

Preliminary Report
Hurricane Pauline
5 - 10 October 1997

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Pauline dumped up to 16 inches of rain along the south coast of Mexico and was responsible for an estimated 230 (or more) deaths in the states of Oaxaca and Guerrero.

a. Synoptic History

Pauline appears to have developed from a tropical wave that moved from Africa to the eastern tropical Atlantic Ocean on 16 September. The southern portion of this wave moved across northern South America and then into the eastern Pacific Ocean near Panama about ten days later. By the 3rd of October, a weak lower-tropospheric trough from the northwestern Caribbean Sea had developed southwestward across southeast Mexico and northern Central America and disrupted the normally westward steering currents in this area. By the 3rd, the wave had developed a distinct area of associated convection and it began to drift eastward. On the 5th, a well-defined low-level circulation had formed and tropical depression status is assigned at a location about 200 nautical miles south of Puerto Angel, Mexico. The best track begins on the 5th. Fig. 1 shows a plot of the best track of Pauline and this track is listed in Table 1.

With an absence of vertical shear and the appearance of convective banding features and a small central dense overcast, the system gradually strengthened to a tropical storm early on the 6th. Hurricane status was reached later that day as satellite imagery showed a hint of an eye feature. This was soon followed by the appearance of a small well-defined eye which was the beginning of a period of rapid intensification. A strong high pressure system over the southeastern United States eroded the trough over southeastern Mexico and began to influence Pauline's motion. The hurricane gradually turned toward the northwest on the 6th through the 8th while intensifying. Pauline reached a peak intensity of 115 knots on the 7th, weakened slightly, and again reached 115 knots on the 8th. By the 8th, the center of the hurricane was close to the coast of Mexico near Puerto Angel and interaction of the northern half of the circulation with the high terrain of Mexico resulted in a weakening trend. The center crossed the coast at about 0000 UTC on the 9th near Puerto Escondido with sustained winds estimated at 95 knots. The center then turned toward the northwest and accelerated. It moved nearly parallel to the coast for about 24 hours while continuing to weaken. Pauline dissipated by 1200 UTC on the 10th over the state of Jalisco near Tuxpan.

b. Meteorological Statistics

Figures 2 and 3 show curves of minimum sea-level pressure and maximum one-minute

surface wind speed, respectively, as a function of time. Satellite data plotted in these figures are based on the Dvorak satellite intensity estimating technique as applied at the Tropical Analysis and Forecast Branch (TAFB), the Synoptic Analysis Branch (SAB) and the U.S. Air Force Global Weather Center (AFGWC). The ship **Rijndam**, located about 120 nautical miles northeast of the center at 0600 UTC on the 7th, reported sustained winds of 51 knots.

Only limited surface reports have been received from Mexico. A report of 30 knots with gusts to 60 knots was received from Puerto Escondido at 2145 UTC on the 8th and there were no reports available after this time. Acapulco did report continuously while the center was nearby and the maximum wind from there was 40 knots with gusts to 51 at 0745 UTC on the 9th. Based on satellite intensity estimates, sustained winds of 115 knots may have affected the coastline of the state of Oaxaca near Puerto Angel. But Acapulco's observations indicate that Pauline was, at most, a minimal hurricane when it reached the Acapulco area and the primary effect to the state of Guerrero was the heavy rainfall, which also affected Oaxaca. Table 2 lists the rainfall totals provided by the National Meteorological Service of Mexico.

c. Casualty and Damage Statistics

Pauline moved along several hundred miles of the Pacific coastline of Mexico. The associated heavy rainfall sent muddy flood waters over many communities. The hill-side outskirts of Acapulco were particularly hard hit by flooding. Media reports put the death toll at 230 or more persons and hundreds of thousands were left homeless. Reuters reported that the Red Cross estimated the death toll at 400, but this has been disputed by Mexican officials.

