

Tropical Cyclone Report  
Hurricane Olga  
24 November - 4 December 2001

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17 December 2001

Tenacious late season Hurricane Olga roamed over the Atlantic Ocean for about a week.

a. Synoptic History

Hurricane Olga had a non-tropical origin and formed from the interaction of a cold front and a small area of disturbed weather in the north Atlantic. Five previous tropical cyclones and gale centers had already originated from a similar pattern in that area during this season. Olga was an uncommon event but not unique. There have been other late- or off-season tropical cyclones which moved southwestward across the Atlantic, such as Hurricane Lili during December of 1984. The long and winding track of Olga is displayed in Fig. 1.

Surface observations and satellite imagery showed falling pressures and increasing weather in the area between Bermuda and the Leeward Islands as early as the 21<sup>st</sup> of November. A cold front reached the area on the 22<sup>nd</sup>, resulting in the formation of an extratropical low. The extratropical low gradually intensified and it is estimated that it transformed into a subtropical storm at 0000 UTC on the 24<sup>th</sup>, about 780 n mi east-southeast of Bermuda. At this time, satellite imagery showed the typical pattern of a subtropical cyclone with most of the weather within a comma-shaped cloud band located to the east of a low-level circulation center and a large area of gale force winds extending far to the north. During the next several hours, the thunderstorm activity markedly increased near an inner center of circulation which began to form, suggesting that the system was acquiring tropical characteristics. However, the wind field indicated that the system was a hybrid.

The shower activity continued to become more concentrated near the center and a post-analysis of satellite imagery indicates that by 1200 UTC 24 November, the inner portion of the system had already transformed into a tropical storm. In fact, there was a hint of an eye feature on visible satellite imagery at 1545 UTC on that day (Fig. 2). However, one can argue that the system was not purely tropical, because it remained embedded within the much larger extratropical circulation.

The cyclone, now Tropical Storm Olga, moved slowly toward the northeast. As a high pressure ridge built to the north, Olga turned toward the west and west-southwest and gradually intensified. By then, satellite imagery showed well defined hooking bands surrounding a central dense overcast. Olga became a hurricane by 1200 UTC on the 26<sup>th</sup> and reached its peak intensity of 80 knots and a minimum pressure of 973 mb around 0600 UTC 27 November.

From the 26<sup>th</sup> to the 28<sup>th</sup>, Olga made a double cyclonic loop as it interacted with a large-scale deep-layer cyclonic circulation that was pretty much isolated from the main belt of westerlies. Once it completed the second loop on the 28<sup>th</sup>, Olga became steered southwestward by another strong area of high pressure to the northwest. It then encountered strong upper-level northerly and then westerly shear, displacing the convection from the center of circulation. Olga weakened to

tropical depression status by 1200 UTC 30 November, but a temporary relaxation of the shear, allowed deep convection to redevelop near the center. Satellite imagery suggested that Olga regained tropical storm status at 0000 UTC 2 December. By then, Olga was moving northward and began to make another loop, this time anticyclonic.

Olga weakened as it was making this final loop and another high pressure ridge to the north steered the tropical cyclone west-southwestward. Olga gradually lost its associated deep convection and low-level circulation, and dissipated by 0000 UTC on the 5<sup>th</sup> about 600 n mi east of Nassau in the Bahamas. A vorticity maximum, embedded within a trough continued westward across the Bahamas, the Florida Straits, Cuba and the eastern Gulf of Mexico producing gusty winds and locally heavy showers.

#### b. Meteorological Statistics

Table 1 gives the best track positions and intensities of Olga at six-hourly intervals. Figure 1 shows a plot of this track. Figures 3 and 4 depict the curves of maximum one-minute average (10 m above sea-level) wind speed and minimum sea-level pressure, respectively, as functions of time. Also plotted are the observations on which the curves are based. These consist of ship observations and data from satellite-based Dvorak- and Hebert-Poteat technique estimates by the Tropical Analysis and Forecast Branch (TAFB), Satellite Analysis Branch (SAB), and the U.S. Air Force Weather Agency (AFWA). The peak intensity associated with Olga was based on Dvorak objective T-numbers which were the highest around 0600 UTC 27 November.

