Tropical Cyclone Report
Tropical Storm Hector
(EP082012)
11-16 August 2012

Todd B. Kimberlain
National Hurricane Center
9 November 2012

Hector formed from the remnants of Atlantic Hurricane Ernesto, which moved across south-central Mexico and entered the eastern North Pacific to the southwest of Manzanillo. As a heavily sheared and weak tropical cyclone, Hector moved generally westward until reaching cooler waters to the southwest of the Baja California peninsula, where it turned northward and gradually weakened.

a. Synoptic History

After Atlantic Hurricane Ernesto made landfall as a tropical storm in the central Bay of Campeche on 9 August, the cyclone's low-level center dissipated over the high terrain of the Sierra Madre in south-central Mexico. However, the mid-level circulation continued west-southwestward and emerged over the eastern Pacific on 10 August, where it encountered strong low-level westerly flow associated with the passage of an atmospheric Kelvin wave a few days before. The large mass of deep convection that accompanied the cloud system was slow to become organized due to moderate easterly wind shear, with no signs of a new low-level circulation developing until 11 August. On that date, cloud lines in first-light visible satellite imagery suggested that a low-level circulation had developed and was becoming better defined, marking the formation of a tropical depression around 1200 UTC 11 August about 110 n mi south-southwest of Manzanillo, Mexico. The depression strengthened into a tropical storm 6 h later. The "best track" chart of Hector'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].

Hector moved on a west-northwestward and then westward heading to the south of a middle- to upper-level anticyclone extending westward from the southwestern United States. The forward speed decreased on this westward heading as the cyclone moved into a region of even stronger low-level westerly flow. Within moderate easterly vertical wind shear, Hector strengthened and reached a peak intensity of 45 kt early on 12 August, and maintained this strength for 6-12 h before the easterly shear increased. The stronger shear displaced the convection from the center, and Hector weakened to a minimal tropical storm when its center passed about 30 n mi south of Socorro Island. During the next couple of days, the cyclone maintained about the same intensity as transient bursts of deep convection formed west of the

[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.

circulation center, generally following a diurnal cycle. After the last significant burst of convection early on 14 August, however, Hector weakened while it turned southwestward and then southward.

By 15 August, a middle- to upper-level low west of the Baja California peninsula eroded the ridge to the north of the storm, and Hector turned northward during the day. The shear and gradually decreasing sea surface temperatures encountered by the cyclone caused it to weaken further, and Hector became a tropical depression around 1200 UTC 15 August while centered about 430 n mi southwest of the southern tip of the Baja peninsula. Sporadic bursts of convection persisted into 16 August, but slow weakening continued as Hector moved over 24-25°C waters. Hector's forward speed slowed by 17 August, and the depression degenerated into a remnant low around 0000 UTC that day while located about 385 n mi west-southwest of the southern tip of the Baja California peninsula. The remnant low gradually turned eastward over the next couple of days in the low-level flow while continuing to weaken, and the circulation dissipated by early on 20 August.

b. Meteorological Statistics

Observations in Hector (Figs. 2 and 3) include subjective satellite-based Dvorak technique intensity estimates 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 Meteorological Satellite Program (DMSP) satellites, among others, were also useful in constructing the best track of Hector.

The estimated peak intensity of 45 kt is based on subjective Dvorak classifications of T3.0 from TAFB and SAB between 0600 and 1200 UTC 12 August.

Ship reports of winds of tropical storm force associated with Hector are listed in Table 2. Ship A8IY2 (*Maersk Dieppe*) reported winds of around 40 kt just 6-12 h after genesis, and these reports were helpful in establishing the intensity of the storm at that time. Socorro Island reported sustained tropical-storm-force winds (35 kt with gusts to 51 kt) just prior to 1200 UTC 12 August, but observations after that time are unavailable. The station also reported a minimum pressure of 993 mb, however, a post-analysis suggests that this observation may be a little low.

c. Casualty and Damage Statistics

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

d. Forecast and Warning Critique

The genesis of Hector was well forecast, especially considering the unclimatological nature of this type of tropical cyclone formation[2]. After Atlantic Hurricane Ernesto moved inland over northeastern Mexico as a tropical storm, global models indicated the potential for tropical cyclone formation in the eastern Pacific in association with Ernesto's remnants. The system was introduced in the Tropical Weather Outlook with a low chance (less than 20%) of development 48 h prior to genesis. The likelihood of genesis was assessed as a medium chance (30-50%) 6 h later and was raised to a high chance (greater than 60%) 30 h before tropical cyclone formation occurred.

