

Tropical Cyclone Report
Tropical Storm Edouard
1-6 September 2002

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Edouard made landfall on the northeast coast of Florida as a minimal tropical storm.

a. Synoptic History

Edouard formed from a disturbance of non-tropical origin. Cloudiness and isolated showers developed several hundred miles east-southeast of Bermuda on 25 August, likely in association with a low-level disturbance that had formed along a dying frontal zone. The system moved southwestward for several days, and when the disturbance was located near the southwest end of an upper-level trough a few hundred miles north of Puerto Rico, deep convection associated with the system increased. The area of disturbed weather moved slowly westward over the next couple of days, and on the 31st, when the system was located just to the east of the northern Bahamas, it began to become better organized. On 1 September deep convection became persistent, and surface and reconnaissance aircraft data indicate the system became a tropical depression around 1800 UTC that day, centered about 120 n mi east of Daytona Beach, Florida. Figure 1 is a map showing the best track of the tropical cyclone, and Table 1 contains a listing of the best track

In the early stage of the tropical cyclone, the environment was characterized by modest west-northwesterly shear, and the system strengthened into Tropical Storm Edouard by 0600 UTC 2 September. Later that day and early on the 3rd, the environment appeared to become more hostile. Water vapor imagery suggested that dry mid- to upper-tropospheric air was overspreading the center, and radiosonde data indicated 30 to 40 kt winds affecting the storm at the 200 mb level. Despite this, Edouard was able to intensify further, and it reached its peak strength of 55 kt around 1200 UTC 3 September. However, very soon thereafter, the storm soon began to succumb to the influence of strong shear and dry air aloft and a weakening trend was underway. By midday on the 3rd, the associated deep convection had decreased, and the low-cloud circulation center was clearly exposed.

Soon after Edouard's genesis, steering currents weakened. From 2-3 September, the cyclone moved in a clockwise loop. Then, as a weak and narrow mid-tropospheric ridge developed to its north, Edouard headed erratically westward and west-southwestward toward the northeast coast of Florida. Strong shear continued to impact the system, and although occasional bursts of deep convection occurred near the center, the cyclone was barely of tropical storm strength when the center crossed the coastline in the vicinity of Ormond Beach, Florida around 0045 UTC 5 September. Edouard weakened to a depression almost immediately after landfall, and crossed north-central Florida. The weak depression emerged into the Gulf of Mexico near Crystal River, Florida around 1400 UTC on the 5th. Strong northwesterly shear, associated with the upper-tropospheric outflow from developing Tropical Storm Fay located over the western Gulf, precluded any redevelopment of Edouard. On the 6th, Tropical Depression Edouard moved westward over the northeastern Gulf, and by 1200 UTC on that day, it was a rather insignificant-looking low cloud swirl with minimal deep convection. The system dissipated shortly thereafter, as it became absorbed into the larger circulation of Tropical Storm Fay.

b. Meteorological Statistics

Figures 2 and 3 are curves of the best track maximum wind speed and minimum central pressure for Edouard, along with the observations on which these curves are based. Observations for Edouard 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 flight-level observations from flights of the 53rd Weather Reconnaissance Squadron of the U. S. Air Force Reserve Command. The peak intensity of Edouard, 55 kt, is based on a reconnaissance aircraft wind measurement of 71 kt at a flight level of about 1000 ft at 1159 UTC 3 September.

Table 2 lists ship reports of tropical storm force winds associated with Edouard. There were no reports of sustained tropical storm force winds over land associated with Edouard. On 4 September, Patrick Air Force Base reported a peak wind gust of 34 kt at 2127 UTC, and the St. Augustine C-MAN station reported a peak gust of 33 kt at 1900 UTC. Reliable rainfall estimates from the Melbourne radar indicated maxima of 4 to 5 inches near the Seminole/Orange County line, just northeast of Union Park (Orange County) Florida. Storm tides and wave action were not significant, and there were no tornadoes reported.

c. Casualty and Damage Statistics

There were no reports of casualties due to Edouard. Some flooding occurred in Brevard, Seminole, and Orange counties in Florida. This appears to have been mainly roadway flooding and damages, if any, appeared to be minor. No dollar amounts are available.

