

Tropical Cyclone Report
Tropical Storm Debby
(AL042006)
21-26 August 2006

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Debby was a tropical storm that passed just south of the Cape Verde Islands as a tropical depression, and eventually dissipated over the north-central Atlantic without striking land.

a. Synoptic History

Debby formed from a vigorous tropical wave that moved across the west coast of Africa on 20 August. Almost immediately after moving offshore, the wave developed convective banding and a broad closed circulation. The first Dvorak classification was made at 1200 UTC 21 August, and by 1800 UTC a tropical depression had formed, about 225 n mi south-southeast of Praia in the Cape Verde Islands.

The “best track” chart of the tropical cyclone’s path is given in Fig. 1, with the wind and pressure histories shown in Figs. 2 and 3, respectively. The best track positions and intensities are listed in Table 1. The depression initially moved west-northwestward to the south of the subtropical ridge. Around 1200 UTC 22 August, the center of the cyclone passed about 100 n mi to the southwest of the southernmost Cape Verde Islands, bringing thunderstorms and gusty winds to the southern islands of Fogo and Brava. The depression strengthened as it moved away from the islands, becoming a tropical storm around 0000 UTC 23 August. By 1200 UTC that day Debby’s sustained winds reached 45 kt, and there was little or no change in strength for the next two days as the cyclone moved between west-northwest and northwest at 15-20 kt over the open waters of the eastern Atlantic. Intensification during this period appeared to be limited by a dry and stable air mass surrounding the cyclone, along with marginal sea-surface temperatures. On 25 August, southerly shear began to increase in association with an upper-level trough, displacing the deep convection to the north of the center. Debby started to weaken, and became a depression around 0600 UTC 26 August. By 1200 UTC that day there was no deep convection within about 150 n mi of the center, and Debby degenerated to a remnant low about 1225 n mi east-southeast of Bermuda. The remnant low turned gradually northward ahead of an approaching frontal trough, generating intermittent convection before dissipating just ahead of the trough early on 28 August.

b. Meteorological Statistics

Observations in Debby (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 the U. S. Air Force Weather Agency (AFWA). Microwave satellite imagery from NOAA polar-orbiting satellites, the NASA Tropical Rainfall Measuring Mission (TRMM), the NASA QuikSCAT, and Defense Meteorological Satellite Program (DMSP) satellites were also useful in tracking Debby.

There were no *in situ* reports of tropical storm force winds associated with Debby, although wind gusts to 30 kt were reported on Fogo in the Cape Verde Islands. The estimated storm peak intensity of 45 kt was based on several QuikSCAT passes.

c. Casualty and Damage Statistics

There were no reports of damage or casualties associated with Debby.

d. Forecast and Warning Critique

The genesis of Debby occurred more rapidly than anticipated by the Tropical Weather Outlook products (TWOs). The precursor tropical wave was introduced into the TWO immediately after it emerged off the coast of Africa on 20 August, and the first two TWO products mentioned the possibility of additional development. However, the first TWO to explicitly anticipate the formation of a tropical cyclone was issued just three hours prior to genesis, at 1500 UTC 21 August.

A verification of official and guidance model track forecasts is given in Table 2. Average official track errors for Debby were 32, 54, 73, 87, 111, and 93 n mi for the 12, 24, 36, 48, 72, and 96 h forecasts, respectively. The number of forecasts ranged from 17 at 12 h to 3 at 96 h. There were no verifying 120 h forecasts. These errors are considerably lower than the average long-term official track errors (Table 2) and mostly lower than the consensus (GUNA/CONU/FSSE) model errors. Among the individual guidance models, the GFDI and GFSI performed particularly well, while the NGPI lagged well behind. The shallow BAM (BAMS) also performed very well.

A verification of official and guidance model intensity forecasts is given in Table 3. Average official intensity errors were 4, 6, 8, 10, 18, and 30 kt for the 12, 24, 36, 48, 72, and 96 h forecasts, respectively. For comparison, the average long-term official intensity errors are 6, 10, 12, 14, 18, and 20 kt, respectively. The intensity forecasts had a consistent high bias, with numerous forecasts calling for Debby to reach hurricane strength. Guidance from the DSHP, GHMI, and FSSE models had a similarly high bias. Examination of the DSHP predictors suggests that this model underestimated the negative influences of the unfavorable thermodynamic environment.

Warnings associated with Debby are listed in Table 4.

Table 1. Best track for Tropical Storm Debby, 21-26 August 2006.

