

Tropical Cyclone Report
Hurricane Gil
4 - 9 September 2001

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Gil was an eastern North Pacific hurricane with maximum winds that reached 85 kt, but that will be best remembered for its interaction with and absorption of Tropical Storm Henriette.

a. Synoptic history

A tropical wave moved westward from the African coast on 14-15 August. The system showed signs of organization as it approached the Lesser Antilles on 21 August, with the northern portion of the wave spawning Tropical Storm Dean on 22 August. The southern portion of the wave continued westward, crossing Central America into the Pacific on 24 August. Little development occurred for the next several days as the wave continued westward. Convection associated with the wave increased on 30 August while large-scale low-level cyclonic turning developed over the tropical eastern Pacific - an environment similar to the western Pacific monsoon environment. The wave gradually organized over the next few days, and Tropical Depression Eight-E formed near 0600 UTC 4 September about 850 n mi southwest of Cabo San Lucas, Mexico (Table 1 and Figure 1). The cyclone strengthened and became Tropical Storm Gil six hours later. At that time, Tropical Depression Nine-E (which became Henriette) formed about 765 n mi to the east of Gil.

Gil moved westward with its speed varying from 3-8 kt from 4-6 September. Steady strengthening occurred during this time, with Gil becoming a hurricane early on the 6th. It reached a peak intensity of 85 kt by 1800 UTC that day when an eye was visible in both conventional and microwave satellite imagery. At that time the stronger Gil was 465 n mi southwest of the larger Henriette.

Gil turned northwestward early on 7 September. Later that day it accelerated northward as Henriette began to pass to the north and the two cyclones began interacting in earnest. Gil weakened during this time because the rapid northward motion into the northeasterly upper-level outflow from Henriette caused shear. By 0000 UTC on the 8th, Henriette was passing 330 n mi north of Gil and the two cyclones began to rotate around each other. This caused Gil to move at 20-25 kt on a north-northwest track that changed to west by 0000 UTC on the 9th. Gil weakened steadily during this time and had become a depression by early on the 9th.

While Henriette dissipated as a tropical cyclone shortly after 1200 UTC on the 8th about 210 n mi west of Gil, the remnant low-to-mid level vorticity center continued to move around the south and east sides of Gil. This caused Gil to turn southwestward early on the 9th. Once Henriette was fully absorbed, Gil slowed from a 20-25 kt motion to a westward drift in a few hours. Associated convection totally dissipated during the merger and did not return afterwards. This resulted in Gil dissipating late on the 9th about 1000 n mi east of the Hawaiian Islands. The remnant low cloud swirl

moved generally west-northwestward to northwestward for several days, finally being absorbed by a cold front well to the north of the Hawaiian Islands on the 19th.

The merger of two tropical cyclones or the absorption of one tropical cyclone by another are uncommon events in the National Hurricane Center's area of responsibility. The last documented case of such an occurrence in the eastern North Pacific was when Tropical Storm (later to become Hurricane) Norbert absorbed Tropical Depression Eighteen-E in September 1990 (Avila 1991).

b. Meteorological statistics

The "best track" of Gil is given in Table 1 and Figure 1. Figures 2 and 3 show the best track maximum sustained (1 min average) surface (10 m elevation) wind speed and minimum central pressure, as well as the associated observations. These include Dvorak technique position and intensity estimates from the Tropical Analysis and Forecast Branch (TAFB), the NOAA/NESDIS Satellite Analysis Branch (SAB), and the Air Force Weather Agency (AFWA).

