Tropical Cyclone Report
Hurricane Olaf
3-8 October 2003

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15 November 2003

Olaf briefly reached hurricane force with 65-kt winds while located south of Mexico, then made landfall near Manzanillo with 50-kt winds and heavy rain.

a. Synoptic History

Olaf formed from a tropical wave that moved from Africa to the Atlantic Ocean on 17 September and moved westward to the eastern Pacific Ocean during the next two weeks. The wave was difficult to track for several days in the Atlantic and eastern Caribbean. The wave acquired a partially-symmetric convective cloud structure, along with a hint of a low-level circulation, on 2 October when centered about 400 n mi south-southeast of Acapulco, Mexico. Microwave imagery suggested the presence of a closed low-level circulation early on the next day and visible imagery showed a closed low-level cloud pattern several hours later. The "best track" starts at 0600 UTC on 3 October when the new tropical cyclone was centered about 325 n mi south-southeast of Acapulco. The best track chart is plotted in Fig. 1, and the wind and pressure histories are shown in Figs. 2 and 3, respectively. The best track positions and intensities are listed in Table 1.

Tropical Storm Nora was located about 650 n mi west-northwest of the newly-formed depression, but there did not appear to be any direct interaction between the two cyclones.

The 30-kt depression strengthened to a 50-kt tropical storm in 12 h as it moved northwestward at 10 kt around the southwestern periphery of a weak mid-level anticyclone over Mexico. Olaf continued this motion for two days while the cyclone's winds, under weak vertical shear, increased to their highest estimated value of 65 kt at 1200 UTC on 5 October. A radar at Cuyutlan showed a partial eyewall at this time. Soon after, the cloud structure became disorganized, and Olaf is estimated to have been a hurricane for only a few hours. Gradually weakening and slowing its forward speed, Olaf appeared to turn toward the east on 6 October. It then resumed a slow northward track and moved inland just west of Manzanillo on 7 October, with 50-kt winds and heavy rain. Olaf dissipated over the high terrain of Mexico by early on 8 October. The slow forward motion allowed for considerable rainfall over southwestern Mexico.

b. Meteorological Statistics

Observations in Olaf (Figs. 2 and 3) include satellite-based Dvorak technique intensity estimates from the Tropical Analysis and Forecast Branch (TAFB), the Satellite Analysis Branch (SAB) and the U. S. Air Force Weather Agency (AFWA), as well as two flight-level observations from a flight by the 53rd Weather Reconnaissance Squadron of the U. S. Air Force Reserve Command. The highest aircraft observation of 64 kt at flight level was at 2038 UTC on 5 October, 8 to 9 h after Olaf is estimated to have reached its highest wind speed of 65 kt. The standard

reduction of 80% converts a 64-kt wind at 850-mb flight level to a surface wind speed of 51 kt as plotted in Fig. 2.

The ship with call sign ABCA2 reported winds of 47 and 44 kt, while passing just south of the tropical cyclone center at 1800 and 2100 UTC on 3 October . These ship reports are the basis for a best-track wind speed of 50 kt at 1800 UTC on 3 October.

Olaf's sharp turn toward the east occurred on the night of 5 October when GOES infrared position estimates had the storm continuing a northwestward motion near 10 kt. However, the next day's visible imagery as well as microwave data showed that a convection-free low level center was displaced to the east of the last visible imagery from the previous day and was moving very slowly northward. Whether Olaf made a sharp turn toward the east during this overnight weakening period or whether a new center formed to the east of the previous track can not be determined with confidence. The best track shows the sharp turn as an arbitrary choice. Scatterometer wind speeds across Olaf were below 40 kt at 1308 UTC of 6 October, confirming that the intensity had been decreasing since the previous day.

c. Casualty and Damage Statistics

Olaf contributed to a season of heavy rain for Mexico. A document from ReliefWeb titled "Mexico: Post-hurricane flooding appeal No. 22/03" indicates that there were no reported deaths, but rain-induced floods caused severe damage to homes, crops and roads in the states of Jalisco and Guanajuato. More than 12 thousand houses in Jalisco were damaged by the floods.

d. Forecast and Warning Critique

Average official track errors (with the number of cases in parentheses) were 53 (17), 100 (15), 140 (13), 162 (11), 160 (7), and 244 (3) n mi for the 12, 24, 36, 48, 72, and 96 h forecasts, respectively[1]. These errors are greater than the average official track errors for the 10-yr period 1993-2002[2] (39, 72, 103, 131, 186, and 197 n mi, respectively). Some of the largest track errors were made just before and during the eastward turn and slowing of the forward speed, neither of which were well forecast. Guidance model track errors were also larger than normal. Olaf did not last long enough to verify any 120 h forecasts.

