

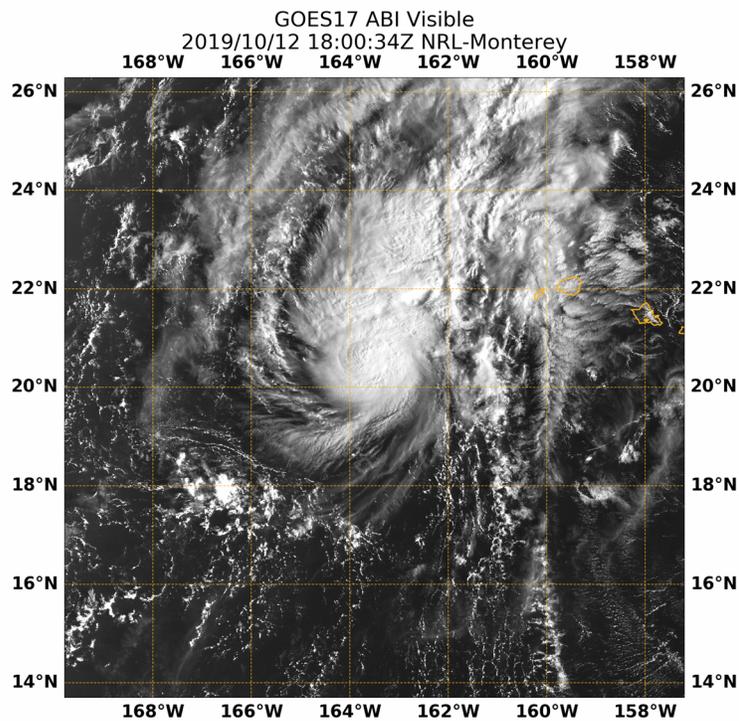


# CENTRAL PACIFIC HURRICANE CENTER TROPICAL CYCLONE REPORT

## TROPICAL STORM EMA (CP012019)

12–14 October 2019

Thomas Birchard  
Central Pacific Hurricane Center  
27 January 2022



GOES-17 VISIBLE SATELLITE OF TROPICAL STORM EMA WAS NEAR PEAK INTENSITY AT 1800 UTC 12 OCTOBER 2019. IMAGE COURTESY U.S. NAVAL RESEARCH LABORATORY.

Emma was a short-lived tropical storm that developed southwest of the main Hawaiian Islands in October 2019.

# Tropical Storm Ema

12–14 OCTOBER 2019

## SYNOPTIC HISTORY

Ema was a short-lived tropical cyclone that formed from a disturbance initially located a couple hundred n mi west of the main Hawaiian Islands on 12 October 2019. Ema formed in an area that was generally conducive for development, with high ocean heat content (Fig. 1) and light to moderate vertical wind shear due to a ridge aloft located far northeast of the system. Ema rapidly organized in the short time that it was in this environment, reaching an estimated maximum intensity of 45 kt shortly after developing around 1800 UTC 12 October. Just before this time, a 1435 UTC Special Sensor Microwave/Imager (SSM/I) image (Fig. 2) detected an eye-like feature while conventional infrared imagery indicated a persistent area of deep convection over the center. An ASCAT-C pass around 2100 UTC 12 October added confidence in the maximum wind speed estimate of 45 kt.

As Ema moved generally northward after developing, it rounded the western edge of the ridge aloft by 0000 UTC 13 October, while a trough aloft sharpened to the northwest of the tropical cyclone. This placed Ema in an environment characterized by increasingly strong southwesterly vertical wind shear, and the persistent deep convection (and an apparent mid-level circulation center) was quickly sheared northeastward from the center. The exposed low-level circulation center (LLCC) then began to move toward the northwest, steered by the low-level flow from a surface high far east-northeast of the tropical cyclone. Brief pulses of deep convection near and north of the LLCC led to periodic northward jogs in the observed motion on 13 October, as the cyclone was briefly steered by the mid- to upper-level southwesterly flow associated with the sharp deep-layer trough to the west. These pulses of deep convection were unable to persist over the exposed LLCC as they became increasingly infrequent, but Ema managed to remain at tropical storm strength, as evidenced by 35 kt winds present in a 0727 UTC 13 October ASCAT pass. Ema weakened to a tropical depression about 500 n mi west of Kauai, Hawaii by 1800 UTC 13 October, and subsequently degenerated to a post-tropical remnant low by 0600 UTC 14 October as deep convection completely waned.

