

Tropical Cyclone Report
Tropical Storm Norma
23-27 September 2005

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Norma was a short-lived tropical storm that did not affect any land areas.

a. Synoptic History

Norma originated from a large tropical disturbance that developed south of Manzanillo, Mexico on 19 September. An elongated area of low pressure formed within the slowly-moving disturbance on 21 September, but persistent easterly shear helped keep the disturbance from becoming better organized. A number of small vortices were observed rotating within a broader cyclonic envelope on 21 and 22 September. One particularly well-defined vortex spun out of the southeast edge of the deep convection early on 22 September and spent most of the day executing a loop to the east of the convection. Continuing its loop, the vortex then re-entered the convection near 0000 UTC 23 September. Within a couple of hours, convection in the area increased markedly and no further small vortices were noted. It is estimated that the improved organization of the system that occurred around 0000 UTC represents the formation of a tropical depression.

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. A weak mid-level ridge to the north and east of the cyclone provided an initial steering current toward the west-northwest. Satellite classifications and QuikSCAT data indicate that by 1200 UTC 23 September the depression had strengthened to a tropical storm about 475 n mi south of Cabo San Lucas, Mexico. With its center of circulation remaining near the eastern side of the deep convection due to easterly wind shear, Norma continued to slowly strengthen while it turned northwestward the following day. An increase in organization occurred near midday on 24 September when the center became more embedded within the convection and some banding features developed. Norma reached its estimated peak intensity of 50 kt at 1800 UTC, but by late in the day the circulation center became exposed and the convection weakened. A large upper-level ridge to the north of Norma maintained easterly shear over the cyclone, from which Norma never recovered. Norma continued northwestward while gradually weakening, becoming a depression at 1800 UTC 26 September. Early the next day Norma crossed the 26EC isotherm and deep convection diminished. Norma degenerated to a remnant low near 1800 UTC 27 September about 410 n mi west of Cabo San Lucas. The remnant low survived for several more days before dissipating on 1 October about 600 n mi west-southwest of Cabo San Lucas.

b. Meteorological Statistics

Observations in Norma (Figs. 2 and 3) include satellite-based Dvorak technique intensity estimates from the Tropical Analysis and Forecast Branch (TAFB), the Satellite Analysis Branch (SAB) and the U. S. Air Force Weather Agency (AFWA). Microwave satellite imagery from NOAA polar-orbiting satellites, the NASA Tropical Rainfall Measuring Mission (TRMM), the NASA QuikSCAT, and Defense Meteorological Satellite Program (DMSP) satellites were also useful in tracking Norma. The peak intensity of 50 kt represents a compromise between Dvorak estimates of 55 kt and QuikSCAT values that never exceeded 45 kt.

No ship reports of winds of tropical storm force were received in association with Norma.

c. Casualty and Damage Statistics

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

d. Forecast and Warning Critique

Average official track errors (with the number of cases in parentheses) for the slow-moving Norma were 24 (17), 41 (15), 61 (13), 80 (11), 130 (7), and 168 (3) n mi for the 12, 24, 36, 48, 72, and 96h forecasts, respectively. These errors are well below the average official track errors for the 10-yr period 1995-2004¹ (Table 2). The table indicates that the best-performing models for Norma were the interpolated GFS (GFSI), the shallow BAM (BAMS), and the GUNA consensus.

Intensity forecasts for Norma were also relatively good. Average official intensity errors were 4, 7, 10, 12, 17, and 15 kt for the 12, 24, 36, 48, 72, and 96 h forecasts, respectively. For comparison, the average official intensity errors over the 10-yr period 1995-2004 are 6, 11, 14, 17, 19, and 18, and 19 kt, respectively. Official forecasts for Norma had a modest high bias throughout the cyclone's lifetime.

Norma's precursor disturbance was first mentioned in Tropical Weather Outlooks (TWOs) on 19 September. The possibility that the system could become a depression "during the next day or two" was first mentioned on 20 September. On 22 September, the day prior to genesis, the disturbance appeared to be strongly sheared and the TWOs indicated only a modest chance of subsequent development.

