



CENTRAL PACIFIC HURRICANE CENTER TROPICAL CYCLONE REPORT

TROPICAL CYCLONES 1998

Central Pacific Hurricane Center

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NOTE: The following is **NOT** official information. For the official information source, please obtain the NOAA TECHNICAL MEMORANDUM NWSTM PR-45.

INTRODUCTION

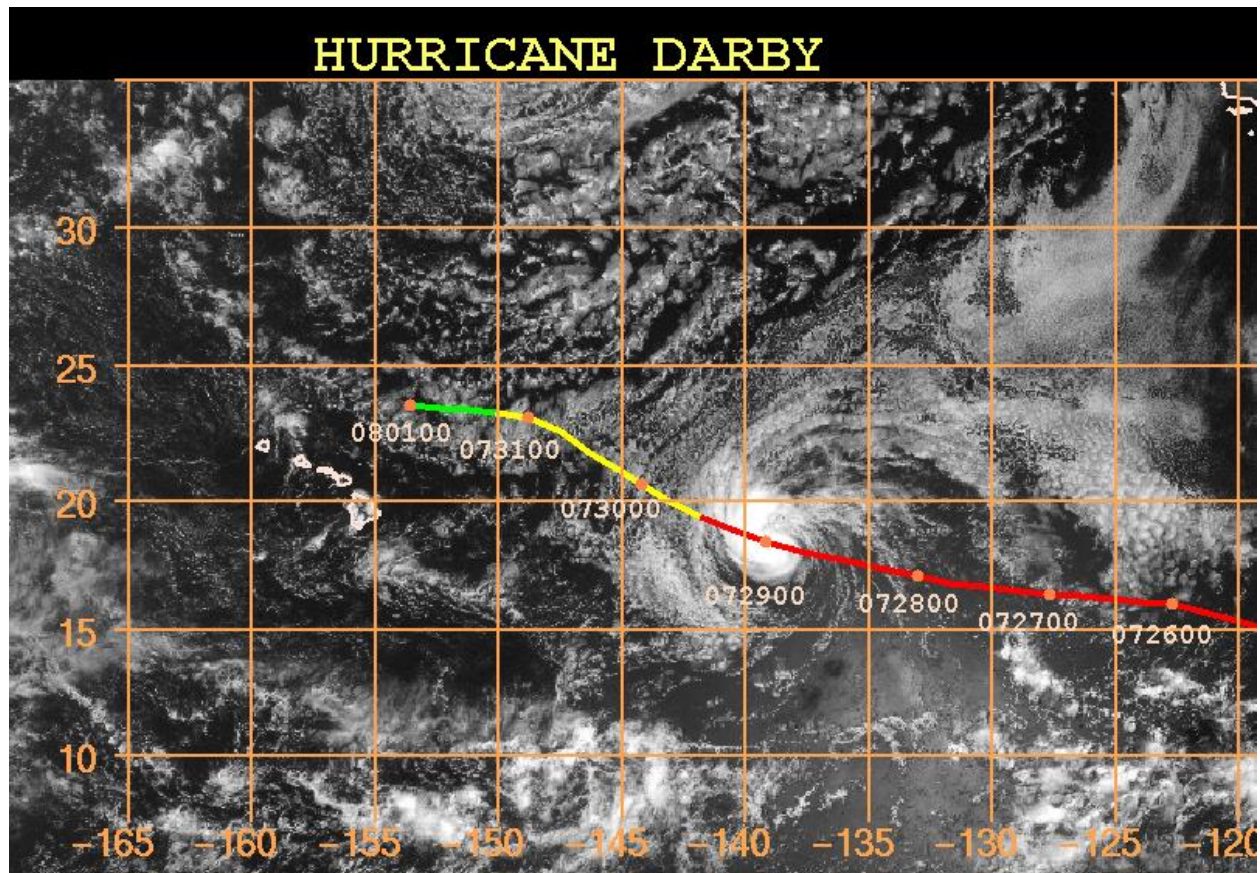
During the 1998 Central Pacific tropical cyclone season, sea surface temperatures in the Eastern and Central Pacific were near or slightly below normal, except near the equator where there were negative anomalies between 1-2 degrees Celsius. In the vicinity of the Hawaiian Islands, sea surface temperatures were near normal.

Three tropical cyclones were observed in the Central Pacific during 1998, one hurricane and two tropical depressions. This is below the 37 year average of 4.5 and substantially less than the 9 tropical cyclones in 1997. The three tropical cyclones occurred during a short period from July 28 through August 18. This is in contrast to the 1998 Atlantic tropical cyclone season in which there was a very active period from the middle of August into November.