Although winds up to 115 knots may have hit the coast in the Puerto Angel area, there have been no reports received that specifically describe the wind or storm surge damage, which may have been confined to a sparsely populated area.

d. Forecast and Warning Critique

The official track forecast errors for Pauline were close to the previous ten-year averages for eastern Pacific storms for the 0-, 12-, 24-, 36-, and 48-hour forecast periods. However, at 72 hours, the average official forecast error was 306 nautical miles and this is 50 percent larger than the ten-year average. This average is based on only four forecasts and is the result of the unusual movement toward the east followed by a turn toward the northwest. The track guidance models had rather large errors at all forecast periods for this unusual track.

The official intensity forecasts had a rather large negative bias as the rapid intensification to 115 knots was not correctly anticipated. The largest official intensity error was a 55-knot under-forecast issued at 0900 UTC on the 6th.

The operational intermediate advisory issued at 0600 UTC on the 9th placed the maximum sustained wind speed at 100 knots. Using the surface data reported from Acapulco, the best track estimate of the wind speed is 70 knots at 0600 UTC, so the operational wind speed value was

overestimated by 30 knots.

Table 3 lists the various watches and warnings that were issued by the National Meteorological Service of Mexico. The initial hurricane warning was issued at 0900 UTC on the 7th, which is 39 hours prior to the center reaching the coast and at least 24 hours before hurricane force winds began at the coast. The initial warning only covered as far northwestward as Punta Maldonado and was not extended further northwestward to Zihuatanejo until 0300 UTC on the 9th. This means that there was only from 3 to 15 hours of warning lead time for the coastal area from Punta Maldonado to Zihuatanejo. Pauline is estimated to have dropped below hurricane strength at 0900 UTC on the 9th and may have done so even earlier, so that the negative effects of a short lead time for strong winds was minimal. It was the heavy rains and flash flooding west of Zihuatanejo that was responsible for the deaths in this area.