¹ Errors given for the 96 and 120 h periods are averages over the four-year period 2001-4.

Table 1. Best track for Tropical Storm Norma, 23-27 September 2005.

Date/Time (UTC)	Latitude (EN)	Longitude (EW)	Pressure (mb)	Wind Speed (kt)	Stage
23 / 0000	14.8	108.5	1008	30	tropical depression
23 / 0600	14.9	109.1	1006	30	"
23 / 1200	15.0	109.6	1005	35	tropical storm
23 / 1800	15.2	109.9	1003	40	"
24 / 0000	15.4	110.2	1002	40	"
24 / 0600	15.7	110.4	1000	45	"
24 / 1200	16.0	110.6	998	45	"
24 / 1800	16.3	110.8	997	50	"
25 / 0000	16.7	111.0	998	45	"
25 / 0600	17.1	111.2	999	45	"
25 / 1200	17.6	111.7	1000	45	"
25 / 1800	18.0	112.2	1000	45	"
26 / 0000	18.5	112.8	1001	40	"
26 / 0600	19.0	113.4	1002	40	"
26 / 1200	19.6	114.0	1003	35	"
26 / 1800	20.3	114.7	1004	30	tropical depression
27 / 0000	21.0	115.3	1005	30	"
27 / 0600	21.6	116.1	1006	25	"
27 / 1200	22.0	116.7	1006	25	"
27 / 1800	22.3	117.3	1006	25	remnant low
28 / 0000	22.3	117.8	1006	20	"
28 / 0600	22.2	118.3	1006	20	"
28 / 1200	21.9	118.7	1006	20	"
28 / 1800	21.5	119.0	1006	20	"
29 / 0000	21.1	119.4	1006	20	"
29 / 0600	20.6	119.9	1007	20	"
29 / 1200	20.0	120.4	1007	20	"
29 / 1800	19.5	120.7	1008	20	"
30 / 0000	19.2	120.7	1008	20	"
30 / 0600	18.9	120.5	1009	15	"
30 / 1200	18.8	120.2	1009	15	"
30 / 1800	18.7	119.9	1010	15	"
01 / 0000	18.6	119.5	1010	15	"
01 / 0600					dissipated
24 / 1800	16.3	110.8	997	50	minimum pressure

Table 2. Preliminary forecast evaluation (heterogeneous sample) for Tropical Storm Norma, 23-27 September 2005. Forecast errors (n mi) are followed by the number of forecasts in parentheses. Errors smaller than the NHC official forecast are shown in bold-face type. Verification includes the depression stage.

Forecast Technique	Forecast Period (h)						
	12	24	36	48	72	96	120
CLP5	28 (17)	53 (15)	84 (13)	112 (11)	126 (7)	110 (3)	
GFNI	53 (14)	106 (12)	147 (10)	189 (8)	329 (4)		
GFDI	31 (15)	59 (13)	90 (11)	120 (9)	170 (5)	244 (1)	
GFSI	31 (15)	47 (12)	57 (10)	27 (7)	87 (3)		
AEMI	27 (16)	39 (14)	50 (12)	49 (10)	85 (6)	96 (2)	
NGPI	31 (14)	60 (12)	85 (10)	119 (8)	172 (4)		
UKMI	36 (16)	64 (14)	86 (12)	101 (10)	102 (6)	173 (2)	
BAMD	26 (17)	59 (15)	101 (13)	152 (11)	208 (7)	247 (3)	
BAMM	29 (16)	50 (15)	82 (13)	115 (11)	116 (7)	122 (3)	
BAMS	23 (16)	31 (15)	52 (13)	77 (11)	108 (7)	86 (3)	
CONU	30 (15)	51 (13)	67 (11)	83 (9)	146 (5)	208 (1)	
GUNA	22 (14)	35 (11)	44 (9)	43 (6)	74 (2)		
FSSE	29 (13)	53 (12)	67 (10)	78 (8)	136 (5)	45 (1)	
OFCL	24 (17)	41 (15)	61 (13)	80 (11)	130 (7)	168 (3)	
NHC Official (1995-2004 mean)	37 (2654)	68 (2378)	97 (2096)	123 (1829)	175 (1386)	208 (355)	259 (224)

