NATIONAL HURRICANE CENTER
TROPICAL CYCLONE REPORT

TROPICAL STORM CHANTAL

(AL042019)

20–23 August 2019

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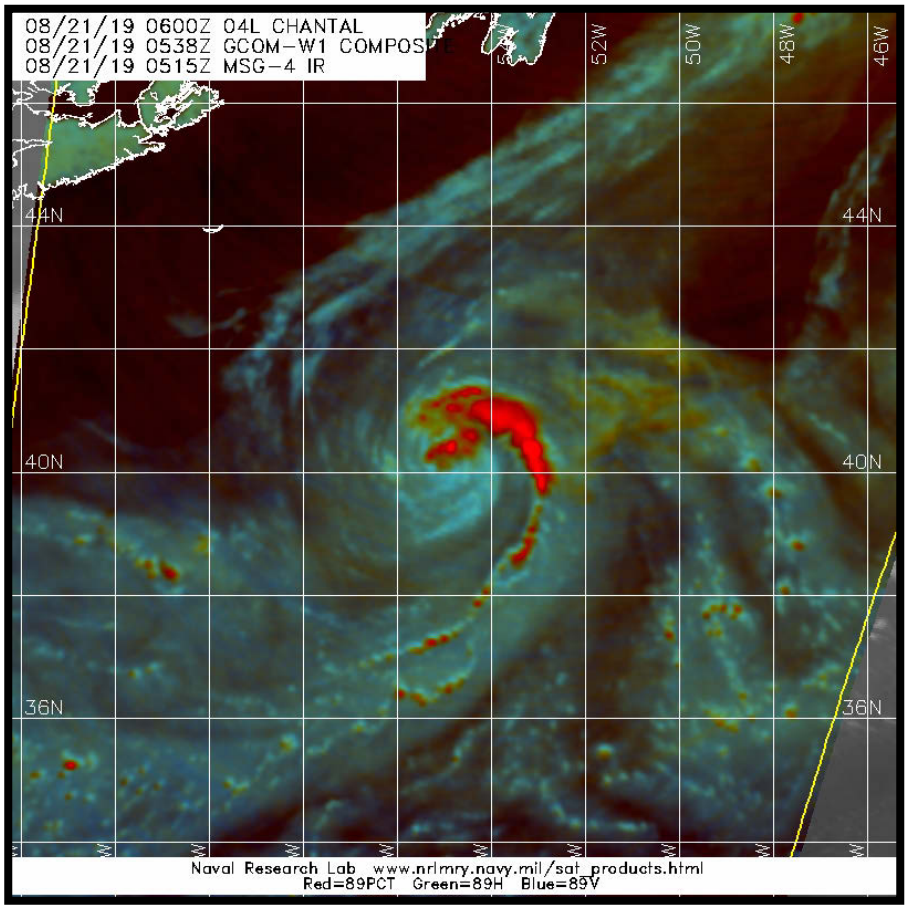

89-GHZ AMSR-2 IMAGE OF TROPICAL STORM CHANTAL AT 0538 UTC 21 AUGUST 2019 FROM THE JAPAN AEROSPACE EXPLORATION AGENCY GCOM-W1 SATELLITE. IMAGE COURTESY OF THE NAVAL RESEARCH LABORATORY.

Chantal was a short-lived tropical storm over the northwestern Atlantic Ocean.

Tropical Storm Chantal

20–23 AUGUST 2019

SYNOPTIC HISTORY

On 14 August, a cold front moved across the southeastern United States and became nearly stationary for a few days, and extended roughly from central North Carolina to the northern Gulf coast. Surface winds in the vicinity of the summertime front were light and variable; however, the pressure gradient between the frontal trough and high pressure over the Atlantic Ocean resulted in moderate southwesterly winds just offshore of the southeastern United States coast. This difference in wind speeds between land and ocean produced an area of shear vorticity near the immediate coast, and a mesoscale low formed by 1200 UTC 17 August over southern South Carolina about 25 n mi east-northeast of Savannah, Georgia. The development of the low also appears to have had some support from a weak mid-level disturbance which moved across the southeastern United States on 16 and 17 August. The small low moved northeastward across coastal South Carolina and North Carolina over the next 30 h, emerging over the western Atlantic just south of Oregon Inlet around 1800 UTC 18 August. The low maintained its well-defined center and circulation through 0600 UTC 19 August, but it was not producing organized shower and thunderstorm activity.

