

Tropical Cyclone Report
Hurricane Daniel
(EP052006)
16-26 July 2006

Jack Beven
National Hurricane Center
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(updated 4 January 2007 for best track intensities and verification)

Daniel reached category 4 intensity on the Saffir-Simpson Hurricane Scale over the open eastern North Pacific.

a. Synoptic History

Daniel formed from a tropical wave that moved westward from the coast of Africa on 2 July. The wave crossed the Atlantic Ocean and Caribbean Sea with little associated convection and reached the eastern North Pacific Ocean on 12 July. As the wave moved westward, convection increased beginning on 13 July, and the system showed signs of convective organization starting on 15 July. It is estimated that the wave spawned a tropical depression near 1800 UTC 16 July about 455 n mi south-southwest of Manzanillo, 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.

The cyclone moved westward in a light vertical shear environment to the south of a large subtropical ridge. It strengthened into a tropical storm on 17 July and into a hurricane on 18 July. Daniel turned west-northwestward on 20 July, when intensification was briefly halted by an eyewall replacement cycle. Strengthening resumed after the cycle, and it is estimated that Daniel became a category 4 hurricane later that day about 965 n mi southwest of Cabo San Lucas, Mexico. Daniel turned westward on 21 July during a second eyewall replacement cycle. After this cycle, the hurricane reached an estimated peak intensity of 130 kt around 0000 UTC 22 July. A slow weakening trend began later that day as Daniel moved over progressively cooler sea surface temperatures.

The hurricane turned west-northwestward on 23 July, and early the next day it crossed 140°W into the central North Pacific basin, where it became the forecast responsibility of the Central Pacific Hurricane Center. It turned westward and decelerated as the subtropical ridge to the north weakened. Due to a combination of cooler waters and increasing easterly shear, Daniel weakened a tropical storm on 25 July and a tropical depression on 26 July. The cyclone degenerated to a non-convective remnant low near 0000 UTC 27 July about 645 n mi east-southeast of Hilo, Hawaii. The low moved generally west-northwestward until it dissipated the next day about 220 n mi east-southeast of Hilo.

b. Meteorological Statistics

Observations in Daniel (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 Aqua, the NASA QuikSCAT, the Department of Defense WindSat, and Defense Meteorological Satellite Program (DMSP) satellites were also useful in tracking Daniel.

There were no observations of tropical-storm-force or greater winds from Daniel.

c. Casualty and Damage Statistics

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

d. Forecast and Warning Critique

The genesis of Daniel was not well anticipated. While the pre-Daniel disturbance was first mentioned in the Tropical Weather Outlook on 15 July, these outlooks generally indicated that development would be slow to occur. The potential for tropical cyclone formation was not mentioned until the Outlook near 1700 UTC 16 July. This was only 1 h before the best-track time of genesis, and only 9 h before the first advisory was written operationally.

A verification of official and guidance model track forecasts is given in Table 2. Average official track errors for Daniel were 22, 46, 71, 96, 126, 169, and 222 n mi for the 12, 24, 36, 48, 72, 96, and 120 h forecasts, respectively. The number of forecasts ranged from 30 at 12 h to 20 at 120 h. These errors are smaller than the average long-term official track errors (Table 2). While the official track forecast errors are generally smaller than those of the numerical guidance models, the various Beta and Advection Models (BAM S, M, and D) out-performed the official forecasts. The official forecasts also had larger errors than climatology and persistence (CLP5) at 120 h, indicating these forecasts had no skill. This resulted from forecasts during 19-21 July that anticipated a faster weakening of the subtropical ridge than what actually occurred. This led to the 120 h forecast positions being far to the northeast of the verifying positions.

Average official intensity errors were 4, 8, 14, 20, 28, 28, and 24 kt for the 12, 24, 36, 48, 72, 96, and 120 h forecasts, respectively (Table 3). For comparison, the average long-term official intensity errors are 6, 11, 14, 17, 19, 18, and 19 kt, respectively. The average intensity forecast errors are larger than average from 48-120 h, but are less than those of climatology and persistence (SHF5), indicating that they had skill. These large average errors had two causes. First, the official intensity forecast underestimated how much Daniel would strengthen during its development phase. Second, the forecasts called for a slower weakening than was observed as Daniel weakened over the central North Pacific.

