CENTRAL PACIFIC HURRICANE CENTER
TROPICAL CYCLONE REPORT

TROPICAL STORM HALOLA

(CP012015)

10 – 12 July 2015

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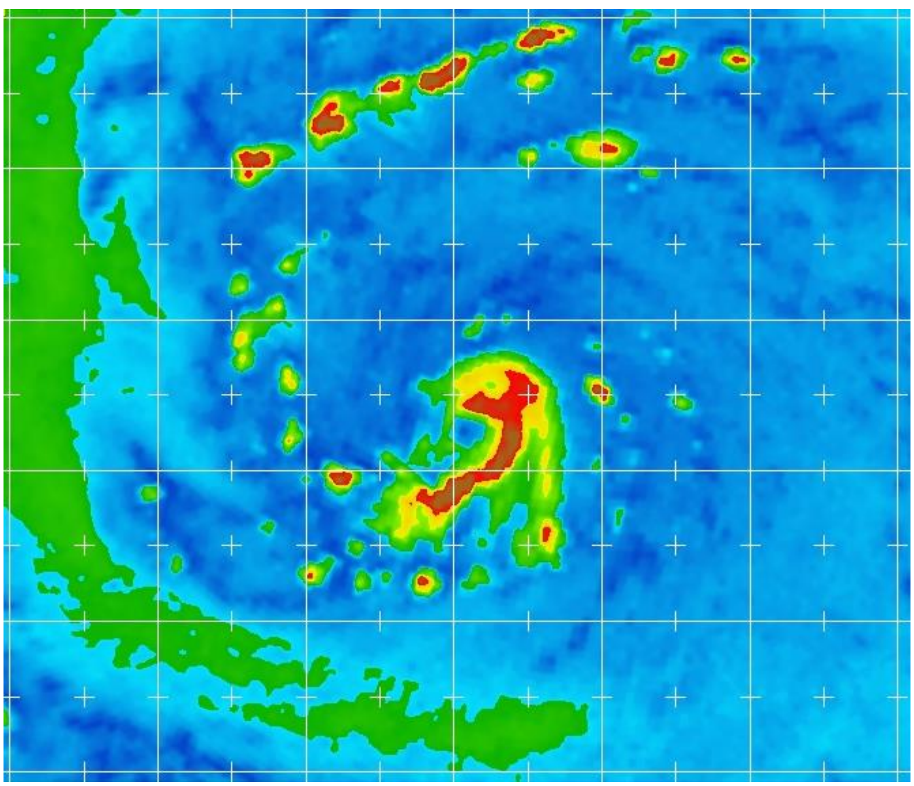

SSMI/S MICROWAVE (91 GHZ) IMAGE AT 1929 UTC 12 JULY. IMAGE COURTESY OF FLEET NUMERICAL METEOROLOGY AND OCEANOGRAPHY CENTER

Tropical Storm Halola was a tropical storm (on the Saffir-Simpson Hurricane Wind Scale) that formed in the open waters of the central North Pacific, then spent much of its time as a tropical cyclone in the western North Pacific, where it became a typhoon.
Note that this report only covers the portion of the tropical cyclone's life cycle within the central North Pacific basin.

TROPICAL STORM HALOLA

10 – 12 JULY 2015

SYNOPTIC HISTORY

Halola formed within the central Pacific but spent the vast majority of its life cycle as a tropical cyclone west of the International Date Line in the western Pacific, outside of the Central Pacific Hurricane Center (CPHC) area of responsibility. Halola formed at approximately the same time that Tropical Storm Iune became a tropical cyclone. As a result, these systems became the earliest known tropical cyclones to form during a central Pacific hurricane season and were among the first systems in what would become the most active central Pacific hurricane season on record.

Halola formed from a persistent, long-lived monsoon trough that originated from the western Pacific. The trough, which had already spawned a pair of tropical cyclones in the western Pacific, built eastward into the central Pacific by 5 July and would go on to produce three tropical cyclones in the central Pacific during the following week. Halola was the western-most of these three tropical cyclones, which included Ela and Iune.