There were several reports from vessels along the path of Olga and these are included in Table 2. The most significant observation came from a German sailing yacht "**Manana Tres**" which apparently went through the center of the cyclone and reported a minimum pressure of 989 mb at 0900 UTC 24 November. This was the basis for starting advisories. The ship "**Liberty Sun**" encountered the center of Olga during the 25<sup>th</sup> and the 26<sup>th</sup>, and captured the wind shift and the pressure change associated with the tropical cyclone as summarized in Table 2. Large waves associated with Olga spread onto the U.S. east coast, the Bahamas and most of the Caribbean Islands. In fact, some of the France's buoys reported waves in excess of 12 feet as far south as Guadeloupe.

#### c. Casualty and Damage Statistics

The only report of damage came from the **Manana Tres** which indicated "lots of damage" during its encounter with Olga.

#### d. Forecast and Warning Critique

Average official track errors for Olga were 63, 115, 141, 173, and 215 n mi for the 12, 24, 36, 48 and 72 h forecasts, respectively. With the exception of the 72 h forecasts, these errors were larger than last the 10-yr period as indicated in Table 3. Although the interaction of Olga with the large-scale deep-layer cyclonic circulation was considered in the official forecast, the tropical cyclone ended both loops and moved toward the west and west-southwest faster than anticipated. This probably caused large speed errors during that period. The NCEP Global model (AVNI) outperformed every other model and the official forecast. The absolute wind speed errors for Olga

were 4, 7, 11, 14 and 12 kt for the 12, 24, 36, 48, and 72 h forecasts, respectively. For comparison the past 10-yr errors are 7, 11, 14, 16 and 20 kt, for the same forecast periods.

Operationally, Olga was carried as a subtropical storm until 1500 UTC 26 November; while the best track shows the system becoming a tropical cyclone two days earlier - at 1200 UTC on the 24<sup>th</sup>. The lack of well-defined criteria separating subtropical from fully-tropical cyclones continues to be troublesome in these designations. In the initial advisory on the system on the 24<sup>th</sup>, it was noted that the low had a "small tropical-like center embedded within a huge non-tropical cyclone", and therefore was designated a subtropical cyclone (one that shares characteristics of tropical and non-tropical cyclones). The primary goal was to focus the marine community's attention on the large area of strong winds, which were largely unrelated to the developing inner core. Over the next two days the wind field gradually contracted in response to the persistent inner convection and the system was designated Olga on the 26<sup>th</sup>. An alternative interpretation, and the one taken in the construction of the post-storm best track, is that a small tropical cyclone had formed on the 24<sup>th</sup> with the development of the inner core, and that this tropical cyclone was embedded within a large-scale cyclonic environment.

Table 1. Best track, Hurricane Olga, 24 November - 4 December, 2001.

Date/Time (UTC)	Latitude (°N)	Longitude (°W)	Pressure (mb)	Wind Speed (kt)	Stage
23 / 0600	30.5	51.0	1003	25	extratropical
23 / 1200	30.2	51.0	1000	25	"
23 / 1800	29.7	50.7	994	30	"
24 / 0000	29.3	50.3	990	50	subtropical storm
24 / 0600	29.3	50.0	990	50	"
24 / 1200	29.5	49.8	989	50	tropical storm
24 / 1800	30.3	49.5	989	50	"
25 / 0000	31.3	50.6	989	50	"
25 / 0600	31.8	52.0	989	50	"
25 / 1200	31.7	53.5	989	55	"
25 / 1800	30.8	55.0	987	60	"
26 / 0000	30.3	55.3	979	60	"
26 / 0600	30.1	55.6	979	60	"
26 / 1200	30.6	55.9	979	65	hurricane
26 / 1800	31.1	56.0	977	65	"
27 / 0000	32.1	56.2	975	75	"
27 / 0600	32.6	57.0	973	80	"
27 / 1200	31.5	57.2	974	80	"
27 / 1800	32.0	56.0	975	75	"
28 / 0000	32.3	55.8	975	75	"
28 / 0600	32.6	55.7	975	75	"
28 / 1200	32.4	56.2	977	75	"
28 / 1800	31.4	57.0	979	70	"
29 / 0000	30.3	57.6	987	65	"
29 / 0600	29.3	58.7	990	60	tropical storm
29 / 1200	28.4	60.1	992	60	"
29 / 1800	27.3	61.8	994	55	"