The “best track” chart of the tropical cyclone’s path is given in Fig. 3, while the “best track” positions and intensities are listed in Table 1<sup>1</sup>.

## METEOROLOGICAL STATISTICS

Observations in Ema (Figs. 4 and 5) include subjective satellite-based Dvorak technique

---

<sup>1</sup> 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.

intensity estimates from the Central Pacific Hurricane Center (CPHC/PHFO), the Satellite Analysis Branch (SAB), and the Joint Typhoon Warning Center (JTWC/PGTW). 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 Ema.

The genesis of Ema occurred several hundred n mi southwest of the main Hawaiian Islands, and it subsequently moved northward toward portions of the Papahānaumokuākea Marine National Monument in the Northwest Hawaii islands. The maximum intensity of the cyclone is estimated to be 45 kt, based on a blend of intensity estimates from PHFO, JTWC and SAB, and the UW-CIMSS SATCON and ADT.

There were no ship or surface observations that reported winds of tropical-storm-force associated with Ema.

## CASUALTY AND DAMAGE STATISTICS

There were no reports of damage or casualties<sup>2</sup> associated with Ema.

## FORECAST AND WARNING CRITIQUE

The genesis of Ema (Table 2) was not well anticipated by the Central Pacific Hurricane Center (CPHC), partially because the nearby environment west of the genesis area was characterized by strong vertical wind shear, with the incipient low expected to move quickly northwestward into this hostile area. Ema became a tropical depression at 0600 UTC 12 October, the first time that the disturbance was initially discussed in the Tropical Weather Outlook, thus genesis lead times are listed as zero.

Due to the cyclone's short existence, there were only five verifying 12-h forecasts, three verifying 24-h forecasts and one verifying 36-h forecast. Therefore, a comprehensive verification of official and guidance track and intensity forecast errors is not provided. Generally speaking, official forecast track errors were greater than the mean official errors for the previous 5-yr period, but the official track forecasts correctly anticipated a motion toward the north-northwest. The official intensity forecasts correctly anticipated that Ema would be a short-lived tropical cyclone as it moved into an area of increasingly strong vertical wind shear, although the maximum intensity

---

<sup>2</sup> 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.

of 45 kt was not well anticipated. Comparisons between CPHC official and climatology-persistence skill baseline (OCD5) track and intensity forecast errors are provided in Tables 3 and 4, respectively.

While Tropical Storm Ema was expected to weaken while moving northward toward the Papahānaumokuākea Marine National Monument, uncertainty associated with the rate of weakening necessitated a Tropical Storm Watch for the area from Nihoa to French Frigate Shoals to Maro Reef, which was issued at 2100 UTC 12 October. All watches associated with Ema were discontinued by 2100 UTC 13 October as the cyclone weakened to a tropical depression.

## ACKNOWLEDGEMENTS

Kevin Kodama produced the track map, while John Bravender, Sam Houston and Mike Brennan provided valuable input on the manuscript.

Table 1. Best track for Tropical Storm Ema, 12—14 October 2019.