Evidence of a broad and elongated low-level circulation was observed roughly 900 to 1,100 n mi southwest of Hawaii within the monsoon trough as early as 3 July, but the feature did not became more distinct until 6 July. On 7 July, deep convection increased around the better-defined low-level circulation, which began to break away from the monsoon trough and drift northward. Late on 7 July, development was interrupted as the upper-level anticyclone, which had been directly overhead, lifted northward and imparted easterly vertical wind shear. Through 8 July, the low-level circulation center remained separated as much as 70 n mi to the east of the persistent cluster of deep convection marking the mid- to upper- level portion of the circulation. Easterly vertical wind shear relaxed enough during the overnight hours on 9 July to allow the low cloud swirl marking the exposed low-level circulation to be drawn northwestward toward the deep convection. By late 9 July, the low-level circulation center had become reestablished along the southeastern edge of a small but persistent cluster of deep convection, and the system then began to turn toward the west, steered by a deep-layered ridge to the north. Deep convection slowly increased in all quadrants, becoming sufficiently organized by 0600 UTC 10 July for the system to be deemed Tropical Depression One-C centered about 890 n mi southwest of Honolulu, Hawaii.

The depression continued to track westward to the south of a deep ridge through the remainder of 10 July. The organization and amount of deep convection changed little during much of this time, followed by some increase late on 10 July. By 0000 UTC 11 July, the system had gained additional organization and strengthened to Tropical Storm Halola.

Slow strengthening occurred on 11 July as deep convection became concentrated to the south and southwest of the center. This caused Halola to lose some latitude while continuing on a general westward motion. By the end of 11 July, a weakness developed within the deep-layered ridge located north of Halola, leading to a slow turn toward the west-northwest. Gradual strengthening continued, and the maximum sustained winds around Halola reached 50 kt on 0600 UTC 12 July. Through the remainder of 12 July, an upper level trough located to the northwest weakened the upper level ridge to the north of Halola. This led to a disruption of the outflow aloft and introduced weak, northwesterly vertical wind shear that prohibited further strengthening of Halola. Halola moved west of the International Date Line just before 0000 UTC 13 July, exiting the CPHC area of responsibility.

The "best track" chart of the tropical cyclone's path is given in Fig. 1. The best track positions and intensities are listed in Table 1[1]. Note that this report only describes the time that Halola was east of the International Date Line in the CPHC area of responsibility.

METEOROLOGICAL STATISTICS

Observations in Halola include subjective satellite-based Dvorak technique intensity estimates from the CPHC, the Joint Typhoon Warning Center (JTWC), 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 (CIMSS). 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 Halola.

The peak intensity of 50 kt in the CPHC area of responsibility is based on Dvorak satellite estimates from CPHC, SAB, and JTWC, and ADT from CIMSS. No ship reports of tropical-storm-force winds associated with Halola were received.

CASUALTY AND DAMAGE STATISTICS

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

FORECAST AND WARNING CRITIQUE

The genesis of Halola was reasonably well anticipated (Table 2). Note that in 2015, CPHC only produced genesis forecasts for a 48 h period. The incipient disturbance was first mentioned

[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.

in the CPHC Tropical Weather Outlook at 1800 UTC 4 July, which was 138 h before actual genesis occurred. The disturbance was given a “low” probability of genesis (≤ 30%) at that time and remained in the “low” category through 0600 UTC 7 July, as the system remained poorly defined and embedded within a monsoon trough. Seventy-two hours before actual genesis, the probability was raised into the “medium” category (40-60%) at 1200 UTC 7 July. The low-level circulation was becoming better defined, and the system showed signs of breaking away from the monsoon trough, where it had been embedded for several days. However, easterly vertical wind shear developed later on 7 July, exposing the low-level circulation center into 9 July. As a result, probabilities were held in the “medium” category. By 0000 UTC 10 July, vertical wind shear had relaxed enough to allow the low-level center to become collocated with a persistent area of deep convection, and the probability was raised to the “high” category (≥ 70%) 12 h before actual genesis.

A verification of CPHC official track forecasts for Halola is given in Table 3a. Although the somewhat small number of CPHC forecasts limit meaningful analysis, the official track errors were higher than the mean official errors for the previous 5-yr period. This is likely attributed to the undulation in the general westward-moving track of Halola. A homogeneous comparison of the official track errors with selected guidance models is given in Table 3b. Almost all guidance outperformed CPHC in the first 24 h, though the margin was small. At 36 and 48 h, CPHC track errors were lower than most of the guidance. The best performing member of the guidance group was the United Kingdom Meteorological Office’s EGRI, which produced the lowest errors at all times compared to the official forecast and all other guidance.

