Tropical Cyclone Report
Tropical Storm Estelle
(EP072010)
6-10 August 2010

Eric S. Blake
National Hurricane Center
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Estelle ended a prolonged drought of tropical storm activity over the eastern Pacific Ocean, becoming the first tropical storm to form in 44 days during what is normally a rather busy climatological period for the basin.

a. Synoptic History

The wave that eventually spawned Estelle left the African coast on 22 July without much thunderstorm activity. Convection remained minimal for much of the next week until 29 July when the wave interacted with an upper-level trough over the eastern Caribbean. Some organization of the system was noted in satellite images over the western Caribbean, but the wave moved inland over Central America on 2 August before significant development occurred. Thunderstorms increased over a large area in southeastern Mexico by late on 3 August, with a thunderstorm complex moving southward from the Isthmus of Tehuantepec into the far eastern Pacific Ocean. After this complex dissipated, a weak low developed just south of the Gulf of Tehuantepec the next day. Moving west-northwestward, the low gradually acquired organized convection and by 0000 UTC 6 August, a tropical depression formed about 120 n mi southwest of Acapulco, Mexico. The "best track" chart of the tropical cyclone's path is given in Figure 1, and the best track positions and intensities are listed in Table 1[1].

Twelve hours later, the depression became a tropical storm and slowly intensified. Early on 7 August, microwave images indicate that the center of Estelle reformed to the southwest, but the overall system continued moving toward the west and west-northwest. The tropical storm reached a peak intensity of 55 kt around 0000-0600 UTC 8 August, as indicated by Dvorak classifications and the presence of a mid-level eye feature on microwave passes. Thereafter, Estelle gradually decreased in strength due to cooler waters, a more stable environment and southeasterly shear. The storm turned westward and its forward speed slowed by late on 8 August. Shear further increased the next day, and Estelle weakened into a tropical depression near 1800 UTC 9 August. Twelve hours later, it degenerated to a remnant low, centered about 370 n mi south-southwest of the southern tip of Baja California. The remnants of Estelle drifted slowly southeastward and were absorbed by the Intertropical Convergence Zone (ITCZ) late on 10 August.

[1] A digital record of the complete best track, including wind radii, can be found on line at ftp://ftp.nhc.noaa.gov/atcf. Data for the current year's storms are located in the *btk* directory, while previous years' data are located in the *archive* directory.

b. Meteorological Statistics

Observations in Estelle (Figs. 2 and 3) include satellite-based Dvorak technique intensity estimates from the Tropical Analysis and Forecast Branch (TAFB), the Satellite Analysis Branch (SAB), and UW-CIMSS intensity estimates using the Advanced Microwave Sounding Unit (AMSU) and the Advanced Dvorak Technique (ADT). Data and imagery from NOAA polar-orbiting satellites, Defense Meteorological Satellite Program (DMSP) satellites, National Aeronautics and Space Administration (NASA) satellites, including TRMM, and Aqua, the U.S. Navy WindSat, and the EUMETSAT ASCAT, among other satellites, were also useful in constructing the best track of Estelle.

The 55-kt estimated peak intensity of Estelle is based on Dvorak classifications.

There were no ships reporting winds of tropical storm force associated with Estelle.

c. Forecast and Warning Critique

The genesis of Estelle was not well anticipated. The wave that eventually became Estelle was introduced in the Tropical Weather Outlook (TWO) only about 36 hours before genesis. The genesis forecasts did reach the medium (between 30-50%) category about a day before formation, although the chance of formation only reached the high (>50% percent) category six hours before genesis.

A verification of NHC official track forecasts for Estelle is given in Table 2a. Official forecast track errors were considerably lower than the mean official errors for the previous five-year period at most forecast periods except for 96 h, where there was only one verifying case. A homogeneous comparison of the official track errors with selected guidance models is given in Table 2b. The official forecast bested most of the available guidance, although the GFSI and EMXI models provided the best guidance for this storm. The HWFI and GFNI models had particularly poor performances for this cyclone.

A verification of NHC official intensity forecasts for Estelle is given in Table 3a. Official forecast intensity errors were much lower than the mean official errors for the previous five-year period and, given that most of the OCD5 errors were near or above average, can be considered a very skillful set of official forecasts. A homogeneous comparison of the official track errors with selected guidance models is given in Table 3b. The official forecast was the best performer through the first 24 hours, though several models bested the official forecast at 72 and 96 h (with a small number of cases). The decay SHIPS model (DSHP) had much higher errors for Estelle than typical.