Date/Time (UTC)	Latitude (°N)	Longitude (°W)	Pressure (mb)	Wind Speed (kt)	Stage
11 / 1200	15.4	161.8	1009	25	low
11 / 1800	16.6	162.4	1009	25	“
12 / 0000	17.6	162.6	1009	25	“
12 / 0600	18.6	163.0	1009	30	tropical depression
12 / 1200	19.6	163.3	1008	35	tropical storm
12 / 1800	20.5	163.7	1003	45	“
13 / 0000	21.4	164.1	1005	40	“
13 / 0600	21.9	165.0	1006	35	“
13 / 1200	22.1	165.9	1008	35	“
13 / 1800	22.5	166.6	1008	30	tropical depression
14 / 0000	23.3	167.5	1008	30	“
14 / 0600	24.7	168.0	1009	30	low
14 / 1200	26.1	168.3	1010	30	“
14 / 1800	27.5	168.2	1011	25	“
15 / 0000	28.5	168.3	1013	25	“



Date/Time (UTC)	Latitude (°N)	Longitude (°W)	Pressure (mb)	Wind Speed (kt)	Stage
15 / 0600	29.0	168.2	1015	25	“
15 / 1200	29.1	168.6	1017	25	“
15 / 1800	29.4	168.9	1017	25	“
16 / 0000	29.3	169.3	1017	25	“
16 / 0600	28.9	170.0	1018	15	“
16 / 1200					dissipated
12 / 1800	20.5	163.7	1003	45	maximum wind and minimum pressure

Table 2. Number of hours in advance of formation associated with the first CPHC 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, and these values are based on when Ema initially became a tropical depression in the final best track.

	Hours Before Genesis	
	48-Hour Outlook	120-Hour Outlook
Low (<40%)	0	0
Medium (40%-60%)	0	0
High (>60%)	0	0

Table 3. CPHC official (OFCL) and climatology-persistence skill baseline (OCD5) track forecast errors (n mi) for Ema. 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
OFCL	31.8	56.1	75.3
OCD5	42.0	140.9	195.4
Forecasts	5	3	1
OFCL (2014-18)	<b>26.7</b>	<b>40.8</b>	<b>53.9</b>
OCD5 (2014-18)	41.2	89.9	144.7

Table 4. CPHC official (OFCL) and climatology-persistence skill baseline (OCD5) intensity forecast errors (kt) for Ema. 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
OFCL	<b>2.0</b>	<b>1.7</b>	<b>0.0</b>
OCD5	5.0	5.7	10.0
Forecasts	5	3	1
OFCL (2014-18)	5.8	9.2	11.8
OCD5 (2014-18)	7.9	12.6	17.2

Table 5. Wind watch and warning summary for Tropical Storm Ema.

Date/Time (UTC)	Action	Location
12 / 2100	Tropical Storm Watch issued	Nihoa to French Frigate Shoals to Maro Reef
13 / 1500	Tropical Storm Watch discontinued	Nihoa to French Frigate Shoals
13 / 2100	Tropical Storm Watch discontinued	French Frigate Shoals to Maro Reef

