

Preliminary Report
Hurricane Erika
03 - 15 September 1997

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24 October 1997

a. Synoptic History

Erika became a category three hurricane on the Saffir/Simpson Hurricane Scale, was the only named tropical cyclone of 1997 to form from a tropical wave at low latitudes, and just missed the islands of the northeastern Caribbean Sea.

Erika was first tracked as a tropical wave and large area of disturbed weather moving westward from Africa to the eastern tropical Atlantic Ocean on 31 August. The system immediately showed evidence of a large-scale low-level cyclonic turning. But it was not until 3 September, when located about 1000 nautical miles east of the Lesser Antilles, that a low-level center was defined well enough for it to be upgraded to a tropical depression. The best track begins at this time as shown in Fig. 1 and as listed in Table 1.

The depression quickly strengthened to tropical storm Erika on the 3rd and to a hurricane on the 4th as it moved mostly west-northwestward at 15 knots or so under the steering control of a well-established subtropical high pressure ridge. There was a hint of an eye as infrared satellite imagery showed a warm spot embedded in the deep convection over the center early on the 4th, but visible satellite imagery later showed a partially exposed low level center. The strengthening of Erika to a hurricane, based on drifting buoy data east of the Lesser Antilles, occurred under what appears to be an unfavorable shearing situation. However, deep convection soon reappeared over the center and strengthening continued, while Erika moved toward the west-northwest.

On the 5th through the 8th, the forward motion gradually decreased as the center of the hurricane came within about 75 nautical miles to the northeast of the northeastern-most Lesser Antilles...just far enough away for hurricane conditions to miss these islands. By the 8th, Erika had turned toward the north with a movement of only five knots as an amplifying trough over the western north Atlantic eroded the subtropical ridge and weakened the nearby steering currents.

Erika reached its peak intensity of 110 knots at 1800 UTC on the 8th and retained this wind speed for a period of about 24 hours, while it was located 300 nautical miles north of the Caribbean islands and started to accelerate northward. Reconnaissance aircraft and satellite imagery indicated an eye diameter of about 30 nautical miles during this time and the hurricane's radius of tropical storm force wind speeds expanded to 250 nautical miles.

The hurricane passed about 300 nautical miles east of Bermuda on the 10th and became

embedded in westerly steering currents which caused a turn toward the east-northeast on the 11th and 12th. By this time, weakening had commenced due to a combination of cool sea surface temperatures and westerly winds aloft. Winds dropped below hurricane force on the 12th. However, Erika periodically retained deep convection near its center for another four days along with wind speeds between 45 and 60 knots while it moved mostly eastward across the north Atlantic. The center passed very near the western-most Azores on the 15th and tropical storm conditions were experienced in these islands. Erika then lost most of its deep convection and became extratropical by the 16th. It continued moving northeastward for several more days, followed by dissipation on the 20th while located about 200 nautical miles southwest of Ireland.

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).

Ship reports of wind speeds of 34 knots or higher caused by the hurricane are listed in Table 2. The large number of such reports in northern latitudes is the result of Erika's path through the north Atlantic shipping lanes.

The NOAA Gulfstream high-altitude jet flew missions which resulted in data available for the 0000 UTC NCEP model runs on the 4th and 5th. This was when Erika was threatening the Caribbean islands and several days in advance of the recurvature across the north Atlantic. This data set provides an opportunity to evaluate the impact of synoptic-scale high-altitude dropsonde missions.

A NOAA drifting data buoy reported a 60-knot wind speed at 1600 UTC on the 4th, when Erika was located some 500 nautical miles east of the Lesser Antilles. The best track takes Erika to a hurricane at 1800 UTC based on this report, although there is considerable uncertainty about the accuracy of drifting buoy wind measurements as well as the method used to adjust the wind speed to the 10 meter level.

There were no reports of tropical storm force or higher sustained winds from the islands of the northeastern Caribbean as Erika passed nearby. The highest report received was 32 knots sustained wind speed with gusts to 41 knots from St. Thomas in the U.S. Virgin Islands on the 7th, when Erika was centered 125 nautical miles north-northeast of this location. There were, undoubtedly, stronger winds over the higher terrain of the islands from the Virgin Islands east and southward through Antigua and Montserrat. The largest rainfall total reported from the islands is 3.28 inches from St. Thomas.

NOAA research aircraft dropped GPS dropsondes into the eye wall on the 7th and 8th, as Erika was strengthening to its maximum intensity. While maximum 700-millibar flight level winds were

near 110 knots late on the 8th, the vertical wind profile obtained near the eye wall showed that wind speeds between 150 and 1500 meters reached nearly 50 percent higher. The wind speed from this dropsonde nearest to the surface (approx. 15 meters) was 117 knots and the best track surface wind speed of 110 knots is based on this data.