There were no coastal watches or warnings required for Estelle and no reports of damage or injuries.

Table 1. Best track for Tropical Storm Estelle, 6-10 August 2010.

Date/Time (UTC)	Latitude (°N)	Longitude (°W)	Pressure (mb)	Wind Speed (kt)	Stage
04 / 1200	14.9	94.9	1008	20	low
04 / 1800	14.7	96.3	1008	25	"
05 / 0000	14.7	97.6	1007	25	"
05 / 0600	14.9	98.8	1007	25	"
05 / 1200	15.2	99.9	1006	25	"
05 / 1800	15.5	100.9	1005	25	"
06 / 0000	15.8	101.7	1004	30	tropical depression
06 / 0600	16.2	102.6	1004	30	"
06 / 1200	16.6	103.5	1003	35	tropical storm
06 / 1800	16.9	104.6	1002	40	"
07 / 0000	17.0	105.6	1000	45	"
07 / 0600	16.8	106.4	1000	45	"
07 / 1200	16.9	107.3	998	50	"
07 / 1800	17.1	108.3	998	50	"
08 / 0000	17.3	109.2	994	55	"
08 / 0600	17.5	109.8	994	55	"
08 / 1200	17.7	110.4	996	50	"
08 / 1800	17.9	110.9	999	45	"
09 / 0000	17.9	111.3	1001	40	"
09 / 0600	17.9	111.7	1002	35	"
09 / 1200	17.8	112.0	1004	35	"
09 / 1800	17.7	112.4	1005	30	tropical depression
10 / 0000	17.7	112.8	1005	30	"
10 / 0600	17.5	113.2	1005	25	remnant low
10 / 1200	17.3	113.2	1006	25	"
10 / 1800	17.2	113.1	1006	25	"
11 / 0000					dissipated
08 / 0000	17.3	109.2	994	55	minimum pressure and maximum wind

