

Preliminary Report  
Hurricane Dolly  
19-25 August 1996

Edward N. Rappaport  
National Hurricane Center  
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a. Synoptic History

Hurricane Dolly formed from a tropical wave of large lateral extent that moved from the west coast of Africa to the central Caribbean Sea during 9-18 August 1996. Although the wave generated deep convection when it emerged from Africa, there was little accompanying thunderstorm activity for much of its passage across the tropical North Atlantic Ocean. Deep convection redeveloped when the wave reached the eastern Caribbean, but did not persist in a concentrated pattern until the system was south to southwest of Jamaica on the 18th-19th. A low- to mid-level cyclonic circulation was then detected in data obtained during a NOAA research flight to study the development of tropical cyclones. Satellite analysts indicated that the system was too weak to classify using the Dvorak technique late on the 18th, but they calculated Dvorak T-numbers of 1.5 and 2.0 on the afternoon of the 19th. By mid-afternoon on the 19th, the first center "fix" by reconnaissance aircraft was made and data from the plane, satellite, and a ship that reported 45 knots at 1800 UTC were used to estimate that the tropical depression stage began with a poorly-defined circulation center near 0600 UTC on the 19th, and that the depression became Tropical Storm Dolly a little more than six hours later.

The tropical cyclone developed near or just south of a mid- to upper-level anticyclone. In that environment, Dolly strengthened on the 19th and 20th and moved toward the west-northwest (Table 1, Fig. 1) at a speed that decreased from 15 knots to about 8 knots. Convection became better organized near the circulation center on the 20th and, just before making landfall on the Yucatan peninsula to the northeast of Chetumal, Dolly became a hurricane. It weakened back to a tropical depression and slowed to about 5 knots during its 24-hour passage over the peninsula, and satellite pictures showed the center of cloud rotation displaced to the south of the estimated surface circulation center.

Gradual restrengthening began a few hours after the surface

center arrived over the Bay of Campeche. Dolly regained hurricane status and was at its strongest, with 70 knot winds and a central pressure of 989 mb, when it accelerated to 15 knots and made its final landfall about midway between Tuxpan and Tampico near 1800 UTC on the 23rd.

Dolly then weakened and, as a tropical depression, crossed central Mexico. It continued to generate areas of deep convection and, likely, heavy precipitation even while its surface center dissipated over the eastern North Pacific Ocean on the 25th.

#### b. Meteorological Statistics

The "best track" (Table 1) was obtained from the data presented in Figs. 2 and 3, and in Table 2. Those figures show Dolly's estimated central pressure and maximum one-minute wind speed, respectively, versus time. Position and intensity estimates from satellite pictures were provided by the NOAA Synoptic Analysis Branch (SAB) and Tropical Analysis and Forecast Branch (TAFB), and by the Air Force Global Weather Central (AFGWC). This information was supplemented by reconnaissance aircraft data provided by the U.S. Air Force Reserves, and surface observations from land sites and ships.

The only available official observations of at least tropical storm force winds from a surface land site came from Tampico, Mexico. There, 10-minute winds of 40 knots with gusts to 60 knots occurred at 1045 UTC and 1145 UTC on the 23rd. An amateur radio report of a gust to 59 knots was received from Tampico.

Ship reports of 34 knot or higher wind speeds are listed in Table 2.

The three largest 24-hour rainfall totals reported to the meteorological service of Mexico came from Micos (12.94 inches), Santa Rosa (10.59 inches), and Puerto de Valles (10.00 inches). The rains, which in some cases were heavier on Mexico's west coast than its east coast, also occurred in the more widely-known cities of Acapulco (7.48 inches), Los Mochis (7.06), Tuxpan (5.88 inches), Chetumal (5.73 inches), Monterrey (4.93 inches), and Cancun (1.35 inches).

#### c. Casualty and Damage Statistics

According to newspapers reports, Hurricane Dolly was

responsible for fourteen deaths in Mexico--including six in Veracruz (all drowned), three in Nuevo Leon, and one each in Pueblo Viejo and Monterrey. Two people were missing in Nuevo Leon.