30 / 0000	26.2	63.2	998	45	"
30 / 0600	25.3	64.7	1001	35	"
30 / 1200	24.5	66.2	1003	30	tropical depression
30 / 1800	23.7	67.1	1004	30	"
01 / 0000	23.4	67.7	1004	30	"
01 / 0600	23.1	68.0	1005	30	"
01 / 1200	22.8	68.3	1004	30	"
01 / 1800	23.0	68.6	1004	30	"
02 / 0000	23.4	68.9	1003	35	tropical storm
02 / 0600	24.3	68.9	1003	35	"
02 / 1200	25.5	69.2	1001	40	"
02 / 1800	26.4	69.5	1001	40	"
03 / 0000	27.0	69.7	1004	35	"
03 / 0600	27.4	69.9	1005	35	"
03 / 1200	27.8	69.9	1005	35	"
03 / 1800	27.7	69.6	1005	35	"
04 / 0000	27.7	69.1	1006	30	tropical depression
04 / 0600	27.8	68.2	1006	30	"
04 / 1200	27.8	68.0	1006	30	"
04 / 1800	27.0	67.4	1006	30	"
05 / 0000					dissipated
27 / 0600	32.6	57.0	973	80	minimum pressure

Table 2. Selected ship reports with winds of at least 34 kt for Hurricane Olga, 24 November- 4 December, 2001.

Date/Time (UTC)	Ship name or call sign	Latitude (°N)	Longitude (°W)	Wind dir/speed (kt)	Pressure (mb)
24/0000	Dorothea Schulte	31.9	51.5	010/38	1008.0
24/0600	Dorothea Schulte	32.3	50.3	010/39	1008.0
24/0600	Irvin Primrose	34.2	52.2	040/45	1012.5
24/0900	Manana Tres	29.5	51.0		989.0
24/1200	Liberty Sun	33.1	58.4	350/36	
24/1200	ELWZ7	26.3	54.2	320/43	1009.0
24/1200	Dorothea Schulte	32.6	49.1	070/39	1005.0
24/1200	Irvin Primrose	34.2	53.8	040/45	1013.5
24/1800	Dorothea Schulte	32.9	48.0	070/39	1005.1
25/0900	Lykes Liberator	37.4	52.7	050/47	1013.5
25/1200	Lykes Liberator	37.3	53.8	040/44	1015.2
25/1800	Liberty Sun	30.8	56.1	360/55	990.0
25/2100	Liberty Sun	30.1	55.8	340/38	983.5
26/0000	Liberty Sun	29.7	55.5	270/31	981.4
26/0600	Liberty Sun	30.1	54.5	275/45	990.0
26/0900	Liberty Sun	30.4	53.9	170/29	993.0
26/1200	Liberty Sun	30.7	53.4	160/38	995.0
26/1200	Safmarine Infanta	24.1	58.2	320/37	1004.0
26/1500	V7CR4	32.4	55.8	090/39	986.0
26/1800	V7CR4	32.6	56.3	090/39	985.5
27/0000	V7CR4	33.3	57.8	050/31	986.0
29/1800	Sabina	26.7	62.2	340/34	1001.2
29/1800	City of Alberni	27.2	65.5	020/35	1008.0
25/1200	Lykes Liberator	37.3	53.8	040/44	1015.2

Table 3. Forecast evaluation (heterogeneous sample) for Olga, 24 November- 4 December, 2001. Forecast errors for tropical storm and hurricane stages (n mi) are followed by the number of forecasts in parentheses. Errors smaller than the NHC official forecast are shown in bold-face type.

