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NOAA TECHNICAL MEMORANDUM NWSTM PR-34

1988 TROPICAL CYCLONES - CENTRAL NORTH PACIFIC

Honolulu, HI
May 1989

U.S. DEPARTMENT OF COMMERCE / National Oceanic and Atmospheric Administration / National Weather Service

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- Continued on inside back cover -

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CENTRAL NORTH PACIFIC TROPICAL CYCLONE DATA SUMMARY, 1988*

GILMA	30 Jul - 3 Aug	Tropical Depression	E30 (SFSS)	N/A	84(TD)
FABIO	2-9 Aug	Hurricane	E120 (SFSS)	N/A**	54(H), 24(TS), 96(TD)
HECTOR	8-9 Aug	Tropical Depression	E30 (SFSS)	N/A	18(TD)
ULEKI	28 Aug - 8 Sep	Hurricane	110 (RECCE)	957MB	198(H), 30(TS), 18(TD)
WILA	20 - 25 Sep	Tropical Storm	35 (RECCE)	N/A	18(TS), 96(TD)

Key

H - Hurricane

TS - Tropical Storm

TD - Tropical Depresion

Example: 36(H), 84(TS), 12(TD)

Total hours per class: H 36 hrs

TS 83 hrs

TD 12 hrs

NOTES:

* Data pertain only to period when tropical cyclone was in the central Pacific.

** RECCE flown after system reached its peak.

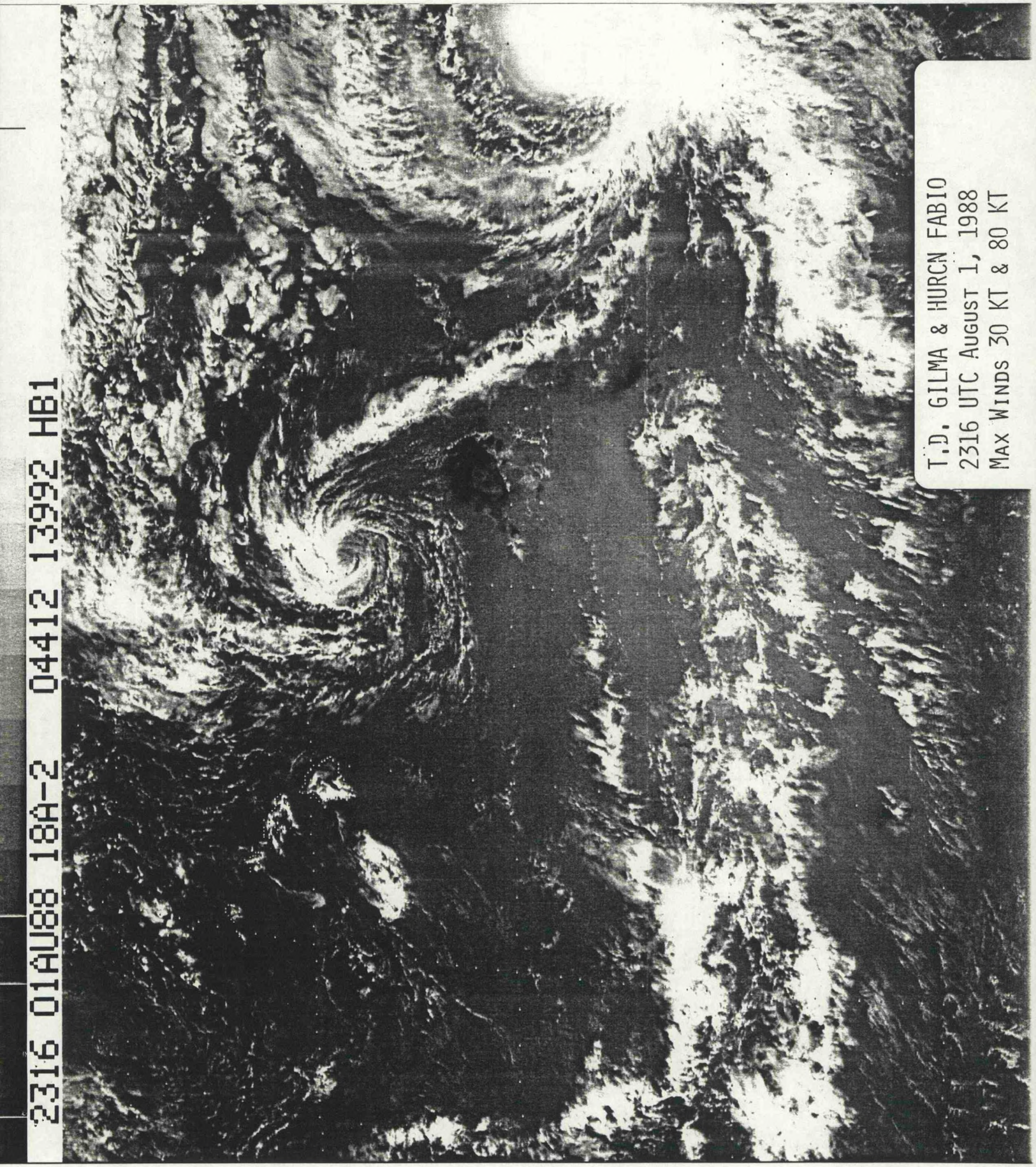
TROPICAL DEPRESSION GILMA
30 July - 3 August 1988

Tropical Depression GILMA was on a weakening trend with maximum sustained surface winds estimated at 30 knots when she entered the Central Pacific Hurricane Center's (CPHC) area of responsibility near 17N 140W during the evening of July 30. GILMA was one of four tropical cyclones that formed at about the same time on July 28. The National Hurricane Center began to issue advisories on T.Ds. 7E (EMILIA), 8E (FABIO), 9E (unnamed), and 10E (GILMA) within a period of 6 hours on the 28th. GILMA and FABIO moved westward and eventually crossed over into the CPHC's area of responsiblity (Fig. 1).

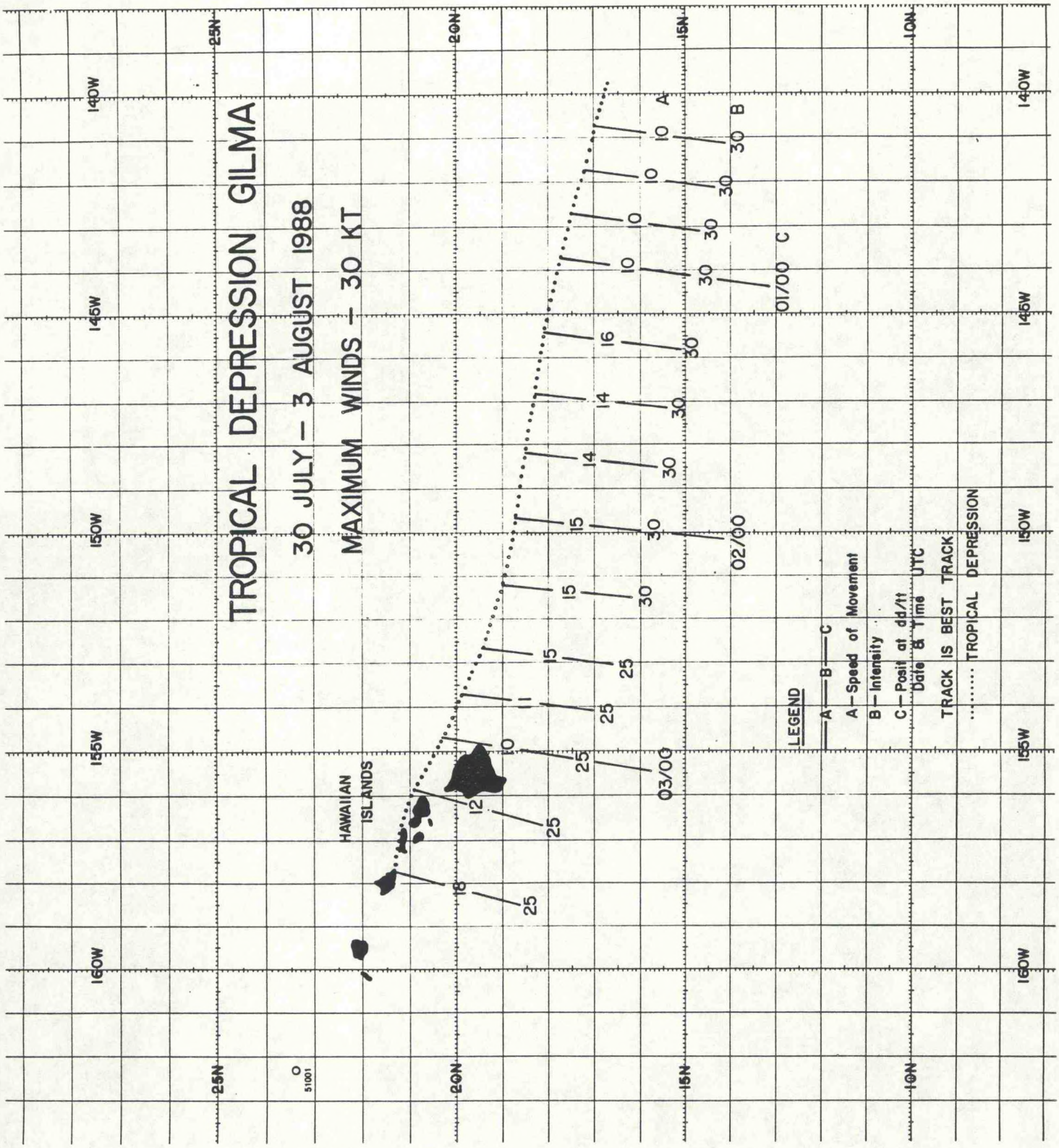
GILMA was over cooler sea surface temperatures as she moved in a west northwesterly direction on a course taking her up the windward side of the main Hawaiian Islands. The center of the weakening depression moved very close to the islands of Maui and Molokai the evening of August 2 and over Oahu and just south of Kauai early in the morning August 3 (Fig. 2). GILMA was in a dissipating mode as she glided past Oahu and Kauai. Her circulation was evident in satellite imagery and consisted mainly of low and middle clouds. A few cumulonimbus clouds did spring up north of the center as the system began to react with a cold upper level trough located just to the northwest of the islands. Some welcome rain fell over the islands of Kauai and Oahu where locally heavy amounts, in the 2 to 4 inch range, were reported.

The CPHC issued its last advisory on GILMA on August 3 at 1200 UTC.

(FIG. 1)


2316 01AU88 18A-2 04412 13992 HB1
T.D. GILMA & HURCN FABIO
2316 UTC AUGUST 1, 1988
MAX WINDS 30 KT & 80 KT

(FIG. 2)


TROPICAL DEPRESSION GILMA
30 JULY – 3 AUGUST 1988
MAXIMUM WINDS – 30 KT
HAWAIIAN ISLANDS
LEGEND
A – Speed of Movement
B – Intensity
C – Posit at dd/tt Date & Time UTC
TRACK IS BEST TRACK
TROPICAL DEPRESSION
03/00
02/00
01/00
25N
20N
15N
10N
140W
145W
150W
155W
160W

TROPICAL DEPRESSION GILMA
30 JULY - 3 AUGUST 1988

DATE/TIME UTC	BEST TRACK	ACTUAL TRACK	DIST ERROR (NM)
31/0600	17.0N 140.7W	17.0N 140.7W	0
31/1200	17.2N 141.7W	17.3N 141.8W	8
31/1800	17.5N 142.7W	17.9N 142.7W	24
01/0000	17.8N 144.7W	18.3N 144.4W	34
01/0600	18.1N 145.4W	18.5N 145.5W	24
01/1200	18.3N 146.8W	18.3N 146.8W	0
01/1800	18.5N 148.2W	18.5N 148.2W	0
02/0000	18.8N 149.7W	18.8N 149.7W	0
02/0600	19.0N 151.2W	18.9N 150.6W	34
02/1200	19.4N 152.7W	19.4N 152.7W	0
02/1800	19.9N 153.7W	19.9N 153.7W	0
03/0000	20.3N 154.7W	20.3N 154.7W	0
03/0600	20.9N 155.9W	20.9N 155.9W	0
03/1200	21.3N 157.7W	21.3N 157.7W	0
		AVERAGE DISTANCE ERROR	9 NM

