Tropical Cyclone Report
Hurricane Daniel
(EP042012)
4-12 July 2012

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Daniel was a category 3 hurricane (on the Saffir-Simpson Hurricane Wind Scale) that moved steadily westward across the eastern North Pacific.

a. Synoptic History

Daniel originated from a tropical wave that moved off the west coast of Africa on 20 June and moved westward across the tropical Atlantic and the Caribbean Sea for several days with limited shower activity.   Convection blossomed as the wave crossed Central America on 29 June, and a low pressure system formed south of the Gulf of Tehuantepec on 1 July.   The westward progression of the convection, vorticity, and moisture associated with the wave is displayed in Fig. 1. The low and its associated shower activity continued moving westward well south of the coast of Mexico, and once a well-defined center of circulation developed, the system was classified as a tropical depression at 0600 UTC 4 July about 425 n mi south of Manzanillo, Mexico.   The "best track" chart of Daniel'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].

The depression developed banding features and some upper-level outflow, and it became a tropical storm at 0600 UTC 5 July. Initially, the cyclone was affected by moderate easterly wind shear and its center was located east of the main convection. Daniel continued generally westward embedded within the easterly flow south of a persistent subtropical ridge, and this steering pattern prevailed through the life of the cyclone. The shear relaxed, and Daniel became a hurricane at 0000 UTC 7 July when an eye became apparent in both visible and microwave satellite images. This was followed by a period of steady intensification, and Daniel reached an estimated peak intensity of 100 knots and a minimum pressure of 961 mb at 0600 UTC 8 July. The eye then rapidly disappeared as the hurricane moved over cooler waters and into a stable atmospheric environment. Daniel continued westward while weakening and became a post-tropical remnant low at 1200 UTC 12 July. The low-level circulation dissipated, opening into a trough around 1200 UTC 14 July near 160°W.

b. Meteorological Statistics

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[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.

Observations in Daniel (Figs. 3 and 4) include subjective satellite-based Dvorak technique intensity estimates from the Tropical Analysis and Forecast Branch (TAFB), the Satellite Analysis Branch (SAB), and the Central Pacific Hurricane Center (CPHC), as well as objective Advanced Dvorak Technique (ADT) 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 Tropical Rainfall Measuring Mission (TRMM), 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 Hurricane Daniel. The peak estimated intensity of Daniel was based on a blend of subjective and objective Dvorak estimates.

There were no ship reports of tropical-storm-force winds associated with Daniel.

c.   Casualty and Damage Statistics

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

d.   Forecast and Warning Critique

A 10% chance of tropical cyclone formation was first mentioned in the Tropical Weather Outlook at 1200 UTC 2 July, about 42 h before genesis. A high chance of formation (80%) was forecast only 12 h prior to genesis.

A verification of NHC official track forecasts for Hurricane Daniel is given in Table 2a. Official forecast track errors were lower than the mean official errors for the previous 5-yr period.   In fact, these track errors for Daniel were one-half or even three-quarters lower than the previous 5-yr period.   However, the hurricane was embedded within very steady steering currents, making the forecasts relatively straightforward. A homogeneous comparison of the official track errors with selected guidance models is given in Table 2b. The official forecast errors were lower than all models except for the consensus (TVCE) at the 120-h period.

A verification of NHC official intensity forecasts for Hurricane Daniel is given in Table 3a. With the exception of the 96-h period, the official forecast intensity errors were lower than the mean official errors for the previous 5-yr period. Furthermore, the NHC forecasts were better than the guidance for most of the times, as indicated in Table 3b

There were no watches and warnings associated with Hurricane Daniel.

Table 1.   Best track for Hurricane Daniel, 4-12 July 2012.