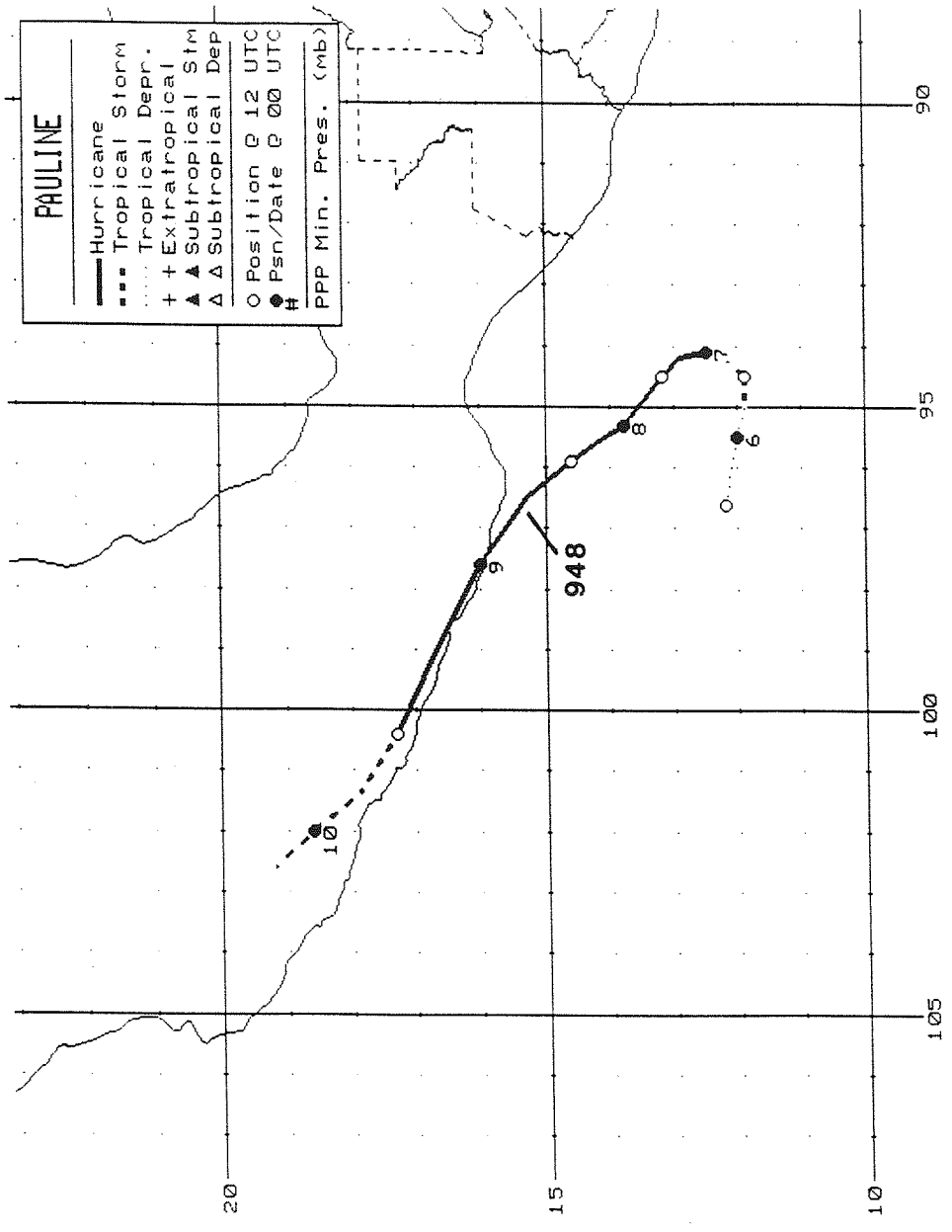


Fig. 1. Best track positions for Hurricane Pauline, 05-10 October 1997.

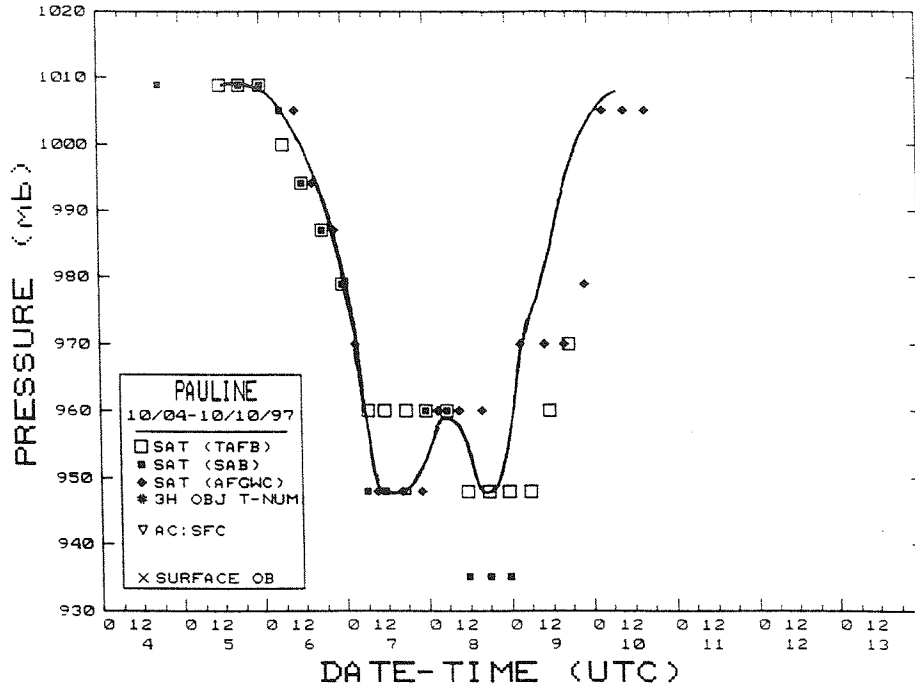


Fig. 2. Best track minimum sea level pressure curve for Hurricane Pauline.