HURRICANE FABIO
2 - 9 August 1988

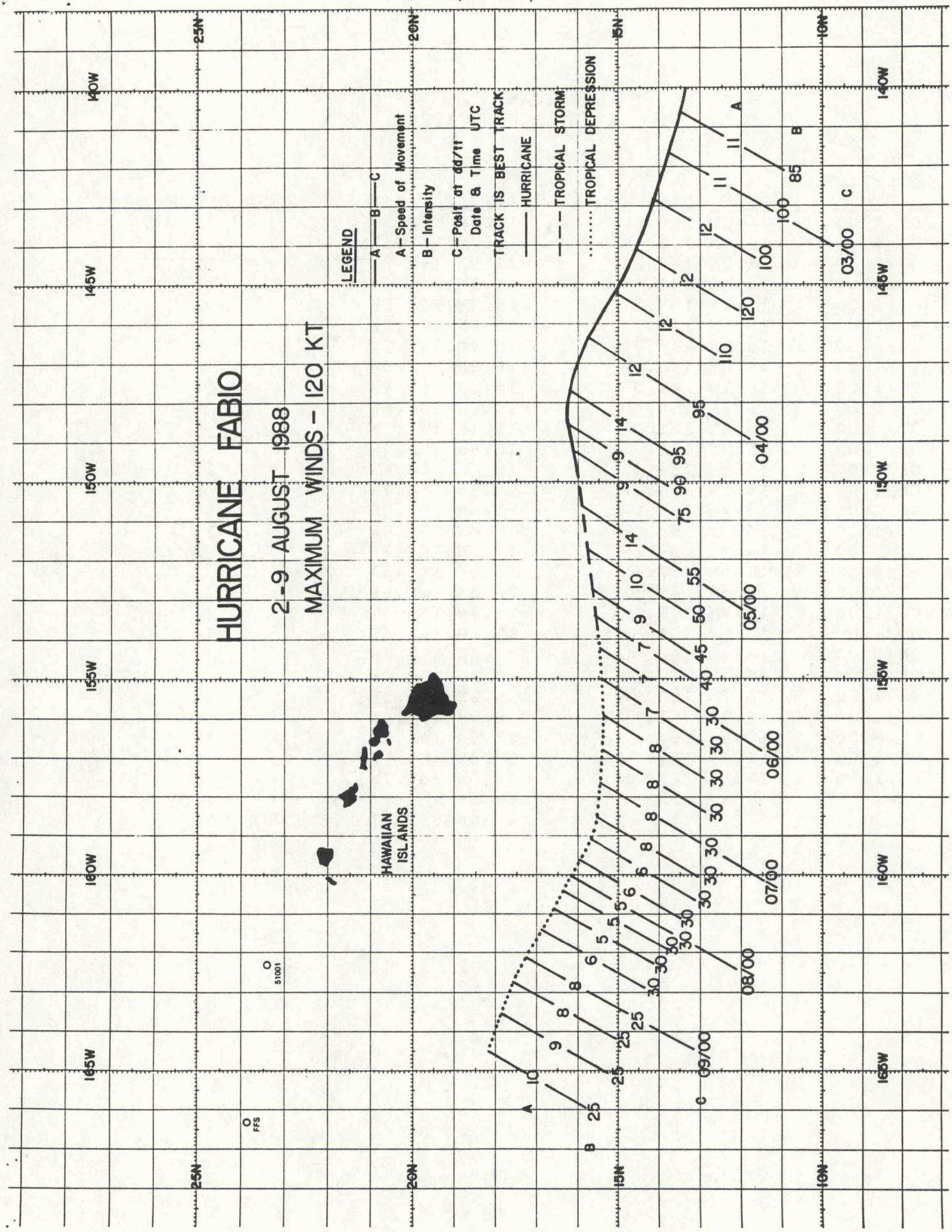
Hurricane FABIO crossed into the Central Pacific Hurricane Center's (CPHC) area of warning responsibility near 13N 140W on August 2 as an intensifying hurricane with maximum sustained winds estimated at 85 knots. FABIO was one of five tropical cyclones, four named and one unnamed, that formed in an active east/west trough of low pressure between Hawaii and the Central American coast during the waning days of July. The other cyclones were EMILIA, GILMA and HECTOR. FABIO intensified farther south and west than most tropical cyclones of the "midseason" variety do (Fig. 3). It was in a potentially very dangerous location climatologically with respect to the Hawaiian Islands as it spun up to a very intense hurricane with winds estimated at 120 knots at 031200 UTC near 14N 144W (Fig. 4 and Fig. 5). This proved to be the peak intensity as conditions in the upper level flow became less favorable and began to make their presence felt on FABIO. These unfavorable conditions included excessive vertical wind shear, and, as seen in satellite water vapor imagery, a cold/dry environment aloft within a trough in the upper atmosphere.

Air Force reconnaissance aircraft flew into the hurricane at 040000 UTC and found its center near 17N 145W. Maximum observed surface winds were estimated to be 95 knots. FABIO at this time was moving steadily toward the Hawaiian Islands and a tropical storm watch was subsequently issued for the Big Island of Hawaii. The watch remained in effect for about 24 hours and was cancelled at 050300 UTC as FABIO was now a rapidly weakening cyclone and was veering on a course that took it westward well south of the Big Island. The center of FABIO passed about 210 nautical miles south of South Point at 061200 UTC as a tropical depression with winds estimated at 30 knots.

Some high surf was reported along the black sand beaches on the southeast coast of the Big Island and some heavy showers with rainfall amounts in the 12 to 18 inch range fell near Hilo as FABIO passed to the south and southwest. Minor flooding and some road closures due to high water were reported in the Hilo area the evening of August 6.

Satellite pictures indicated a hint of strengthening as FABIO passed to the southwest of the islands on the 7th and 8th along a track that was briefly bending northward (Fig. 6). The outer fringes of the moribund depression interacted with an upper level trough to cause some heavy showers over the island of Kauai on the 8th. FABIO subsequently weakened again and the last advisory was issued by the CPHC at 091800 UTC when the remains were near 18N 165W. The remnants of FABIO were tracked for several more days and could be seen crossing the International Dateline near 22N at 121800 UTC.

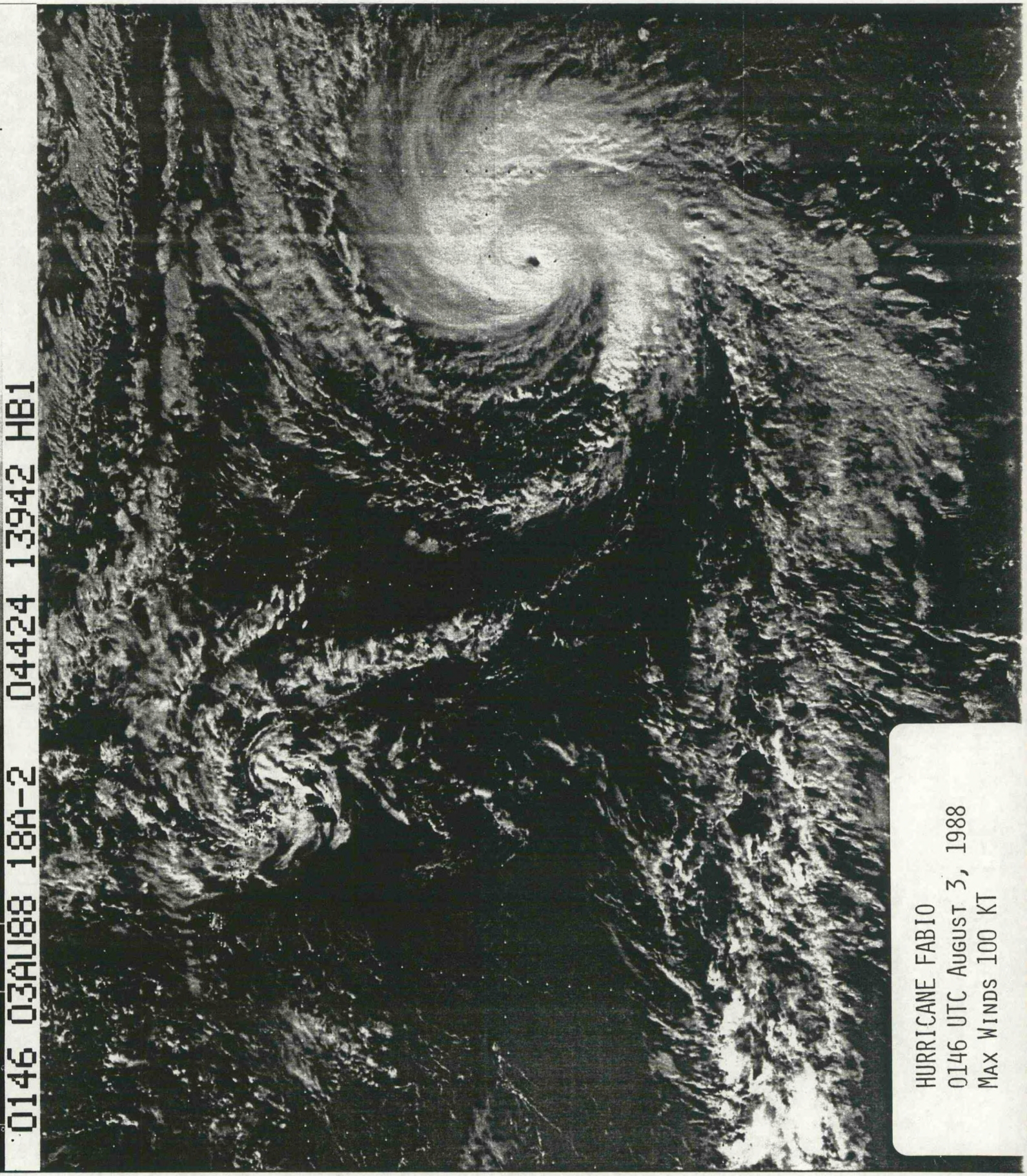
(FIG. 3)


HURRICANE FABIO
2-9 AUGUST 1988
MAXIMUM WINDS - 120 KT
LEGEND
A-Speed of Movement
B-Intensity
C-Posit at dd/tt
Date & Time UTC
TRACK IS BEST TRACK
HURRICANE
TROPICAL STORM
TROPICAL DEPRESSION
HAWAIIAN ISLANDS
51001
FFS
25N
20N
15N
10N
140W
145W
150W
155W
160W
165W
03/00
04/00
05/00
06/00
07/00
08/00
09/00

HURRICANE FABIO
2 - 9 AUGUST 1988

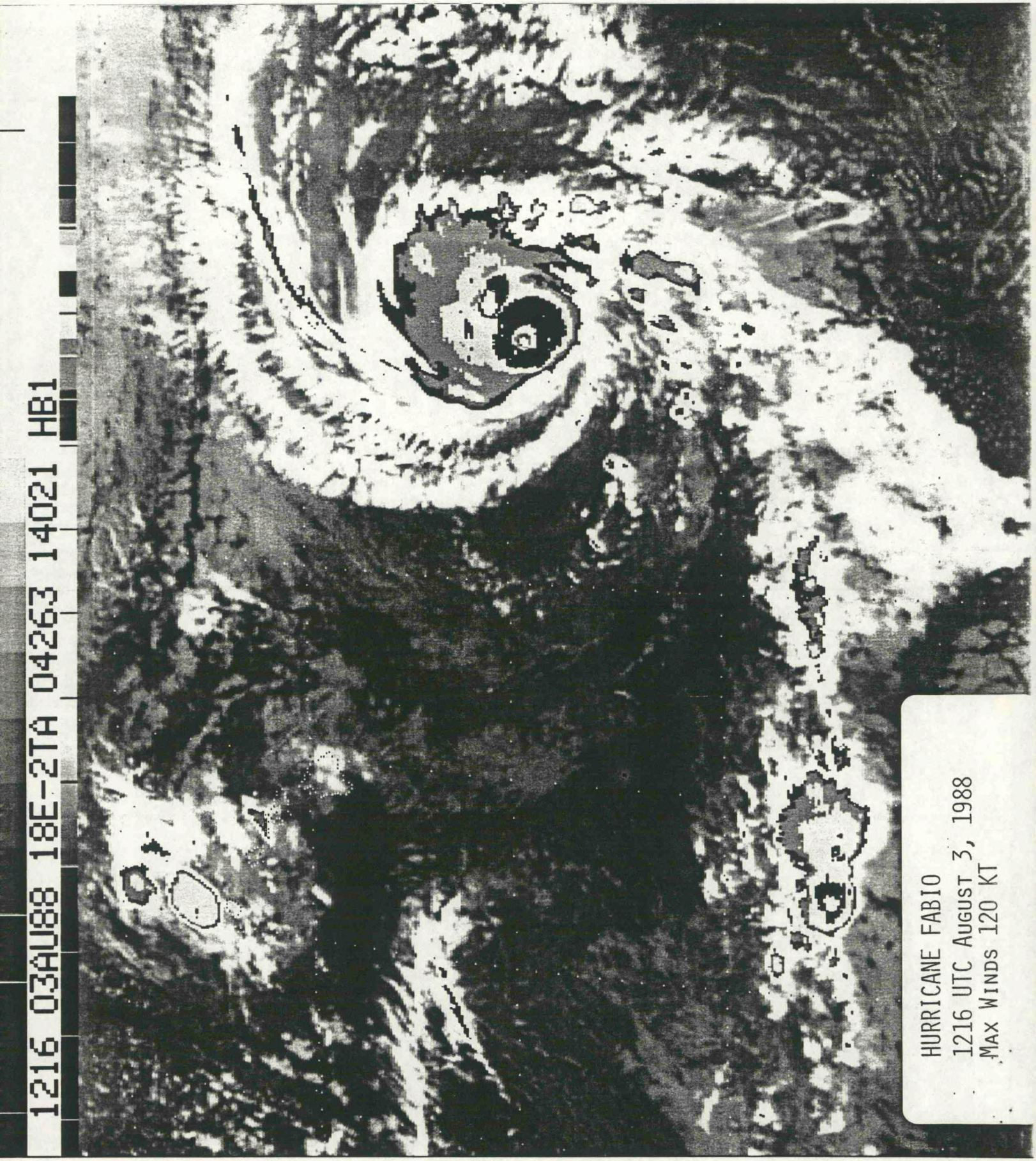
DATE/TIME UTC	BEST TRACK	ACTUAL TRACK	DIST ERROR (NM)
02/1800	13.5N 140.6W	13.3N 140.5W	14
03/0000	13.8N 141.6W	13.7N 141.6W	6
03/0600	14.2N 142.8W	13.9N 142.8W	18
03/1200	14.6N 144.1W	14.3N 144.1W	18
03/1800	15.1N 145.2W	15.3N 145.5W	21
04/0000	15.8N 146.3W	15.7N 146.3W	6
04/0600	16.2N 147.7W	16.2N 147.7W	0
04/1200	16.3N 148.5W	16.3N 148.5W	0
04/1800	16.1N 149.2W	16.2N 149.2W	6
05/0000	15.9N 150.6W	16.0N 150.6W	6
05/0600	15.8N 151.7W	15.7N 151.7W	6
05/1200	15.7N 152.7W	15.8N 152.7W	6
05/1800	15.6N 153.4W	15.4N 153.4W	12
06/0000	15.5N 154.2W	15.5N 154.2W	0
06/0600	15.4N 155.0W	15.5N 155.0W	6
06/1200	15.4N 155.9W	15.6N 155.9W	12
06/1800	15.4N 156.8W	15.5N 156.7W	8
07/0000	15.5N 157.6W	15.5N 157.5W	7
07/0600	15.6N 158.5W	15.5N 158.5W	6
07/1200	15.7N 159.1W	15.4N 159.3W	22
07/1800	16.0N 159.6W	15.8N 159.5W	14
08/0000	16.2N 160.0W	16.6N 159.6W	33
08/0600	16.4N 160.4W	17.2N 160.0W	53
08/1200	16.7N 160.8W	16.8N 160.3W	30
08/1800	16.9N 161.4W	16.9N 161.4W	0
09/0000	17.3N 162.1W	17.0N 162.1W	18
09/0600	17.6N 162.7W	17.0N 162.7W	36
09/1200	17.8N 163.6W	17.0N 163.7W	48
		AVERAGE DISTANCE ERROR	17