Tropical cyclones for 1998 began with Hurricane Darby on July 28-31 and ended with Tropical Depression One-C on August 16-18. July 28 was the first hurricane day in the Central Pacific since Hurricane Kristy on September 1, 1994.

HURRICANE DARBY

JULY 28-31, 1998



HISTORY. Tropical Depression Five-E formed south of Manzanillo, Mexico on July 22 near 13N 113W. It moved west northwest and became Tropical Storm Darby on July 23 near 13N 114W. The storm further intensified and became a hurricane on July 24 near 14N 117W. Maximum sustained winds peaked at 105 knots on July 27 and then began to weaken.

Darby continued on a west northwest track and crossed into the Central Pacific near 19N 141W on the evening of July 28. Maximum sustained winds were 65 knots and Darby became the first Eastern Pacific tropical cyclone to enter the Central Pacific as a hurricane since Kristy in August 1994. Six hours later, Darby was downgraded to a tropical storm.

The storm continued toward the west northwest and dissipated near 24N 154W or about 300 miles north northeast of the Big Island of Hawaii on the afternoon of July 30. Remnants of the tropical depression passed north of the Hawaiian Islands and did not affect weather over the island chain.

SYNOPTIC SITUATION (July 28 - July 31, 1998)

SURFACE. A strong 1033 hectopascal (hPa) high pressure area was centered near 40N 155W with a ridge extending southeast to 25N 120W and southwest through 30N 180. Although the

high moved slowly southwest, the ridge remained nearly stationary and favored a movement of the storm toward the west northwest.

Sea surface temperatures along the storm's track in the Central Pacific were near normal at approximately 24 degrees Celsius.

UPPER LEVELS. At 250 hPa, west winds near 40 knots prevailed over the Hawaiian Islands east to 150W and became southwest at approximately 40 knots east of 150W. The storm encountered shearing as it came under the influence of the southwest flow when it crossed into the Central Pacific. It further weakened as it moved west northwest and came under the influence of stronger westerly flow.

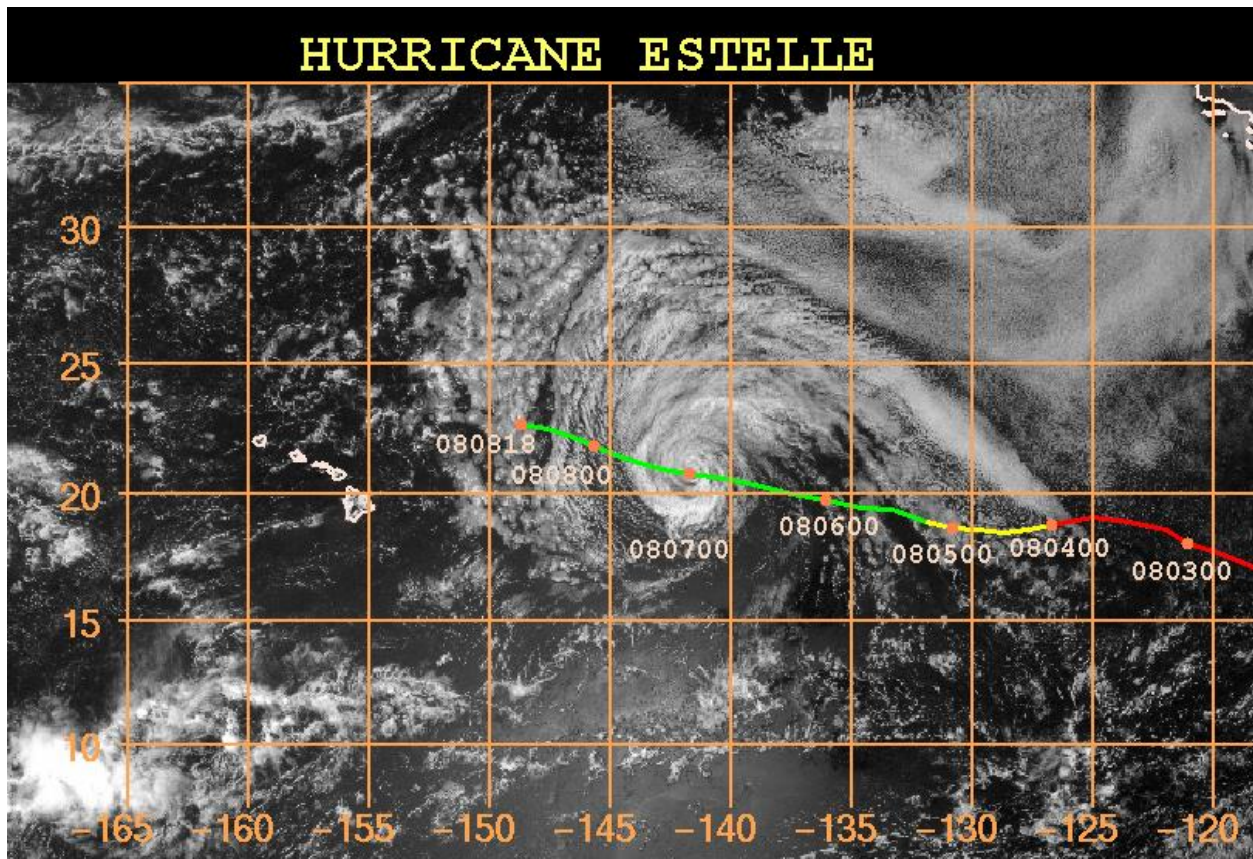
SATELLITE DATA. Hurricane Darby crossed 140W with cumulus and cumulonimbus clouds that extended 200 miles from the center. As the system moved west northwest, the deep convection and associated thunderstorms dissipated northeast of the Hawaiian Islands.