d. Forecast and Warning Critique

Edouard was of tropical storm strength for less than 72 h, so there is a relatively small sample of forecasts to verify through 48 h. Excluding the tropical depression stage, the average official track forecast errors for Edouard (with the number of cases in parentheses) are 32 (10), 57 (8), 75 (6), and 90 (4) for the 12, 24, 36, and 48 h forecasts, respectively. These errors are less than the most recent 10-yr average average official track errors for the Atlantic basin. The GUNS and GUNA ensemble forecasts had somewhat lower average track errors than the official forecasts. In general, the official track predictions correctly called for Edouard to loop back and make landfall along the southeast U.S. coast.

Average official intensity errors were 6, 7, 8, and 13 kt for the 12, 24, 36, and 48 h forecasts, respectively. For comparison, the average official intensity errors over the most recent 10-yr period are 7, 11, 14, and 16 kt, respectively. Although there was a positive bias to the wind speed forecasts at 36 and 48 h, the official forecasts correctly recognized that strong shear would inhibit significant intensification.

Table 3 lists the watches and warnings associated with Edouard. A tropical storm warning was issued early on 2 September while Edouard was moving slowly northwestward. The looping motion delayed the threat to the coastline, however, resulting in the discontinuation of tropical storm warnings later that day. A tropical storm warning was re-issued for the northeast Florida coast about 16 h prior to landfall.

Table 1. Best track for Tropical Storm Edouard, 1-6 September 2002.

Date/Time (UTC)	Latitude (°N)	Longitude (°W)	Pressure (mb)	Wind Speed (kt)	Stage
01 / 1800	29.2	78.8	1013	30	tropical depression
02 / 0000	29.7	79.1	1011	30	"
02 / 0600	30.1	79.7	1007	35	tropical storm
02 / 1200	30.4	79.6	1007	35	"
02 / 1800	30.5	79.0	1005	35	"
03 / 0000	30.5	78.6	1003	35	"
03 / 0600	30.4	78.5	1003	35	"
03 / 1200	30.4	78.4	1002	55	"
03 / 1800	30.0	79.0	1004	45	"
04 / 0000	29.9	79.1	1005	40	"
04 / 0600	29.9	79.5	1002	35	"
04 / 1200	29.9	79.8	1006	35	"
04 / 1800	29.7	80.5	1009	35	"
05 / 0000	29.4	81.0	1008	35	"
05 / 0600	29.2	81.6	1011	25	tropical depression
05 / 1200	28.9	82.4	1011	20	"
05 / 1800	28.6	83.4	1011	20	"
06 / 0000	28.4	83.9	1009	20	"
06 / 0600	28.3	84.7	1010	20	"
06 / 1200	28.5	86.0	1008	20	"
06 / 1800					dissipated
03 / 1200	30.4	78.4	1002	55	minimum pressure
5 / 0045	29.4	81.1	1009	35	landfall near Ormond Beach, FL

Table 2. Selected ship reports with winds of at least 34 kt for Tropical Storm Edouard, September 2002.

Date/Time (UTC)	Ship call sign	Latitude (°N)	Longitude (°W)	Wind dir/speed (kt)	Pressure (mb)
02 / 1200	4XFE	30.4	79.2	170 / 35	1010.5
02 / 1800	4XFC	29.8	79.0	240 / 36	1010.5
03 / 0900	VGDY	29.3	78.1	200 / 38	1008.0

Table 3. Watch and warning summary for Tropical Storm Edouard, September 2002.

Date/Time (UTC)	Action	Location
1/2100	Tropical storm watch issued	North of Titusville, Florida to Brunswick, Georgia
2/0900	Tropical storm warning issued	North of Fernandina Beach, Florida to Savannah River, Georgia
2/0900	Tropical storm watch issued	North of Savannah River, Georgia to South Santee River, South Carolina
2/2100	Tropical storm warning changed to tropical storm watch	Fernandina Beach, Florida to Savannah River, Georgia
3/0300	Tropical storm watch discontinued	North of Fernandina Beach and south of Flagler Beach, Florida
3/2100	Tropical storm watch issued	South of Flagler Beach to Titusville, Florida
4/1500	Tropical storm watch changed to tropical storm warning	Titusville to Fernandina Beach, Florida
4/1500	Tropical storm warning issued	North of Fernandina Beach, Florida to Brunswick, Georgia
4/1500	Tropical storm watch issued	South of Titusville to Sebastian Inlet, Florida
5/0300	Tropical storm watch and warning discontinued	-