(FIG. 4)



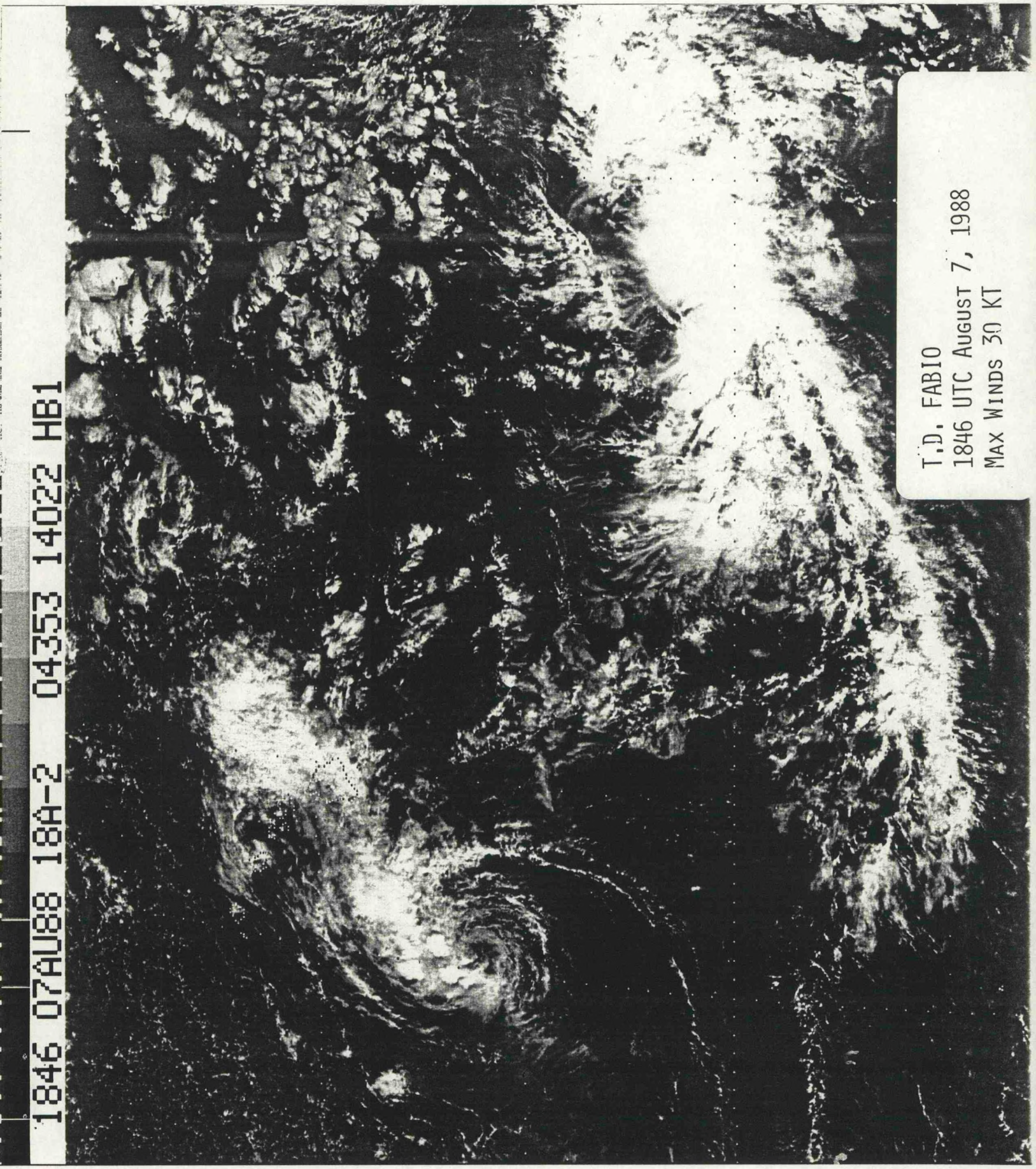
HURRICANE FABIO
0146 UTC AUGUST 3, 1988
MAX WINDS 100 KT

(FIG. 5)



HURRICANE FABIO
1216 UTC AUGUST 3, 1988
MAX WINDS 120 KT

(FIG. 6)


1846 07AU88 18A-2 04353 14022 HB1
T.D. FABIO
1846 UTC AUGUST 7, 1988
MAX WINDS 30 KT

HURRICANE FABIO - AUGUST 2 - 9, 1988

DTG	CPHC	EP SS87	EP AN85	EP CL84	EP CL81	QLM	NTCM	CPHC	EP SS87	EP AN85	EP CL84	EP CL81	QLM	NTCM
	24 HOUR FORECAST POSITION							24 HOUR FORECAST ERROR						
UTC	N/W	N/W	N/W	N/W	N/W	N/W	N/W	NM	NM	NM	NM	NM	NM	NM
0318	14.0	14.3	14.1	14.3				80	67	83	67			
	145.2	145.0	144.8	145.0										
0400	14.6	14.8	14.5	14.7	14.6	19.1	14.8	68	55	76	61	72	207	54
	146.0	146.1	145.9	146.1	145.8	146.9	146.2							
0406	14.9	15.3	14.7	14.8			14.9	83	71	104	99			81
	147.2	146.9	146.8	146.8			147.3							
0412	15.7	16.0	15.8	16.0	15.3	19.3	15.5	40	22	32	22	62	230	67
	148.8	148.7	148.7	148.7	148.8	151.0	149.3							
0418	16.6	17.1	17.0	16.9			16.6	84	83	84	76			52
	150.6	150.3	150.4	150.3			150.0							
0500	16.9	17.5	17.4	17.2	16.4	19.4		68	96	91	80	42	207	
	151.3	151.2	151.2	151.2	151.2	151.2								
0506	17.3	17.8	17.8	17.7			16.5	102	134	139	131			94
	152.3	152.5	152.7	152.6			150.3							
0512	17.5	17.8	17.6	17.5	16.5	18.0	17.4	105	123	109	106	46	179	98
	153.1	152.2	152.4	152.2	153.0	154.8	153.0							
0518	17.4	17.5	16.9	16.8				121	126	90	84			
	153.2	153.3	153.3	153.3										
AVERAGE DISTANCE ERRORS								83	86	90	81	56	206	74

HURRICANE FABIO - AUGUST 2 - 9, 1988

	36 HOUR FORECAST POSITION							36 HOUR FORECAST ERROR						
DTG	CPHC	EP SS87	EP AN85	EP CL84	EP CL81	QLM	NTCM	CPHC	EP SS87	EP AN85	EP CL84	EP CL81	QLM	NTCM
UTC	N/W	N/W	N/W	N/W	N/W	N/W	N/W	NM	NM	NM	NM	NM	NM	NM
0406	14.5	14.8	14.5	14.9				105	91	115	81			
	147.3	147.1	146.8	147.3										
0412	15.2	15.4	14.9	15.3	15.1	19.9	15.5	68	55	91	60	136	219	48
	148.2	148.3	147.9	148.4	146.5	149.1	148.5							
0418	15.5	15.9	15.1	15.4			15.6	42	22	75	51			43
	149.2	149.0	148.6	148.9			149.6							
0500	16.3	16.8	16.2	16.8	15.7	20.2	16.0	22	48	32	51	55	298	81
	150.8	150.7	151.1	150.9	149.7	153.4	152.0							
0506	17.3	17.9	17.6	17.7			17.1	109	140	128	133			86
	152.6	152.5	152.7	152.7			152.0							
0512	17.5	18.3	18.0	17.9	16.6	20.4		108	157	140	138	75	278	
	153.3	153.5	153.5	153.7	151.7	153.3								
0518	18.0	18.5	18.6	18.4			15.7	164	198	213	202			66
	154.3	154.6	155.0	155.0			152.3							
AVERAGE DISTANCE ERRORS								88	102	113	102	89	265	65

HURRICANE FABIO - AUGUST 2 - 9, 1988

DTG	48 HOUR FORECAST POSITION							48 HOUR FORECAST ERROR						
	CPHC	EP SS87	EP AN85	EP CL84	EP CL81	QLM	NTCM	CPHC	EP SS87	EP AN85	EP CL84	EP CL81	QLM	NTCM
UTC	N/W	N/W	N/W	N/W	N/W	N/W	N/W	NM	NM	NM	NM	NM	NM	NM
0418	15.0	15.5	14.9	15.4				76	44	83	59			
	149.6	149.0	148.7	149.8										
0500	15.9	16.2	15.4	16.0	15.2	21.1	16.2	14	26	63	0	67	309	17
	150.4	150.2	149.7	150.6	149.8	151.3	150.8							
0506	16.3	16.7	15.4	16.1			16.2	40	79	77	52			31
	151.4	150.8	150.4	150.9			151.8							
0512	17.2	17.6	16.6	17.6	15.7	20.5	16.6	89	109	56	113	8	311	125
	153.2	152.9	153.2	153.3	152.6	155.0	154.7							
0518	18.2	18.7	18.0	18.4			17.5	180	212	173	205			131
	154.5	154.7	154.7	155.1			154.0							
AVERAGE DISTANCE ERRORS								80	94	90	86	38	310	76

HURRICANE FABIO - AUGUST 2 - 9, 1988

	72 HOUR FORECAST POSITION							72 HOUR FORECAST ERROR						
DTG	CPHC	EP SS87	EP AN85	EP CL84	EP CL81	QLM	NTCM	CPHC	EP SS87	EP AN85	EP CL84	EP CL81	QLM	NTCM
UTC	N/W	N/W	N/W	N/W	N/W	N/W	N/W	NM	NM	NM	NM	NM	NM	NM
0518	16.5	16.8	15.4	16.4				75	102	98	62			
	154.0	152.4	151.7	153.7										
AVERAGE DISTANCE ERRORS								75	102	98	62			

HURRICANE FABIO - AUGUST 2-9, 1988

CPHC MEAN ERROR FROM BEST TRACK.....17 NM

	MEAN ERROR [ERROR (NM)/# OF CASES]			
	24 HR FCST	36 HR FCST	48 HR FCST	72 HR FCST
CPHC	83/ 9	88/ 7	80/ 5	75/ 1
EPSS87	86/ 9	102/ 7	94/ 5	102/ 1
EPAN85	90/ 9	113/ 7	90/ 5	98/ 1
EPCL84	81/ 9	102/ 7	86/ 5	62/ 1
EPHC81	56/ 4	89/ 3	38/ 2	N/F
QLM	206/ 4	265/ 3	310/ 2	N/F
NTCM	74/ 6	65/ 5	76/ 4	N/F

