CENTRAL PACIFIC HURRICANE CENTER TROPICAL CYCLONE REPORT

TROPICAL STORM/TYPHOON PEWA

(CP012013)

16 – 25 August 2013

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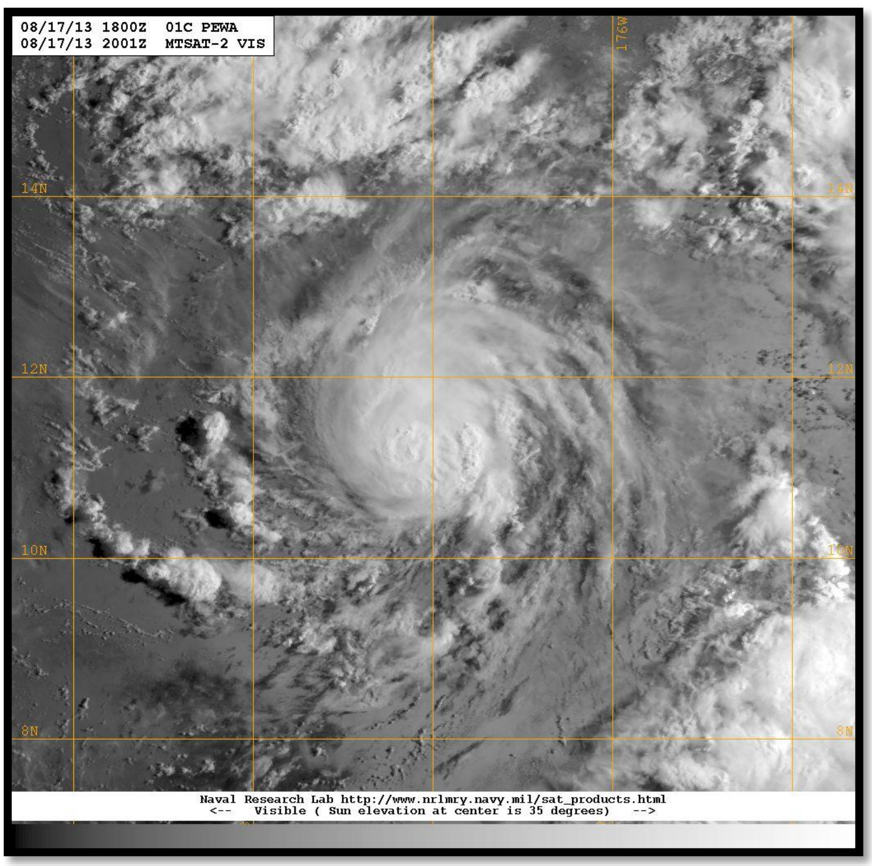

METEOSAT VISIBLE SATELLITE IMAGE OF TROPICAL STORM PEWA AT 2001 UTC 17 AUGUST 2013

(COURTESY OF NAVAL RESEARCH LABORATORY)

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SYNOPTIC HISTORY

Pewa developed during a relatively short-lived active period within an otherwise inactive 2013 central North Pacific tropical cyclone season. Pewa formed within an unusually persistent area of low level troughing that eventually produced three central Pacific tropical cyclones in a span of about 3 days: Tropical Storm Pewa, Tropical Storm Unala, and Tropical Depression Three-C. This area of broad low level troughing can be traced back for more than 10 days - to an east-northeast to west-southwest oriented monsoon trough west of the central American coast. The disturbance that became Pewa developed on the southwest periphery of this trough as it neared the date line.

As the trough drifted westward to the south of the Hawaiian Islands on 14 August, three distinct embedded areas of disturbed weather became established, each separated by roughly 10 degrees of longitude. The western disturbance, which would later become Pewa, initially had the least amount of associated deep convection, until thunderstorms began to organize around the developing center between 18 UTC 15 August and 12 UTC 16 August. Organized convection persisted sufficiently long to deem the disturbance a significant tropical cyclone at 06 UTC 16 August, at which time Pewa became the first tropical cyclone to form in the central Pacific basin in the 2013 season, and the first tropical cyclone to originate in the central Pacific since Tropical Storm Omeka in December 2010.

