

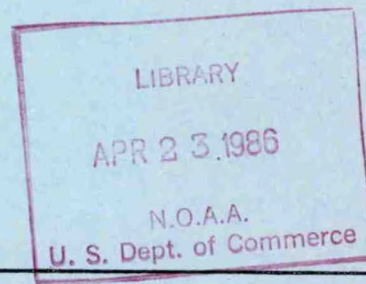
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NOAA TECHNICAL MEMORANDUM NWSTM PR-30



1984 TROPICAL CYCLONES - CENTRAL NORTH PACIFIC

Honolulu, HI
March 1986



**U.S. DEPARTMENT OF
COMMERCE**

National Oceanic and
Atmospheric Administration

National Weather
Service

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- No. 1 The Trade Wind Regime of Central and Western Maui. Carl M. Peterson. January 1966.
- No. 2 A Meteorological Glossary of Terms Used by Forecasters in Hawaii (Revised). R. F. Shaw. November 1967.
- No. 3 Utilization of Aircraft Meteorological Reports at WBFC Honolulu. E. M. Chadsey, P. R. Moore, R. E. Rush, J. E. Smith, J. Vederman. June 1967.
- No. 4 Tropical Numerical Weather Prediction in Hawaii - A Status Report. E. M. Carlstead. November 1967. (PB-183-621)
- No. 5 A Computer Method to Generate and Plot Streamlines. Roger A. Davis. February 1969. (PB-183-622)
- No. 6 Verification of an Objective Method to Forecast Frontal Passages in the Hawaiian Islands. E. M. Carlstead. September 1969.
- No. 7 Meteorological Characteristics of the Cold January 1969 in Hawaii. Richard I. Sasaki. November 1969. (PB-188-040)
- No. 8 Giant Waves Hit Hawaii. Jack D. Bottoms. September 1970. (COM-71-00021)
- No. 9 Tropical Numerical Weather Prediction in Hawaii - 1971. E. M. Carlstead. March 1971. (COM-71-00494)

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NOAA TECHNICAL MEMORANDUM NWSTM PR-30

1984 TROPICAL CYCLONES - CENTRAL NORTH PACIFIC

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Honolulu, HI
March 1986

CENTRAL NORTH PACIFIC TROPICAL CYCLONE DATA, 1984¹

| <u>NAME</u> | <u>DATES</u> | <u>MAXIMUM CLASS</u> | <u>MAXIMUM SUSTAINED WINDS (KT)</u> | <u>LOWEST PRESSURE (MB)</u> | <u>TOTAL HOURS OBSERVED</u> |
|-------------|----------------|----------------------|-------------------------------------|-----------------------------|-----------------------------|
| DOUGLAS | Jul 3-6 | Tropical Depression | E30 (SFSS) | N/A | 66 (TD) |
| KELI | Aug 16-21 | Hurricane | E100 (SFSS, RECCE) | 974 (RECCE) | 78 (H), 42 (TS), 6 (TD) |
| KENNA | Aug 18-20 | Tropical Storm | E50 (SFSS, RECCE) | 1005 (RECCE) | 24 (TS), 6 (TD) |
| IALA | Aug 26 - Sep 2 | Tropical Storm | E40 (SFSS) | N/A | 18 (TS), 150 (TD) |
| MOKE | Sep 3-4 | Tropical Storm | E45 (SFSS) | N/A | 18 (TS) |

Key

H Hurricane

TS Tropical Storm

TD Tropical Depression

Total hours per observed class:

H 36

TS 84

TD 12

¹Data pertains only to period tropical cyclone was in the central Pacific

TROPICAL DEPRESSION DOUGLAS

July 3 - 6, 1984

T. D. DOUGLAS entered the Central Pacific Hurricane Center's (CPHC) area of responsibility on July 3 near 18N 140W with sustained winds of 30 knots near its center. DOUGLAS, only a few days earlier, had been a powerful hurricane over the eastern North Pacific. The weakening tropical cyclone moved along a west northwesterly track and continued to lose strength. DOUGLAS's forward motion slowed to a crawl and the system became quasi-stationary near 21N 149W, some 500 miles east of Honolulu. The CPHC issued its last advisory on the dissipating depression on July 6 at 1200 GMT.

The remnant circulation was embedded in the low level trade wind flow and was carried west southwestward toward the islands of Maui and Hawaii on July 8 and 9. The remains of DOUGLAS produced some welcome rainfall over parched areas of Maui and the Big Island of Hawaii. Rainfall amounts of 2 or more inches were reported over the dry slopes of both islands during this period.

The CPHC issued 12 regular advisories on T.D. DOUGLAS. There were no reports of damages or casualties to ships in the area.