The system continued to produce showers and thunderstorms on 19 and 20 August, but the deep convection did not show signs of significant organization. In addition, while a broad low was observed in scatterometer data, the disturbance lost its closed and well-defined surface circulation (Fig. 1a). On 20 August, however, conventional satellite images and scatterometer data revealed that a more well-defined circulation was developing (Fig. 1b), and the system became a tropical depression by 1800 UTC 20 August while centered about 320 n mi southeast of Halifax, Nova Scotia. Scatterometer data indicated that the cyclone was producing tropical-storm-force winds later that evening (Fig. 1c), and the depression became a tropical storm by 0000 UTC 21 August. The “best track” chart of Chantal’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[1].

By the time Chantal formed, it was already well embedded within the mid-latitude westerlies, and the storm moved quickly eastward over marginally warm waters of 25–27°C near the northern edge of the Gulf Stream. These waters, and moderate-to-strong southwesterly shear, prevented Chantal from strengthening further, and it remained at its peak intensity of 35 kt for just under a day. Chantal weakened to a tropical depression by 0000 UTC 22 August while centered about 475 n mi south-southeast of Cape Race, Newfoundland, and it only produced a small amount of deep convection during the next couple of days as it turned southeastward and

[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.

slowed down. Chantal moved out of the westerlies and beneath an upper-level anticyclone, and the associated subsidence caused the cyclone's remaining deep convection to dissipate by 1800 UTC 23 August. Chantal degenerated into a remnant low at that time, and it then made a slow clockwise loop over the next several days. The remnant low's winds gradually decreased, and the system ultimately dissipated soon after 1800 UTC 26 August about 715 n mi southeast of Cape Race.

METEOROLOGICAL STATISTICS

Observations in Chantal (Figs. 3 and 4) include subjective satellite-based Dvorak technique intensity estimates from the Tropical Analysis and Forecast Branch (TAFB), subjective Dvorak technique estimates from 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. 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 Chantal.

Chantal's estimated peak intensity of 35 kt from 0000 to 1800 UTC 21 August is mainly based on scatterometer data from around 0000 UTC 21 August. Subsequent scatterometer data from the next evening, around 0000 UTC 22 August, indicated that Chantal's maximum winds had decreased below tropical storm force. The estimated minimum central pressure of 1007 mb is based on the Knaff-Zehr-Courtney pressure wind relationship.

Chantal did not meet the dual criteria of a closed, well-defined circulation and organized deep convection to be a tropical cyclone until 1800 UTC 20 August. Even though a well-defined low moved off the coast of North Carolina on 18 August, ASCAT directional ambiguity data from 19 August indicated that the low's circulation opened up on its northwestern side (Fig. 1a). During the morning of 20 August, the low's circulation was still broad and somewhat elongated, and it did not quite appear closed on its northeastern side (Fig. 1b). Late that evening, however, the low's circulation did become closed and well defined (Fig. 1c). In addition, the associated convection was not organized enough to yield Dvorak classifications any higher than T1.0 from TAFB on 19 and 20 August, and no intensity estimates were provided by SAB on those days. The preponderance of these data indicate that Chantal's genesis did not occur until 1800 UTC 20 August.

There were no land-based or ship reports of winds of tropical storm force in association with Chantal.

CASUALTY AND DAMAGE STATISTICS

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

FORECAST AND WARNING CRITIQUE

Chantal's genesis was not very well forecast. Table 2 provides the number of hours in advance of formation associated with the first NHC Tropical Weather Outlook (TWO) forecast in each likelihood category. The incipient surface trough over the southeastern United States was first introduced in the TWO and given a low (<40%) chance of genesis during the next 2 and 5 days 90 h (3.75 days) before Chantal became a tropical depression. Operationally, the 2- and 5-day chances of genesis were only raised to the medium (40-60%) category after genesis is estimated to have occurred in the post analysis, and they never reached the high category. A combination of land interaction in the early stages of the disturbance's life, shear, and cooler waters when the system would be moving over the northwestern Atlantic made it unlikely, although not impossible, that Chantal would become a tropical cyclone, and hence NHC's genesis forecasts generally remained in the low category.