Watches or warnings were not required for Daniel.

Table 1. Best track for Hurricane Daniel, 16 – 26 July 2006. The track west of 140°W is based on analyses from the Central Pacific Hurricane Center.

Date/Time (UTC)	Latitude (°N)	Longitude (°W)	Pressure (mb)	Wind Speed (kt)	Stage
16 / 1800	12.3	108.0	1008	25	tropical depression
17 / 0000	12.4	109.2	1007	30	"
17 / 0600	12.4	110.4	1007	30	"
17 / 1200	12.3	111.6	1005	35	tropical storm
17 / 1800	12.3	112.6	1002	40	"
18 / 0000	12.2	113.6	1000	45	"
18 / 0600	12.2	114.8	994	55	"
18 / 1200	12.2	116.0	990	60	"
18 / 1800	12.1	117.1	987	65	hurricane
19 / 0000	11.9	117.9	984	70	"
19 / 0600	11.8	118.6	980	75	"
19 / 1200	11.8	119.2	976	80	"
19 / 1800	11.8	119.9	973	85	"
20 / 0000	11.9	120.7	966	95	"
20 / 0600	12.2	121.4	966	95	"
20 / 1200	12.4	122.2	960	100	"
20 / 1800	12.6	123.0	948	115	"
21 / 0000	13.0	123.9	942	120	"
21 / 0600	13.1	124.9	948	115	"
21 / 1200	13.3	125.9	942	120	"
21 / 1800	13.3	126.9	938	125	"
22 / 0000	13.5	128.0	933	130	"
22 / 0600	13.7	129.1	933	130	"
22 / 1200	13.8	130.3	933	130	"
22 / 1800	14.0	131.4	935	125	"
23 / 0000	14.2	132.6	941	120	"
23 / 0600	14.5	133.9	948	115	"
23 / 1200	14.7	135.2	948	115	"
23 / 1800	15.1	136.5	952	105	"
24 / 0000	15.5	137.9	965	95	"
24 / 0600	15.9	139.1	975	85	"
24 / 1200	16.2	140.4	980	80	"
24 / 1800	16.2	141.3	985	75	"
25 / 0000	16.2	141.8	994	65	"
25 / 0600	16.2	142.3	999	55	tropical storm
25 / 1200	16.2	142.4	1003	45	"
25 / 1800	16.2	142.6	1004	35	"
26 / 0000	16.2	142.8	1006	30	tropical depression
26 / 0600	16.2	142.9	1008	30	"
26 / 1200	16.2	143.1	1009	25	"

26 / 1800	16.1	143.6	1009	25	"
27 / 0000	16.2	144.4	1009	25	remnant low
27 / 0600	16.3	145.1	1009	25	"
27 / 1200	16.9	146.6	1009	25	"
27 / 1800	17.2	147.4	1009	25	"
28 / 0000	17.4	148.8	1010	25	"
28 / 0600	17.6	150.1	1010	25	"
28 / 1200	17.8	151.8	1010	25	"
28 / 1800					dissipated
22 / 0000	13.5	128.0	933	130	minimum pressure