1745 03JL84 38A-2 03451 15111 HB20N147W-2



TROPICAL DEPRESSION DOUGLAS

1745 GMT JUL 3, 1984

MAX WINDS 30 KT

160W

155W

150W

145W

140W

25N

06/12Z

05/00Z

04/00Z

06/00Z

LEGEND

A — B — C

A — Speed of Movement

B — Intensity

C — Position at XX/0000Z

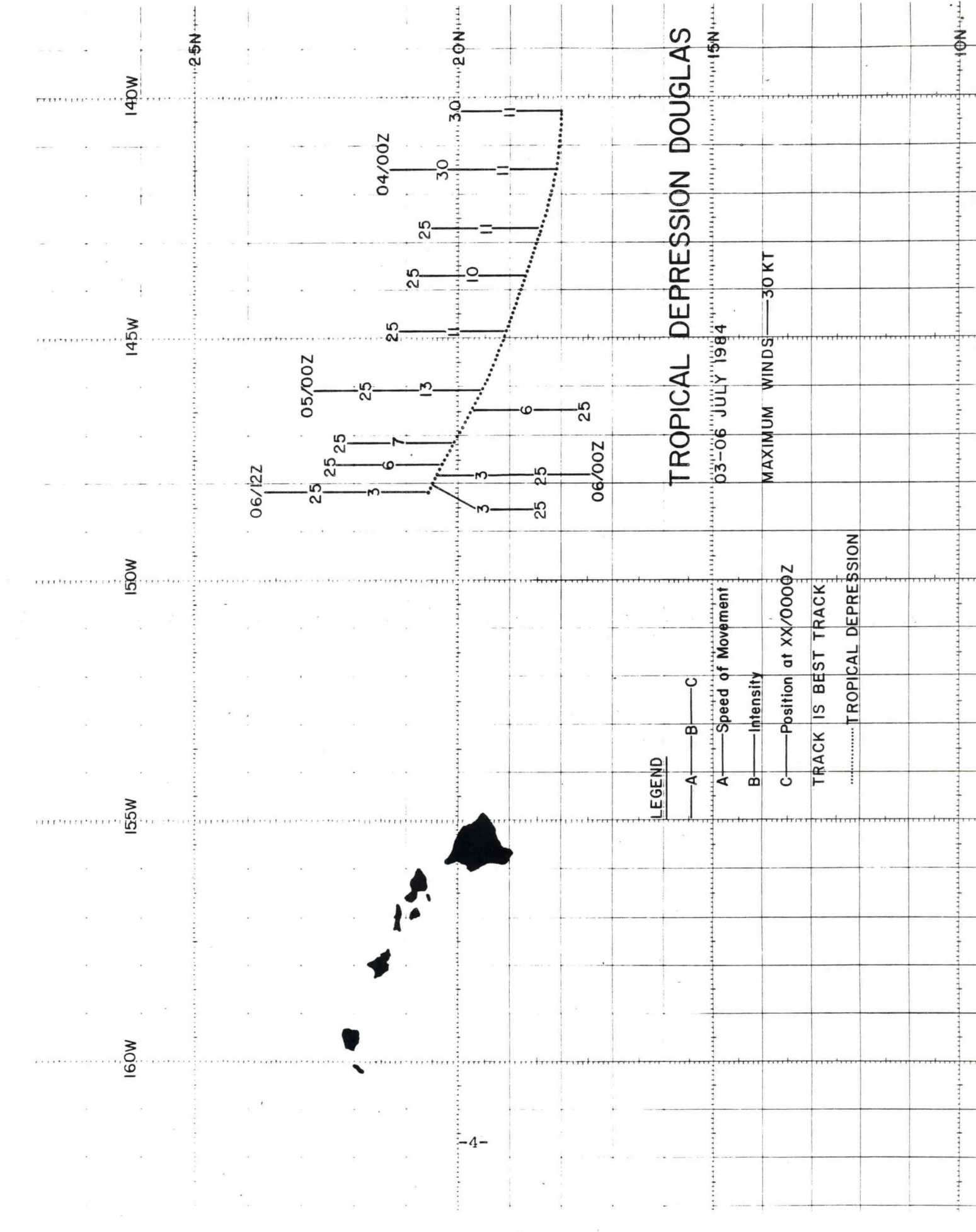
TRACK IS BEST TRACK

..... TROPICAL DEPRESSION

03-06 JULY 1984

TROPICAL DEPRESSION DOUGLAS

MAXIMUM WINDS — 30 KT



HURRICANE KELI
August 16-21, 1984

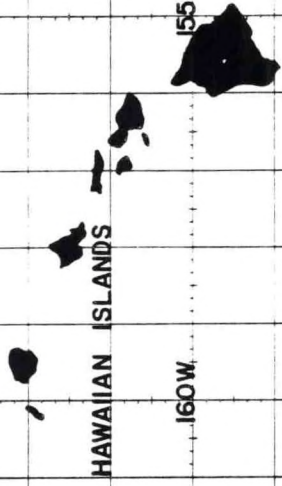
Hurricane KELI began as Tropical Depression 01C on August 16. The Central Pacific Hurricane Center (CPHC) in Honolulu had been watching a disturbed area along the Intertropical Convergence Zone (ITCZ) to the south southeast of Hawaii for several days. The disturbance showed definite signs of organization and strengthening so the first advisory on T.D. 01C was issued by the CPHC on August 16 at 1800 GMT. The system at this time was centered near 9N 150W. The depression developed rapidly to tropical storm strength and was named KELI 6 hours later (170000 GMT) by the CPHC.

KELI moved westward at a rather low latitude between 9N and 11N while gaining strength and was upgraded to a hurricane at 180000 GMT near 11N 158W. KELI moved along a path which took it well south of the Hawaiian Islands. However, KELI took aim at and was moving toward the tiny atoll of Johnston Island. A U.S. Air Force reconnaissance aircraft fixed KELI's position near 14N 169W at about 200000 GMT as it approached Johnston Island and measured maximum sustained winds of 100 knots near the hurricane's center. About this time, a trough aloft was starting to make its presence felt on KELI as the upper reaches of the circulation were being pulled northward toward Johnston Island while the trade winds were carrying the lower portion of the circulation westward. The shearing stresses were now causing KELI to weaken rapidly.

Closest point of approach to Johnston Island was about 70 miles to the southwest at 201800 GMT. Lowest pressure reported at the Johnston Island weather station was 1009 millibars at 201500Z when KELI was directly south of the island and slightly more intense. Strongest winds reported were two gusts of 34 knots recorded between 202200 and 202400 GMT. KELI at this time was approximately 100 miles south of Johnston. The Johnston tide recorder showed no unusual high water or surges. Rainfall totaled about 1 inch. No damage due to winds or water was reported by personnel stationed on Johnston, however, the island's military commander ordered an evacuation of all personnel to Honolulu as a precautionary measure.

KELI's low level circulation separated out from under its upper circulation and started to move westward after passing Johnston Island. The CPHC issued its final advisory on the rapidly dissipating cyclone late on the 21st near 18N 173W.

The CPHC issued 22 advisories on KELI. No damages or casualties to shipping were reported.



