

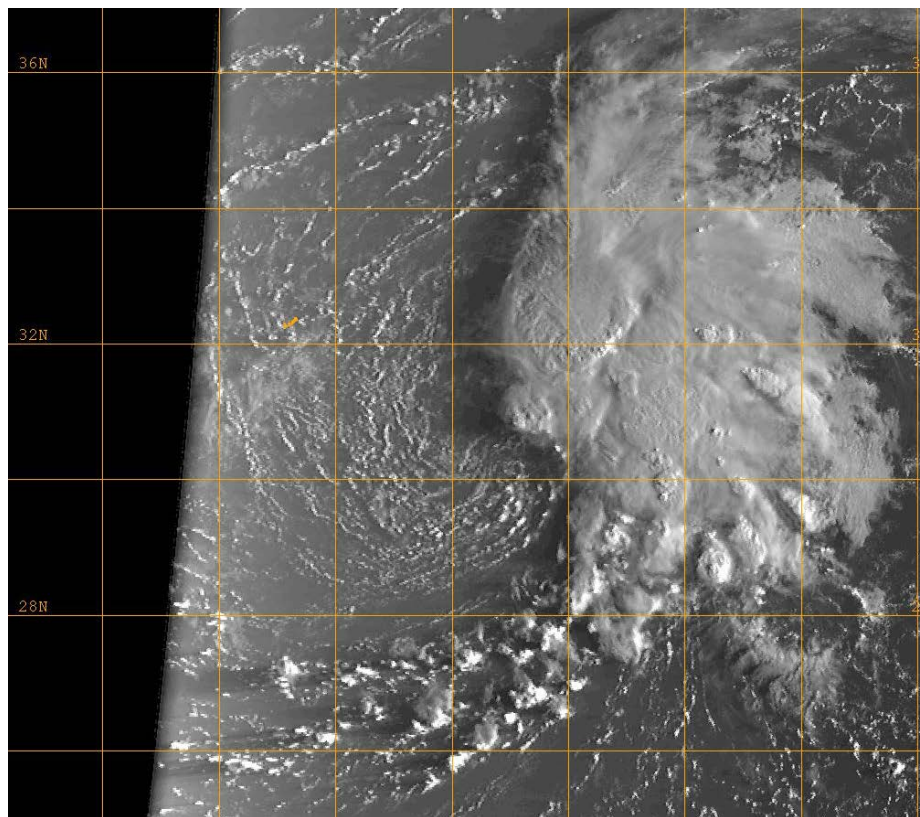


NATIONAL HURRICANE CENTER TROPICAL CYCLONE REPORT

TROPICAL STORM HENRI (AL082015)

8 – 11 September 2015

Todd B. Kimberlain
National Hurricane Center
21 October 2015



DMSP EARLY LIGHT VISIBLE IMAGE OF TROPICAL STORM HENRI AT 1001 UTC 9 SEPTEMBER. IMAGE COURTESY OF NRL TC WEBPAGE.

Henri was a weak and short-lived storm of non-tropical origin that formed well southeast of Bermuda. It accelerated northward before dissipating well south of Atlantic Canada.

TROPICAL STORM HENRI

8 – 11 SEPTEMBER 2015

SYNOPTIC HISTORY

A strong shortwave trough passed through the northeastern United States and Atlantic Canada on 3 September, and pushed a frontal boundary into the western Atlantic. Another shortwave trough swept into the same region a few days later and nudged the front farther south, with the boundary extending roughly along 30°N from near the U.S. southeast coast to 50°W by 6 September. The tail of the second upper-level trough fractured over the western Atlantic around this time and moved southeastward over the decaying frontal zone, contributing to the formation of a low- to mid-level cyclonic circulation a few hundred n mi southeast of Bermuda by late on 7 September, in a manner similar to that described by Pfeffer and Challa (1990) and Montgomery and Farrell (1993). A small area of concentrated convection developed around the cyclonic circulation along with a couple of fragmented curved convective bands as the system drifted south-southeastward in a westerly shear environment. A surface low developed upshear of the mid-level circulation by 0600 UTC 8 September and quickly became better defined, with a tropical depression forming 12 h later. At the time of genesis moderate to strong westerly shear was displacing the associated deep convection well to the northeast of the center. Despite the shear, the depression intensified into a tropical storm around 0000 UTC 9 September. The “best track” chart of Henri’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 1¹.

