

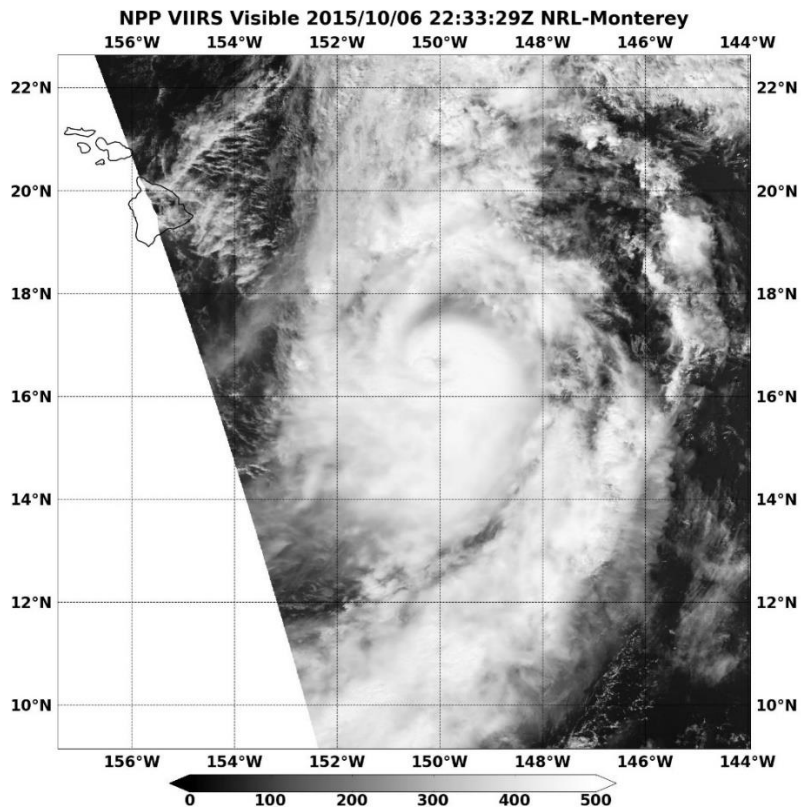


CENTRAL PACIFIC HURRICANE CENTER TROPICAL CYCLONE REPORT

HURRICANE OHO (CP072015)

3-8 OCTOBER 2015

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VISIBLE INFRARED IMAGING RADIOMETER SUITE (VIIRS) IMAGE OF OHO AT 2233 UTC 6 OCTOBER 2015.
IMAGE COURTESY OF THE NAVAL RESEARCH LABORATORY.

Oho was a category 2 hurricane (on the Saffir-Simpson Hurricane Wind Scale) that formed in the Central North Pacific basin during the prolific hurricane season of 2015.

Hurricane OHO

3-8 OCTOBER 2015

SYNOPTIC HISTORY

Oho developed from a disturbance that was embedded in a monsoon trough located about 520 n mi south of Honolulu, Hawaii on 1 October. This disturbance moved slowly toward the east-northeast during the next 24 h, and by 2 October, a surface low had developed in this monsoon trough. This low then moved slowly toward the east-southeast and started to emerge from the monsoon trough. Once the low had shifted far enough away from this feature, its circulation was no longer being directly influenced by the trough. At the same time, the showers and thunderstorms associated with the low became persistent and better organized, so this system was classified as Tropical Depression Seven-C at 0600 UTC 3 October. Note that genesis of tropical cyclones in the vicinity of monsoon troughs is not typical in the Central North Pacific Basin. However, with the development of the strong El Niño in late 2015, this was not a surprising occurrence. The “best track” chart of the tropical cyclone’s path is given in Fig. 1, while the best track positions and intensities are listed in Table 1¹.