Date/Time (UTC)	Latitude (°N)	Longitude (°W)	Pressure (mb)	Wind Speed (kt)	Stage
04 / 0600	12.1	105.3	1006	30	tropical depression
04 / 1200	12.7	106.3	1006	30	"
04 / 1800	13.2	107.3	1005	30	"
05 / 0000	13.6	108.1	1005	30	"
05 / 0600	13.8	109.0	1004	35	tropical storm
05 / 1200	14.0	110.0	1002	40	"
05 / 1800	14.1	111.2	997	50	"
06 / 0000	14.3	112.6	995	55	"
06 / 0600	14.4	113.5	995	55	"
06 / 1200	14.4	114.5	995	55	"
06 / 1800	14.4	115.5	993	60	"
07 / 0000	14.4	116.5	988	65	hurricane
07 / 0600	14.5	117.5	984	70	"
07 / 1200	14.6	118.6	980	75	"
07 / 1800	14.7	119.6	977	80	"
08 / 0000	14.8	120.7	968	90	"
08 / 0600	14.9	121.7	961	100	"
08 / 1200	15.0	123.1	968	90	"
08 / 1800	15.1	124.4	970	90	"
09 / 0000	15.2	125.7	973	85	"
09 / 0600	15.3	127.0	977	80	"
09 / 1200	15.3	128.4	984	75	"
09 / 1800	15.4	129.9	988	70	"
10 / 0000	15.4	131.5	992	65	"
10 / 0600	15.4	133.0	994	60	tropical storm
10 / 1200	15.3	134.3	996	55	"
10 / 1800	15.3	135.9	1000	50	"
11 / 0000	15.4	137.5	1003	45	"
11 / 0600	15.4	139.0	1005	40	"
11 / 1200	15.4	140.4	1006	30	"
11 / 1800	15.4	141.5	1007	30	tropical depression
12 / 0000	15.5	143.0	1007	30	"
12 / 0600	15.5	144.4	1007	25	"
12 / 1200	15.5	145.7	1008	25	low
12 / 1800	15.6	147.1	1008	25	"
13 / 0000	15.6	148.3	1008	25	"
13 / 0600	15.5	150.0	1008	25	"
13 / 1200	15.2	151.6	1008	25	"
13 / 1800	15.0	153.5	1008	25	"
14 / 0000	15.0	155.3	1009	25	"
14 / 0600	15.0	157.2	1009	25	"

14 / 1200					dissipated
08 / 0600	14.9	121.7	961	100	minimum pressure

Table 2a.   NHC official (OFCL) and climatology-persistence skill baseline (OCD5) track forecast errors (n mi) for Hurricane Daniel. Mean errors for the 5-yr period 2007-11 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	**16.5**	**21.9**	**29.8**	**36.5**	**44.1**	**54.0**	**83.5**
OCD5	24.1	45.7	74.1	112.5	192.0	278.5	364.8
Forecasts	29	28	26	24	20	16	12
OFCL (2007-11)	28.6	46.3	62.7	78.1	108.0	145.3	181.1
OCD5 (2007-11)	38.5	74.8	116.0	159.8	246.1	324.2	392.8

Table 2b.   Homogeneous comparison of selected track forecast guidance models (in n mi) for Hurricane Daniel. 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	17.1	21.4	30.0	36.6	43.5	52.2	82.0
OCD5	24.1	46.9	73.9	113.2	194.3	280.8	373.4
BAMS	46.5	84.9	125.2	163.1	224.8	285.1	357.2
BAMM	28.6	47.6	71.9	92.5	121.1	155.9	203.7
BAMD	28.5	51.0	76.0	97.6	136.1	168.1	236.9
GFSI	23.2	33.5	45.0	56.8	66.6	87.3	128.7
EMXI	23.0	28.7	34.0	45.6	72.0	92.5	106.9
HWFI	24.3	35.9	47.9	62.7	74.0	87.4	106.9
GHMI	24.0	40.0	53.9	61.6	71.3	102.6	159.5
AEMI	24.5	37.9	51.5	63.6	91.0	128.5	159.1
TVCE	23.2	31.1	39.9	48.9	62.3	62.8	**71.7**
Forecasts	26	25	24	22	18	14	11

Table 3a.   NHC official (OFCL) and climatology-persistence skill baseline (OCD5) intensity
              forecast errors (kt) for Hurricane Daniel. Mean errors for the 5-yr period 2007-11
              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	**4.8**	**7.3**	**11.0**	**13.3**	19.8	22.8	**16.7**
OCD5	6.2	9.9	13.1	16.6	22.1	22.7	15.3
Forecasts	29	28	26	24	20	16	12
OFCL (2007-11)	6.4	10.6	13.7	15.1	17.0	18.5	17.8
OCD5 (2007-11)	7.5	12.4	16.1	18.4	20.1	20.1	20.8

