Tropical Cyclone Report
Tropical Storm Danny
(AL052009)
26-29 August 2009

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Danny was a short-lived and poorly organized tropical cyclone off the southeastern coast of the United States.

a. Synoptic History

Danny was spawned by a tropical wave that moved westward from the coast of Africa on 18 August. Shower activity associated with the wave briefly showed some organization on 22 August, although development was halted by westerly vertical wind shear. The shower activity increased again on 24 August as the wave interacted with an upper-level trough. On 25 August, an Air Force Reserve Hurricane Hunter aircraft reported a large area of tropical-storm-force winds associated with the wave, but there was no closed circulation. Subsequent satellite imagery and QuikSCAT data showed that a closed circulation formed near 0900 UTC 26 August. Since tropical-storm-force winds were already present, it is estimated that the system became a tropical storm at that time about 430 n mi east of Nassau in the Bahamas. The "best track" chart of the 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]

Danny moved erratically northwestward and strengthened slightly for the remainder of 26 August. It reached a peak intensity of 50 kt the next day. Southwesterly vertical wind shear then caused Danny to gradually weaken as it continued moving northwestward.

A strong upper-level trough moving northeastward through the southeastern United States caused Danny to turn northeastward late on 28 August. This trough caused the formation of a low pressure area near the coast of North Carolina early on 29 August, and this, in turn, caused Danny to degenerate to a trough about 240 n mi southeast of Wilmington, North Carolina. The new low moved northeastward into New England later on 29 August, and the remnants of Danny were absorbed into a developing frontal zone south of the low.

b. Meteorological Statistics

[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 Danny (Figs. 2 and 3) include satellite-based Dvorak technique intensity estimates from the Tropical Analysis and Forecast Branch (TAFB) and the Satellite Analysis Branch (SAB), as well as flight-level, stepped frequency microwave radiometer (SFMR), and dropwindsonde observations from flights of the 53rd Weather Reconnaissance Squadron of the U. S. Air Force Reserve Command and the NOAA Aircraft Operations Center. Data and imagery from NOAA polar-orbiting satellites, the NASA Tropical Rainfall Measuring Mission (TRMM), the NASA QuikSCAT, and Defense Meteorological Satellite Program (DMSP) satellites, among others, were also useful in constructing the best track of Danny.

The Air Force Reserve and NOAA aircraft flew 13 missions in association with Danny. The maximum flight-level winds were 66 kt at an altitude of 12,000 ft at 2339 UTC 26 August (not plotted in Figure 2 due to uncertainties in how to adjust that observation to the surface), while the highest estimated surface winds from the Stepped Frequency Microwave Radiometer were 45 kt at 0600 UTC 27 August. In addition, QuikSCAT data near 2255 UTC 26 August and 1007 UTC 27 August showed several 45-kt wind vectors. The peak intensity is set to 50 kt based on a combination of these data.

There were two reliable surface observations of tropical-storm-force winds in Danny. NOAA buoy 41047 reported a 10-minute wind of 39 kt at 0600 UTC 27 August, with a peak gust of 48 kt at 0553 UTC. The buoy reported a minimum pressure of 1007.1 mb at 0650 UTC 27 August. A ship with the call sign **H3VS** reported 37-kt winds at 0100 UTC 27 August.

The initial interaction of the tropical wave and the upper-level trough caused Danny to have a very non-classical structure, at least somewhat resembling a subtropical cyclone. The strongest winds and primary convective areas were displaced far from the center, with the radius of maximum winds on the order of 120 n mi. There was little change in this structure through Danny's life.

The nature of the second low that formed near Danny requires some comment. While the system was triggered by a strong baroclinic trough, there were no surface fronts associated with the system until it reached New England. In addition, the second low formed inside Danny's surface cyclonic envelope as defined by the surface pressure field. However, satellite imagery and surface observations suggest that the low did not have the characteristics of a tropical or subtropical cyclone, and thus it is not considered to be a reformation or continuation of Danny.

c. Casualty and Damage Statistics

One death is attributed to Danny – a 12-year old boy in Corolla, North Carolina who drowned in surf generated by the storm.

d. Forecast and Warning Critique

The genesis of Danny was well forecast. A low chance (20 percent or less) for development was first noted in the Tropical Weather Outlook on 23 August. This was subsequently increased to a moderate chance (30-50 percent) on 24 August and a high chance (greater than 50 percent) on 25 August about 24 h before genesis occurred.

