

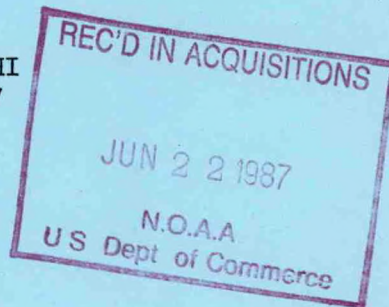
H
QC
995
U66
no. 32

NOAA TECHNICAL MEMORANDUM NWSM PR-32



1986 TROPICAL CYCLONES - CENTRAL NORTH PACIFIC

Honolulu, HI
April 1987



**U.S. DEPARTMENT OF
COMMERCE**

National Oceanic and
Atmospheric Administration

National Weather
Service

NOAA TECHNICAL MEMORANDA
National Weather Service, Pacific Region Subseries

The Technical Memoranda series provides an informal medium for the documentation and quick dissemination of results not appropriate, or not yet ready, for formal publication in the standard journals. The series is used to report on work in progress, to describe technical procedures and practices, or to report on investigations devoted primarily to regional and local problems of interest mainly to Pacific Region personnel and, hence, will not be widely distributed.

Papers 1 and 2 are in the former series, ESSA Technical Memoranda, Pacific Region Technical Memoranda (PRTM); papers 3-8 are in the former series, ESSA Technical Memoranda, Weather Bureau Technical Memoranda (WBTM); and papers 9-31 are part of the series, NOAA Technical Memoranda NWS.

Papers 1-3 are available from the Pacific Region Headquarters, Attention: TSD, P. O. Box 50027, Honolulu, HI 96850. Beginning with 4, the papers are available from the National Technical Information Service, U. S. Department of Commerce, 5285 Port Royal Road, Springfield, VA 22151. Prices vary for paper copy and microfiche. Order by accession number, when given, in parentheses at the end of each entry.

- 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)
- 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)

NOAA TECHNICAL MEMORANDUM NWSTM PR-32

H
QC
995
U66
no. 32

1986 TROPICAL CYCLONES - CENTRAL NORTH PACIFIC
"

Wyman Au
Andrew Chun
Hans Rosendal
Raymond Sewake

Honolulu, Hawaii
April 1987

TABLE OF CONTENTS

1986 TROPICAL CYCLONES - Central Pacific

1.	Central North Pacific Tropical Cyclone Data, 1986	1
2.	Hurricane Estelle	2, 3
3.	Fig. 1 - GOES-West IR Imagery of Hurricane Estelle on 21 Jul 86	4
4.	Fig. 2 - GOES-West Visual Imagery of Hurricane Estelle on 22 Jul 86	5
5.	Fig. 3 - Decoded Buoy 51004 Data	6
6.	Fig. 4 - Hurricane Estelle - Best Track Map	7
7.	Hurricane Estelle - Actual vs Best Track Error	8
8.	Hurricane Estelle - Verification	9 - 12
9.	Tropical Depression One-C	13
10.	Fig. 5 - T. D. 01C Best Track Map	14
11.	Tropical 01C - Actual vs Best Track Error	15
12.	Tropical Depression Ten-E	16
13.	Fig. 6 - T. D. 10E Best Track	17
14.	T.D. 10E - Actual vs Best Track Error	18
15.	Tropical Depression Frank	19
13.	Fig. 7 - T. D. Frank Best Track Map	20
14.	T. D. Frank - Actual vs Best Track Error	21
15.	Tropical Storm Georgette	22
16.	Fig. 8 - Tropical Storm Georgette Best Track Map	23
17.	Tropical Storm Georgette - Actual vs Best Track Error	24
18.	Tropical Depression Lester	25
19.	Fig. 9 - T. D. Lester Best Track Map	26
20.	T. D. Lester - Actual vs Best Track Error	27

21.	Hurricane Orlene	28
22.	Fig. 10 - GOES-West Visual Imagery of Hurricane Orlene on 21 Sep 86	29
23.	Fig. 11 - GOES-West IR Imagery of Hurricane Orlene on 22 Sep 86	30
24.	Fig. 12 - Hurricane Orlene Best Track Map	31
25.	Hurricane Orlene - Best Track vs Actual Track Error	32
26.	Hurricane Orlene - Verification	33 - 35
27.	1986 Forecast Errors	36

CENTRAL NORTH PACIFIC TROPICAL CYCLONE DATA, 1986*

NAME	DATES	MAXIMUM CLASS	MAXIMUM SUSTAINED WINDS (KT)	LOWEST PRESSURE (MB)	TOTAL HOURS OBSERVED
ESTELLE	Jul 21-25	Hurricane	E115 (SFSS)	N/A**	48(H), 30(TS), 36(TD)
ONE-C	Jul 27-28	Tropical Depression	E30 (SFSS)	N/A	24(TD)
TEN-E	Jul 29-30	Tropical Depression	E30 (SFSS)	N/A	18(TD)
FRANK	Aug 1-2	Tropical Depression	E30 (SFSS)	N/A	18(TD)
GEORGETTE	Aug 3-4	Tropical Storm	E40 (SFSS)	N/A	6(TS), 6(TD)
LESTER	Sep 16	Tropical Depression	E30 (SFSS)	N/A	6(TD)
ORLENE	Sep 21-24	Hurricane	E70 (SFSS)	N/A**	30(H), 24(TS), 12(TD)

Key

H Hurricane
 TS Tropical Storm
 TD Tropical Depression

* Data pertains only to period tropical cyclone was in the central Pacific
 **RECECE flown after hurricane reached peak and was in a weakening trend

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

Total hours per class: H 36 hrs
 TS 84 hrs
 TD 12 hrs

HURRICANE ESTELLE
July 21-25, 1986

Hurricane ESTELLE developed a few days earlier on July 16 in the eastern Pacific near 10N 115W. ESTELLE crossed 140W and into the Central Pacific Hurricane Center's (CPHC) area of responsibility at about 0600 UTC 21 July 1986. ESTELLE was a well developed and quite powerful hurricane during the previous 24 hours when her maximum sustained winds were estimated at 115 knots (Fig.1). While in the area between 130W and 140W, ESTELLE was moving toward the west northwest at 20 knots and maintained this forward motion after she crossed 140W.

The synoptic pattern over the north Pacific during ESTELLE's early days had been rather unique for mid summer with strong pressure features more reminiscent of winter. A large trough in the upper westerlies was located off the west coast of North America during the formative stages of ESTELLE. This trough retrograded westward and was in the vicinity of the Hawaiian Islands as ESTELLE made her approach from the east and for a time it appeared she could recurve to the east of the islands or become sheared as the upper westerlies descended in both altitude and latitude near the cyclone. In any event, ESTELLE started to weaken gradually on July 21st and continued this slow decline over the next few days as she moved rapidly westward and approached the Hawaiian Islands (Fig. 2).

The combination of the rapid forward motion speed of about 20 knots on a course aiming directly at the Hawaiian Islands during this intense stage of ESTELLE's life resulted in some very large swell moving toward the Big Island of Hawaii. With the wave energy and the cyclone moving at approximately the same speed, the swell bunched up and hit the east facing shores of the Big Island with high intensity during the afternoon hours of July 22nd. All beaches along the southeast coast of the Big Island were evacuated before 10 to 20 foot surf began to pound the shoreline. The waves from ESTELLE came at a time of spring tides near full moon and during a period of high water induced by the cyclone itself as strong northeast winds gusting to near 50 mph blew parallel to the Puna and Kau Coast and piled water to the right of it toward the shore. This caused the waves to break higher up on the beach and in the process demolished five beach front homes and caused heavy damage to several others in the Vacationland Estates subdivision. Total dollar damage on the Big Island was estimated at \$2 million.