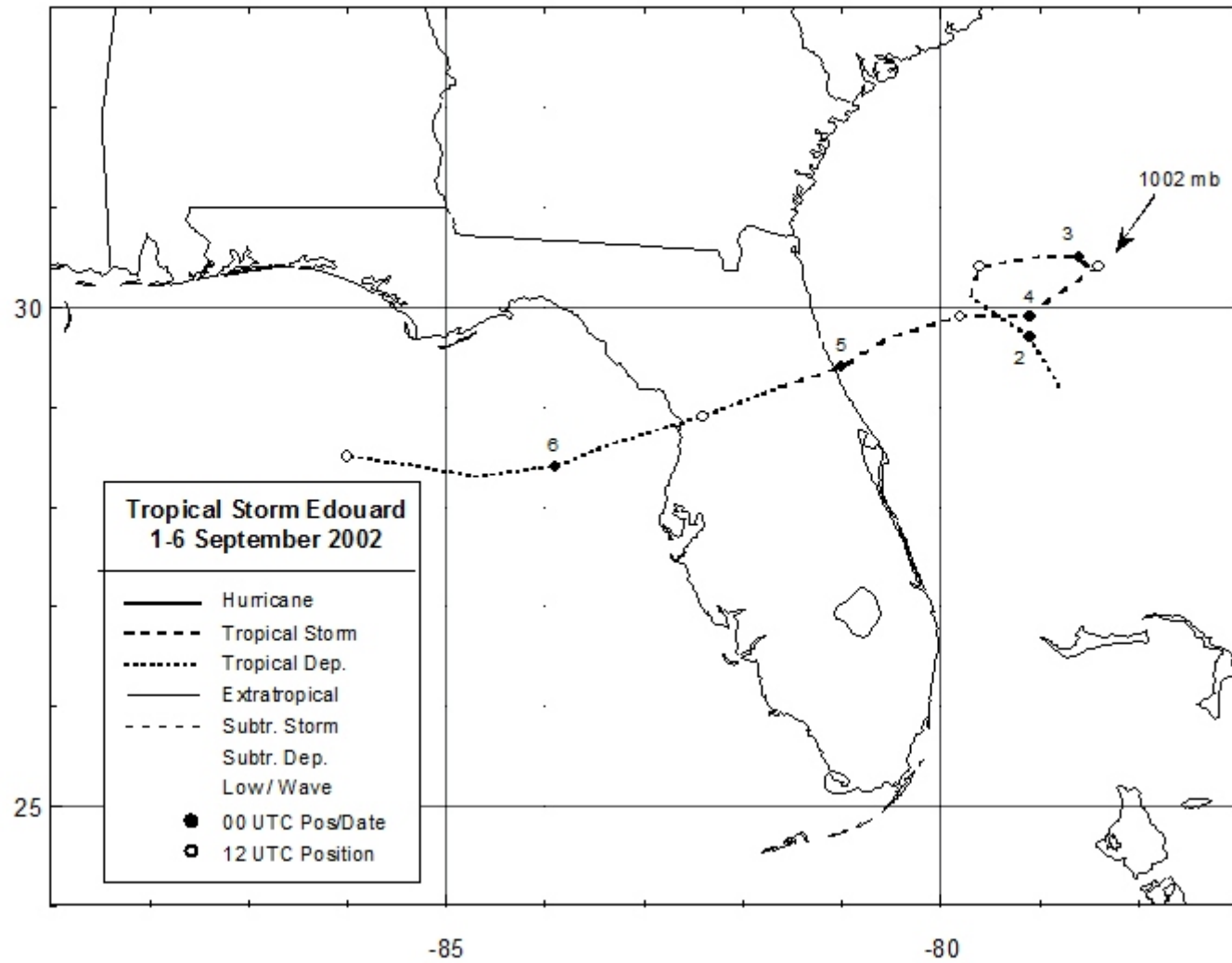


Figure 1. Best track positions for Tropical Storm Edouard, 1-6 September 2002, with minimum pressure at arrowhead.

