

Preliminary Report
Hurricane Guillermo
30 July - 15 August 1997

Max Mayfield
National Hurricane Center
2 October 1997

a. Synoptic History

Rawinsonde data from Dakar indicated that a well-defined tropical wave emerged from the west coast of Africa on 16 July. The wave was tracked across the Atlantic in satellite imagery, although associated deep convection was minimal. Strong westerly winds aloft made tracking the wave difficult as it crossed the Caribbean. However, reasonable extrapolation would place the wave in the vicinity of increased cloudiness and convection off the Pacific coast of Central America on 27 and 28 July. Evidence of a poorly-defined cloud system center within a somewhat isolated tropical disturbance appeared in satellite imagery on 29 July. Convective banding increased as a broad cyclonic circulation became established. The "best track" indicates that a tropical depression formed from the disturbance near 1200 UTC 30 July while centered about 300 n mi south of Salina Cruz, Mexico (Fig. 1 and Table 1). The tropical cyclone moved west-northwestward at 10 to 15 knots in response to a deep-layer-mean ridge to the north.

Deep convection became concentrated near the circulation center and the depression strengthened into Tropical Storm Guillermo at 0600 UTC 31 July while centered about 325 n mi south-southeast of Acapulco, Mexico. A well-defined central dense overcast developed over the circulation center and Guillermo became a hurricane at 1800 UTC 1 August while centered about 300 n mi southwest of Acapulco. Upper-level outflow became well established, and an eye appeared in satellite imagery on 2 August. Strengthening continued and it is estimated that Guillermo reached its peak intensity with 140 knot winds and 919 mb minimum central pressure near 0000 UTC 5 August while centered about 700 n mi southwest of the southern tip of Baja California. Shortly thereafter, cloud-top temperatures surrounding the eye gradually warmed, although the eye remained visible until 7 August.

Guillermo moved over cooler water and weakened to a tropical storm by 0600 UTC 8 August while centered about 1100 n mi east of Hawaii. It passed 140°W longitude into the Central Pacific Hurricane Center's (CPHC) area of responsibility just after

1800 UTC 9 August. The low- to mid-level flow turned the weakening cyclone more toward the north-northwest around the western periphery of the subtropical ridge. Guillermo weakened to a tropical depression at 1800 UTC 10 August but regained tropical storm strength about 24 hours later. The storm temporarily turned more toward the west-northwest and passed about 700 n mi to the northeast of the Hawaiian Islands on 13 August.

Guillermo again weakened to a tropical depression at 1200 UTC 15 August and became extratropical near 0000 UTC 16 August. The extratropical low recurved over the North Pacific, moving to a position about 500 n mi west of Vancouver Island, British Columbia on 19 August. The low persisted for a few days longer, slowly moving to within 300 n mi off the coast of northern California before being absorbed by a larger extratropical cyclone on 24 August.

b. Meteorological Statistics

Figures 2 and 3 show the curves of minimum central pressure and maximum one-minute wind speed, respectively, versus time (while Guillermo was in the NHC area of responsibility), along with the observations on which they are based. As usual for an eastern Pacific tropical cyclone, satellites provided the primary source of observational data. Dvorak technique location and intensity estimates from the satellite data were produced by the Air Force Global Weather Center (AFGWC), the NOAA Synoptic Analysis Branch (SAB) and the NOAA Tropical Analysis and Forecast Branch (TAFB). Most objective Dvorak T numbers were near 7.0 (140 knots) between 1200 UTC 4 August and 1800 UTC 5 August. The highest 3-hour average objective T number was 7.3 between 0000 UTC and 0300 UTC 5 August and is the basis for estimating the peak intensity at that time. Although maximum sustained winds of 140 knots and minimum central pressure of 919 mb indicated in the best track makes Guillermo one of the strongest hurricanes on record in the eastern North Pacific, one should remember that intensities are usually *estimated* from satellite interpretations for this basin. Best track records show Hurricane Linda in September 1997 with maximum sustained winds of 160 knots and Hurricane Ava in 1976 with maximum sustained winds of 140 knots. There could well have been other cyclones as strong as, or stronger than, Linda, Ava and Guillermo.