A verification of NHC official track forecasts for Chantal is given in Table 3. Official forecast track errors were lower than the mean official errors for the previous 5-yr period at all time periods for which official forecasts verified (12–48 h). Some model trackers were not available at several forecast cycles, which limited the forecasts available for a homogeneous sample verification, and thus it is difficult to draw any meaningful conclusions from the verification statistics. Due to this homogeneity requirement, only five, three, two, and two official track forecasts were verified against the models at 12, 24, 36, and 48 h, respectively. Of the available sample, the HFIP Corrected Consensus (HCCA) aid was the only guidance to have lower errors than the official forecasts at every forecast period. The European (EMXI) model also performed well, having lower errors than the official forecasts from 12–36 h.

A verification of NHC official intensity forecasts for Chantal is given in Table 4. Official forecast intensity errors were lower than the mean official errors for the previous 5-yr period at all forecast times for which the official forecasts verified (12–48 h). Some intensity models were not available at several forecast cycles, which limited the forecasts available for a homogeneous sample verification, and thus it is difficult to draw any meaningful conclusions from the verification statistics. Due to this homogeneity requirement, only seven, five, three, and two official intensity forecasts were verified against the models at 12, 24, 36, and 48 h, respectively. Within the available sample, most of the dynamical models and consensus aids had lower errors than the official forecasts from 24–48 h, but not significantly so. The statistical-dynamical models (SHIPS and LGEM) generally had a high bias and indicated Chantal would strengthen more than it did.

There were no coastal watches or warnings issued in association with Chantal.

Table 1. Best track for Tropical Storm Chantal, 20–23 August 2019.

Date/Time (UTC)	Latitude (°N)	Longitude (°W)	Pressure (mb)	Wind Speed (kt)	Stage
20 / 1800	40.1	59.7	1008	30	tropical depression
21 / 0000	40.3	57.1	1007	35	tropical storm
21 / 0600	40.3	54.8	1007	35	"
21 / 1200	40.1	52.5	1007	35	"
21 / 1800	39.9	50.3	1007	35	"
22 / 0000	39.6	48.3	1007	30	tropical depression
22 / 0600	39.3	46.3	1007	30	"
22 / 1200	38.9	44.4	1007	30	"
22 / 1800	38.5	42.9	1007	30	"
23 / 0000	38.0	41.8	1007	30	"
23 / 0600	37.5	41.2	1009	25	"
23 / 1200	36.9	40.9	1011	25	"
23 / 1800	36.3	40.8	1012	25	low
24 / 0000	35.7	40.9	1013	25	"
24 / 0600	35.3	41.2	1013	25	"
24 / 1200	35.1	41.8	1013	25	"
24 / 1800	35.0	42.5	1013	25	"
25 / 0000	35.1	43.2	1014	20	"
25 / 0600	35.5	43.6	1014	20	"
25 / 1200	35.9	43.9	1014	20	"
25 / 1800	36.1	44.1	1014	15	"
26 / 0000	36.2	44.4	1014	15	"
26 / 0600	36.2	44.8	1014	15	"
26 / 1200	36.4	45.0	1014	15	"
26 / 1800	36.5	44.8	1014	15	"
27 / 0000					dissipated
21 / 0000	40.3	57.1	1007	35	maximum winds 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%)	90	90
Medium (40%-60%)	-	-
High (>60%)	-	-

Table 3. NHC official (OFCL) and climatology-persistence skill baseline (OCD5) track forecast errors (n mi) for Tropical Storm Chantal, 20-23 August 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	**17.7**	**27.1**	**23.9**	**36.4**			
OCD5	38.7	107.4	186.5	324.7			
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 4. NHC official (OFCL) and climatology-persistence skill baseline (OCD5) intensity forecast errors (kt) for Tropical Storm Chantal, 20-23 August 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	**2.2**	**3.6**	**5.0**	**5.0**			
OCD5	5.0	9.6	17.4	27.3			
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

