

Tropical Cyclone Report
Tropical Storm Earl
13-15 August 2004

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Earl was a short-lived tropical storm that moved quickly across the Windward Islands of the Caribbean with brief but heavy rains and winds up to 45 kt.

a. Synoptic History

Earl formed from a tropical wave that moved from Africa to the eastern tropical Atlantic Ocean on 10 August. The wave developed into a tropical depression on 13 August while centered about 1000 n mi east of the Lesser Antilles. The tropical cyclone was embedded in deep easterly flow to the south of a strong subtropical ridge and moved westward at 18 to 25 kt during its 48 hours of existence. Based on banding features observed on satellite imagery and the associated Dvorak intensity estimates, the depression is estimated to have strengthened to Tropical Storm Earl on 14 August while centered about 325 n mi east of Barbados. Earl moved quickly across the southern Windward Islands on 15 August with maximum one-minute surface wind speeds estimated at 45 kt and briefly brought tropical storm conditions or near-tropical storm conditions to Barbados, Grenada, St. Vincent and the Grenadines. Shortly thereafter, even though the system appeared to be well-organized on satellite imagery, a hurricane hunter aircraft reported that the low level circulation was not well-defined, probably due to the fast forward speed of motion. Earl degenerated to an open tropical wave later on 15 August. The remnant wave was eventually tracked to the eastern Pacific Ocean where it developed into Hurricane Frank on 23 August.

The “best track” chart of the tropical cyclone’s path is given in Fig. 1, with the wind and pressure histories shown in Figs. 2 and 3, respectively. The best track positions and intensities are listed in Table 1.

b. Meteorological Statistics

Observations in Earl (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), and flight-level observations from one mission of the 53rd Weather Reconnaissance Squadron of the U. S. Air Force Reserve Command on 15 August. Earl’s maximum one-minute surface winds are estimated to be 45 kt on 15 August, based on NASA QuikSCAT microwave satellite data, as well as from the sources mentioned above. The highest surface wind reports received were 30 knots at Barbados and St. Lucia, as Earl passed over the Windward Islands on the morning of 15 August.

There were no ship reports of winds of tropical storm force associated with Earl while it was a tropical cyclone. After Earl degenerated to an open wave, two ships reported tropical storm

force winds associated with the fast-moving wave over the central Caribbean Sea. The *Buffalo Soldier* reported 35-knot east winds on 17 August while located just north of Colombia and the ship with call sign *A8CF2* reported 37-knot east winds on 16 and 17 August while located just south of Haiti.

c. Casualty and Damage Statistics

There were no reports of casualties associated with Earl. Fox News reported that Tropical Storm Earl's winds tore off about a dozen roofs throughout Grenada and that there was flooding in western Grenada. Also, at least two roofs were destroyed in nearby St. Vincent and the Grenadines and banana crops were damaged there.

d. Forecast and Warning Critique

Earl was a tropical cyclone for only 48 hours, precluding the verification of forecasts at longer time periods. The official track errors that were verified ranged up to 217 n mi at 48 hours and these errors were above long-term average errors. These large errors were primarily the result of a slow bias to the forecasts of the storm's fast forward speed of motion. The watches and warnings issued for the Windward Islands are listed in Table 2.

Table 1. Best track for Tropical Storm Earl, 13-15 August 2004.

Date/Time (UTC)	Latitude (°N)	Longitude (°W)	Pressure (mb)	Wind Speed (kt)	Stage
13/1800	9.0	45.6	1011	30	tropical depression
14/0000	9.2	47.4	1011	30	"
14/0600	9.6	49.2	1011	30	"
14/1200	10.1	51.4	1011	30	"
14/1800	10.5	53.5	1010	35	tropical storm
15/0000	11.0	55.9	1010	35	"
15/0600	11.5	58.3	1009	45	"
15/1200	11.8	60.8	1009	45	"
15/1800	12.1	62.8	1010	35	"
16/0000	dissipated to open tropical wave				
15/0600	11.5	58.3	1009	45	minimum pressure

Table 2. Watch and warning summary for Tropical Storm Earl, 13-15 August 2004.

Date/Time (UTC)	Action	Location
14/1500	tropical storm watch	Barbados, St. Vincent, and St. Lucia
14/2100	tropical storm warning	Barbados, St. Vincent, the Grenadines, Trinidad, Tobago, Grenada and its dependencies, and St. Lucia
15/1200	change tropical storm warning to watch	Barbados
15/1230	tropical storm warning discontinued	Trinidad and Tobago
15/1500	tropical storm watch discontinued	Barbados
15/1800	tropical storm warning discontinued	For the remainder of the Windward Islands