Forecast Technique	Forecast Period (h)				
	12	24	36	48	72
CLIP	86(28)	195(24)	281(20)	406(18)	488(18)
GFDI	<b>49(25)</b>	<b>89(21)</b>	161(17)	302(15)	576(14)
LBAR	76(28)	162(24)	242(20)	352(18)	483(18)
AVNI	<b>44(25)</b>	<b>67(21)</b>	<b>88(17)</b>	<b>134(14)</b>	<b>186(12)</b>
BAMD	<b>60(28)</b>	119(24)	170(20)	232(18)	318(18)
BAMM	<b>62(28)</b>	<b>111(24)</b>	154(20)	199(18)	233(17)
BAMS	74(28)	128(24)	169(20)	225(18)	298(18)
NGPI	<b>51(26)</b>	<b>69(22)</b>	<b>74(18)</b>	<b>116(16)</b>	<b>195(14)</b>
UKMI	63(19)	<b>110(16)</b>	<b>119(14)</b>	<b>130(13)</b>	<b>159(8)</b>
GUNS	<b>50(19)</b>	<b>80(16)</b>	<b>105(14)</b>	<b>159(13)</b>	269(8)
GUNA	<b>47(19)</b>	<b>71(16)</b>	<b>92(14)</b>	<b>143(13)</b>	219(8)
NHC Official	63(27)	115(23)	141(19)	173(17)	215(17)
NHC Official (1991-2000 mean)	44 (2049)	82 (1835)	118 (1646)	151 (1475)	226 (1187)

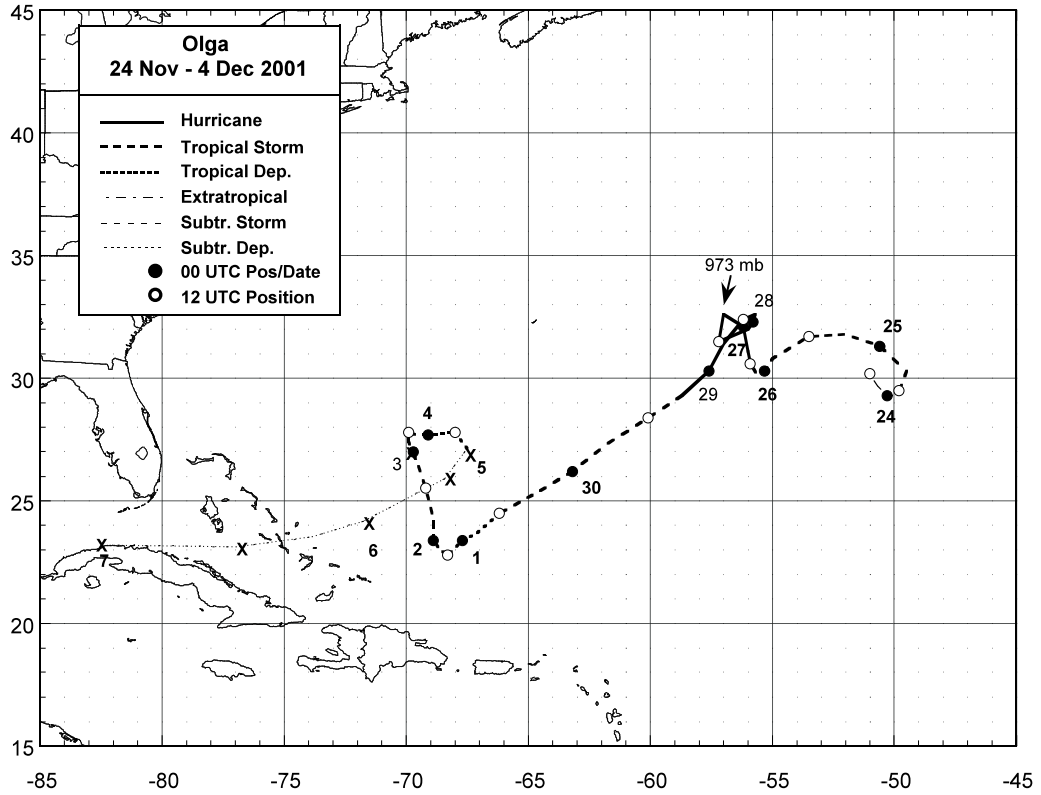


Fig. 1 Best track positions for Hurricane Olga, 24 November to 4 December, 2001. Dotted line with X marks the locations of the vorticity maximum associated with the remnants of Olga.



