

Preliminary Report
Hurricane Darby
23 July - 1 August 1998

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a. Synoptic History

The formation of Hurricane Darby can be associated with a tropical wave that generated little cloudiness during its passage across the tropical North Atlantic Ocean and Caribbean Sea on 4-16 July. Convection near the wave began to increase on the 19th, when the activity passed a few hundred nautical miles to the south of Acapulco, Mexico. Two days later, the cloud pattern displayed some curvature on satellite pictures and Dvorak T-numbers were assigned to the system for the first time. Convective bands developed within the pattern on the 22nd and the disturbance became sufficiently well-organized so that it can be estimated that tropical depression status was reached around 0000 UTC on the 23rd (Table 1). It was then centered about 625 n mi to the south of the southern tip of Baja California, several hundred miles west of the area of most frequent formation in the eastern North Pacific Ocean.

A mid- to upper-tropospheric ridge extending westward from an anticyclone initially over the U.S. southwest was the dominant large-scale circulation feature over the eastern Pacific during Darby's development. That feature helped provide a steering current that drove the tropical cyclone toward the west or west-northwest at about 10-15 knots for nearly a week (Fig. 1). Early in this period, the cyclone quickly strengthened (Figs. 2 and 3). Convection became more concentrated and outflow aloft increased over the cyclone's western semicircle. The depression became Tropical Storm Darby at 1800 UTC on the 23rd and, just 36 hours later with a 10-15 n mi wide eye, reached Category 3 on the Saffir-Simpson Hurricane Scale. On the 25th-26th, the eye disappeared from geostationary satellite imagery and then reappeared with a diameter of 20-30 n mi. This occurred in conjunction with a possible eyewall replacement cycle inferred from the imagery. During this period, Darby's winds are analyzed to have decreased a little from 100 kt and then returned to that level.

Darby was likely its strongest, with 100 kt winds and a minimum pressure of 958 mb, near 1800 UTC on the 26th when objectively determined T-numbers reached their peak for this tropical cyclone. The hurricane stayed nearly that strong until early on the 28th when a steady, four-day decline in strength began while Darby gradually crossed sea-surface isotherms toward colder waters and encountered increasing southwesterly vertical wind shear. On the 29th, Darby was downgraded to a tropical storm by

the Central Pacific Hurricane Center (CPHC) shortly after its center crossed 140°W and entered their area of responsibility. The analyses from CPHC (e.g., Fig. 1 and Table 1) show Darby dissipating a few hundred miles to the north of the Hawaiian Islands early on 1 August.

b. Meteorological Statistics

Table 1 provides the post-storm analysis of "best track" location and intensity estimates for Darby. Most of the data west of 140 °W (i.e., after about 0000 UTC on the 29th) were provided by the CPHC. Figures 2 and 3 show the hurricane's estimated central pressure and maximum one-minute wind speed, respectively, versus time and the associated satellite data. Position and intensity estimates from satellite pictures were provided by the Air Force Weather Agency (AFGWC in figures), NOAA Tropical Analysis and Forecast Branch (TAFB) and NOAA Synoptic Analysis Branch (SAB). Satellite estimates from analysts at the CPHC are not shown in the figures.

There were no surface observations of tropical storm force winds.

c. Casualty and Damage Statistics

Darby did not directly affect land and there were no reports of casualties or damages.

d. Forecast and Warning Critique

In general, the track forecast errors from the numerical models and the NHC were much smaller than the long-term NHC averages (Table 2). The AVN, ETA, NGM, and NOGAPS models provided the exceptions.

The intensity forecast models did not indicate the initial rapid strengthening. The NHC intensity forecasts were a little better than the guidance during that phase, but began the forecast of Darby's steady demise about a day too soon.

Watches and warnings were neither issued nor necessary for this cyclone.

Table 1. Preliminary best track, Hurricane Darby, 23 July-1 August 1998.
Data west of 140°W provided by Central Pacific Hurricane Center.