In addition to the satellite information on Guillermo, aircraft reconnaissance data were provided by the NOAA Hurricane Research Division (HRD) from P-3 aircraft conducting a vortex motion and evolution experiment on 2 and 3 August. Some unique observations were obtained by research scientists on 3 August when several Global Positioning System (GPS) dropwindsondes were released from the 700 mb

level within the eyewall of Guillermo. For the first time, wind data with relatively high vertical resolution from flight level to the surface were recorded within the eyewall of a major hurricane. Profiles of wind speed versus altitude showed considerable variations among the individual “drops”. Figure 4 shows a profile from one of the GPS sondes dropped within the southwest quadrant of the eyewall at 2342 UTC. In this example, it is noted that the winds are strongest in the low levels, and in fact, are a little *stronger* at the surface than at flight level. These data will continue to be studied to better understand the relationship between flight-level winds and surface winds. In-depth analyses from HRD scientists are in progress, and publication of these analyses are eagerly awaited.

The best track data west of 140°W as well as during the extratropical stage were obtained from the CPHC.

c. Casualty and Damage Statistics

There were no reports of casualties or damage from Guillermo received at the National Hurricane Center.

d. Forecast and Warning Critique

NHC average official track forecast errors (excluding tropical depression stage) were 29 (39 cases), 48 (38 cases), 68 (36 cases), 93 (34 cases) and 149 n. mi. (31 cases), respectively, for the 12-, 24-, 36-, 48- and 72-hour forecast periods. These were all lower than the 1988-1996 average errors. The NHC average official track forecast errors were lower than the averages from all of the operationally available track prediction models except at the 48 and 72 hour time periods when the UKMI model had comparable or slightly lower errors.

The NHC official intensity forecasts showed a distinct negative bias (i.e., intensity was underestimated) while Guillermo was strengthening and a positive bias (i.e., intensity was overestimated) when the cyclone was weakening.

Watches and warnings were neither issued nor necessary for Guillermo.

Acknowledgments:

Aircraft data were provided by James Franklin and Mike Black from the NOAA HRD. Thanks to Ben Hablutzel from CPHC for providing best track data after 1800 UTC 9 August.