Those reports also indicated hundreds of residences destroyed and 35,000 people displaced. Severe damage occurred in Tuxpan, Tamiahua, Pueblo Viejo, Platan, Panuco, Tampico Alto and elsewhere along the coast of northeast Mexico. A river overflowed its banks causing damage in Pueblo Viejo. A large area of farm land was lost to flooding in Quintana Roo on the Yucatan peninsula.

Rain prompted evacuations in the southern part of the state of San Luis Potosi. About 6500 people were evacuated from low-lying zones of Tampico.

Widespread communication and power outages were noted as far west as Mazatlan.

#### d. Forecast and Warning Critique

Table 3 provides track forecast error statistics. The cyclone was relatively short-lived and only five forecasts through 72 hours could be evaluated. The best model performance was made by BAMD which had astonishingly small errors (e.g., average error of 31 nm at 72 hours). The NHC average track forecast errors were not as small as those of the BAMD, but were much smaller than the those of the GFDL, VBAR, and the interpolated GFDI and UKMI guidance. The NHC errors were smaller than the most recent 10-year average, as well. Most NHC intensity forecast errors were 15 knots or less.

Table 4 lists tropical storm and hurricane watches and warnings issued by the government of Mexico.

Table 1. Preliminary best track, Hurricane Dolly, 19-25 August 1996.

Date/Time (UTC)	Latitude (°N)	Longitude (°W)	Pressure (mb)	Wind Speed (kt)	Stage
19/0600	17.3	80.2	1009	25	Tropical Depression
1200	17.8	81.7	1008	30	" "
1800	18.2	83.0	1006	45	Tropical Storm
20/0000	18.6	84.4	1006	45	" "
0600	18.8	85.7	1005	55	" "
1200	19.0	86.9	1002	60	" "
1800	19.2	87.8	999	65	Hurricane
21/0000	19.2	88.7	1001	40	Tropical Storm
0600	19.3	89.5	1002	35	" "
1200	19.4	90.1	1002	30	Tropical Depression
1800	19.5	90.7	1002	30	" "
22/0000	19.7	91.4	1002	35	Tropical Storm
0600	20.1	92.6	1002	45	" "
1200	20.4	93.7	999	45	" "
1800	20.6	94.2	993	50	" "
23/0000	20.9	94.9	990	55	" "
0600	21.3	96.1	991	60	" "
1200	21.6	97.7	989	70	Hurricane
1800	21.6	99.3	997	45	Tropical Storm
24/0000	21.6	100.9	1002	30	Tropical Depression
0600	21.6	102.5	1004	25	" "
1200	21.7	104.0	1005	20	" "
1800	21.7	105.7	1005	20	" "
25/0000	21.8	107.3	1005	20	" "
25/0600					Dissipated
23/1200	21.6	97.7	989	70	Minimum Pressure

Landfall information:

Near Punta Herrero, Mexico (northeast of Chetumal)

20/1730 19.1 87.7 999 65 Hurricane

Midway between Tampico and Tuxpan, Mexico

23/1200 21.6 97.7 989 70 Hurricane

Table 2

Ship reports of at least 34 knots

Name	Date/ Time (UTC)	Latitude (°N)	Longitude (°W)	Wind Speed (knots)	Pressure (mb)
<i>Iver Explorer</i>	19/1800	18.2	82.0	45	1007.9
<i>Golfo Di Trieste</i>	20/0300	19.2	83.3	36	1013.0(?)
<i>Celebration</i>	20/0300	21.3	84.3	35	1001.3(?)
ELRU3	20/0500	20.7	85.8	40	1013.0
unknown	20/0600	20.6	86.3	37	1014.8(?)
ELRU3	20/0800	21.4	85.5	40	1012.0
<i>Titan Scan</i>	20/1200	18.6	82.9	37	1010.9
3EWJ9	20/1200	21.5	84.9	50	1017.0
<i>Titan Scan</i>	20/1800	19.7	83.9	37	1012.3
<i>Columbus Queensland</i>	20/1800	21.9	86.2	34	1015.0
<i>Titan Scan</i>	20/2100	20.2	84.3	37	1011.5
PJZE	22/1200	21.9	93.9	39	1005.5
PJZE	22/1800	22.3	93.4	41	1006.2
V2DH	22/1800	22.3	94.7	34	1005.0
V2DH	23/0000	22.3	94.1	34	1004.0
PJZE	23/0600	22.0	91.0	35	1012.5
WWLH	23/1200	22.2	94.0	35	1011.5