Table 2. Preliminary track forecast evaluation (heterogeneous sample) for Hurricane Daniel, 16 – 26 July 2006. 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	24 (31)	52 (31)	83 (31)	118 (31)	169 (29)	198 (25)	197 (21)
GFDI	30 (31)	54 (31)	77 (31)	102 (31)	153 (29)	226 (25)	348 (21)
GFDL*	26 (28)	48 (28)	66 (28)	92 (28)	150 (26)	216 (23)	339 (19)
GFNI	30 (28)	66 (28)	101 (28)	133 (28)	171 (26)	219 (22)	287 (18)
GFDN*	25 (25)	54 (25)	90 (25)	123 (25)	163 (23)	200 (20)	264 (17)
GFSI	27 (31)	55 (31)	81 (31)	104 (31)	148 (29)	191 (25)	279 (21)
GFSO*	26 (31)	46 (31)	67 (31)	88 (31)	136 (28)	178 (24)	267 (20)
AEMI	31 (31)	64 (31)	98 (31)	129 (31)	185 (29)	237 (25)	293 (21)
AEMN*	26 (27)	53 (27)	85 (27)	119 (27)	187 (25)	234 (21)	296 (17)
NGPI	39 (31)	79 (31)	115 (31)	143 (31)	186 (29)	201 (25)	261 (20)
NGPS*	36 (30)	66 (30)	97 (30)	125 (30)	167 (28)	195 (24)	227 (20)
UKMI	28 (29)	52 (29)	74 (29)	102 (29)	146 (25)	169 (21)	217 (17)
UKM*	35 (15)	46 (15)	68 (15)	90 (15)	131 (13)	159 (11)	200 (9)
CMC*	76 (13)	74 (13)	80 (13)	92 (12)	121 (11)	135 (4)	121 (3)
EMX*	73 (14)	94 (14)	117 (14)	130 (14)	147 (13)	167 (11)	165 (9)
P91E	24 (31)	49 (31)	75 (31)	101 (31)	136 (29)	160 (25)	239 (21)
P9UK	25 (15)	52 (15)	75 (15)	97 (15)	141 (14)		
BAMD	21 (31)	36 (31)	51 (31)	69 (31)	106 (29)	178 (25)	254 (21)
BAMM	20 (31)	37 (31)	56 (31)	76 (31)	108 (29)	158 (25)	209 (21)
BAMS	27 (31)	47 (31)	72 (31)	95 (31)	121 (29)	143 (25)	197 (21)
LBAR	19 (31)	43 (31)	74 (31)	108 (31)	164 (29)	195 (25)	177 (21)
CONU	25 (31)	52 (31)	77 (31)	98 (31)	130 (29)	181 (25)	242 (21)
GUNA	25 (28)	47 (28)	68 (28)	87 (28)	124 (25)	181 (21)	256 (17)
FSSE	24 (28)	47 (28)	70 (28)	93 (28)	125 (26)	177 (22)	229 (18)
OFCL	22 (30)	46 (30)	71 (30)	96 (30)	126 (28)	169 (24)	222 (20)
NHC Official (2001-2005 mean)	35 (1300)	60 (1152)	83 (1009)	103 (877)	145 (652)	192 (465)	231 (313)

* Output from these models is unavailable at forecast time.

Table 3. Preliminary intensity forecast evaluation (heterogeneous sample) for Hurricane Daniel, 16 – 26 July 2006. Forecast errors (kt) 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
SHF5	5.1 (31)	10.2 (31)	16.3 (31)	21.3 (31)	29.4 (29)	36.6 (25)	38.6 (21)
GFDI	8.2 (31)	14.1 (31)	18.4 (31)	24.3 (31)	34.3 (29)	36.8 (25)	31.8 (21)
GFDL*	17.1 (28)	18.6 (28)	16.3 (28)	19.2 (28)	24.7 (26)	27.0 (23)	21.5 (19)
SHIP	5.5 (31)	11.1 (31)	18.8 (31)	24.9 (31)	33.7 (29)	38.2 (25)	34.9 (21)
DSHP	5.5 (31)	11.1 (31)	18.8 (31)	24.9 (31)	33.7 (29)	38.2 (25)	34.9 (21)
FSSE	5.7 (28)	11.0 (28)	16.5 (28)	21.3 (28)	25.0 (26)	24.0 (22)	20.7 (18)
ICON	6.7 (31)	12.1 (31)	17.6 (31)	23.0 (31)	32.8 (29)	36.4 (25)	33.1 (21)
OFCL	4.2 (30)	7.8 (30)	13.5 (30)	20.0 (30)	27.9 (28)	28.3 (24)	23.8 (20)
NHC Official (2001-2005 mean)	6.2 (1300)	10.8 (1152)	14.3 (1009)	16.5 (876)	18.7 (652)	18.3 (465)	19.3 (313)

* Output from these models is unavailable at forecast time.