The tropical cyclone maintained a disorganized cloud pattern on 9 September, and the circulation contained multiple vortices rotating around a mean center. In addition to the strong vertical shear, a very dry air mass ushered in behind by the first shortwave trough contributed to the system’s poor organization. Despite the hostile environment, the cyclone strengthened, perhaps due to baroclinic forcing associated with the trough that helped to spawn it. Henri reached a peak intensity of 45 kt around 1800 UTC 9 September, when it turned northward in the deep-layer southerly flow ahead of that same nearby upper-level trough. While Henri’s cloud pattern changed little in organization on 10 September while it was accelerating northward, scatterometer data indicate that the cyclone’s radius of maximum winds increased to about 120 n mi, nearly double what it had been a day earlier. The expansion of Henri’s wind field coincided with Henri’s increasing interaction with the upper-level trough just to its west. By early on 11 September, Henri’s circulation became increasingly distorted, and the cyclone degenerated into a trough by 1200 UTC that day. The trough accelerated northeastward and merged with a large extratropical cyclone over the far North Atlantic a couple of days later.

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 *bt*k directory, while previous years’ data are located in the *archive* directory.

METEOROLOGICAL STATISTICS

Observations in Henri (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), and 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 Global Precipitation Mission (GPM), 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 Henri.

Henri's estimated peak intensity of 45 kt is based on an ASCAT pass at 0050 UTC 10 September, just after the time the cyclone's cloud pattern exhibited its greatest organization. It is worth noting that the concurrent satellite classifications were only 30-35 kt.

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

CASUALTY AND DAMAGE STATISTICS

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

FORECAST AND WARNING CRITIQUE

The genesis of Henri was poorly forecast. The disturbance from which Henri developed was introduced into the Tropical Weather Outlook 18 h before tropical cyclone formation with a low probability (<30%) of development (Table 2). Its potential for genesis was only raised to the medium (40-60%) category 6 h later. The case of Henri underscores the continued issues with forecasting the genesis of tropical cyclones from systems of non-tropical origin (Kimberlain 2014).

A verification of NHC official track forecasts for Henri is given in Table 3a. No official forecasts verified after 48 h. Official forecast track errors were greater than the mean official errors for the previous 5-yr period, except at 12 h. A homogeneous comparison of the official track errors with selected guidance models is given in Table 3b. Several models outperformed the official forecast after 24 h, including the European Center for Medium Range Weather Forecasting (ECMWF) model, the Navy version of the GFDL (GFDN), the GFS Ensemble Mean (AEMI), and the BAMS and BAMB models. Interestingly, a large number of models bested the skillful multi-model consensus (TVCA). The sample size is too small, however, to draw any meaningful conclusions.

A verification of NHC official intensity forecasts for Henri is given in Table 4a. Official forecast intensity errors were lower than the mean official errors for the previous 5-yr period at all



times through 48 h. A homogeneous comparison of the official intensity errors with selected guidance models is given in Table 4b. The official forecast generally performed well relative to the guidance, but the LGEM, the multi-model consensus ICON and the HWRF bested the official forecast beyond 24 h. Intensity predictions correctly anticipated that unfavorable environmental conditions and the poorly organized structure of the system would result in little intensification.

There were no watches or warnings associated with Henri.

References

Challa, M, and R. Pfeffer, 1990: Formation of Atlantic hurricanes from cloud clusters and depressions. *J. Atmos. Sci.*, **47**, 909-927.

Kimberlain, T., 17 December 2014: Hurricane Fay Tropical Cyclone Report. NOAA National Hurricane Center. [Available online at http://www.nhc.noaa.gov/data/tcr/AL072014_Fay.pdf]

Montgomery, M.T., and B.F. Farrell, 1993: Tropical Cyclone Formation. *J. Atmos. Sci.*, **50**, 285 - 310.



Table 1. Best track for Tropical Storm Henri, 8-11 September 2015.

