NATIONAL HURRICANE CENTER TROPICAL CYCLONE REPORT

TROPICAL DEPRESSION NINE

(AL092015)

16 – 19 September 2015

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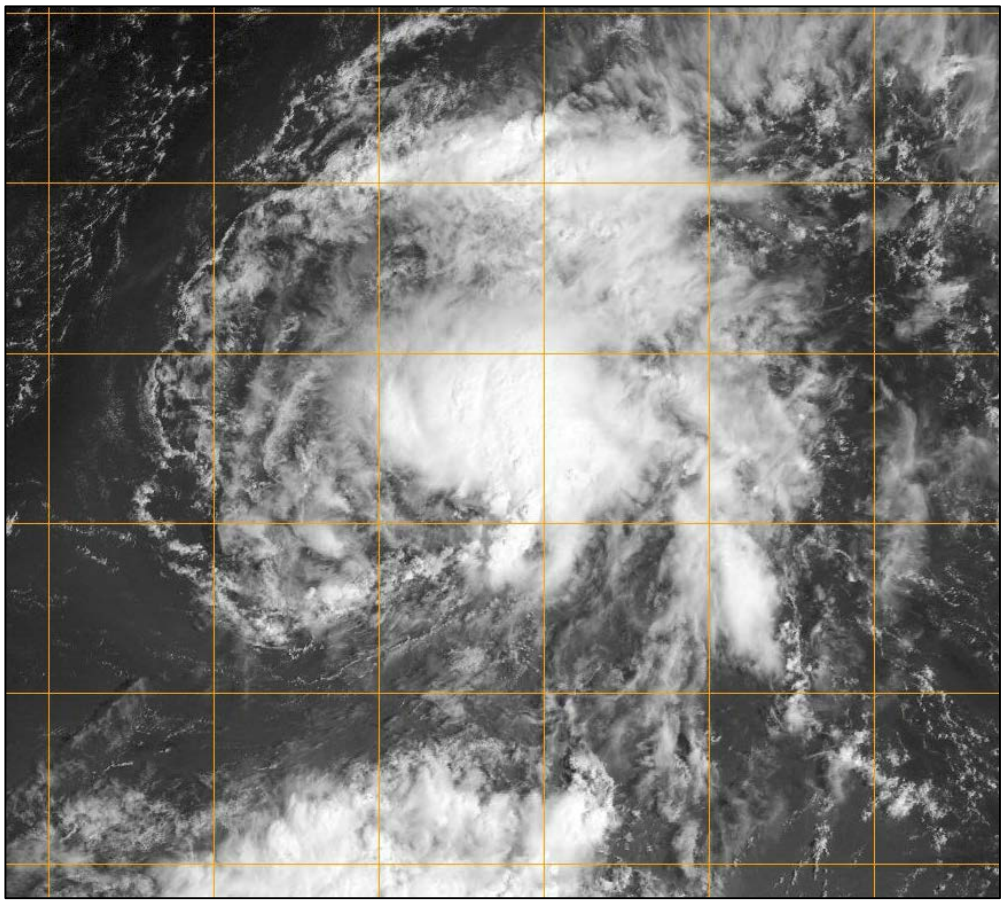

GOES 13 VISIBLE SATELLITE IMAGE OF TROPICAL DEPRESSION NINE AROUND THE TIME OF ITS GENESIS OVER THE CENTRAL TROPICAL ATLANTIC OCEAN ON 16 SEPTEMBER.

Tropical Depression Nine was a relatively short-lived tropical cyclone that remained over the open waters of the central tropical Atlantic Ocean.