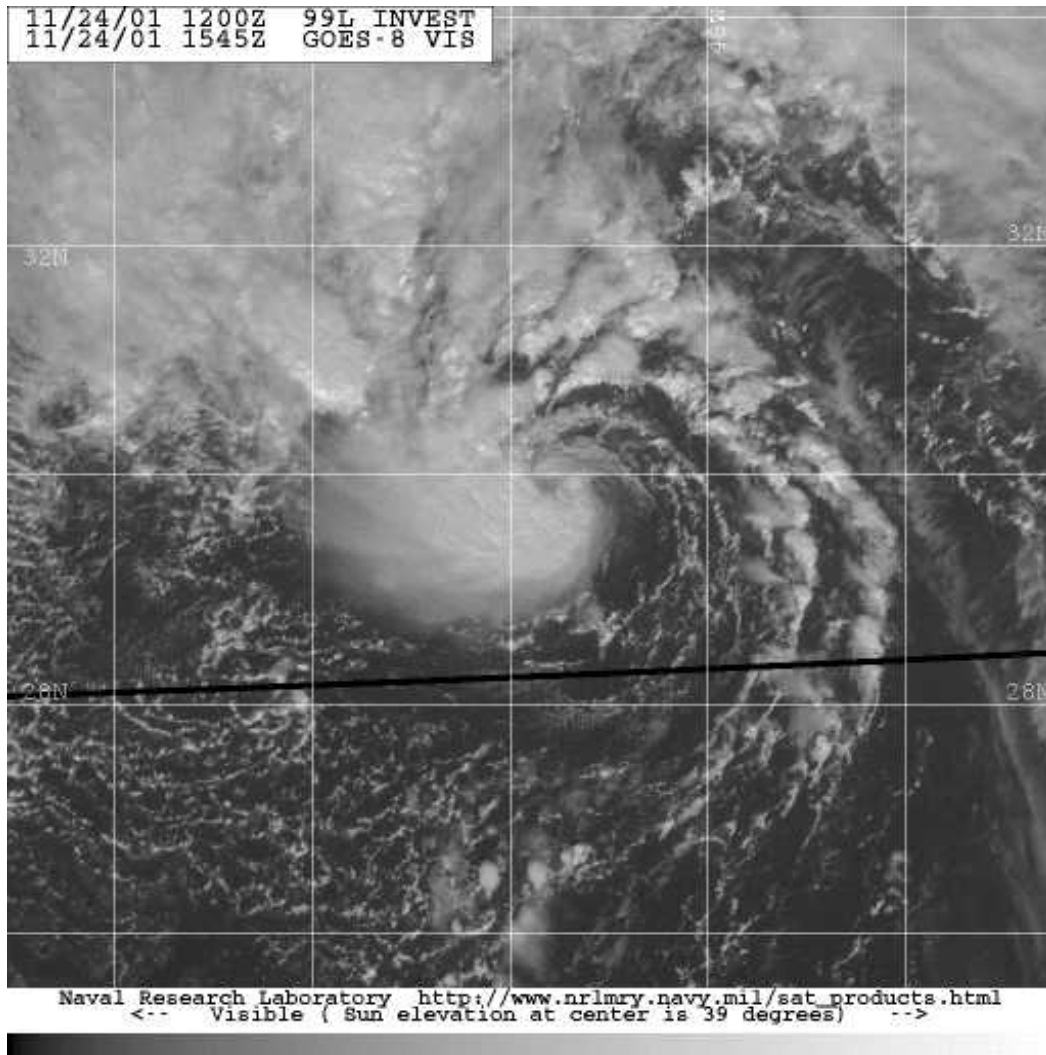


Figure 2. GOES visible satellite image showing Olga as a tropical storm at 1545 UTC 24 November, 2001. Note the eye feature trying to form.