Date/Time (UTC)	Latitude (°N)	Longitude (°W)	Pressure (mb)	Wind Speed (kt)	Stage
23/0000	12.4	111.0	1008	25	Tropical Dep.
0600	12.7	111.9	1008	30	" "
1200	12.9	112.8	1007	30	" "
1800	13.1	113.7	1005	35	Trop. Storm
24/0000	13.4	114.5	1002	40	" "
0600	13.6	115.3	997	50	" "
1200	14.0	116.3	987	65	Hurricane
1800	14.4	117.3	977	80	" "
25/0000	14.8	118.3	965	95	" "
0600	15.3	119.3	960	100	" "
1200	15.5	120.4	960	100	" "
1800	15.8	121.5	965	95	" "
26/0000	16.0	122.7	969	90	" "
0600	16.1	123.9	970	90	" "
1200	16.2	125.2	969	90	" "
1800	16.3	126.5	958	100	" "
27/0000	16.5	127.7	960	100	" "
0600	16.6	128.9	960	100	" "
1200	16.7	130.2	960	100	" "
1800	16.8	131.7	960	100	" "
28/0000	17.1	133.1	960	100	" "
0600	17.4	134.6	964	95	" "
1200	17.7	136.1	974	85	" "
1800	18.0	137.6	979	75	" "
29/0000	18.4	139.2	984	70	" "
0600	18.9	140.6	990	65	" "
1200	19.4	141.8	995	60	Trop. Storm
1800	20.0	143.1	1004	50	" "
30/0000	20.6	144.2	1006	45	" "
1200	21.2	145.2	1008	40	" "
0600	21.8	146.3	1008	40	" "
1800	22.6	147.5	1010	35	" "
31/0000	23.1	148.8	1010	35	" "
0600	23.3	150.1	1011	30	Tropical Dep.
1200	23.4	151.2	1011	25	" "
1800	23.5	152.4	1013	25	" "
01/0000	23.6	153.6	1013	25	Dissipating
26/1800	16.3	126.5	958	100	Minimum Pressure

