

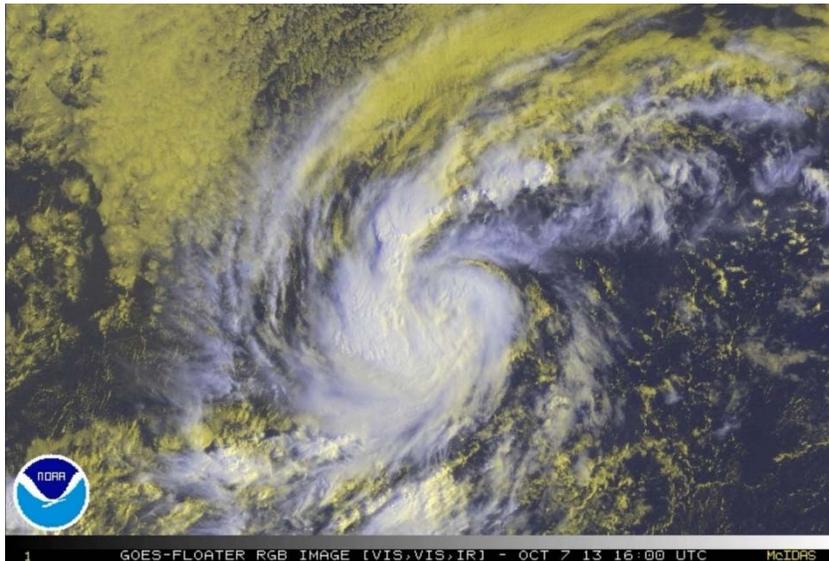


NATIONAL HURRICANE CENTER TROPICAL CYCLONE REPORT

TROPICAL STORM NARDA (EP142013)

6 –10 October 2013

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National Hurricane Center
13 November 2013



GOES-15 visible satellite image at 1600 UTC 7 October 2013.

Narda formed well to the southwest of Mexico and spent its life over open waters.

Tropical Storm Narda

6–10 October 2013

SYNOPTIC HISTORY

Narda originated from a tropical wave that moved off the west coast of Africa on 12 September. The wave continued westward across the tropical Atlantic, and it took almost two weeks to reach the eastern Pacific basin. During its trek across the Atlantic Ocean and Caribbean Sea, the wave was accompanied by disorganized and limited convection. The thunderstorm activity increased some when the wave was located south of Central America along 90°W on 27 September. There were no signs of organization, however, until the wave was a few hundred miles south of Manzanillo, Mexico, on 1 October. By then, satellite animation showed some cyclonic rotation in the low clouds associated with a broad area of low pressure embedded within the wave. The low separated from the wave and moved west or west-northwestward while some organized convective bands began to form in association with the low, which resulted in the formation of a tropical depression at 1800 UTC 6 October about 750 n mi southwest of the southern tip of the Baja California peninsula. 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 1¹.

The convection continued to increase and gain organization as the depression moved west-northwestward within a light-shear environment and over a warm ocean. It is estimated that the depression became a tropical storm at 0000 UTC 7 October and reached its peak intensity of 55 kt at 1800 UTC later that day, when microwave imagery showed a partial eyewall. After that time, the convection began to weaken as the cyclone encountered drier air and the low- and mid- level centers became decoupled due to wind shear. Narda weakened to a tropical depression at 0000 UTC 9 October and produced sporadic bursts of convection for a day or so. It became a remnant low at 1200 UTC 10 October and dissipated a couple of days later.

METEOROLOGICAL STATISTICS

Observations in Narda (Figs. 2 and 3) include subjective satellite-based Dvorak technique intensity 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 Tropical Rainfall Measuring Mission (TRMM), the European Space Agency’s Advanced Scatterometer (ASCAT), and Defense

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 Satellite Program (DMSP) satellites, among others, were also useful in constructing the best track of Narda.

The estimated 55-kt peak intensity of Narda at 1800 UTC 7 October is based on Dvorak estimates of T3.5 from both TAFB and SAB. Narda's microwave presentation was also strongest about this time, and included a convective ring feature.

CASUALTY AND DAMAGE STATISTICS

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

FORECAST AND WARNING CRITIQUE

The genesis of Narda was not particularly well predicted. The disturbance from which Narda developed was introduced with a 20% chance of formation in 5 days at 0000 UTC 28 September. A 20% chance of formation within the 2-day period was introduced at 0000 UTC 2 October while the chances of formation in five days remained unchanged until 0600 UTC 5 October. After that time, the chances were increased to 30% and 40% until genesis at 1800 UTC 6 October.