The combination of Gil and Henriette helped trigger a strong surge of southwesterly and southerly flow to the east and southeast of the cyclones. The ship **Pacific Highway** (call sign H3AK) encountered this flow, reporting 40 kt winds, a 1005.3 mb pressure, and 22 ft seas at 0000 UTC 7 September while about 205 n mi southeast of the center of Gil.

c. Casualty and damage statistics

No reports of damages or casualties have been received by the National Hurricane Center (NHC).

d. Forecast and warning critique

Fujiwhara interaction between tropical cyclones and absorption of one cyclone by another are rare events in the NHC area of responsibility. Thus, it might be expected that this complex scenario would produce worse-than-average track forecasts, and this was indeed the case for Gil, although not for Henriette. Table 2 shows the average errors during the tropical storm and hurricane stages of Gil for the official NHC track forecast and a selection of objective guidance models. The average track forecast errors (with the number of cases in parentheses) were 55 (16), 104 (14), 133 (12), 143 (10), and 151 (6) n mi for 12, 24, 36, 48, and 72 h respectively. This compares to the 1991-2000 average errors of 37, 68, 99, 128, and 185 n mi for 12, 24, 36, 48, and 72 h. Examination of individual forecasts shows two main sources of error. Early forecasts moved the cyclone steadily toward the west-northwest or west and failed to capture either the slow motion on 5-6 September or the northward turn on the 7th and 8th. Later forecasts did capture the northward turn and the subsequent westward turn. However, these forecasts were generally too slow.

The average intensity forecast errors were 8, 14, 19, 17, and 13 kt for the 12, 24, 36, 48, and 72 h forecasts respectively. These can be compared to the 10-year average errors of 7, 12, 16, 19, and 21 kt for those forecast times. Examination of the individual forecasts shows that early forecasts on Gil underestimated how much it would intensify, while later forecasts underestimated how much

it would weaken during the interaction with Henriette.

Warnings and watches were not required for Gil.

References

- Avila, L. A., 1991: Eastern North Pacific hurricane season of 1990. *Mon. Wea. Rev.*, **119**, 2034-2046.

Table 1. Best track, Hurricane Gil, 4 - 9 September 2001

Date/Time (UTC)	Latitude (°N)	Longitude (°W)	Pressure (mb)	Wind Speed (kt)	Stage
04 / 0600	15.4	122.6	1006	30	tropical depression
04 / 1200	15.4	123.4	1004	35	tropical storm
04 / 1800	15.4	124.2	1002	40	"
05 / 0000	15.4	124.5	997	50	"
05 / 0600	15.4	124.7	994	55	"
05 / 1200	15.3	125.0	994	55	"
05 / 1800	15.2	125.5	990	60	"
06 / 0000	15.1	126.0	986	65	hurricane
06 / 0600	15.1	126.5	983	70	"
06 / 1200	15.0	127.3	979	75	"
06 / 1800	14.9	128.0	975	85	"
07 / 0000	15.1	128.5	975	85	"
07 / 0600	15.4	128.7	975	85	"
07 / 1200	15.9	129.1	979	80	"
07 / 1800	16.5	129.5	979	75	"
08 / 0000	17.4	129.5	987	65	"
08 / 0600	18.8	129.8	990	60	tropical storm
08 / 1200	20.6	130.3	997	50	"
08 / 1800	22.1	132.1	1003	40	"
09 / 0000	22.4	134.5	1006	30	tropical depression
09 / 0600	21.5	136.2	1008	30	"
09 / 1200	20.7	137.2	1008	30	"
09 / 1800	20.7	137.5	1009	25	"
10 / 0000					dissipated
06 / 1800	14.9	128.0	975	85	minimum pressure

Table 2. Preliminary track forecast evaluation for Hurricane Gil - heterogeneous sample. Errors in nautical miles for tropical storm and hurricane stages with number of forecasts in parentheses. Numbers in bold represent forecasts which were better than the official forecast.

