Tropical Cyclone Report
Tropical Storm Omeka
(CP012010)
16-22 December 2010

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Omeka, a December rarity, became a tropical storm after it moved eastward across the International Dateline into the central North Pacific Ocean. Omeka was the first tropical cyclone during the month of December since Tropical Storm Paka, which developed in the CPHC area of responsibility, (i.e., north of the Equator between Longitude 140^{O}W and the International Dateline) in December 1997. Omeka was the latest tropical storm to form over the North Pacific east of the International Dateline since reliable records began during the satellite era in the mid-1960s.

a. Synoptic History

The system that eventually became Omeka started out as a non-tropical low just west of the International Dateline at 0000 UTC 16 December. The weak low was a surface reflection of a well defined upper-level low that moved southeast across the International Dateline at about 0000 UTC 17 December. From 16 December until 18 December, surface winds around the low increased as the central pressure gradually lowered. At 0000 UTC 18 December, the system became a subtropical depression, and at 1200 UTC 18 December, a subtropical storm. After a period of slow movement to the south, the system picked up speed, turned toward the south-southwest, and crossed the International Dateline for a second time shortly after 1800 UTC 18 December. The subtropical storm was then in the RSMC Tokyo Area of Responsibility.

According to sea surface temperature charts produced by the Earth Systems Research Laboratory's Physical Sciences Division (ESRL/PSD) of NOAA, the storm was moving over increasingly warmer water, with sea surface temperatures close to 25^{O}C. The ESRL/PSD analysis of sea surface temperature anomalies for the period from 12 December 2010 to 08 January 2011 indicated that there was a greater than 1 ^{O}C sea surface temperature anomaly near the International Dateline. With the storm over warm water, thunderstorms developed and increased in coverage and intensity near the low level circulation center. At the same time, the central pressure of the low decreased enough for it to acquire gale force winds in the tightened pressure gradient between it and a relatively strong 1037 mb surface high pressure located about 1400 miles to the north.

Figure 2a is a MTSAT visible image of the subtropical storm at 0157 UTC 19 December, just after it moved west of the International Dateline. This image, along with infrared satellite imagery (Fig. 2b), shows that a distinct clearing or "eye-like feature" had developed near the apparent center of the low. Fixes from the Joint Typhoon Warning Center indicated that the system was subtropical. However, with the appearance of tropical cyclone characteristics, the

Satellite Analysis Branch (SAB) of NESDIS issued tropical cyclone Subjective Dvorak fixes rather than sub-tropical cyclone fixes.

The subtropical storm continued to intensify as it moved slowly south until 1800 UTC 19 December. Scatterometer data from an ASCAT satellite passing over the storm indicated a tight asymmetric wind field with peak winds of at least 45 kt. Since ASCAT surface wind data has a known low bias, the wind speeds were likely closer to 50 kt. Dvorak classifications from JTWC, SAB, and CPHC at 1200 UTC and 1800 UTC 19 December agreed with the ASCAT data, independently estimating maximum winds of at least 50 kt.

At 1800 UTC 19 December, the subtropical storm turned to the southeast, crossing the International Dateline for a third and final time shortly after 0000 UTC 20 December. Upon crossing over to the East Pacific, it was determined that the system was a tropical storm, and CPHC issued the first bulletin on Tropical Storm Omeka at 0900 UTC 20 December. Omeka was already weakening by then, as it was moving into an environment with increasing southwesterly vertical wind shear. The shear was located east of a long-wave trough aloft that dug southward along 165E.

With an exposed low-level circulation center southwest of a convective cluster, Omeka turned toward the northeast and accelerated on 20 December. As Omeka weakened over cooler waters, it gradually acquired extra-tropical characteristics. Shortly before 0900 UTC 21 December, the now extra-tropical low moved past Lisianski Island in the Northwest Hawaiian Islands, which are part of the Papahānaumokuākea Marine National Monument. Maximum sustained wind speeds were around 35 kt, and its core was almost completely devoid of convection. The last advisory on Omeka was issued by CPHC at 0900 UTC 21 December.

Succeeding High Seas Forecasts issued by WFO Honolulu followed the remnants of Omeka as it moved to the north-northeast then north. Winds dropped below gale force at 0000 UTC 22 December. The last forecast on the barely recognizable circulation was issued at 1800 UTC 22 December. Winds were estimated near 25 kt in the last forecast.