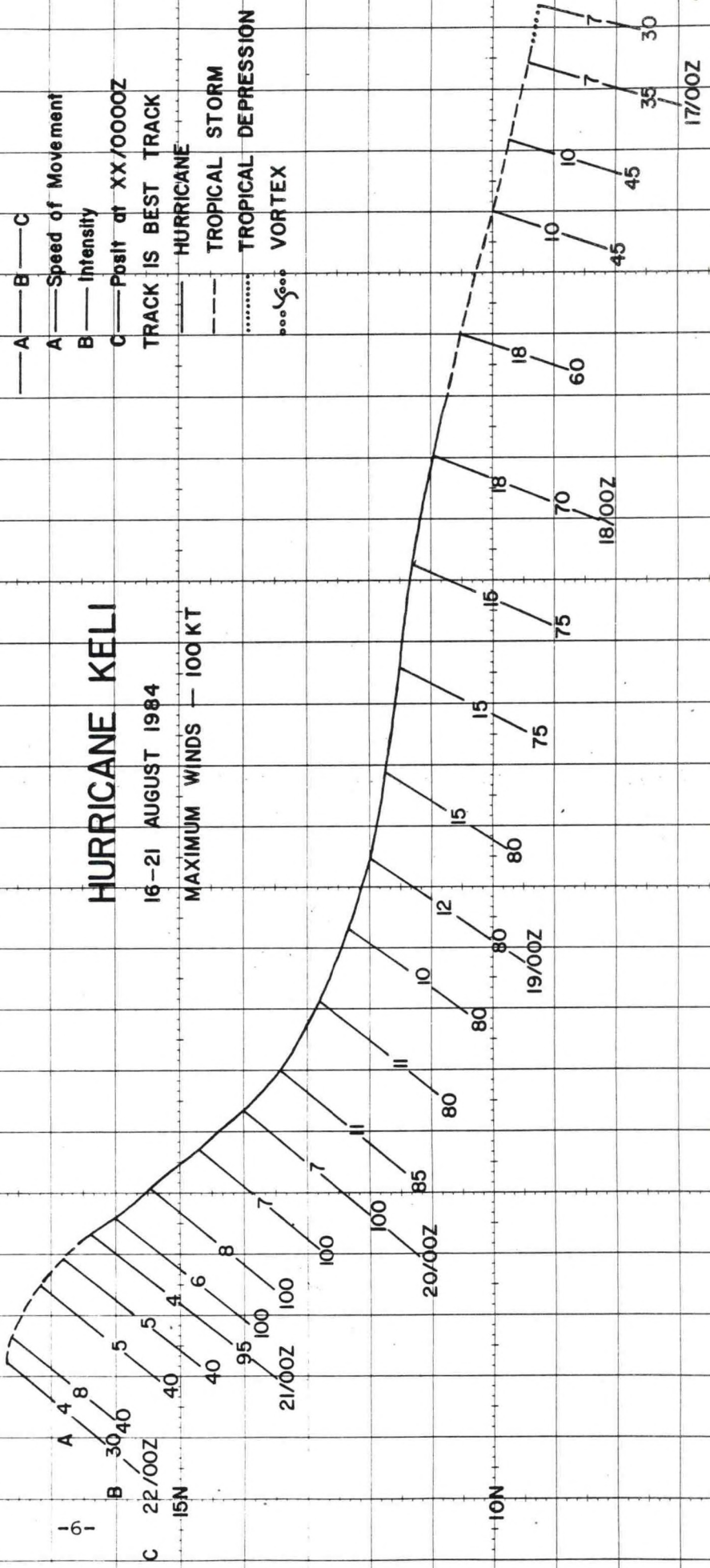
HAWAIIAN ISLANDS

20N 170W 165W 160W 155W 150W

HURRICANE KELI

16-21 AUGUST 1984

MAXIMUM WINDS — 100 KT



HURRICANE KELI - August 16-21, 1984

| DTG | Best Track | Actual Track | Error |
|--------|---------------|-----------------|-------|
| GMT | N/W | N/W | NM |
| 161800 | 9.3 | 9.3 | |
| | 150.7 | 150.7 | 0 |
| 170000 | 9.4 | 9.4 | |
| | 151.6 | 151.6 | 0 |
| 170600 | 9.7 | 9.7 | |
| | 152.8 | 152.8 | 0 |
| 171200 | 10.0 | 10.0 | |
| | 154.0 | 154.0 | 0 |
| 171800 | 10.5 | 10.5 | |
| | 156.0 | 155.5 | 29 |
| 180000 | 10.9 | 10.8 | |
| | 158.0 | 158.0 | 6 |
| 180600 | 11.4 | 11.4 | |
| | 159.7 | 159.7 | 0 |
| 181200 | 11.5 | 12.0 | |
| | 161.4 | 161.4 | 30 |
| 181800 | 11.8 | 11.8 | |
| | 163.1 | 163.0 | 6 |
| 190000 | 12.0 | 12.0 | |
| | 164.5 | 164.5 | 0 |
| 190600 | 12.3 | 12.2 | |
| | 165.7 | 165.8 | 8 |
| 191200 | 12.8 | 12.3 | |
| | 166.9 | 167.3 | 38 |
| 191800 | 13.4 | 13.4 | |
| | 168.0 | 168.0 | 0 |
| 200000 | 14.0 | 14.0 | |
| | 168.7 | 168.7 | 0 |
| 200600 | 14.7 | 14.4 | |
| | 169.3 | 169.6 | 25 |
| 201200 | 15.5 | 15.4 | |
| | 169.9 | 170.0 | 8 |
| 201800 | 16.0 | 15.9 | |
| | 170.4 | 170.4 | 6 |
| 210000 | 16.4 | 16.8 | |
| | 170.7 | 170.8 | 24 |
| 210600 | 16.8 | 16.9 | |
| | 171.1 | 170.8 | 18 |
| 211200 | 17.2 | 17.5 | |
| | 171.5 | 171.3 | 21 |
| 211800 | 17.6 | 17.9 | |
| | 172.4 | 172.2 | 21 |