The highest sustained surface wind report seen from the Azores was 26 knots with a gust to 39 knots at Lajes Air Base at 1900 UTC on the 15th as Erika's center was passing 180 nautical miles to the northwest. A report from Flores at 2300 UTC on the 15th gave a gust to 76 knots. A report from Lajes showed a gust to 91 knots from a 200-foot tower. A storm rainfall total of 2.35 inches was also reported from Flores.

c. Casualty and Damage Statistics

The only effects to Puerto Rico were from the large waves and swells generated by the hurricane. Two surfers died in the northern and eastern waters due to the high wave action. Most of the islands of the northeastern Caribbean suffered minor damage from wave action and there was likely minor wind damage at higher elevations. The general mood as expressed in the media was one of relief that a dangerous hurricane had turned north and missed the islands.

The passage of the hurricane caused the lower-tropospheric winds to blow from the southwest and advect a cloud of falling ash over Antigua from the active volcano in Montserrat.

d. Forecast and Warning Critique

There were 49 official forecasts issued while Erika was a tropical storm or hurricane. The average track errors were 12, 46, 78, 99, 121, and 191 nautical miles at 0, 12, 24, 36, 48, and 72 hours. These numbers are small compared to the previous official ten-year-average errors. The interpolated GFDL model errors were approximately 20 percent smaller than the official errors at 48 and 72 hours for about 30 simultaneous forecast cases. The official track forecasts also had a left bias for the few days when Erika was threatening the islands of the northeastern Caribbean Sea, which was prior to the recurvature toward the north.

The official wind speed forecasts had a negative bias just before Erika began strengthening toward its 110-knot maximum winds. Negative errors of up to 45 knots for the 72-hour forecast issued early on the 5th were the result of strengthening occurring under what appeared to be a strong vertical wind shear environment.

A list of the various watches and warnings issued for this hurricane is given in Table 3. Hurricane warnings were issued for a number of the island countries of the northeastern Caribbean Sea. Although hurricane conditions did not occur in the warning area, the storm passed sufficiently close to the islands to justify the warnings. Although tropical storm warnings were not issued for the Azores, National Hurricane Center advisories contained the equivalent statement that tropical storm conditions were expected to occur there.

Table 1. Best track, Hurricane Erika, 3 - 15 September 1997.

Date/Time (UTC)	Latitude (°N)	Longitude (°W)	Pressure (mb)	Wind Speed (kt)	Stage
03/0600	10.9	44.1	1006	30	tropical depression
1200	11.5	45.5	1005	30	"
1800	12.3	47.1	1004	35	tropical storm
04/0000	13.1	48.5	1002	40	"
0600	13.9	49.9	1001	50	"
1200	14.6	51.7	1000	55	"
1800	15.2	53.7	999	65	hurricane
05/0000	15.6	55.3	998	65	"
0600	16.0	56.4	997	65	"
1200	16.4	57.4	996	65	"
1800	17.0	58.3	990	65	"
06/0000	17.5	59.2	988	65	"
0600	18.1	60.0	986	70	"
1200	18.6	60.9	982	70	"
1800	19.0	61.7	980	75	"
07/0000	19.4	62.4	979	75	"
0600	19.7	62.8	978	75	"
1200	20.2	63.1	975	75	"
1800	20.6	63.2	970	90	"
08/0000	21.2	63.2	966	95	"
0600	21.8	63.2	961	100	"
1200	22.5	62.9	957	105	"
1800	23.2	62.5	952	110	"
09/0000	24.1	62.0	948	110	"
0600	25.2	61.4	946	110	"
1200	26.5	60.8	947	110	"
1800	27.9	60.2	951	110	"
10/0000	29.3	59.6	955	105	"
0600	30.8	58.9	960	100	"
1200	32.2	58.3	965	95	"
1800	33.6	57.5	970	90	"
11/0000	34.8	56.4	973	80	"
0600	35.7	55.1	977	75	"
1200	36.4	53.6	984	70	"
1800	37.1	51.9	988	65	"
12/0000	37.6	49.9	990	60	tropical storm
0600	38.0	48.0	994	55	"
1200	38.5	46.2	995	55	"
1800	38.9	44.9	995	50	"
13/0000	39.0	44.0	995	45	"
0600	38.9	43.2	995	45	"

Table 1(cont.). Best track, Hurricane Erika, 3 - 15 September 1997.