Date/Time (UTC)	Latitude (°N)	Longitude (°W)	Pressure (mb)	Wind Speed (kt)	Stage
08 / 0600	31.1	62.2	1014	20	low
08 / 1200	30.9	61.9	1012	25	"
08 / 1800	30.8	61.6	1011	30	tropical depression
09 / 0000	30.8	61.4	1009	35	tropical storm
09 / 0600	30.8	61.2	1007	35	"
09 / 1200	30.8	61.0	1005	40	"
09 / 1800	30.9	60.8	1003	45	"
10 / 0000	31.2	60.8	1003	45	"
10 / 0600	31.6	60.9	1005	45	"
10 / 1200	32.2	60.9	1006	40	"
10 / 1800	33.2	60.9	1007	40	"
11 / 0000	34.3	60.7	1009	40	"
11 / 0600	35.7	60.3	1010	40	"
11 / 1200					dissipated
09 / 1800	30.9	60.8	1003	45	maximum wind and minimum pressure



Table 2. Number of hours in advance of formation associated with the first NHC Tropical Weather Outlook forecast in the indicated likelihood category. Note that the timings for the “Low” category do not include forecasts of a 0% chance of genesis.

	Hours Before Genesis	
	48-Hour Outlook	120-Hour Outlook
Low (<30%)	18	18
Medium (30%-50%)	6	6
High (>50%)		



Table 3a. NHC official (OFCL) and climatology-persistence skill baseline (OCD5) track forecast errors (n mi) for Tropical Storm Henri, 8-11 September 2015. Mean errors for the previous 5-yr period 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	24.3	48.5	84.9	129.5			
OCD5	47.0	101.3	147.2	156.7			
Forecasts	8	6	4	2			
OFCL (2010-14)	28.4	45.0	60.4	77.1			
OCD5 (2010-14)	48.3	101.5	161.5	222.6			



Table 3b. Homogeneous comparison of selected track forecast guidance models (in n mi) for Tropical Storm Henri, 8-11 September 2015. Errors smaller than the NHC official forecast are shown in boldface type.

Model ID	Forecast Period (h)						
	12	24	36	48	72	96	120
OFCL	24.3	48.5	84.9	129.5			
OCD5	47.0	101.3	147.2	156.7			
GFSI	26.2	48.8	80.6	145.7			
GHMI	32.1	83.1	128.5	172.9			
HWFI	30.4	51.2	104.5	120.3			
EMXI	26.2	53.2	83.4	102.4			
NVGI	34.8	71.8	96.5	119.3			
GFNI	28.4	37.9	74.3	81.2			
CMCI	34.6	69.0	94.6	128.5			
TVCA	25.0	54.9	94.7	134.0			
AEMI	27.3	51.4	72.7	61.2			
BAMS	34.4	53.7	58.9	82.2			
BAMM	26.1	40.6	50.7	59.9			
BAMD	29.7	63.4	90.5	112.9			
LBAR	34.1	56.6	87.0	115.6			
NAMI	35.9	67.4	98.7	127.3			
GFEX	26.6	52.4	83.8	118.2			
Forecasts	8	6	4	2			



Table 4a. NHC official (OFCL) and climatology-persistence skill baseline (OCD5) intensity forecast errors (kt) for Tropical Storm Henri, 8-11 September 2015. Mean errors for the previous 5-yr period 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	4.4	3.3	5.0	10.0			
OCD5	4.9	3.5	6.5	15.0			
Forecasts	8	6	4	2			
OFCL (2010-14)	6.2	9.4	11.5	13.3			
OCD5 (2010-14)	7.3	10.8	13.3	15.3			



Table 4b. Homogeneous comparison of selected intensity forecast guidance models (in kt) for Tropical Storm Henri, 8-11 September 2015. Errors smaller than the NHC official forecast are shown in boldface type.