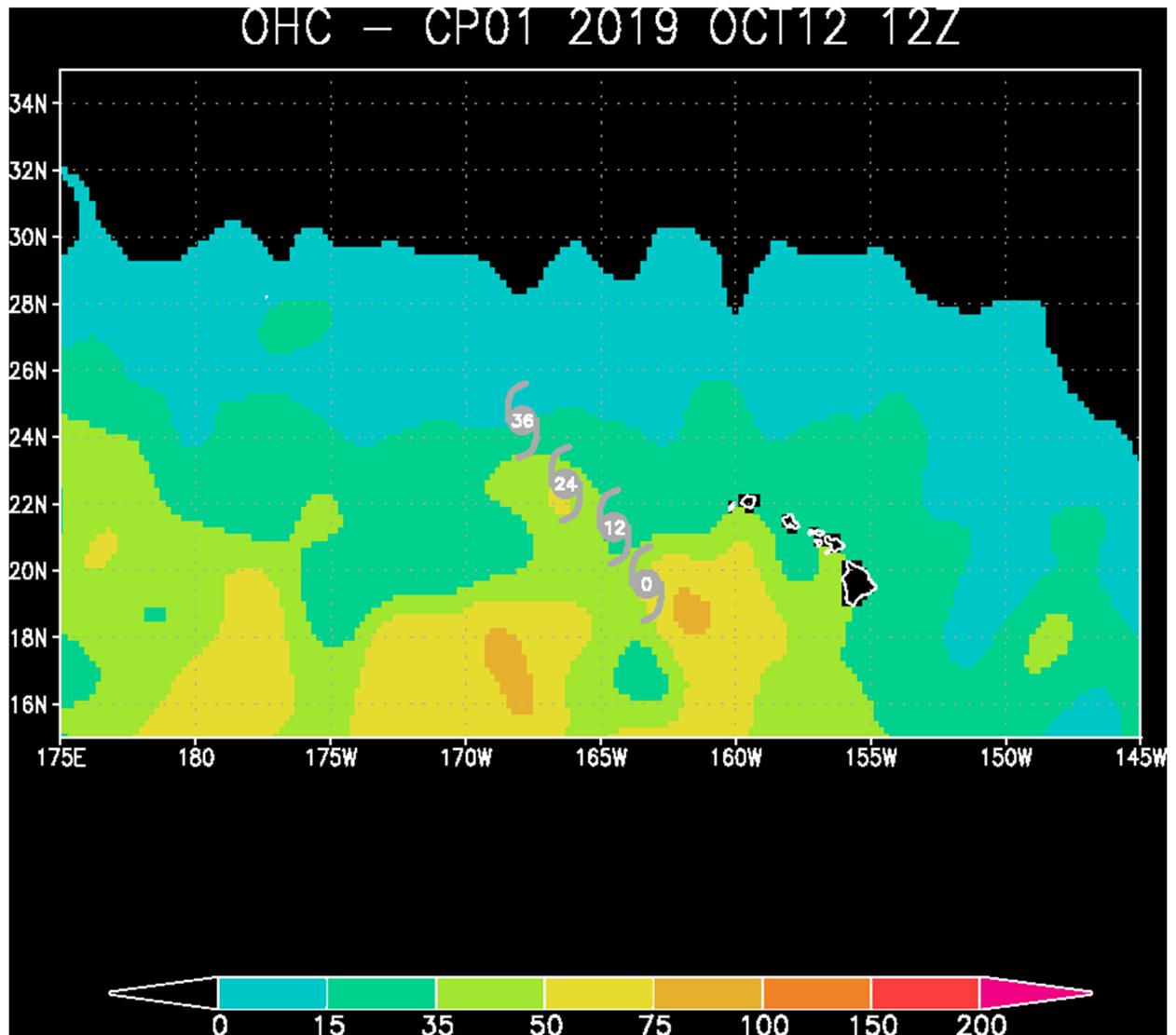


Figure 1. Ocean heat content ( $\text{kJ}/\text{cm}^2$ ) and initial official forecast track associated with Tropical Storm Ema, 1200 UTC 12 October 2019 (image courtesy of Regional and Mesoscale Meteorology Branch-Cooperative Institute for Research in the Atmosphere, RAMMB-CIRA).