Date/Time (UTC)	Latitude (°N)	Longitude (°W)	Pressure (mb)	Wind Speed (kt)	Stage
13/1200	38.5	42.3	995	45	“
1800	38.1	41.3	995	45	“
14/0000	37.8	40.2	995	45	“
0600	37.6	39.1	992	50	“
1200	37.6	37.9	989	55	“
1800	37.8	36.5	987	55	“
15/0000	38.2	35.0	984	60	“
0600	38.9	33.4	984	55	“
1200	39.7	31.7	983	50	“
1800	40.9	29.9	984	50	“
16/0000	42.2	28.2	985	50	extratropical
0600	43.5	26.5	987	50	“
1200	45.0	24.5	989	50	“
1800	46.0	22.5	991	55	“
17/0000	46.8	21.0	993	60	“
0600	47.0	20.0	994	60	“
1200	46.5	19.0	992	60	“
1800	46.0	20.0	994	55	“
18/0000	47.2	19.8	996	50	“
0600	48.0	19.0	998	45	“
1200	48.5	18.0	1000	40	“
1800	48.8	17.5	1000	40	“
19/0000	48.9	17.0	1000	35	“
0600	48.9	16.2	1000	30	“
1200	49.0	15.3	1005	30	“
1800	49.0	14.0	1009	25	“
20/0000	dissipated				
09/0600	25.2	61.4	946	110	minimum pressure

Table 2. Ship reports of 34 knots or higher sustained winds.

Id.	Name	Date/time (UTC)	Lat. Lon.	Wind dir./spd.	Pressure (mb)
KRPP	Nobel Star	04/0900	15.9 50.8	090/49	1009.5
KMJL	Itb Groton	07/1500	21.8 60.3	130/35	1008.8
KMJL	Itb Groton	08/0000	20.6 59.7	020/86?	1009.2
LADR4	Star Gran	08/0000	23.8 65.0	050/39	1006.5
WCHF	Sealand Consumer	08/0300	19.0 68.0	350/71?	1011.7
C6QK	Barrington Island	10/0900	33.6 59.9	080/38	1001.0
C6QK	Barrington Island	10/1200	33.5 61.2	080/38	1000.5
C6QK	Barrington Island	10/1500	33.2 62.5	040/38	1004.0
9HOP3	Sarajevo Express	11/0900	37.1 58.8	020/45	1009.0
9HOP3	Sarajevo Express	11/1500	36.4 58.8	020/45	1010.0
9HOP3	Sarajevo Express	11/1800	35.7 58.0	320/35	1012.0
V7AZ5	?	11/1800	35.8 48.1	160/42	1006.1
9HOP3	Sarajevo Express	11/2100	35.7 57.5	360/40	1011.3
C6JY9	Eastern Bridge	14/0000	32.3 38.9	240/37	1007.3
ship	-----	14/1200	33.0 37.3	260/60	1000.6
PGBO	Music	14/1800	41.8 45.8	360/36	1012.3
ship	-----	15/0000	33.4 40.0	280/60	1011.1
DDSK	Sea Progress	15/0000	37.4 28.6	140/37	1011.2
DDSK	Sea Progress	15/0600	36.5 30.4	210/41	1005.0
DDSK	Sea Progress	15/1200	35.9 31.4	240/44	1007.3
DDSK	Sea Progress	15/1500	36.0 32.1	250/37	1007.5
C6LU4	Hood Island	15/1800	34.5 27.8	200/40	1013.0
4XGT	Zim Italia	15/1800	37.0 28.6	240/45	1007.5
DDSK	Sea Progress	16/0000	36.2 35.3	260/35	1012.0
FNRS	Douce France	16/0600	39.6 20.7	160/38	1009.7
ship	-----	16/0600	41.6 22.1	170/51	1002.0
9VPP	Frankfurt Express	16/1200	45.0 26.5	010/45	-----
PCDE	Admiralengracht	17/0000	47.6 22.9	010/58	1000.4
LAHE2	Star Evvivia	17/1200	46.3 26.8	030/40	1013.0
PFEI	Jo Selje	18/0000	48.7 20.7	010/52	1004.0
PFEI	Jo Selje	18/0300	48.4 19.8	360/49	1000.9

Table 3. Watch and warning summary, Hurricane Erika, September 1997.