Table 3b.   Homogeneous comparison of selected intensity forecast guidance models (in kt) for Hurricane Daniel. 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	4.7	7.1	10.8	13.1	19.5	22.5	16.7
OCD5	6.1	9.8	12.9	16.4	21.9	**22.4**	**15.3**
HWFI	7.3	11.0	14.0	16.8	23.4	27.5	25.2
GHMI	6.7	12.2	19.2	21.3	25.0	23.5	16.8
LGEM	6.3	11.1	16.2	20.8	26.9	28.1	23.8
IVCN	5.8	9.2	13.7	17.0	23.8	25.7	20.9
Forecasts	29	28	26	24	20	16	12
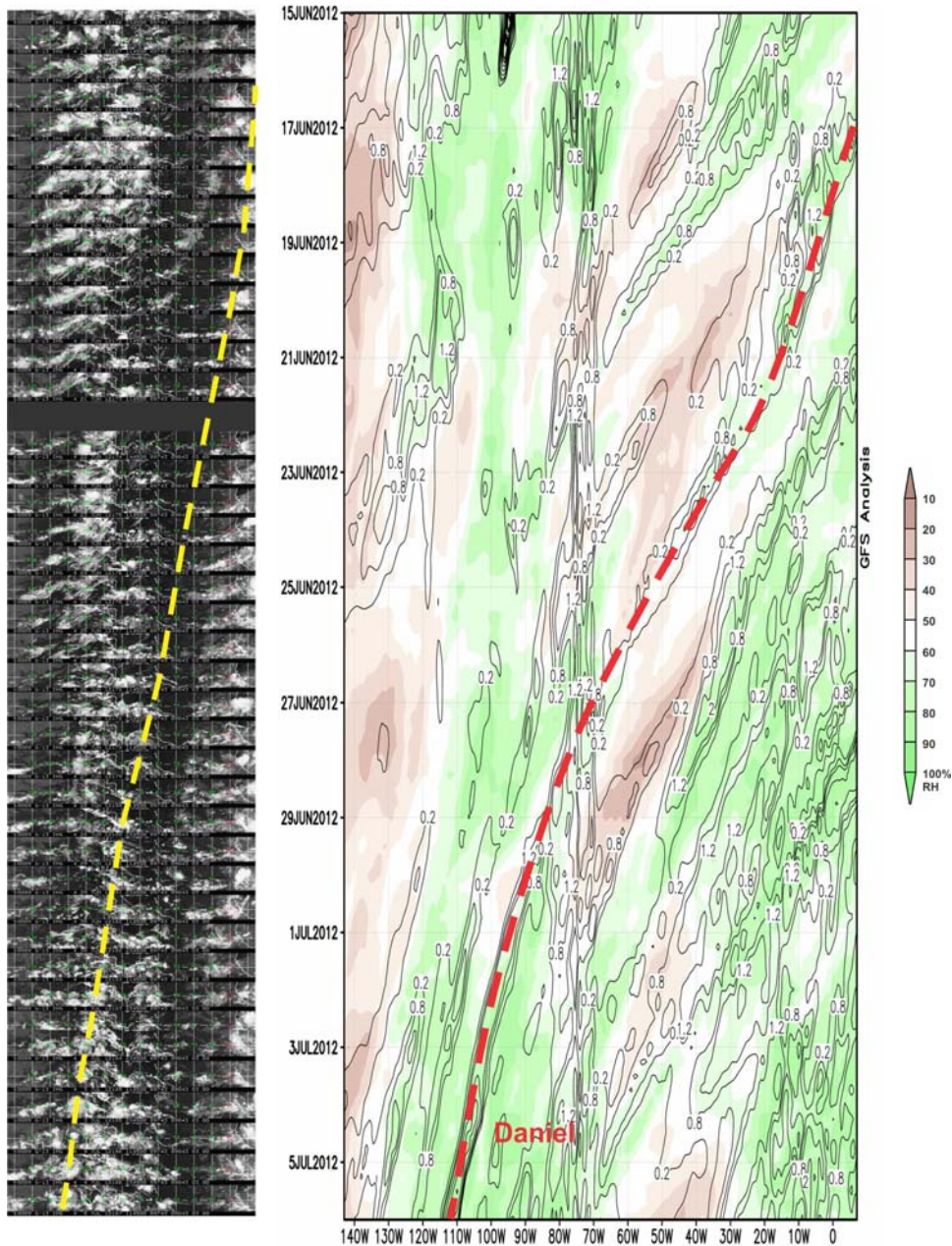
Figure 1. Time-longitude Hovmoller diagrams for the tropical wave that spawned Daniel, as observed by GOES-E (left panel) and the operational GFS analysis (right panel). In the right panel, mean 700-500-mb relative humidity (shaded, %) and 700-mb relative vorticity (contoured, 10^{-5} s^{-1}) are shown. The