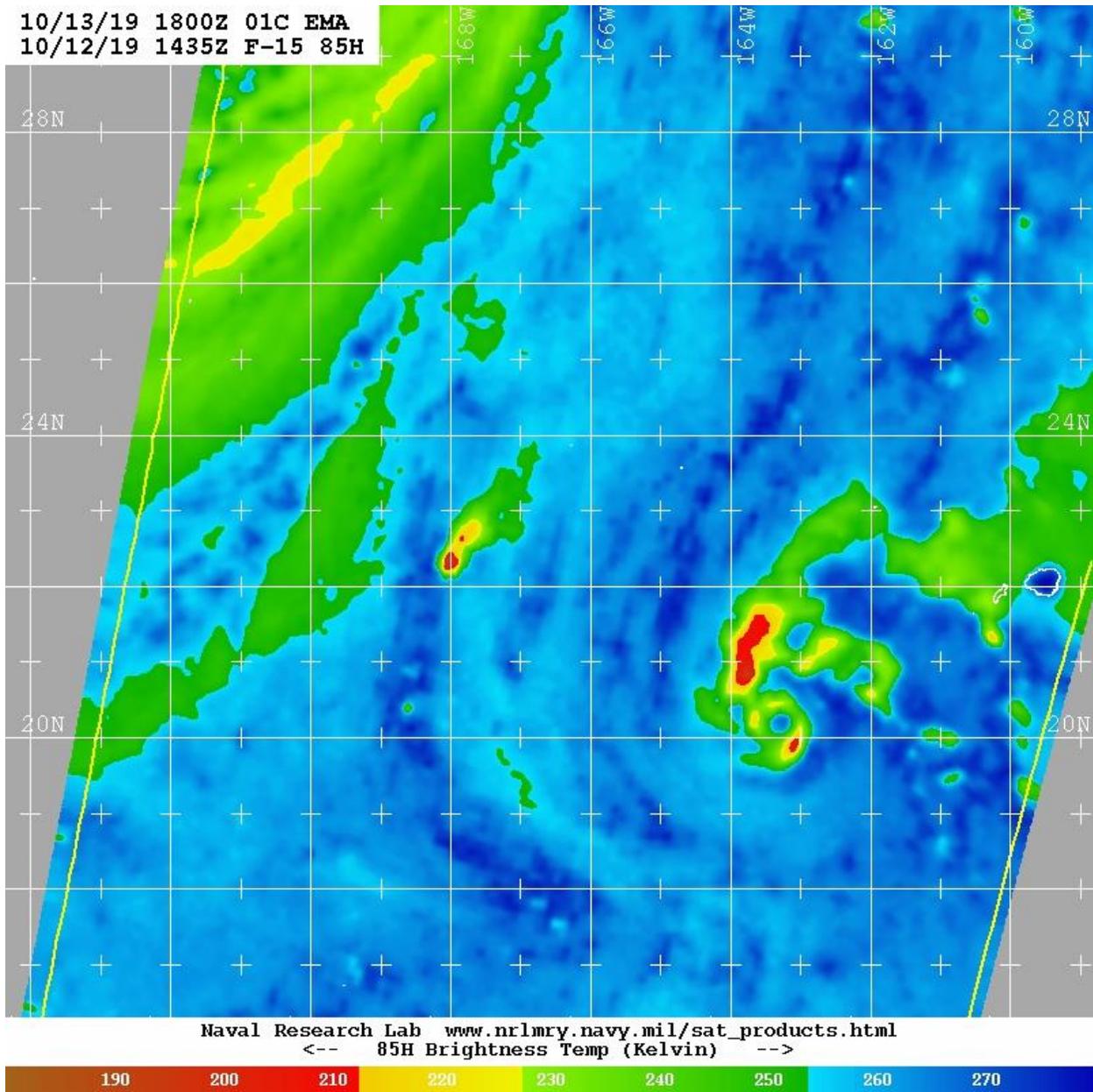


Figure 2. A Special Sensor Microwave/Imager (SSM/I) view of Tropical Storm Ema at 1435 UTC 12 October 2019, located southwest of the Hawaiian islands of Niihau and Kauai (image courtesy of the Naval Research Laboratory, Monterey).