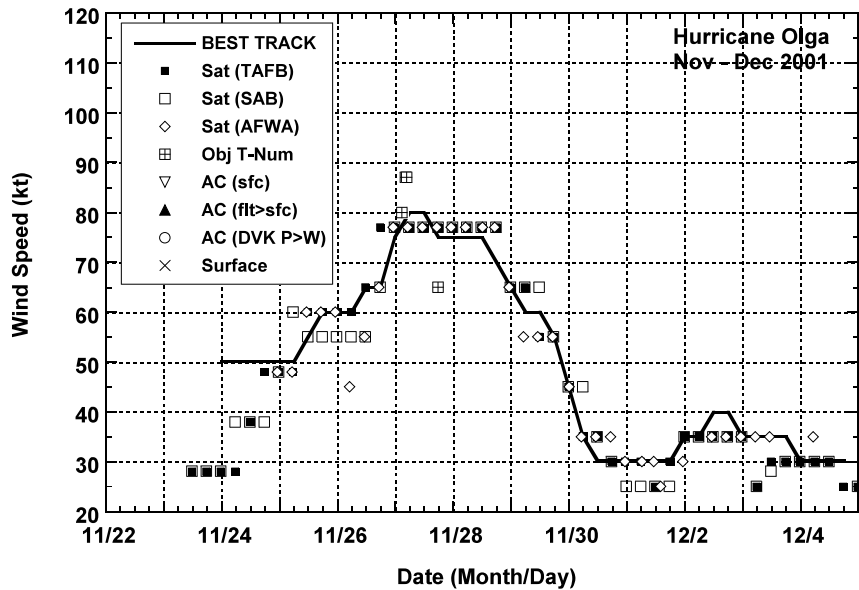


Figure 3. Best track maximum sustained surface wind speed curve for Hurricane Olga, 24 November to 4 December, 2001, and the observations on which the best track curve is based.

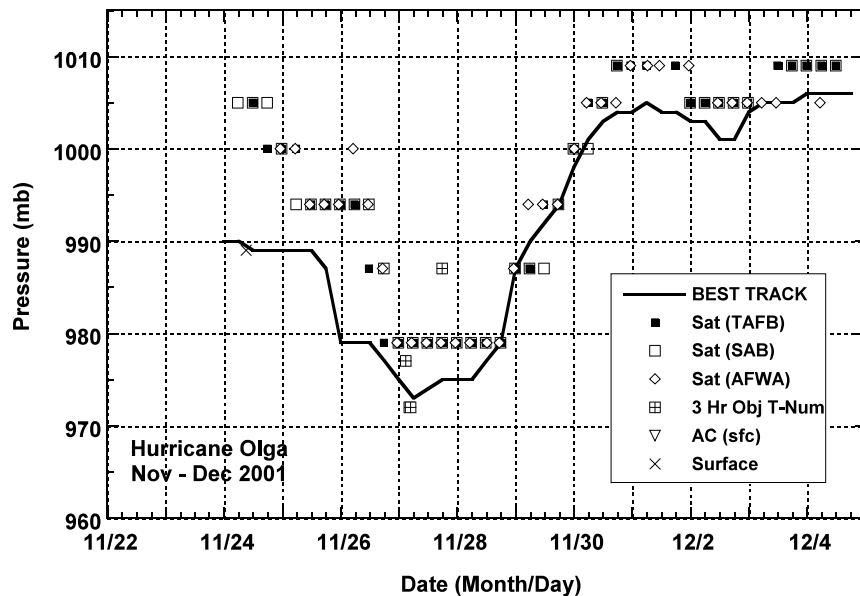


Figure 4. Best track minimum central pressure for Hurricane Olga, 24 November to 4 December, 2001, and the observations on which the best track curve is based.