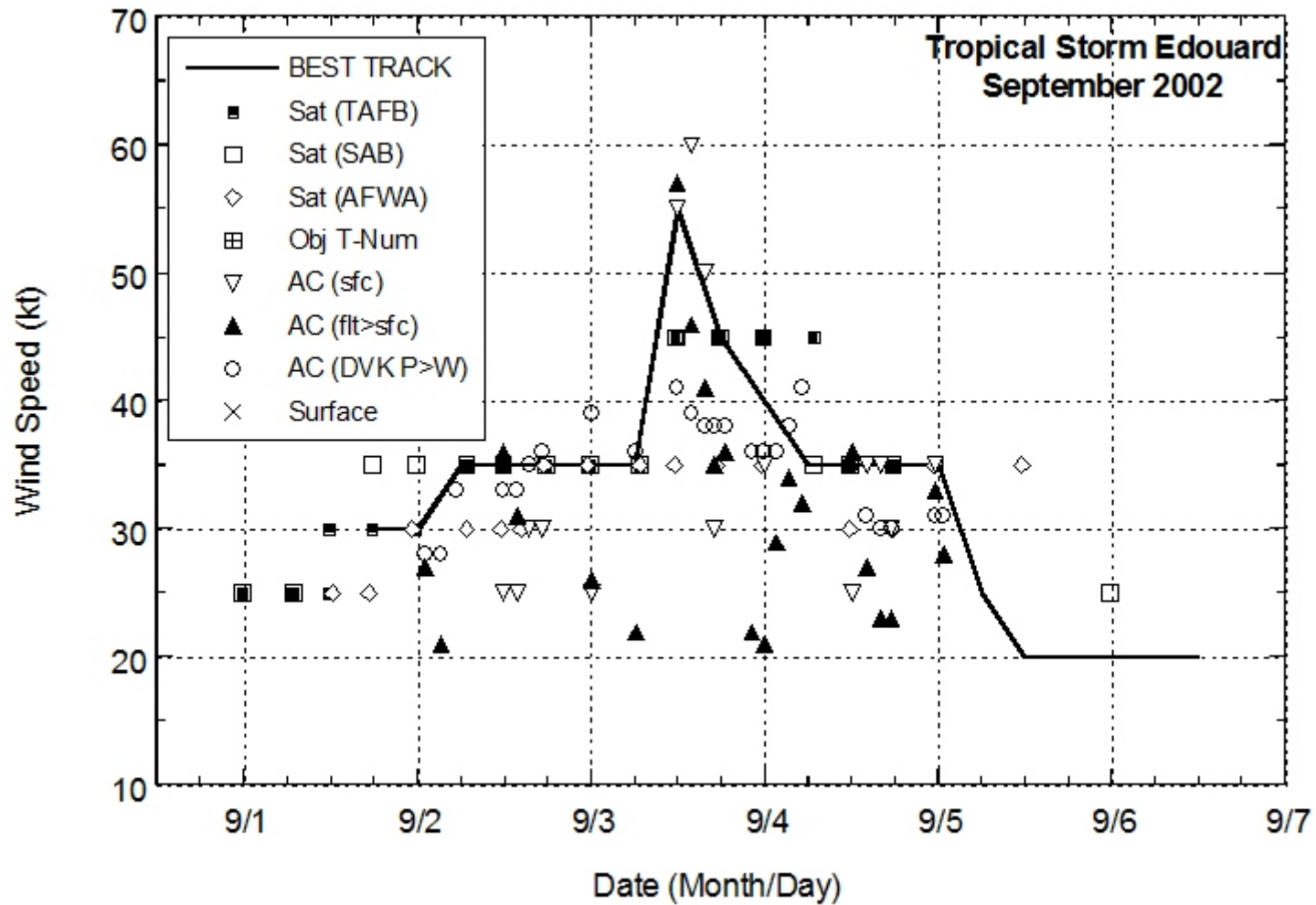


Figure 2. Selected wind observations and best track maximum sustained surface wind speed curve for Tropical Storm Edouard, September 2002. Aircraft observations have been adjusted for elevation using 90%, 80%, and 80% reduction factors for observations from 700 mb, 850 mb, and 1500 ft, respectively.