The environment in which Pewa initially developed was conducive for additional intensification, characterized by weak vertical shear of the horizontal wind, and high SST/OHC (sea surface temperature/oceanic heat content) along the forecast track. However, global forecast models and SHIPS guidance anticipated that increased southerly shear along the forecast track would limit opportunities for significant intensification, especially after Pewa moved west of the International Date Line, and drew closer to a sprawling low aloft centered to the northwest. While some interaction between Pewa and developing Tropical Depression 03-C to the northeast may have initially limited Pewa's intensification rate, the system tracked west-northwestward under the influence of a deep layer ridge to the north, and gradually intensified as it crossed the Date Line and later tracked toward the northwest. Although Pewa did briefly reach typhoon intensity within the western North Pacific basin, persistent southerly shear led to the low level circulation center becoming exposed as the system dissipated over the open ocean in the northwest Pacific. There were no surface observations of tropical-storm-force or greater winds from Pewa.

The “best track” chart of Pewa’s path is given in Fig. 1, with the wind history shown in Fig. 2. The best track positions and intensities are listed in Table 1[1].

METEOROLOGICAL STATISTICS

Observations of Pewa include subjective satellite-based Dvorak technique intensity estimates from the Central Pacific Hurricane Center (HFO), Joint Typhoon Warning Center (JTWC) and the Satellite Analysis Branch (SAB), as well as objective Advanced Dvorak Technique (ADT) estimates from the Cooperative Institute for Meteorological Satellite Studies/University of Wisconsin-Madison (UW-CIMSS), and objective analyses produced by the Regional and Mesoscale Meteorology Branch (RAMMB) at the Cooperative Institute for Research in the Atmosphere (CIRA). 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 utilized in constructing the best track of Pewa (Table 1).

CASUALTY AND DAMAGE STATISTICS

There were no reports of damage or casualties[2] associated with tropical storm Pewa.

FORECAST AND WARNING CRITIQUE

The genesis of Pewa was not well anticipated early on, as the system was first introduced in a Tropical Weather Outlook (TWO) issued at 18 UTC Wednesday August 14th, and given a 10% chance of development within the following 48 hour period. Subsequent TWO issuances increased the 48-hour probability of development to 20%, until the issuance of a Special TWO from CPHC around 21 UTC August 15th. This outlook increased the probability of development to 60% over the next 48 hours, with the next two regularly scheduled issuances of the TWO increasing the probability of development to 80%. The TWO issued at 12 UTC Friday August 16th indicated a nearly 100% chance of development, and advisories were initiated at 15 UTC August 16th.

A verification of CPHC official track forecasts for Pewa is given in Table 2a. Although the 12 hour forecast track error was less than mean official errors, other official forecast track

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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.

[2] Deaths occurring as a direct result of the forces of the tropical cyclone are referred to as “direct” deaths. These would include those persons who drowned in storm surge, rough seas, rip currents, and freshwater floods. Direct deaths also include casualties resulting from lightning and wind-related events (e.g., collapsing structures). Deaths occurring from such factors as heart attacks, house fires, electrocutions from downed power lines, vehicle accidents on wet roads, etc., are considered indirect” deaths.

errors were greater than the mean official errors for the previous 5-yr period, with the differences becoming significantly larger with time. These large errors at extended time ranges are primarily due to Pewa tracking to the right of the official forecast track, with Pewa gaining latitude more rapidly than expected, due to southerly steering winds associated with a deep layer low centered west of the International Date Line. A homogeneous comparison of the official track errors with selected guidance models is given in Table 2b. A consensus of track forecast models (TVCA/TCVE) outperformed the official track forecast at all forecast hours, with the usually less-skillful BAMD outperforming both the official forecast and the consensus forecast at nearly all forecast periods.

A verification of CPHC official intensity forecasts for Pewa is given in Table 3a. Official forecast intensity errors through the first 48 hours of the forecast were lower than the mean official errors for the previous 5-yr period, but were greater than the mean at later forecast time ranges. A homogeneous comparison of the official intensity errors with selected guidance models is given in Table 3b. The official intensity forecast outperformed all guidance models through the initial 48 hours, except the intensity consensus (IVCN) was the best performer for forecasts verified at 48 hours. Interestingly, a climatology and persistence forecast (OCD5) provided the best guidance for forecasts that verified on days 3 through 5, indicating that the official and model forecasts at those times lacked skill.

Table 1. Best track for Tropical Storm Pewa, 16-25 August 2013.