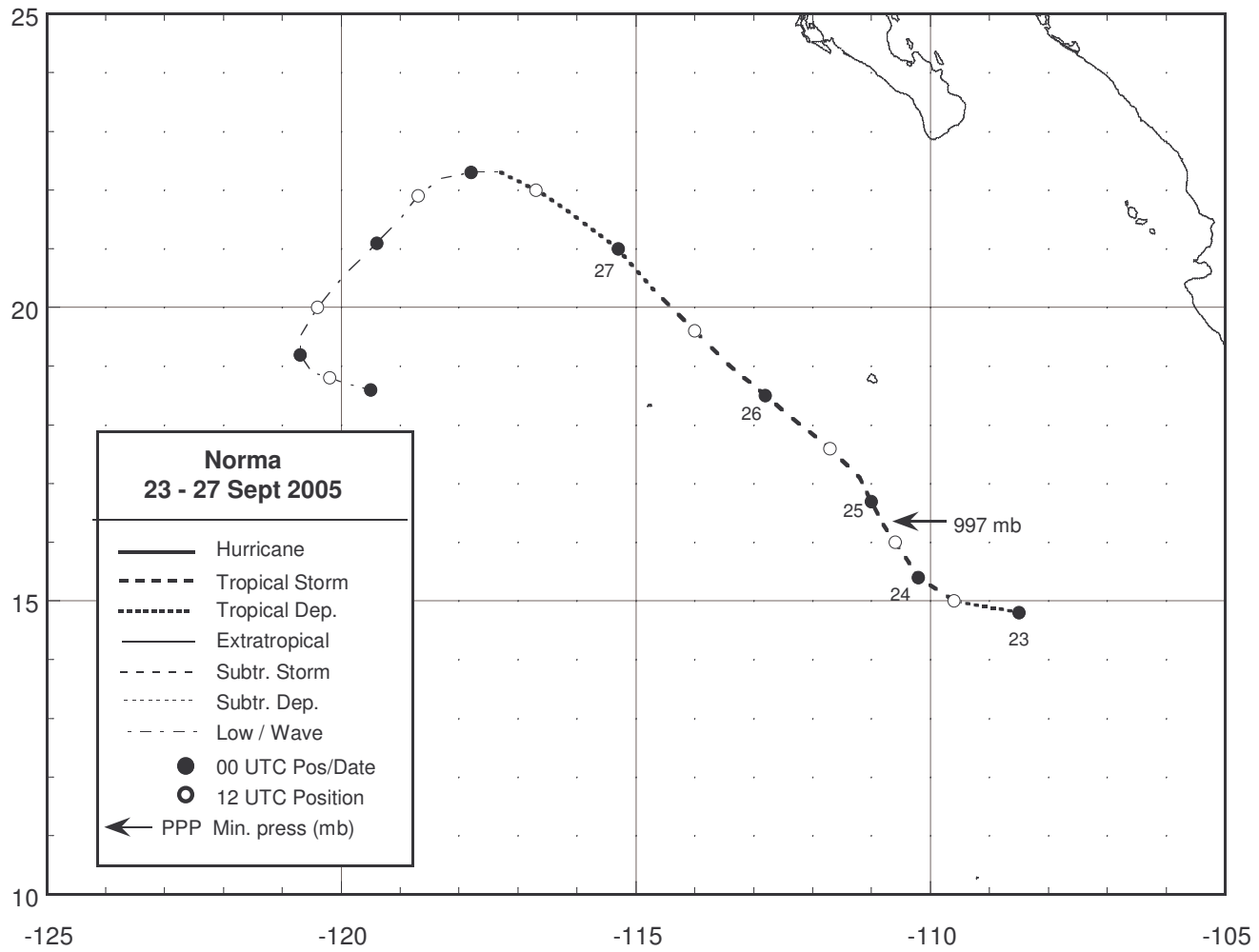


Figure 1. Best track positions for Tropical Storm Norma, 23-27 September 2005.