On the island of Maui, the wave action on the eastern coast caused a stretch of dirt road between Kipahulu and Kaupo to be washed away. On the island of Oahu, two drownings occurred on July 23rd and may have been caused by the rough waters associated with ESTELLE.

NOAA buoy 51004 proved to be a valuable observing platform. Forecasters at the CPHC were able to obtain vital wind, pressure, and wave data as ESTELLE approached the Big Island and 51004. The lowest pressure, peak wind, and largest sea height was reported at 222300 UTC when ESTELLE was about 30 nautical miles south of 51004. Decoded buoy data depicting the approach and passage of ESTELLE at the buoy is shown in Fig. 3. The lowest hourly SLP reported was 1000.6mb, the maximum winds 080 degrees 52 kt gusting to 66 kt and the largest waves reported 21 half meters (34.4 feet).

A U.S. Air Force reconnaissance aircraft flying into the center of ESTELLE fixed her surface position at 17.0N 152.6W at 222307 UTC. This position is exactly 30 NM south of buoy 51004. The reconnaissance aircraft reported measured sea level pressure of 981MB in the center of ESTELLE and observed maximum winds in the northwest quadrant of 52 knots 60 NM from the center.

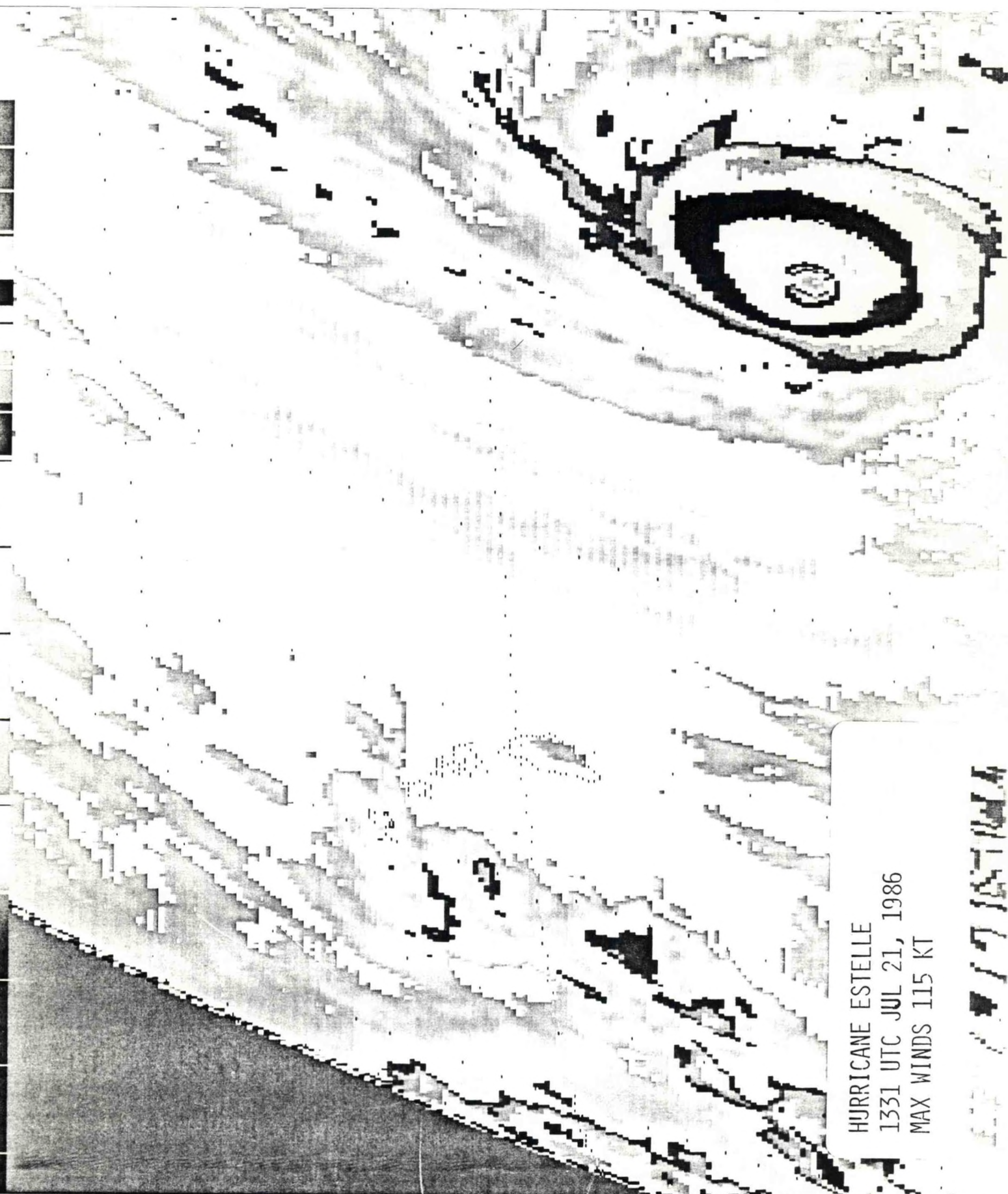
ESTELLE moved along a very predictable westward track at about 20 knots from 140W to 155W (Fig. 4). Her west northwest track turned westerly near 150W as she started to feel the presence of the massive mountains of the Big Island. ESTELLE moved almost due west along 17N latitude from 150W to 160W. Closest point of approach to the southernmost tip of the Big Island occurred at about 231000 UTC when ESTELLE's center passed about 120 miles to the south with maximum sustained winds estimated near 75 kt. Winds on the Big Island were not unusually strong with winds estimated at 40 to 50 mph over locally exposed areas. Rainfall was also light during the passage of the tropical cyclone. However, heavy showers did occur when ESTELLE was southwest of the Big Island and some 48 hour rainfall amounts in the 5 to 10 inch range were reported over the Kau and Puna districts.

ESTELLE was downgraded to a tropical storm at 231800 UTC. The storm continued to weaken as she moved on a more north of west track and was downgraded to a tropical depression at 250000 UTC. The final advisory on ESTELLE was issued by the CPHC at 260600 UTC when the remains of the once powerful tropical cyclone were located near 19N 166W. The EPHC and the CPHC issued a total of 40 advisories on ESTELLE which denotes a 10-day life span.

Moisture laden air carried along by ESTELLE interacted with the dynamics of a cold upper level trough to the north of the islands during her dissipating stage and caused heavy thunderstorms over most of the Hawaiian Islands. Rainfall amounts of 4 to 7 inches fell on portions of Oahu on the 24th and 25th.

There were no reports of serious damages or casualties to ships attributed to ESTELLE.