approximate westward progression of the pre-Daniel disturbance is denoted by the heavy dashed lines, and the dates are labeled at 0000 UTC.
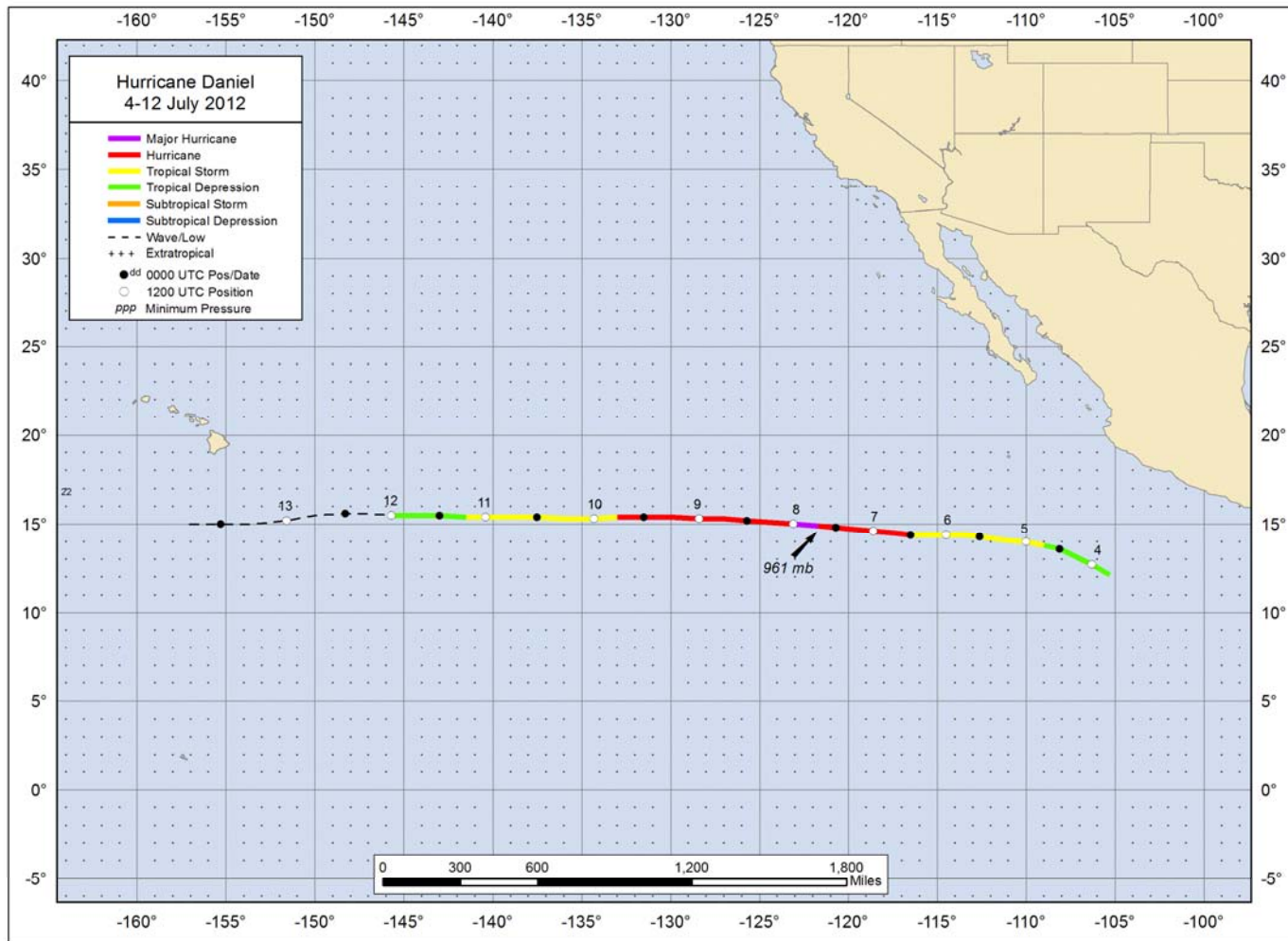
Figure 2.   Best track positions for Hurricane Daniel, 4-12 July, 2012. The best track west of 140W was provided by the Central
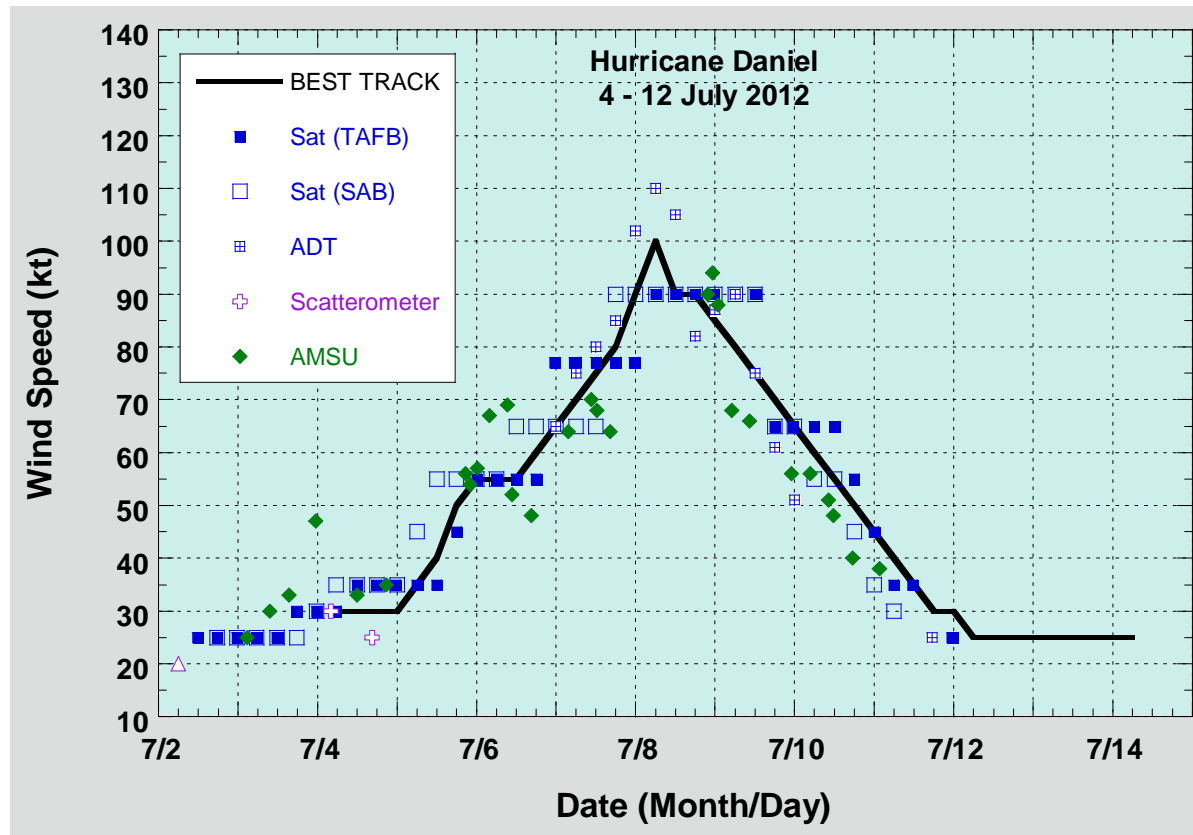Pacific Hurricane Center, at Honolulu, Hawaii.