Tropical Depression Nine

16 – 19 SEPTEMBER 2015

SYNOPTIC HISTORY

Tropical Depression Nine formed from a strong tropical wave that crossed the west coast of Africa on 10 September. Shower and thunderstorm activity associated with the wave decreased while it passed to the south of the Cape Verde Islands, but on 13 September, an eastward-moving convectively coupled Kelvin wave caused a general increase in cloudiness and thunderstorms over the eastern tropical Atlantic, including the convection associated with the tropical wave. The increase in convection resulted in the formation of a broad area of low pressure about 650 n mi west-southwest of the Cape Verde Islands on 13 September. The next day, the convection became better organized, to the point that the system nearly became a tropical cyclone, however late that day the convection became significantly less organized, apparently due to the entrainment of dry mid-level air. On 15 September, the convection began to gradually increase again near the now well-defined low pressure area, and the next day the thunderstorm activity became better organized, leading to formation of a tropical depression by 1200 UTC 16 September, about 1100 n mi west of the Cape Verde Islands. 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 center of the newly formed depression almost immediately became separated from the convection by moderate southwesterly shear, which prevented strengthening while the depression moved slowly northwestward toward a break in the subtropical ridge over the central Atlantic. Early the next day, the tropical cyclone turned north-northwestward while the deep convection increased over the northeastern portion of the circulation. Although the low-level center remained exposed to the southwest of the thunderstorm activity, the depression strengthened slightly and reached its estimated peak intensity of 30 kt at 0600 UTC 17 September.

The increase in organization was short lived, however, due to moderate to strong vertical wind shear and dry mid-level air nearby, and the tropical cyclone weakened by 1800 UTC as it turned northward. During the next 36 h, deep convection waxed and waned with little organization due to the unfavorable environmental conditions. The depression turned west-northwestward late on 18 September, and early the next day strong westerly vertical wind shear caused the circulation to become elongated. Visible satellite imagery the next day showed that the tropical cyclone had dissipated by 1800 UTC, about 700 n mi east of northern Leeward Islands.

[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 Nine (Figs. 2 and 3) include subjective satellite-based Dvorak technique intensity estimates from the Tropical Analysis and Forecast Branch (TAFB) and the Satellite Analysis Branch (SAB). 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 tropical depression.

The estimated peak intensity of 30 kt at 0600 and 1200 UTC 17 September is based on subjective Dvorak intensity estimates of T2.0 from SAB and TAFB.

CASUALTY AND DAMAGE STATISTICS

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

FORECAST AND WARNING CRITIQUE

The genesis of Tropical Depression Nine was somewhat well predicted, although it did not occur as quickly as anticipated. The tropical wave from which the tropical cyclone formed was first mentioned in the Tropical Weather Outlook at 0000 UTC 10 September, around the time the system exited the west coast of Africa. The 5-day probability of formation was raised to the medium category (40-60%) at 1200 UTC 11 September, and to the high category (>60%) at 0000 UTC 13 September, about 120 and 84 h before formation, respectively (Table 2). The 48-h probability of formation was first raised to the medium category 72 h before development, and to the high category 66 h before formation occurred. When the precursor disturbance did not develop as anticipated and encountered hostile conditions, the probability of development was lowered to the medium category early on 15 September. The probability of development was raised back into the high category at 0600 UTC 16 September, about 6 h before formation occurred.

A verification of NHC official track forecasts for Tropical Depression Nine is given in Table 3a. Official forecast track errors were greater than the mean official errors for the previous 5-yr period, which is fairly typical for track forecasts of tropical depressions. A homogeneous comparison of the official track errors with selected guidance models is given in Table 3b. The GHMI, HWFI, UKMI, and CMCI models exhibited lower mean track errors than the NHC forecasts at most verifying lead times; the NHC forecasts however outperformed the GFS at 36 and 48 h, and the EMXI at all verifying lead times. The consensus models TCON and TVCA also beat the NHC forecast at most lead times.

A verification of NHC official intensity forecasts for Tropical Depression Nine is given in Table 4a. Official forecast intensity errors were much lower than the mean official errors for the previous 5-yr period. A homogeneous comparison of the official intensity errors with selected guidance models is given in Table 4b. The NHC forecasts and most of the intensity guidance correctly anticipated that the tropical depression would not strengthen due to the hostile environmental conditions.

Table 1. Best track for Tropical Depression Nine, 16-19 September 2015.