A verification of NHC official track forecasts for Tropical Storm Narda is given in Table 2a. Official forecast track errors were higher than the mean official errors for the previous 5-yr period, except at the 72-h period. Climatology-persistence model errors, however, were much higher than NHC errors. A homogeneous comparison of the official track errors with selected guidance models is given in Table 2b. The GFS ensemble mean (AEMI) and the multi-model consensus (TVCE) had lower errors than the official forecast beyond 36 h. The rest of the models results were mixed.

A verification of NHC official intensity forecasts for Narda is given in Table 3a, and a homogeneous comparison of the official intensity errors with selected guidance models is given in Table 3b. Official forecast intensity errors were higher than the mean official errors for the previous 5-yr period at all times. In addition, most of the models performed better than the official forecast. Since the environment appeared to be favorable for intensification, the NHC over forecast the strength of Narda.

Table 1. Best track for Tropical Storm Narda, 6 - 10 October 2013.

Date/Time (UTC)	Latitude (°N)	Longitude (°W)	Pressure (mb)	Wind Speed (kt)	Stage
06 / 1800	12.9	118.0	1007	30	tropical depression
07 / 0000	13.1	119.2	1005	35	tropical storm
07 / 0600	13.6	120.5	1003	40	"
07 / 1200	14.0	121.7	999	50	"
07 / 1800	14.4	122.8	997	55	"
08 / 0000	14.8	123.9	998	55	"
08 / 0600	15.1	124.9	999	50	"
08 / 1200	15.6	126.0	1002	40	"
08 / 1800	16.1	127.0	1007	35	"
09 / 0000	16.5	127.7	1007	30	tropical depression
09 / 0600	16.8	128.2	1007	30	"
09 / 1200	16.9	128.4	1007	30	"
09 / 1800	16.9	128.4	1007	30	"
10 / 0000	16.7	128.5	1007	30	"
10 / 0600	16.5	128.7	1007	30	"
10 / 1200	16.4	128.9	1007	25	low
10 / 1800	16.3	129.2	1007	25	"
11 / 0000	16.1	129.6	1007	25	"
11 / 0600	15.9	130.1	1007	25	"
11 / 1200	15.9	130.8	1007	25	"
11 / 1800	15.7	131.5	1007	25	"
12 / 0000	15.2	132.1	1007	25	"
12 / 1200	14.5	133.0	1008	20	"
12 / 1800					dissipated
07 / 1800	14.4	122.8	997	55	Max winds and minimum press



Table 2a. NHC official (OFCL) and climatology-persistence skill baseline (OCD5) track forecast errors (n mi) for Tropical Storm Narda, 6 - 10 October. 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	29.9	53.9	68.8	82.4	77.1		
OCD5	45.4	91.0	131.8	162.3	120.1		
Forecasts	13	11	9	7	3		
OFCL (2008-12)	27.0	43.1	57.8	71.9	101.7		
OCD5 (2008-12)	37.4	73.0	114.9	158.3	238.4		



Table 2b. Homogeneous comparison of selected track forecast guidance models (in n mi) for Tropical Storm Narda. 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 2a due to the homogeneity requirement.

Model ID	Forecast Period (h)						
	12	24	36	48	72	96	120
OFCL	30.9	56.1	70.7	86.3	77.1		
OCD5	49.7	97.9	126.5	156.1	120.1		
GFSI	41.2	72.1	82.8	92.9	93.8		
GHMI	35.1	56.1	67.9	76.2	82.7		
HWFI	46.4	75.4	87.6	105.2	131.2		
EMXI	31.5	55.9	80.0	111.7	99.6		
CMCI	36.1	72.1	110.3	136.2	165.3		
AEMI	39.1	59.6	67.7	78.7	44.5		
TVCE	31.7	57.2	71.8	82.4	68.1		
LBAR	39.9	62.8	73.2	82.3	105.4		
BAMD	37.6	54.9	67.0	97.5	158.0		
BAMM	32.1	49.8	60.8	72.8	131.2		
BAMS	37.9	68.2	95.9	115.1	116.2		
Forecasts	11	9	7	6	3		