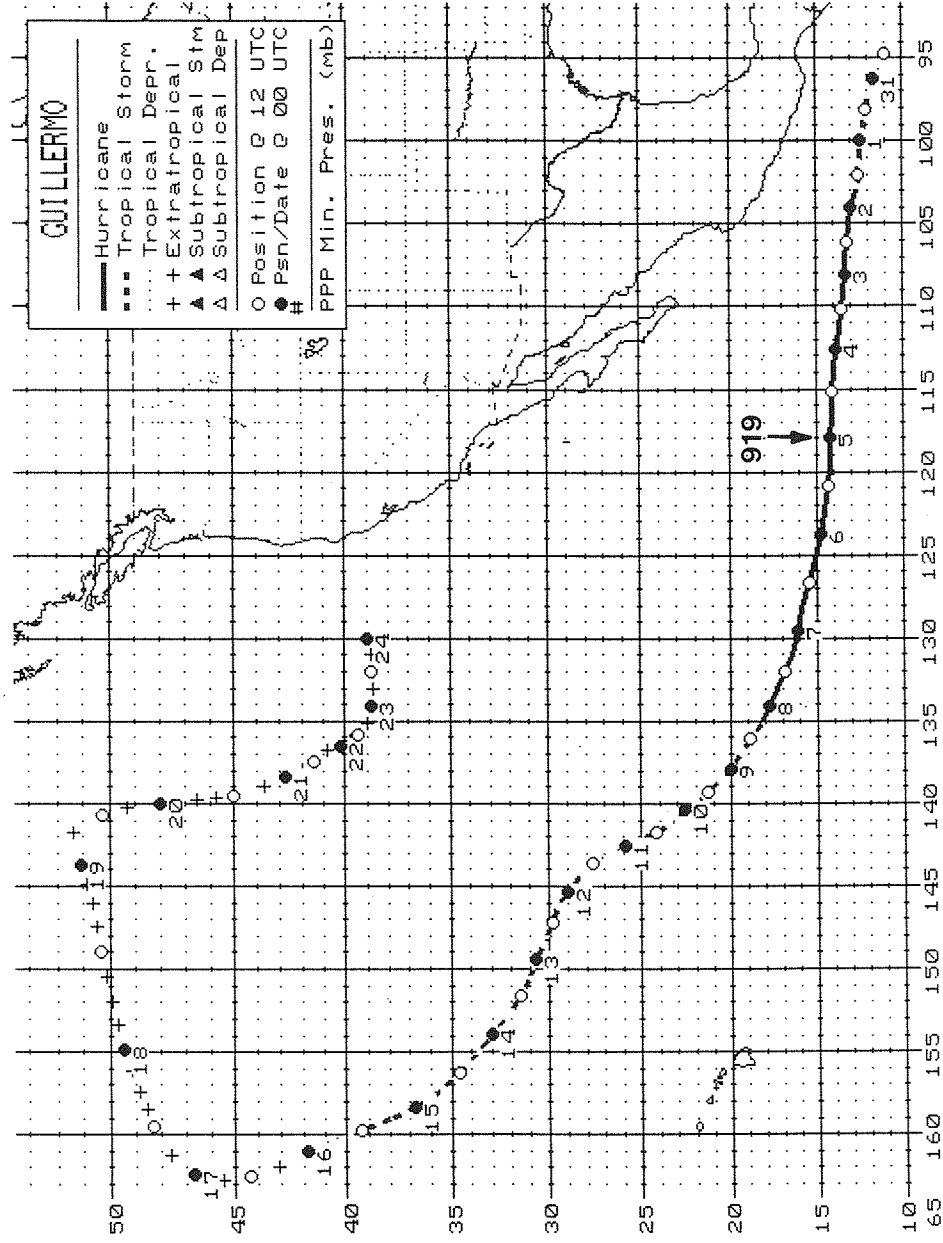


Figure 1. Best track positions for Hurricane Guillermo, 30 July-15 August 1997.

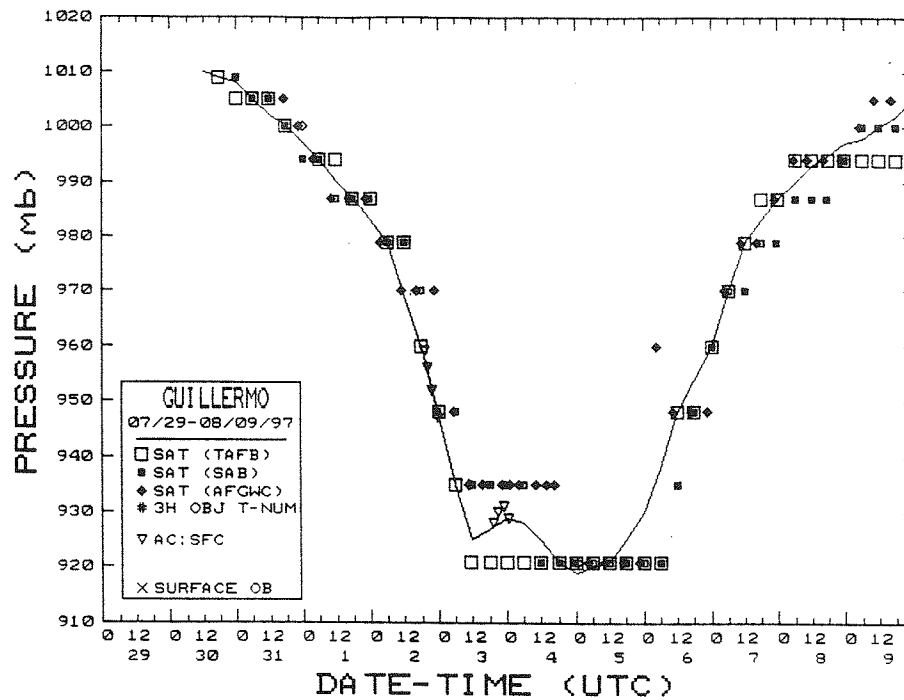


Figure 2. Best track minimum central pressure curve for Hurricane Guillermo.