Date/Time (UTC)	Latitude (°N)	Longitude (°W)	Pressure (mb)	Wind Speed (kt)	Stage*
15 / 0000	11.5	40.3	1011	20	low
15 / 0600	11.7	41.1	1011	20	"
15 / 1200	11.9	41.9	1011	20	"
15 / 1800	12.5	42.4	1011	20	"
16 / 0000	13.3	42.7	1010	25	"
16 / 0600	14.0	43.1	1009	25	"
16 / 1200	14.5	43.7	1009	25	tropical depression
16 / 1800	15.0	44.4	1009	25	"
17 / 0000	15.3	44.8	1008	25	"
17 / 0600	15.6	45.0	1006	30	"
17 / 1200	15.9	45.1	1006	30	"
17 / 1800	16.3	45.1	1007	25	"
18 / 0000	16.8	45.2	1007	25	"
18 / 0600	17.3	45.8	1007	25	"
18 / 1200	17.6	46.6	1007	25	"
18 / 1800	17.9	47.3	1007	25	"
19 / 0000	18.1	48.1	1008	25	"
19 / 0600	18.3	48.8	1009	25	"
19 / 1200	18.5	49.4	1009	25	"
19 / 1800					dissipated
17 / 0600	15.6	45.0	1006	30	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%)	96	156
Medium (40%-60%)	72	120
High (>60%)	66	84

Table 3a. NHC official (OFCL) and climatology-persistence skill baseline (OCD5) track forecast errors (n mi) for Tropical Depression Nine, 16-19 September 2015. 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	57.5	72.4	99.2	228.5		
OCD5	52.3	95.5	126.1	128.3	198.6		
Forecasts	11	9	7	5	1		
OFCL (2010-14)	28.4	45.0	60.4	77.1	113.1	157.8	210.0
OCD5 (2010-14)	48.3	101.5	161.5	222.6	329.8	412.6	483.9

Table 3b. Homogeneous comparison of selected track forecast guidance models (in n mi) for Tropical Depression Nine. 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	32.1	52.0	66.5	89.4			
OCD5	50.3	98.0	131.1	131.8			
GFSI	**29.1**	**51.0**	77.4	113.1			
GHMI	**27.2**	**40.5**	**60.1**	122.8			
HWFI	33.2	**47.1**	**63.0**	**61.9**			
UKMI	32.1	**44.6**	**44.0**	**57.1**			
EGRI	34.2	**47.3**	**39.5**	**52.1**			
EMXI	39.9	63.7	108.2	187.4			
CMCI	33.8	**49.7**	**65.7**	**80.6**			
NVGI	58.7	113.5	159.0	243.3			
GFNI	**27.7**	65.1	128.7	256.3			
AEMI	**28.3**	**51.4**	71.4	98.9			
TCON	**27.5**	**41.4**	**54.4**	**73.4**			
TVCA	**30.1**	**44.1**	**64.5**	96.3			
GFEX	33.3	57.2	92.2	149.8			
TVCX	**31.2**	**45.5**	71.8	111.4			
LBAR	66.3	137.8	212.6	307.1			
BAMD	99.4	193.8	283.6	377.2			
BAMM	47.0	88.5	138.5	183.4			
BAMS	36.9	62.1	75.3	**59.2**			
Forecasts	10	8	6	4			

Table 4a. NHC official (OFCL) and climatology-persistence skill baseline (OCD5) intensity forecast errors (kt) for Tropical Depression Nine, 16-19 September 2015. 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	**1.8**	**2.2**	**1.4**	**0.0**	**0.0**		
OCD5	3.7	8.1	11.1	17.8	17.0		
Forecasts	11	9	7	5	1		
OFCL (2010-14)	6.2	9.4	11.5	13.3	14.6	14.6	15.8
OCD5 (2010-14)	7.3	10.8	13.3	15.3	17.7	17.8	17.6

Table 4b. Homogeneous comparison of selected intensity forecast guidance models (in kt) for Tropical Depression Nine, 16-19 September 2015. Errors smaller than the NHC official forecast are shown in boldface type.