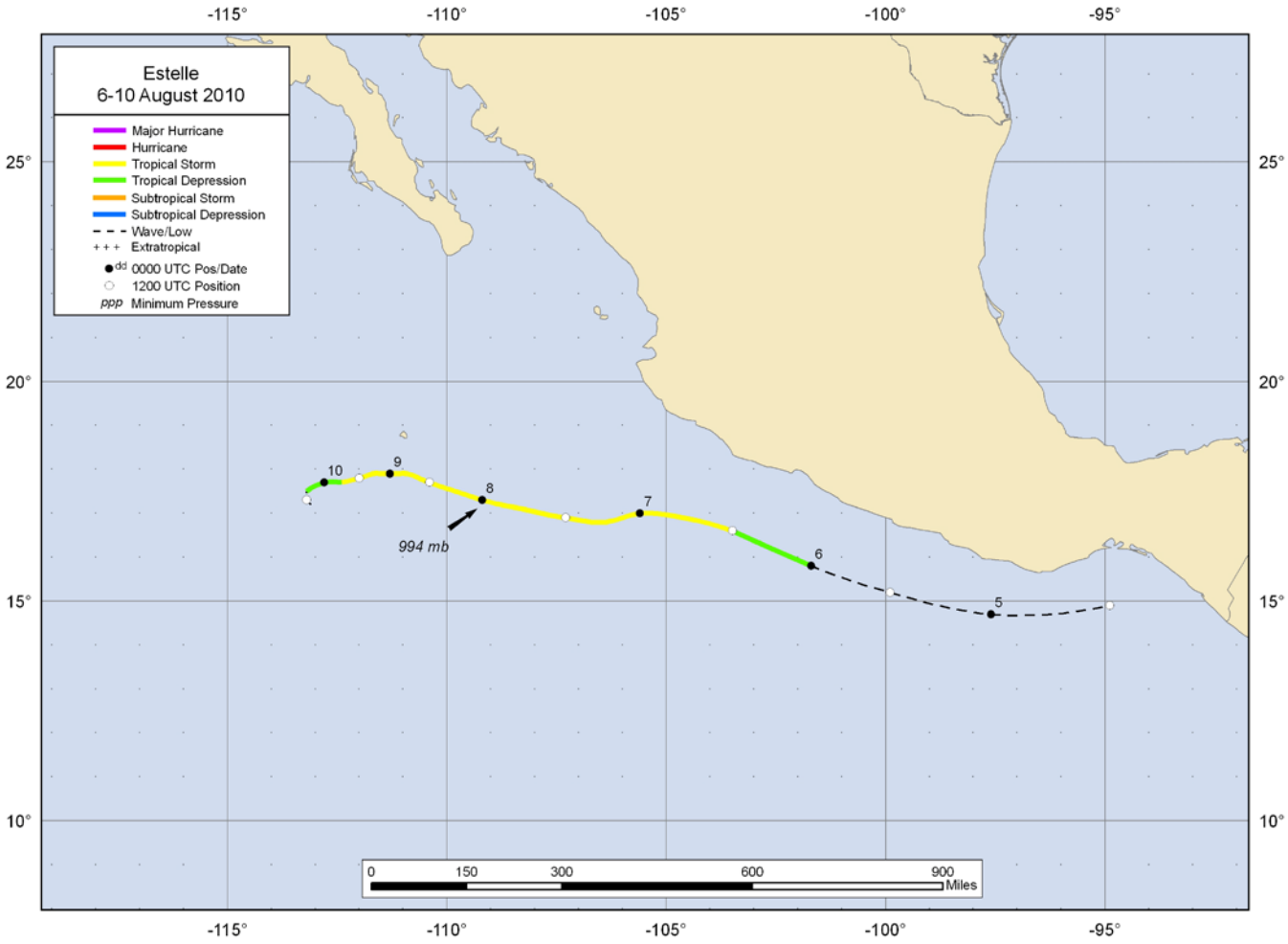

Figure 1. Best track positions for Tropical Storm Estelle, 6-10 August 2010.