The showers and thunderstorms associated with Tropical Depression Seven-C continued to become better organized, and 6 h after its initial development, the system was upgraded to a tropical storm, which was given the name Oho. As is rather typical of tropical cyclones that are initially involved with monsoon troughs, the developing system moved somewhat erratically along an “S-shaped” track. At first, Oho moved slowly toward the east-northeast, and then started moving northeastward. Unfortunately, in real-time it appears that a separate middle tropospheric cyclonic feature was also simultaneously tracking at a faster pace toward the northeast during the first 18 h after development. As a result, there was some uncertainty in the location of the low level center, especially at night in infrared satellite imagery. This caused the apparent initial motion of the system to be too fast through 1800 UTC on 3 October. It was not until loops of visible satellite imagery were available several hours after sunrise on 3 October that an exposed low level center was discovered southwest of the deep convection. Once this was recognized, the positions prior to 0000 UTC 4 October were adjusted in the working best track. Since southwesterly environmental vertical wind shear was providing hostile environmental conditions, Oho did not intensify during the next 18 h, despite moving slowly toward the northwest over warm ocean waters. However, by 0000 UTC 5 October Oho began to slowly become better organized, even though the low level center remained displaced from the deep convection. At the same, a dropwindsonde from the NOAA G-IV aircraft conducting a synoptic flow mission in the vicinity of Oho suggested the surface winds were near 39 kt about 40 nm southeast of the circulation center. Therefore, the maximum sustained wind speed was adjusted upward to 40 kt. Later that same day, the first mission by an aircraft from the 53rd Weather Reconnaissance Squadron (WRS)

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.

flying at 850 mb into Oho revealed flight-level winds of 60 kt and surface winds of 44 kt based on the stepped frequency microwave radiometer (SFMR). As a result, the intensity of Oho was increased another 5 kt while it tracked toward the north-northeast. Oho continued to intensify during the next 12 h, and when another aircraft from the 53rd WRS investigated the tropical cyclone, the low level center was becoming less exposed. Later that same day, Oho also turned toward the east-northeast and accelerated. By 1200 UTC 6 October, Oho was upgraded to a minimal hurricane based on its improved appearance in infrared and microwave satellite imagery. From that point, the tropical cyclone accelerated toward the northeast and continued to intensify, becoming a 95 kt hurricane by 1200 UTC 7 October. After that, cooler ocean temperatures and increasing southwesterly vertical wind shear started taking their toll on Oho, which began to weaken.

By 1200 UTC 8 October, Oho had continued to move over much cooler ocean waters and had lost tropical characteristics. As a result, the system had transitioned to a post-tropical / extratropical storm low as it raced toward the north-northeast over the cooler waters of the North Pacific. The system briefly weakened to a gale low around 0000 UTC 9 October. However, within 12 h, hurricane force winds were associated with the extratropical low as it intensified due to strong baroclinicity. After that, the system gradually weakened during the next 18 h. By 1200 UTC 10 October, the low had moved inland over southwest Alaska in the vicinity of Icy Bay, and it finally dissipated after it continued moving inland over western Canada 6 h later.

METEOROLOGICAL STATISTICS

Observations in Oho include subjective satellite-based Dvorak technique intensity estimates from the Tropical Analysis and Forecast Branch (TAFB), the Satellite Analysis Branch (SAB), the Central Pacific Hurricane Center (CPHC), and the Joint Typhoon Warning Center. They also include 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 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 Oho.

Observations also include flight-level, SFMR, and dropwindsonde observations obtained from two flights by the 53rd WRS of the U. S. Air Force Reserve Command, which provided four position fixes. There were also 2 synoptic flow missions conducted by the NOAA G-IV aircraft, which launched dropwindsondes in the environment around Oho.

There were no surface observations of tropical-storm-force or greater winds from Oho.

CASUALTY AND DAMAGE STATISTICS

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

FORECAST AND WARNING CRITIQUE

The genesis of Oho was somewhat anticipated well in advance. Oho's precursor disturbance was first mentioned in the Tropical Weather Outlook issued by CPHC 78 h before the time of genesis in the best track, when it was given a low (30% or less) chance of development. The development chance was raised to medium (40%-60% chance) 30 h before genesis. Finally, it was raised to high (70% or greater) 24 h before genesis. The uncertainty in the forecast for genesis was likely due to an expectation that the precursor disturbance would develop slowly, since the incipient system was embedded within a monsoon trough. Also, development of significant tropical cyclones, especially those that reach hurricane intensity, during the month of October is a relatively rare occurrence in the Central North Pacific.