Date/Time (UTC)	Latitude (°N)	Longitude (°)	Pressure (mb)	Wind Speed (kt)	Stage
16 / 0600	9.2	172.0W	1005	30	tropical depression
16 / 1200	9.4	173.1W	1005	35	tropical storm
16 / 1800	9.7	174.0W	1005	35	"
17 / 0000	10.0	175.0W	1001	45	"
17 / 0600	10.4	176.0W	999	45	"
17 / 1200	10.8	176.9W	997	50	"
17 / 1800	11.2	177.9W	995	55	"
18 / 0000	11.5	179.0W	995	55	"
18 / 0600	11.9	179.9W	995	55	"
18 / 1200	12.5	179.3E	997	50	"
18 / 1800	12.9	178.8E	994	55	"
19 / 0000	13.3	178.4E	988	65	typhoon
19 / 0600	13.9	178.0E	987	65	"
19 / 1200	14.6	177.2E	989	60	tropical storm
19 / 1800	14.6	176.3E	994	55	"
20 / 0000	15.3	175.6E	996	50	"
20 / 0600	16.2	174.8E	997	45	"
20 / 1200	17.4	174.0E	998	45	"
20 / 1800	18.3	172.8E	998	45	"
21 / 0000	18.7	171.8E	998	45	“
21 / 0600	19.6	171.3E	1001	35	"
21 / 1200	20.4	170.6E	1002	35	“
21 / 1800	21.2	170.0E	1003	35	“
22 / 0000	22.1	169.9E	1005	30	tropical depression
22 / 0600	23.2	169.6E	1005	30	“
22 / 1200	24.4	169.3E	1006	30	“

22 / 1800	25.2	169.2E	1006	30	“
23 / 0000	26.2	169.5E	1006	30	“
23 / 0600	26.5	169.5E	1006	30	“
23 / 1200	26.8	169.3E	1006	30	“
23 / 1800	27.1	169.3E	1006	30	“
24 / 0000	27.6	169.3E	1006	30	“
24 / 0600	27.9	168.9E	1007	25	“
24 / 1200	27.9	168.8E	1007	20	low
24 / 1800	28.2	167.6E	1008	20	“
25 / 0000	28.3	166.9E	1009	20	“
25 / 0600	28.4	166.2E	1009	20	“
25 / 1200					dissipated
19 / 0600	13.9	178.0	987	65	maximum winds and minimum pressure

Table 2a. CPHC official (OFCL) and climatology-persistence skill baseline (OCD5) track forecast errors (n mi) for Pewa. 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	**26.6**	52.6	96.5	159.1	252.0	342.0	495.2
OCD5	39.0	106.8	214.1	400.3	785.5	1264.1	1592.1
Forecasts	7	7	7	7	7	7	7
OFCL (2008-12)	27.0	43.1	57.8	71.9	101.7	137.2	165.9
OCD5 (2008-12)	37.4	73.0	114.9	158.3	238.4	313.5	389.1

Table 2b. Homogeneous comparison of selected track forecast guidance models (in n mi) for Pewa. Errors smaller than the CPHC 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	26.6	54.7	103.5	170.1	248.4	332.0	495.6
OCD5	39.0	119.5	246.6	448.2	842.8	1320.9	1633.4
AVNI	30.5	56.5	**92.2**	**134.0**	**211.5**	**309.4**	**404.8**
GHMI	**24.3**	**46.1**	**79.6**	**142.3**	261.6	361.0	**445.8**
HWFI	**24.5**	60.8	107.7	172.6	254.5	**326.2**	**440.5**
TVCA/TVCE	**18.5**	**42.3**	**88.2**	**147.0**	**241.6**	**325.5**	**447.1**
AEMI	32.0	68.7	131.6	200.4	299.2	372.1	499.7
BAMS	28.7	76.8	151.5	229.3	361.6	451.1	555.8
BAMM	**25.5**	56.0	105.2	**150.6**	**202.7**	**215.6**	**279.2**
BAMD	**23.4**	**40.9**	**81.8**	**119.2**	**147.8**	**128.0**	**151.0**
Forecasts	7	6	6	6	6	6	6

Table 3a. CPHC official (OFCL) and climatology-persistence skill baseline (OCD5) intensity forecast errors (kt) for Pewa. 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	**3.6**	**6.4**	**4.3**	**8.6**	17.1	22.1	25.7
OCD5	3.6	11.1	18.4	14.6	8.6	9.9	21.1
Forecasts	7	7	7	7	7	7	7
OFCL (2008-12)	6.3	10.5	13.4	14.5	15.3	17.0	17.3
OCD5 (2008-12)	7.6	12.5	16.5	18.8	20.4	20.3	20.6