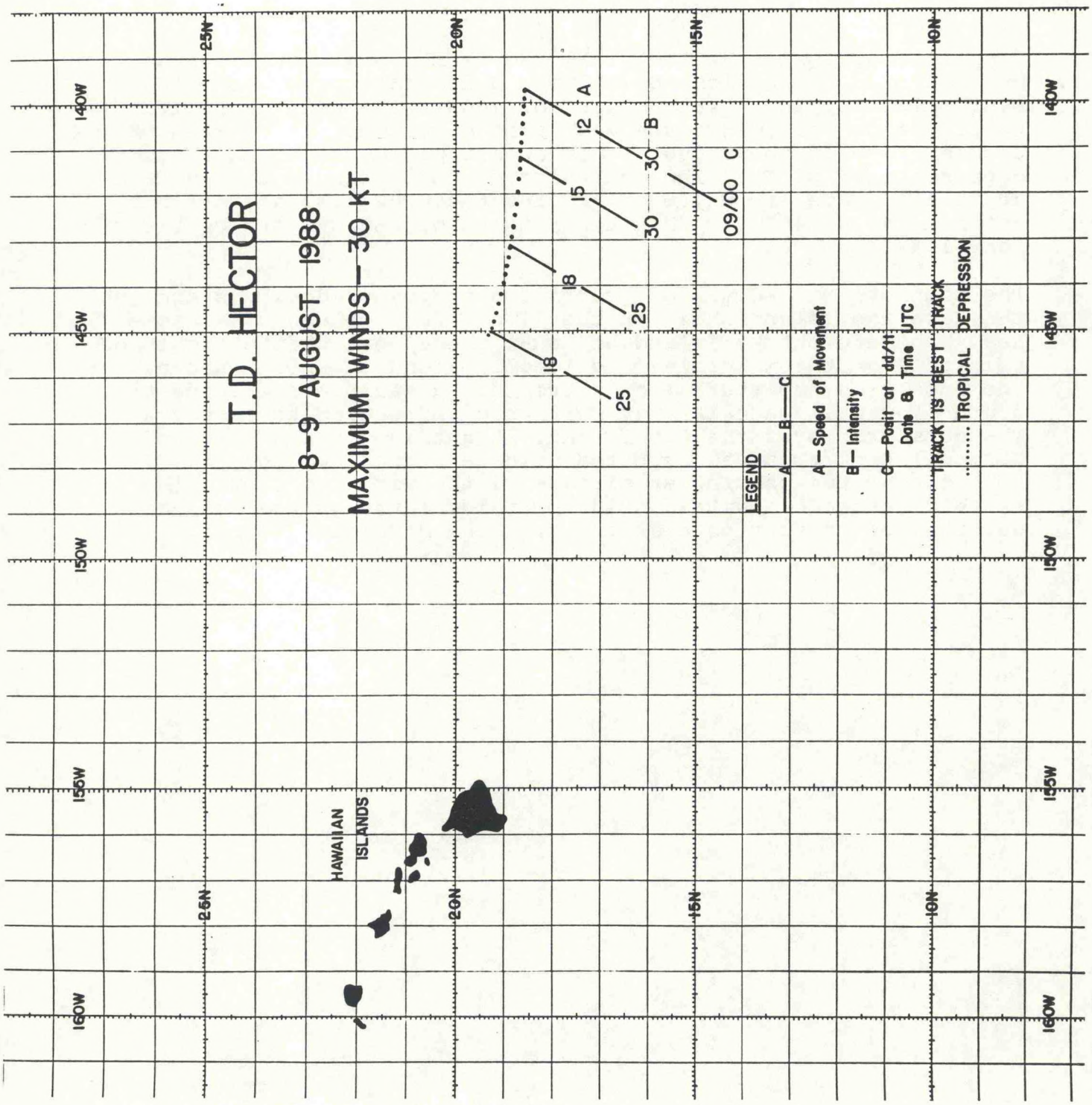
N/F = NO FORECAST

TROPICAL DEPRESSION HECTOR
8 - 9 August 1988

Tropical Depression Hector (11E) had been a small but intense hurricane as it was moving westward quite far north along 18N and over relatively cool waters east of 140W. The Central Pacific Hurricane Center (CPHC) assumed warning responsibility when HECTOR crossed 140W at about 090000 UTC as a rapidly weakening tropical depression (Fig. 6). The weakening trend continued as the depression made its way westward and the CPHC issued its final advisory at 091800 UTC when the remains of HECTOR were centered near 19N 145W.

The remnants of HECTOR were carried along by trade winds and into the Hawaiian Island chain on the 11th. This caused some heavy showers on the island of Kauai where more than 6 inches of rain fell on the mountains and locally along the north shore. At the same time, moisture from a tropical disturbance passing to the south of Hawaii made its way northward and caused some heavy thunderstorms over the Big Island. Lightning in the Volcano National Park area was reported to have struck two people. In both cases, the warm/moist air associated with the tropical systems interacted with a cold upper level trough to cause an outbreak of convection near and over the Hawaiian Islands.

(FIG. 7)


T.D. HECTOR
8-9 AUGUST 1988
MAXIMUM WINDS — 30 KT
HAWAIIAN ISLANDS
160W
155W
150W
145W
140W
25N
20N
15N
10N
18
25
18
25
15
30
12
30
A
B
09/00 C
LEGEND
A — B — C
A — Speed of Movement
B — Intensity
C — Posit at dd/tt
Date & Time UTC
TRACK IS BEST TRACK
TROPICAL DEPRESSION

TROPICAL DEPRESSION HECTOR
8 - 9 AUGUST 1988

DATE/TIME UTC	BEST TRACK	ACTUAL TRACK	DIST ERROR (NM)
09/0000	18.6N 139.7W	18.6N 139.7W	0
09/0600	18.7N 141.2W	18.7N 141.2W	0
09/1200	18.9N 143.1W	18.6N 143.1W	18
09/1800	19.3N 145.0W	19.2N 145.0W	6
		AVERAGE DISTANCE ERROR	6 NM

HURRICANE ULEKI
28 August - 7 September 1988

As August drew to a close, the Central Pacific Hurricane Center (CPHC) in Honolulu began to monitor activity along the ITCZ to the southeast of the Hawaiian Islands. A disturbance some 800 miles to the southeast of the Big Island of Hawaii showed signs of development and was tagged Tropical Depression (T.D.) ONE-C on August 28 (Fig. 8). T.D. ONE-C moved westward while intensifying and was upgraded to a tropical storm and named ULEKI as it neared 13N 149W at 291800 UTC. ULEKI continued to intensify and within 36 hours of becoming a tropical storm was upgraded to a hurricane at 310000 UTC near 14N 155W--about 350 nautical miles south of Hilo, Hawaii. During the next 12 to 18 hours, ULEKI experienced explosive intensification with winds estimated by Air Force hurricane hunters to be 100 knots at 311800 UTC (Figs. 9 & 10). Maximum intensity was reached about 24 hours later when wind speeds near the center were estimated to be 110 knots when ULEKI was near 15N 159W (Fig. 11). Up until this time, ULEKI moved at a fairly steady rate toward the west. However, on the 2nd and 3rd of September, ULEKI stalled and began to drift slowly northward (Fig. 12). The upper flow had become westerly and a distinct steering current was lacking.

The people of Hawaii experienced some anxious moments when ULEKI stalled at great intensity so close to the Islands. It was extremely helpful to the CPHC forecasters to have aerial reconnaissance available to continuously monitor position and intensity of the threatening cyclone. U.S. Air Force reconnaissance crews flew a total of 10 missions and provided 41 center fixes on ULEKI between August 31 and September 5. Estimated maximum sustained surface winds of 110 knots were observed between 012026 and 020028 UTC. The lowest sea level pressure determined by dropsonde was 957 millibars at 021528 and 022306 UTC.

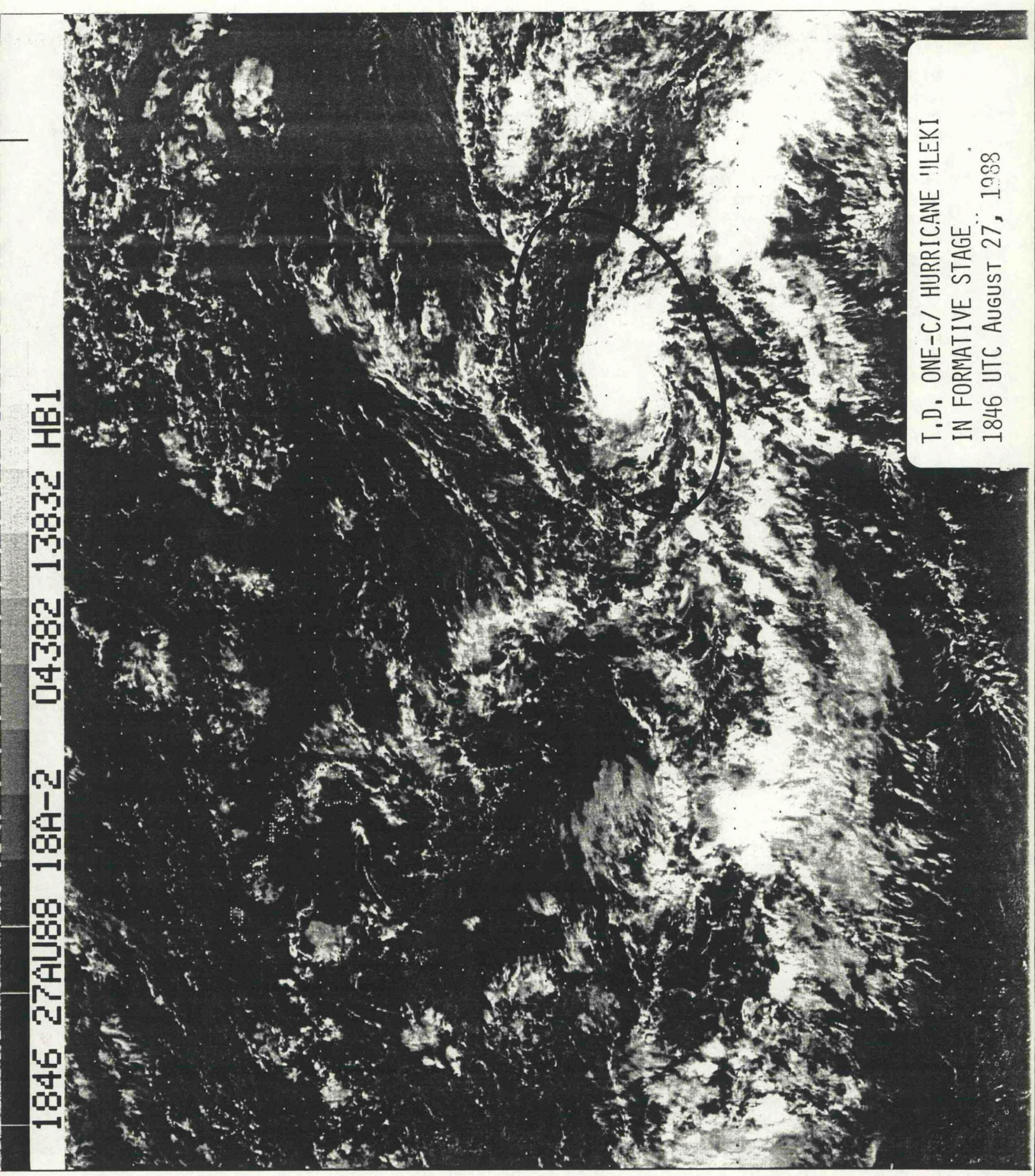
A Tropical Storm Watch was issued for the islands of Niihau, Kauai, and Oahu at 030000 UTC as ULEKI floundered around to the southwest of the Hawaiian Islands with winds of 100 knots. ULEKI made several small loops while drifting northward prior to resuming its west northwest movement early on the 4th. There were no effects on the weather over the Hawaiian Islands. ULEKI's circulation did produce some swell which caused high surf along the southern shores of the Hawaiian Islands--especially on the islands of Kauai and Oahu. Two drownings on Oahu were attributed to the rough water.

ULEKI experienced a slow weakening trend as it paused to the southwest of the Islands. This trend continued as the once powerful hurricane moved westward about 250 nautical miles to the north of Johnston Island and about 250 miles to the south of French Frigate Shoals during the evening of the 5th. The minimal hurricane had little or no impact on the weather at Johnston or French Frigate Shoals. The weakening of ULEKI, however, stopped during the evening of the 6th as a favorable upper flow and warmer sea surface temperatures caused reintensification with winds increasing to 90 knots.

Continuing its west northwestward trek, ULEKI passed to the south of Midway Island. Closest point of approach (CPA) to Midway was approximately 200 nautical miles at 080300 UTC. Winds observed at Midway at CPA were 120 degrees at 18 knots gusting to 27 knots. Maximum winds recorded were 090-120 degrees at 22 knots gusting to 31 knots at 080101 UTC. Midway reported the southeast shoreline as having the most wave action and waves breaking over the runway.

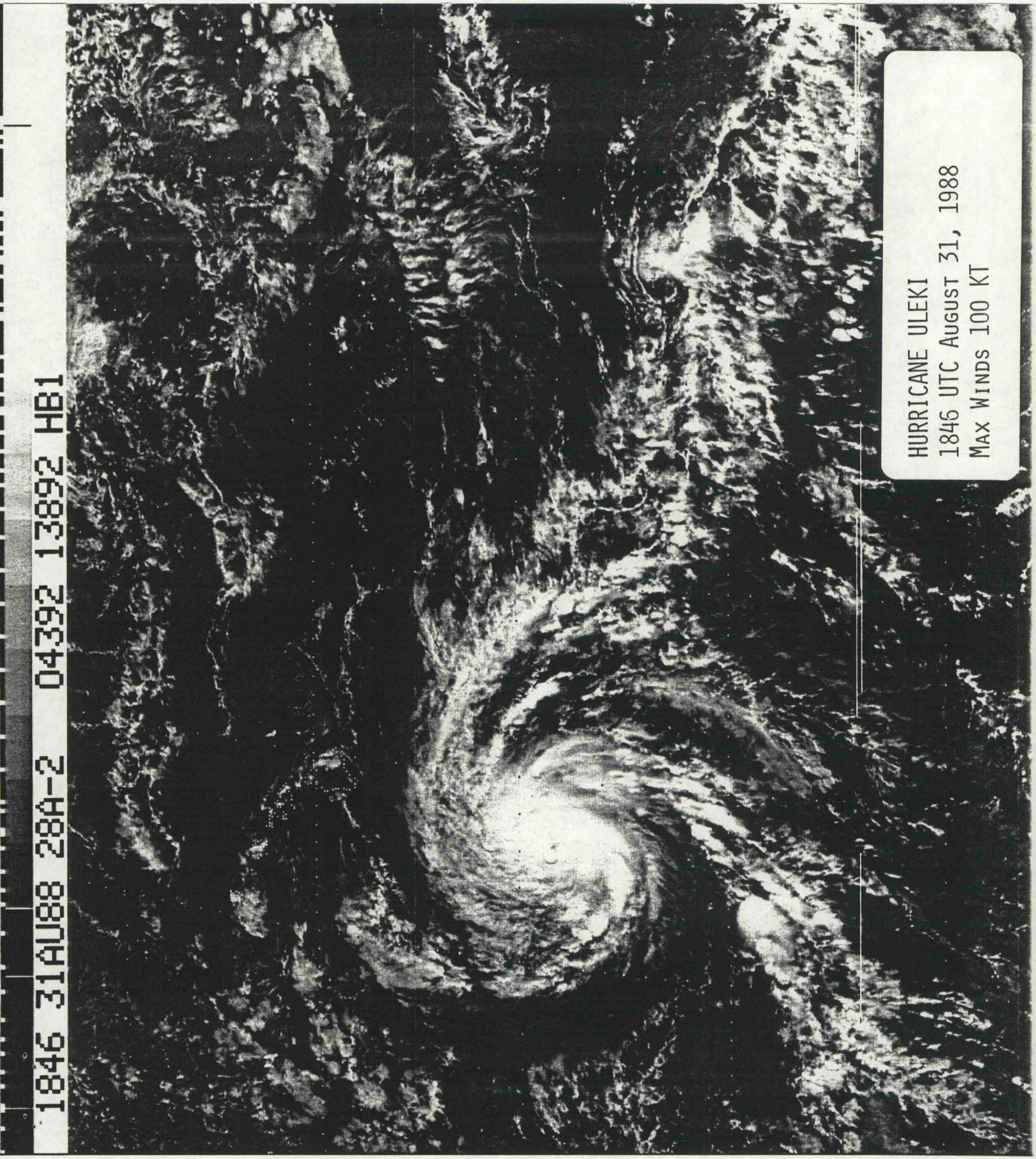
ULEKI became a typhoon when the CPHC passed warning responsibility to the Joint Typhoon Warning Center (JTWC) on Guam at 080000 UTC. ULEKI remained an intense typhoon west of the dateline for several days while meandering in the area near 30N 165E. The last advisory on the dissipating ULEKI was issued by the JTWC at 140000 UTC.