Date/Time (UTC)	Latitude (°N)	Longitude (°W)	Pressure (mb)	Wind Speed (kt)	Stage
21 / 1800	11.6	21.7	1007	30	tropical depression
22 / 0000	12.0	22.7	1007	30	"
22 / 0600	12.6	23.9	1007	30	"
22 / 1200	13.4	25.3	1007	30	"
22 / 1800	14.2	26.7	1005	30	"
23 / 0000	14.9	28.1	1003	35	tropical storm
23 / 0600	15.7	29.5	1002	40	"
23 / 1200	16.7	31.0	1001	45	"
23 / 1800	17.6	32.4	1001	45	"
24 / 0000	18.4	33.9	1000	45	"
24 / 0600	19.2	35.5	999	45	"
24 / 1200	20.1	37.1	1000	45	"
24 / 1800	20.9	38.7	1000	45	"
25 / 0000	21.7	40.2	1000	45	"
25 / 0600	22.6	41.5	1001	45	"
25 / 1200	23.6	42.7	1002	40	"
25 / 1800	24.4	44.1	1005	35	"
26 / 0000	24.8	45.1	1008	35	"
26 / 0600	25.2	46.1	1009	30	tropical depression
26 / 1200	25.7	46.9	1010	25	low
26 / 1800	26.5	47.5	1011	25	"
27 / 0000	27.3	48.1	1012	25	"
27 / 0600	28.3	48.8	1012	25	"
27 / 1200	29.4	49.1	1012	25	"
27 / 1800	30.6	48.9	1012	25	"
28 / 0000	32.1	48.3	1012	25	"
28 / 0600					dissipated
24 / 0600	19.2	35.5	999	45	minimum pressure

Table 2. Preliminary track forecast evaluation (heterogeneous sample) for Tropical Storm Debby, 21-26 August 2006. Forecast errors (n mi) are followed by the number of forecasts in parentheses. Errors smaller than the NHC official forecast are shown in bold-face type. Verifications includes the depression stage, but does not include the extratropical stage, if any.

Forecast Technique	Forecast Period (h)						
	12	24	36	48	72	96	120
CLP5	37 (17)	68 (15)	116 (13)	177 (11)	278 (7)	371 (3)	
GFNI	54 (12)	112 (10)	160 (8)	207 (5)	124 (1)		
GFDI	32 (17)	50 (15)	66 (13)	79 (11)	115 (7)	69 (3)	
GFSI	35 (15)	46 (12)	52 (11)	58 (10)	101 (6)	112 (3)	
AEMI	37 (16)	44 (14)	44 (12)	43 (10)	74 (7)	82 (3)	
NGPI	38 (14)	80 (12)	140 (10)	212 (8)	347 (3)		
UKMI	38 (15)	60 (13)	99 (11)	133 (9)	156 (5)	222 (1)	
A98E	37 (17)	58 (15)	81 (13)	102 (11)	131 (7)	192 (3)	
A9UK	39 (7)	61 (6)	91 (5)	131 (4)	176 (3)		
BAMD	39 (17)	65 (15)	97 (13)	138 (11)	195 (7)	285 (3)	
BAMM	35 (17)	58 (15)	83 (13)	115 (11)	153 (7)	200 (3)	
BAMS	26 (17)	45 (15)	63 (13)	87 (11)	128 (7)	135 (3)	
CONU	33 (17)	58 (15)	82 (13)	108 (11)	122 (7)	85 (3)	
GUNA	30 (11)	52 (8)	79 (7)	99 (6)	121 (2)		
FSSE	34 (12)	56 (10)	79 (8)	88 (6)	52 (2)		
OFCL	32 (17)	54 (15)	73 (13)	87 (11)	111 (7)	93 (3)	
NHC Official (2001-2005 mean)	37 (1930)	65 (1743)	91 (1569)	118 (1410)	171 (1138)	231 (913)	303 (742)

Table 3. Preliminary intensity forecast evaluation (heterogeneous sample) for Tropical Storm Debby, 21-26 August 2006. Forecast errors (kt) are followed by the number of forecasts in parentheses. Errors smaller than the NHC official forecast are shown in bold-face type. Verifications includes the depression stage, but does not include the extratropical stage, if any.