Model ID	Forecast Period (h)						
	12	24	36	48	72	96	120
OFCL	4.4	3.3	5.0	10.0			
OCD5	4.9	3.5	6.5	15.0			
HWFI	7.5	5.7	2.0	2.5			
GHMI	6.9	10.0	10.8	16.0			
DSHP	5.0	2.7	5.8	12.0			
LGEM	6.9	5.0	2.5	7.0			
ICON/IVCN	5.6	5.2	1.3	2.5			
GFNI	9.0	10.3	10.5	16.5			
GFSI	10.1	11.5	11.0	10.5			
EMXI	9.6	10.2	9.3	9.5			
Forecasts	8	6	4	2			

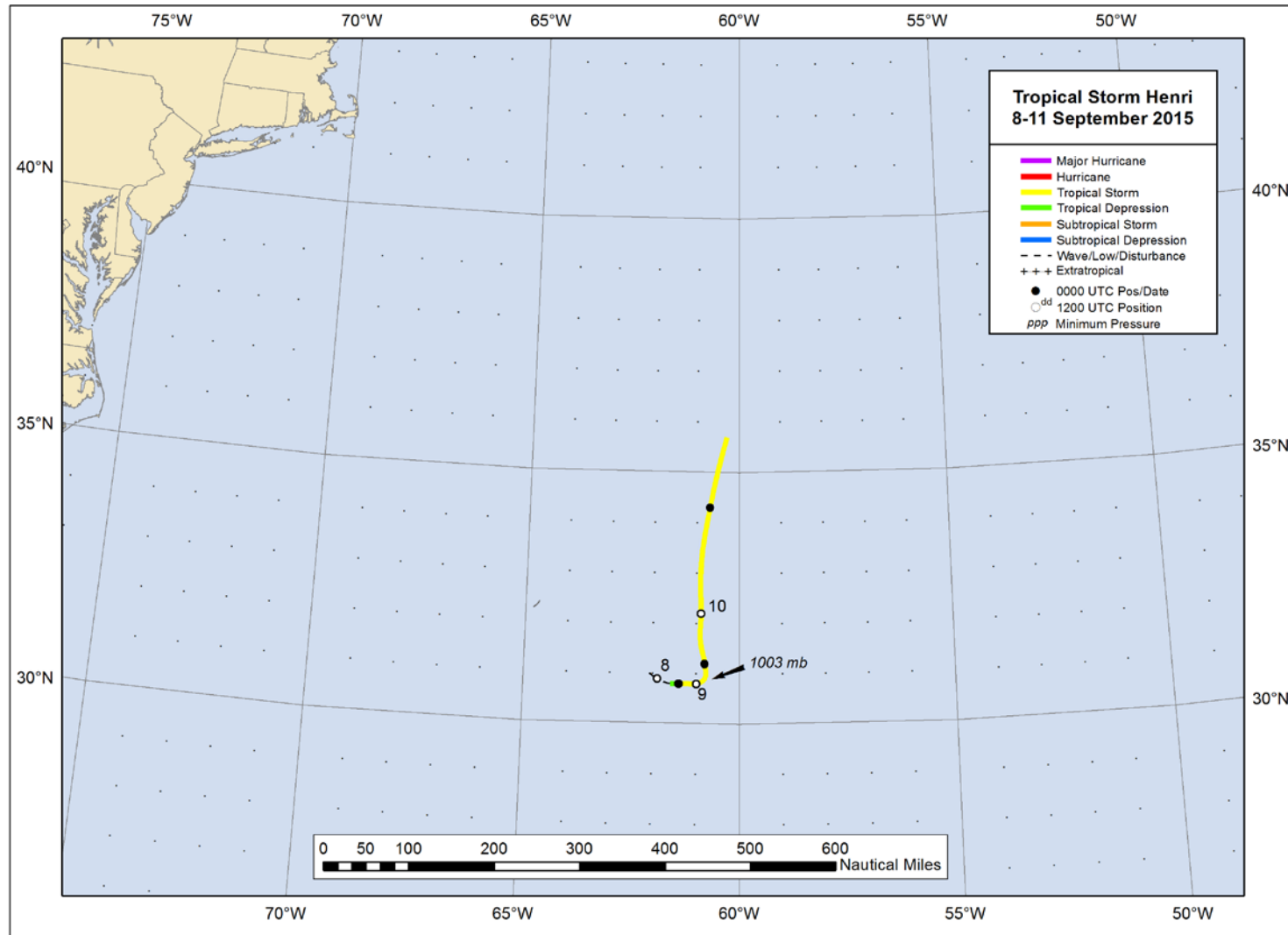


Figure 1. Best track positions for Tropical Storm Henri, 8-11 September 2015.