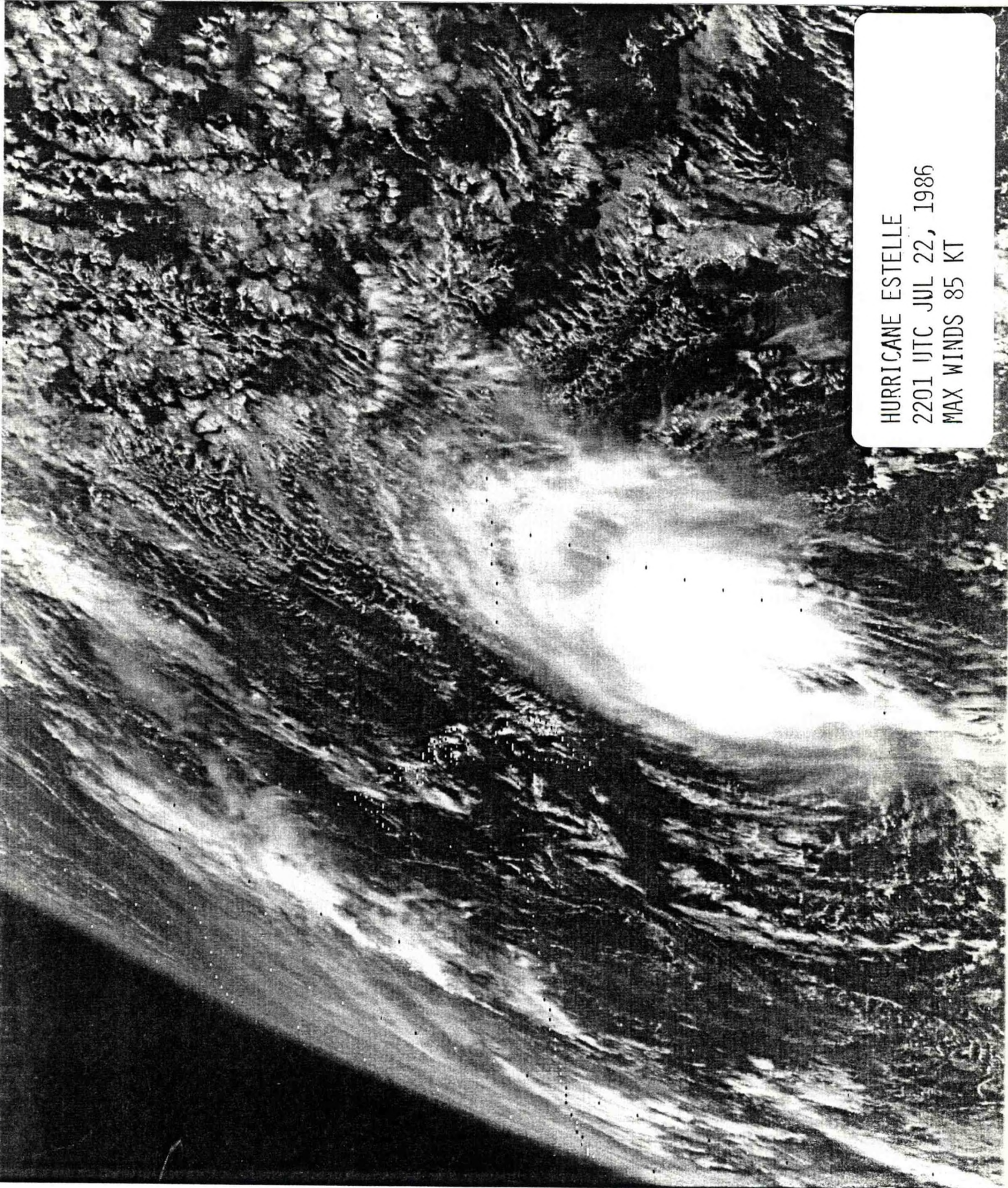
1331 21JUL86 28E-180 04584 04454 HA20N152W-1



HURRICANE ESTELLE
1331 UTC JUL 21, 1986
MAX WINDS 115 KT

1331 21JUL86 28E-180 04584 04454

2201 22JL86 28A-1 04587 04432 HA20N152W-1



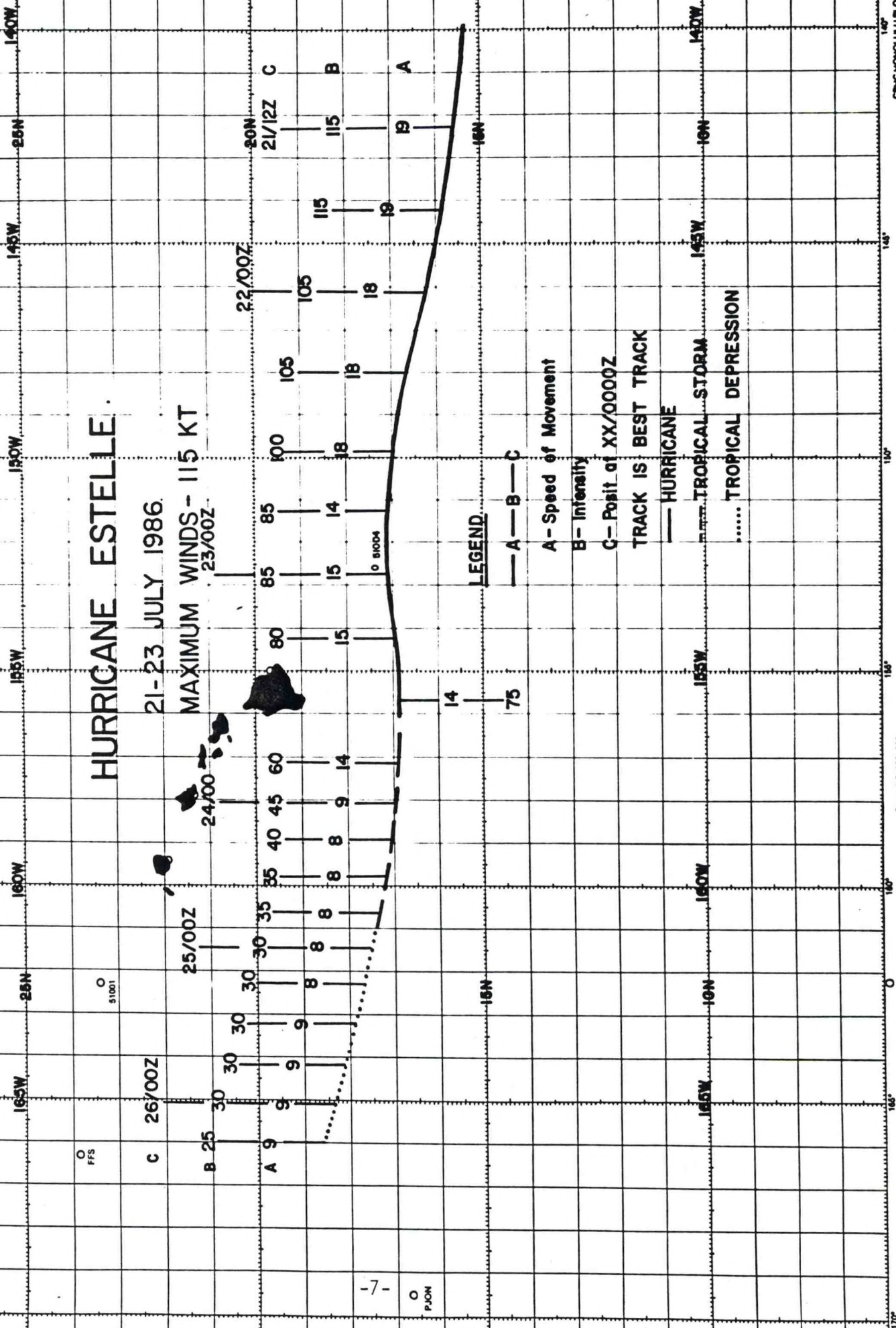
HURRICANE ESTELLE
2201 UTC JUL 22, 1986
MAX WINDS 85 KT

BUOY 51004 (17.5N 152.6W)

<u>DATE/TIME</u> <u>(UTC)</u>	<u>SLP</u> <u>(mb)</u>	<u>WIND</u> <u>(knots)</u>	<u>SEA HGT</u> <u>(half meters)</u>
220000	1012.6	0516	04
220100	1012.2	0416	04
220200	1012.0	0416	04
220300	1011.7	0216	04
220400	1011.7	0218	04
220500	1011.8	0116	04
220600	1012.2	0220	05
220700	1012.5	0414	05
220800	1012.4	0316	05
220900	1012.7	0316	06
221000	1012.1	0318	07
221100	1011.1	0316	06
221200	1010.2	0318	07
221300	1009.5	0320	07
221400	1009.2	0318	07
221500	1009.1	0218	10
221600	1009.0	0220	09
221700	1009.0	0220	10
221800	1009.1	0324 G28	13
221900	1008.5	0328 G36	14
222000	1007.2	0430 G38	13
222100	1005.0	0438 G46	15
222200	1002.7	0442 G56	18
222300	1000.6	0852 G66	21
230000	1003.9	0846 G56	20