Forecast Technique	Forecast Period (h)						
	12	24	36	48	72	96	120
SHF5	4.8 (17)	8.4 (15)	8.8 (13)	9.8 (11)	13.7 (7)	24.7 (3)	
GHMI	7.0 (17)	10.7 (15)	11.5 (13)	13.3 (11)	20.3 (7)	32.7 (3)	
SHIP	4.4 (17)	7.0 (15)	7.9 (13)	11.5 (11)	19.0 (7)	27.3 (3)	
DSHP	4.4 (17)	7.0 (15)	7.9 (13)	11.5 (11)	19.0 (7)	27.3 (3)	
FSSE	4.3 (12)	8.2 (10)	13.6 (8)	18.3 (6)	29.0 (2)		
ICON	5.4 (17)	7.7 (15)	7.7 (13)	9.7 (11)	16.1 (7)	25.3 (3)	
OFCL	3.8 (17)	6.0 (15)	7.7 (13)	10.5 (11)	17.9 (7)	30.0 (3)	
NHC Official (2001-2005 mean)	6.3 (1930)	9.8 (1743)	12.1 (1569)	14.3 (1410)	18.4 (1138)	19.8 (913)	21.8 (742)

Table 4. Watch and warning summary for Tropical Storm Debby, 21-26 August 2006.

Date/Time (UTC)	Action	Location
21 / 2100	Tropical Storm Warning issued	Cape Verde Islands
22 / 1500	Tropical Storm Warning discontinued	Cape Verde Islands