A verification of CPHC official track forecasts for Oho is given in Table 2a. Official forecast track errors were much greater than the mean official errors for the previous 5-yr period for all forecast times. This was likely due in part to the poor initial positions when Oho was first organizing in the vicinity of the monsoon trough. In addition, Oho followed an atypical track compared with most tropical cyclones in the Central North Pacific, especially during the first few days while it was trying to move away from the monsoon trough. A homogeneous comparison of the official track errors with errors associated with select guidance models is given in Table 2b. Most of the model guidance also struggled with the Oho track forecasts. The official track forecast errors were generally similar to, or in some cases worse, than the model guidance errors. The variable consensus models, TCON and TVCE, as well as the UKMET and ECMWF models had lower errors for each of the 12-96 h forecast periods. In addition, the GFS, GFS ensemble mean, and the FSSE had lower track forecast errors during the 12-36 h forecast periods.

A verification of CPHC official intensity forecasts for Oho is given in Table 3a. Official forecast intensity errors were lower than the mean official errors for the previous 5-yr period for the 72-120 h forecast periods. In addition, the official forecast errors were worse than the OCD5 for the 24 h forecast period, indicating that most forecasts at that particular time period lacked skill. A homogeneous comparison of the official intensity errors with errors associated with select guidance models is given in Table 3b. Generally, the official forecasts had lower errors than the intensity guidance beyond the 24 h forecast period. The exception was the variable consensus models, ICON/IVCN, as well as the FSSE, for the 12-96 h forecast periods. In addition, the GFS model had lower intensity forecast errors during the 12-48 h forecast periods.

Coastal watches and warnings were not necessary for Oho while it was a tropical cyclone.

Table 1. Best track for Hurricane Oho, 3 – 8 October 2015.

Date/Time (UTC)	Latitude (°N)	Longitude (°W)	Pressure (mb)	Wind Speed (kt)	Stage
02 / 0600	12.9	157.4	1004	25	low
02 / 1200	12.7	156.9	1003	25	"
02 / 1800	12.4	156.3	1002	25	"
03 / 0000	12.4	155.8	1001	30	"
03 / 0600	12.5	155.4	1001	30	tropical depression
03 / 1200	12.6	155.2	1000	35	tropical storm
03 / 1800	12.7	155.0	1000	35	"
04 / 0000	12.9	154.5	1000	35	"
04 / 0600	13.1	154.6	1000	35	"
04 / 1200	13.2	154.8	1000	35	"
04 / 1800	13.3	154.9	1000	35	"
05 / 0000	13.5	154.8	996	40	"
05 / 0600	13.7	154.7	989	45	"
05 / 1200	14.0	154.5	986	50	"
05 / 1800	14.5	154.0	984	55	"
06 / 0000	14.7	153.7	984	55	"
06 / 0600	14.9	153.1	982	60	"
06 / 1200	15.1	151.9	980	65	hurricane
06 / 1800	15.9	150.7	975	75	"
07 / 0000	17.1	149.4	971	80	"
07 / 0600	19.1	147.9	962	90	"
07 / 1200	21.9	146.6	957	95	"
07 / 1800	25.0	145.1	966	90	"
08 / 0000	28.8	145.2	973	75	"
08 / 0600	30.8	144.1	978	65	"
08 / 1200	33.3	142.5	983	60	extratropical low
08 / 1800	37.0	139.5	985	55	"
09 / 0000	45.0	141.5	987	45	"
09 / 0600	49.0	137.0	982	50	"

Date/Time (UTC)	Latitude (°N)	Longitude (°W)	Pressure (mb)	Wind Speed (kt)	Stage
9 / 1200	53.0	137.0	971	65	"
9 / 1800	56.0	138.0	962	55	"
10 / 0000	57.5	139.0	964	40	"
10 / 0600	59.5	142.0	969	35	"
10 / 1200	63.0	138.0	981	25	inland
10 / 1800					dissipated
07 / 1200	21.9	146.6	957	95	maximum winds and minimum pressure

Table 2a. CPHC official (OFCL) and climatology-persistence skill baseline (OCD5) track forecast errors (n mi) for Hurricane Oho, 3 - 8 October 2015. Mean errors for the previous 5-yr period are shown for comparison.