HURRICANE ESTELLE

21-23 JULY 1986
 MAXIMUM WINDS - 115 KT
 23/00Z



LEGEND

- A — B — C
- A - Speed of Movement
- B - Intensity
- C - Posit. of XX/0000Z
- TRACK IS BEST TRACK
- HURRICANE
- TROPICAL STORM
- TROPICAL DEPRESSION

O FFS
 51001

C 26/00Z

B 25

A 9

HURRICANE ESTELLE - July 21 - 25, 1986

DTG UTC	Best Track N/W	Actual Track N/W	Error NM
211200	15.6	15.6	
	142.3	142.3	0
211800	15.9	16.1	
	144.2	144.2	13
220000	16.3	16.3	
	146.2	146.2	0
220600	16.7	16.7	
	148.0	147.9	7
221200	17.0	16.9	
	149.8	149.8	7
221800	17.1	17.0	
	151.3	151.0	19
230000	17.1	17.0	
	152.7	152.7	7
230600	17.0	17.0	
	154.2	154.5	18
231200	16.9	17.0	
	155.7	156.0	19
231800	16.9	17.0	
	157.2	157.5	19
240000	17.0	17.0	
	158.1	158.1	0
240600	17.1	17.3	
	158.9	158.8	14
241200	17.2	17.5	
	159.8	159.5	25
241800	17.3	17.3	
	160.6	160.4	12
250000	17.5	17.5	
	161.5	161.3	12
250600	17.7	17.8	
	162.3	162.0	18
251200	17.9	18.0	
	163.2	163.5	18
251800	18.1	18.2	
	164.2	164.2	7
260000	18.3	18.4	
	165.1	165.2	8
260600	18.6	18.5	
	166.0	165.7	18

Average Distance Error			12

HURRICANE ESTELLE - July 21 - 25, 1986

DTG UTC	CPHC N/W	24 HOUR FORECAST POSITION					MFM N/W	24 HOUR FORECAST ERROR						
		EP HC77 N/W	EP AN85 N/W	EP CL84 N/W	EP HC81 N/W	NTCM N/W		CP HC NM	EP 77 NM	EP 85 NM	EP 84 NM	EP 81 NM	NT CM NM	MFM NM
2212	16.1	16.5	16.3	16.1	15.7	17.0	17.0	56	95	43	50	78	8	126
	149.3	148.2	150.2	150.0	149.3	149.9	152.0							
2218	16.4	17.2	17.3	17.1		18.0		38	70	25	8		62	
	151.2	149.8	151.3	151.1		150.7								
2300	16.7	17.6	17.1	16.8	16.8	17.7		111	73	69	76	37	51	
	154.6	151.6	153.9	154.0	153.3	153.2								
2306	17.0	17.8	17.4	17.1		18.2		58	84	62	69		73	
	155.5	153.3	155.5	155.7		154.7								
2312	17.3	17.8	17.6	17.3	17.3	18.5	18.7	77	75	83	94	44	93	153
	157.3	155.0	157.3	157.6	156.7	156.4	158.0							
2318	17.2	17.4	17.7	17.4		17.9		17	106	54	38		54	
	157.3	155.7	156.9	157.0		157.4								
2400	18.2	17.0	17.1	16.9	16.8	17.8	18.0	186	58	58	81	48	48	139
	161.1	157.1	159.1	159.5	158.9	158.0	160.3							
2406	18.3	16.9	17.2	16.9		17.5		182	33	138	168		127	
	161.8	159.2	161.2	161.7		161.0								
2412	18.0	17.0	17.1	16.9	16.9	17.6		157	65	157	215	170	223	
	162.2	160.5	162.2	163.2	162.4	163.4								
2418	17.1	17.2	17.2	17.0		17.3		172	98	183	201		138	
	163.4	162.1	163.6	163.9		162.8								
2500	17.1	17.1	17.5	17.0	16.9	17.4		145	57	80	97	109	229	
	163.8	162.2	162.7	162.9	163.1	165.3								
2506	18.1	17.9	18.2	17.9		18.2		19	30	52	35		106	
	161.9	162.5	162.8	162.6		163.8								
2512	18.5	18.6	18.3	18.0	18.2	18.2		42	50	19	7	21	26	
	163.0	162.9	163.4	163.4	163.2	163.9								
2518	17.4	17.5	17.6	17.2		17.9		56	44	38	61		19	
	164.7	164.0	164.4	164.4		164.3								
2600	18.2	18.4	18.3	17.9	18.1		20.0	13	7	8	31	49		97
	165.2	165.3	165.1	165.1	166.0		165.0							
2606	17.8	19.0	18.6	18.2				215	32	8	22			
	162.0	165.5	165.8	165.9										
-----								AVERAGE DISTANCE ERRORS						
								97	61	67	78	70	90	129

HURRICANE ESTELLE - July 21 - 25, 1986

DTG	CPHC	48 HOUR FORECAST POSITION					MFM	48 HOUR FORECAST POSITION						
		EP HC77	EP AN85	EP CL84	EP HC81	NTCM		CP HC	EP 77	EP 85	EP 84	EP 81	NT CM	MFM
UTC	N/W	N/W	N/W	N/W	N/W	N/W	N/W	NM	NM	NM	NM	NM	NM	NM
2312	16.7	16.5	18.0	16.9	16.9	18.6	17.5	18	272	69	46	30	112	146
	156.0	151.3	155.4	156.8	155.5	157.0	158.5							
2318	17.1	17.4	18.4	18.1		20.1		8	293	93	72		198	
	157.4	152.4	156.8	157.0		156.3								
2400	18.2	18.0	18.8	17.4	19.2	19.9		213	259	122	157	135	180	
	161.6	153.7	159.1	160.8	158.6	158.9								
2406	19.0	18.0	19.0	17.7		20.0		287	166	166	224		215	
	163.5	156.0	161.1	162.7		161.3								
2412	18.8	18.0	19.2	22.1	18.8	20.6	19.0	241	135	219	333	129	245	193
	163.5	157.2	162.9	162.8	161.3	162.3	162.5							
2418	18.8	17.3	19.1	18.1		19.0		198	120	122	114		224	
	163.5	158.3	161.4	162.2		163.9								
2500	19.5	16.8	18.5	17.1	17.2	18.9	18.8	293	91	269	253	88	151	158
	166.0	159.9	165.9	165.7	162.8	163.5	163.7							
2506	19.8	16.4	18.6	16.9		18.5		351	87	283	353		288	
	167.8	161.6	166.9	168.1		167.0								
2512	19.8	16.6	18.6	16.7	16.4	18.9		288	91	169	352	207	329	
	168.2	162.9	166.4	169.5	166.7	169.2								
2518	17.8	17.1	18.6	17.1		17.8		292	75	167	277		298	
	169.3	164.8	167.1	168.9		169.4								
2600	17.8	17.1	19.2	17.4	16.4	18.3		164	81	79	91	133	353	
	168.0	165.6	166.3	166.4	166.2	171.4								
2606	19.1	18.2	19.6	18.8		19.0		54	34	77	200		184	
	165.0	166.2	166.4	169.2		168.9								
-----								-----						
AVERAGE DISTANCE ERROR								201	142	153	206	120	231	166