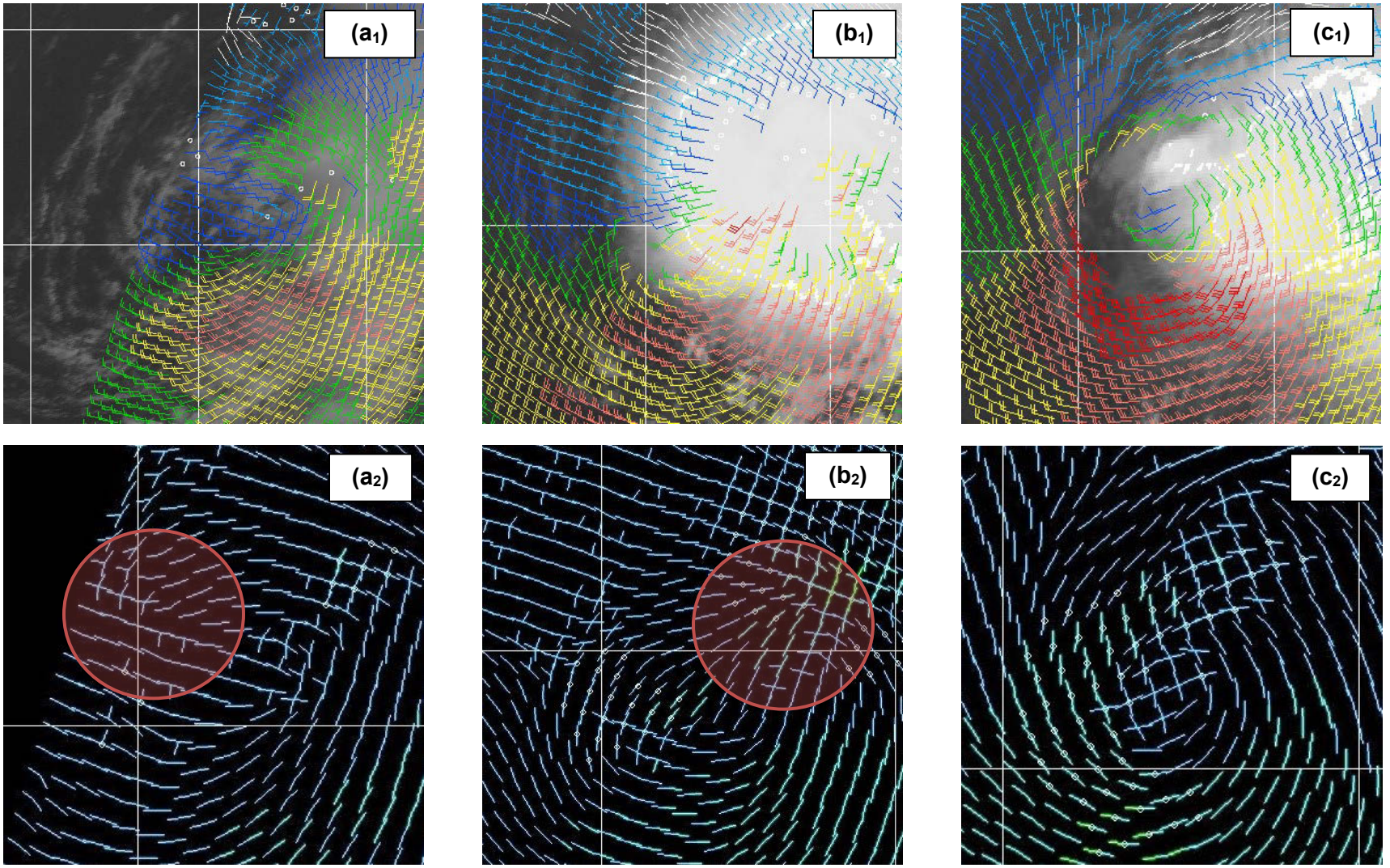

Figure 1. Scatterometer winds (top row) and directional ambiguities (bottom row) before (a and b) and after (c) Chantal became a tropical storm. Data are from the METOP-B ASCAT instrument at (a) 1457 UTC 19 August, (b) 1435 UTC 20 August, and (c) 0017 UTC 21 August. Images courtesy of the Naval Research Laboratory and Fleet Numerical Meteorology and Oceanographic Center. Red circles indicate areas where the circulation does not appear to be closed.