A verification of NHC official track forecasts for Danny is given in Table 2a. Official forecast track errors were generally greater than the mean official errors for the previous five-year period, although the number of cases is small. A homogeneous comparison of the official track errors with selected guidance models is given in Table 2b. Many of the track guidance models had lower average errors than the official forecasts. Examination of the official forecasts shows that while the general northwestward motion was correctly forecast, the erratic motion superimposed on that track was not.

A verification of NHC official intensity forecasts for Danny is given in Table 3a. Official forecast intensity errors were greater than the mean official errors for the previous five-year period, although again the number of cases is small. A homogeneous comparison of the official intensity errors with selected guidance models is given in Table 3b. Examination of the official forecasts show that Danny strengthened less than was forecast.

A tropical storm watch was issued at 2100 UTC 27 August for the North Carolina coast from Cape Lookout to Duck, including the Ablemarle and Pamlico Sounds. The watch was discontinued at 0900 UTC 29 August when Danny dissipated.

Table 1. Best track for Tropical Storm Danny, 26 – 29 August 2009.

Date/Time (UTC)	Latitude (°N)	Longitude (°W)	Pressure (mb)	Wind Speed (kt)	Stage
26 / 0900	24.3	69.6	1009	40	tropical storm
26 / 1200	24.6	70.1	1009	40	"
26 / 1800	25.1	70.7	1009	45	"
27 / 0000	25.9	71.2	1006	50	"
27 / 0600	27.0	71.8	1006	50	"
27 / 1200	27.4	72.7	1006	50	"
27 / 1800	27.4	73.3	1008	45	"
28 / 0000	28.1	73.5	1008	40	"
28 / 0600	29.0	74.4	1008	35	"
28 / 1200	29.7	75.4	1008	35	"
28 / 1800	30.1	75.7	1007	35	"
29 / 0000	31.0	75.0	1006	35	"
29 / 0600					absorbed by another low
27 / 0000	25.9	71.2	1006	50	minimum pressure

Table 2a. NHC official (OFCL) and climatology-persistence skill baseline (OCD5) track forecast errors (n mi) for Tropical storm Danny, 26 – 29 August 2009. Mean errors for the five-year period 2004-8 are shown for comparison. Official errors that are smaller than the five-year means are shown in boldface type.

	Forecast Period (h)						
	12	24	36	48	72	96	120
OFCL (Danny)	57.7	55.1	82.4	**75.9**			
OCD5 (Danny)	73.3	80.8	100.9	55.9			
Forecasts	9	7	5	3			
OFCL (2004-8)	32.1	54.9	77.1	99.0	147.0	200.3	263.6
OCD5 (2004-8)	45.8	95.7	152.8	208.6	306.2	393.6	472.9

Table 2b. Homogeneous comparison of selected track forecast guidance models (in n mi) for Tropical Storm Danny, 26 – 29 August 2009. 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	55.3	54.3	89.8	100.8			
OCD5	77.5	76.4	92.5	**50.0**			
GFSI	55.3	67.6	139.3	175.9			
GHMI	**54.4**	58.2	**89.0**	**79.5**			
HWFI	59.0	77.4	110.4	136.2			
NGPI	61.5	65.6	96.7	105.1			
EGRI	66.6	57.5	104.6	147.8			
EMXI	**50.1**	55.2	**64.1**	**45.3**			
TCON	56.3	**52.9**	91.5	117.9			
TCCN	56.2	**50.1**	95.5	111.0			
TVCN	**53.7**	**53.2**	**81.2**	102.7			
TVCC	**53.5**	**52.3**	**86.8**	100.8			
GUNA	57.2	**48.8**	**87.1**	115.4			
CGUN	56.9	**43.9**	90.4	106.4			
FSSE	57.1	65.6	104.4	135.9			
AEMI	**49.0**	**45.1**	**80.6**	104.1			
BAMS	60.2	**51.0**	**80.9**	**60.0**			
BAMM	55.9	**40.4**	**67.3**	**60.9**			
BAMD	56.2	**41.2**	**47.3**	**48.6**			
LBAR	68.5	59.7	107.0	**38.1**			
Forecasts	7	6	4	2			

Table 3a. NHC official (OFCL) and climatology-persistence skill baseline (OCD5) intensity forecast errors (kt) for Tropical storm Danny, 26 – 29 August 2009. Mean errors for the five-year period 2004-8 are shown for comparison. Official errors that are smaller than the five-year means are shown in boldface type.