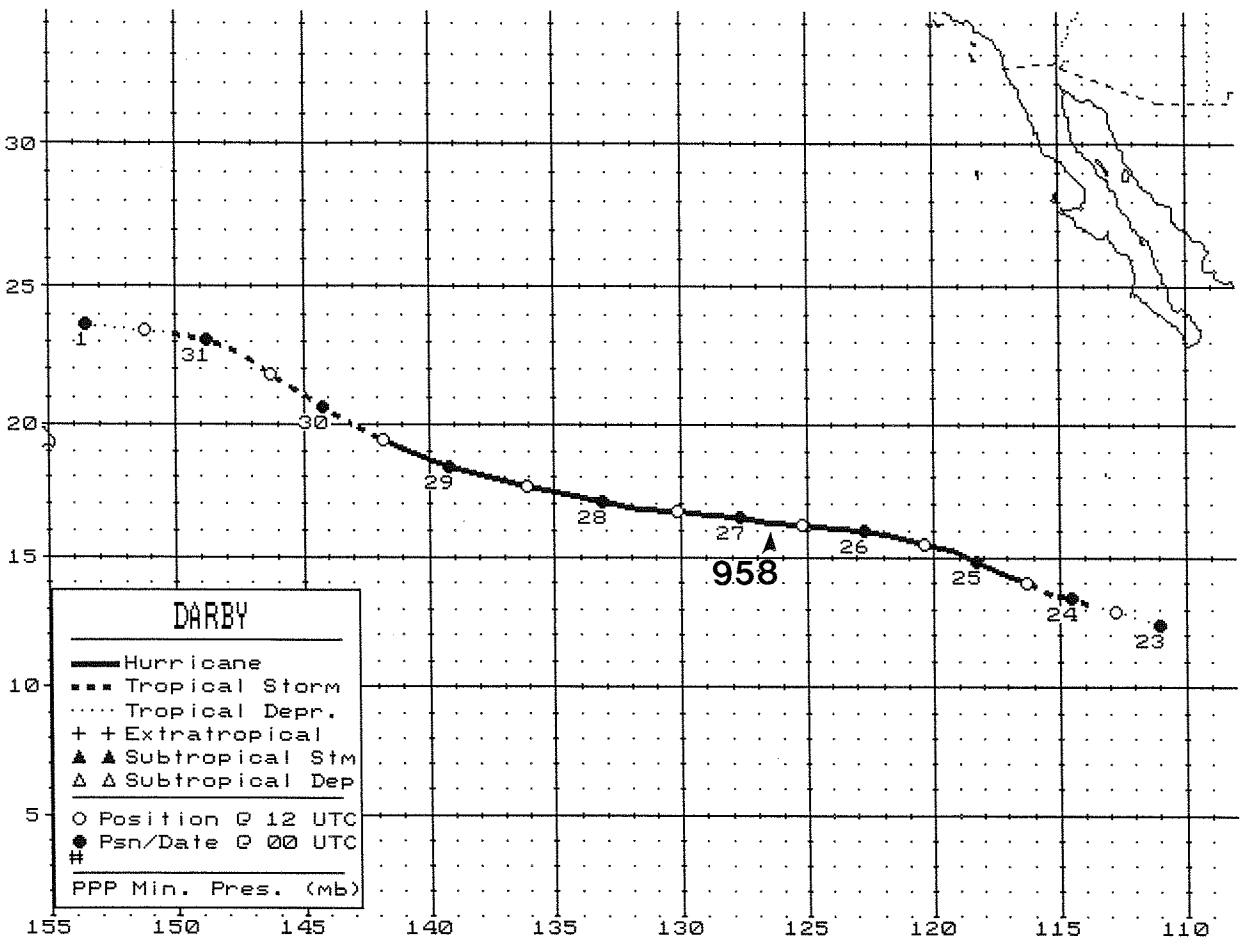


Figure 1. Best track of Hurricane Darby, July-August 1998. Analysis west of 140°W provided by Central Pacific Hurricane Center.

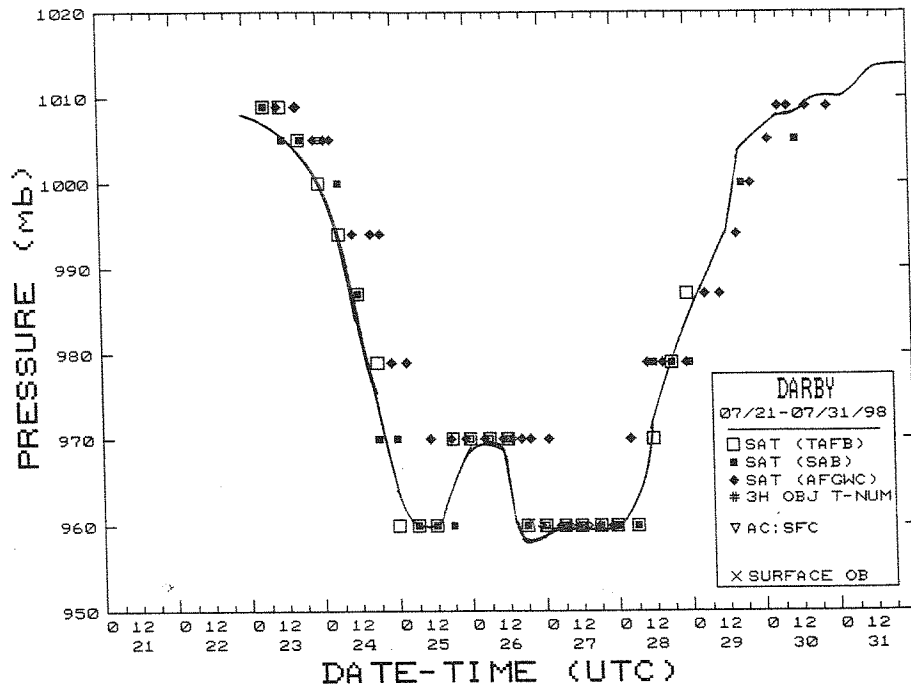


Figure 2. Best track central pressure curve for Hurricane Darby, 23 July-1 August 1998. Analysis beginning 0600 UTC 29 July provided by Central Pacific Hurricane Center. Data from PHNL not shown.