Table 3b. Homogeneous comparison of selected intensity forecast guidance models (in kt) for Pewa. Errors smaller than the CPHC 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	2.5	7.0	4.0	9.0	17.0	22.0	27.0
OCD5	3.2	12.6	19.2	12.4	**11.2**	**10.6**	**22.6**
HWFI	9.8	18.6	14.4	9.4	19.2	27.8	43.4
GHMI	5.5	8.8	6.0	10.8	29.6	56.6	76.0
DSHP	4.0	10.2	10.0	13.6	25.4	36.2	46.0
IVCN	4.5	10.8	9.2	**8.8**	22.8	39.2	55.2
Forecasts	6	5	5	5	5	5	5

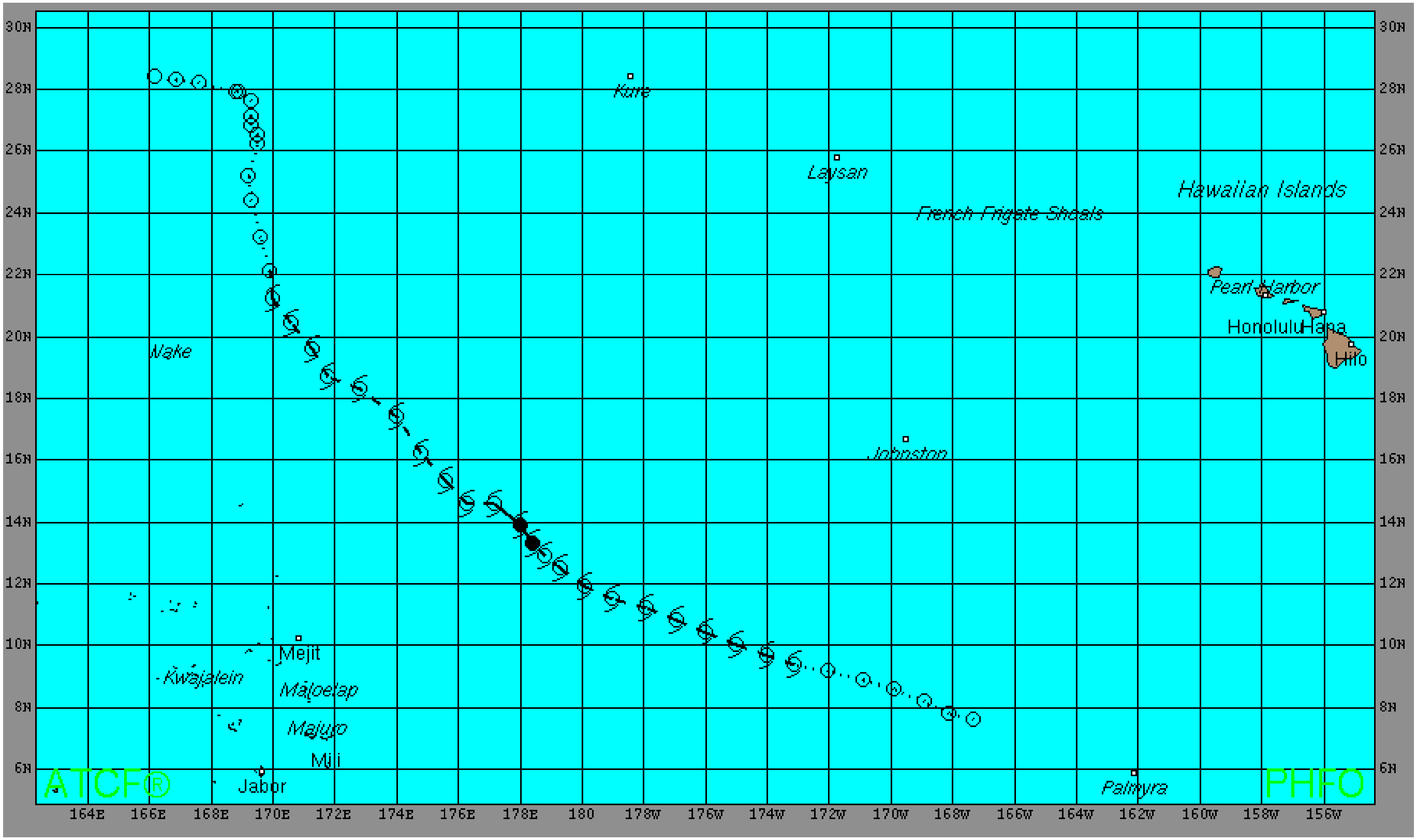

Figure 1. Best track positions for Pewa, 15-25 August 2013.