HURRICANE ESTELLE - July 21 - 25, 1986

DTG	CPHC	72 HOUR FORECAST POSITION						72 HOUR FORECAST ERROR						
		EP HC77	EP AN85	EP CL84	EP HC81	NTCM	MFM	CP HC	EP 77	EP 85	EP 84	EP 81	NT CM	MFM
UTC	N/W	N/W	N/W	N/W	N/W	N/W	N/W	NM	NM	NM	NM	NM	NM	NM
2412	17.1	16.6	20.5	18.3	16.4	20.5	18.5	38	208	182	93	184	290	258
	160.0	156.0	159.0	160.9	162.5	163.5	163.9							
2418	19.0	17.8	18.6	20.0			22.5	199	186	83	162		313	
	163.4	157.2	160.9	160.5			160.9							
2500	20.3	18.6	21.3	18.7	18.7	22.7		447	173	232	223	223	334	
	168.6	158.5	160.5	165.0	165.0	163.4								
2506	20.5	18.2	21.5	18.6		22.0		508	84	222	289		395	
	170.5	160.6	162.2	167.0		167.4								
2512	20.0	18.1	22.1	18.6	18.5	23.2	20.6	372	86	249	321	230	381	227
	169.7	162.0	162.8	169.1	167.5	167.4	166.4							
2518	20.0	17.1	21.5	19.0		20.4		330	84	204	118		386	
	169.7	163.3	163.3	166.1		170.6								
2600	20.0	16.3	21.1	17.5	17.6	20.4	20.0	348	128	162	290	250	246	109
	171.1	164.8	165.4	170.2	169.5	169.0	164.3							
2606	20.0	15.5	21.1	17.2		20.0		479	205	186	413		396	
	174.0	167.4	167.5	172.8		172.5								

AVERAGE DISTANCE ERROR								340	144	190	239	222	343	198

CENTRAL PACIFIC HURRICANE CENTER
VERIFICATION SUMMARY

HURRICANE ESTELLE

JULY 21 - 25, 1986

CPHC MEAN ERROR FOR BEST TRACK 12NM

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

	24 HR FCST	48 HR FCST	72 HR FCSTS
CPHC	97/16	201/12	340/ 8
EPHC77	61/16	142/12	144/ 8
EPAN85	67/16	153/12	190/ 8
EPCL84	78/16	206/12	239/ 8
EPHC81	70/ 8	120/ 6	222/ 4
NTCM	90/14	231/12	343/ 8
MFM	129/ 4	166/ 3	198/ 3

TROPICAL DEPRESSION ONE-C
July 27 - 28, 1986

Tropical Depression ONE-C was tracked westward along 11N at a fairly rapid forward speed of 20 to 25 knots (Fig. 5). The data are sketchy but it is possible that ONE-C was the remains of Tropical Depression EIGHT-E which had dissipated a few days earlier well to the east of 140W. Several ship reports from ABQJ on the 27th and 28th were helpful in locating the depression's center. ONE-C failed to develop past the depression stage. It passed well south of the Hawaiian Islands on the 28th with no noticeable effect on the islands' weather. On the 29th at 0000 UTC, it was dissipating to the southwest of the Hawaiian Islands and the final advisory was issued.

155W

150W

145W

15N

15N

29/00Z

28/00Z

C

25

30

30

B

30

30

10

10

A

25

25

25

10N

10N

TROPICAL DEPRESSION ONE - C

MAXIMUM WINDS - 30 KT

27 - 28 JULY 1986

LEGEND

..... TROPICAL DEPRESSION

TRACK IS BEST TRACK

05N

05N

— A — B — C —

A - Speed of Movement

B - Intensity

C - Posit at XX/00Z

155W

150W

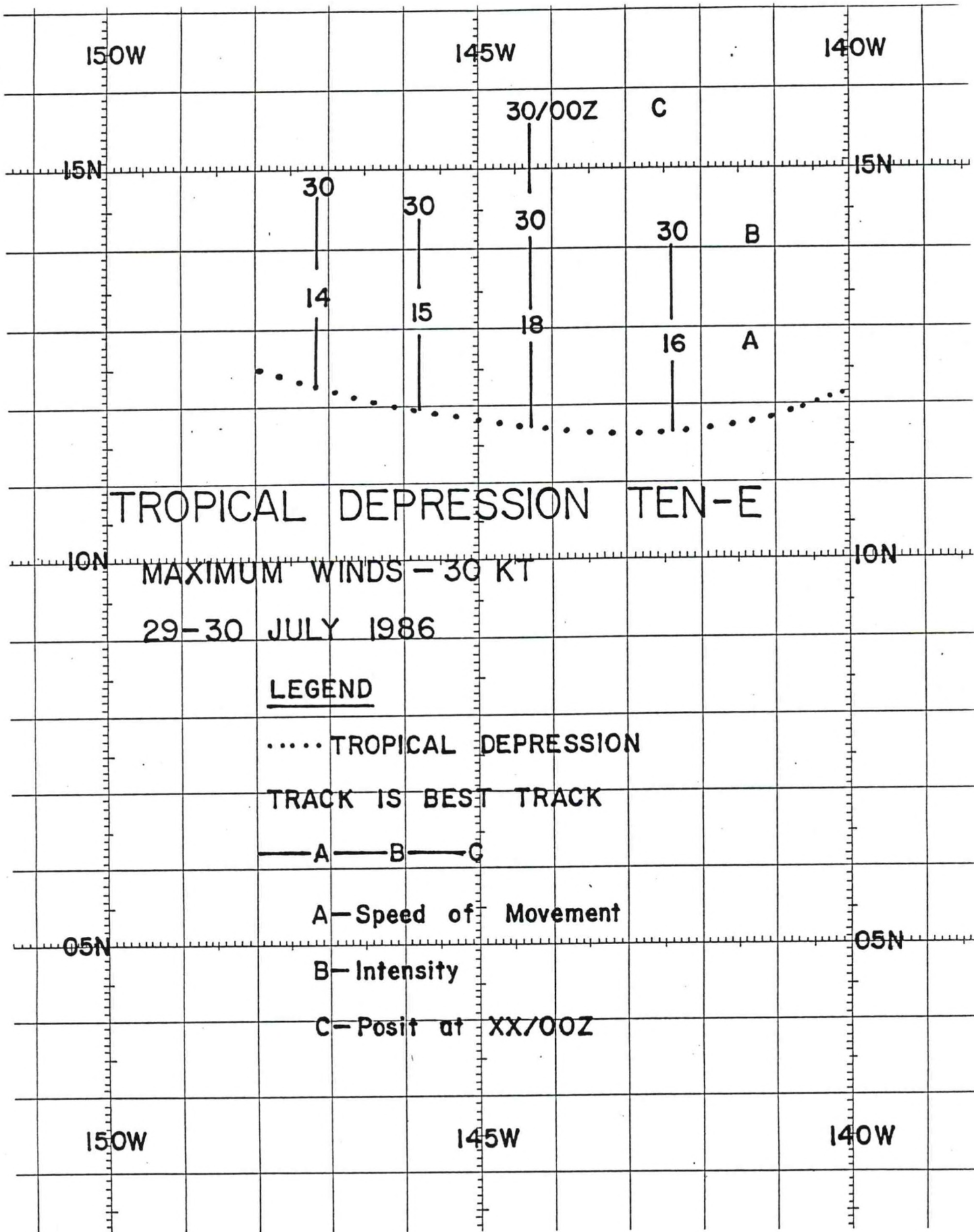
145W

TROPICAL DEPRESSION ONE-C - July 27 - 28, 1986

DTG UTC	Best Track N/W	Actual Track N/W	Error NM
280000	11.5 147.0	11.5 147.0	0
280600	11.8 148.0	11.8 148.0	0
281200	11.0 150.4	11.5 149.5	60
281800	10.3 153.0	10.3 153.0	0
290000	10.6 155.6	10.6 155.6	0
----- Average Distance Error			12

TROPICAL DEPRESSION TEN-E
July 29-30, 1986

Tropical Depression TEN-E had been a steady state system for about 3 days prior to moving into the Central Pacific Hurricane Center's (CPHC) area. TEN-E crossed 140W near 12N on July 29 at about 1000 UTC. A slow weakening began as the depression continued to move westward at about 15 knots (Fig. 6). By 301800 UTC, near 12N 148W, it had become poorly organized and the final advisory was issued.