Forecast Technique	Period (hours)				
	12	24	36	48	72
CLIP	50 (16)	91 (14)	131 (12)	151 (10)	148 (6)
GFDI	49 (15)	95 (13)	133 (11)	139 (9)	119 (5)
GFDL*	52 (16)	91 (14)	133 (12)	154 (10)	119 (6)
GFNI	47 (10)	110 (8)	220 (8)	334 (6)	544 (2)
GFDN*	37 (5)	75 (5)	144 (4)	255 (4)	508 (2)
LBAR	57 (16)	117 (14)	181 (12)	237 (10)	391 (6)
AVNI	43 (15)	73 (13)	112 (11)	136 (9)	157 (5)
AVNO*	40 (15)	67 (14)	100 (12)	116 (10)	136 (6)
BAMD	55 (16)	95 (14)	119 (12)	138 (10)	255 (6)
BAMM	47 (16)	83 (14)	105 (12)	112 (10)	122 (6)
BAMS	52 (16)	83 (14)	102 (12)	110 (10)	116 (6)
NGPI	43 (15)	92 (14)	147 (12)	186 (10)	294 (6)
NGPS*	34 (8)	66 (7)	116 (6)	153 (5)	266 (3)
UKMI	42 (14)	74 (12)	95 (10)	98 (8)	224 (5)
UKM*	43 (8)	71 (7)	86 (6)	102 (5)	174 (3)
P91E	52 (16)	97 (14)	138 (12)	148 (10)	231 (6)
P9UK	49 (8)	92 (7)	131 (6)	155 (5)	293 (3)
GUNS	35 (13)	77 (12)	100 (10)	87 (8)	115 (5)
NHC Official	55 (16)	104 (14)	132 (12)	143 (10)	151 (6)
NHC Official 10-Year Average (1991-2000)	37 (2273)	68 (2034)	99 (1802)	128 (1584)	185 (1203)

* Output from these models was unavailable at time of forecast issuance.