A verification of CPHC official intensity forecasts for Halola is given in Table 4a. Although the somewhat small number of CPHC forecasts limit meaningful analysis, the official forecast intensity errors were lower than the mean official errors for the previous 5-yr period. A homogeneous comparison of the official intensity errors with selected guidance models is given in Table 4b. The CPHC intensity forecasts were quite good, outperforming all guidance at all times, with average errors remaining below 5 kt.

Watches and warnings were not required in the central Pacific.

Table 1. Best track for Tropical Storm Halola, 10-12 July 2015.

Date/Time (UTC)	Latitude (°N)	Longitude (°W)	Pressure (mb)	Wind Speed (kt)	Stage
06 / 1800	7.8	165.6	1008	20	low
07 / 0000	7.6	166.3	1008	20	“
07 / 0600	7.5	166.8	1007	25	"
07 / 1200	7.6	167.1	1007	25	"
07 / 1800	7.8	167.2	1007	25	"
08 / 0000	8.1	167.2	1007	25	"
08 / 0600	8.7	167.0	1007	25	"
08 / 1200	9.4	166.8	1007	25	"
08 / 1800	9.9	166.6	1007	25	"
09 / 0000	10.3	166.6	1007	25	"
09 / 0600	10.9	167.0	1007	25	"
09 / 1200	11.1	167.8	1007	25	"
09 / 1800	11.3	168.6	1006	30	"
10 / 0000	11.4	169.2	1006	30	"
10 / 0600	11.5	169.9	1006	30	tropical depression
10 / 1200	11.5	170.7	1006	30	"
10 / 1800	11.5	171.6	1006	30	"
11 / 0000	11.4	172.7	1004	35	tropical storm
11 / 0600	11.2	173.9	1004	35	"
11 / 1200	10.9	174.9	1003	40	"
11 / 1800	10.7	175.9	1001	45	“
12 / 0000	10.9	176.9	1001	45	"
12 / 0600	11.4	177.7	999	50	“
12 / 1200	11.9	178.6	999	50	“
12 / 1800	12.5	179.6	998	50	“

12 / 1800	12.5	179.6	998	50	maximum winds and minimum pressure

Table 2. Number of hours in advance of formation of Tropical Storm Halola 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.

	Hours Before Genesis in 48-Hour Outlook
Low (≤ 30%)	138
Medium (40%-60%)	72
High (≥ 70%)	12

Table 3a. CPHC official (OFCL) and climatology-persistence skill baseline (OCD5) track forecast errors (n mi) for Tropical Storm Halola. 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	36.1	61.7	78.6	80.4	-	-	-
OCD5	45.3	72.1	68.6	46.4	-	-	-
Forecasts	9	7	5	3	0	0	0
OFCL (2010-14)	27.9	44.1	56.7	73.9	132.3	183.7	258.9

Table 3b. Homogeneous comparison of selected track forecast guidance models (in n mi) for Tropical Storm Halola. 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 4a due to the homogeneity requirement.

Model ID	Forecast Period (h)						
	12	24	36	48	72	96	120
OFCL	38.7	69.8	74.6	78.9	-	-	-
OCD5	51.5	82.5	**62.3**	**52.7**	-	-	-
GFSI	**32.9**	**60.9**	**68.9**	**67.0**	-	-	-
HWFI	**37.0**	73.7	99.6	114.0	-	-	-
EGRI	**30.9**	**49.6**	**51.7**	**51.1**	-	-	-
TCON	**34.3**	**64.6**	82.7	90.2	-	-	-
TVCA/TVCE	**35.5**	**62.6**	83.0	90.2	-	-	-
AEMI	**31.3**	**65.9**	79.0	82.8	-	-	-
Forecasts	7	5	3	1	0	0	0

Table 4a. CPHC official (OFCL) and climatology-persistence skill baseline (OCD5) intensity forecast errors (kt) for Tropical Storm Halola. 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	**1.7**	**4.3**	**1.0**	**0.0**	-	-	-
OCD5	2.8	4.9	4.2	7.0	-	-	-
Forecasts	9	7	5	3	0	0	0
OFCL (2010-14)	4.8	8.6	11.6	13.8	18.5	19.3	20.4

Table 4b. Homogeneous comparison of selected intensity forecast guidance models (in kt) for Tropical Storm Halola. 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 4a due to the homogeneity requirement.