TROPICAL DEPRESSION TEN-E - July 29 - 30, 1986

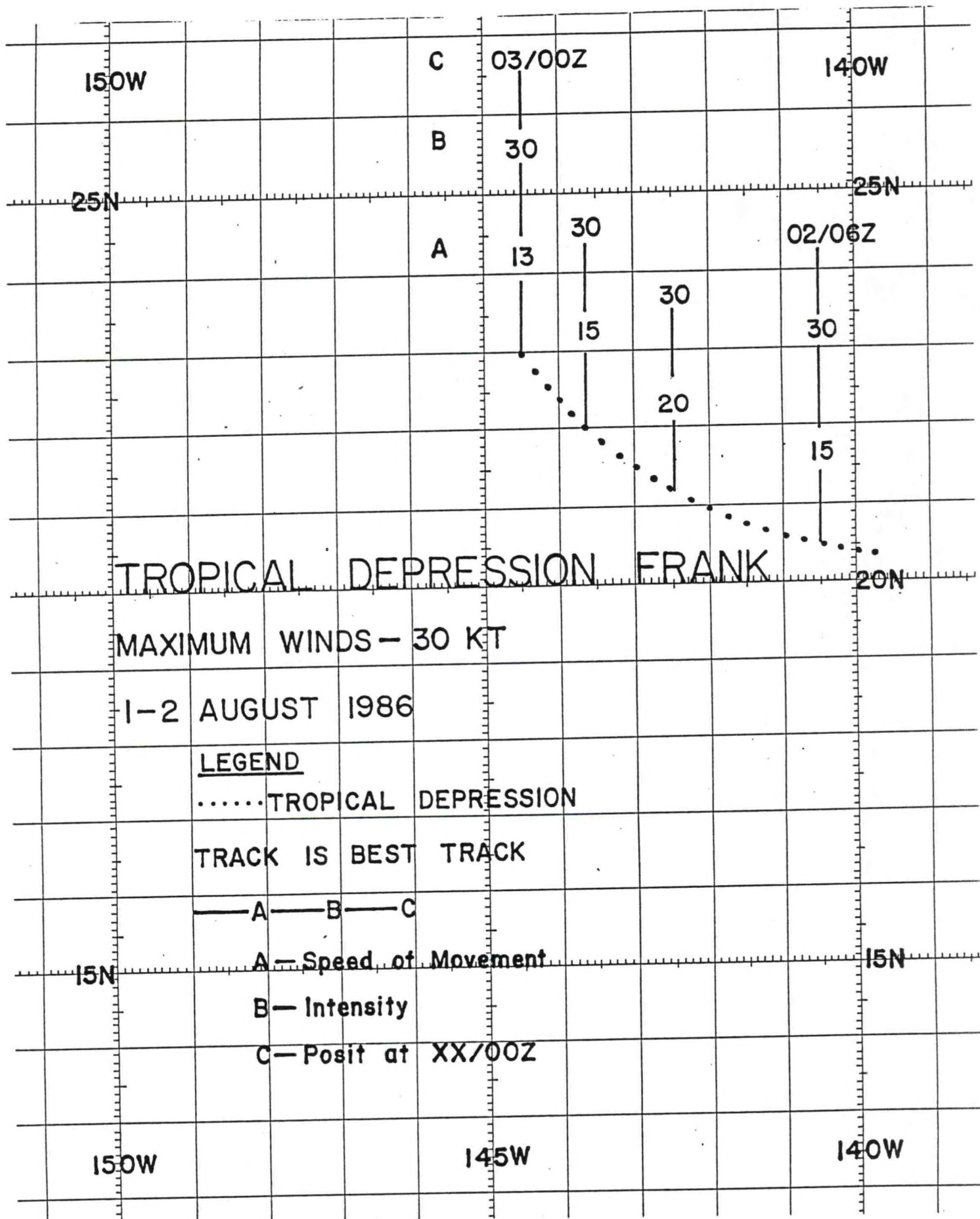
DTG	Best Track	Actual Track	Error
UTC	N/W	N/W	NM
291800	11.7	11.7	
	142.4	142.4	0
300000	11.8	11.8	
	144.3	144.3	0
300600	12.0	12.0	
	145.8	145.8	0
301200	12.3	12.3	
	147.2	147.2	0

	Average Distance Error		0

TROPICAL DEPRESSION FRANK
August 1-2, 1986

Tropical Depression Frank entered the Central Pacific Hurricane Center's area near 20N 140W at 020000 UTC. The depression had been a tropical storm just 12 hours earlier. Frank had maximum sustained winds estimated at 30 knots and was moving northwestward at about 15 knots (Fig. 7). Frank was slowly losing strength as it moved out over slightly cooler waters and encountered unfavorable upper winds that tended to shear its circulation.

The CPHC issued its last advisory on FRANK at 030300 UTC as Frank was considered dissipating or transforming into a weak extratropical system.



TROPICAL DEPRESSION FRANK - August 1 - 2, 1986

DTG	Best Track	Actual Track	Error
UTC	N/W	N/W	NM
020600	20.5	20.5	
	140.5	140.5	0
021200	21.2	21.2	
	142.5	142.4	6
021800	21.0	22.1	
	143.6	143.7	66
030000	23.0	23.0	
	144.5	144.5	0

	Average Distance Error		18

TROPICAL STORM GEORGETTE
August 3-4, 1986

Tropical Depression GEORGETTE crossed into the Central Pacific Hurricane Center's (CPHC) area at a rather low latitude of 08N. The system had earlier been a tropical storm and was in a weakening trend moving westward at a rather rapid pace of 20 to 30 knots just south of 10N (Fig. 8).

GEORGETTE was upgraded to a tropical storm at 041200 UTC as satellite imagery indicated some intensification near 09N 145W. The gathering of strength was short lived, however, as GEORGETTE relapsed into a decline. The final advisory was issued at 042100 UTC as satellite imagery from the GOES satellite showed GEORGETTE's circulation had merged into the convection associated with the intertropical convergence zone and was dissipating.

The CPHC issued just 4 advisories on the weak tropical system.

150W

145W

140W

15N

15N

TROPICAL STORM GEORGETTE

3-4 AUGUST 1986

MAXIMUM WINDS - 40 KT

04/06Z

C

25

30

B

40

25

39

A

10N

10N

LEGEND

TROPICAL STORM

TROPICAL DEPRESSION

TRACK IS BEST TRACK

—A— B —C

A - Speed of Movement

B - Intensity

C - Posit at XX/00Z

05N

05N

150W

145W

140W

TROPICAL STORM GEORGETTE - AUGUST 3 - 4, 1986

DTG	Best Track	Actual Track	Error
UTC	N/W	N/W	NM
040600	9.0	9.0	
	142.5	142.5	0
041200	8.6	8.6	
	146.5	146.5	0
041800	9.0	9.0	
	149.0	149.0	0

	Average Distance Error		0

TROPICAL DEPRESSION LESTER
September 16, 1986

LESTER had already been feeling the adverse effects of strong vertical shear across its circulation for the 24 hours prior to crossing 140W and into the Central Pacific Hurricane Center's (CPHC) area of responsibility about 1800 UTC 16 September 1986. LESTER was classified as a weak tropical depression at this time with maximum sustained winds of 30 knots near its center and was downgraded from a tropical storm (Fig. 9). The tropical depression was moving northwestward about 10 knots in a rather unusual low level flow which featured a broad trough or low pressure system just north of the Hawaiian Islands.

All that remained of LESTER at 170000 UTC was a weak low level circulation with no signs of a closed circulation at the surface. The final advisory on LESTER was issued at this time.