Average Distance Error 12

HURRICANE KELI - August 16-21, 1984

| DTG | 24 HOUR FORECAST POSITION | | | | | | | 24 HOUR FORECAST ERROR | | | | | | |
|--------|---------------------------|-------|-------|-------|-------|-------|-------|------------------------|------|-----|-----|-----|-----|------|
| | CPHC | EP | EP | EP | EP | MFM | NTCM | CPHC | EP | EP | EP | EP | MFM | NTCM |
| | | HC77 | HC81 | ANLG | CL84 | | | | HC77 | H81 | ANG | C84 | | |
| GMT | N/W | N/W | N/W | N/W | N/W | N/W | NW | NM | NM | NM | NM | NM | NM | NM |
| 171800 | 9.5 | 10.0 | | 10.5 | 9.1 | | 8.9 | 67 | 38 | | 29 | 135 | | 102 |
| | 156.0 | 155.9 | | 156.0 | 157.3 | | 154.9 | | | | | | | |
| 180000 | 9.6 | 10.6 | 10.1 | 10.6 | 9.2 | 10.6 | 9.3 | 109 | 106 | 103 | 106 | 107 | 13 | 130 |
| | 156.6 | 156.2 | 156.4 | 156.2 | 157.2 | 158.1 | 156.4 | | | | | | | |
| 180600 | 10.8 | 11.3 | | 10.8 | 10.4 | | 10.2 | 64 | 153 | | 151 | 132 | | 133 |
| | 158.8 | 157.1 | | 157.2 | 157.7 | | 157.8 | | | | | | | |
| 181200 | 10.8 | 11.9 | 11.4 | 11.2 | 10.6 | 11.4 | 10.1 | 174 | 170 | 156 | 194 | 222 | 84 | 293 |
| | 158.7 | 158.5 | 158.8 | 158.2 | 157.9 | 160.1 | 156.8 | | | | | | | |
| 181800 | 12.5 | 12.2 | | 11.5 | 11.3 | | 11.3 | 180 | 236 | | 224 | 202 | | 138 |
| | 160.0 | 159.0 | | 159.2 | 159.6 | | 160.7 | | | | | | | |
| 190000 | 12.7 | 12.4 | 11.9 | 12.0 | 12.3 | 12.3 | 11.8 | 108 | 74 | 47 | 99 | 78 | 55 | 77 |
| | 162.8 | 163.3 | 163.7 | 162.8 | 163.2 | 163.6 | 163.2 | | | | | | | |
| 190600 | 13.6 | 13.2 | | 12.7 | 13.0 | | 12.9 | 96 | 61 | | 60 | 53 | | 58 |
| | 165.0 | 165.6 | | 164.9 | 165.4 | | 165.1 | | | | | | | |
| 191200 | 14.1 | 13.7 | 13.3 | 13.6 | 13.8 | | 13.1 | 139 | 84 | 60 | 78 | 90 | | 49 |
| | 165.8 | 167.2 | 167.4 | 167.1 | 167.3 | | 167.1 | | | | | | | |
| 191800 | 13.6 | 12.6 | | 13.1 | 13.5 | | 13.3 | 31 | 56 | | 39 | 13 | | 18 |
| | 168.5 | 168.5 | | 168.6 | 168.2 | | 168.3 | | | | | | | |
| 200000 | 12.6 | 13.0 | 12.6 | 13.3 | 13.5 | | 13.1 | 130 | 87 | 121 | 54 | 70 | | 88 |
| | 170.4 | 169.8 | 170.2 | 169.3 | 169.8 | | 169.9 | | | | | | | |
| 200600 | 12.8 | 13.7 | | 13.4 | 13.6 | | 13.5 | 146 | 102 | | 83 | 99 | | 97 |
| | 171.5 | 171.2 | | 170.6 | 171.1 | | 171.0 | | | | | | | |
| 201200 | 13.0 | 13.6 | 13.0 | 13.5 | 13.3 | 13.0 | | 249 | 190 | 196 | 167 | 188 | 148 | |
| | 173.5 | 172.7 | 172.3 | 172.1 | 172.4 | 170.6 | | | | | | | | |
| 201800 | 15.5 | 15.6 | | 14.8 | 15.3 | | | 123 | 116 | | 100 | 93 | | |
| | 172.5 | 172.4 | | 171.7 | 171.9 | | | | | | | | | |
| 210000 | 15.5 | 16.1 | | 15.4 | 15.6 | 16.3 | | 100 | 101 | | 120 | 92 | 32 | |
| | 171.9 | 172.4 | | 172.3 | 171.8 | 171.0 | | | | | | | | |
| 210600 | 16.4 | 16.3 | | 16.0 | 17.0 | | | 175 | 159 | | 137 | 137 | | |
| | 173.8 | 173.5 | | 173.0 | 173.2 | | | | | | | | | |
| 211200 | 18.5 | 18.0 | 17.2 | 17.2 | 17.5 | 18.7 | | 72 | 134 | 82 | 49 | 40 | 91 | |
| | 170.6 | 173.6 | 172.7 | 172.1 | 172.0 | 170.3 | | | | | | | | |
| 211800 | 18.9 | 19.2 | | 17.8 | 19.3 | | | 61 | 96 | | 13 | 123 | | |
| | 172.4 | 173.2 | | 172.4 | 170.6 | | | | | | | | | |