Model ID	Forecast Period (h)						
	12	24	36	48	72	96	120
OFCL	1.8	2.2	1.4	0.0	0.0		
OCD5	3.7	8.1	11.1	17.8	17.0		
GHMI	2.9	4.0	5.1	7.4	2.0		
HWFI	3.4	3.3	3.1	2.6	5.0		
GFNI	4.5	10.0	15.6	21.6	12.0		
GFSI	2.9	3.3	2.9	1.2	1.0		
EMXI	2.5	4.3	3.3	2.0	3.0		
DSHP	2.9	3.4	5.3	3.0	4.0		
LGEM	3.5	4.0	3.9	2.0	3.0		
ICON	2.5	2.7	3.7	2.6	1.0		
IVCN	2.5	2.7	3.7	2.6	1.0		
Forecasts	11	9	7	5	1		

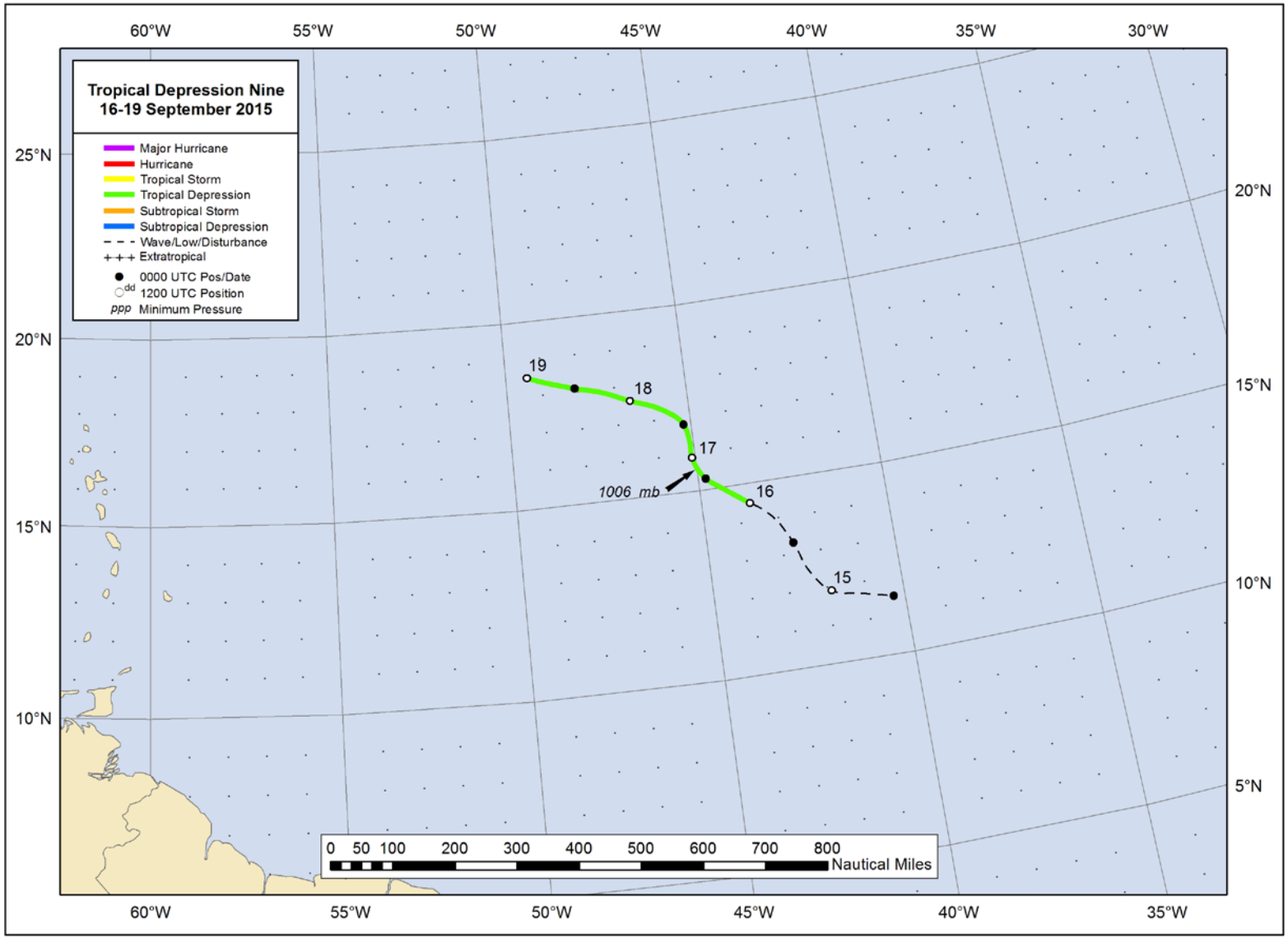

Figure 1. Best track positions for Tropical Depression Nine, 16-19 September 2015.