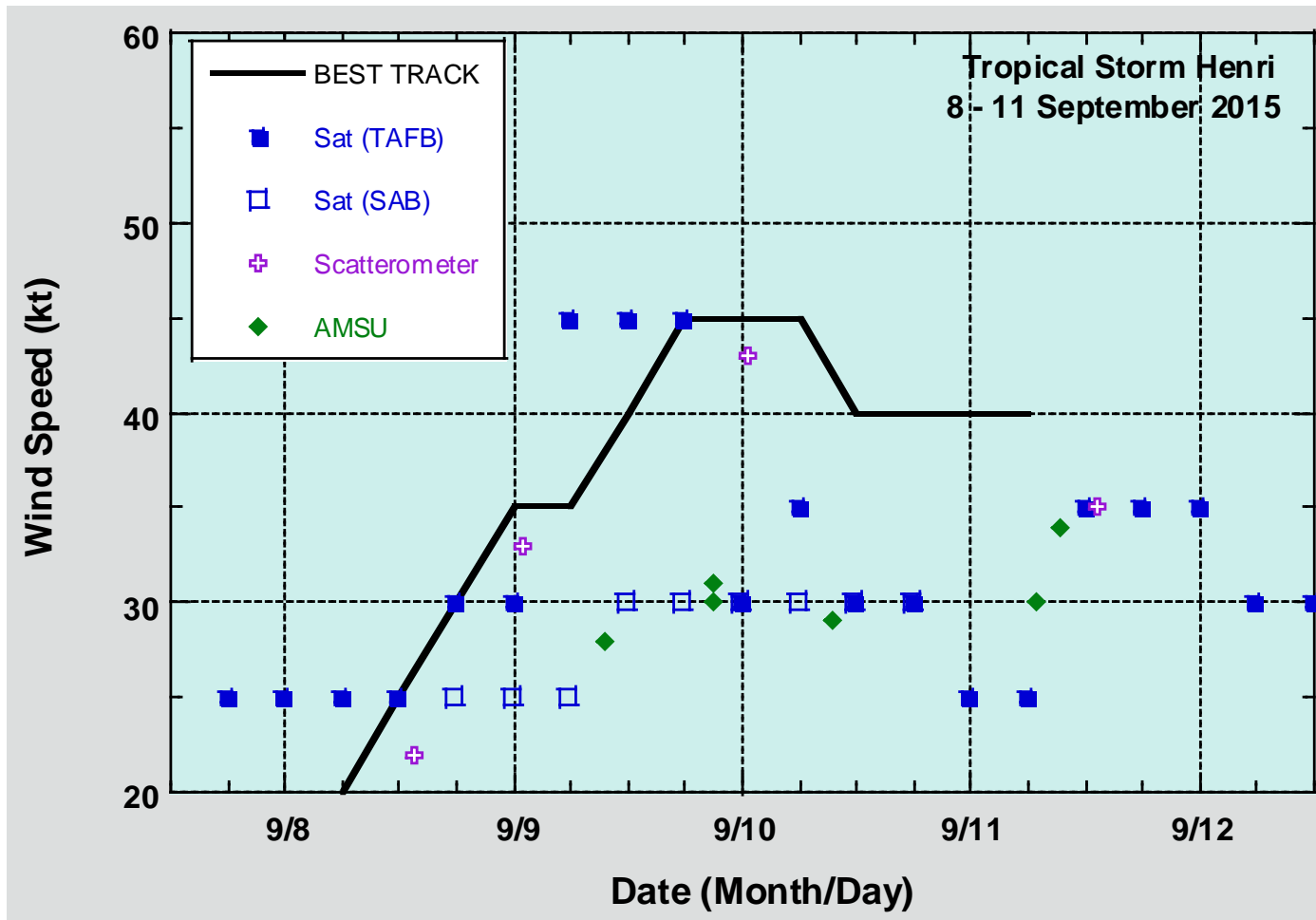


Figure 2. Selected wind observations and best track maximum sustained surface wind speed curve for Tropical Storm Henri, 8-11 September 2015. AMSU intensity estimates are from the Cooperative Institute for Meteorological Satellite Studies technique. Dashed vertical lines correspond to 0000 UTC.