Average Distance Errors

119 116 110 101 111 71 108

HURRICANE KELI - August 16-21, 1984

| DTG | 48 HOUR FORECAST POSITION | | | | | | | 48 HOUR FORECAST ERROR | | | | | | | |
|--------|---------------------------|-------|-------|-------|-------|-------|------|------------------------|------|-----|-----|-----|-----|------|-----|
| | CPHC | EP | EP | EP | EP | MFM | NTCM | CPHC | EP | EP | EP | EP | MFM | NTCM | |
| | | HC77 | HC81 | ANLG | CL84 | | | | HC77 | HB1 | ANG | C84 | | | |
| GMT | N/W | N/W | N/W | N/W | N/W | N/W | N/W | NM | NM | NM | NM | NM | NM | NM | |
| 181800 | 9.7 | 10.5 | | 11.9 | 10.2 | | | 8.8 | 172 | 203 | | 111 | 227 | | 283 |
| | 161.0 | 159.8 | | 161.1 | 159.5 | | | 159.3 | | | | | | | |
| 190000 | 9.7 | 11.2 | 11.6 | 12.1 | 10.3 | 11.0 | | 9.2 | 238 | 286 | 306 | 223 | 219 | 126 | 257 |
| | 161.2 | 159.7 | 159.3 | 160.7 | 161.2 | 162.6 | | 161.2 | | | | | | | |
| 190600 | 11.9 | 11.9 | | 12.2 | 12.0 | | | 10.3 | 136 | 323 | | 258 | 211 | | 220 |
| | 163.5 | 160.3 | | 161.4 | 162.2 | | | 162.6 | | | | | | | |
| 191200 | 11.9 | 12.6 | 13.2 | 12.7 | 12.4 | 12.2 | | 10.5 | 235 | 340 | 343 | 311 | 281 | 193 | 285 |
| | 163.3 | 161.5 | 161.5 | 162.0 | 162.5 | 164.0 | | 162.8 | | | | | | | |
| 191800 | 14.3 | 13.4 | | 13.0 | 12.9 | | | 11.8 | 336 | 385 | | 281 | 212 | | 165 |
| | 162.3 | 161.4 | | 163.2 | 164.4 | | | 165.7 | | | | | | | |
| 200000 | 14.0 | 13.4 | 12.6 | 13.5 | 13.9 | 13.5 | | 12.2 | 157 | 133 | 189 | 109 | 24 | 81 | 120 |
| | 166.0 | 166.5 | 165.8 | 166.9 | 168.3 | 167.4 | | 167.8 | | | | | | | |
| 200600 | 15.6 | 14.3 | | 14.3 | 14.4 | | | 14.0 | 74 | 46 | | 35 | 75 | | 37 |
| | 169.3 | 168.8 | | 169.0 | 170.9 | | | 169.1 | | | | | | | |
| 201200 | 16.0 | 14.7 | 13.0 | 15.1 | 15.1 | | | 14.2 | 37 | 48 | 149 | 88 | 186 | | 100 |
| | 170.2 | 170.4 | 169.3 | 171.5 | 173.2 | | | 171.2 | | | | | | | |
| 201800 | 14.8 | 13.4 | | 14.6 | 15.2 | | | 15.1 | 191 | 165 | | 164 | 167 | | 125 |
| | 173.5 | 171.6 | | 172.9 | 173.2 | | | 172.4 | | | | | | | |
| 210000 | 13.4 | 13.9 | 13.2 | 14.6 | 15.6 | | | 14.6 | 326 | 212 | 235 | 204 | 235 | | 241 |
| | 175.2 | 172.9 | 172.4 | 173.5 | 174.7 | | | 174.3 | | | | | | | |
| 210600 | 13.6 | 14.6 | | 14.8 | 15.9 | | | 15.6 | 360 | 264 | | 278 | 282 | | 243 |
| | 176.0 | 174.7 | | 175.1 | 175.6 | | | 174.8 | | | | | | | |
| 211200 | 14.8 | 14.5 | 13.8 | 14.8 | 15.4 | 15.4 | | | 526 | 339 | 288 | 335 | 351 | 191 | |
| | 180.0 | 176.3 | 174.5 | 176.4 | 177.0 | 173.8 | | | | | | | | | |
| 211800 | 17.5 | 17.3 | | 16.2 | 17.6 | | | | 286 | 158 | | 220 | 235 | | |
| | 177.2 | 174.9 | | 175.6 | 176.3 | | | | | | | | | | |

Average Distance Errors

237 224 252 202 209 148 189

HURRICANE KELI - August 16-21, 1984

| DTG | 72 HOUR FORECAST POSITION | | | | | | 72 HOUR FORECAST ERROR | | | | | | | |
|--------|---------------------------|------------|------------|------------|------------|-----|------------------------|------|------------|-----------|-----------|-----------|-----|------|
| | CPHC | EP HC77 | EP HC81 | EP ANLG | EP CL84 | MFM | NTCM | CPHC | EP HC77 | EP HB1 | EP ANG | EP C84 | MFM | NTCM |
| GMT | N/W | N/W | N/W | N/W | N/W | N/W | N/W | NM | NM | NM | NM | NM | NM | NM |
| 191800 | 10.0 | 10.4 | | 13.4 | 14.3 | | 8.9 | 269 | 329 | | 204 | 160 | | 362 |
| | 165.0 | 163.3 | | 164.5 | 165.4 | | 163.9 | | | | | | | |
| 200000 | 10.1 | 10.8 | 11.9 | 13.5 | 14.9 | | | 311 | 431 | 367 | 281 | 102 | | |
| | 165.2 | 162.1 | 162.8 | 163.9 | 167.2 | | 166.0 | | | | | | | |
| 200600 | 12.8 | 11.7 | | 13.5 | 15.8 | | 10.1 | 142 | 440 | | 319 | 208 | | 293 |
| | 167.8 | 162.6 | | 164.2 | 166.3 | | 167.2 | | | | | | | |
| 201200 | 13.0 | 12.3 | 13.9 | 14.1 | 16.1 | | 10.1 | 188 | 406 | 298 | 300 | 240 | | 357 |
| | 167.9 | 163.8 | 165.1 | 165.0 | 165.9 | | 167.2 | | | | | | | |
| 201800 | 16.0 | 13.3 | | 14.4 | 16.1 | | 11.9 | 380 | 467 | | 253 | 47 | | 240 |
| | 163.8 | 162.8 | | 166.3 | 169.6 | | 170.3 | | | | | | | |
| 210000 | 15.0 | 12.3 | 12.3 | 14.8 | 16.2 | | 12.0 | 194 | 277 | 270 | 122 | 72 | | 291 |
| | 168.0 | 169.7 | 170.9 | 170.4 | 169.7 | | 171.6 | | | | | | | |
| 210600 | 16.8 | 11.8 | | 15.6 | 16.3 | | 14.9 | 172 | 319 | | 148 | 93 | | 130 |
| | 173.8 | 172.4 | | 173.0 | 172.3 | | 171.7 | | | | | | | |
| 211200 | 16.8 | 12.9 | 15.1 | 16.4 | 16.7 | | 15.1 | 171 | 329 | 216 | 238 | 151 | | 203 |
| | 174.2 | 174.4 | 174.1 | 175.3 | 173.8 | | 173.8 | | | | | | | |
| 211800 | 15.1 | 11.9 | | 15.9 | 17.5 | | 17.2 | 328 | 402 | | 311 | 29 | | 187 |
| | 177.1 | 175.3 | | 177.2 | 171.9 | | 175.4 | | | | | | | |

Average Distance Errors 240 378 288 242 123 N/A 258

VERIFICATION SUMMARY
HURRICANE KELI
AUGUST 16-21, 1984

CPHC MEAN ERROR FROM BEST TRACK 12NM

| | MEAN ERROR [ERROR (NM)/# OF CASES] | | |
|--------|------------------------------------|------------|------------|
| | 24 HR FCST | 48 HR FCST | 72 HR FCST |
| CPHC | 119/17 | 237/13 | 240/ 9 |
| EPHC77 | 116/17 | 224/13 | 378/ 9 |
| EPHC81 | 110/ 7 | 252/ 6 | 288/ 4 |
| EPANLG | 101/17 | 202/13 | 242/ 9 |
| EPCL84 | 111/17 | 209/13 | 123/ 9 |
| MFM | 71/ 6 | 148/ 4 | N/A |
| NTCM | 108/11 | 189/11 | 258/ 8 |