(FIG. 8)

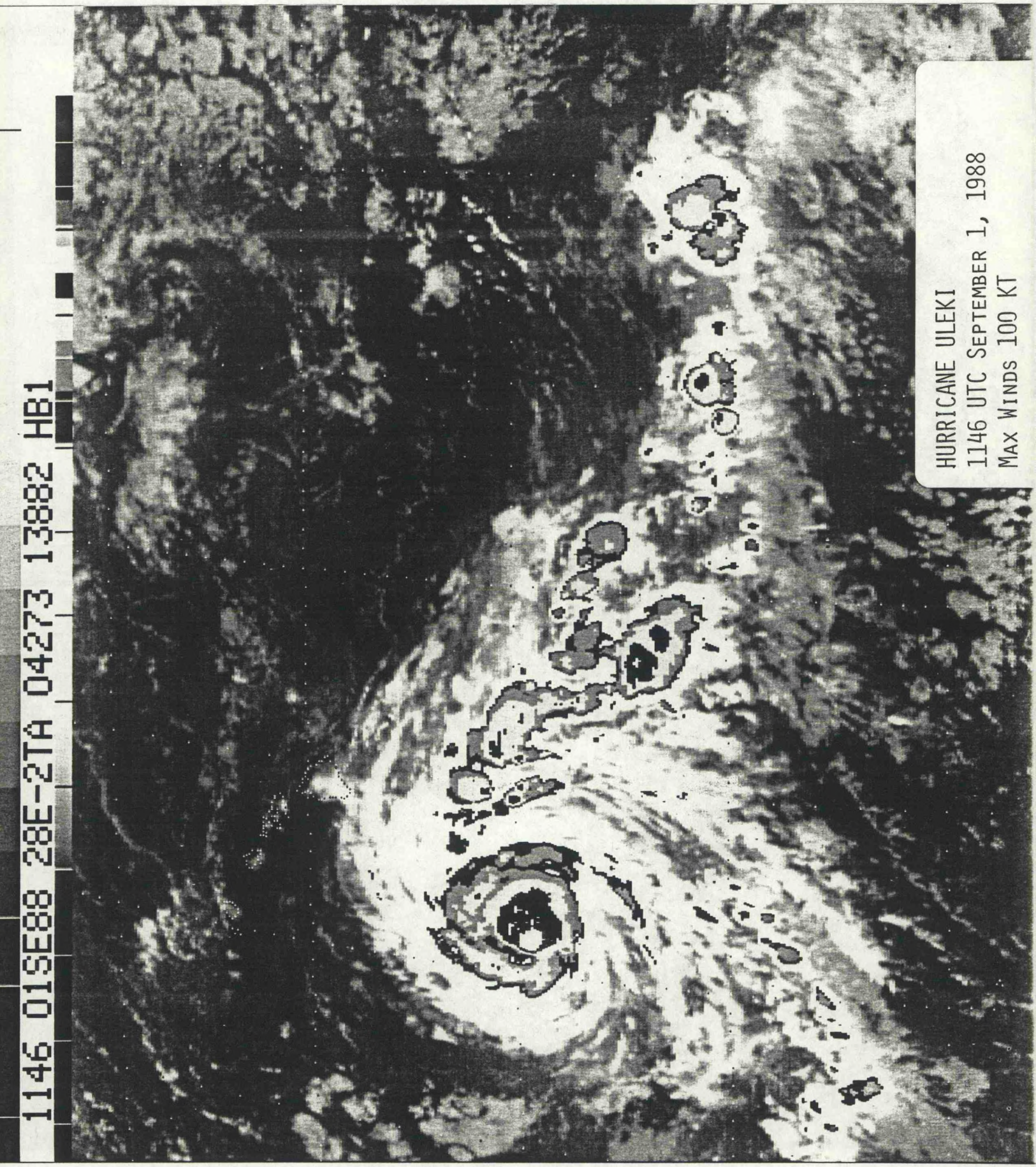


T.D. ONE-C/ HURRICANE 'ILEKI
IN FORMATIVE STAGE
1846 UTC AUGUST 27, 1988

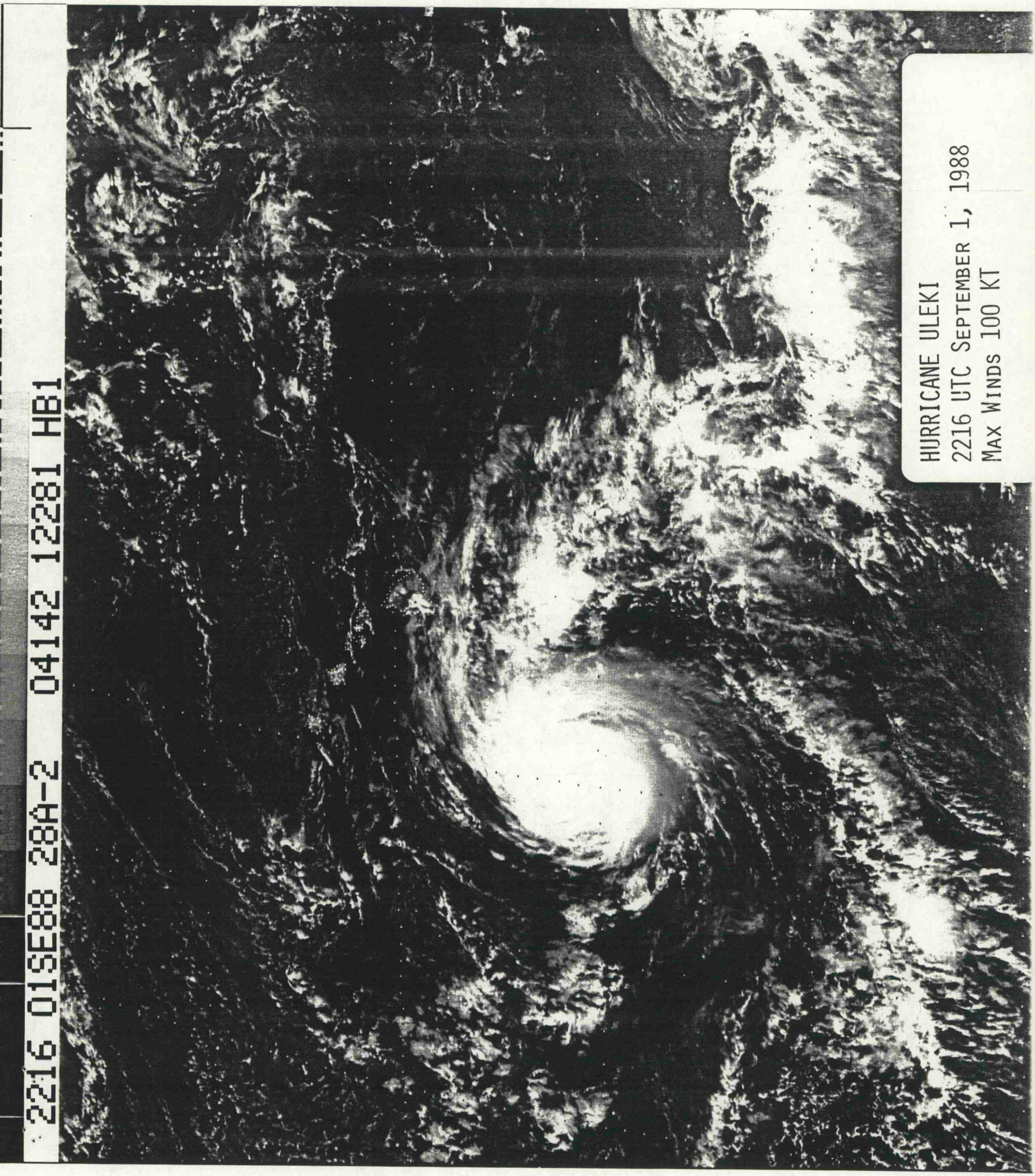
(FIG. 9)


1846 31AU88 28A-2 04392 13892 HB1
HURRICANE ULEKI
1846 UTC AUGUST 31, 1988
MAX WINDS 100 KT

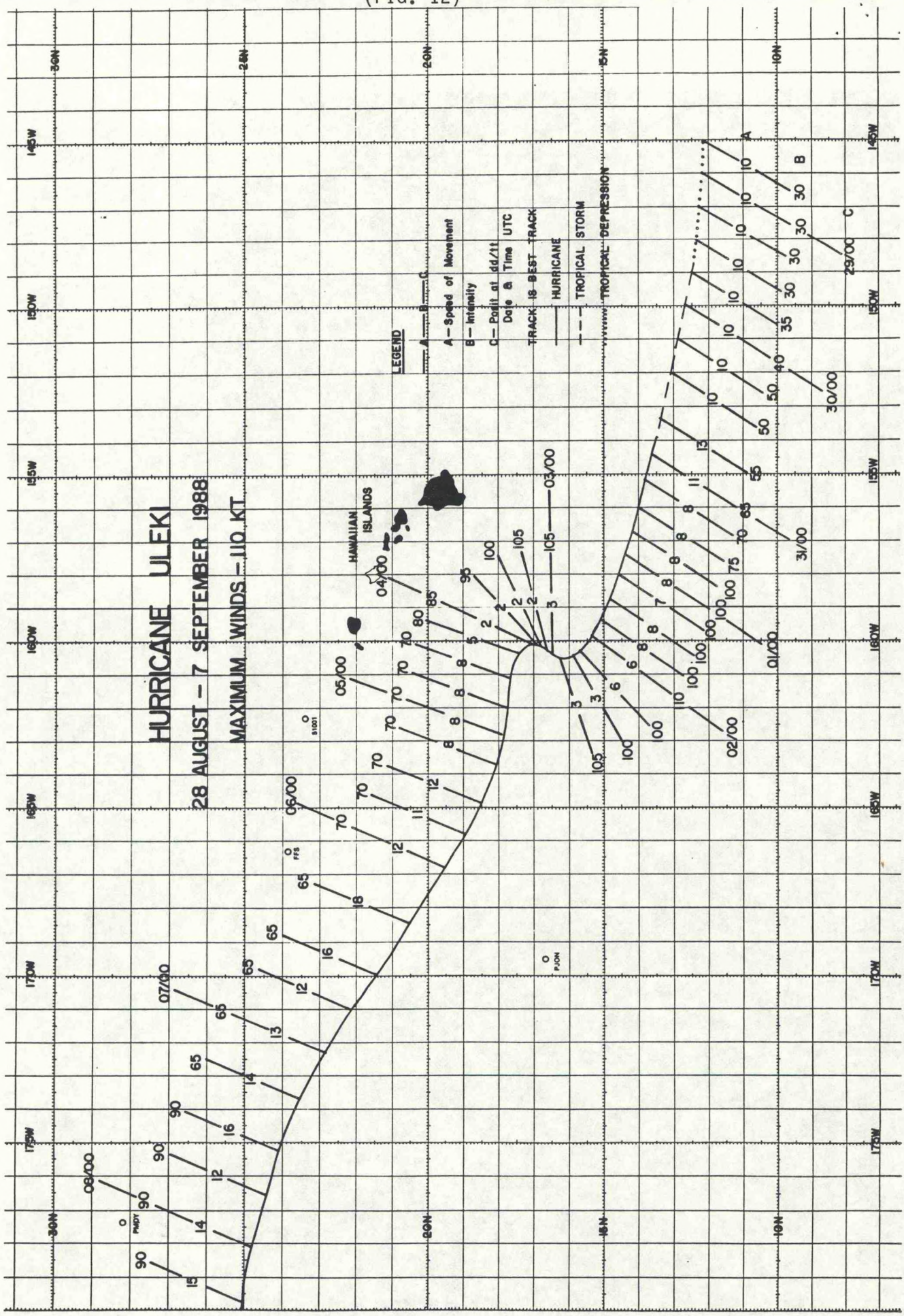
(FIG. 10)


1146 01SE88 28E-2TA 04273 13882 HB1
HURRICANE ULEKI
1146 UTC SEPTEMBER 1, 1988
MAX WINDS 100 KT

(FIG. 11)


2216 01SE88 28A-2 04142 12281 HB1
HURRICANE ULEKI
2216 UTC SEPTEMBER 1, 1988
MAX WINDS 100 KT

(FIG. 12)