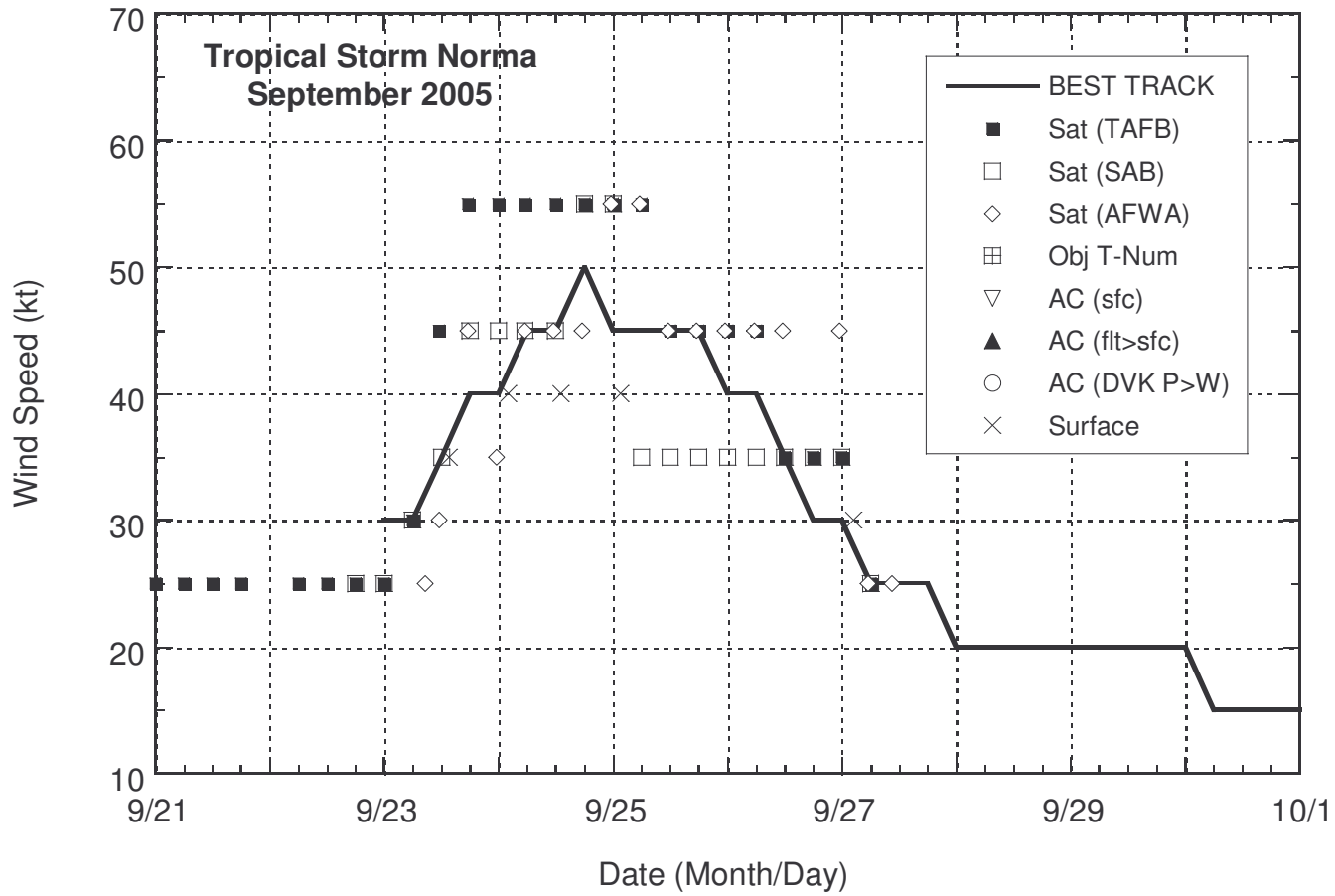


Figure 2. Selected wind observations and best track maximum sustained surface wind speed curve for Tropical Storm Norma, 23-27 September 2005. QuikSCAT estimates are indicated by an "X".