X 44

1930 18AU84 18A-2 05023 05841 HB10N155W-2



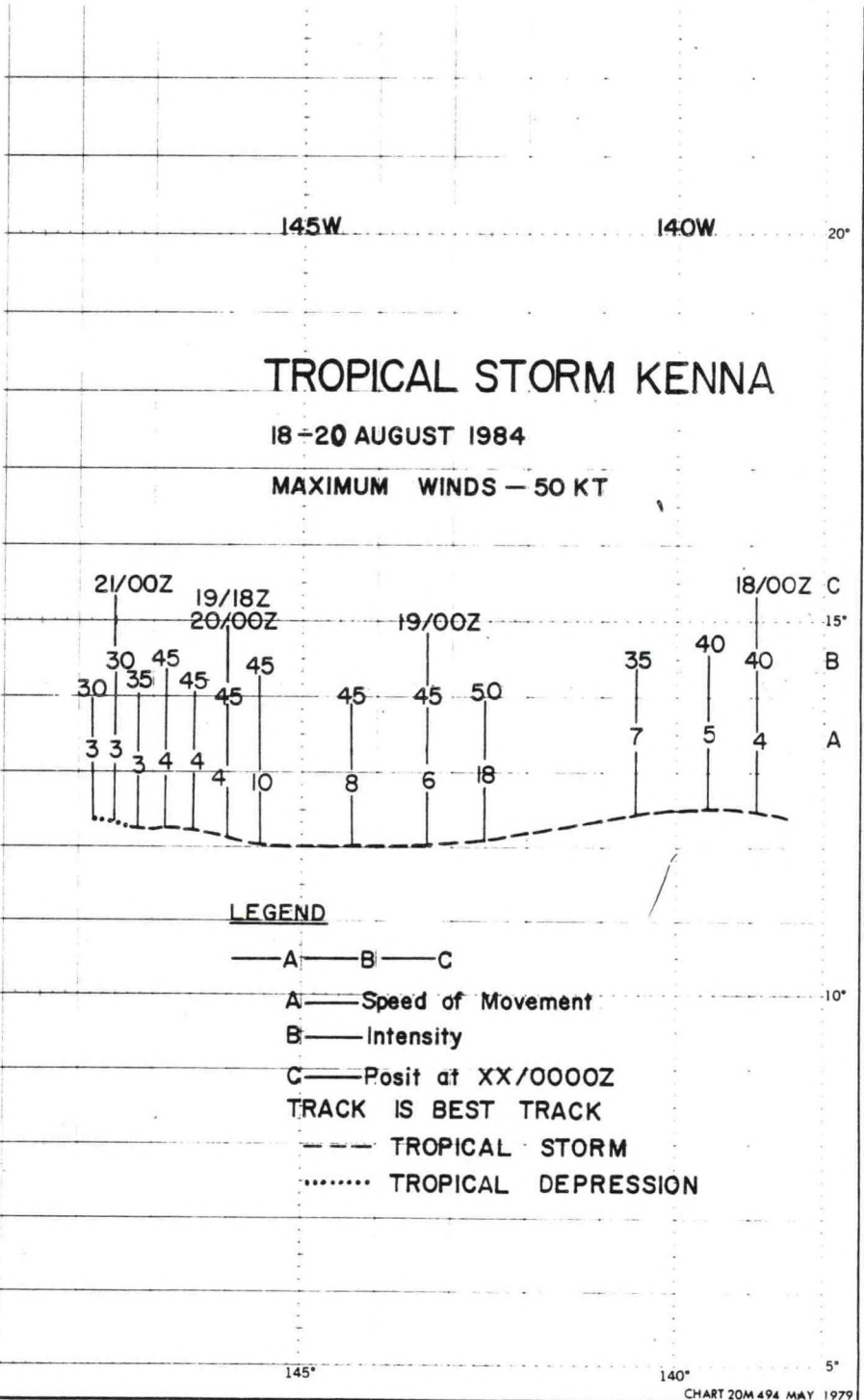
HURRICANE KELI & TROPICAL STORM
KENNA
1930 GMT AUG 18, 1984
MAX WINDS 80 KT & 50 KT

TROPICAL STORM KENNA
August 18-20, 1984

Tropical Storm KENNA moved into the Central Pacific Hurricane Center's (CPHC) area at about 181000 GMT near 12N 140W. Maximum sustained winds were estimated to be between 35 and 40 knots. U. S. Air Force weather reconnaissance aircraft flying into KENNA at 181800 GMT estimated the maximum sustained winds to be 50 knots. KENNA, however, had the appearance of becoming quite disorganized in satellite imagery as it began to slow its forward progress and drift westward along 12N on August 19 and 20. KENNA was downgraded to a tropical depression at 210000 GMT and the last advisory issued at 210600 GMT with the remnant circulation centered near 12N 148W.

The remains of KENNA now began to move in a more northwesterly direction toward the Big Island of Hawaii. Much appreciated rain drenched portions of the windward slopes of the Big Island on August 22 and 23 as the weak circulation center passed to the south of the island. Some sections of the windward districts of the Big Island reported measured rainfall amounts of 6 to 8 inches.

The CPHC issued 12 advisories on KENNA. No damages or casualties to shipping were reported.