Model ID	Forecast Period (h)						
	12	24	36	48	72	96	120
OFCL	1.3	4.2	1.3	0.0	-	-	-
OCD5	3.0	5.0	5.0	7.0	-	-	-
HWFI	5.3	7.2	4.8	12.5	-	-	-
DSHP	2.8	5.3	6.0	4.0	-	-	-
LGEM	3.0	6.8	8.3	14.0	-	-	-
ICON	2.9	4.2	4.3	0.5	-	-	-
IVCN	2.9	4.2	4.3	0.5	-	-	-
Forecasts	8	6	4	2	0	0	0

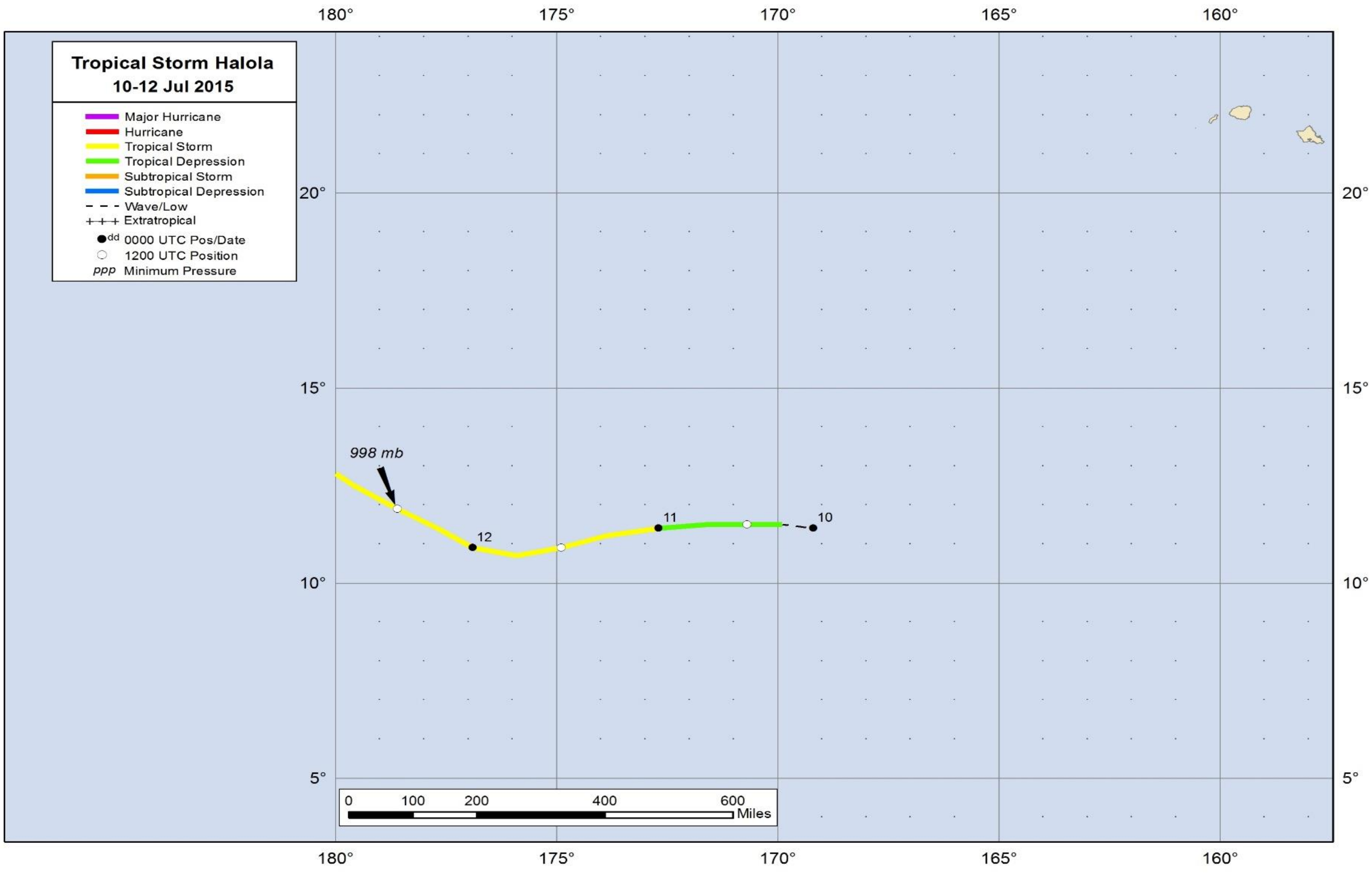

Figure 1. Best track positions for Tropical Storm Halola, 10-12 July 2015. Halola persisted as a tropical cyclone to the west of the International Date Line, outside of the Central Pacific Hurricane Center area of responsibility.