	Forecast Period (h)						
	12	24	36	48	72	96	120
OFCL (Danny)	7.8	12.1	19.0	26.7			
OCD5 (Danny)	6.0	11.9	22.2	24.3			
Forecasts	9	7	5	3			
OFCL (2004-8)	7.1	10.5	12.8	14.7	18.1	19.0	20.9
OCD5 (2004-8)	8.5	12.3	15.3	17.7	20.8	23.1	23.2

Table 3b. Homogeneous comparison of selected intensity forecast guidance models (in kt) for Tropical Storm Danny, 26 – 29 August 2009. 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	7.5	13.3	21.3	27.5			
OCD5	**6.0**	13.5	24.3	**25.0**			
HWFI	8.4	19.0	26.8	**27.0**			
GHMI	8.4	16.2	24.8	27.5			
DSHP	**5.4**	**12.8**	23.3	**26.0**			
LGEM	**5.5**	**12.0**	23.8	27.5			
ICON	**6.5**	15.2	25.0	27.5			
FSSE	**6.8**	15.3	24.3	**26.5**			
Forecasts	8	6	4	2			

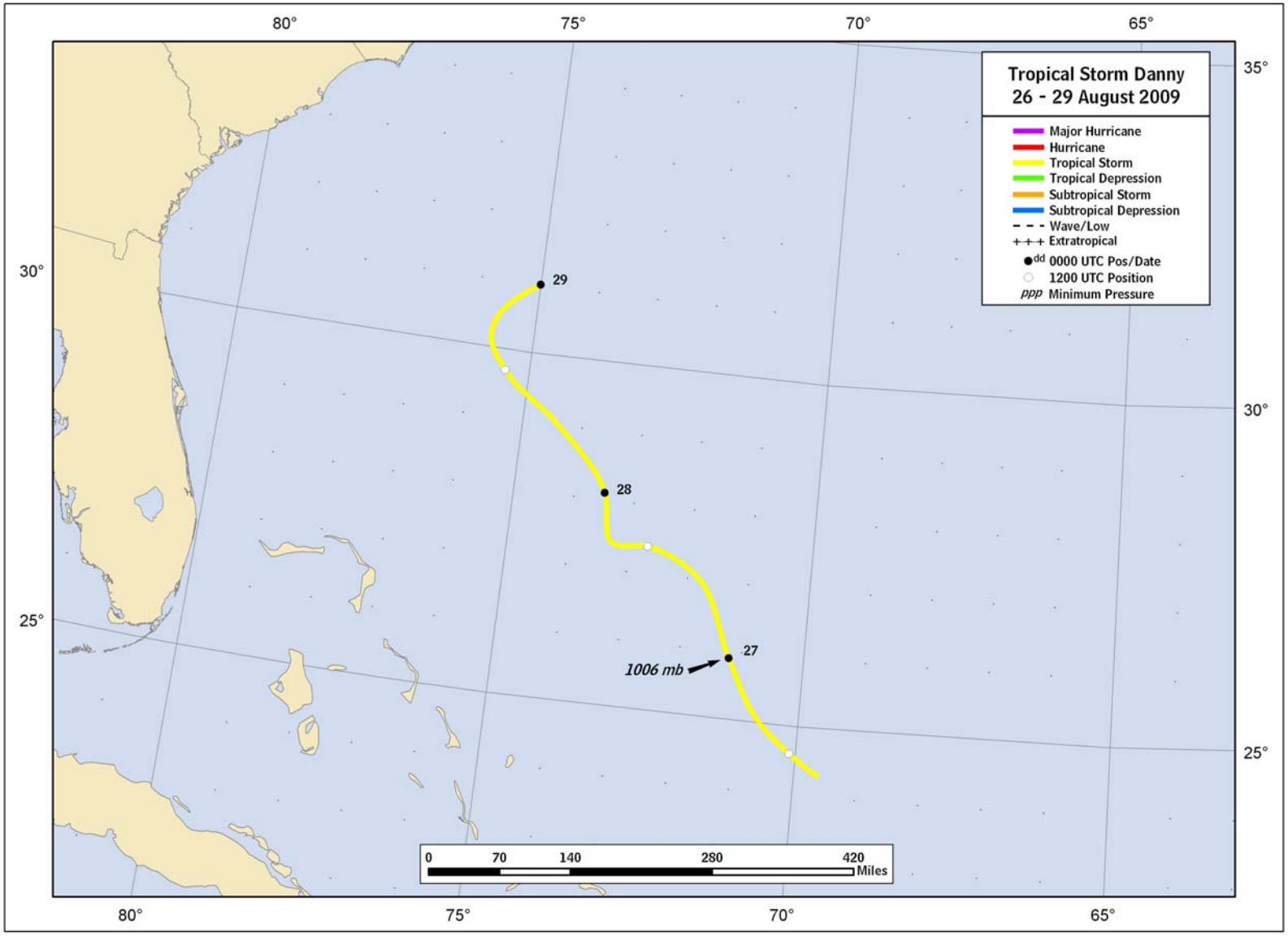

Figure 1. Best track positions for Tropical Storm Danny, 26 – 29 August 2009.