Figure 3. Selected wind observations and best track maximum sustained surface wind speed curve for Hurricane Daniel, 4-12 July 2012. Advanced Dvorak Technique estimates represent CI numbers. AMSU intensity estimates are from the Cooperative Institute for Meteorological Satellite Studies technique. Dashed vertical lines correspond to 0000 UTC.
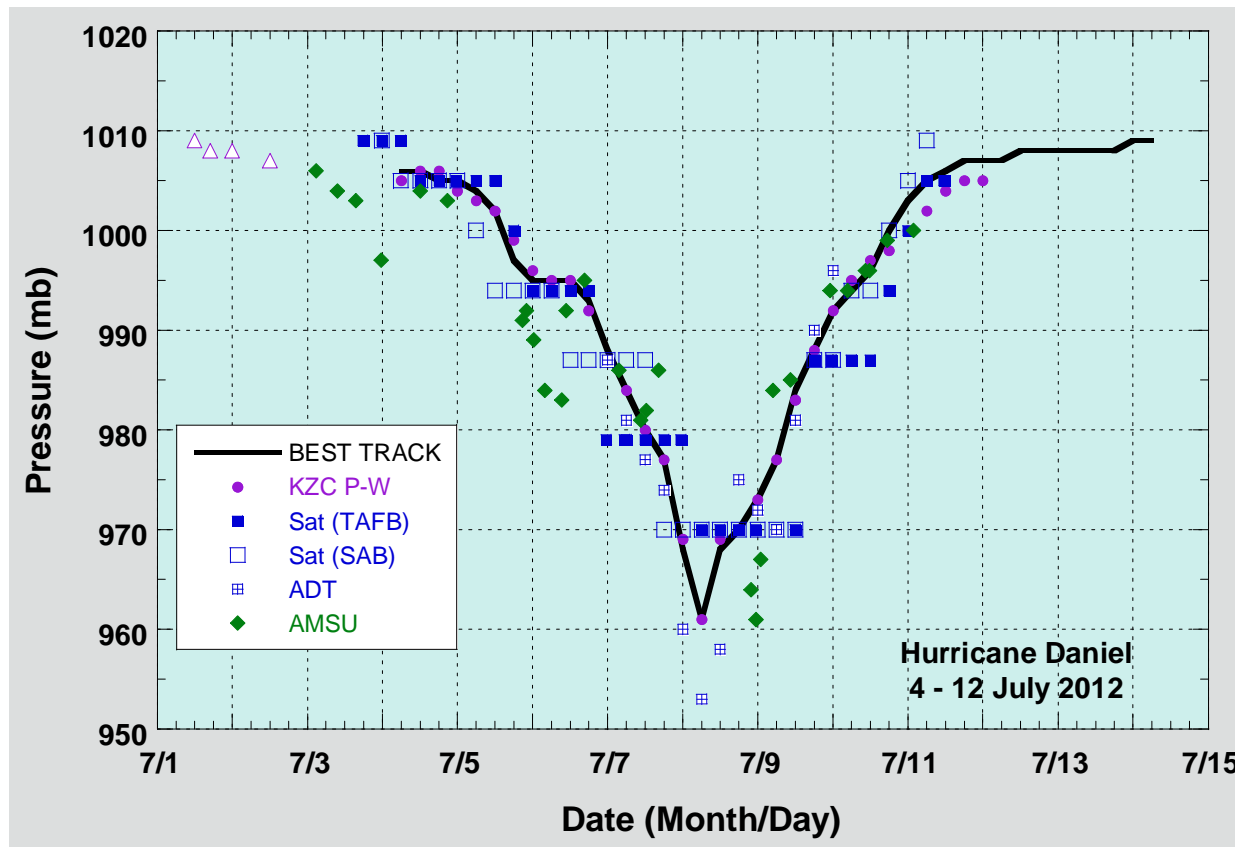
Figure 4. Selected pressure observations and best track minimum central pressure curve for Hurricane Daniel, 4-12 July 2012. Advanced Dvorak Technique estimates represent CI numbers. AMSU intensity estimates are from the Cooperative Institute for Meteorological Satellite Studies technique. The KZC P-W values are obtained by applying the Knaff-Zehr-Courtney pressure-wind relationship to the best track wind data. Dashed vertical lines correspond to 0000 UTC.