Table 3

Preliminary forecast evaluation of Hurricane Dolly  
Heterogeneous sample

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

Technique	Period (hours)				
	12	24	36	48	72
GFDI	71 ( 7)	119 (5)	184 (5)	236 (5)	415 (3)
GFDL*	41 ( 4)	108 (3)	145 (2)	215 (3)	341 (2)
VBAR	34 (11)	82 (9)	154 (7)	259 (6)	404 (5)
LBAR	35 (11)	50 (9)	102 (7)	190 (6)	290 (5)
AVNI	56 ( 2)	193 (1)	323 (1)	289 (2)	95 (2)
BAMD	35 (11)	40 (9)	46 (7)	49 (6)	31 (5)
BAMM	34 (11)	48 (9)	77 (7)	114 (6)	126 (5)
BAMS	37 (11)	52 (9)	92 (7)	129 (6)	128 (5)
A90E	42 (11)	55 (9)	91 (7)	134 (6)	181 (5)
CLIP	45 (11)	54 (9)	94 (7)	107 (6)	132 (5)
NGPI	(0)	(0)	(0)	(0)	(0)
UKMI	77 ( 4)	129 (2)	200 (2)	256 (1)	306 (1)
NHC OFFICIAL	40 (11)	53 (9)	94 (7)	137 (6)	182 (5)
NHC OFFICIAL (1986-1995 10- year average)	49 (1670)	93 (1484)	136 (1314)	181 (1155)	273 (882)

\* GFDL output not available until after forecast issued. VBAR  
output sometimes not available until after forecast issued.

Table 4

## Tropical Cyclone watch and warning summary, Hurricane Dolly

Date/Time (UTC)	Action	Location
19/1800	Tropical Storm Warning issued	Chetumal to Progreso, Mexico
19/1800	Tropical Storm Watch issued	Pinar del Rio Province and Isle of Pines, Cuba
19/2100	Tropical Storm Warning issued	San Pedro, Belize to Mexico border
20/1200	Tropical Storm Watch discontinued	Cuba
20/1500	Tropical Storm Warning issued	Progreso to Ciudad del Carmen
20/1600	Hurricane Warning issued--replaced Tropical Storm Warning	Cozumel to Chetumal
20/2100	Hurricane Warning and Tropical Storm Warning discontinued	South of Cozumel
21/0300	Tropical Storm Warning discontinued	eastward from 88°W
21/0900	Tropical Storm Warning discontinued	east of Progreso
21/1500	Tropical Storm Warning discontinued	remainder of Mexico
22/0900	Hurricane Watch issued	Veracruz to La Pesca, Mexico
22/1500	Hurricane Warning issued-replaced Hurricane Watch	Veracruz to La Pesca
23/1800	Hurricane Warning discontinued	Veracruz to La Pesca