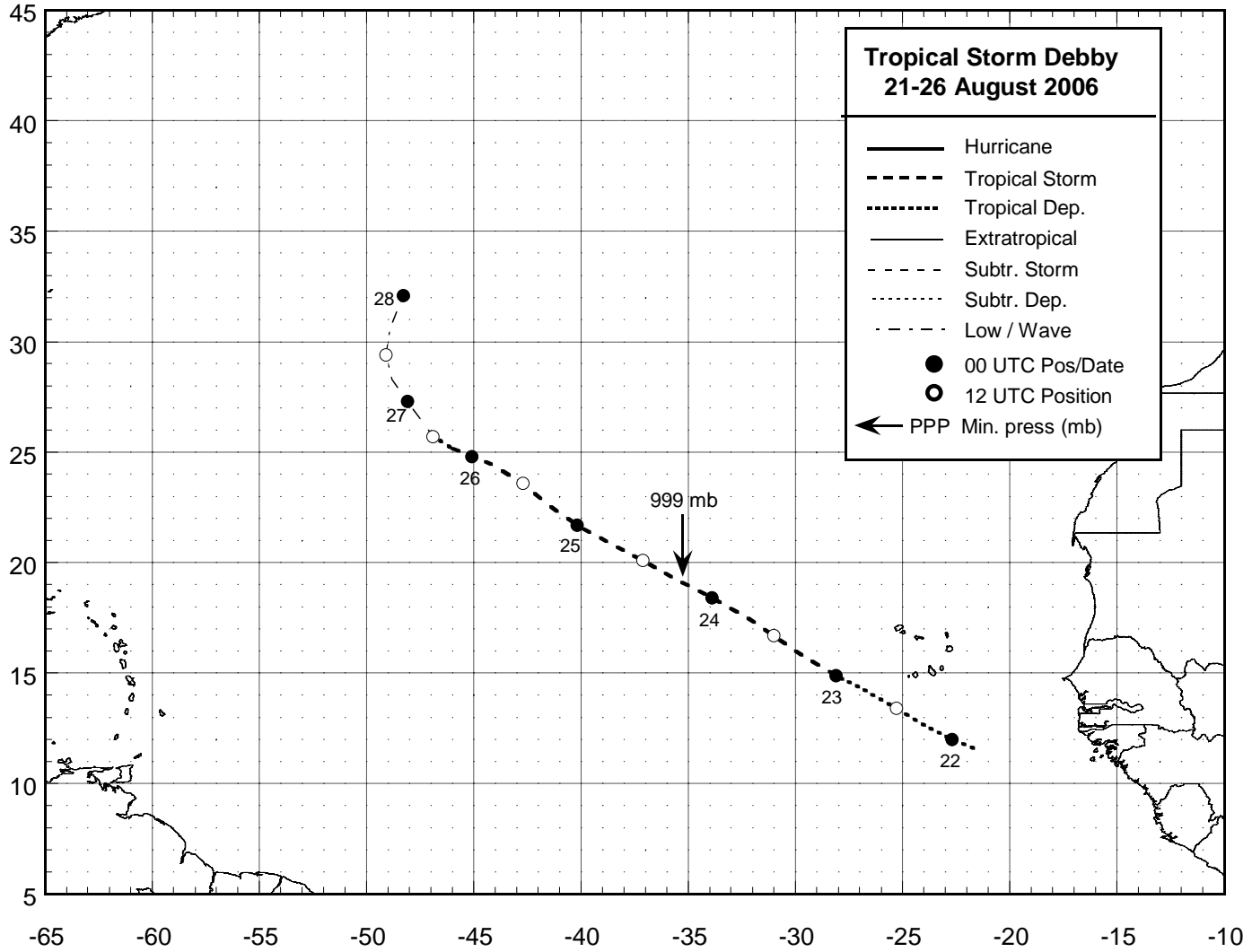


Figure 1. Best track positions for Tropical Storm Debby, 21-26 August 2006.

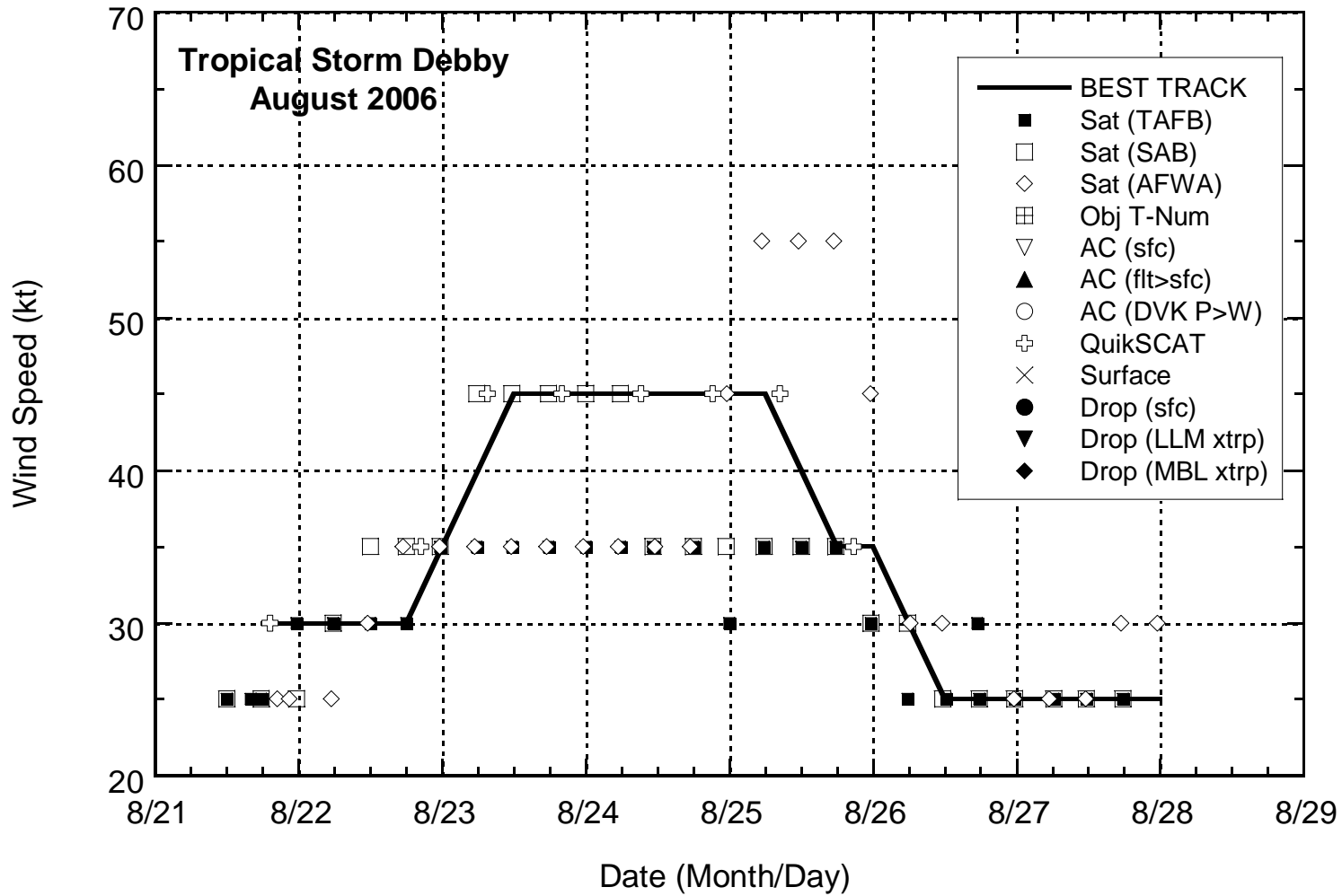


Figure 2. Selected wind observations and best track maximum sustained surface wind speed curve for Tropical Storm Debby, 21-26 August 2006.