TROPICAL STORM KENNA - August 18-20, 1984

| DTG | Best | Actual | Error |
|--------|-------|--------|-------|
| GMT | Track | Track | |
| | N/W | N/W | NM |
| 181200 | 12.4 | 12.5 | |
| | 141.0 | 140.5 | 29 |
| 181800 | 12.1 | 12.1 | |
| | 142.5 | 142.5 | 0 |
| 190000 | 12.0 | 12.0 | |
| | 143.3 | 143.3 | 0 |
| 190600 | 12.0 | 12.0 | |
| | 144.3 | 144.5 | 11 |
| 191200 | 12.0 | 12.0 | |
| | 145.5 | 145.5 | 0 |
| 191800 | 12.1 | 12.1 | |
| | 146.0 | 146.0 | 0 |
| 200000 | 12.1 | 12.1 | |
| | 146.0 | 146.0 | 0 |
| 200600 | 12.2 | 12.1 | |
| | 146.4 | 146.6 | 13 |
| 201200 | 12.2 | 12.0 | |
| | 146.8 | 148.3 | 88 |
| 201800 | 12.2 | 12.0 | |
| | 147.2 | 147.3 | 13 |

Average Distance Error 16

TROPICAL STORM KENNA - August 18-20, 1984

| DTG | 24 HOUR FORECAST POSITION | | | | | | | 24 HOUR FORECAST ERROR | | | | | | |
|--------|---------------------------|-------|-------|-------|-------|-------|-------|------------------------|-----|-----|-----|-----|-----|------|
| | CPHC | EP | EP | EP | EP | EP | NTCM | CPHC | EP | EP | EP | EP | EP | NTCM |
| GMT | N/W | HC77 | HC81 | ANLG | CL84 | SNBR | N/W | NM | NM | NM | NM | NM | NM | NM |
| 191200 | 13.0 | 13.1 | 13.0 | 13.5 | 12.7 | 13.2 | 12.5 | 69 | 100 | 88 | 107 | 113 | 132 | 98 |
| | 144.9 | 144.2 | 144.4 | 144.5 | 143.7 | 143.6 | 143.9 | | | | | | | |
| 191800 | 12.2 | 12.2 | | 13.1 | 12.2 | | 12.0 | 29 | 35 | | 79 | 29 | | 29 |
| | 146.5 | 146.6 | | 146.9 | 146.5 | | 146.5 | | | | | | | |
| 200000 | 12.0 | 12.3 | 12.1 | 12.5 | 11.8 | 12.1 | 11.4 | 82 | 71 | 105 | 102 | 84 | 58 | 97 |
| | 147.4 | 147.2 | 147.8 | 147.7 | 147.4 | 147.0 | 147.5 | | | | | | | |
| 200600 | 12.0 | | | | | | 11.9 | 99 | | | | | | 100 |
| | 148.3 | | | | | | 148.3 | | | | | | | |
| 202300 | 12.1 | 12.8 | 12.6 | 12.8 | 12.1 | 12.2 | | 82 | 100 | 100 | 105 | 64 | 31 | |
| | 149.7 | 149.8 | 149.9 | 149.9 | 149.4 | 148.8 | | | | | | | | |
| 201800 | 12.3 | 13.1 | | 13.1 | 12.1 | | | 176 | 155 | | 187 | 76 | | |
| | 150.3 | 149.7 | | 150.3 | 148.6 | | | | | | | | | |

Average Distance Errors 90 93 98 117 74 74 82

TROPICAL STORM KENNA - August 18-20, 1984

| DTG | CPHC | 48 HOUR FORECAST POSITION | | | | | NTCM | 48 HOUR FORECAST ERROR | | | | | | |
|--------|-------|---------------------------|-------|-------|-------|-------|-------|------------------------|-----|-----|-----|------|-----|------|
| | | EP | EP | EP | EP | EP | | CPHC | EP | EP | EP | EP | EP | NTCM |
| | | HC77 | HC81 | ANLG | CL84 | SNBR | | HC77 | 81 | ANG | C84 | SNBR | | |
| GMT | N/W | N/W | N/W | N/W | N/W | N/W | NM | NM | NM | NM | NM | NM | NM | |
| 201200 | 13.3 | 14.2 | 13.9 | 14.7 | 13.5 | 14.3 | 12.2 | 90 | 136 | 116 | 162 | 110 | 177 | 48 |
| | 147.5 | 147.7 | 147.9 | 148.5 | 147.2 | 146.4 | 147.5 | | | | | | | |
| 201800 | 12.5 | 13.1 | | 14.4 | 12.7 | | 11.7 | 190 | 182 | | 274 | 215 | | 177 |
| | 150.5 | 150.2 | | 151.3 | 150.9 | | 150.3 | | | | | | | |

Average Distance Errors 141 159 116 218 163 177 113

VERIFICATION SUMMARY
TROPICAL STORM KENNA
AUGUST 18-20, 1984

CPHC MEAN ERROR FROM BEST TRACK 16NM

| | MEAN ERROR [ERROR (NM)/# OF CASES] | | |
|--------|------------------------------------|------------|------------|
| | 24 HR FCST | 48 HR FCST | 72 HR FCST |
| CPHC | 90/ 6 | 141/ 2 | N/ A |
| EPHC77 | 93/ 5 | 159/ 2 | N/ A |
| EPHC81 | 98/ 3 | 116/ 1 | N/ A |
| EPANLG | 117/ 5 | 218/ 2 | N/ A |
| EPCL84 | 74/ 5 | 163/ 2 | N/ A |
| EPSNBR | 74/ 3 | 177/ 1 | N/ A |
| NTCM | 82/ 4 | 113/ 2 | N/ A |
| MFM | 235/ 2 | 364/ 1 | N/ A |

TROPICAL STORM LALA
August 26 - September 2, 1984

Tropical Storm LALA crossed into the Central Pacific Hurricane Center's (CPHC) area of responsibility as Tropical Depression 14E at 260400 GMT with maximum sustained winds estimated at 30 knots. T.D. 14E moved westward rather slowly, 5 to 10 knots, along 11N until it neared 11N 145W on the 29th and started to move on a more northwesterly course. U.S. Air Force weather reconnaissance aircraft flew into the circulation on the 29th and found winds of tropical storm strength near 45 knots. Subsequently, the CPHC named the depression LALA and upgraded it to a tropical storm. LALA remained a minimal tropical storm for a day or so before reverting back to a depression near 15N 150W. At this time, LALA commenced to move along a more westerly track which took the center of the weakening depression about 180 miles south of South Point, Hawaii at 011200 GMT. No effect from LALA was felt on the Big Island with respect to increases in wind or rainfall as the weak depression moved by. The CPHC issued its last advisory on T.D. LALA at 021800 GMT near 15N 165W.

The remnants of the dying circulation passed about 100 miles south of Johnston Island at 031500 GMT. No noticeable effects were reported.