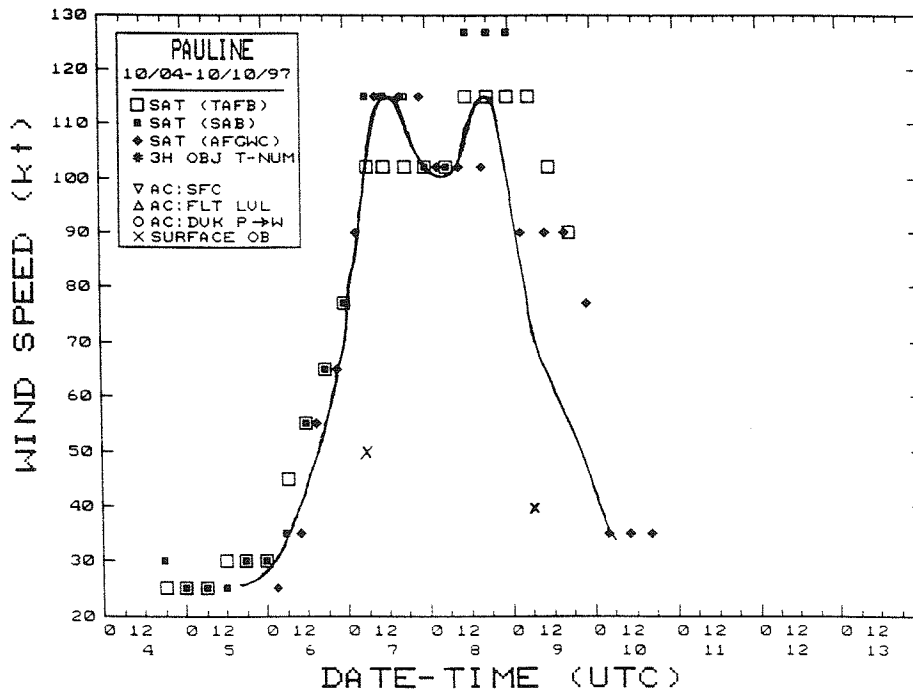


Fig. 3. Best track maximum one-minute wind speed curve for Hurricane Pauline.

Table 1. Best track, Hurricane Pauline, 05-10 October 1997.

Date/Time (UTC)	Latitude (°N)	Longitude (°W)	Pressure (mb)	Wind Speed(kt)	Stage
05/1200	12.2	96.6	1009	25	tropical depression
1800	12.1	96.0	1009	25	“
06/0000	12.0	95.5	1008	30	“
0600	11.9	95.0	1005	35	tropical storm
1200	11.9	94.5	1000	45	“
1800	12.2	94.2	990	55	“
07/0000	12.5	94.1	977	70	hurricane
0600	12.9	94.2	955	100	“
1200	13.2	94.5	948	115	“
1800	13.5	94.9	949	110	“
08/0000	13.8	95.3	955	100	“
0600	14.2	95.6	959	100	“
1200	14.6	95.9	954	110	“
1800	15.3	96.3	948	115	“
09/0000	16.0	97.6	960	95	“
0600	16.7	99.0	973	70	“
1200	17.3	100.4	989	60	tropical storm
1800	17.9	101.4	1000	50	“
10/0000	18.6	102.0	1005	40	“
0600	19.2	102.6	1009	30	tropical depression
1200	dissipated				
09/0000	16.0	97.6	960	95	landfall
08/1800	15.3	96.5	948	115	minimum pressure

Table 2. Hurricane Pauline rainfall totals.

Location	Rainfall in inches	Location	Rainfall in inches
Acapulco	16.2	J. Del Marques	6.5
Coyuca	8.2	Juchitan	9.1
Cruz Grande	9.1	Las Pilas	6.3
Cuajinicuilapa	5.0	Las Vigas	11.9
Ixtepec	6.3	Rio Verde	13.8

Table 3. Watch and warning summary, Hurricane Puline, October 1997.

Date/time (UTC)	Action	Location
07/0900	hurricane warning issued	Tapachula to Punta Maldonado
09/0300	hurricane warning extended	northwestward to Zihuatanejo
09/0300	hurricane warning discontinued	Huatulco eastward
09/0900	hurricane warning extended	northwestward to Manzanillo
09/0900	hurricane warning discontinued	east of Puerto Escondido
09/0900	hurricane watch issued	west of Manzanillo to Puerto Vallarta
09/1500	hurricane warning extended	northwestward to Puerto Vallarta
09/1500	hurricane warning discontinued	east of Punta Maldonado
10/0000	change hurricane warning to tropical storm warning	Zihuatanejo to Puerto Vallarta
10/0900	all warnings discontinued	