HURRICANE ULEKI
28 AUGUST – 7 SEPTEMBER 1988
MAXIMUM WINDS – 110 KT
LEGEND
A – Speed of Movement
B – Intensity
C – Posit at dd/1t
Date & Time UTC
TRACK IS BEST TRACK
HURRICANE
TROPICAL STORM
TROPICAL DEPRESSION
HAWAIIAN ISLANDS
PHDY
PFS
PJON
30N
25N
20N
15N
10N
145W
150W
155W
160W
165W
170W
175W
08/00
07/00
06/00
05/00
04/00
03/00
01/00
02/00
30/00
31/00
29/00

HURRICANE ULEKI
28 AUGUST - 7 SEPTEMBER 1988

DATE/TIME UTC	BEST TRACK	ACTUAL TRACK	DIST ERROR (NM)
28/1800	12.2N 145.0W	13.0N 145.0W	48
29/0000	12.2N 146.0W	12.2N 146.2W	12
29/0600	12.3N 147.0W	12.2N 147.2W	14
29/1200	12.4N 148.0W	12.3N 148.3W	19
29/1800	12.5N 149.0W	12.5N 149.0W	0
30/0000	12.7N 150.0W	12.7N 150.0W	0
30/0600	12.9N 151.0W	12.9N 151.1W	7
30/1200	13.1N 152.0W	13.2N 152.0W	6
30/1800	13.3N 153.3W	13.7N 153.3W	24
31/0000	13.6N 154.4W	14.1N 154.4W	30
31/0600	13.8N 155.2W	14.0N 155.2W	12
31/1200	14.0N 156.0W	14.1N 156.0W	6
31/1800	14.2N 156.7W	14.1N 156.7W	6
01/0000	14.4N 157.4W	14.4N 157.4W	0
01/0600	14.6N 158.0W	14.7N 158.8W	47
01/1200	14.8N 158.8W	15.0N 158.8W	13
01/1800	15.1N 159.4W	15.1N 159.4W	0
02/0000	15.4N 159.8W	15.4N 159.8W	0
02/0600	15.7N 160.3W	15.7N 160.3W	0
02/1200	15.9N 160.4W	15.9N 160.5W	7
02/1800	16.3N 160.5W	16.4N 160.4W	8
03/0000	16.5N 160.4W	16.4N 160.6W	14
03/0600	16.6N 160.3W	16.5N 160.2W	8
03/1200	16.8N 160.2W	16.8N 160.1W	7
03/1800	16.9N 160.1W	17.0N 160.1W	6
04/0000	17.0N 160.1W	17.0N 160.2W	7
04/0600	17.4N 160.4W	17.4N 160.4W	0
04/1200	17.7N 161.1W	17.6N 161.1W	6
04/1800	17.8N 162.0W	17.8N 162.0W	0
05/0000	17.9N 162.8W	18.1N 162.8W	12
05/0600	18.1N 163.7W	18.2N 163.6W	8
05/1200	18.5N 164.9W	18.7N 164.8W	14
05/1800	18.9N 165.8W	19.5N 165.8W	36
06/0000	19.5N 166.8W	20.2N 166.8W	42
06/0600	20.5N 168.5W	20.7N 168.5W	12
06/1200	21.4N 170.0W	21.5N 170.0W	6
06/1800	22.1N 171.0W	22.2N 171.0W	6
07/0000	22.8N 172.3W	22.9N 172.3W	6
07/0600	23.5N 173.7W	23.5N 173.7W	0
07/1200	24.1N 175.3W	24.2N 175.2W	8
07/1800	24.4N 176.6W	24.4N 176.6W	0
08/0000	24.8N 178.1W	25.0N 178.1W	0
		AVERAGE DISTANCE ERROR	15 NM

The following data was used for verification purposes. Actual track positions from JTWC bulletins. Smoothed best track by CPHC.

DATE/TIME UTC	BEST TRACK	ACTUAL TRACK	DIST ERROR (NM)
08/0600	25.0N 179.8W	25.1N 179.8W	6
08/1200	25.3N 178.6E	25.3N 178.6E	0
08/1800	26.0N 177.0E	26.0N 177.0E	0
09/0000	26.5N 176.3E	26.5N 176.4E	7
09/0600	27.1N 175.3E	27.1N 175.3E	0
09/1200	27.4N 174.3E	27.5N 174.3E	6
09/1800	27.4N 173.7E	27.6N 173.2E	30
10/0000	27.5N 173.0E	27.5N 173.0E	0
10/0600	27.6N 172.3E	27.5N 172.3E	6
10/1200	28.0N 171.5E	28.0N 171.7E	11
10/1800	28.7N 170.8E	28.7N 170.7E	7
11/0000	29.4N 170.4E	29.4N 170.5E	7

HURRICANE ULEKI
28 AUGUST - 7 SEPTEMBER 1988

	24 HOUR FORECAST POSITION							24 HOUR FORECAST ERROR						
DTG	CPHC	EP SS87	EP AN85	EP CL84	EP CL81	QLM	NTCM	CPHC	EP SS87	EP AN85	EP CL84	EP CL81	QLM	NTCM
UTC	N/W	N/W	N/W	N/W	N/W	N/W	N/W	NM	NM	NM	NM	NM	NM	NM
3018	13.5	13.8	13.9	13.6			13.5	54	64	43	70			17
	152.4	152.2	152.6	152.1			153.1							
3100	14.0	14.0	14.1	13.8	13.1	15.8	13.3	53	70	47	78	80	238	71
	153.5	153.2	153.6	153.1	153.5	150.7	153.5							
3106	13.8	13.8	13.8	13.6			13.7	14	14	12	27			25
	155.1	155.1	155.2	155.0			155.5							
3112	14.0	14.2	14.4	14.1	13.7	15.3	14.5	6	14	19	12	38	216	42
	156.0	155.8	155.9	155.8	155.5	152.5	156.6							
3118	15.7	14.8	15.2	14.8			15.1	98	46	70	46			92
	157.0	157.0	157.1	157.0			157.9							
0100	16.2	15.1	15.8	15.4	15.1	16.4	15.8	114	76	106	88	67	221	125
	158.0	158.5	158.5	158.5	158.3	154.2	159.0							
0106	15.0	14.8	14.8	14.7			15.2	19	7	8	7			35
	158.7	158.8	158.9	158.9			159.1							
0112	15.0	15.0	14.9	14.9	14.4	16.6	14.9	23	52	53	53	43	193	70
	159.2	159.7	159.7	159.7	159.2	155.9	160.0							
0118	14.1	14.9	14.3	14.6			14.7	67	37	67	46			58
	159.9	160.0	160.2	160.0			160.3							
0200	15.2	15.4	15.1	15.4	15.5	17.6	15.1	42	58	61	52	35	152	30
	160.5	160.8	160.8	160.7	160.4	158.5	160.2							
0206	15.6	16.0	16.2	16.4			15.8	35	50	55	58			58
	160.9	161.1	161.1	161.0			161.3							
0212	15.8	16.3	16.5	16.7	16.2	18.3	16.1	47	79	73	89	77	174	93
	161.3	161.8	161.6	161.8	161.8	158.8	162.1							
0218	15.4	16.3	15.7	16.0			16.1	91	110	128	112			105
	161.7	162.3	162.5	162.3			162.2							
0300	15.6	16.6	15.8	16.1	16.0	18.3	16.1	84	76	99	66	101	116	88
	161.8	161.9	162.2	161.7	162.3	161.0	162.1							
0306	16.4	17.3	16.0	17.1			16.6	121	146	151	137			127
	162.3	162.6	162.8	162.5			162.4							
0312	16.5	17.5	17.1	17.4	16.9	19.0	16.9	139	171	167	170	149	146	127
	162.5	163.0	163.0	163.0	162.7	161.2	162.3							

	24 HOUR FORECAST POSITION							24 HOUR FORECAST ERROR						
DTG	CPHC	EP SS87	EP AN85	EP CL84	EP CL81	QLM	NTCM	CPHC	EP SS87	EP AN85	EP CL84	EP CL81	QLM	NTCM
UTC	N/W	N/W	N/W	N/W	N/W	N/W	N/W	NM	NM	NM	NM	NM	NM	NM
0318	18.1	17.8	17.5	18.3			17.6	95	70	91	108			58
	161.3	161.0	161.6	161.4			160.9							
0400	18.2	16.8	17.0	17.0	16.8	18.3	18.2	85	17	69	18	133	173	96
	161.0	160.4	161.4	160.5	162.5	162.9	161.3							
0406	17.3	17.0	17.1	17.2			17.2	8	27	39	13			13
	160.5	160.2	161.0	160.4			160.4							
0412	17.5	17.7	18.0	18.2	17.6		17.7	35	69	67	72	12		69
	160.5	159.9	160.0	160.0	161.3		159.9							
0418	18.9	18.2	18.2	18.4			18.5	142	111	117	114			80
	159.8	160.1	160.0	160.1			160.8							
0500	18.9	17.8	17.6	17.6	17.9	18.8	18.7	177	110	107	118	17	90	119
	159.8	160.9	161.0	160.8	162.6	164.2	160.8							
0506	19.0	19.0	18.7	19.7			19.2	199	134	129	149			119
	160.2	161.4	161.4	161.5			161.8							
0512	19.0	18.9	18.8	19.7	18.5	18.7		104	114	125	128	21	51	
	163.0	162.8	162.6	162.8	164.5	165.7								
0518	18.5	18.6	18.5	18.5			18.7	66	55	66	61			53
	165.3	165.6	165.3	165.6			165.4							
0600	19.5	18.9	18.9	18.8	18.7	21.5	19.1	44	80	79	86	91	132	66
	166.6	167.1	166.6	167.1	167.0	168.7	166.9							
0606	19.5	19.7	19.4	19.3			19.5	111	90	103	108			88
	167.0	167.3	167.3	167.3			167.6							
0612	19.9	20.2	19.9	19.8	19.4	20.8		148	93	114	114	134	58	
	168.0	169.1	168.9	169.1	169.2	170.7								
0618	21.0	21.4	21.6	21.7				79	78	49	78			
	170.4	169.9	170.4	169.7										
0700	21.2					22.7		107					57	
	171.7					173.3								
0706	21.9	22.6		22.7			22.9	108	54		48			49
	174.6	173.7		173.7			174.3							
0712	23.2	24.8		25.7	22.5	24.5	24.3	61	131		172	106	63	13
	175.0	172.9		172.5	175.7	176.3	175.0							
0718	24.7	25.0		25.6				18	105		135			
	176.6	174.8		174.5										
0800	25.7	25.0		25.4		25.3	24.6	47	44		64		28	50
	178.5	177.3		177.0		178.5	177.3							

DTG	CPHC	EP SS87	EP AN85	EP CL84	EP CL81	QLM	NTCM	CPHC	EP SS87	EP AN85	EP CL84	EP CL81	QLM	NTCM
	24 HOUR FORECAST POSITION							24 HOUR FORECAST ERROR						
UTC	N/W	N/W	N/W	N/W	N/W	N/W	N/W	NM	NM	NM	NM	NM	NM	NM
0806	26.0	25.4		25.6			25.2	73	110		128			33
	178.9	177.8		177.5			179.2							
0812	26.6	26.2		26.6	25.1	24.9	25.3	120	146		161	45	29	38
	179.7	178.9		178.8	177.8E	178.9E	179.3E							
0818	25.8	25.3		25.3			25.9	35	53		50			18
	177.6E	177.6E		177.5E			177.3E							
0900	26.5	26.2		26.5			27.5	38	21					61
	175.7E	176.6E		176.4E			176.6E							
AVERAGE DISTANCE ERRORS								77	75	80	84	72	126	66

HURRICANE ULEKI
28 AUGUST - 7 SEPTEMBER 1988

	36 HOUR FORECAST POSITION							36 HOUR FORECAST ERROR						
DTG	CPHC	EP SS87	EP AN85	EP CL84	EP CL81	QLM	NTCM	CPHC	EP SS87	EP AN85	EP CL84	EP CL81	QLM	NTCM
UTC	N/W	N/W	N/W	N/W	N/W	N/W	N/W	NM	NM	NM	NM	NM	NM	NM
3106	14.3	14.4	14.7	14.2			14.1	72	102	67	117			8
	154.0	153.5	154.3	143.2			155.1							
3112	14.8	14.7	15.0	14.4	13.5	15.2	13.8	63	89	68	101	144	236	45
	155.2	154.6	155.3	154.3	153.6	152.1	155.3							
3118	14.4	14.4	14.4	14.0			14.2	34	30	45	19			64
	157.2	157.1	157.4	157.0			157.8							
0100	14.5	14.8	15.2	14.6	14.2	16.4	15.0	19	30	56	17	100	276	100
	157.7	157.7	157.9	157.6	155.7	153.1	159.0							
0106	16.7	15.4	16.1	15.4			15.8	120	43	85	42			114
	158.8	158.9	159.0	158.8			160.4							
0112	17.0	15.7	16.8	16.1	16.2	16.8	16.5	133	107	146	123	78	281	180
	159.8	160.5	160.5	160.6	158.3	154.3	161.5							
0118	15.5	15.4	15.3	15.2			16.1	79	89	88	93			125
	160.7	160.9	160.9	161.0			161.3							
0200	15.6	15.5	15.4	15.5	16.1	17.4	15.8	48	104	110	110	44	210	147
	160.6	161.6	161.7	161.7	159.6	156.8	162.3							
0206	14.2	15.6	14.5	15.4			15.4	117	98	132	100			117
	161.6	162.0	162.2	162.0			162.3							
0212	15.3	16.1	15.5	16.3	16.8	18.4	15.8	105	133	135	123	59	176	75
	162.2	162.8	162.8	162.6	160.9	158.9	161.8							
0218	15.9	16.9	17.0	17.5			16.3	119	130	143	128			156
	162.4	162.6	162.8	162.3			163.1							
0300	16.0	17.1	17.3	17.8	17.1	19.3	16.5	140	161	175	166	112	197	190
	163.0	163.3	163.5	163.1	162.4	159.0	163.9							
0306	15.5	17.1	16.0	16.8			16.6	167	227	238	225			207
	162.9	164.1	164.3	164.1			163.8							
0312	15.8	17.5	16.3	17.0	16.8	19.0	16.8	205	194	226	173	155	164	190
	163.5	163.4	164.0	163.1	162.8	161.8	163.4							
0318	16.8	18.2	17.6	18.1			17.2	201	229	238	222			213
	163.6	163.9	164.2	163.8			163.8							
0400	17.0	18.4	17.8	18.4	17.6	19.9	17.4	218	244	268	249	176	189	185
	164.0	164.2	164.8	164.3	163.2	161.5	163.4							