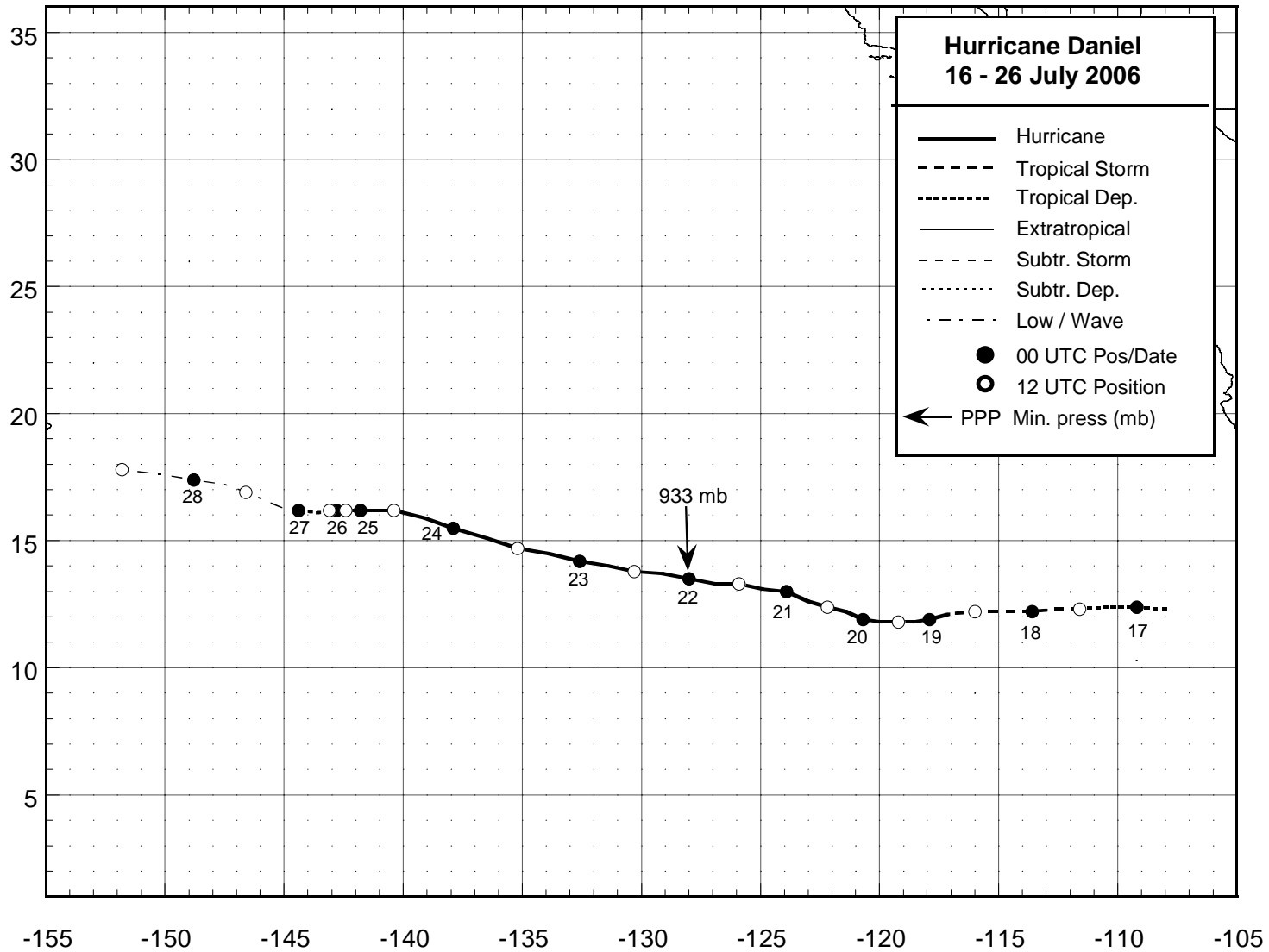


Figure 1. Best track positions for Hurricane Daniel, 16 - 26 July 2006. The track west of 140°W is based on analyses from the Central Pacific Hurricane Center.