A verification of NHC official track forecasts for Hector is given in Table 3a. Official forecast track errors were lower the mean official errors for the previous 5-yr period, except at 12 h. There were just a few verifying official forecasts beyond 72 hours, but for those the mean errors were impressively small, considering the difficulty of the forecasts (i.e., OCD5 errors were greater than normal). A homogeneous comparison of the official track errors with selected guidance models is given in Table 3b. There were no verifying forecasts beyond 72 h in the homogeneous sample. The ECMWF (EMXI) and TVCE consensus model outperformed the official forecast through 72 h, with the EMXI having a 3-day error less than half of that of the official forecast. The GFS (GFSI) and GFS ensemble mean (AEMI) were also more successful than the official forecast through 24 h.

A verification of NHC official intensity forecasts for Hector is given in Table 4a. Official forecast intensity errors were smaller than the mean official errors for the previous 5-yr period through 72 h but were larger than the official mean errors beyond that time. The larger-than-average errors beyond 72 h are mostly due to the first two forecasts which called for Hector to reach or be near hurricane strength. It is noted that OCD5 errors were greater than the 5-yr means, implying that their level of difficulty was higher. A homogeneous comparison of the official intensity errors with selected guidance models is given in Table 4b. Much of the intensity guidance was better than the official forecast from 36-120 h. The intensity consensus aids, ICON and IVCN, were exceptionally good performers, especially beyond 12 h when mean errors were less than half of that of the official forecast. DSHP and LGEM also generally beat the official forecast after 24 h.

There were no watches or warnings associated with Hector.

[2] Most Atlantic tropical cyclones that cross the high terrain of mainland Mexico do not redevelop in the eastern North Pacific.

Table 1. Best track for Tropical Storm Hector, 11-16 August 2012.

Date/Time (UTC)	Latitude (°N)	Longitude (°W)	Pressure (mb)	Wind Speed (kt)	Stage
11 / 1200	17.5	105.5	1000	30	tropical depression
11 / 1800	17.8	106.7	999	35	tropical storm
12 / 0000	18.2	107.8	998	40	"
12 / 0600	18.3	108.7	996	45	"
12 / 1200	18.2	109.4	995	45	"
12 / 1800	18.1	110.0	996	40	"
13 / 0000	18.1	110.5	997	35	"
13 / 0600	18.1	111.1	999	35	"
13 / 1200	18.1	111.8	998	35	"
13 / 1800	18.0	112.5	996	40	"
14 / 0000	17.9	113.2	996	40	"
14 / 0600	17.8	113.8	997	40	"
14 / 1200	17.7	114.3	998	40	"
14 / 1800	17.4	114.8	1000	35	"
15 / 0000	17.0	115.0	1002	35	"
15 / 0600	17.2	115.2	1003	35	"
15 / 1200	17.6	115.1	1004	30	tropical depression
15 / 1800	18.1	115.1	1005	25	"
16 / 0000	18.6	115.3	1005	25	"
16 / 0600	19.0	115.5	1005	25	"
16 / 1200	19.3	115.7	1006	25	"
16 / 1800	19.6	115.9	1006	25	"
17 / 0000	20.0	116.0	1007	25	low
17 / 0600	20.7	116.1	1008	25	"
17 / 1200	21.5	116.2	1008	25	"
17 / 1800	22.2	116.4	1008	25	"
18 / 0000	22.5	116.4	1008	25	"
18 / 0600	22.8	116.4	1008	25	"
18 / 1200	23.0	116.4	1008	25	"
18 / 1800	23.3	116.4	1008	25	"
19 / 0000	23.4	116.3	1009	25	"
19 / 0600	23.3	116.2	1010	25	"

19 / 1200	23.2	116.1	1010	20	"
19 / 1800	23.1	115.9	1011	20	"
20 / 0000	23.1	115.7	1011	15	"
20 / 0600	23.1	115.7	1011	15	"
20 / 1200					dissipated
12 / 1200	18.2	109.4	995	45	Maxium wind and minimum pressure

Table 2. Selected ship reports with winds of at least 34 kt for Tropical Storm Hector, 11-16 August 2012.