	36 HOUR FORECAST POSITION							36 HOUR FORECAST ERROR						
DTG	CPHC	EP SS87	EP AN85	EP CL84	EP CL81	QLM	NTCM	CPHC	EP SS87	EP AN85	EP CL84	EP CL81	QLM	NTCM
UTC	N/W	N/W	N/W	N/W	N/W	N/W	N/W	NM	NM	NM	NM	NM	NM	NM
0406	19.1	18.6	17.7	19.4			18.1	137	80	122	147			76
	162.0	161.0	162.5	161.9			161.5							
0412	19.5	17.3	17.5	17.8	17.0	18.8	18.7	116	49	97	17	131	212	80
	161.5	160.3	162.8	160.9	163.3	164.6	161.9							
0418	18.5	17.6	17.6	18.0			17.8	85	98	26	59			63
	160.7	160.3	162.4	161.0			160.9							
0500	18.5	18.5	18.8	19.3	18.5		18.4	105	178	143	164	30		155
	161.0	159.7	160.4	160.2	162.5		160.1							
0506	19.8	19.2	19.0	19.4			19.4	210	219	188	201			135
	160.3	159.9	160.4	160.3			161.6							
0512	19.8	18.6	18.1	18.2	18.2	19.6	19.6	263	182	141	179	35	141	189
	160.3	161.6	162.4	161.7	164.5	167.1	161.6							
0518	20.0	19.8	19.1	20.9			20.0	301	249	205	251			178
	160.5	161.4	162.2	161.6			162.7							
0600	19.6	19.6	19.1	20.8	19.3	19.2		108	212	209	211	57	108	
	165.0	163.1	163.3	163.1	166.5	168.4								
0606	19.2	19.1	19.0	18.9			19.3	132	117	133	119			112
	166.8	167.3	167.0	167.6			167.2							
0612	19.9	19.4	19.5	19.2	19.2	21.7	19.7	121	136	150	142	182	101	124
	168.7	169.1	168.4	169.4	167.9	171.8	168.9							
0618	20.1	20.5	20.1	19.9			20.3	180	160	176	185			132
	168.7	168.8	168.8	168.8			169.8							
0700	20.6	21.0	20.6	20.4	20.4	20.2		200	141	164	169	194	170	
	169.7	170.8	170.7	170.9	170.1	173.2								
0706	21.3	22.3	22.0	22.7				141	141	98	167			
	172.8	171.5	173.0	170.8										
0712	21.6					22.4		167				136		
	174.1					176.7								
0718	22.8	23.5		23.6			23.8	108	81		77			53
	177.5	175.5		175.5			177.3							
0800	24.4	26.6		28.0	23.0	24.3	25.1	70	302		393	146	97	28
	177.0	172.8		171.6	179.6	179.7	177.6							
0806	26.6	26.4		27.3				98	225		290			
	179.1	175.9		175.0										
0812	28.3	26.1		26.8		24.7	25.2	188	123		190		40	71
	179.6E	179.3		178.3		178.3E	179.9E							

	36 HOUR FORECAST POSITION							36 HOUR FORECAST ERROR						
DTG	CPHC	EP SS87	EP AN85	EP CL84	EP CL81	QLM	NTCM	CPHC	EP SS87	EP AN85	EP CL84	EP CL81	QLM	NTCM
UTC	N/W	N/W	N/W	N/W	N/W	N/W	N/W	NM	NM	NM	NM	NM	NM	NM
0818	28.5	26.4		26.8			25.7	197	179		226			52
	179.4E	179.7		178.9			177.9E							
0900	29.0	27.2		27.9	25.6	25.6	25.8	211	171		210	63	61	50
	179.2E	179.5E		180.0	177.0E	175.9E	176.9E							
0906	26.8	25.9		25.9			26.8	37	74		81			47
	174.7E	175.0E		174.6E			174.5E							
0912	27.5	26.9		27.4			28.7	69	37		18			72
	173.0E	174.4E		174.0E			174.4E							
				AVERAGE DISTANCE ERRORS				134	140	140	149	108	166	113

HURRICANE ULEKI
28 AUGUST - 7 SEPTEMBER 1988

DTG	48 HOUR FORECAST POSITION							48 HOUR FORECAST ERROR						
	CPHC	EP SS87	EP AN85	EP CL84	EP CL81	QLM	NTCM	CPHC	EP SS87	EP AN85	EP CL84	EP CL81	QLM	NTCM
UTC	N/W	N/W	N/W	N/W	N/W	N/W	N/W	NM	NM	NM	NM	NM	NM	NM
3118	15.0	15.1	15.7	14.8			14.7	75	136	98	157			46
	155.8	154.6	156.4	154.1			157.2							
0100	15.6	15.5	16.0	15.0	14.7	15.3	14.2	80	114	96	127	95	295	17
	156.8	155.8	157.4	155.3	155.8	152.4	157.2							
0106	15.1	15.1	15.1	14.6			14.8	27	27	47	14			76
	159.0	158.6	159.5	158.6			160.1							
0112	15.2	15.5	16.1	18.2	15.5	16.7	15.6	32	38	92	365	55	290	155
	159.3	159.2	159.9	164.2	158.0	154.1	161.4							
0118	17.5	16.2	17.1	16.1			16.5	162	88	148	83			214
	160.7	160.4	160.9	160.4			162.8							
0200	17.8	16.4	17.8	16.8	16.8	16.9	17.2	181	151	203	177	99	357	265
	161.7	162.2	162.3	162.5	160.7	153.8	164.0							
0206	16.2	16.1	16.0	15.9			16.9	136	124	157	139			198
	162.6	162.4	163.0	162.7			163.5							
0212	16.0	16.2	16.1	16.2	15.7	18.1	16.6	98	157	185	174	88	236	240
	162.2	163.2	163.7	163.5	162.0	157.1	164.6							
0218	14.3	16.3	15.0	16.1			16.0	215	173	235	185			226
	163.4	163.4	164.2	163.6			164.3							
0300	15.4	16.8	16.1	17.1	17.2	19.8	16.4	216	231	225	222	119	206	167
	164.2	164.6	164.5	164.4	162.5	160.1	163.5							
0306	16.3	17.6	18.0	18.4			16.7	231	250	246	246			271
	164.2	164.4	164.2	164.0			164.9							
0312	16.5	17.8	18.3	18.6	17.5	19.8	16.9	254	293	289	295	205	181	322
	164.5	165.1	164.9	164.9	163.6	159.7	165.7							
0318	15.7	17.9	16.8	17.6			17.2	243	319	327	328			304
	164.1	165.6	165.8	165.8			165.4							
0400	16.1	18.2	16.9	17.7	17.0	20.0	17.4	287	273	321	250	218	233	253
	165.1	164.8	165.8	164.5	164.0	162.8	164.6							
0406	17.3	19.0	18.8	18.9			17.8	264	301	308	299			253
	165.0	165.4	165.6	165.4			164.8							
0412	17.5	19.2	19.0	19.1	18.1	20.8	18.0	252	279	281	293	191	217	201
	165.5	165.7	165.8	166.0	164.4	162.9	164.6							

	48 HOUR FORECAST POSITION							48 HOUR FORECAST ERROR						
DTG	CPHC	EP SS87	EP AN85	EP CL84	EP CL81	QLM	NTCM	CPHC	EP SS87	EP AN85	EP CL84	EP CL81	QLM	NTCM
UTC	N/W	N/W	N/W	N/W	N/W	N/W	N/W	NM	NM	NM	NM	NM	NM	NM
0418	19.8	19.5	18.5	20.2			18.6	135	108	95	164			48
	163.1	161.4	163.5	163.4			162.1							
0500	20.6	17.9		18.3	17.9	19.6	19.2	153	143		64	81	208	68
	162.3	160.3		161.7	164.2	166.1	162.5							
0506	20.0	18.2		18.4			18.4	161	182		92			132
	161.5	160.4		162.0			161.3							
0512	20.0	19.1	17.7	19.9	20.6		19.0	202	268	208	216	191		251
	161.5	160.1	161.3	161.2	162.1		160.4							
0518	20.4	19.9	17.9	19.9			20.2	265	312	273	255			202
	161.2	160.3	161.3	161.3			162.3							
0600	20.4	19.1		18.4	19.5	19.9	20.4	315	274		261	100	181	254
	161.2	162.1		162.6	165.2	170.0	162.3							
0606	20.8	20.7	20.2	21.8			20.8	365	370	305	336			269
	162.0	161.9	163.1	162.6			163.7							
0612	20.2	20.5	19.8	21.8	20.3	19.8		137	375	325	346	168	114	
	168.0	163.4	164.5	163.8	167.3	170.9								
0618	19.8	19.5	19.8	19.0			20.0	205	204	205	214			173
	168.4	168.8	168.4	169.3			169.0							
0700	20.0	19.8	20.3	19.3	18.7	22.0	20.3	193	204	213	221	272	118	174
	170.8	170.8	169.7	171.5	170.5	174.2	170.9							
0706	20.8	21.2	21.0	20.4			21.1	232	247	250	269			172
	170.7	170.0	170.1	170.2			172.0							
0712	21.3	21.7	21.4	20.8	20.2	20.3		260	219	236	247	286	234	
	171.7	172.3	172.2	172.7	172.4	175.0								
0718	21.8	23.1	22.2	23.6				174	207	136	246			
	175.2	173.1	176.0	172.2										
0800	22.2					22.4		190					172	
	176.5					179.4								
0806	24.3	24.2		24.2			24.7	48	132		127			33
	179.9	177.6		177.7			179.8E							
0812	25.3	28.0		29.8	22.9	24.1	26.0	168	458		596	145	117	82
	178.3	173.4		171.4	178.9E	176.9E	179.9E							
0818	29.2	27.5		28.7				234	313		412			
	179.5E	177.4		175.9										
0900	30.2	26.9		27.8		25.0	25.9	224	120		207		114	52
	177.0E	178.6E		180.0		175.1E	177.1E							

DTG	48 HOUR FORECAST POSITION							48 HOUR FORECAST ERROR						
	CPHC	EP SS87	EP AN85	EP CL84	EP CL81	QLM	NTCM	CPHC	EP SS87	EP AN85	EP CL84	EP CL81	QLM	NTCM
UTC	N/W	N/W	N/W	N/W	N/W	N/W	N/W	NM	NM	NM	NM	NM	NM	NM
0906	30.4	27.2		27.8			26.1	208	160		217			61
	176.5E	178.3E		179.3E			175.1E							
0912	30.5	28.1		28.8	27.6	25.6	26.3	214	174		201	123	117	74
	176.5E	177.5E		177.8E	172.0E	173.8E	174.0E							
0918	27.8	26.1		25.8			27.8	65	114		160			86
	172.0E	171.9E		171.0E			171.6E							
1000	28.8	27.4		27.7			30.0	154	54		107			156
	170.5E	172.0E		171.0E			172.2E							
AVERAGE FORECAST ERROR								186	205	212	225	152	199	167

HURRICANE ULEKI
28 AUGUST - 7 SEPTEMBER 1988

	72 HOUR FORECAST POSITION							72 HOUR FORECAST ERROR						
DTG	CPHC	EP SS87	EP AN85	EP CL84	EP CL81	QLM	NTCM	CPHC	EP SS87	EP AN85	EP CL84	EP CL81	QLM	NTCM
UTC	N/W	N/W	N/W	N/W	N/W	N/W	N/W	NM	NM	NM	NM	NM	NM	NM
0118	16.7	16.5	18.5	15.8			16.0	99	117	221	102			128
	159.0	158.0	160.9	157.8			161.4							
0200	17.3	16.8	18.8	16.1	13.7	16.1	15.3	115	87	240	62	159	424	81
	160.0	159.4	162.0	159.0	157.7	152.5	161.2							
0206	16.6	16.3	16.8	15.6			16.3	165	99	223	122			279
	163.0	161.9	164.0	162.4			165.1							
0212	16.5	16.7	18.2	16.3	14.8	17.7	16.4	149	130	253	152	84	416	347
	163.0	162.6	164.2	163.1	159.6	153.5	166.5							
0218	18.8	17.5	19.6	17.2			17.8	275	211	316	224			449
	164.5	163.9	164.8	164.2			168.1							
0300	18.5	17.8	20.0	17.9	16.3	18.2	18.3	323	293	344	367	115	465	500
	165.8	165.5	165.3	166.8	162.6	152.7	169.1							
0306	17.5	17.5	17.6	17.1			19.0	355	271	413	352			487
	166.3	164.8	167.3	166.3			168.3							
0312	17.0	17.7	17.7	17.4	16.2	20.2	19.1	282	325	450	403	250	249	582
	165.0	165.7	167.9	167.1	164.4	157.6	170.0							
0318	15.0	17.8	15.9	17.3			17.9	432	324	499	373			495
	167.3	165.7	168.7	166.6			168.7							
0400	15.6	18.2	17.8	18.2	19.0	21.2	18.1	361	446	461	441	273	268	411
	166.3	167.9	168.2	167.8	164.5	161.8	167.3							
0406	17.1	19.1	20.6	19.5			17.4	459	478	421	478			481
	168.4	168.6	167.0	168.5			168.8							
0412	17.0	19.3	20.6	19.7	19.8		17.3	340	455	405	477	278		487
	167.0	168.9	167.5	169.2	165.4		169.6							
0418	16.3	19.6	18.5	18.9			18.2	317	320	373	370			394
	167.3	167.3	168.5	168.4			168.9							
0500	17.3	20.0	17.8	19.2	18.5	20.5	19.2	312	229	371	194	167	236	270
	168.2	166.3	169.3	166.0	165.7	166.1	167.4							
0506	18.5	20.8	21.0	20.1			19.0	280	270	310	300			227
	168.5	167.5	168.2	168.5			167.5							
0512	19.0	20.9	21.2	20.2	19.9	21.8	19.2	239	189	252	249	92	275	145
	169.0	167.2	168.4	168.9	165.8	168.4	167.3							