Average official intensity errors were 9, 16, 24, 33, 34, and 32 kt for the 12, 24, 36, 48, 72, and 96 h forecasts, respectively. These errors are considerably larger than the average official intensity errors over the 10-yr period 1993-2002, which are 6, 11, 15, 17, 20, and 18 kt. The official forecast issued at 0300 UTC on 5 October brought the winds to 90 kt in two days with a forecast track over water, when, in fact, Olaf weakened late on 5 October and early on 6 October during the

[1] All forecast verifications in this report include the depression stage of the cyclone. National Hurricane Center verifications presented in these reports prior to 2003 did not include the depression stage.

[2] Errors given for the 96 h period are averages over the two-year period 2001-2.

eastward turn (or reformation) episode described in Section b.

Table 2 lists the watches and warnings associated with Olaf. A hurricane warning was issued for the landfall area 41 h prior to landfall. Olaf was a tropical storm at landfall.

Table 1. Best track for Hurricane Olaf, 3-8 October 2003.

Date/Time (UTC)	Latitude (°N)	Longitude (°W)	Pressure (mb)	Wind Speed (kt)	Stage
03 / 0600	11.7	98.4	1006	30	tropical depression
03 / 1200	12.1	98.9	1002	40	tropical storm
03 / 1800	12.4	99.5	1000	50	"
04 / 0000	13.1	100.0	1000	45	"
04 / 0600	13.8	100.6	1000	45	"
04 / 1200	14.5	101.3	997	50	"
04 / 1800	15.0	102.1	994	55	"
05 / 0000	15.5	102.9	994	55	"
05 / 0600	15.9	103.6	992	55	"
05 / 1200	16.5	104.2	987	65	hurricane
05 / 1800	17.1	104.8	990	55	tropical storm
06 / 0000	17.4	105.0	995	50	"
06 / 0600	17.5	104.9	1000	45	"
06 / 1200	17.4	104.5	1000	35	"
06 / 1800	17.9	104.4	998	40	"
07 / 0000	18.4	104.5	997	45	"
07 / 0600	19.0	104.6	997	50	"
07 / 1200	19.6	104.6	999	40	"
07 / 1800	20.3	104.5	1002	30	tropical depression
08 / 0000	20.8	103.8	1004	25	"
08 / 0600	dissipated				
07/0800	19.2	104.6	50	997	landfall 15 n mi west of Manzanillo, Mexico
05 / 1200	16.5	104.2	987	65	minimum pressure

Table 2. Watch and warning summary for Hurricane Olaf, 3-8 October 2003.

Date/Time (UTC)	Action	Location
5 / 1500	Tropical Storm Warning issued	Punta San Telmo to Lazaro Cardenas
5 / 1500	Hurricane Warning issued	Punta San Telmo to San Blas including the Islas Marias
6 / 1500	Tropical Storm Warning modified	Manzanillo to Punta San Telmo
6 / 1500	Hurricane Watch issued	San Blas to Mazatlan
6 / 1500	Hurricane Warning modified	Manzanillo to San Blas including the Islas Marias
6 / 1800	Tropical Storm Warning modified	Punta San Telmo to Cabo Corrientes
6 / 1800	Hurricane Watch discontinued	All
6 / 1800	Hurricane Warning discontinued	All
7 / 1800	Tropical Storm Warning discontinued	All

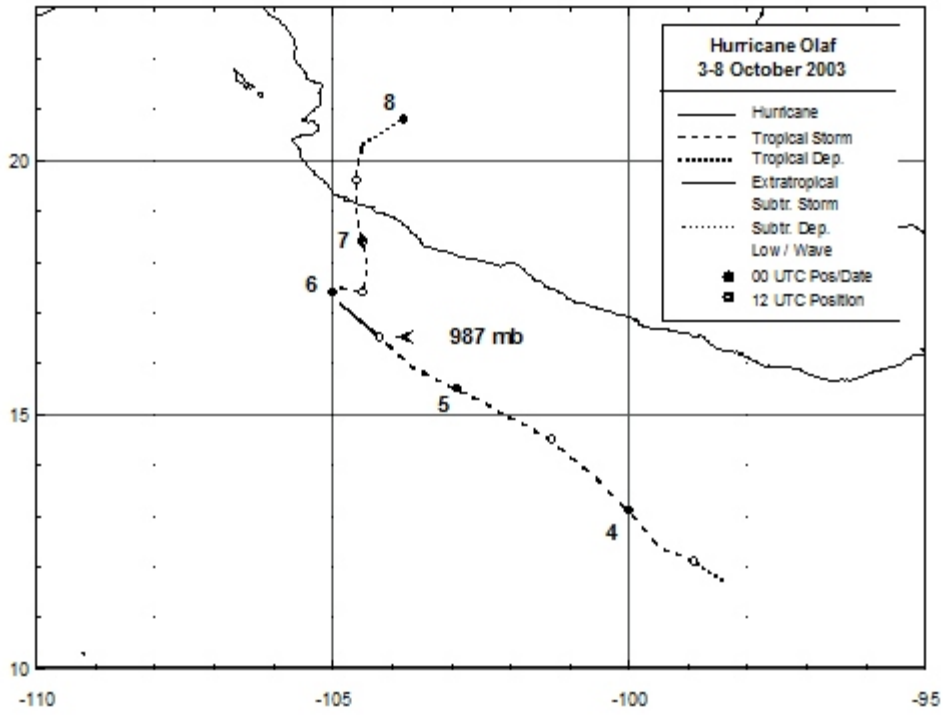

Figure 1. Best track positions for Hurricane Olaf, 3-8 October 2003.