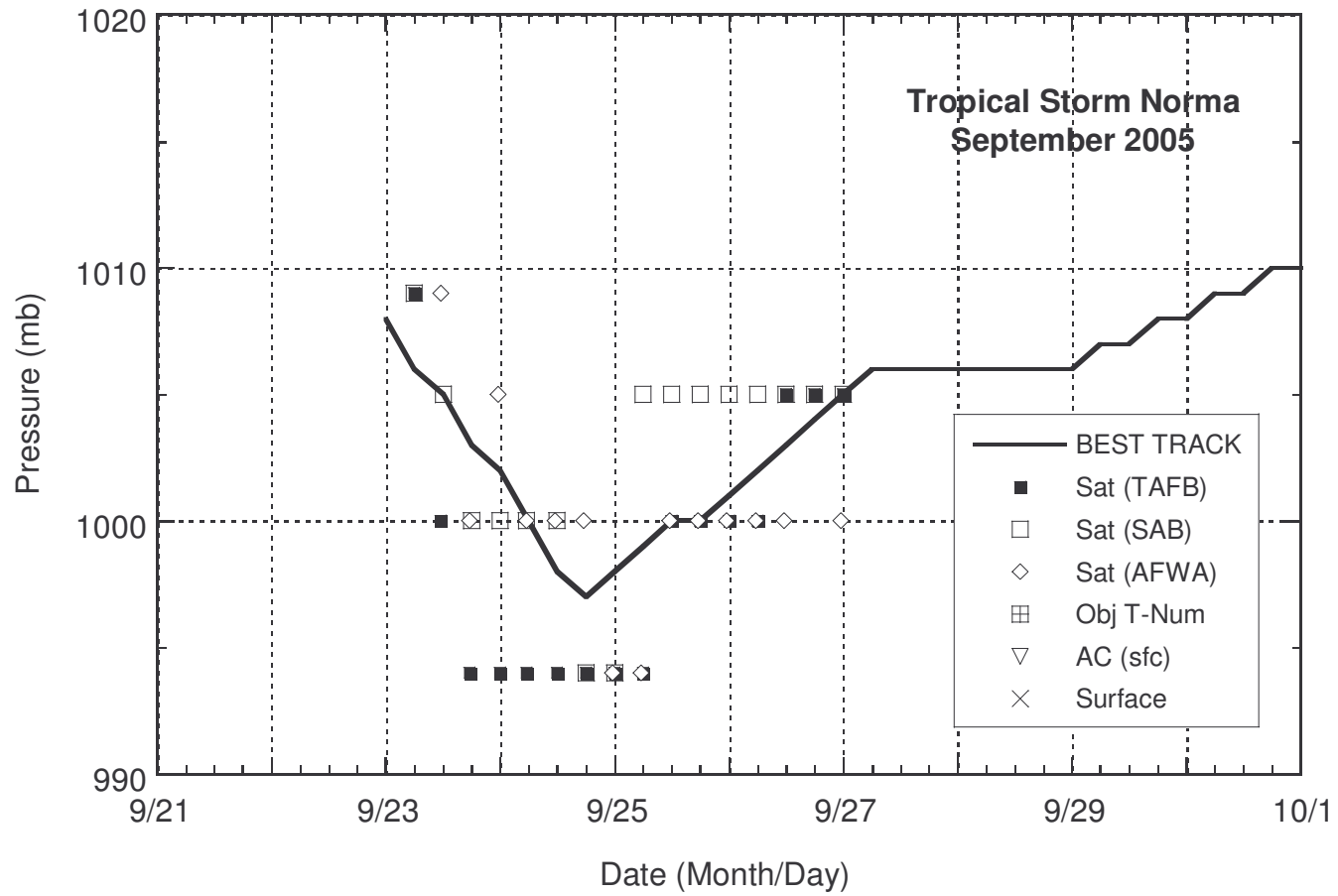


Figure 3. Selected pressure observations and best track minimum central pressure curve for Tropical Storm Norma, 23-27 September 2005.