DTG	72 HOUR FORECAST POSITION							72 HOUR FORECAST ERROR						
	CPHC	EP SS87	EP AN85	EP CL84	EP CL81	QLM	NTCM	CPHC	EP SS87	EP AN85	EP CL84	EP CL81	QLM	NTCM
UTC	N/W	N/W	N/W	N/W	N/W	N/W	N/W	NM	NM	NM	NM	NM	NM	NM
0518	20.2	20.8		21.7			19.3	54	260		132			108
	166.4	161.4		165.9			163.9							
0600	21.0	19.7		20.2	20.0	22.2	19.7	112	475		315	198	230	150
	165.0	158.4		161.2	170.3	170.3	164.2							
0606	21.2	20.0		20.3			19.9	116	581		422			319
	166.5	158.2		161.0			162.9							
0612	21.0	20.9		21.5	22.0		20.5	198	549		441	314		469
	166.5	160.2		162.1	164.4		161.7							
0618	21.2	21.5		21.6			22.3	395	592		497			361
	164.0	160.4		162.1			164.5							
0700	21.2	20.8		20.2	20.3	22.1	22.5	473	663		613	183	211	432
	164.0	160.6		161.7	170.6	176.0	164.5							
0706	21.3	21.8		23.1			22.3	500	557		425			410
	165.0	163.8		166.0			166.4							
0712	20.7	21.6		22.9	21.4			243	569		420	343		
	173.0	165.3		167.7	169.8									
0718	20.0	20.6	21.9	19.7			21.6	367	431	363	381			269
	172.0	170.0	170.6	172.0			172.8							
0800	20.0	20.9	22.5	19.8	17.6	23.6	21.9	346	395	377	362	483	92	260
	175.0	172.5	171.8	174.8	174.7	178.8	174.8							
0806	21.6	22.6	23.4	21.1			23.1	338	443	449	409			203
	175.0	172.2	171.8	173.8			176.8							
0812	22.0	23.1	23.3	21.5	19.9	20.9		357	384	380	345	409	309	
	176.0	174.8	174.8	176.7	176.9	178.5								
0818	23.8	24.3	22.2	24.8				232	352	382	328			
	179.5	176.8	177.4	177.1										
0900	24.6					21.4		194					306	
	179.3E					176.5E								
0906	27.1	26.1		25.5			26.2	80	137		119			93
	176.8E	177.6E		176.6E			173.9E							
0912	27.0	30.6		34.0	25.0	23.3	26.6	263	393		634	150	260	60
	179.2E	179.1		176.0	174.1E	173.1E	174.8E							
0918	32.0	29.3		31.5				409	249		387			
	179.2E	177.5E		179.1E										
1000	31.0	28.5		30.1		25.0	26.4	262	60		177		159	130
	170.0E	172.9E		174.6E		172.0E	170.9E							

	72 HOUR FORECAST POSITION							72 HOUR FORECAST ERROR						
DTG	CPHC	EP SS87	EP AN85	EP CL84	EP CL81	QLM	NTCM	CPHC	EP SS87	EP AN85	EP CL84	EP CL81	QLM	NTCM
UTC	N/W	N/W	N/W	N/W	N/W	N/W	N/W	NM	NM	NM	NM	NM	NM	NM
1006	31.0	28.6		29.6			26.0	272	116		186			189
	169.0E	174.1E		174.9E			169.2E							
1012	31.0	29.7		30.8	28.0	25.9	26.7	184	197		233	397	130	212
	171.0E	174.9E		174.8E	164.2E	171.1E	168.0E							
1018	30.5	27.5		26.7			30.1	173	84		183			250
	168.1E	169.9E		168.1E			166.2E							
1100	32.1	29.8		29.1			32.6	266	32		143			213
	166.4E	170.1E		167.8E			168.7E							
				AVERAGE DISTANCE ERRORS				272	318	357	319	243	269	300

HURRICANE ULEKI - AUGUST 28 - SEPTEMBER 7, 1988

CPHC MEAN ERROR FROM BEST TRACK.....15 NM

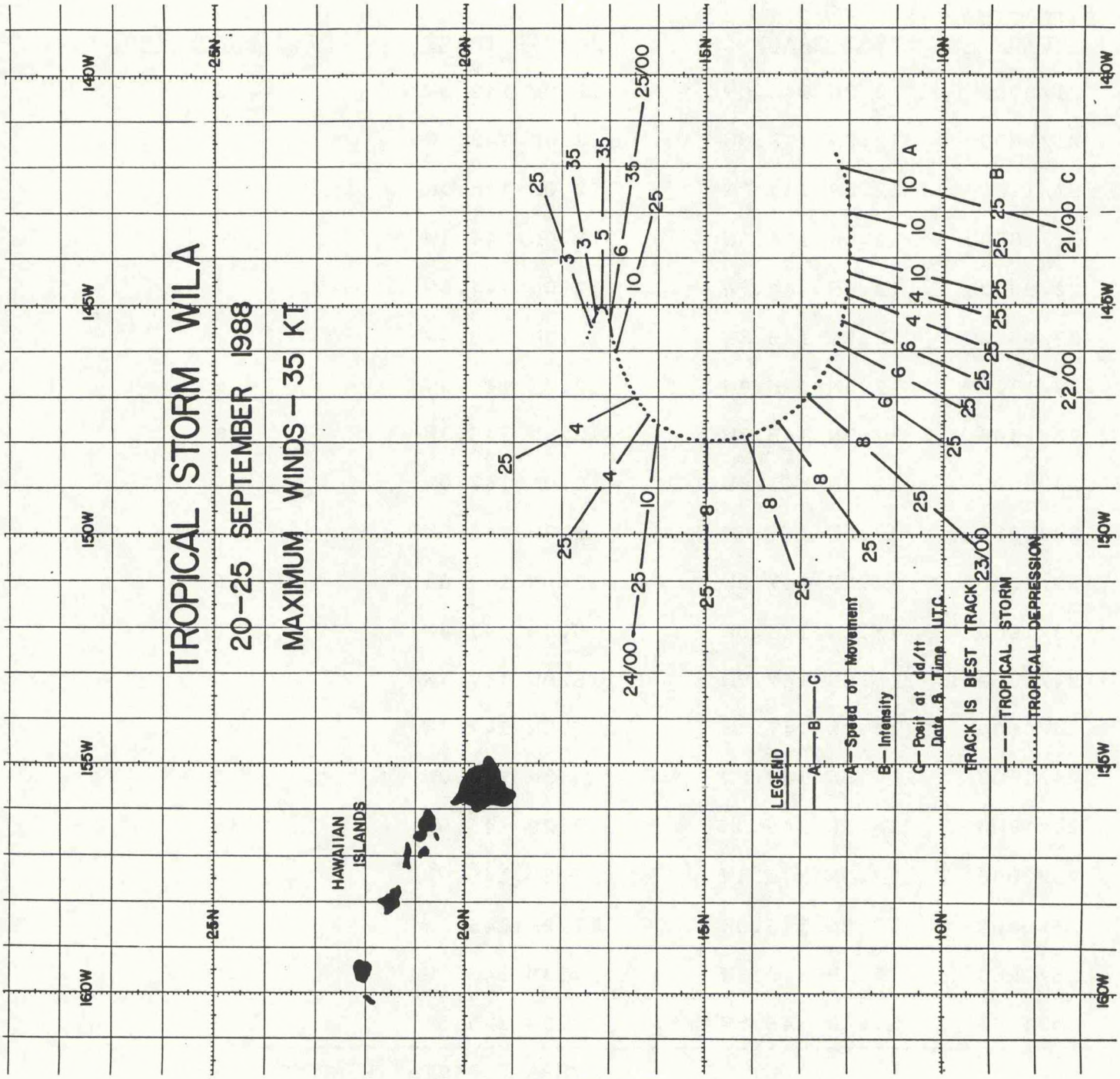
MEAN FORECAST ERROR [ERROR (NM)/# OF CASES]

	24 HR FCST	36 HR FCST	48 HR FCST	72 HR FCST
CPHC	77/38	134/38	186/38	272/38
EPSS87	75/37	140/37	205/37	318/37
EPAN85	80/29	140/29	212/26	357/21
EPCL84	84/36	149/37	225/37	319/37
EPHC81	72/16	108/17	152/16	243/16
QLM	126/17	166/16	199/17	269/15
NTCM	66/33	113/33	167/33	300/33

TROPICAL STORM WILA
20 - 25 September 1988

WILA was the second tropical cyclone to develop within the CPHC area of responsibility during the 1988 season. The first advisory on Tropical Depression TWO-C was issued at 210000 UTC as an area of convection near 12N 142W showed signs of development. T.D. TWO-C was, however, slow in getting organized. It drifted slowly, first westward and later northwestward, over the next day or two with winds estimated at 25 knots near the center. The deep easterly flow in which the depression was embedded turned to the southwest at higher levels as a trough in the westerlies approached. This caused TWO-C to recurve toward the northeast at about 231800 UTC near 15N 148W (Fig. 13). Some intensification occurred as the depression moved northeastward. The slight intensification was confirmed by an Air Force reconnaissance plane investigating the circulation which measured winds of 40 knots near 17N 145W. Based on the observations received from the reconnaissance aircraft, TWO-C was upgraded to a tropical storm at 250000 UTC and named WILA (Fig. 14). At this time, the vertical wind shear over the circulation was quite large. This caused the lower portion of the storm to begin moving westward toward the Hawaiian Islands while the top portion blew eastward with the upper level westerlies. WILA's life as a tropical storm was short-lived--eighteen hours; the system now void of any deep convection quickly weakened and WILA was downgraded to a tropical depression. Moisture carried along with the remnant circulation produced a few heavy showers over the Hawaiian Islands on September 26 and 27.

(FIG. 13)


TROPICAL STORM WILA
20-25 SEPTEMBER 1988
MAXIMUM WINDS — 35 KT
HAWAIIAN ISLANDS
LEGEND
A—Speed of Movement
B—Intensity
C—Posit at dd/tt
Date & Time UTC
TRACK IS BEST TRACK
TROPICAL STORM
TROPICAL DEPRESSION
24/00
25/00
23/00
21/00
22/00
160W
155W
150W
145W
140W
25N
20N
15N
10N

TROPICAL STORM WILA
20 - 25 SEPTEMBER 1988

DATE/TIME UTC	BEST TRACK	ACTUAL TRACK	DIST ERROR (NM)
21/0000	12.2N 142.0W	12.0N 142.0W	12
21/0600	12.0N 143.0W	12.0N 143.0W	0
21/1200	12.0N 144.0W	12.0N 144.0W	0
21/1800	12.0N 144.3W	12.0N 144.3W	0
22/0000	12.1N 144.7W	12.0N 144.6W	7
22/0600	12.2N 145.3W	12.0N 145.4W	13
22/1200	12.3N 145.8W	12.2N 145.8W	6
22/1800	12.5N 146.3W	12.8N 146.3W	18
23/0000	12.9N 147.0W	13.0N 147.0W	6
23/0600	13.5N 147.6W	13.2N 148.0W	29
23/1200	14.2N 147.9W	13.5N 149.0W	76
23/1800	15.0N 148.0W	15.0N 147.8W	10
24/0000	16.0N 147.7W	16.0N 147.7W	0
24/0600	16.3N 147.4W	16.5N 147.7W	21
24/1200	16.5N 147.0W	16.5N 147.0W	0
24/1800	16.9N 146.0W	17.2N 146.0W	18
25/0000	17.0N 145.4W	17.2N 145.0W	0
25/0600	17.2N 145.0W	17.2N 145.0W	0
25/1200	17.3N 145.3W	17.3N 145.3W	0
25/1800	17.4N 145.5W	17.3N 145.5W	6
		AVERAGE DISTANCE ERROR	7 NM

(FIG. 14)

TROPICAL STORM WILA
0016 UTC SEPTEMBER 25, 1988
MAX WINDS 35 KT

1988 FORECAST VERIFICATION SUMMARY

Forecast Periods
(Average error in nautical miles (NM)/
number of forecasts)

FORECASTER/MODEL	24-HR	36-HR	48-HR	72-HR
CPHC FORECASTER	78/47	127/45	173/43	267/39
EPSS87	77/46	134/44	192/42	312/38
EPAN85	87/36	135/36	192/31	346/22
EPCL84	84/45	141/44	208/42	313/38
EPHC81	69/20	105/20	157/18	243/16
QLM	141/21	182/19	211/19	269/15
NTCM	67/39	107/38	157/37	300/33

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