	Forecast Period (h)						
	12	24	36	48	72	96	120
OFCL	51.7	77.9	113.3	164.9	336.4	598.0	854.9
OCD5	94.5	199.2	288.6	418.0	638.0	844.5	1136.3
Forecasts	19	17	15	13	9	5	1
OFCL (2010-14)	27.9	44.1	56.7	73.9	132.3	183.7	258.9

Table 2b. Homogeneous comparison of select track forecast guidance model errors (n mi) for Hurricane Oho, 3 - 8 October 2015. Errors smaller than the CPHC official track forecast errors (OFCL) are shown in boldface type.

Model ID	Forecast Period (h)						
	12	24	36	48	72	96	120
OFCL	51.7	77.9	113.3	164.9	336.4	598.0	854.9
OCD5	94.5	199.2	288.6	418.0	638.0	844.5	1136.3
GFSI	41.0	67.7	112.7	186.7	424.5	666.4	948.4
GHMI	47.0	76.2	116.5	173.4	343.4	513.2	773.7
HWFI	50.6	74.7	106.6	152.5	342.8	587.7	776.9
NVGI	54.3	111.3	140.9	155.4	199.5	301.4	551.8
EGRI	41.8	61.9	88.3	136.6	207.5	152.7	n/a
EMXI	31.0	55.8	76.1	97.2	284.7	590.3	n/a
CMCI	54.4	95.8	143.8	184.4	279.1	168.0	n/a
TCON	38.7	62.7	99.1	159.2	345.1	531.7	n/a
TVCE	44.0	67.2	98.9	145.4	293.4	474.8	875.2
FSSE	38.9	55.5	85.7	130.5	343.8	603.7	n/a
AEMI	41.9	69.7	112.0	183.5	365.8	582.3	812.8
LBAR	71.6	122.9	168.3	215.1	378.1	490.4	238.0
BAMS	82.3	126.4	162.7	245.1	427.9	666.3	1098.9
BAMM	55.6	90.5	138.1	220.4	425.6	669.2	1011.3
BAMD	57.6	93.1	154.9	241.2	476.9	676.9	946.4
Forecasts	19	17	15	13	9	5	1

Table 3a. CPHC official (OFCL) and climatology-persistence skill baseline (OCD5) intensity forecast errors (kt) for Hurricane Oho, 3 – 8 October 2015. Mean errors for the previous 5-yr period are shown for comparison. Official intensity forecast errors that are smaller than the 5-yr mean intensity errors are shown in boldface type.

	Forecast Period (h)						
	12	24	36	48	72	96	120
OFCL	7.1	12.4	15.3	18.1	17.2	13.0	5.0
OCD5	8.2	11.6	17.7	23.8	38.6	48.2	22.0
Forecasts	19	17	15	13	9	5	1
OFCL (2008-12)	4.8	8.6	11.6	13.8	18.5	19.3	20.4

Table 3b. Homogeneous comparison of select intensity forecast guidance model errors (kt) for Hurricane Oho, 3 – 8 October 2015. Errors smaller than the CPHC official forecast errors (OFCL) are shown in boldface type.

Model ID	Forecast Period (h)						
	12	24	36	48	72	96	120
OFCL	7.1	12.4	15.3	18.1	17.2	13.0	5.0
OCD5	8.2	11.6	17.7	23.8	38.6	48.2	22.0
HWFI	6.0	11.4	17.0	20.8	12.3	14.4	16.0
GHMI	9.1	13.1	13.5	18.6	18.1	8.4	21.0
DSHP	7.0	11.6	16.1	18.5	20.3	16.8	7.0
LGEM	6.6	11.2	17.4	20.8	23.9	19.2	2.0
ICON	6.7	10.8	14.7	17.7	17.1	12.0	11.0
IVCN	6.8	11.6	14.1	17.7	17.1	12.0	11.0
GFSI	5.5	9.5	13.3	17.5	21.2	13.2	16.0
EMXI	7.4	12.0	16.9	19.0	30.7	23.0	n/a
FSSE	6.3	10.6	15.4	16.8	11.5	8.8	n/a
Forecasts	19	17	15	13	9	5	1