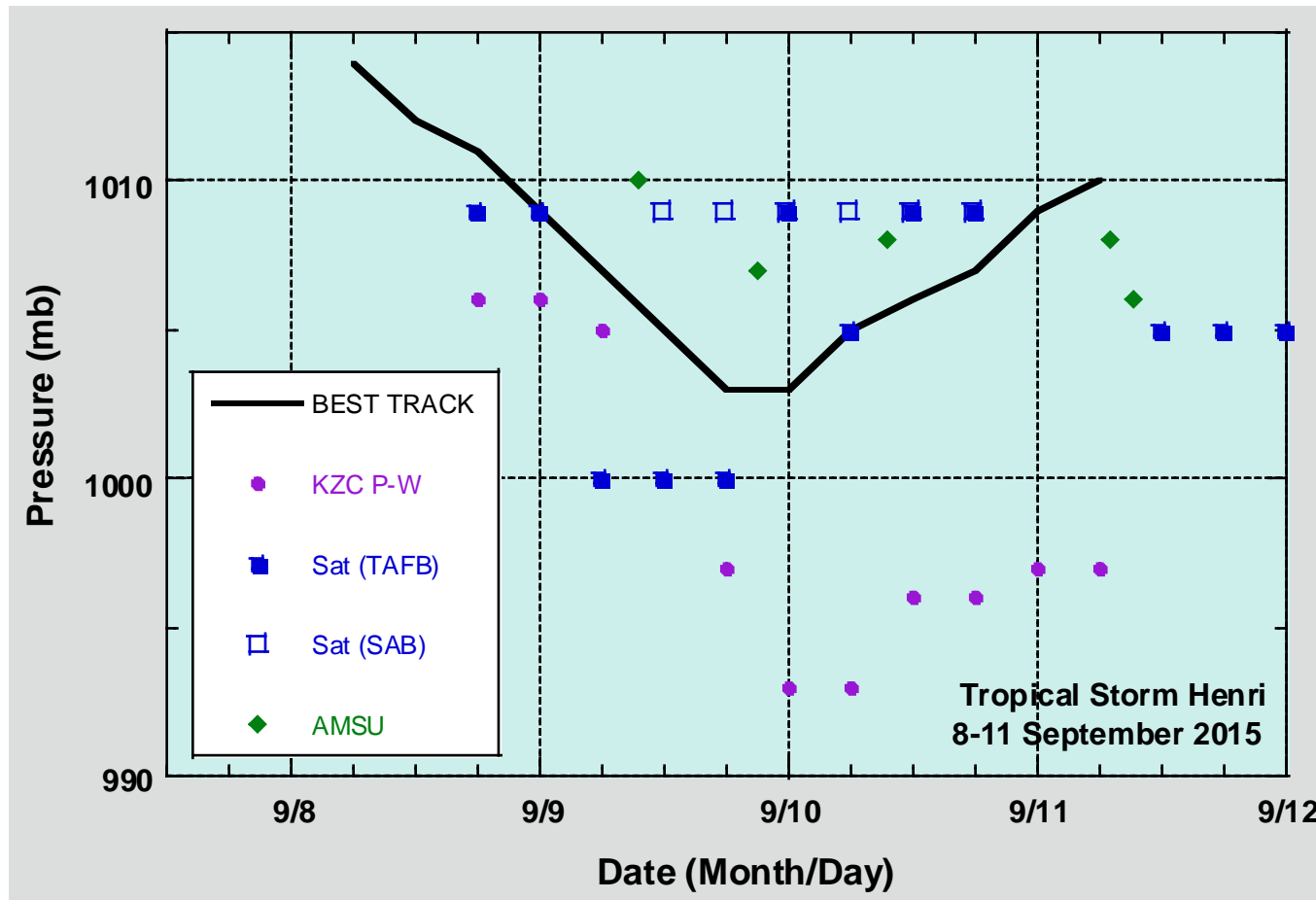


Figure 3. Selected pressure observations and best track minimum central pressure curve for Tropical Storm Henri, 8-11 September 2015. AMSU intensity estimates are from the Cooperative Institute for Meteorological Satellite Studies technique. KZC P-W refers to pressure estimates derived using the Knaff-Zehr-Courtney pressure-wind relationship. Dashed vertical lines correspond to 0000 UTC.