The following is the best track data for Hurricane Darby. Included are the maximum sustained wind values for each period.

Date/Time(Z)	Latitude (N)	Longitude (W)	Max Winds (KT)
07/29/0600	18.9	140.6	65
1200	19.4	141.8	60
1800	20.0	143.1	50
07/30/0000	20.6	144.2	45
0600	21.2	145.2	40
1200	21.8	146.3	40
1800	22.6	147.5	35
07/31/0000	23.1	148.8	35
0600	23.3	150.1	30
1200	23.4	151.2	25
1800	23.5	152.4	25
08/01/0000	23.6	153.6	25

TROPICAL DEPRESSION ESTELLE

AUGUST 6-8, 1998



HISTORY. Tropical Depression Six-E formed on July 29 southeast of Manzanillo, Mexico near 15N 101W. It moved west and became Tropical Storm Estelle on July 29 near 15N 104W. The storm further intensified and became a hurricane on July 30 near 15N 108W. Maximum sustained winds peaked at 115 knots on August 2 and then began to weaken.

Estelle generally moved west northwest and was downgraded to a tropical storm on August 4 near 19N 129W and a tropical depression on August 5 near 20N 134W. The system moved into the Central Pacific on the afternoon of August 6.

In the Central Pacific, Tropical Depression Estelle continued to weaken as it moved toward the west northwest. The final advisory was issued on the morning of August 8 when it was located near 23N 149W or about 400 miles east northeast of the Big Island of Hawaii. A well defined low level circulation persisted for about a week. The proximity of former Tropical Depression Estelle, as it passed to the north of the Hawaiian Islands, produced a decrease in normal trade wind conditions. Instead, light winds with sea breezes during the day and land breezes at night occurred. Showers from rain bands, associated with the persistent low level circulation, affected Kauai and Oahu.

SYNOPTIC SITUATION (August 6-8, 1998)

SURFACE. A strong 1033 hPa high pressure area was centered near 38N 172W with ridges extending to the southwest through 20N 160E and east to the mainland Pacific Northwest.

Although the high pressure area moved northeast, the ridges remained nearly stationary and favored a movement of the storm to the west or west northwest.

Sea surface temperatures near the storm were between 24 and 25 degrees Celsius or near normal.

UPPER LEVELS. At 250 hPa, southwest winds were occurring over the Hawaiian Islands and eastward through 140W. As the depression approached 145W, it was sheared by the southwest winds.