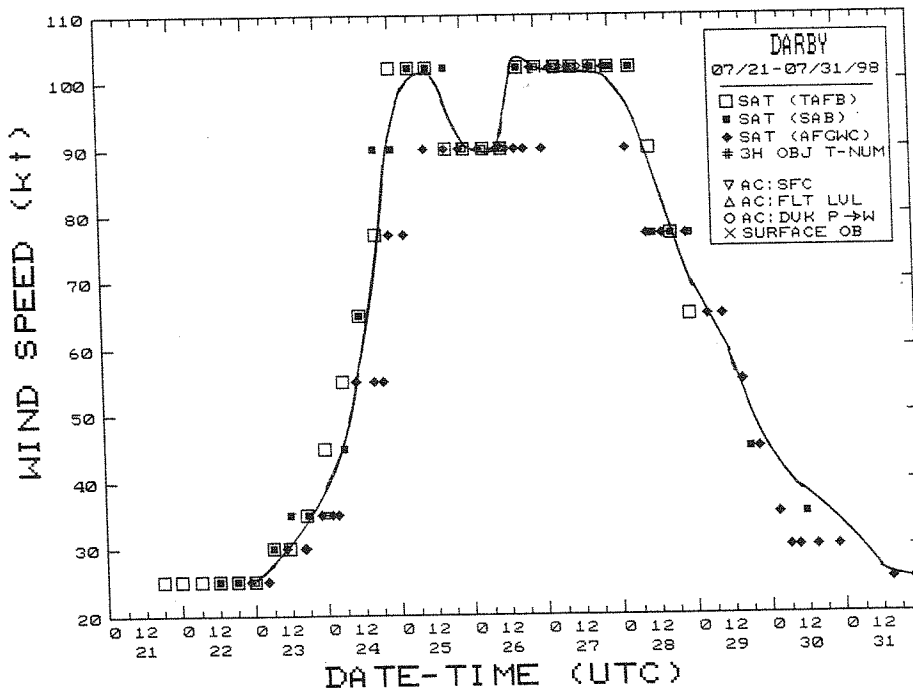


Figure 3. As in Fig. 2, except for maximum wind speed.

Table 2. Preliminary forecast evaluation of Hurricane Darby for heterogeneous sample of forecasts east of 140°W

(Errors in nautical miles for tropical storm and hurricane stages with number of forecasts in parenthesis)

Technique	Period (hours)				
	12	24	36	48	72
CLIP	24 (22)	48 (22)	79 (22)	115 (22)	199 (18)
GFDI	22 (22)	37 (22)	55 (22)	73 (22)	117 (18)
LBAR	21 (22)	46 (22)	81 (22)	117 (22)	185 (18)
AVNI	34 (22)	77 (22)	129 (22)	204 (22)	430 (16)
BAMD	23 (22)	50 (22)	80 (22)	114 (22)	154 (18)
BAMM	23 (22)	48 (22)	73 (22)	98 (22)	146 (18)
BAMS	24 (22)	55 (22)	89 (22)	127 (22)	221 (18)
P91E	22 (22)	39 (22)	57 (22)	69 (22)	105 (18)
P9UK	22 (11)	39 (11)	52 (11)	50 (11)	73 (9)
NGPI	54 (3)	85 (3)	174 (3)	257 (3)	387 (3)
UKMI	24 (22)	42 (22)	67 (22)	94 (22)	145 (18)
ETA*	227 (8)	348 (8)	465 (8)	579 (8)	
NGM*	71 (9)	129 (9)	225 (8)	277 (4)	
GFDL*	23 (20)	38 (20)	54 (20)	68 (20)	108 (17)
MRFO*	52 (6)	87 (6)	137 (6)	163 (5)	274 (4)
AVNO*	52 (11)	80 (11)	123 (11)	172 (11)	355 (8)
NGPS*	44 (5)	89 (5)	130 (5)	197 (5)	334 (5)
UKM*	32 (11)	47 (11)	65 (11)	84 (11)	131 (9)
NHC OFFICIAL	23 (22)	43 (22)	61 (22)	78 (22)	110 (18)
NHC OFFICIAL (1988-1997 10-year average)	39 (2527)	71 (2266)	105 (1998)	137 (1755)	195 (1337)

* Output not available until after the NHC forecast is issued.