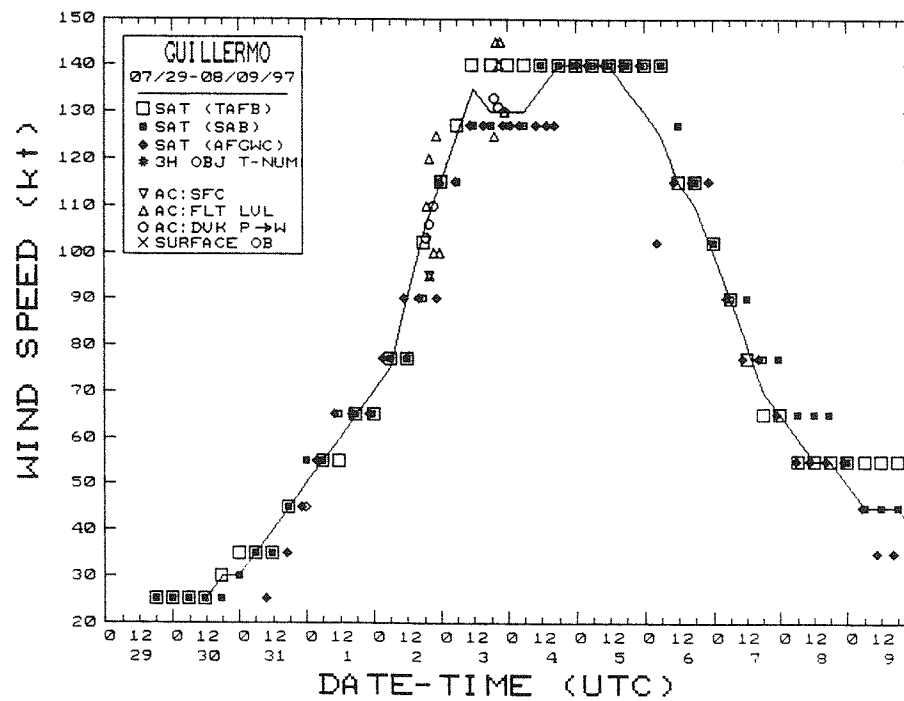


Figure 3. Best track maximum sustained wind speed curve for Hurricane Guillermo.