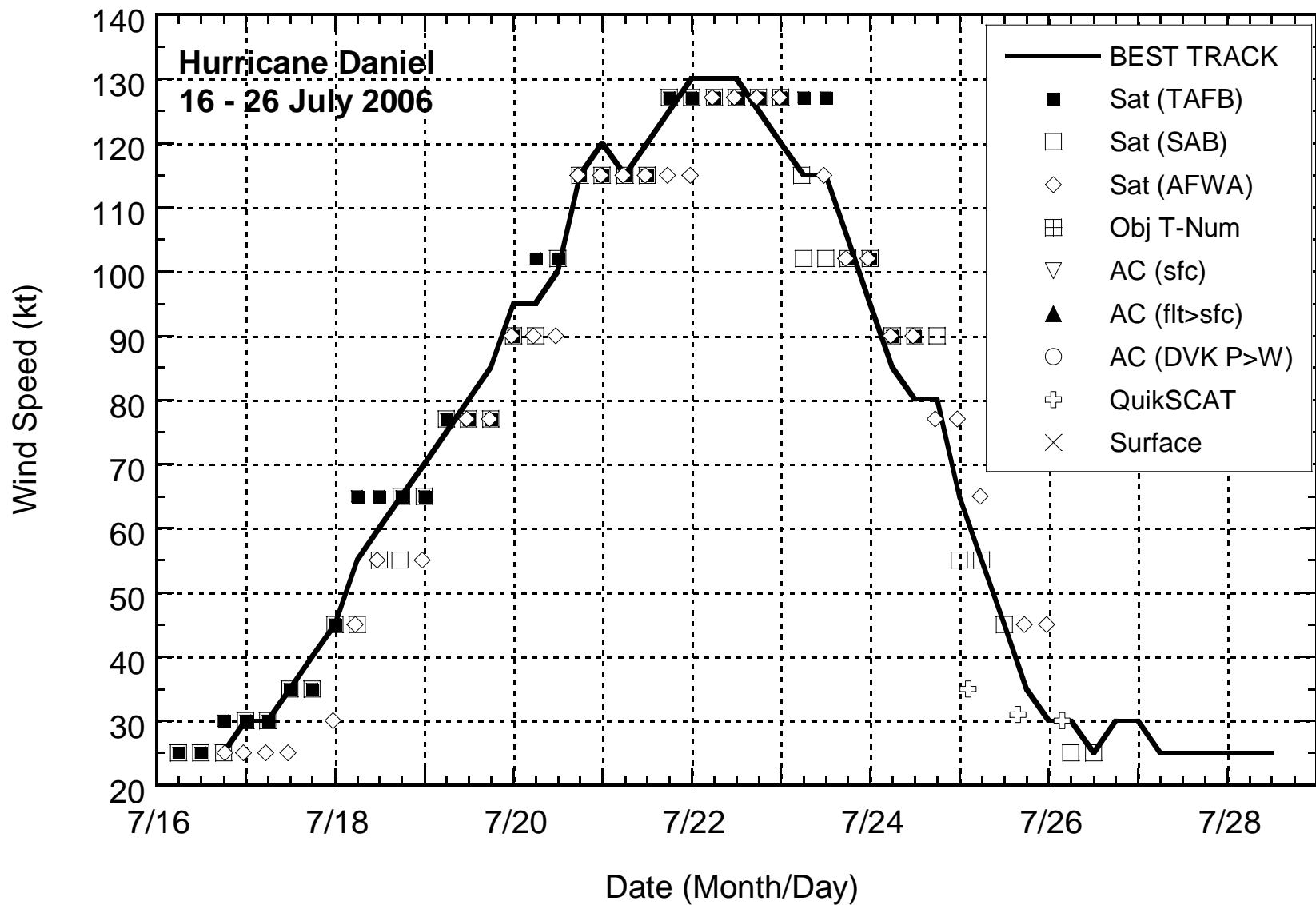


Figure 2. Selected wind observations and best track maximum sustained surface wind speed curve for Hurricane Daniel, 16 – 26 July 2006. The track west of 140°W is based on analyses from the Central Pacific Hurricane Center.