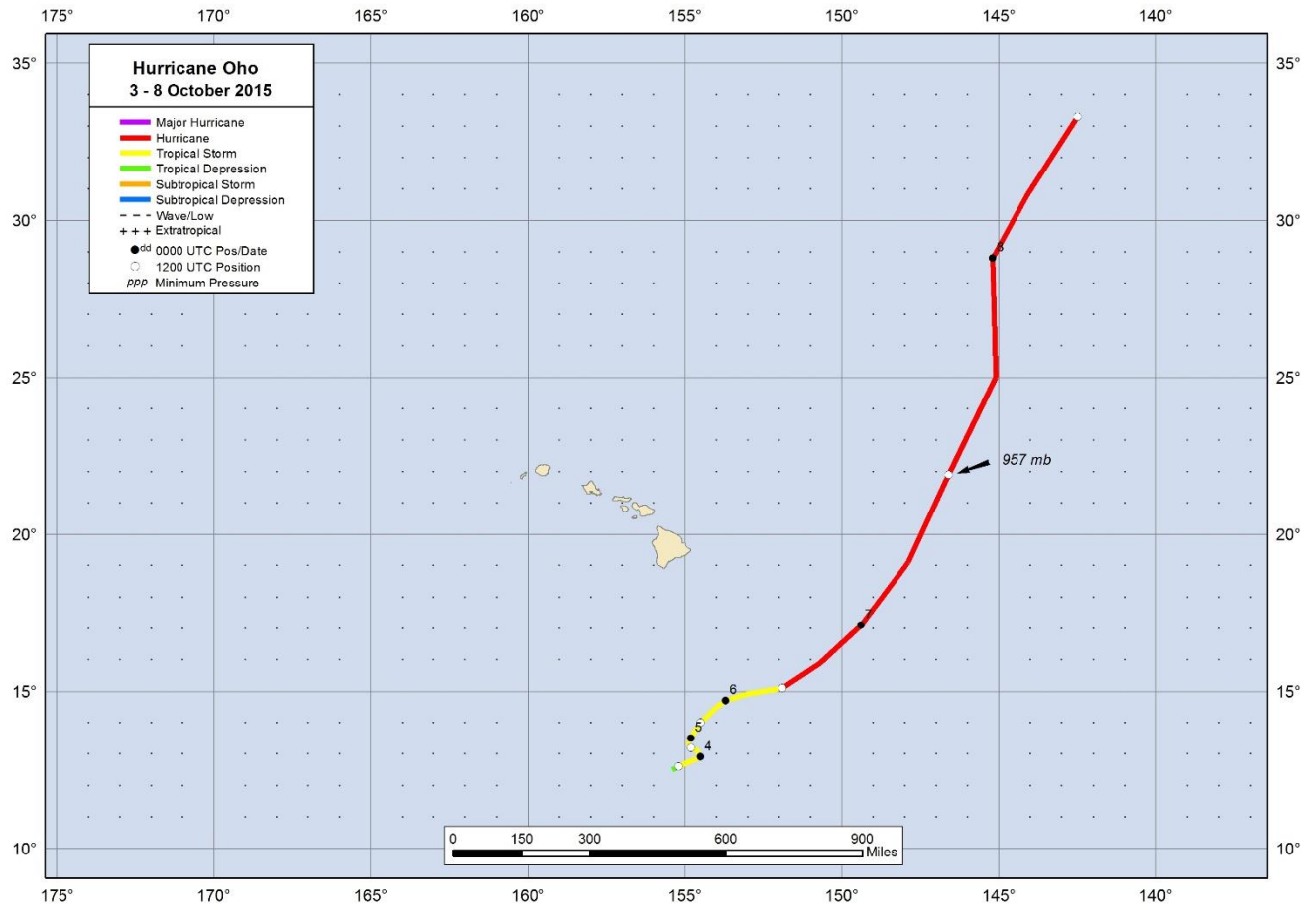


Figure 1. Best track positions for Hurricane Oho, 3 – 8 October 2015.