145W

140W

135W

TROPICAL DEPRESSION LESTER

16 SEPTEMBER 1986

20N

MAXIMUM WINDS - 30 KT

20N

C

17/00Z

B

30

30

A

9

9

15N

15N

LEGEND

—— TROPICAL STORM

..... TROPICAL DEPRESSION

TRACK IS BEST TRACK

— A — B — C

A — Speed of Movement

B — Intensity

C — Posit at XX/00Z

10N

10N

TROPICAL DEPRESSION LESTER - September 16. 1986

DTG	Best Track	Actual Track	Error
UTC	N/W	N/W	NM
161800	18.3	18.4	
	140.0	140.0	6
170000	18.7	18.8	
	140.8	140.8	6

	Average Distance Error		6

HURRICANE ORLENE
September 21-24, 1986

Hurricane ORLENE formed out of tropical depression 22-E which developed within an active trough to the southwest of Tropical Storm Madeline in the vicinity of 10N 140W on the 21st. The Eastern Pacific Hurricane Center (EPHC) issued the first few advisories as the poorly defined center was located just east of 140W and there was a good chance that 22-E would recurve and follow Madeline north northeastward. Twenty Two-E was classified as a tropical storm at 211200 UTC near 13N 139W. A few hours later, a distinct eye could be seen developing in satellite imagery (Fig. 10) and the EPHC upgraded the tropical storm to a hurricane at 212300 UTC and passed the responsibility for the issuance of advisories to the Central Pacific Hurricane Center (CPHC).

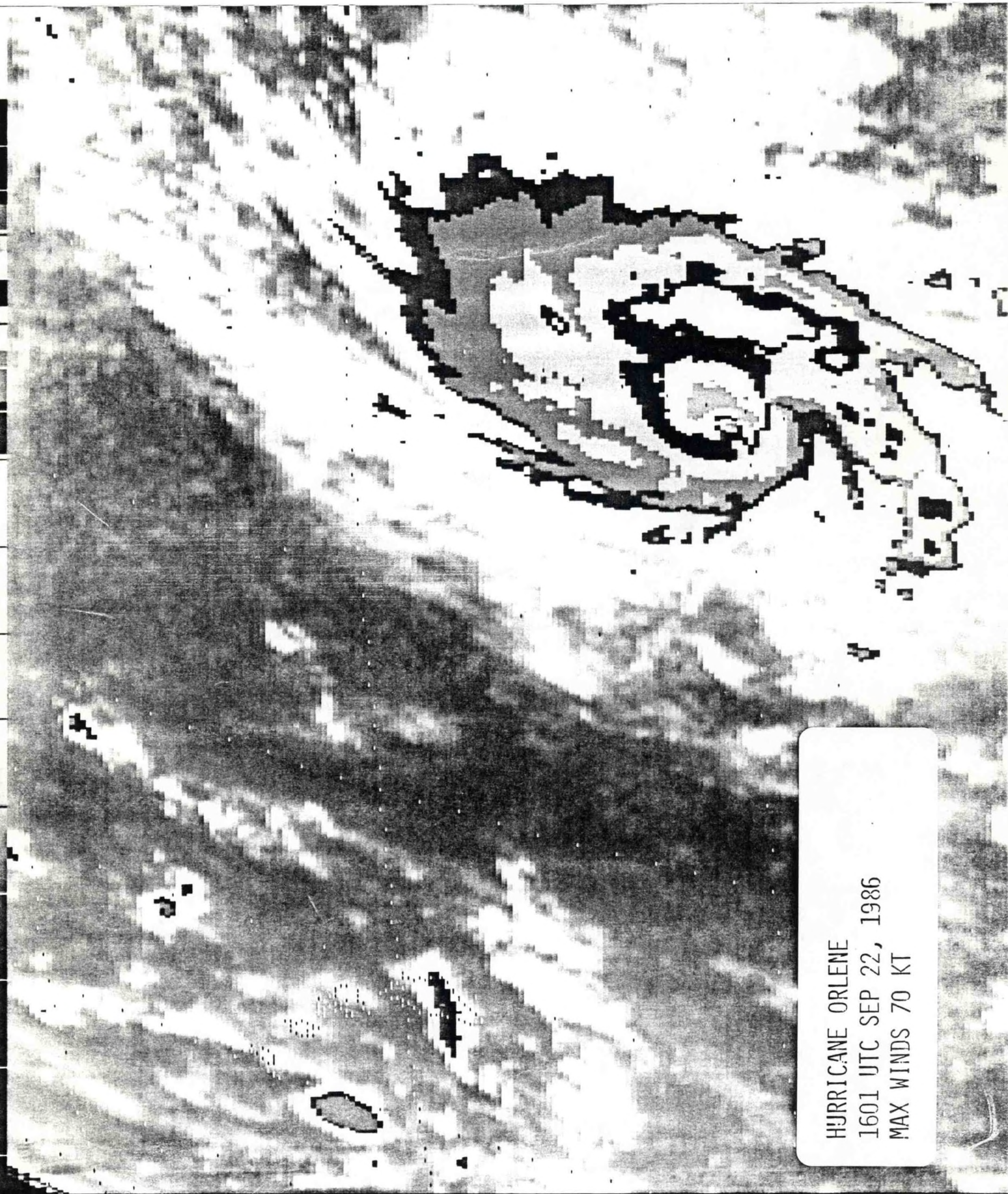
ORLENE tracked almost due northward just west of 140W with maximum sustained winds estimated at 65 to 70 knots (Fig. 11). ORLENE soon started to move into an environment with unfavorable strong southwesterlies aloft and slightly cooler sea surface temperatures which resulted in shearing and rapid weakening near 16.5N 141.5W and the subsequent downgrading to a tropical storm at 231800 UTC (Fig. 12). Stripped of its upper level circulation, the low level remains of tropical storm ORLENE took on a westerly course along 17N at a relatively slow rate of 5 to 10 knots. At 241800 UTC, ORLENE was downgraded to a tropical depression near 17N 144W. The final advisory was issued a few hours later at 250000 UTC as the remains of ORLENE drifted slowly westward.

The CPHC issued twelve advisories on ORLENE. There were no reports of damage or casualties to ships.

