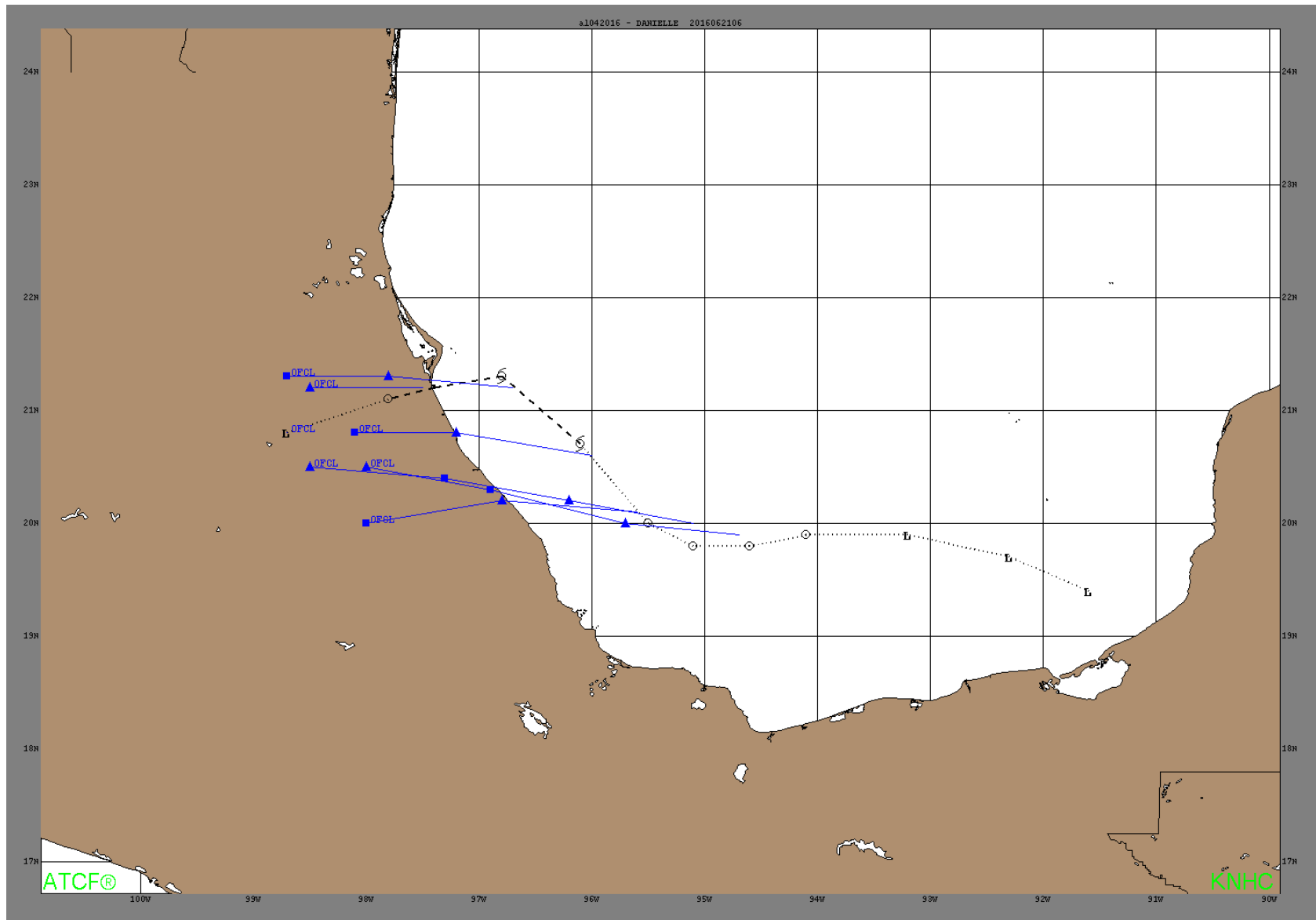


Figure 4. Selected official track forecasts (dashed lines, with 0, 12, 24, and 36 h positions indicated) for Tropical Storm Danielle, 19 – 21 June 2016. The best track is given by the thick solid line with positions given at 6 h interval.