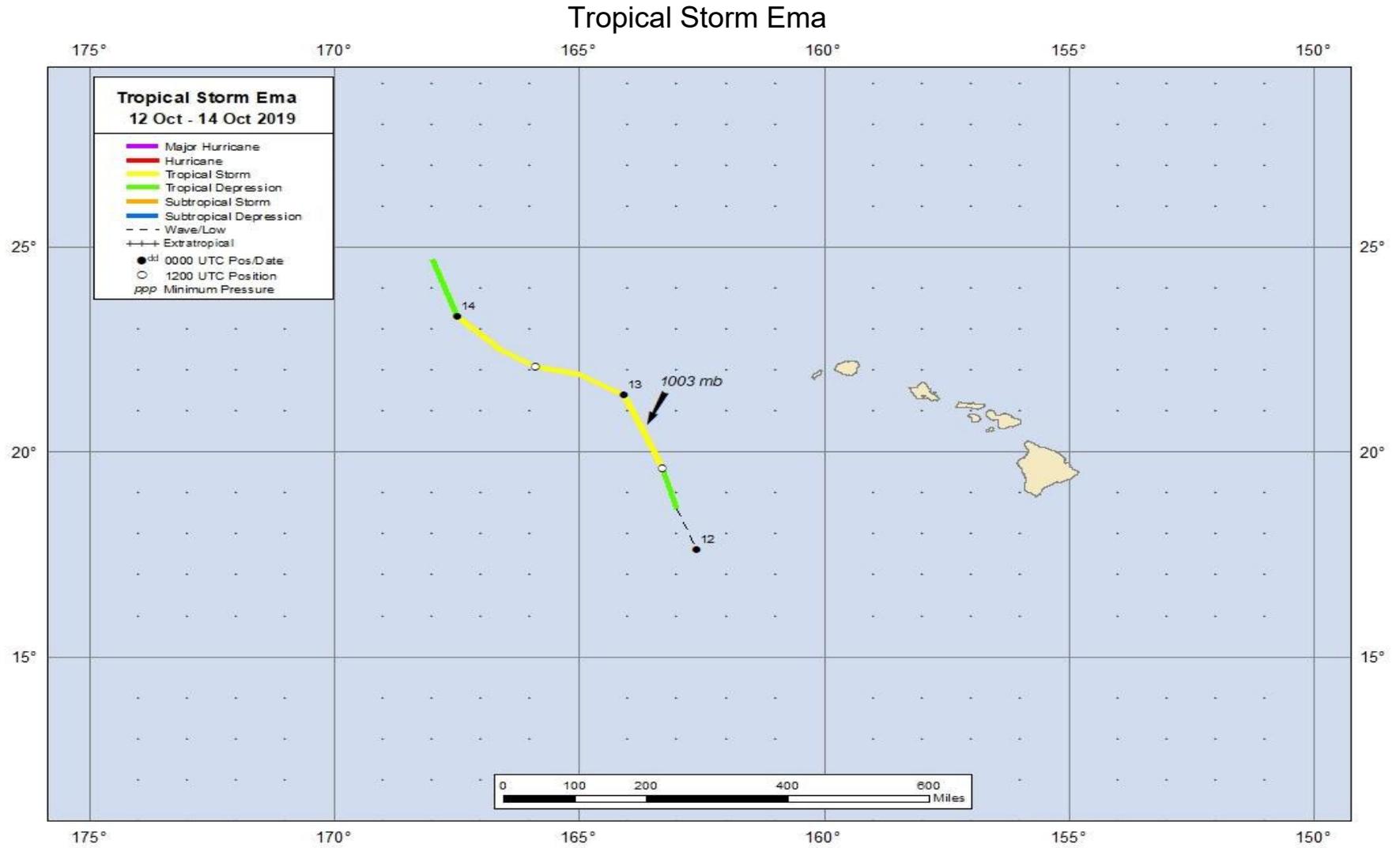


Figure 3. Best track positions for Tropical Storm Ema, 12–14 October 2019.