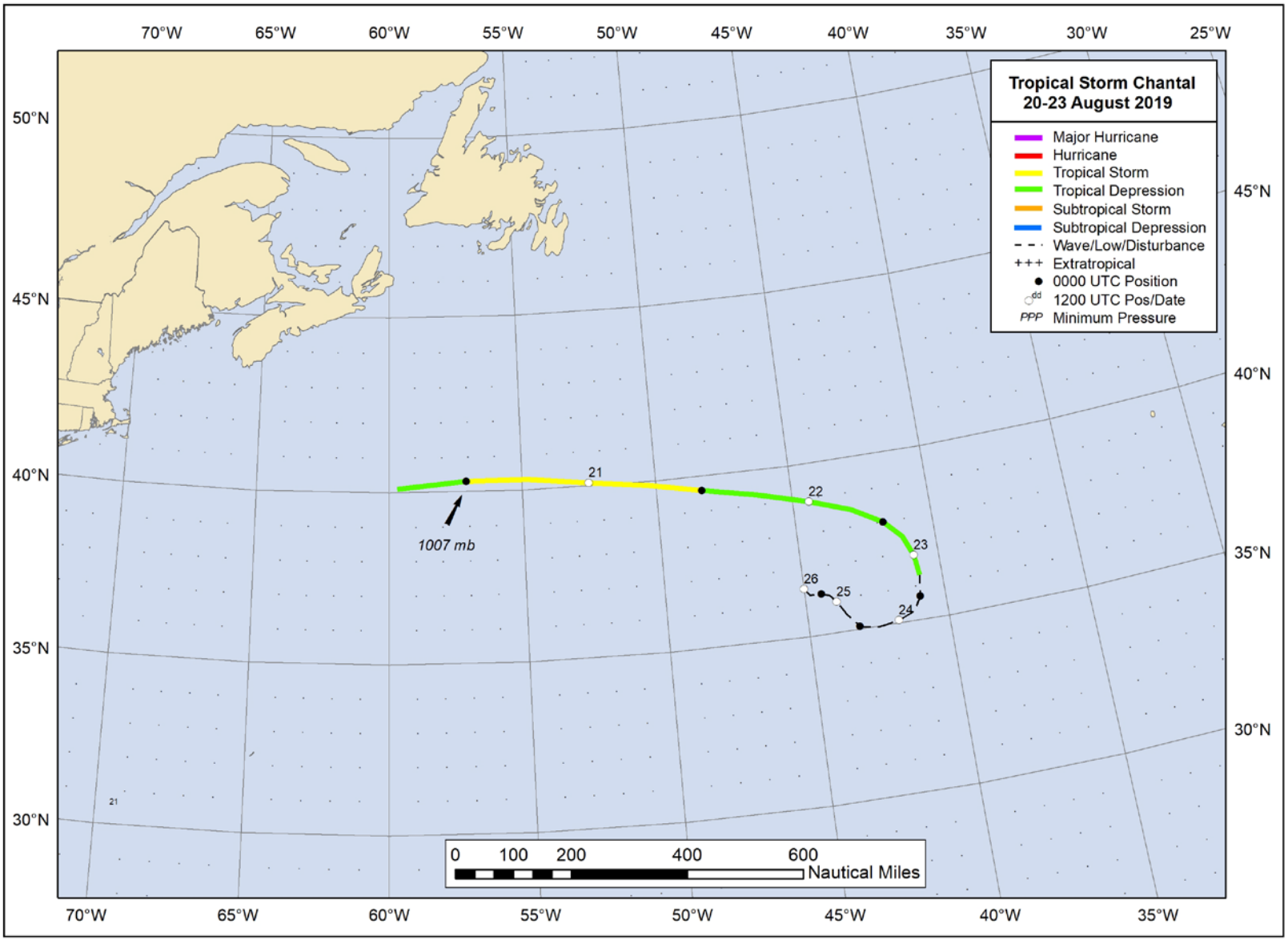

Figure 2. Best track positions for Tropical Storm Chantal, 20–23 August 2018.