Table 3a. NHC official (OFCL) and climatology-persistence skill baseline (OCD5) intensity forecast errors (kt) for Tropical Storm Narda. 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	6.9	15.5	21.1	29.3	33.3		
OCD5	7.3	14.0	17.3	23.7	27.3		
Forecasts	13	11	9	7	3		
OFCL (2008-12)	6.3	10.5	13.4	14.5	15.3		
OCD5 (2008-12)	7.6	12.5	16.5	18.8	20.4		

Table 3b. Homogeneous comparison of selected intensity forecast guidance models (in kt) for Tropical Storm Narda. 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	6.9	15.5	21.1	29.3	33.3		
OCD5	7.3	14.0	17.3	23.7	27.3		
HWFI	5.4	10.9	17.3	24.6	33.7		
GHMI	7.0	9.5	7.3	12.9	21.7		
DSHP	8.0	14.1	18.9	26.4	31.0		
LGEM	8.6	14.8	18.0	23.9	23.7		
ICON	6.8	10.7	14.9	22.1	27.7		
Forecasts	13	11	9	7	3		

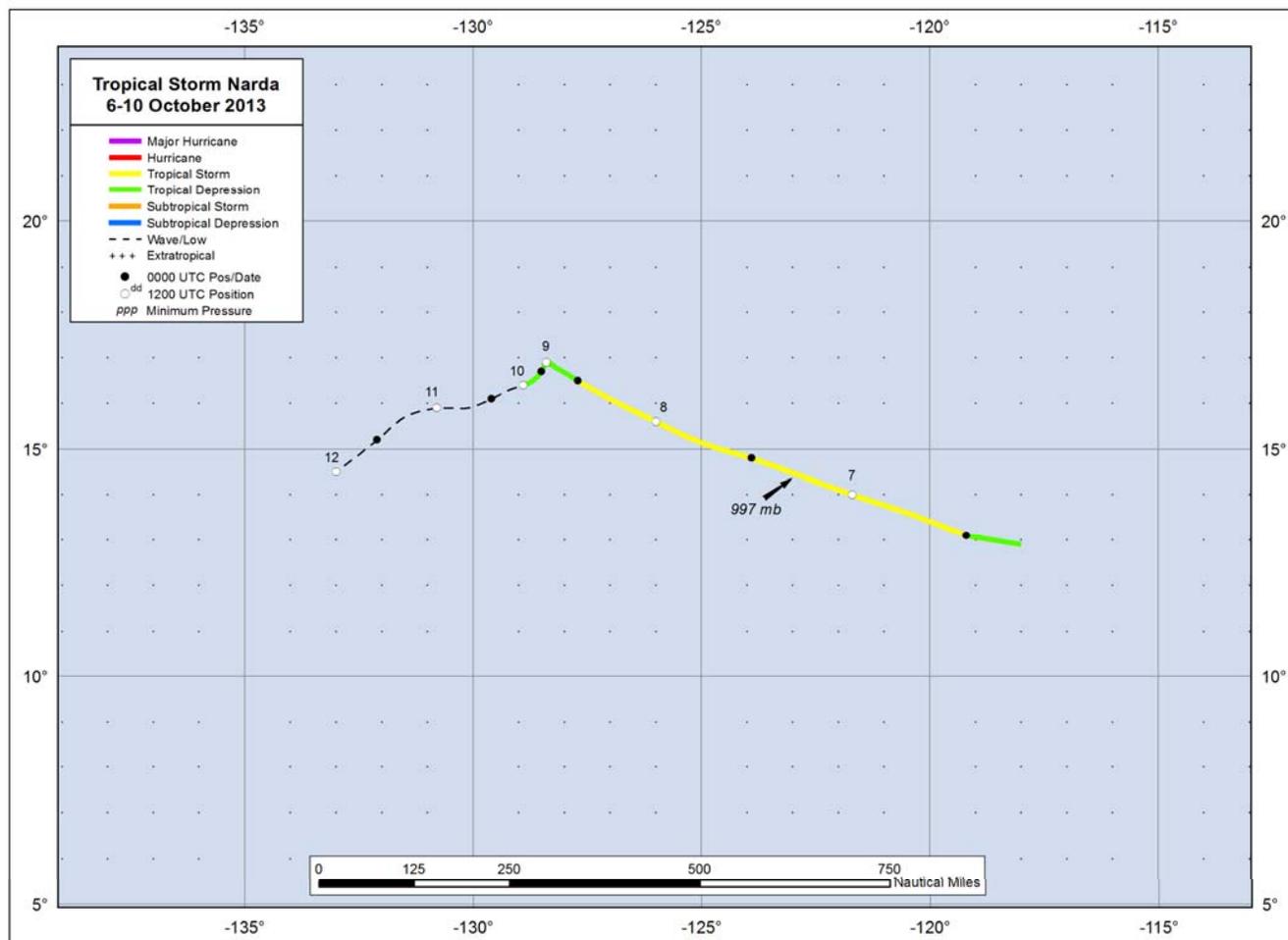


Figure 1. Best track positions for Tropical Storm Narda, 6-10 October 2013.