Date/Time (UTC)	Ship call sign	Latitude (°N)	Longitude (°W)	Wind dir/speed (kt)	Pressure (mb)
11 / 2000	A8IY2	18.8	105.2	120 / 41	1003.0
11 / 2100	3FQS8	16.8	101.6	140 / 35	1007.0

Table 3a. NHC official (OFCL) and climatology-persistence skill baseline (OCD5) track forecast errors (n mi) for Tropical Storm Hector, 11-16 August 2012. 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 (Hector)	29.6	**40.2**	**51.4**	**71.2**	**100.6**	**95.4**	**24.7**
OCD5 (Hector)	41.9	74.7	113.0	151.2	245.0	384.8	414.9
Forecasts	19	17	15	13	9	5	1
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 3b. Homogeneous comparison of selected track forecast guidance models (in n mi) for Tropical Storm Hector, 11-16 August 2012. 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	29.4	42.0	54.2	72.3	88.5		
OCD5	41.1	75.4	114.5	147.9	223.2		
GFSI	**25.1**	**41.4**	64.5	79.1	109.4		
GHMI	35.3	50.6	66.6	88.5	141.0		
HWFI	41.7	58.2	69.9	85.0	96.7		
UKMI	40.3	67.2	86.1	102.6	139.2		
EGRI	40.3	67.2	86.1	102.6	139.2		
EMXI	**28.8**	**40.7**	**47.1**	**52.4**	**43.8**		
CMCI	34.4	53.9	72.5	102.6	206.6		
AEMI	**26.3**	**41.7**	68.3	87.7	127.3		
TVCE	**27.9**	**40.3**	**50.8**	**65.0**	**85.2**		
LBAR	48.4	112.8	195.2	292.3	495.9		
NAMI	55.3	101.4	139.1	162.7	243.5		
BAMS	33.2	56.2	72.9	93.1	126.1		
BAMM	52.9	90.7	119.5	137.6	179.8		
BAMD	69.6	131.4	188.2	235.3	317.8		
Forecasts	17	15	13	10	6		

Table 4a. NHC official (OFCL) and climatology-persistence skill baseline (OCD5) intensity forecast errors (kt) for Tropical Storm Hector, 11-16 August 2012. 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 (Hector)	**4.2**	**4.7**	**6.0**	**6.9**	**12.8**	21.0	20.0
OCD5 (Hector)	6.4	9.3	11.9	12.7	21.4	24.8	24.0
Forecasts	19	17	15	13	9	5	1
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 4b. Homogeneous comparison of selected intensity forecast guidance models (in kt) for Tropical Storm Hector, 11-16 August 2012. 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 4a due to the homogeneity requirement.

Model ID	Forecast Period (h)						
	12	24	36	48	72	96	120
OFCL	4.3	4.7	5.9	8.1	14.0	23.3	20.0
OCD5	6.4	9.2	11.3	12.2	20.3	23.7	23.5
HWFI	**4.2**	5.4	7.3	8.8	**10.0**	**7.2**	**7.5**
GHMI	6.4	9.2	11.3	12.2	20.3	23.7	23.5
DSHP	4.6	**3.9**	**3.8**	**6.3**	**9.6**	**15.8**	**16.5**
LGEM	6.0	6.7	**5.8**	**6.2**	**7.3**	**17.5**	21.0
ICON	4.8	**3.9**	**2.6**	**3.2**	**3.0**	**8.5**	**10.5**
IVCN	4.8	**3.9**	**2.6**	**3.2**	**3.0**	**8.5**	**10.5**
Forecasts	20	18	16	13	10	6	2