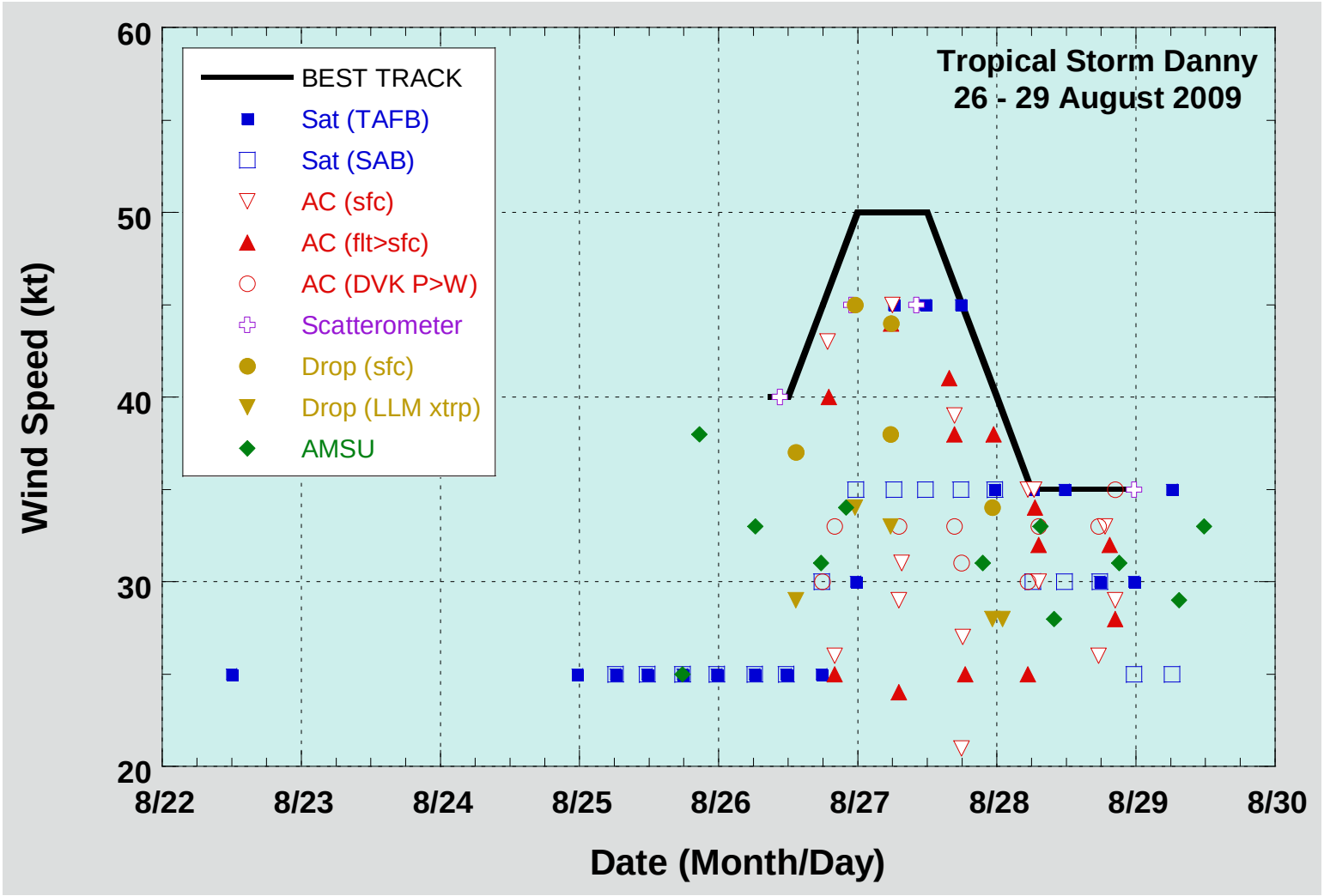

Figure 2. Selected wind observations and best track maximum sustained surface wind speed curve for Tropical Storm Danny, 26-29 August 2009. Aircraft observations have been adjusted for elevation using 90%, 80%, and 80% adjustment factors for observations from 700 mb, 850 mb, and 1500 ft, respectively. Dropwindsonde observations include actual 10 m winds (sfc), as well as surface estimates derived from the mean wind over the lowest 150 m of the wind sounding (LLM). Dashed vertical lines correspond to 0000 UTC.