1700 219E86 28A-1 04816 05233 HA18N145W-1

HURRICANE ORLENE
1700 UTC SEP 21, 1985
MAX WINDS 65 KT

1001 223000 ZOL IIA 04001 03233 NAION143W I



HURRICANE ORLENE
1601 UTC SEP 22, 1986
MAX WINDS 70 KT

145W

140W

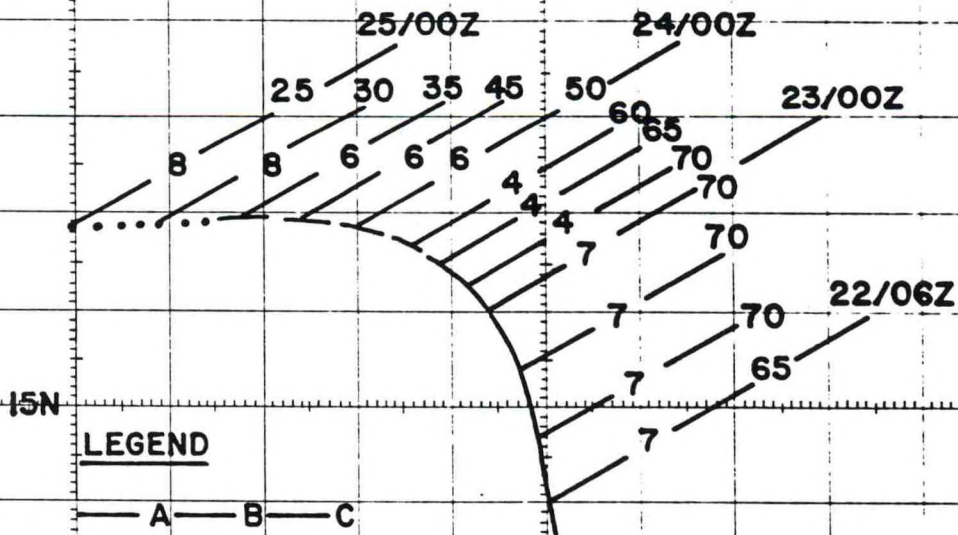
135W

HURRICANE ORLENE

21-24 SEPTEMBER 1986

MAXIMUM WINDS - 70 KT

20N



LEGEND

A — B — C

A - Speed of Movement

B - Intensity

C - Posit at XX/00Z

TRACK IS BEST TRACK

— HURRICANE

- - - TROPICAL STORM

..... TROPICAL DEPRESSION

10N

10N

145W

140W

135W

HURRICANE ORLENE - September 21 - 24, 1986

DTG	Best	Actual	Error
UTC	Track	Track	
	N/W	N/W	NM
220600	14.0	14.0	
	140.0	140.0	0
221200	14.7	14.9	
	140.1	140.1	13
221800	15.4	15.3	
	140.3	140.5	14
230000	16.0	16.0	
	140.6	140.7	7
230600	16.3	16.6	
	140.8	140.7	19
231200	16.5	17.0	
	141.2	141.0	32
231800	16.7	16.6	
	141.4	141.5	8
240000	16.9	17.0	
	142.0	142.3	19
240600	17.0	17.1	
	142.6	142.6	7
241200	17.0	17.0	
	143.3	143.0	18
241800	16.9	16.9	
	144.1	144.1	0
250000	16.8	16.9	
	145.0	145.0	7

Average Distance Error			12

HURRICANE ORLENE - September 21 - 24, 1986

DTG	CPHC	24 HOUR FORECAST POSITION						24 HOUR FORECAST ERROR						
		EP HC77	EP AN85	EP CL84	EP HC81	NTCM	MFM	CP HC	EP 77	EP 85	EP 84	EP 81	NT CM	MFM
UTC	N/W	N/W	N/W	N/W	N/W	N/W	N/W	NM	NM	NM	NM	NM	NM	NM
2306	15.5	16.2	15.8	16.0			16.1	67	24	48	43		30	
	140.9	140.7	140.8	141.1			140.7							
2312	17.8	17.8	18.0	18.4			17.6	16.4	48	48	69	84		37 131
	141.1	140.9	140.4	140.9			141.1	143.2						
2318	17.5	18.0	17.4	17.3			17.5		57	87	51	58		64
	141.8	141.9	141.8	142.2			142.1							
2400	18.3	18.5	18.1	18.0	17.2		18.1		79	91	68	61	48	67
	142.5	142.1	142.0	142.5	143.1		142.1							
2406	18.5	19.0	18.5	18.4					96	116	105	88		
	141.8	142.2	141.5	141.9										
2412	18.9	18.8	19.1	19.1	17.7	18.6	18.3	118	112	136	131	62	100	183
	142.5	142.5	142.1	142.4	143.8	142.5	145.9							
2418	18.0	17.8	18.2	18.3			17.9		84	88	100	105		72
	145.0	142.9	143.0	143.0			143.4							
2500	18.3	18.4	18.3	18.1	17.7				112	90	87	83	48	
	146.3	144.9	145.4	145.7	145.1									
-----								AVERAGE DISTANCE ERRORS						
								83	82	83	82	53	62	157

HURRICANE ORLENE - September 21 - 24, 1986

DTG	CPHC	48 HOUR FORECAST POSITION						48 HOUR FORECAST POSTION						
		EP HC77	EP AN85	EP CL84	EP HC81	NTCM	MFM	CP HC	EP 77	EP 85	EP 84	EP 81	NT CM	MFM
UTC	N/W	N/W	N/W	N/W	N/W	N/W	N/W	NM	NM	NM	NM	NM	NM	NM
2406	17.0	18.9	17.4	18.0			18.4	8	125	19	54		100	
	142.5	141.5	142.7	142.7			141.5							
2412	20.0	20.5		21.5			20.0	17.3	187	211		293	180	236
	143.9	142.6		141.0			142.9	147.1						
2418	19.2	20.5	19.2	19.0			19.8		144	232	145	128		174
	144.8	142.6	143.3	144.5			144.1							
2500	19.7	20.8	19.9	19.6	20.7	20.0			168	253	199	162	230	193
	145.0	143.3	143.5	144.9	145.5	144.1								
-----								-----						
AVERAGE DISTANCE ERRORS								127	205	121	159	230	162	236

CENTRAL PACIFIC HURRICANE CENTER
VERIFICATION SUMMARY

HURRICANE ORLENE
September 21 - 24, 1986

CPHC MEAN ERROR FOR BEST TRACK 12NM

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

	24 HR FCST	48 HR FCST	72 HR FCSTS
CPHC	83/ 8	127/ 4	N/A
EPHC77	82/ 8	205/ 4	N/A
EPAN85	83/ 8	121/ 3	N/A
EPCL84	82/ 8	159/ 4	N/A
EPHC81	53/ 3	230/ 1	N/A
NTCM	62/ 6	162/ 4	N/A
MFM	157/ 2	236/ 1	N/A

1986 FORECAST VERIFICATION

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

<u>FORECASTER/MODEL</u>	<u>24-HOUR</u>	<u>48-HOUR</u>	<u>72-HOUR</u>
CPHC Forecaster	92/24	182/16	340/ 8
EPHC77	68/24	158/16	144/ 8
EPAN85	73/24	147/15	190/ 8
EPCL84	79/24	194/16	239/ 8
EPHC81	65/11	137/ 7	222/ 4
NTCM	81/20	214/16	343/ 8
MFM	138/6	183/ 4	198/ 3

- 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)
- No. 19 A Program to Compute Turbulence in the Vicinity of Lee Waves Downstream of Selected Mountains in the Hawaiian Islands. Lawrence D. Burroughs. October 1978. (PB-289-792)
- 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/AS)
- No. 30 1984 Tropical Cyclones - Central North Pacific. W. Au, A. Chun, A. Inouye, L. Iwai, H. Rosendal, T. Yamashiroya. March 1986. (PB86-183-951/AS)
- No. 31 1985 Tropical Cyclones - Central North Pacific. W. Au, A. Chun, L. Iwai, H. Rosendal, T. Yamashiroya. May 1986. (PB86-202-215/AS)



NOAA SCIENTIFIC AND TECHNICAL PUBLICATIONS

The National Oceanic and Atmospheric Administration was established as part of the Department of Commerce on October 3, 1970. The mission responsibilities of NOAA are to assess the socioeconomic impact of natural and technological changes in the environment and to monitor and predict the state of the solid Earth, the oceans and their living resources, the atmosphere, and the space environment of the Earth.

The major components of NOAA regularly produce various types of scientific and technical information in the following kinds of publications:

PROFESSIONAL PAPERS—Important definitive research results, major techniques, and special investigations.

CONTRACT AND GRANT REPORTS—Reports prepared by contractors or grantees under NOAA sponsorship.

ATLAS—Presentation of analyzed data generally in the form of maps showing distribution of rainfall, chemical and physical conditions of oceans and atmosphere, distribution of fishes and marine mammals, ionospheric conditions, etc.

TECHNICAL SERVICE PUBLICATIONS—Reports containing data, observations, instructions, etc. A partial listing includes data serials; prediction and outlook periodicals; technical manuals, training papers, planning reports, and information serials; and miscellaneous technical publications.

TECHNICAL REPORTS—Journal quality with extensive details, mathematical developments, or data listings.

TECHNICAL MEMORANDUMS—Reports of preliminary, partial, or negative research or technology results, interim instructions, and the like.



Information on availability of NOAA publications can be obtained from:

**PUBLICATION SERVICES BRANCH (E/A113)
NATIONAL ENVIRONMENTAL SATELLITE, DATA, AND INFORMATION SERVICE
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
U.S. DEPARTMENT OF COMMERCE**

Washington, DC 20235