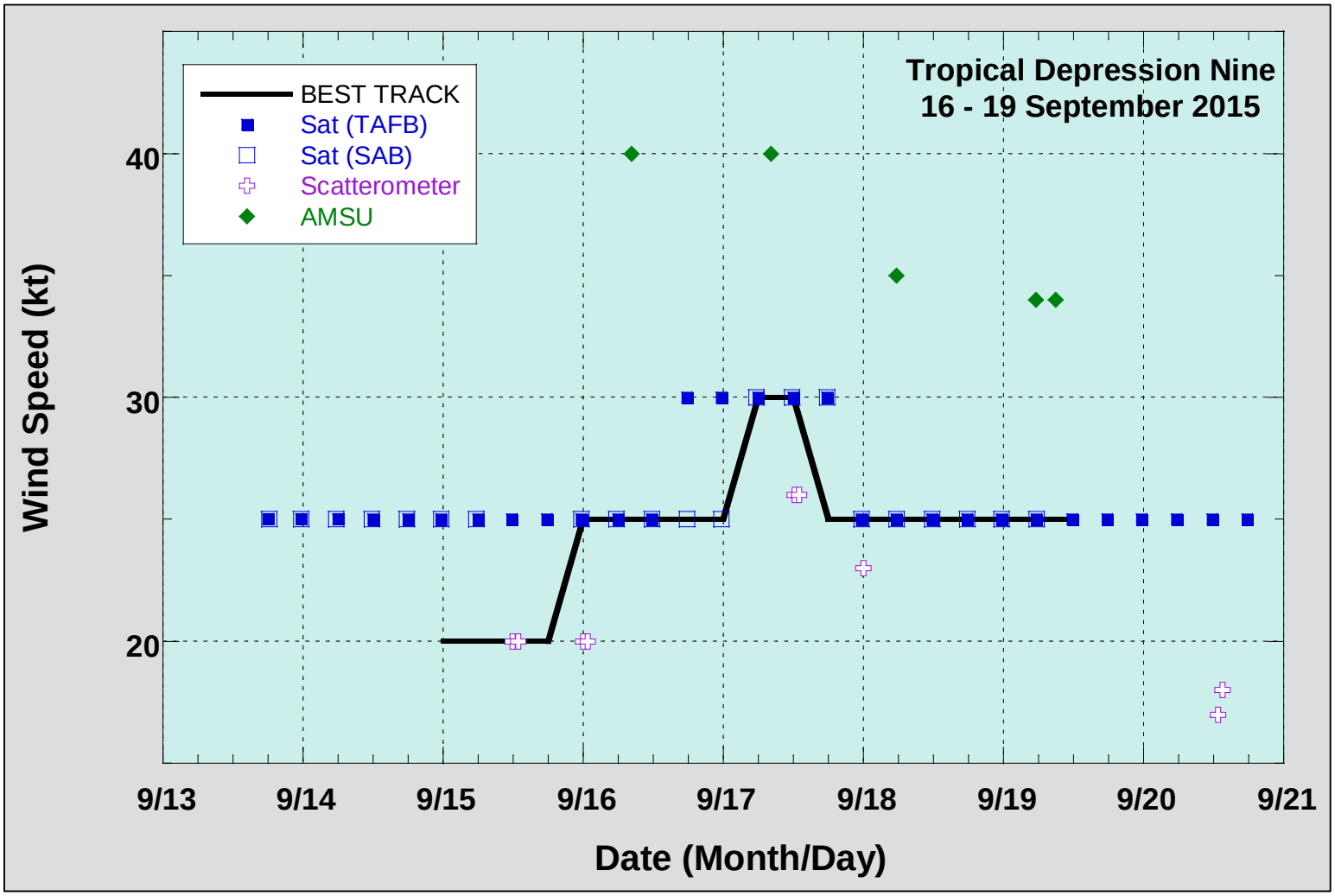

Figure 2. Selected wind observations and best track maximum sustained surface wind speed curve for Tropical Depression Nine, 16-19 September 2015. AMSU intensity estimates are from the Cooperative Institute for Meteorological Satellite Studies technique. Dashed vertical lines correspond to 0000 UTC.