The CPHC issued 30 advisories on T.D. 14E/Tropical Storm LALA. No damages or casualties to shipping were reported.

TROPICAL STORM MOKE
September 3-5, 1984

Tropical Storm MOKE formed near the International Dateline at about 28N on September 3. MOKE developed in an area of low pressure which had been meandering in the vicinity of Midway Island for several weeks. Initially, the circulation which became Tropical Storm MOKE was a cold core system as evidenced by the relatively cold temperatures aloft, as reported in radiosonde observations from Midway Island. An unusually high amplitude flow pattern had persisted over the north Pacific during the month of August with strong blocking action and associated cut-off lows. MOKE developed under one of the more dominant and persistent upper level cut-off lows.

It is very difficult to pinpoint the exact time of tropical storm development in cases such as this when a cold core system is gradually transformed into a warm tropical one through the intense latent heat releases in the convection over the warm waters in the area. The lack of adequate satellite coverage after the failure of the eastern GOES satellite and subsequent movement of GOES-West eastward made surveillance of the area less than ideal. September 3 appears to be the time that rapid intensification occurred, and the first advisory was issued by the Central Pacific Hurricane Center (CPHC) in Honolulu at 040000 GMT. Satellite imagery at this time showed an unusually well developed cyclone with even a slight hint of an "eye". Several ships in the area had reported winds of 30 to 40 knots and pressures near 1000 millibars with heavy showers for about 24 hours. At Midway Island about 90 miles to the east of the center southerly winds gusted to 30 knots and the pressure fell to 1005 millibars. Closer to the center at Kure Atoll, conditions were somewhat more extreme. Based on estimations using satellite imagery and the Dvorak technique, MOKE's maximum sustained winds were estimated at 45 knots.

MOKE moved on a north northeasterly course at 5 to 10 knots with little change in intensity on September 4. On the 5th, an upper trough approaching from the northwest caused shearing and rapid weakening. MOKE was classified as an extratropical storm near 34N 177W early on the 5th, and the last advisory was issued at 051200 GMT.

The CPHC issued 5 advisories on MOKE. However, while the system was considered cold core, gale warnings were carried in the high seas warnings and forecasts issued by the National Weather Service Forecast Office in Honolulu.

TROPICAL STORM MOKE

03-04 SEPTEMBER 1984

MAXIMUM WINDS — 45 KT

05/12Z EXTRATROPICAL

11 — 35 — 05/00Z

11 — 35

12 — 45

12 — 45 — 04/06Z

O
PMDY

LEGEND

A — B — C

A — Speed of Movement

B — Intensity

C — Position at XX/0000Z

— TRACK IS BEST TRACK

----- TROPICAL STORM

..... TROPICAL DEPRESSION

180

175W

170W

35N

165W

30N

25N

20N

CENTRAL PACIFIC HURRICANE CENTER
Annual Verification Summary

Average Seasonal Forecast Error*
(Average error (NM)/total number of forecasts)

| <u>Year</u> | <u>Best Track</u> | <u>24-Hour</u> | <u>48-Hour</u> | <u>72-Hour</u> |
|-------------|-------------------|----------------|----------------|----------------|
| 1983 | 15/64 | 114/48 | 226/32 | 381/20 |
| 1984 | 14/31 | 105/23 | 189/15 | 240/9 |

* For forecasts to be verified, system must have maintained tropical storm or hurricane intensity for a minimum of 24 hours in the central Pacific.

- No. 10 Climatology of Rainfall Probabilities for Oahu, Hawaii. A. N. Hull and Jon Pitko. April 1972. (COM-73-10242)
- No. 11 A Cirrus Climatology for Honolulu. Clarence B. H. Lee and Wesley Young. April 1974. (COM-74-11244)
- No. 12 Straight Line Wind Variability Over Selected Stations on Leeward Oahu. Michael J. Morrow. July 1974. (COM-74-11669)
- No. 13 Forecasting Hurricanes in the Central Pacific. Paul Haraguchi. October 1975. (PB-248-371)
- No. 14 Trade Wind Speed Estimation at Selected Stations on Oahu Using Honolulu Wind Observations, A Pilot Study. Michael J. Morrow. February 1976. (PB-251-685)
- No. 15 An Experiment in the Production of "POP" Forecasts Using a Statistical Model. G. Hirata. September 1976. (PB-260-926)
- No. 16 Forecasting Floods in Hawaii (Excluding Hawaii Island). Paul Haraguchi. January 1977. (PB-265-939)
- No. 17 An Operational Swell and Surf Program Using the N.W.S. Automatic Data Acquisition System (ADAS) Computer System. E. M. Carlstead. May 1977. (PB-269-650)
- No. 18 An Operational Message Composition System Using the N.W.S. Automatic Data Acquisition System (ADAS) Computer System. G. H. Hirata. April 1978. (PB-283-088)
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- No. 20 Application of the Zero Relative Vorticity Line in Synoptic Forecasting. Hans E. Rosendal. August 1979. (PB-300-790)
- No. 21 The Estimation of Cirrus Cloud Over Oahu. Michael J. Morrow. August 1980. (PB81-108-086)
- No. 22 1980 Tropical Cyclones - Central Pacific. Andrew K. T. Chun. March 1981. (PB81-198-699)
- No. 23 Some Mean Characteristics of Central North Pacific Tropical Cyclones. Hans E. Rosendal. June 1981. (PB81-230-492)
- No. 24 Relationship of Maximum Sustained Winds to Minimum Sea Level Pressure in Central North Pacific Tropical Cyclones. Hans E. Rosendal & Samuel L. Shaw. February 1982. (PB82-193-160)
- No. 25 1981 Tropical Cyclones - Central Pacific. Andrew K. T. Chun. February 1982. (PB82-195-306)
- No. 26 A Statistical Analysis of Ala Moana Surf Heights. Robert Y. G. Lee. May 1982. (PB82-229-196)
- No. 27 1982 Tropical Cyclones - Central Pacific. Andrew K. T. Chun. March 1984. (PB84-175-512)
- No. 28 Skywarn * Hawaii. Michael J. Morrow. December 1984. (PB86-107-505)
- No. 29 1983 Tropical Cyclones - Central North Pacific. W. Au, A. Chun, A. Inouye, H. Rosendal, T. Yamashiroya. December 1985. (PB86-158-185)



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