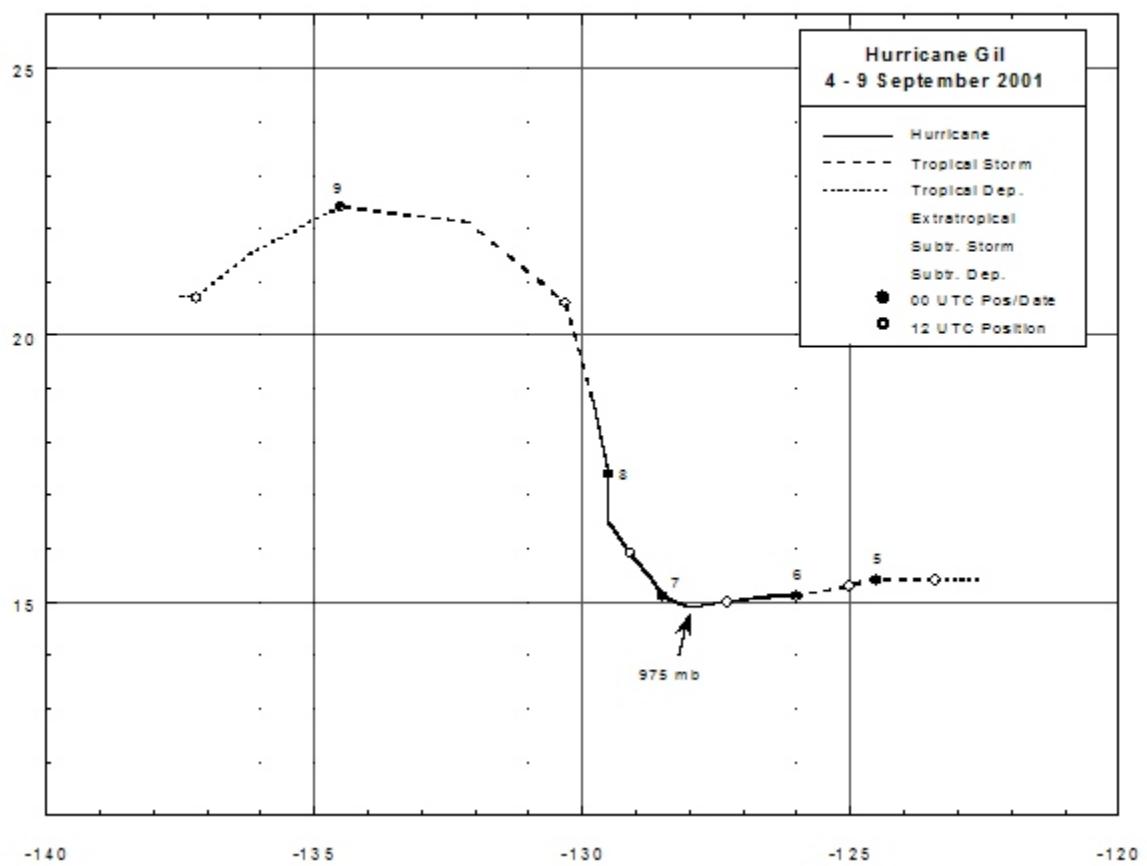


Figure 1. Best track of Hurricane Gil, 4 - 9 September 2001.

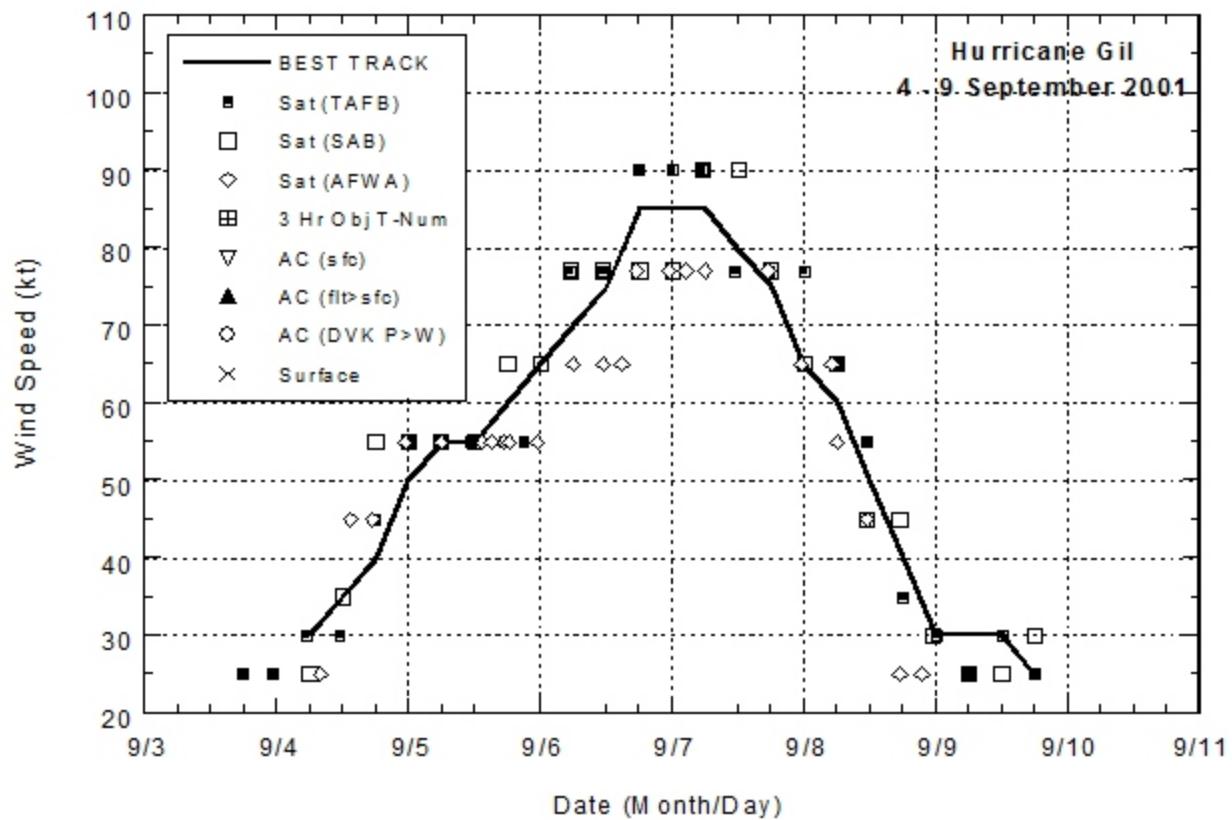


Figure 2. Best track maximum sustained 1-minute 10 meter wind speed curve for Hurricane Gil, 4 - 9 September 2001.