Hurricane Guillermo 970803/2342 UTC
GPS Dropsonde in SW Eyewall

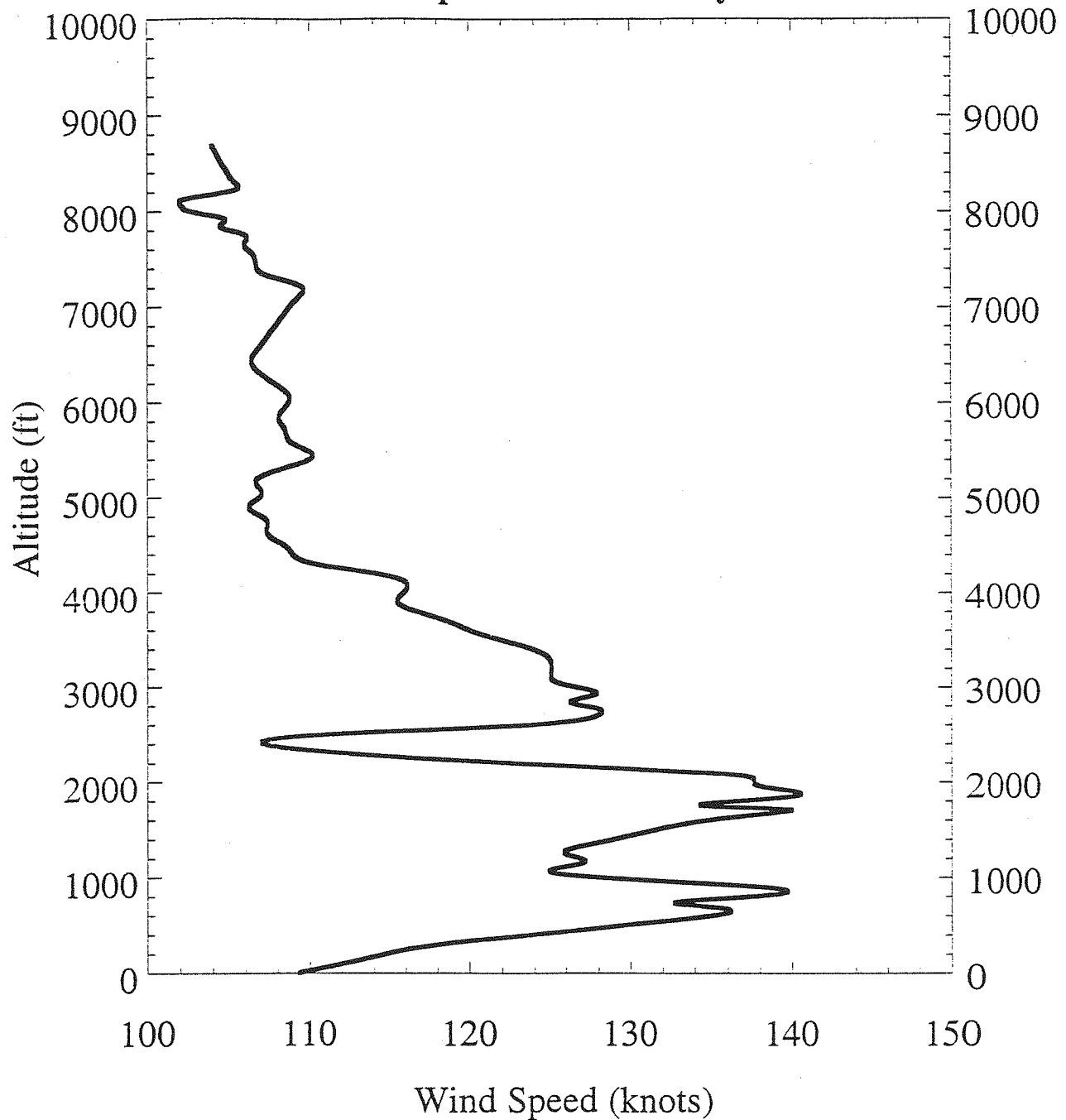


Fig. 4. Profile of wind speed (knots) versus altitude (feet) from a GPS dropwindsonde released within the southwest quadrant of the eyewall of Hurricane Guillermo at 2342 UTC 3 August. (Courtesy of the Hurricane Research Division)

Table 1. Best track, Hurricane Guillermo, 30 July - 15 August 1997.