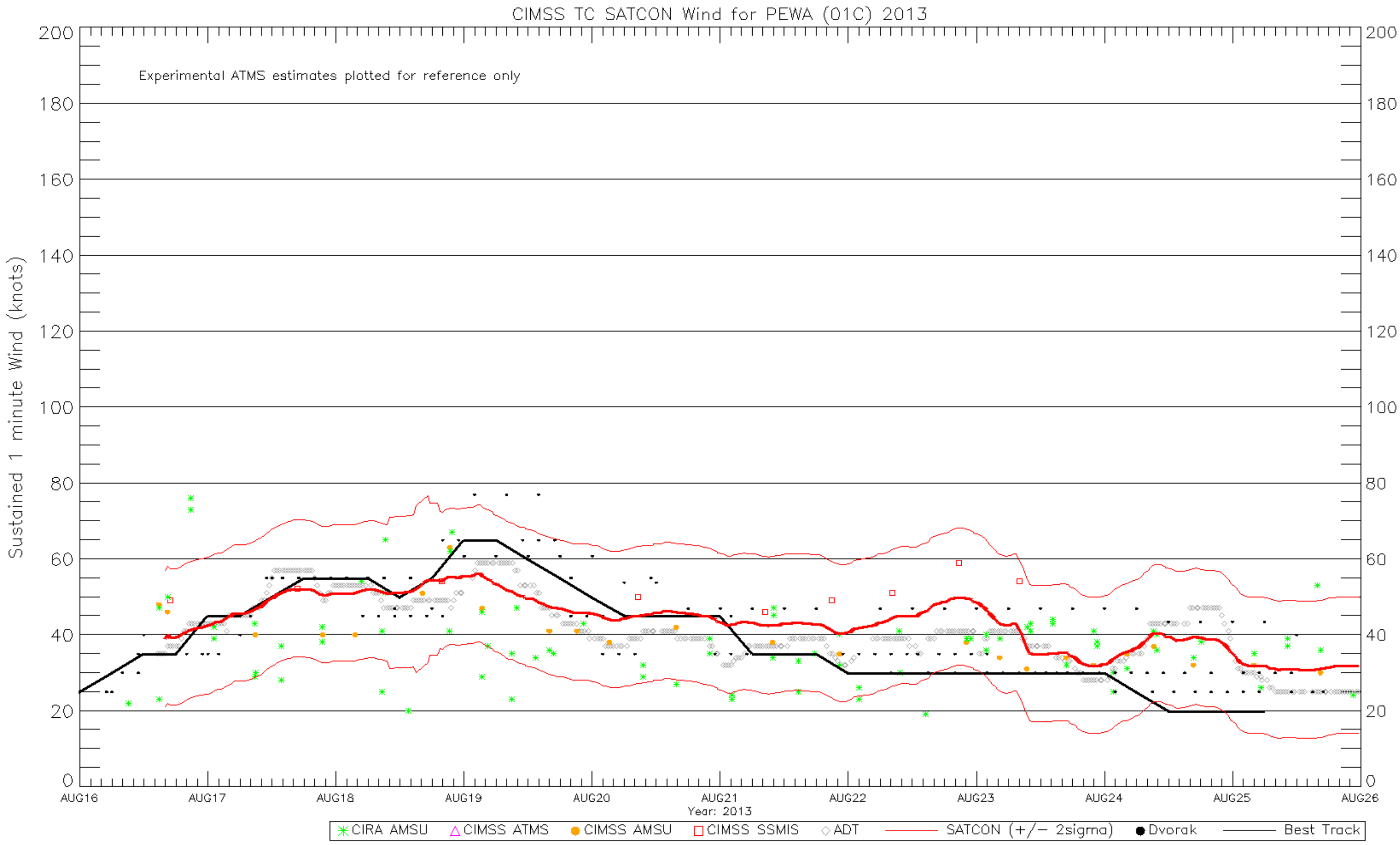

Figure 2. Pewa's best track intensity (solid black line) and the satellite consensus intensity estimate (SATCON – bold red line), objectively derived from satellite-based microwave imagers. Also plotted are subjective and objective Dvorak intensity estimates, and the individual microwave members which are utilized to derive the SATCON. Image courtesy of UW-CIMSS, which contains objective microwave analyses provided by UW-CIMSS and CIRA. More on the SATCON technique can be found at http://tropic.ssec.wisc.edu/misc/satcon/info.html