Some may question when this system became a tropical cyclone, which it clearly was after it crossed the dateline on 20 December. For background on this question, we would like to refer you to other tropical cyclones from the recent past that had similar non-tropical origins. The most notable of these is South Atlantic Ocean Hurricane Catarina of 2004, which is described by McTagerrt-Cowen et al. (2006). Hurricane Catarina struck the coast of Brazil with winds strong enough to cause over 80% of homes to receive damage to roof structures, with almost 40% of these structures completely failing.

The last three tropical cyclones that formed during the prolific North Atlantic Hurricane season of 2005 had non-tropical origins that appeared to have similar characteristics to the development and life cycle of Tropical Storm Omeka. These are Tropical Storm Delta described by Beven (2006), Hurricane Epsilon described by Franklin (2006), and Tropical Storm Zeta described by Knabb and Brown (2006). Links to these papers are located in the reference section below.

b. Forecast and Warning Critique

There were no coastal watches or warnings required for Omeka, and there were no reports of damage or injuries. Track and intensity verification can be found in Table 2 and 3.

c. References

Beven, J., 2006: Tropical Cyclone Report: Tropical Storm Delta, 22-28 November 2005. *http://www.nhc.noaa.gov/pdf/TCR-AL292005_Delta.pdf* , National Hurricane Center, Miami, FL. 12 pp.

Franklin, J., 2006: Tropical Cyclone Report: Hurricane Epsilon, 29 November – 8 December 2005. http://www.nhc.noaa.gov/pdf/TCR-AL302005_Epsilon.pdf , National Hurricane Center, Miami, FL. 9 pp.

Knabb, R.D., and D.P. Brown, 2006: Tropical Cyclone Report: Tropical Storm Zeta, 30 December 2005 – 6 January 2006. http://www.nhc.noaa.gov/pdf/TCR-AL312005_Zeta.pdf , National Hurricane Center, Miami, FL. 10 pp.

McTaggert-Cowan, R., L. Bosart, C.A. Davis, E.H. Atallah, J.R. Gyakum, and K.A Emanuel, 2006: Analysis of Hurricane Catarina (2004). *Mon. Wea. Rev.*, **134**, 3029-3053.

Table 1. Best track for Tropical Storm Omeka, 16-22 December 2010.

Date/Time (UTC)	Latitude (°)	Longitude (°)	Pressure (mb)	Wind Speed (kt)	Stage
16 / 0000	30.0N	175.0E	1006	25	low
16 / 0600	29.0N	176.0E	1006	25	"
16 / 1200	28.0N	177.0E	1006	25	"
16 / 1800	27.0N	179.0E	1005	25	"
17 / 0000	26.0N	180.0W	1004	25	"
17 / 0600	25.6N	179.5W	1004	25	"
17 / 1200	25.0N	179.0W	1004	25	"
17 / 1800	24.6N	178.7W	1003	30	"
18 / 0000	24.2N	178.5W	1002	30	subtropical depression
18 / 0600	23.8N	178.6W	1002	30	"
18 / 1200	23.6N	178.7W	1002	35	subtropical storm
18 / 1800	23.0N	179.8W	1002	35	"
19 / 0000	22.2N	179.4E	1001	40	"
19 / 0600	21.6N	179.1E	1000	45	"
19 / 1200	21.1N	179.0E	999	50	"
19 / 1800	20.4N	179.1E	999	50	"
20 / 0000	20.1N	179.9E	998	45	"
20 / 0600	20.4N	178.9W	997	45	tropical storm
20 / 1200	21.0N	177.3W	997	45	"
20 / 1800	22.4N	176.1W	999	35	"
21 / 0000	23.8N	174.6W	1000	35	"
21 / 0600	25.4N	173.7W	1001	35	"
21 / 1200	27.0N	173.0W	1002	35	low
21 / 1800	29.0N	172.6W	1002	35	"
22 / 0000	30.7N	172.2W	1002	30	"
22 / 0600	32.2N	172.4W	1004	30	"
22 / 1200	33.3N	172.3W	1006	25	"
22 / 1800	34.1N	172.0W	1008	25	"
23 / 0000					dissipated
20 / 0600	20.4N	178.9W	997	45	minimum pressure
19 / 1200	21.1N	179.0E	999	50	maximum wind

Table 2. Track Verification Table entries are track forecast errors, measured in nautical miles. Values in parentheses indicate the number of forecasts. Values in bold represent guidance forecast errors equal to or less than the office CPHC forecast.