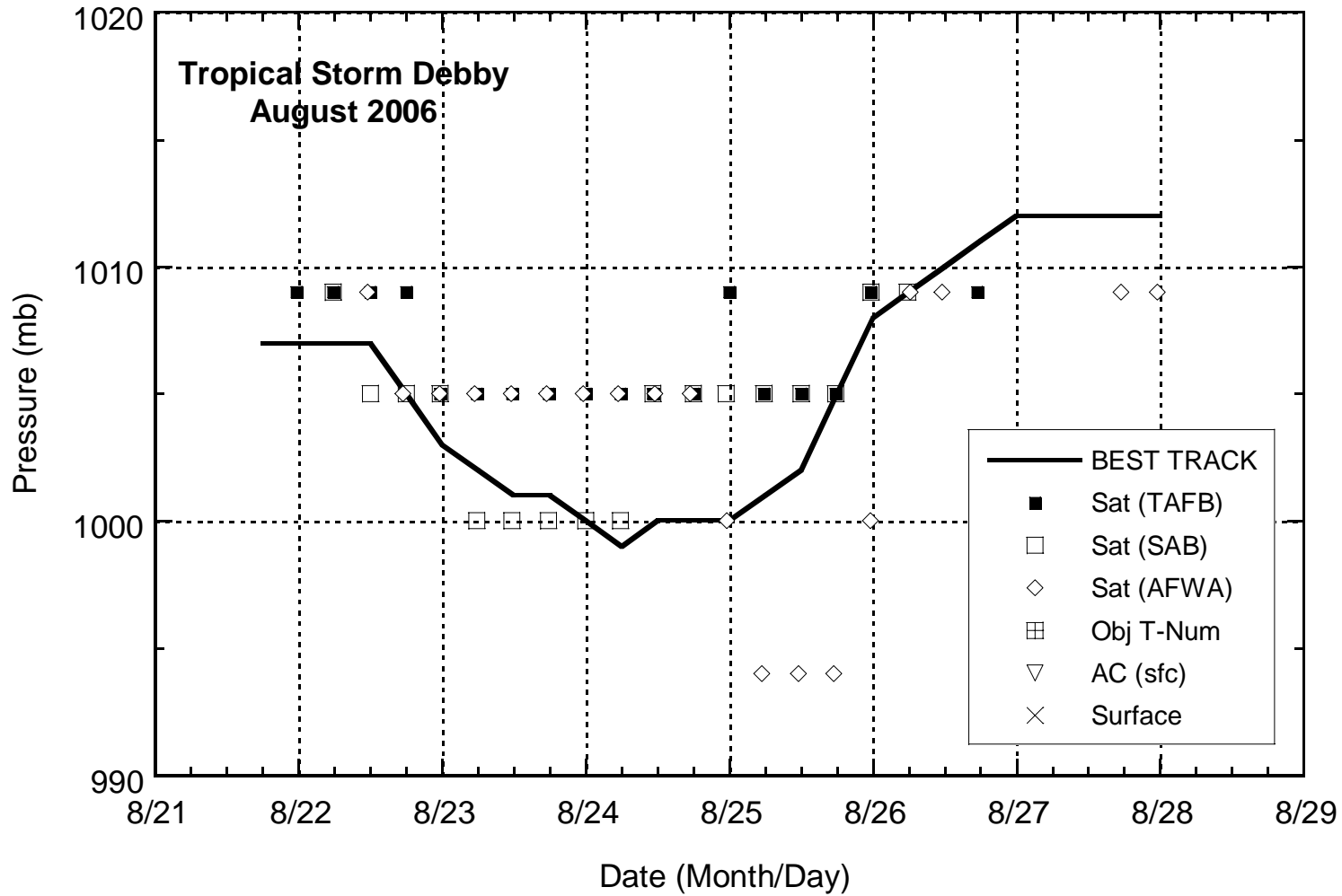


Figure 3. Selected pressure observations and best track minimum central pressure curve for Tropical Storm Debby, 21-26 August 2006.