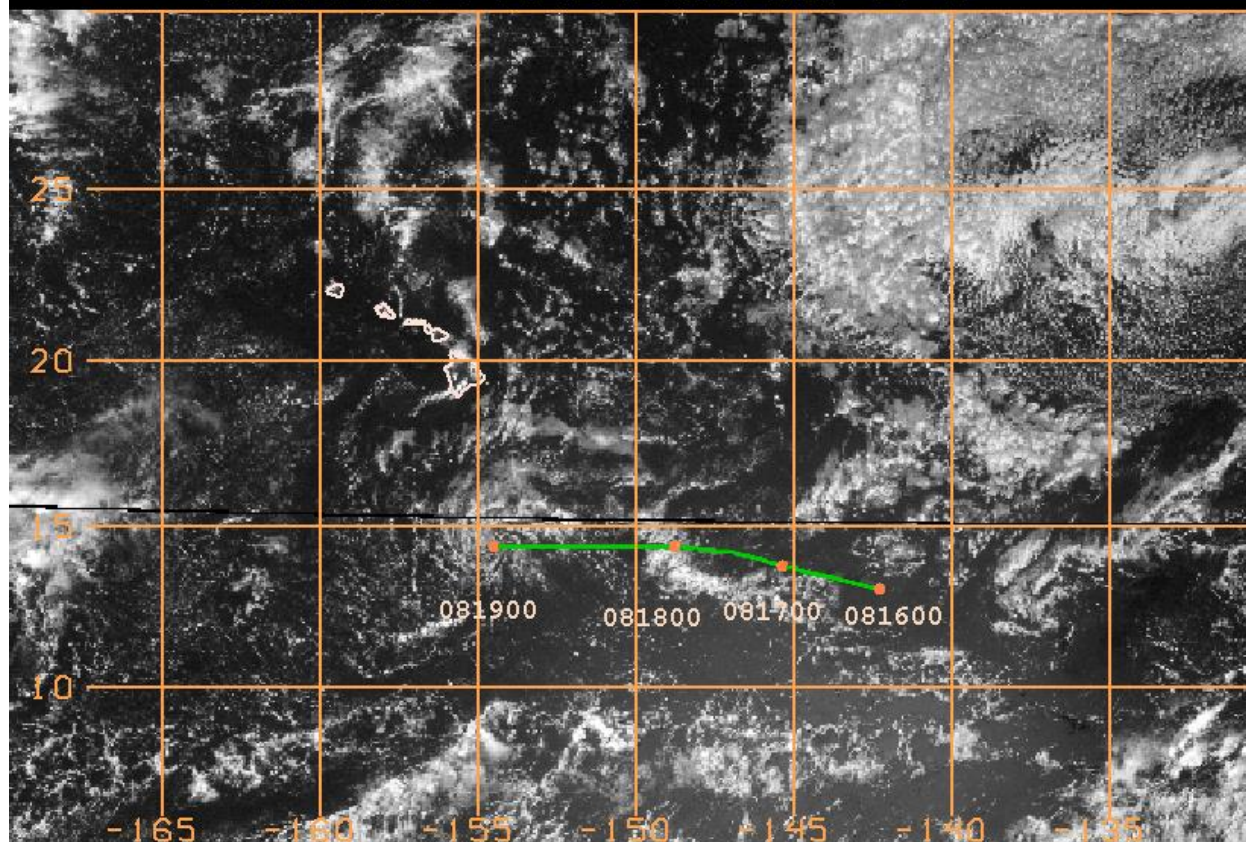
SATELLITE DATA. Tropical Depression Estelle crossed 140W with a well defined low level circulation center. A broad area of cumulus and stratocumulus clouds extended about 350 miles northwest of the center. A 60-mile wide spiral of deep convection extended from the center to points 120 miles west, 150 miles north and 180 miles east of the center. When the depression crossed 145W, most of the cumulus and stratocumulus had dissipated with a few thunderstorms persisting as far as 120 miles northeast of the center.

The following is the best track data for Tropical Depression Estelle. Included are the maximum sustained wind values for each period.

Date/Time(Z)	Latitude (N)	Longitude (W)	Max Winds (KT)
08/06/1800	20.6	140.3	30
08/07/0000	20.8	141.7	30
0600	21.0	142.9	30
1200	21.3	144.0	30
1800	21.6	144.9	25
08/08/0000	21.9	145.7	25
0600	22.2	146.6	25
1200	22.5	147.6	25
1800	22.7	148.7	25

TROPICAL DEPRESSION ONE-C AUGUST 16-18, 1998

TROPICAL DEPRESSION 1-C



HISTORY. Tropical Depression One-C developed during the morning of August 16 along a northward bulge of the near equatorial trade wind convergence zone about 1000 miles southeast of the Hawaiian Islands near 14N 147W. It moved toward the west northwest until August 18 when it turned west. The system did not attain tropical storm strength. The final advisory was issued on the afternoon of August 18 when the depression was about 365 miles south of Hilo on the Big Island of Hawaii.