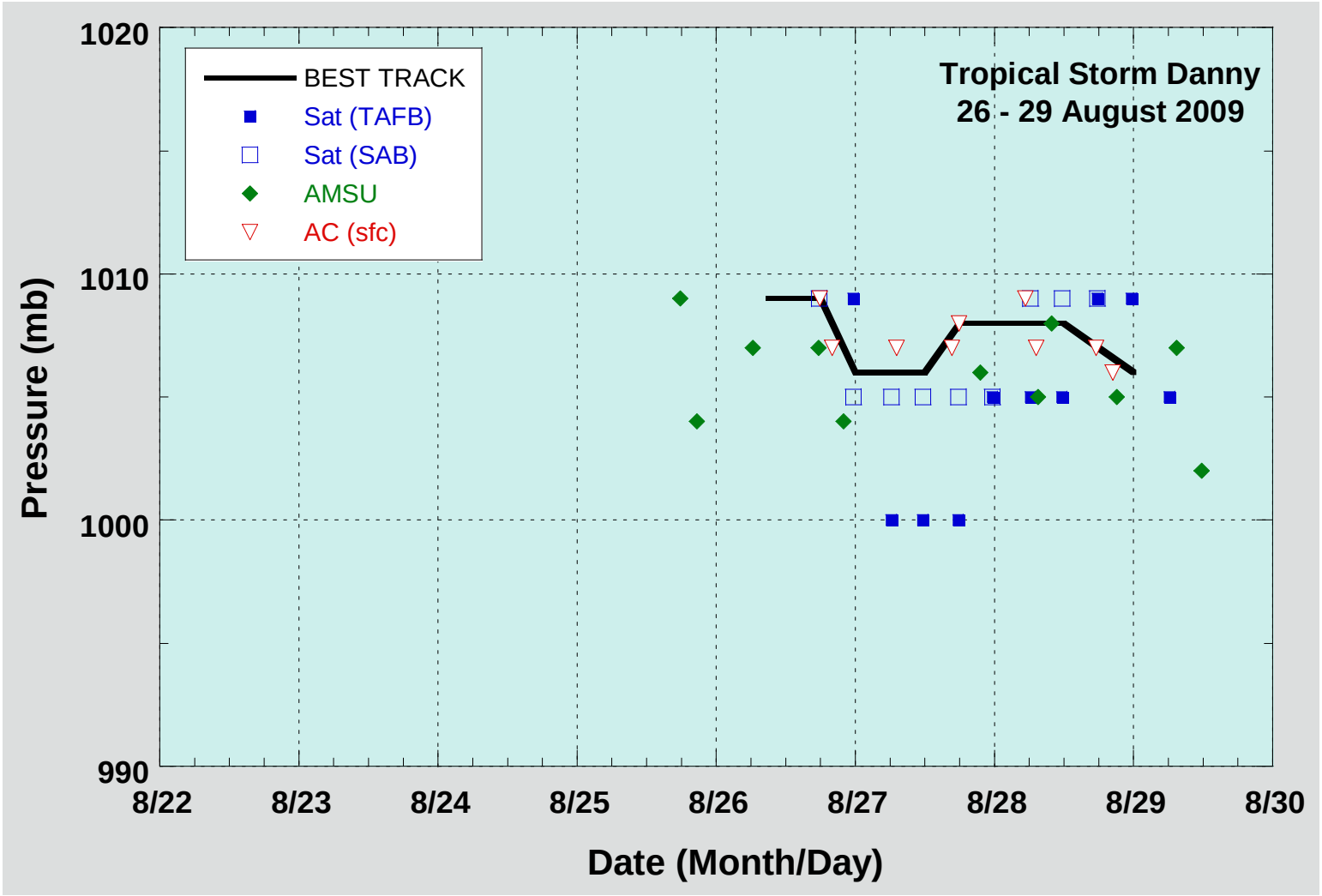

Figure 3. Selected pressure observations and best track minimum central pressure curve for Tropical Storm Danny, 26 – 29 August 2009. Dashed vertical lines correspond to 0000 UTC.