Date/Time (UTC)	Position		Pressure (mb)	Wind Speed (kt)	Stage
	Lat. (°N)	Lon. (°W)			
30/1200	11.0	94.7	1010	25	tropical depression
1800	11.3	95.5	1009	30	"
31/0000	11.6	96.3	1008	30	"
0600	11.9	97.2	1005	35	tropical storm
1200	12.1	98.1	1002	40	"
1800	12.2	99.1	1000	45	"
01/0000	12.4	100.0	997	50	"
0600	12.5	101.0	994	55	"
1200	12.6	102.0	990	60	"
1800	12.7	103.0	987	65	hurricane
02/0000	13.0	104.0	983	70	"
0600	13.1	105.0	979	75	"
1200	13.2	106.1	969	90	"
1800	13.3	107.1	959	105	"
03/0000	13.4	108.1	947	115	"
0600	13.5	109.1	935	125	"
1200	13.6	110.2	925	135	"
1800	13.7	111.4	927	130	"
04/0000	13.9	112.6	929	130	"
0600	14.0	113.9	928	130	"
1200	14.1	115.2	925	135	"
1800	14.2	116.6	921	140	"
05/0000	14.3	118.0	919	140	"
0600	14.3	119.5	920	140	"
1200	14.4	120.9	921	140	"
1800	14.6	122.4	925	135	"
06/0000	14.8	123.8	930	130	"
0600	15.2	125.2	938	125	"
1200	15.5	126.7	948	115	"
1800	15.9	128.2	954	110	"
07/0000	16.2	129.6	960	100	"
0600	16.5	130.9	970	90	"
1200	16.9	132.0	979	80	"
1800	17.4	133.0	983	70	"
08/0000	17.8	134.1	987	65	"
0600	18.3	135.1	990	60	tropical storm
1200	18.9	136.1	993	55	"
1800	19.5	137.0	995	55	"
09/0000	20.0	137.9	997	50	"

0600	20.7	138.6	998	45	“
1200	21.3	139.3	1000	45	“
1800	21.9	139.9	1002	45	“
10/0000	22.6	140.4	1005	40	“
0600	23.3	141.2	1006	35	“
1200	24.2	141.8	1006	35	“
1800	25.0	142.2	1007	30	tropical depression
11/0000	25.9	142.6	1007	30	“
0600	26.8	143.1	1007	30	“
1200	27.6	143.6	1004	30	“
1800	28.4	144.4	1008	35	tropical storm
12/0000	29.0	145.4	1007	35	“
0600	29.5	146.2	1000	40	“
1200	29.8	147.2	1000	40	“
1800	30.2	148.3	1004	40	“
13/0000	30.7	149.4	1004	40	“
0600	31.0	150.4	1004	40	“
1200	31.5	151.6	1004	40	“
1800	32.2	152.9	1004	45	“
14/0000	33.0	153.9	1000	55	“
0600	33.8	155.2	1000	50	“
1200	34.6	156.3	1000	45	“
1800	35.6	157.4	1006	40	“
15/0000	36.8	158.4	1008	35	“
0600	38.0	159.1	1009	35	“
1200	39.3	159.7	1010	30	tropical depression
1800	40.5	160.2	1012	30	“
16/0000	41.8	161.0	1010	30	extratropical
0600	43.1	161.9	1009	30	“
1200	44.3	162.5	1014	30	“
1800	45.5	162.8	1018	30	“
17/0000	46.7	162.4	1016	25	“
0600	47.6	161.2	1016	30	“
1200	48.3	159.5	1018	25	“
1800	48.9	157.4	1016	25	“
18/0000	49.5	154.9	1015	25	“
0600	49.9	152.0	1010	25	“
1200	50.4	149.0	1010	30	“
1800	50.7	146.1	1005	25	“
19/0000	51.1	143.7	1003	30	“
0600	51.2	141.8	1002	30	“
1200	50.3	140.7	1004	30	“
1800	49.3	140.2	1004	30	“

20/0000	48.0	140.0	1004	30	“
0600	46.5	139.8	1006	30	“
1200	45.0	139.5	1004	30	“
1800	43.7	139.0	1005	30	“
21/0000	42.7	138.4	1005	25	“
0600	42.0	137.9	1006	25	“
1200	41.4	137.4	1005	25	“
1800	40.8	136.8	1006	25	“
22/0000	40.2	136.5	1006	25	“
0600	39.8	136.2	1009	30	“
1200	39.4	135.8	1010	25	“
1800	39.0	135.1	1012	25	“
23/0000	38.8	134.1	1012	25	“
0600	38.7	133.0	1014	25	“
1200	38.8	132.0	1014	20	“
1800	38.8	131.0	1014	20	“
24/0000	39.0	130.0	1014	20	“
0600					absorbed by a large extratropical cyclone

5/0000	14.3	118.0	919	140	minimum pressure
--------	------	-------	-----	-----	------------------