SYNOPTIC SITUATION (August 16 - August 18, 1998)

SURFACE. A moderate 1031 hPa high pressure area was centered near 43N 160W with ridges extending west southwest from the center to near 30N 180 and east southeast to a 1026 hPa high pressure area near 38N 148W. The northern high pressure center moved slowly northeast and the second center moved east. However, the ridges remained nearly stationary and this favored a movement of the depression toward the west northwest and west. Sea surface temperatures along the path of the depression were near normal at 26 degrees Celsius.

UPPER LEVELS. The wind flow was light at all levels near the depression. At 250 hPa, a jet stream was on the southeast side of a trough that extended from 40N 160W through 30N 170W. The depression came under the influence of this southwest flow as it approached 155W. This shearing environment inhibited further development and, therefore, a tropical storm did not develop.

SATELLITE DATA. Tropical Depression One-C formed in the Central Pacific near 11N 165W with isolated cumulonimbus clouds within 100 nautical miles of the center in the northeast and west quadrants. Visual imagery showed an exposed low level center. The cumulonimbus clouds dissipated the first day, but reformed in the northeast quadrant the following day. On August 18, very isolated cumulonimbus clouds were all that remained.

The following is the best track data for Tropical Depression One-C. Included are the maximum sustained wind values for each period.

Date/Time(Z)	Latitude (N)	Longitude (W)	Max Winds (KT)
08/16/1200	13.4	143.7	30
1800	13.6	144.6	30
08/17/0000	13.8	145.4	30
0600	14.0	146.1	30
1200	14.2	146.9	25
1800	14.3	147.8	25
08/18/0000	14.4	148.8	25
0600	14.4	149.9	25
1200	14.4	151.2	25
1800	14.4	152.7	25
08/19/0000	14.4	154.5	25

VERIFICATION STATISTICS

This section contains track forecast and intensity verification statistics for Hurricane Darby, Tropical Depression Estelle, and Tropical Depression One-C. All systems dissipated prior to 72 hours of crossing 140W and, therefore, there are no data for the 72-hour forecast point. Given the limited data set and the dissipating stages of the storms, the verification statistics are of limited value. The GFDL had limited number of forecasts, because, with one exception, the model dissipated the first two systems in 24 hours or less.

For Hurricane Darby, CLIPER showed the best overall track forecast skill for this storm with errors of less than 100 miles through 48 hours.

For intensity, there was little difference in errors, except for the 48 hour SHIP forecast where the sample size was small.

The following track forecast verification statistics are for Hurricane Darby for 12, 24, 36, and 48 hours. The first number is the position error in nautical miles and the number in parentheses is the number of forecasts.

Forecast/Model	12	24	36	48	72
CPHC	38(10)	79(8)	98(6)	118(4)	NA
CLIP	38(10)	71(8)	95(6)	70(4)	NA
BAMD	47(10)	132(8)	184(6)	310(4)	NA
BAMM	49(10)	94(8)	109(6)	168(4)	NA
BAMS	52(10)	87(8)	112(6)	158(4)	NA
P91E	39(10)	56(8)	107(6)	203(4)	NA
LBAR	49(10)	81(8)	172(6)	304(4)	NA
GFDL	46(2)	127(2)	97(1)	95(1)	NA

The following intensity verification statistics are for Hurricane Darby for 12, 24, 36, and 48 hours. The first number is the intensity error in knots and the number in parentheses is the number of forecasts.

Forecast/Model	12	24	36	48	72
CPHC	3.5(10)	5.6(8)	4.2(6)	3.5(4)	NA
SHIFR	2.8(9)	4.4(8)	4.2(6)	5.0(4)	NA
SHIP	3.0(9)	3.6(7)	5.0(2)	10.0(1)	NA

For Tropical Depression Estelle, CLIP and P91E were the best performers.

For intensity, CPHC was the best overall performer, although the sample size was small and intensities were not large.

The following track forecast verification statistics are for Tropical Depression Estelle for 12, 24, 36, and 48 hours. The first number is the position error in nautical miles and the number in parentheses is the number of forecasts.

Forecast/Model	12	24	36	48	72
CPHC	34(7)	73(5)	105(3)	123(1)	NA
CLIP	14(7)	40(5)	62(3)	53(1)	NA
BAMD	60(7)	89(5)	129(3)	166(1)	NA
BAMM	39(7)	64(5)	79(3)	97(1)	NA
BAMS	34(7)	61(5)	96(3)	147(1)	NA
P91E	16(7)	28(5)	42(3)	61(1)	NA
LBAR	59(7)	76(5)	101(3)	127(1)	NA
GFDL	19(2)	NA	NA	NA	NA

The following intensity verification statistics are for Tropical Depression Estelle for 12, 24, 36, and 48 hours. The first error is the intensity error in knots and the number in parentheses is the number of forecasts.