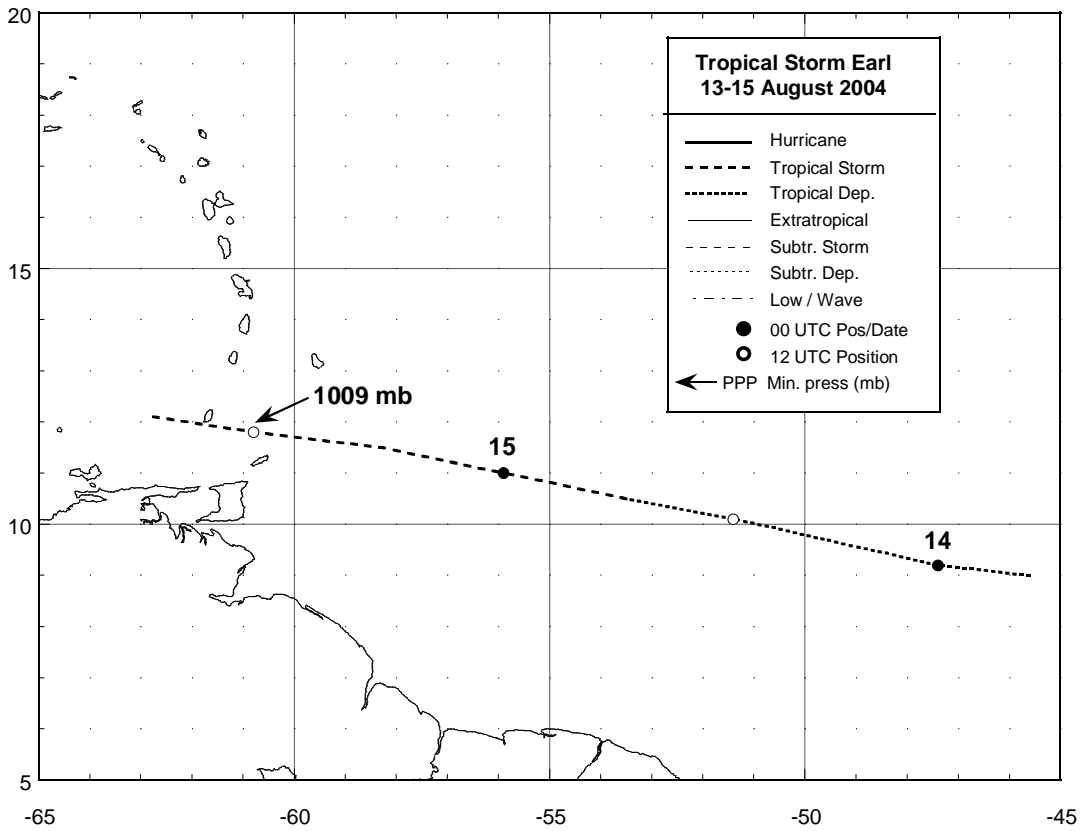


Figure 1. Best track positions for Tropical Storm Earl, 13-15 August 2004.

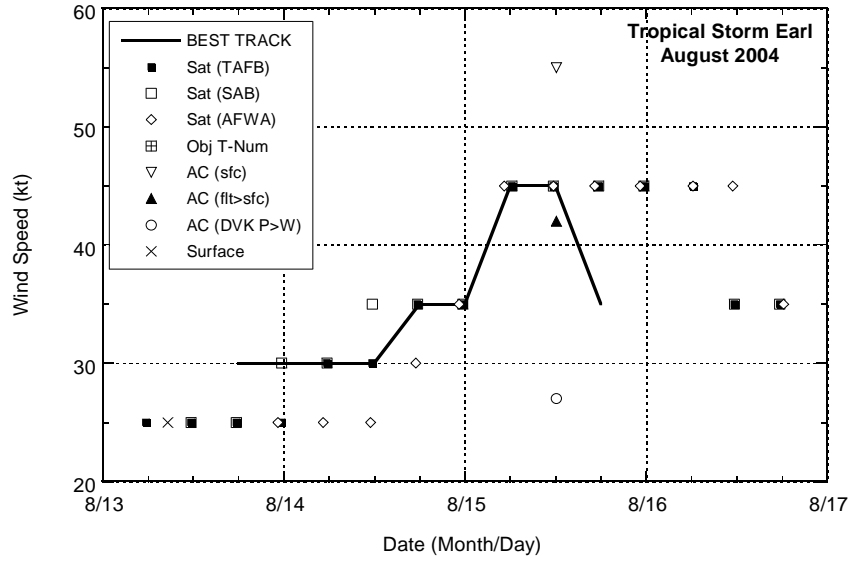


Figure 2. Selected wind observations and best track maximum sustained surface wind speed curve for Tropical Storm Earl, 13-15 August 2004. Aircraft observations at the 850-mb flight level have been adjusted to the surface using an 80% adjustment factor.

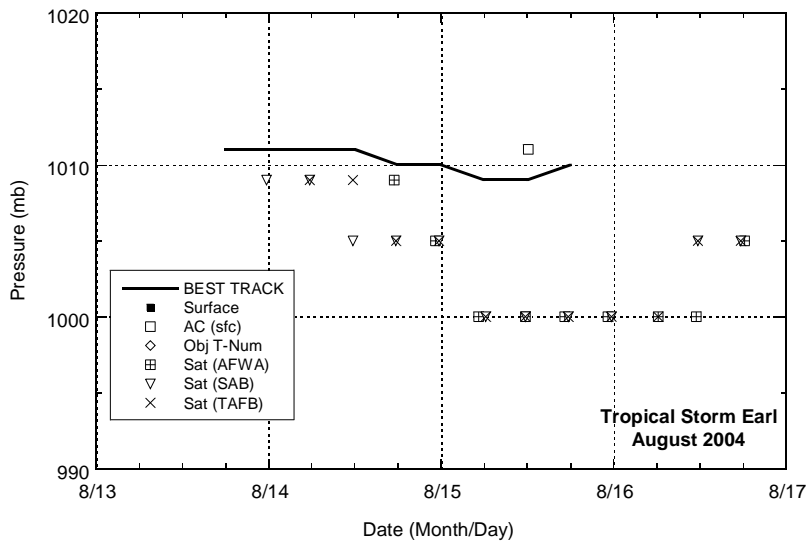


Figure 3. Selected pressure observations and best track minimum central pressure curve for Tropical Storm Earl, 13-15 August 2004.