Date/time (UTC)	Action	Location
04/2100	tropical storm watch issued	Antigua, Montserrat, Barbuda, Nevis, St. Kitts, and Anguilla
04/2100	tropical storm warning issued	Dutch St. Maarten
05/0300	tropical storm watch issued	Guadeloupe, St. Martin, and St. Barthelemy
05/0900	tropical storm warning issued	Antigua, Montserrat, Barbuda, Nevis, St. Kitts, Anguilla, and Dominica
05/0900	tropical storm watch issued	U.S. and British Virgin Islands
05/1200	tropical storm warning issued	Guadeloupe, St. Martin, and St. Barthelemy
05/1500	hurricane warning issued	Antigua, Montserrat, Barbuda, Nevis, St. Kitts, Anguilla, and Dominica; St. Martin and St. Barthelemy; Dutch St. Maarten
05/1500	hurricane watch issued	U.S. and British Virgin Islands and Puerto Rico
06/1200	discontinue tropical storm warning	Guadeloupe and Dominica
06/1800	discontinue hurricane warning	Barbuda, Antigua, Nevis, St. Kitts, Montserrat, and Dominica
06/2100	discontinue hurricane warning	St. Barthelemy, St. Martin, Dutch St. Maarten, and Anguilla
07/2100	discontinue hurricane warning	U.S. and British Virgin Islands and Puerto Rico

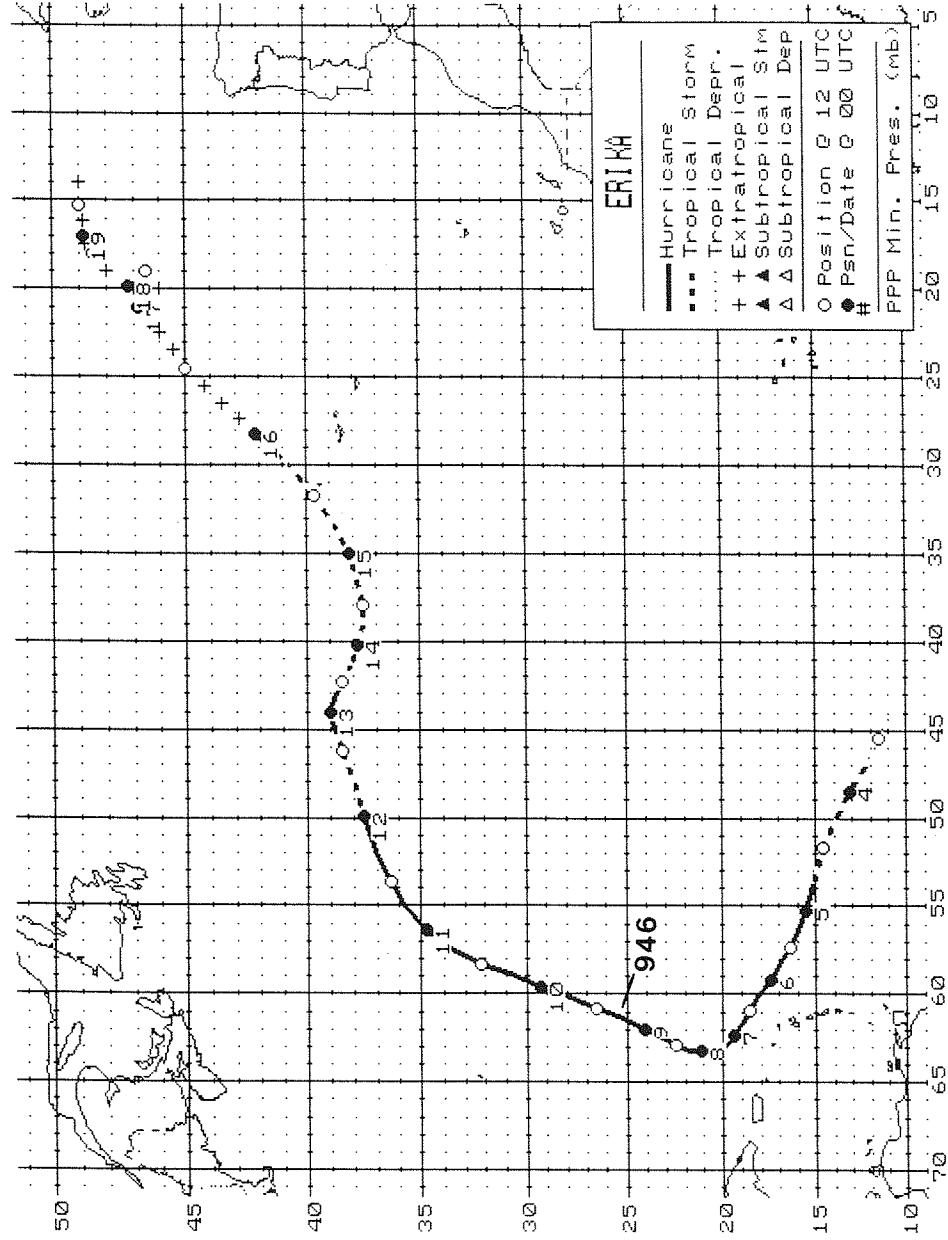


Fig. 1. Best track positions for Hurricane Erika, 03-15 September 1997.
 (Extratropical positions after 15 September are also plotted)