Forecast/Model	12	24	36	48	72
CPHC	1.4(7)	2.0(5)	3.7(3)	0.0(1)	NA
SHIFR	0.0(7)	2.0(5)	8.0(3)	NA	NA
SHIP	1.4(7)	5.0(2)	5.0(1)	NA	NA

For Tropical Depression One-C, all models through 48 hours had track forecast errors of less than 200 nautical miles, except for the CLIP at 48 hours. It appears that the CLIP may have been contaminated on the initial model run in which there were errors of 189, 305, 371, and 468 nautical miles at 12, 24, 36, and 48 hours respectively. The other eight model runs had CLIP errors of 44, 79, 103, and 182 miles for 12, 24, 36, and 48 hours respectively. The CPHC forecaster had the lowest track forecast errors for all time periods, except for the 36 hour BAMD, which had an error of 70, three miles fewer than the CPHC.

For intensity, the SHIFR was the best overall performer. However, sample sizes were again small and intensities were not large.

The following track forecast verification statistics are for Tropical Depression One-C for 12, 24, 36, and 48 hours. The first number is the position error in nautical miles and the number in parentheses is the number of forecasts.

Forecast/Model	12	24	36	48	72
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CPHC	43(9)	61(7)	73(5)	102(3)	NA
CLIPER	61(9)	111(7)	157(5)	277(3)	NA
BAMD	45(9)	67(7)	70(5)	170(3)	NA
BAMM	47(9)	73(7)	84(5)	121(3)	NA
BAMS	60(9)	124(7)	124(5)	161(3)	NA
P91E	53(9)	94(7)	94(5)	197(3)	NA
LBAR	48(9)	85(7)	85(5)	153(3)	NA
GFDL	NA	NA	NA	NA	NA

The following intensity verification statistics are for Tropical Depression One-C for 12, 24 36, 48, and 72 hours. The first number is the intensity error in knots and the number in parentheses is the number of forecasts.

Forecast/Model	12	24	36	48	72
CPHC	2.2(9)	5.0(7)	8.0(5)	15.0(3)	NA
SHIFR	1.1(9)	4.3(7)	8.0(5)	13.3(3)	NA
SHIP	3.3(9)	12.9(7)	20.0(5)	26.9(3)	NA

ACRONYMS that may have been used in this report.

Acronym	Full Spelling/Definition
AOR	Area of Responsibility
AVNO	Operation global forecast system model
BAMD	Deep Layer Beta Advection Model (mean layer averaged between 850 hPa and 250 hPa)
BAMM	Medium Layer Beta Advection Model (mean layer averaged between 850 hPa and 400 hPa)
BAMS	Shallow Layer Beta Advection Model (mean layer averaged between 850 hPa and 700 hPa)

CLIP	Climatology and Persistence
CPHC	Central Pacific Hurricane Center
GFDL	Geophysical Fluid Dynamics Laboratory model
hPa	Hectopascal (formerly millibar)
ITCZ	Inter-tropical Convergence Zone
JTWC	Joint Typhoon Warning Center
kts	knots
LBAR	Barotropic limited area sine transform
mb	millibars
NA	Not Available
NGPS	NOGAPS (Navy Operational Global Atmospheric Prediction System) Vortex Tracking Routine
NHC	National Hurricane Center
nm	nautical miles
P91E	Pacific Statistical Dynamic Model (adapted from NHC90 for the Eastern Pacific)
SHIFR	Statistical Hurricane Intensity Forecast
SHIP	Statistical Hurricane Intensity Prediction
SST	Sea Surface Temperature
TD	Tropical Depression
TPC	Tropical Prediction Center, Miami, FL
TUTT	Tropical Upper Tropospheric Trough
UTC	Universal Time Coordinated
WFO	Weather Forecast Office

TRACK MAPS

The above track maps show tracks of tropical cyclones that crossed into or formed in the Central Pacific. The strength of the storm (HURRICANE, TYPHOON, DEPRESSION) is the maximum strength, regardless of location in the Pacific. The maximum sustained winds (MAX SUST WINDS) occurred: (1) in the Eastern Pacific before crossing into the Central Pacific or (2) in the Central Pacific for systems that formed in the Central Pacific. For each track point, the top five or six numbers give the month, day, and time (Z) and the bottom number indicates the maximum sustained speed in knots.

For example, the numbers 71218 and 25 define the following: July 12 at 1800Z and sustained winds of 25 knots.