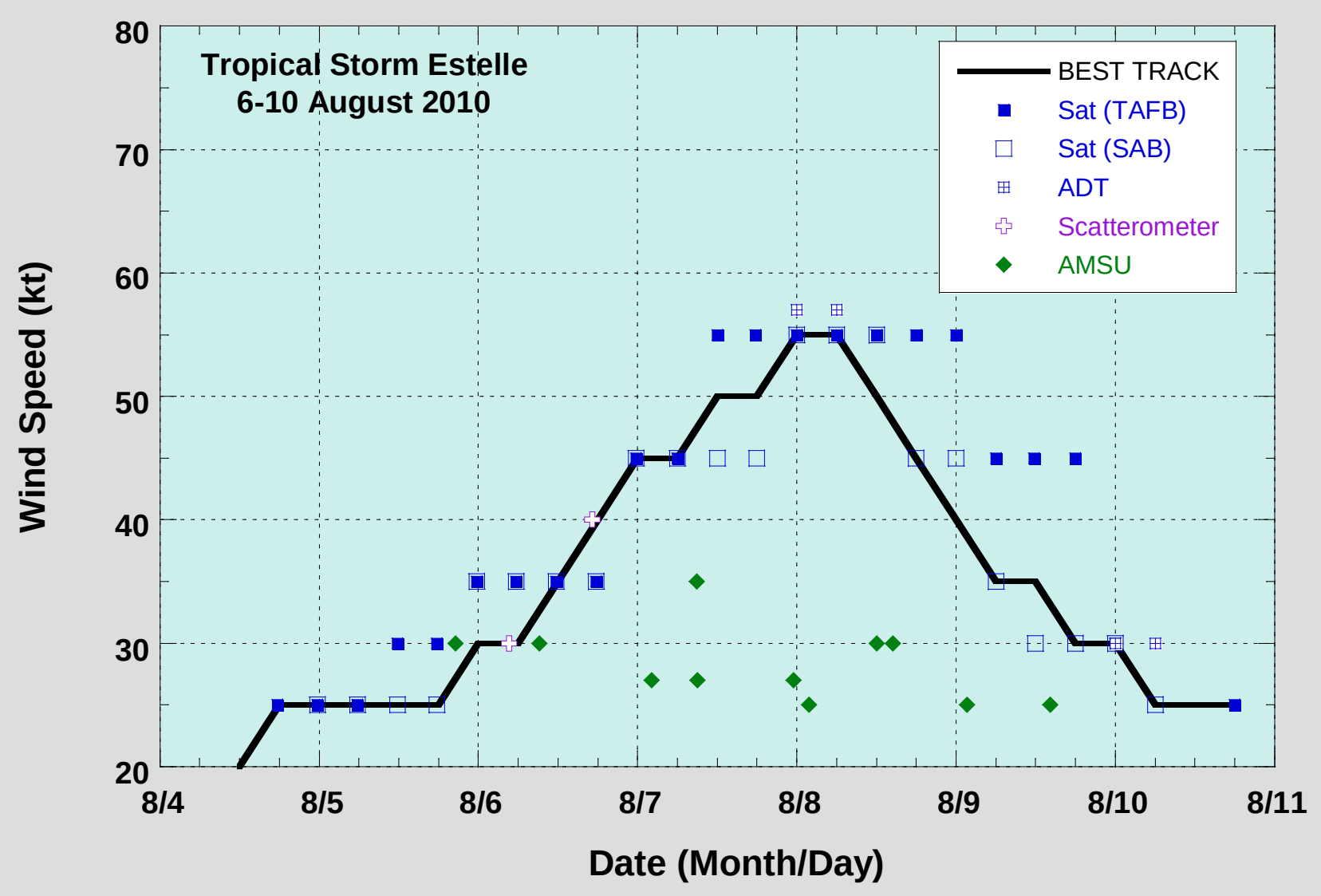

Figure 2. Selected wind observations and best track maximum sustained surface wind speed curve for Estelle, 6-10 August 2010. Dashed vertical lines correspond to 0000 UTC.

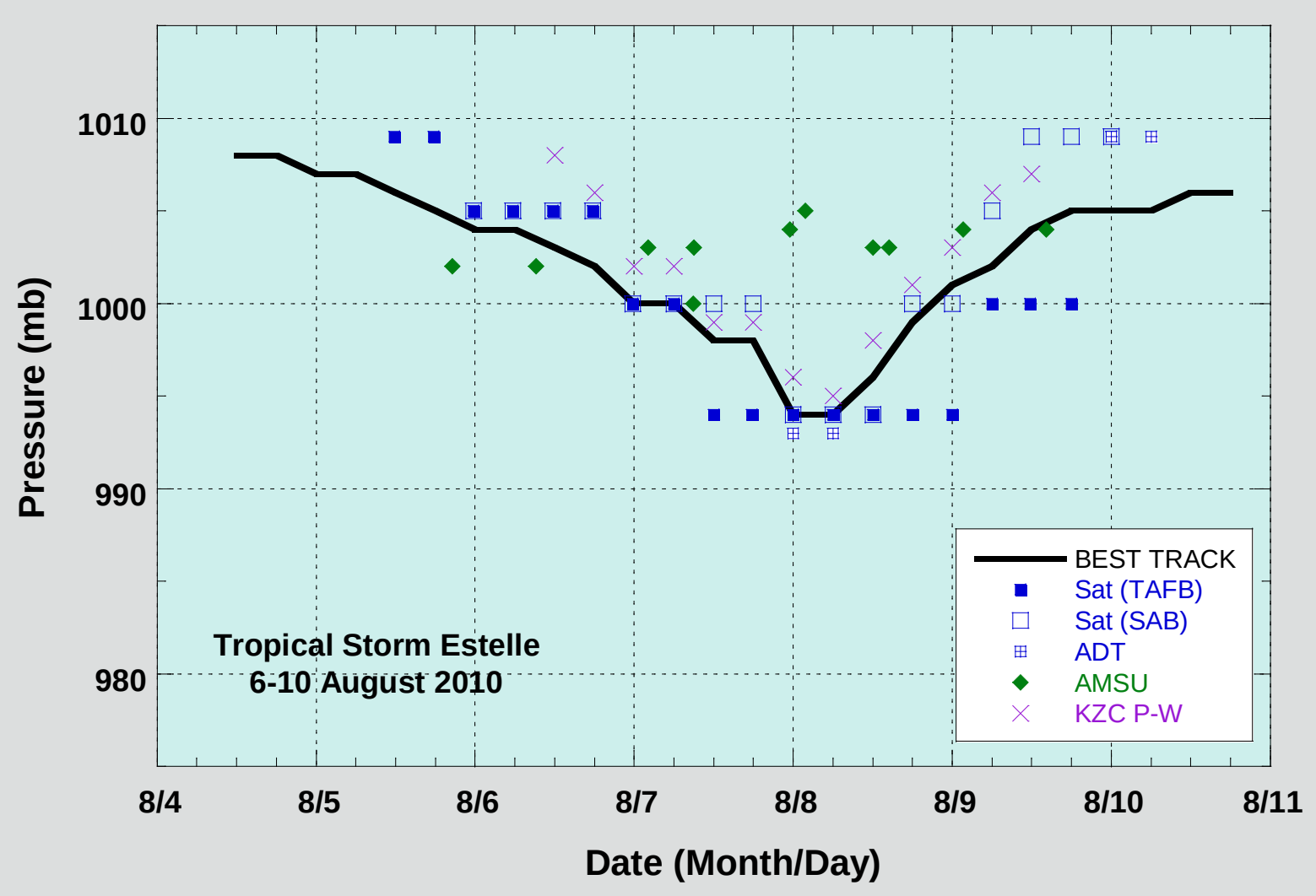

Figure 3. Selected pressure observations and best track minimum central pressure curve for Estelle, 6-10 August 2010. Dashed vertical lines correspond to 0000 UTC.