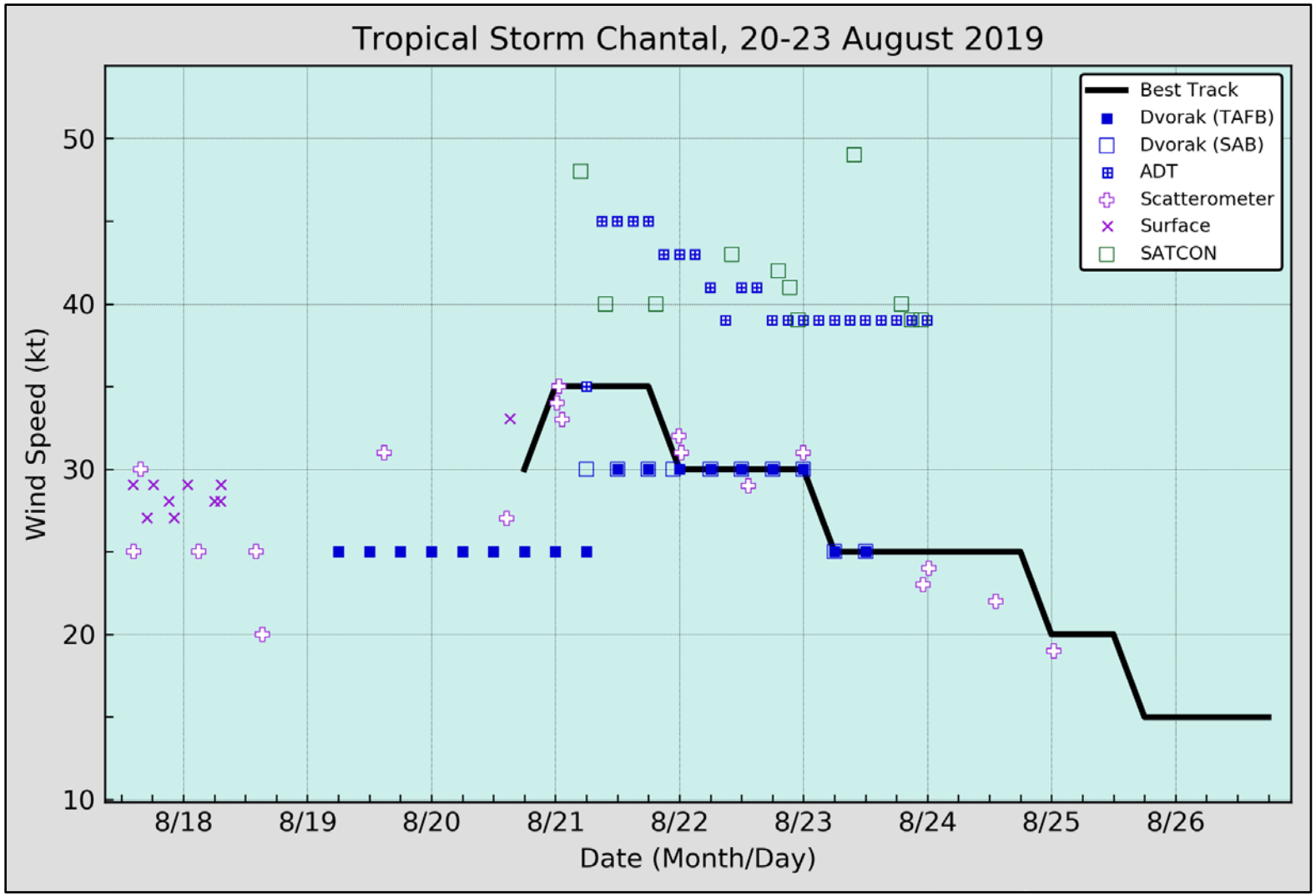

Figure 3. Selected wind observations and best track maximum sustained surface wind speed curve for Tropical Storm Chantal, 20–23 August 2019. Advanced Dvorak Technique estimates represent the Current Intensity at the nominal observation time. SATCON intensity estimates are from the Cooperative Institute for Meteorological Satellite Studies. Dashed vertical lines correspond to 0000 UTC.