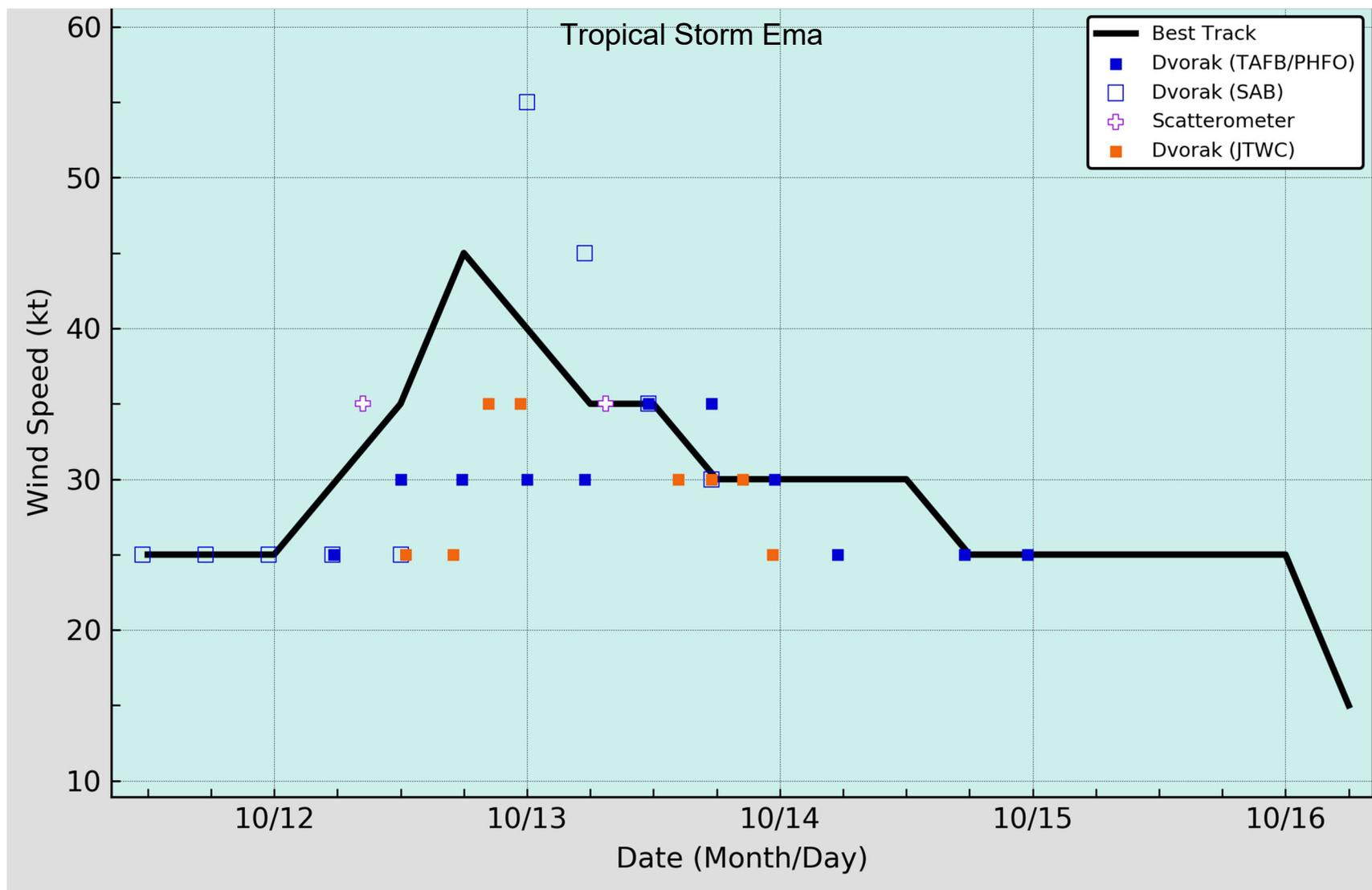


Figure 4. Selected wind observations and best track maximum sustained surface wind speed plot for Tropical Storm Ema, 12–14 October 2019. Dashed vertical lines correspond to 0000 UTC.