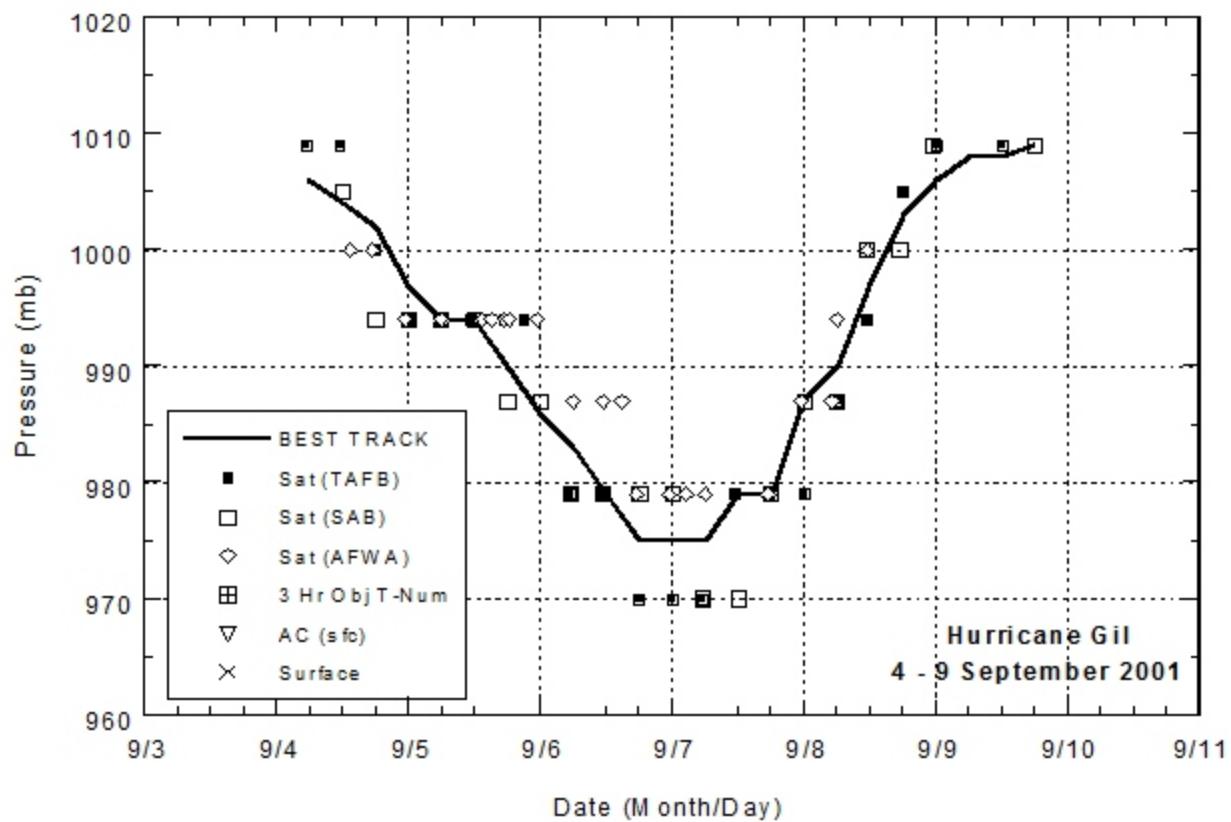


Figure 3. Best track minimum central pressure curve for Hurricane Gil, 4 - 9 September 2001.