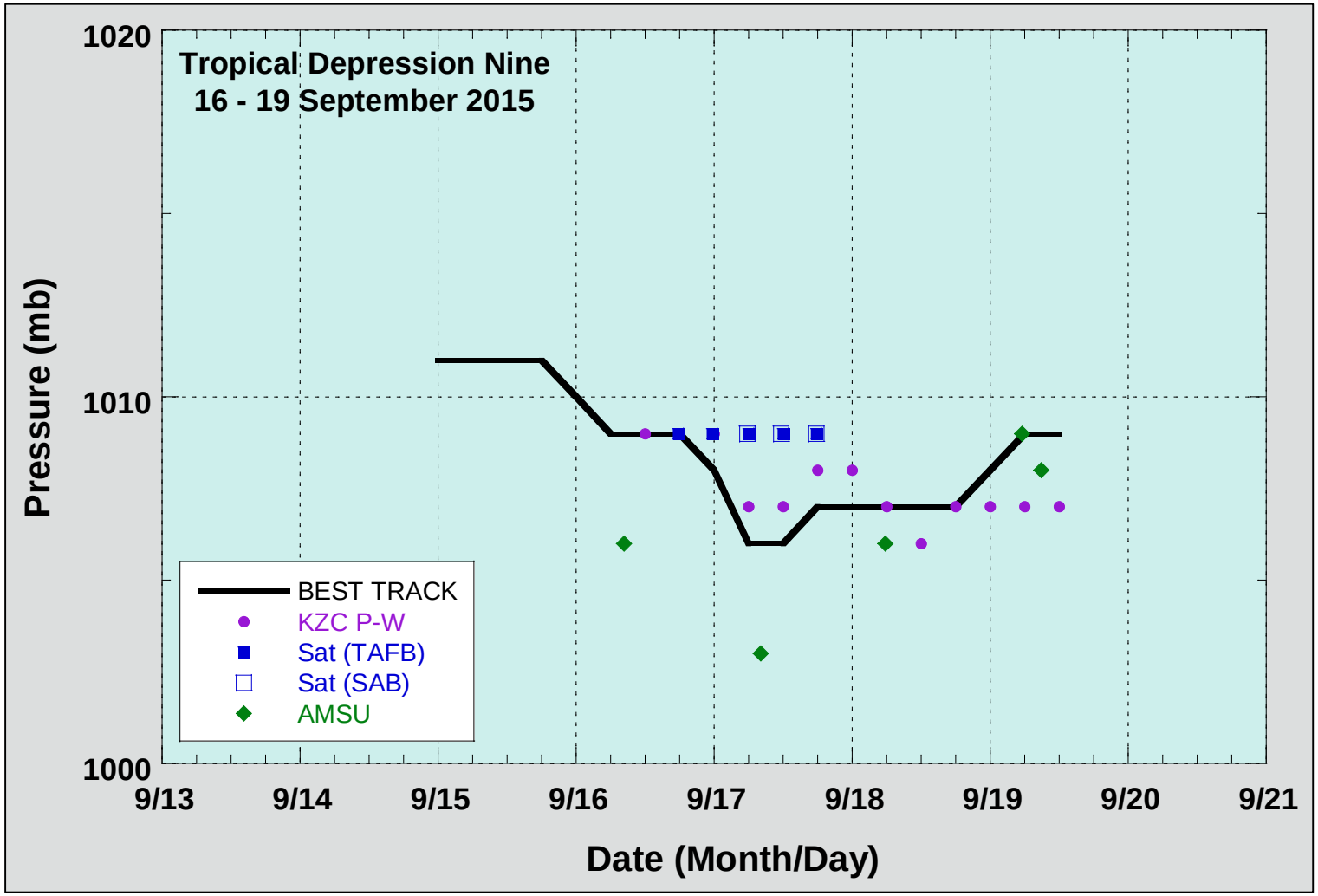

Figure 3. Selected pressure observations and best track minimum central pressure curve for Tropical Depression Nine. AMSU intensity estimates are from the Cooperative Institute for Meteorological Satellite Studies technique. KZC P-W refers to pressure estimates derived using the Knaff-Zehr-Courtney pressure-wind relationship. Dashed vertical lines correspond to 0000 UTC.