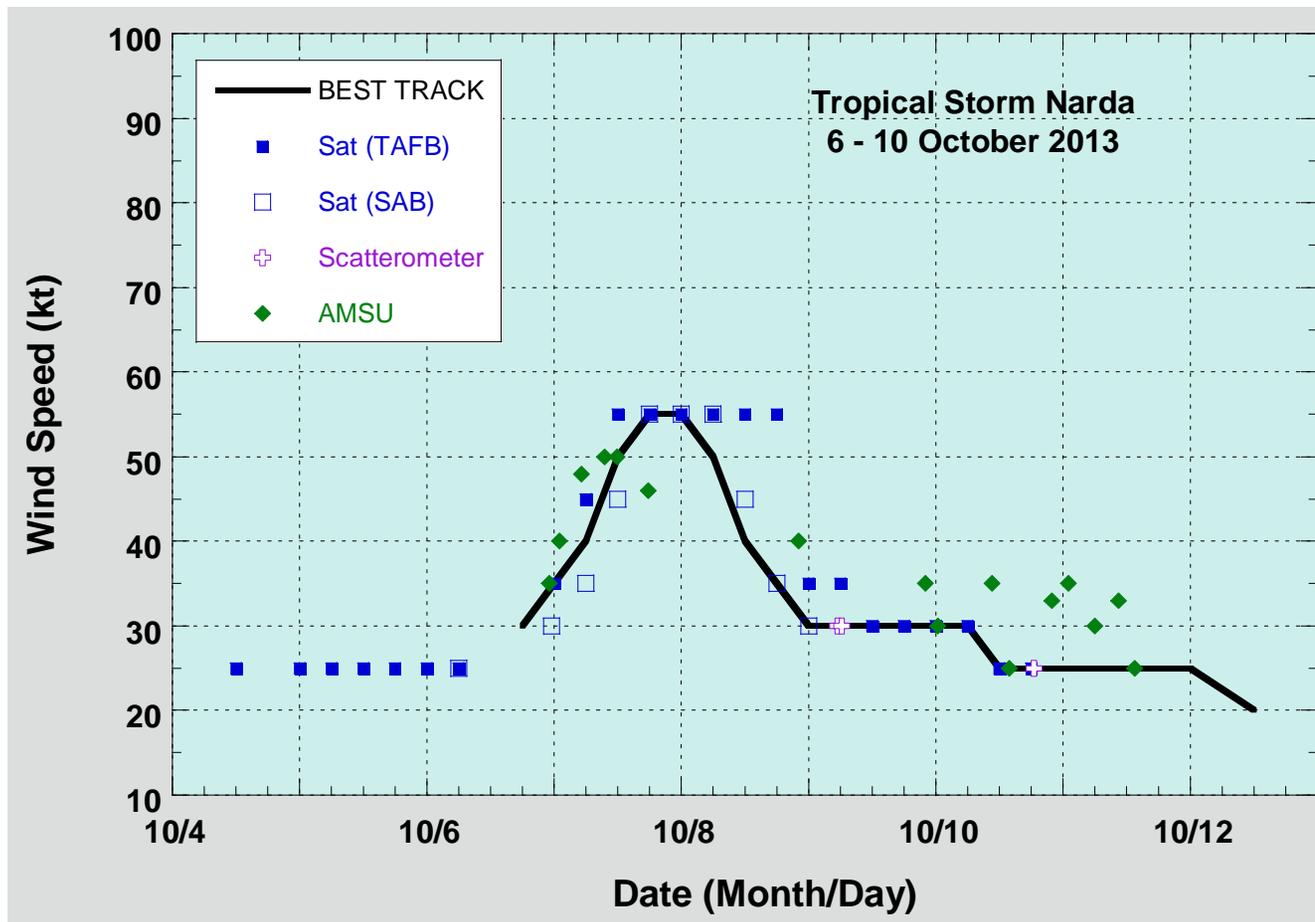


Figure 2. Selected wind observations and best track maximum sustained surface wind speed curve for Tropical Storm Narda, 6-10 October 2013. AMSU intensity estimates are from the Cooperative Institute for Meteorological Satellite Studies technique. Dashed vertical lines correspond to 0000 UTC.