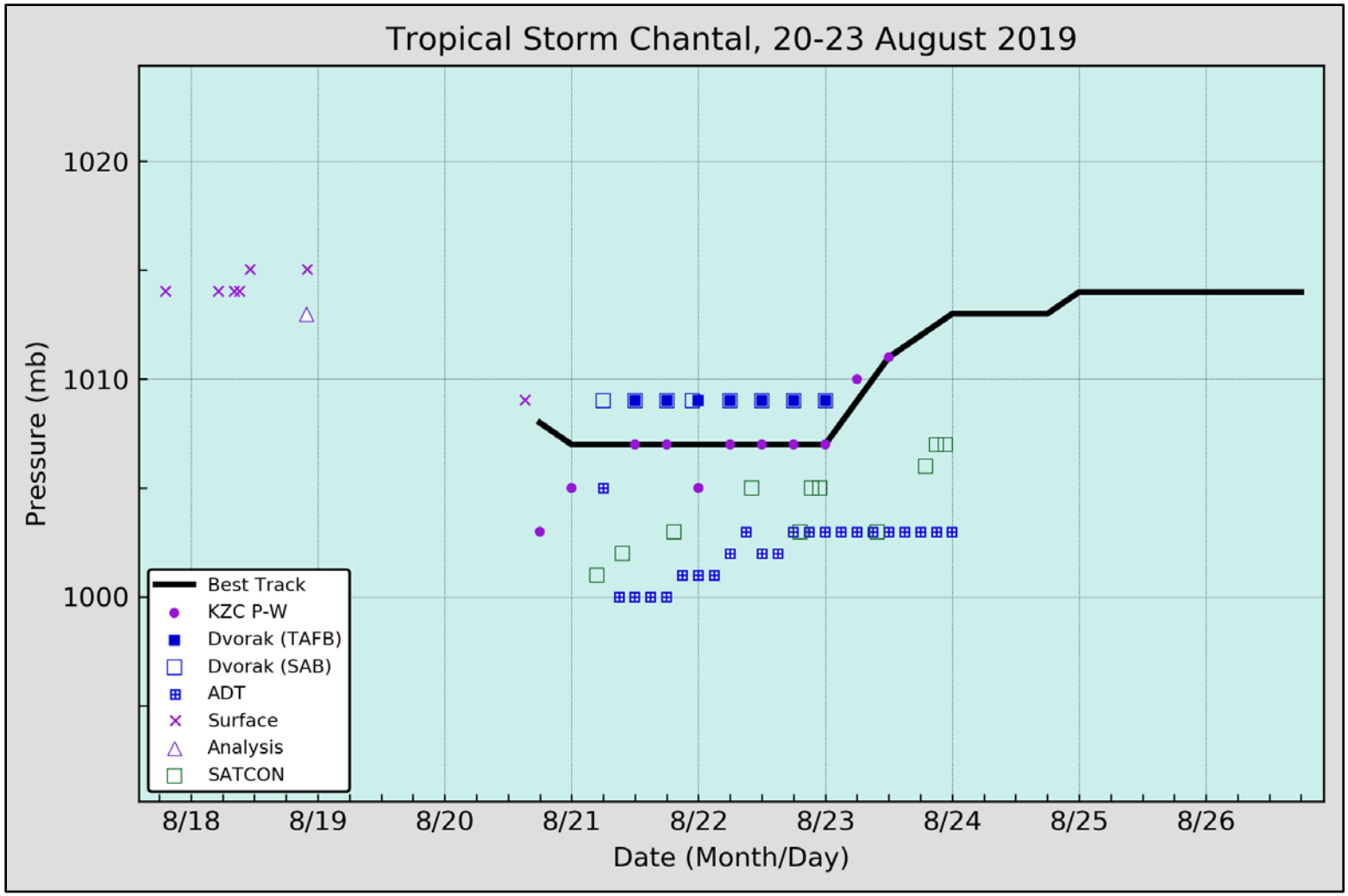

Figure 4. Selected pressure observations and best track minimum central pressure curve for Tropical Storm Chantal, 20–23 August 2019. Advanced Dvorak Technique estimates represent the Current Intensity at the nominal observation time. SATCON intensity estimates are from the Cooperative Institute for 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.