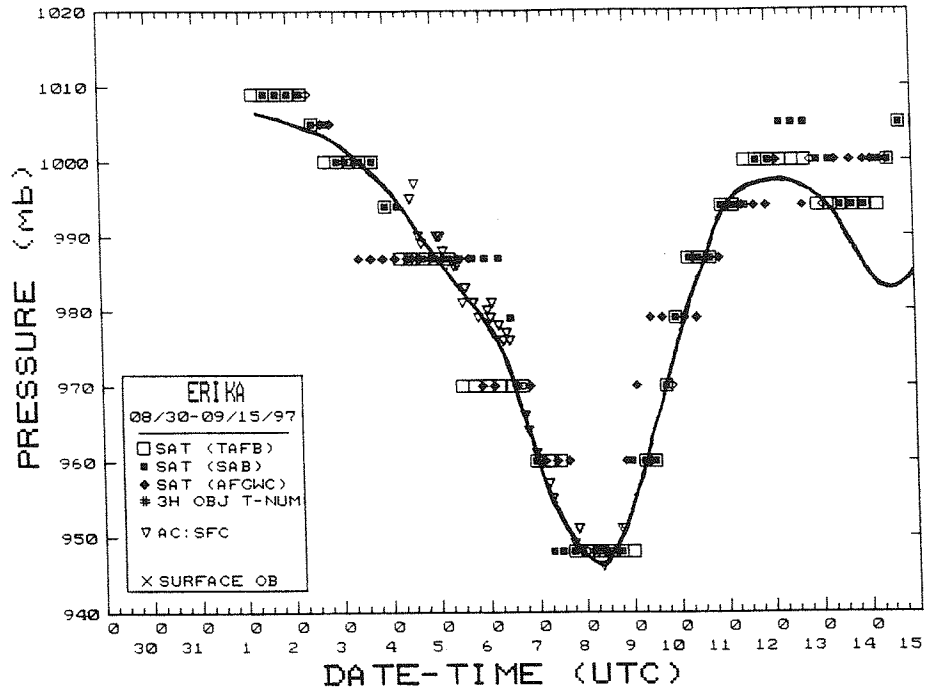


Fig. 2. Best track minimum sea level pressure curve for Hurricane Erika.

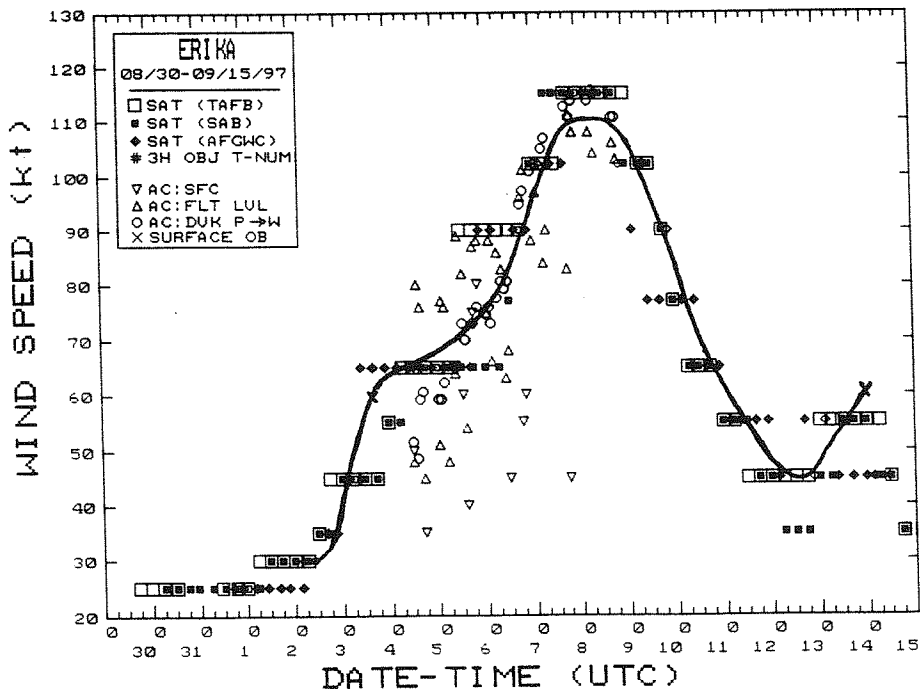


Fig. 3. Best track maximum one-minute wind speed curve for Hurricane Erika.