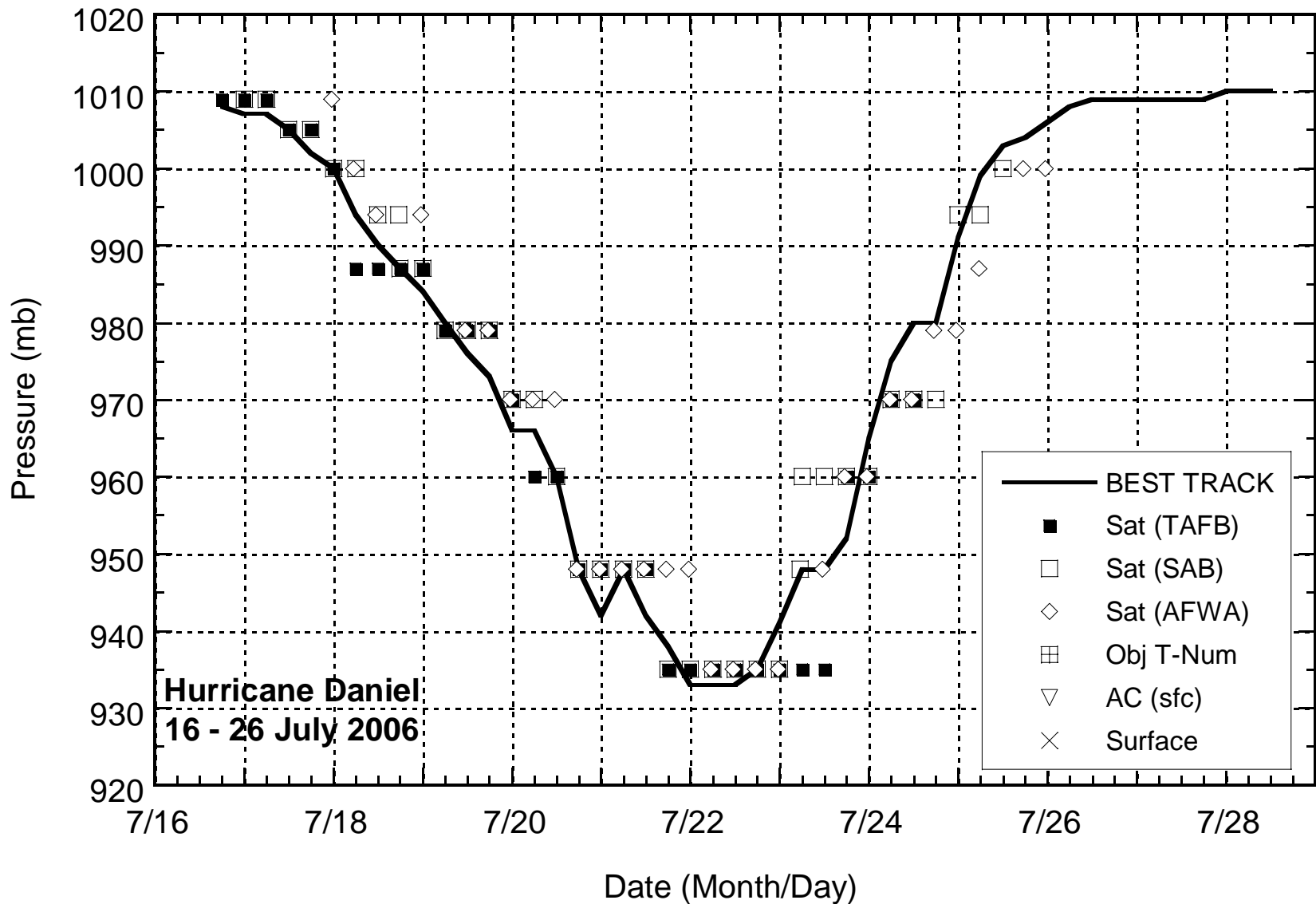


Figure 3. Selected pressure observations and best track minimum central pressure curve for Hurricane Daniel, 16 – 26 July 2006. The track west of 140°W is based on analyses from the Central Pacific Hurricane Center.