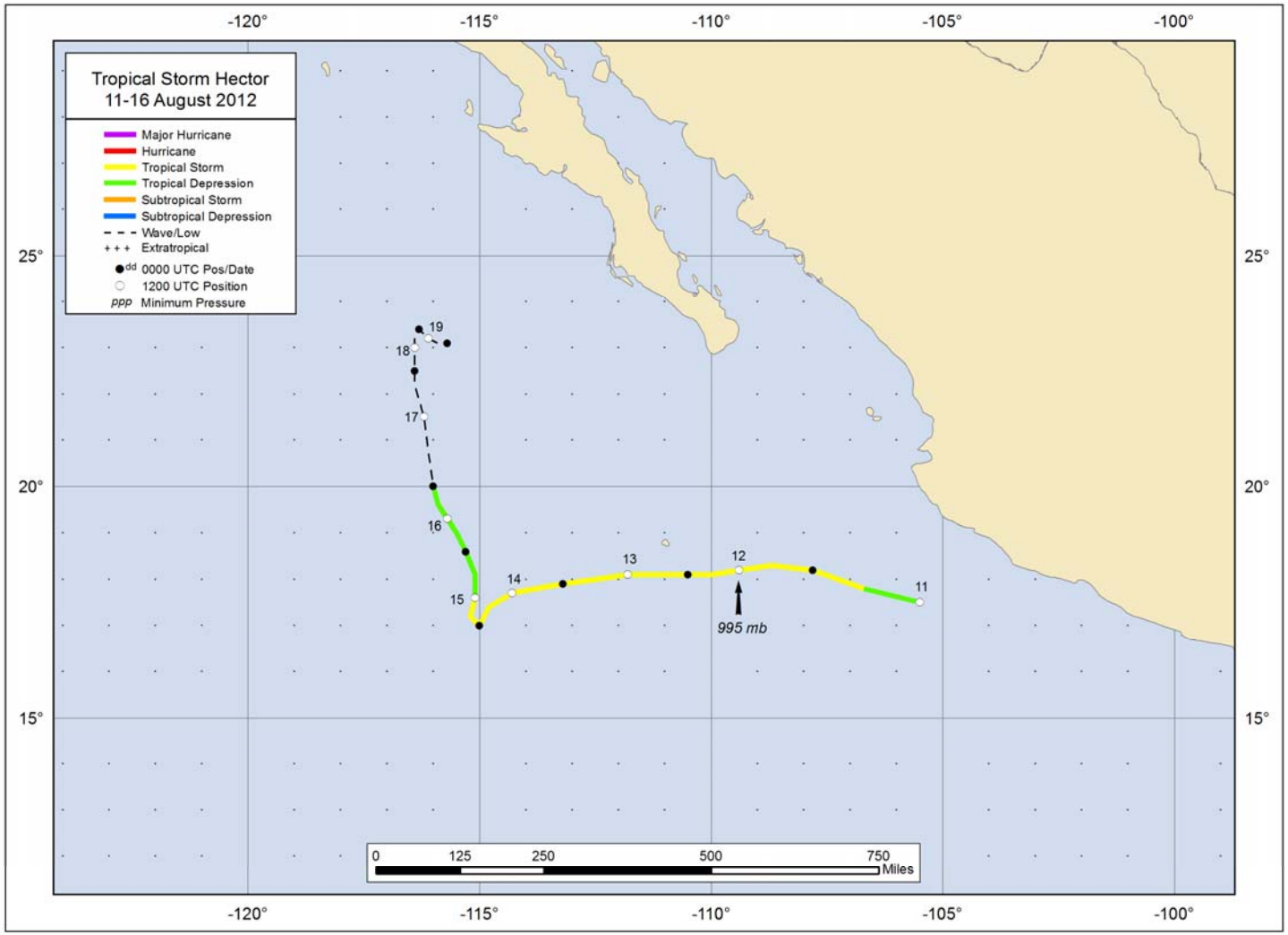

Figure 1. Best track positions for Tropical Storm Hector, 11-16 August 2012.