Forecast	12-hr	24-hr	36-hr	48-hr	72-hr	96-hr	120-hr
CPHC	36 (5)	49 (5)	77 (5)	178 (2)	n/a	n/a	n/a
CLP5	93 (5)	224 (5)	366 (5)	513 (3)	n/a	n/a	n/a
BAMD	84 (5)	128 (5)	201 (5)	432 (3)	n/a	n/a	n/a
BAMM	**28** (5)	**45** (5)	78 (5)	**127** (3)	n/a	n/a	n/a
BAMS	49 (5)	75 (5)	**69** (5)	**85** (3)	n/a	n/a	n/a
GFDL	46 (4)	53 (4)	**69** (3)	**164** (2)	n/a	n/a	n/a
AVNO	94 (4)	154 (2)	n/a	n/a	n/a	n/a	n/a
UKMET	**36** (2)	70 (1)	116 (1)	n/a	n/a	n/a	n/a
NOGAPS	39 (3)	68 (3)	125 (3)	n/a	n/a	n/a	n/a

Table 3. Homogeneous comparison of selected intensity forecast guidance models (in kt). Errors smaller than the CPHC official forecast (OFCL) are shown in boldface type.

Forecast	12-hr	24-hr	36-hr	48-hr	72-hr	96-hr	120-hr
OFCL	0.0	5.0	0.0	n/a	n/a	n/a	n/a
FSSI	0.0	**4.5**	n/a	n/a	n/a	n/a	n/a
HWF1	1.0	9.0	22.0	14.0	1.0	n/a	n/a
GHMI	1.0	5.7	7.0	3.0	2.0	n/a	n/a
NGPI	5.0	16.3	19.7	15.7	9.7	n/a	n/a
ICON	0.0	**5.0**	n/a	n/a	n/a	n/a	n/a
IVCN	1.4	7.4	14.0	10.5	11.5	n/a	n/a
SHFR	1.1	7.9	14.8	1.7	7.0	12.0	n/a
SHIP	0.8	**4.8**	12.5	19.0	28.0	n/a	n/a
LGEM	0.8	7.5	15.5	7.0	14.0	n/a	n/a
Forecasts	6	4	2				

Figure 1. Best track positions for Tropical Storm Omeka 16-22 December 2010. The segments of the track when Omeka was an extratropical low are based on analyses from the Honolulu Forecast Office (south of 30^{O}N) and the Ocean Prediction Center (north of 30^{O}N).