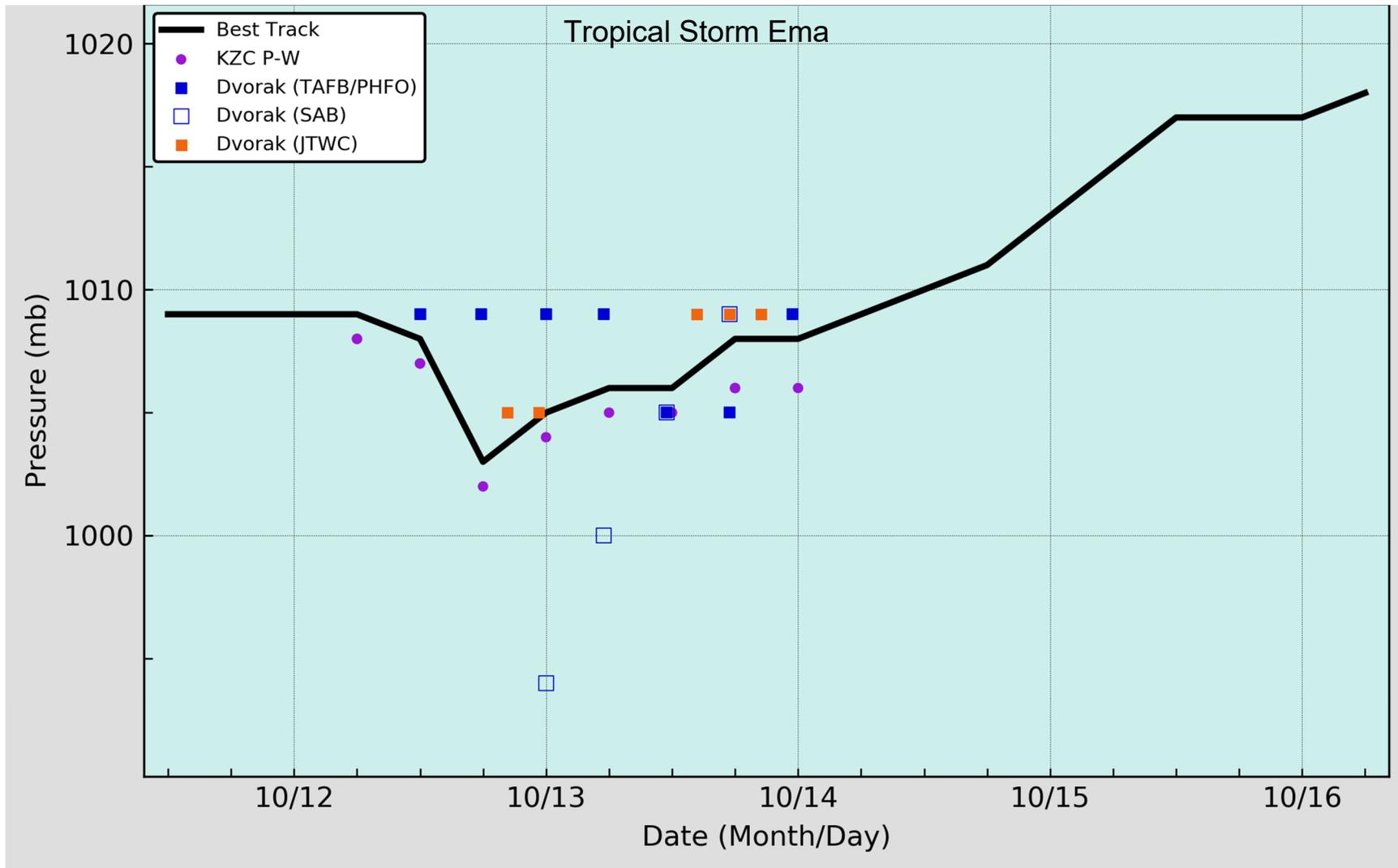


Figure 5. Selected pressure observations and best track minimum central pressure plot for Tropical Storm Ema, 12–14 October 2019. KZC P-W refers to pressure estimates derived using the Knaff-Zehr-Courtney pressure-wind relationship. Dashed vertical lines correspond to 0000 UTC.