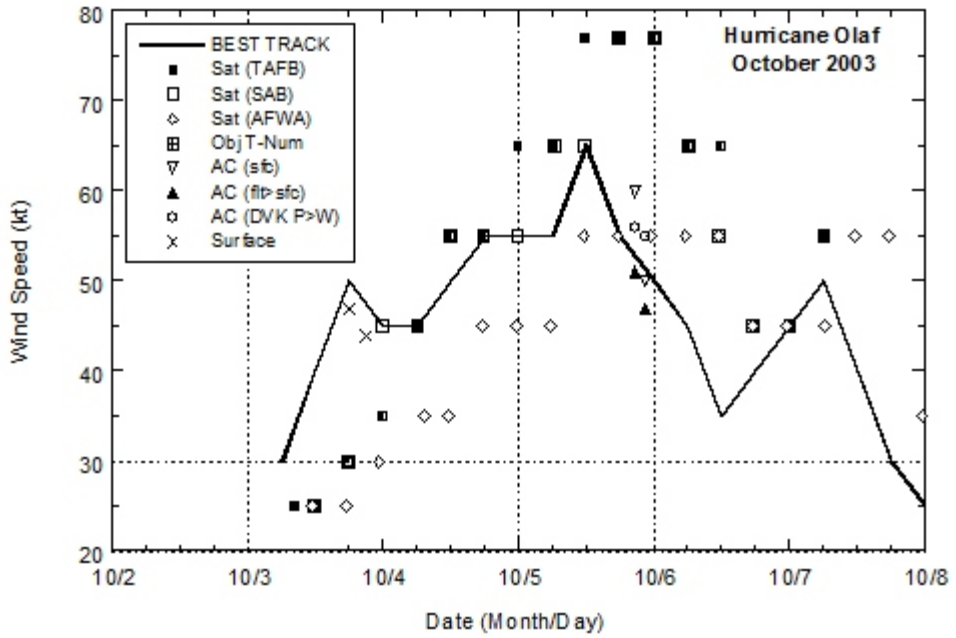

Figure 2. Selected wind observations and best track maximum sustained surface wind speed curve for Olaf, 3-8 October 2003. Aircraft observations have been adjusted for elevation using 90%, 80%, and 80% reduction factors for observations from 700 mb, 850 mb, and 1500 ft, respectively.

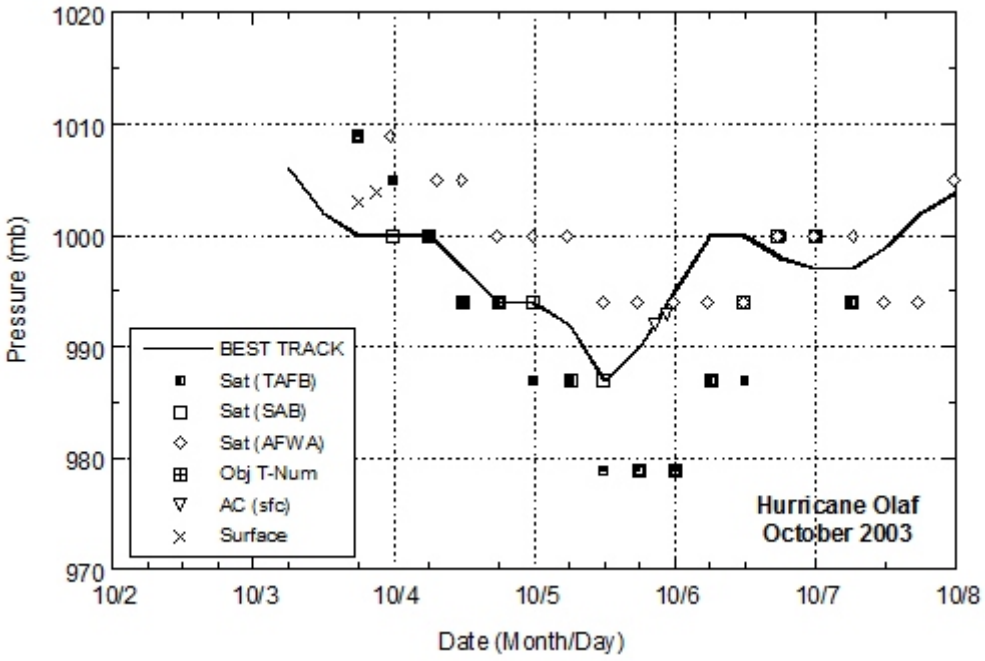

Figure 3. Selected pressure observations and best track minimum central pressure curve for Olaf, 3-8 October 2003.