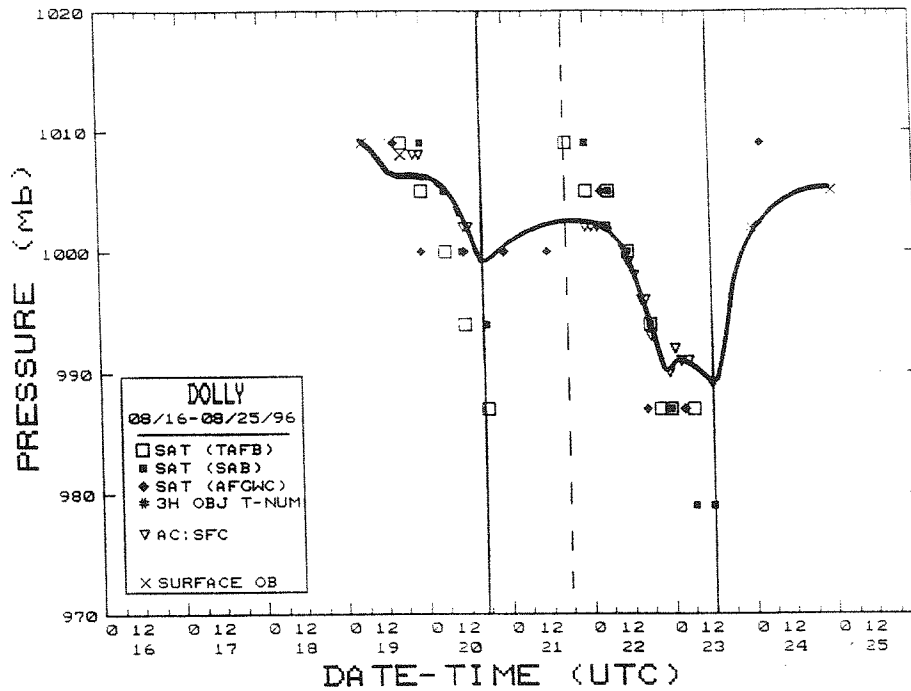


Figure 2. Best track central pressure curve for Hurricane Dolly, August 1996. X indicates surface analysis or observation. Solid vertical lines indicate landfall. Dashed vertical line indicates return of center to sea.

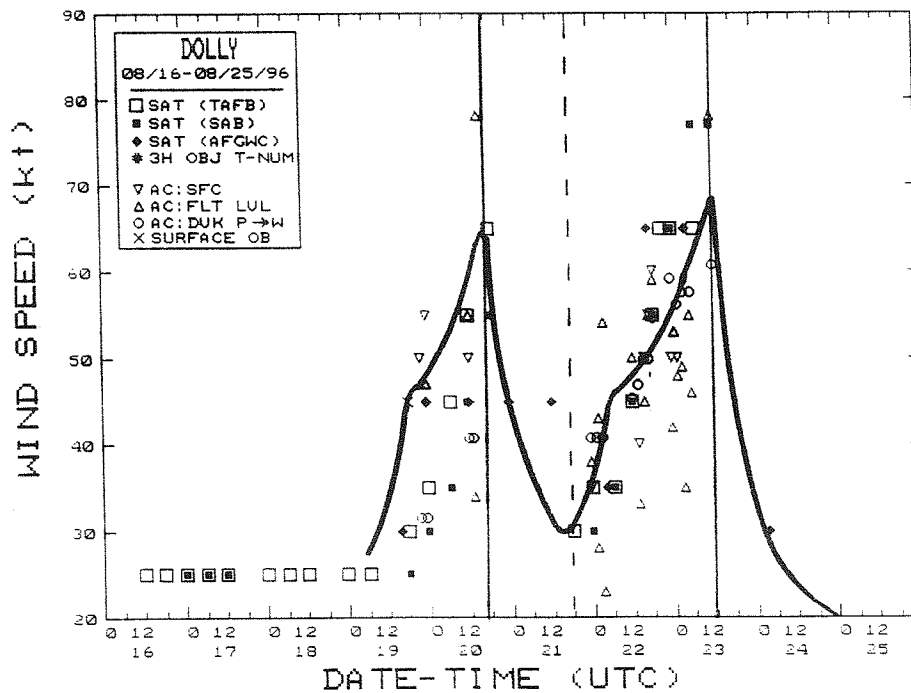


Figure 3. Best track maximum one-minute wind speed curve for Hurricane Dolly, August 1996. Not all aircraft observations are samples of the maximum wind speed. X indicates surface analysis or observation. Solid vertical lines indicate landfall. Dashed vertical line indicates return of center to sea.