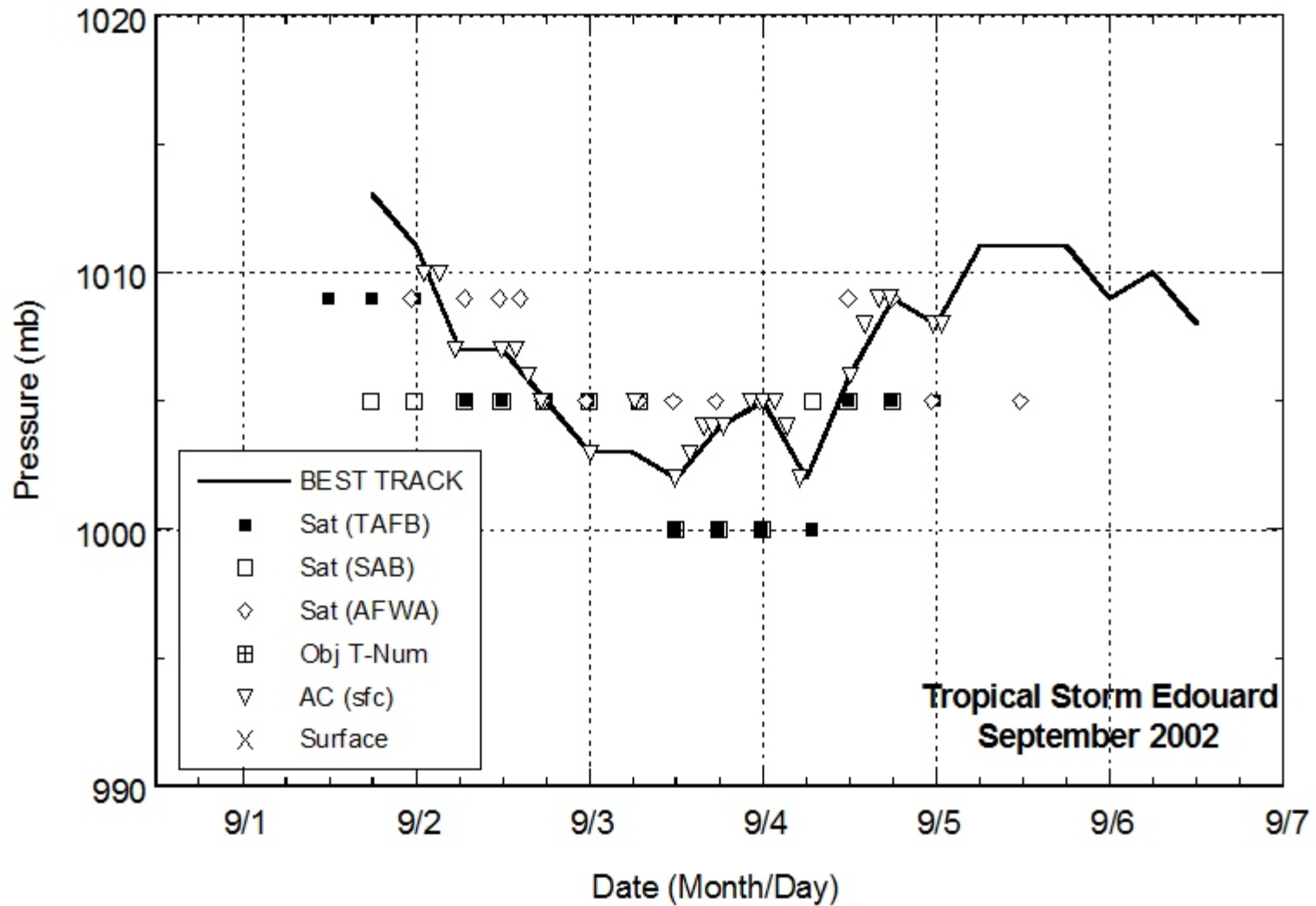


Figure 3. Selected pressure observations and best track minimum central pressure curve for Tropical Storm Edouard, September 2002.