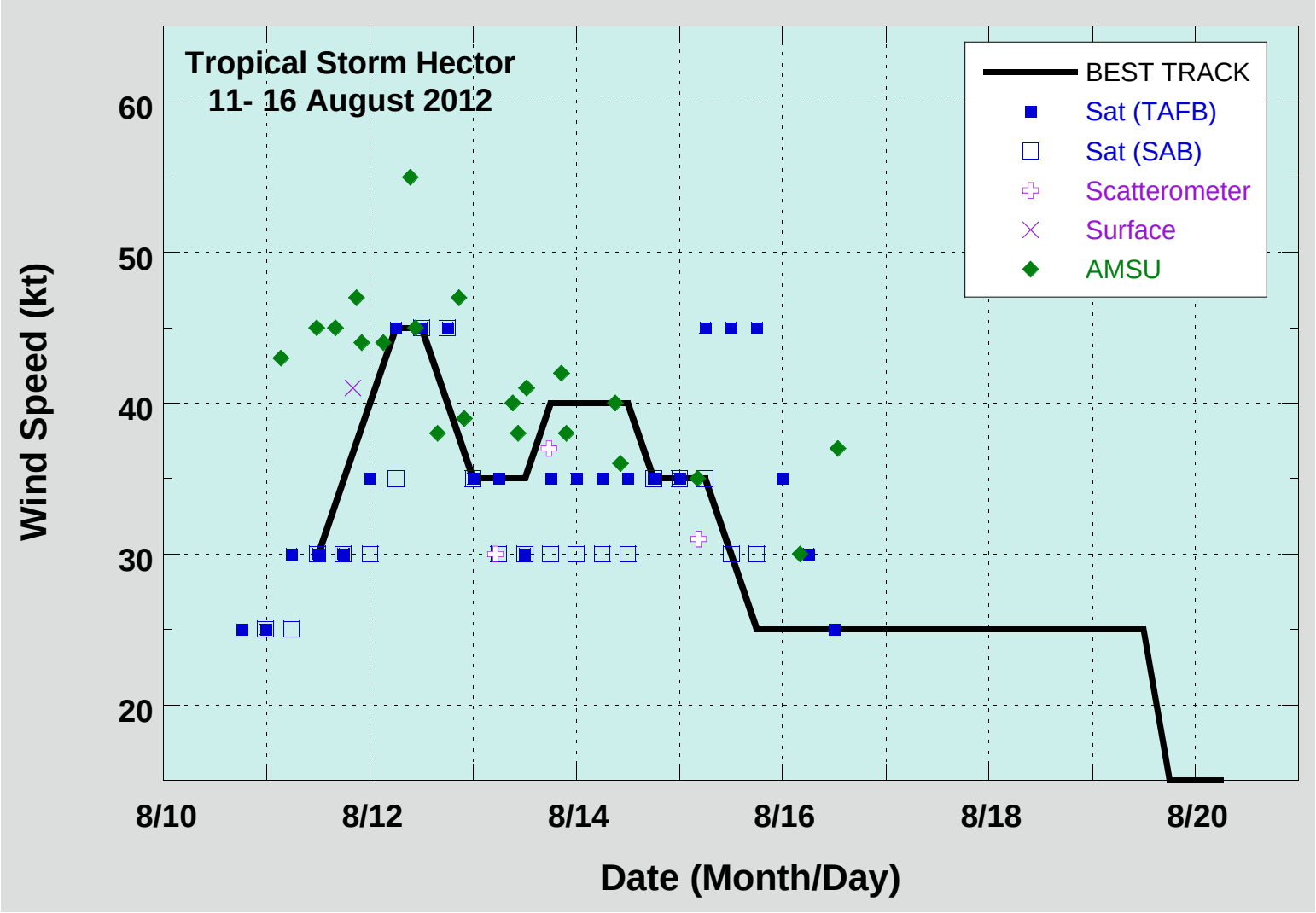

Figure 2. Selected wind observations and best track maximum sustained surface wind speed curve for Tropical Storm Hector, 11-16 August 2012. AMSU intensity estimates are from the Cooperative Institute for Meteorological Satellite Studies technique. Dashed vertical lines correspond to 0000 UTC.