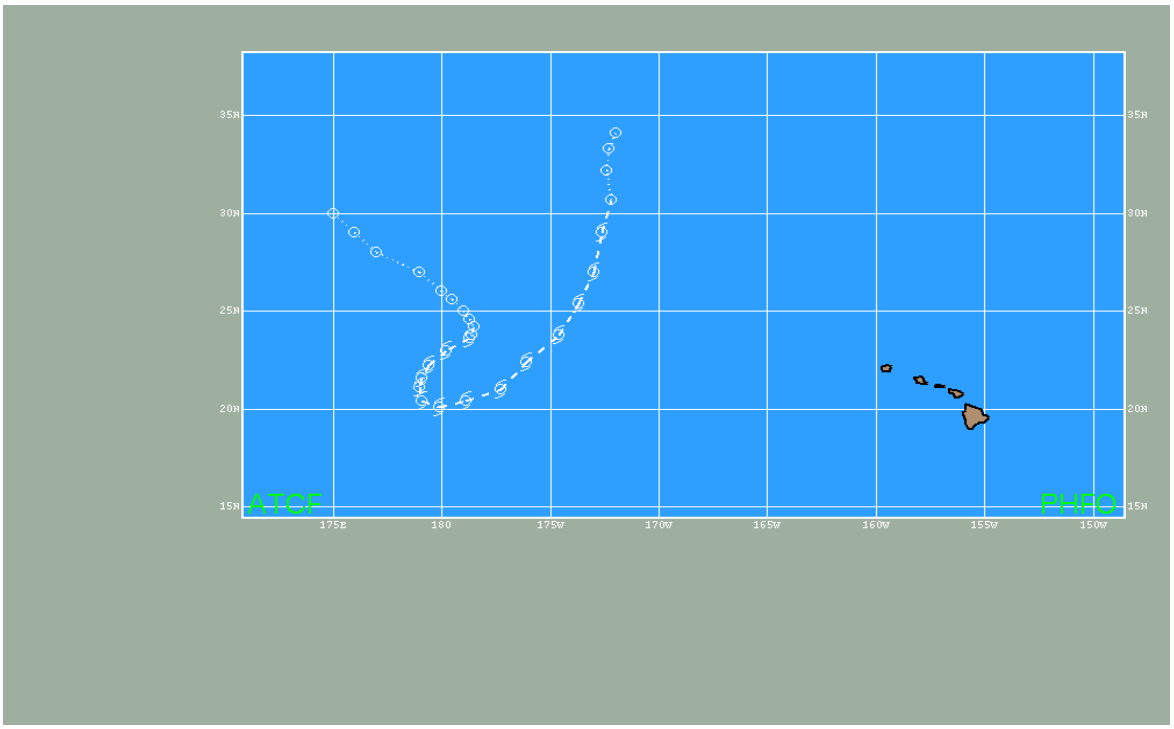
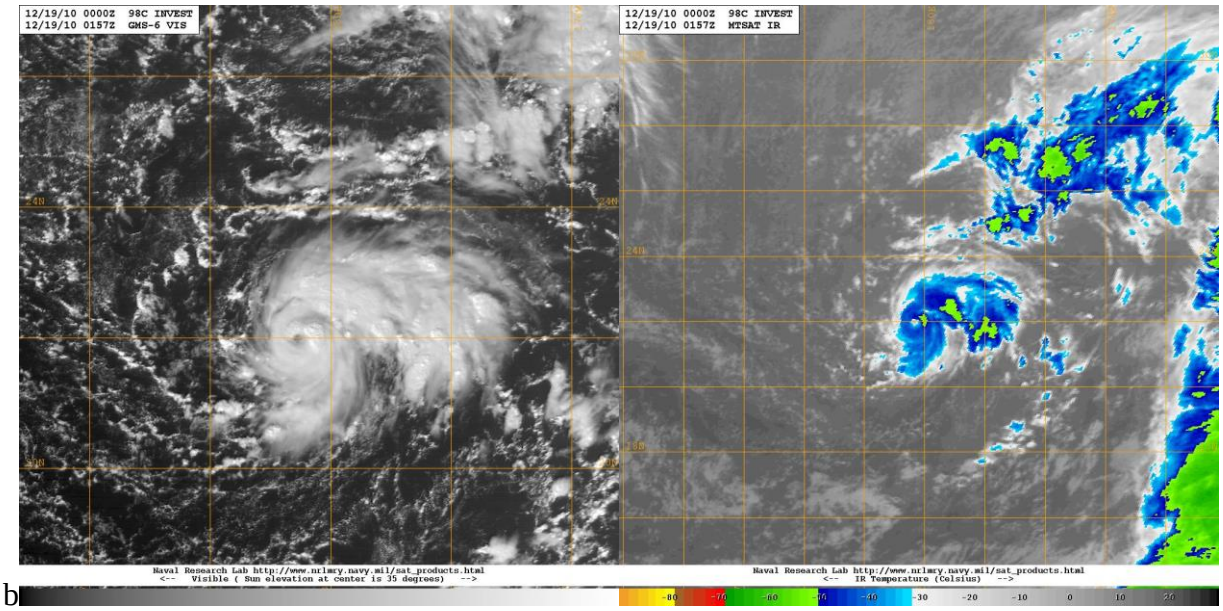


Figure 2. (a) Visible and (b) infrared satellite imagery of Omeka at 0157 UTC 19 December 2010, showing an ‘eye-like” feature, which developed soon after the system crossed into the northwestern Pacific Ocean just west of the International Dateline. Images are courtesy of the Naval Research Laboratory in Monterey, CA.

a



b