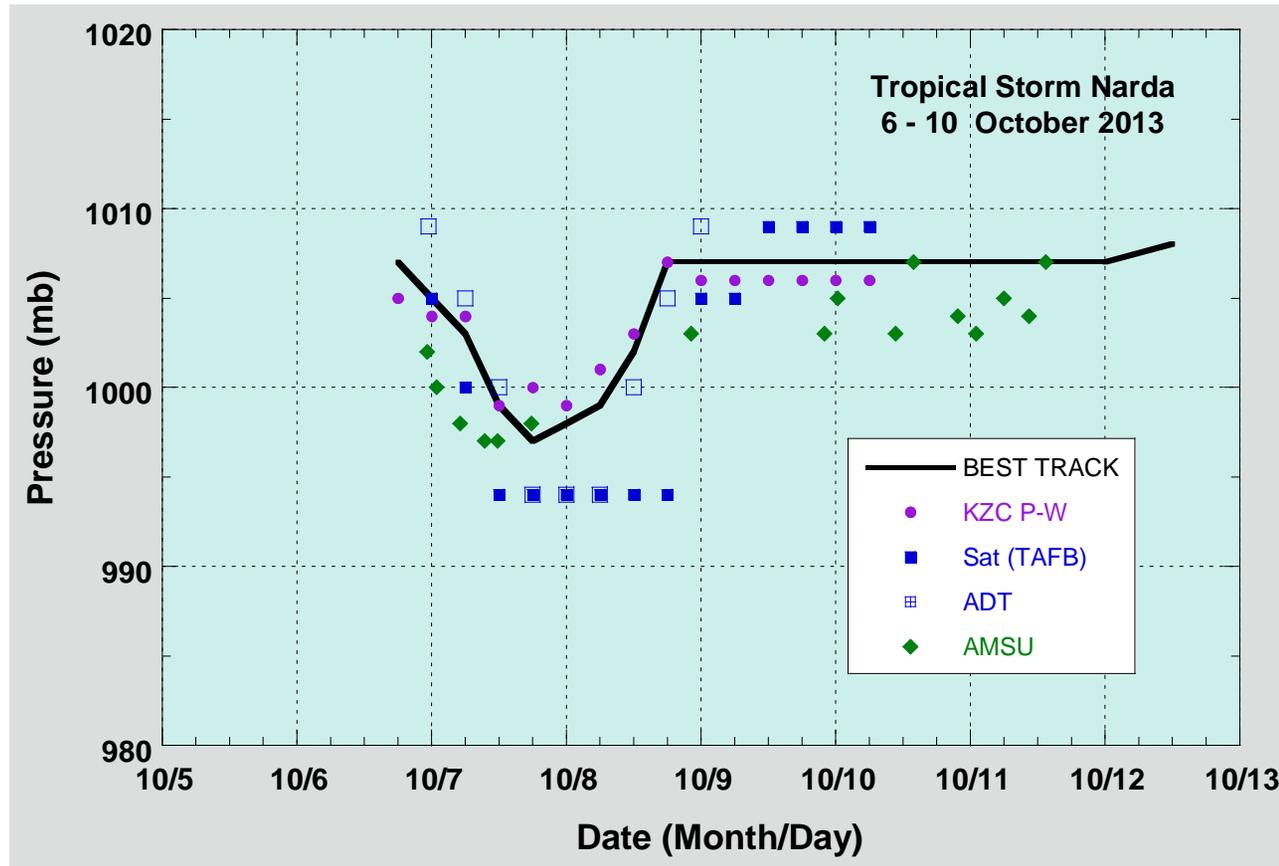


Figure 3. Selected pressure observations and best track minimum central pressure curve for Tropical Storm Narda, 6-10 October 2013. AMSU intensity estimates are from the Cooperative Institute for Meteorological Satellite Studies technique. KZC P-W refers to pressure estimates derived using the Knaff-Zehr-Courtney pressure-wind relationship. Dashed vertical lines correspond to 0000 UTC.