Table 2a. NHC official (OFCL) and climatology-persistence skill baseline (OCD5) track forecast errors (n mi) for Estelle. Mean errors for the five-year period 2005-9 are shown for comparison. Official errors that are smaller than the five-year means are shown in boldface type.

	Forecast Period (h)						
	12	24	36	48	72	96	120
OFCL (Estelle)	**24.3**	**39.2**	**50.3**	**56.0**	**113.1**	180.4	
OCD5 (Estelle)	29.4	59.5	92.1	110.6	162.5	174.0	
Forecasts	15	13	11	9	5	1	
OFCL (2005-9)	30.8	51.5	71.6	89.6	120.9	155.0	
OCD5 (2005-9)	38.9	75.3	115.7	155.8	226.9	275.1	

Table 2b. Homogeneous comparison of selected track forecast guidance models (in n mi) for Estelle. Errors smaller than the NHC official forecast are shown in boldface type. The number of official forecasts shown here will generally be smaller than that shown in Table 2a due to the homogeneity requirement.

Model ID	Forecast Period (h)						
	12	24	36	48	72	96	120
OFCL	27.6	41.4	48.0	52.4	109.1		
OCD5	31.7	56.8	86.2	124.7	198.9		
GFSI	**24.6**	**34.8**	**43.7**	65.1	**97.7**		
GHMI	36.2	69.2	86.8	99.0	205.0		
HWFI	48.5	87.1	110.5	160.6	250.3		
NGPI	42.7	68.4	70.4	97.6	134.7		
GFNI	38.6	72.5	94.5	111.0	271.9		
EGRI	28.2	58.0	97.7	111.8	167.8		
EMXI	28.2	**35.2**	**39.2**	**49.0**	**32.3**		
AEMI	27.8	**33.8**	**42.1**	58.1	**59.4**		
GUNA	**27.1**	52.2	59.6	55.3	**80.2**		
TVCN	28.4	48.5	53.0	55.5	**101.1**		
TVCC	28.8	42.7	57.7	64.1	121.1		
LBAR	51.1	116.3	175.2	276.1	494.2		
BAMD	75.5	128.7	156.7	235.0	348.6		
BAMM	62.3	102.0	112.8	173.0	276.6		
BAMS	40.6	67.9	61.8	73.6	128.7		
Forecasts	11	8	6	6	3		

Table 3a. NHC official (OFCL) and climatology-persistence skill baseline (OCD5) intensity forecast errors (kt) for Estelle. Mean errors for the five-year period 2005-9 are shown for comparison. Official errors that are smaller than the five-year means are shown in boldface type.

	Forecast Period (h)						
	12	24	36	48	72	96	120
OFCL (Estelle)	**3.7**	**5.8**	**8.6**	**9.4**	**12.0**	**15.0**	
OCD5 (Estelle)	5.5	8.4	14.2	15.0	20.6	23.0	
Forecasts	15	13	11	9	5	1	
OFCL (2005-9)	6.3	10.5	13.8	15.5	17.5	19.0	
OCD5 (2005-9)	7.1	11.6	15.0	17.4	18.7	19.8	

Table 3b. Homogeneous comparison of selected intensity forecast guidance models (in kt) for Estelle. Errors smaller than the NHC official forecast are shown in boldface type. The number of official forecasts shown here will generally be smaller than that shown in Table 3a due to the homogeneity requirement.

Model ID	Forecast Period (h)						
	12	24	36	48	72	96	120
OFCL	3.7	5.8	8.6	9.4	12.0	15.0	
OCD5	5.5	8.4	14.2	15.0	20.6	23.0	
DSHP	4.5	6.5	8.7	10.9	13.0	16.0	
LGEM	4.9	7.5	9.1	9.4	**6.2**	**9.0**	
GHMI	4.9	5.8	**6.0**	**5.2**	**5.8**	**8.0**	
HWFI	4.1	5.8	9.5	11.3	**10.2**	**0.0**	
ICON	3.8	5.8	**6.7**	**8.1**	**3.8**	**5.0**	
IVCN	4.3	6.3	**6.9**	**7.2**	**2.8**	**5.0**	
Forecasts	15	13	11	9	5	1	