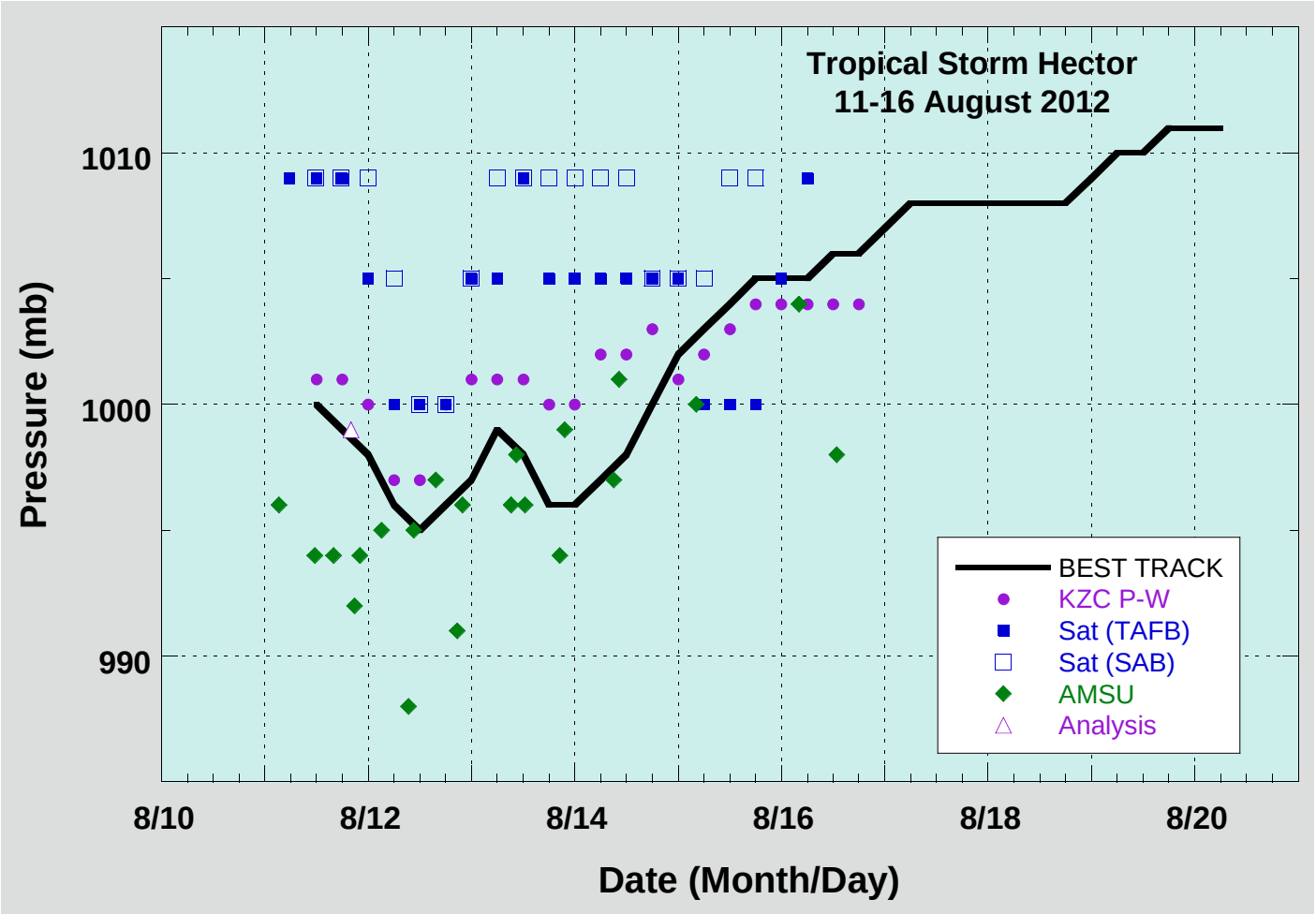

Figure 3. Selected pressure observations and best track minimum central pressure curve for Tropical Storm Hector, 11-15 August 2012. Advanced Dvorak Technique estimates represent CI numbers. AMSU intensity estimates are from the Cooperative Institute for Meteorological Satellite Studies technique. The 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.