

Tropical Cyclone Report
Hurricane Claudette
8-17 July 2003

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Hurricane Claudette made landfall in Texas as a Category 1 hurricane on the Saffir-Simpson Hurricane Scale and on the northeastern Yucatan Peninsula of Mexico as a tropical storm. It maintained tropical storm status for more than 24 hours after landfall in Texas.

a. Synoptic History

Claudette formed from a tropical wave that moved westward from the coast of Africa on 1 July. The wave first showed signs of convective organization on 6 July. By 7 July satellite imagery indicated sufficient organization to possibly classify the system as a tropical depression near the Windward Islands. However, the wave was moving westward at 20-25 kt at the time, and neither surface observations nor an investigation flight by the Air Force Reserve Hurricane Hunters indicated that the system had a closed circulation. The aircraft did report flight-level winds of tropical-storm force north of the vorticity maximum that passed near Barbados and St. Lucia.

The wave continued rapidly westward with a further increase in organization. Satellite intensity estimates suggested the system was near tropical storm strength by 1500 UTC 8 July. However, a second investigative flight could not find a closed center at that time. Finally, near 1800 UTC the plane found a small area of southwesterly winds and a pressure of 1006 mb. The wave became Tropical Storm Claudette at that time. 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.

Claudette continued quickly westward through 9 July, then it turned northwestward with some deceleration on the next day. A continued northwestward motion brought Claudette to its first landfall, on the northeastern Yucatan Peninsula of Mexico near 1000 UTC 11 July.

During this period, Claudette underwent two notable fluctuations in intensity. The first occurred around 0300-0400 UTC 9 July, when flight-level winds reported by an Air Force Reserve Hurricane Hunter aircraft northeast of the center suggested that Claudette might have reached hurricane strength. Subsequent data shortly thereafter showed much lower winds, and it is estimated that Claudette did not become a hurricane at that time.

A second noteworthy sequence of intensity changes occurred on 10 July. An increase in convective organization and strengthening began between 0000-0600 UTC. A Hurricane Hunter flight near 1200 UTC reported a 10-n mi wide eye (also apparent in visible and microwave satellite imagery), along with flight-level winds, dropsonde winds, and pressures that indicated Claudette had

become a hurricane. The cyclone maintained hurricane intensity through 1600 UTC. The central core then completely collapsed during the next two hours. The aircraft could not fix the center at 1800 UTC due to the poor definition of both the wind field and the convective pattern. While it is possible the aircraft did not sample the maximum winds on the attempted 1800 UTC penetration, rapid weakening was clearly underway.

Claudette then proceeded to become very disorganized. The center became broad and poorly defined, and multiple low-level centers were seen several times in satellite imagery between 1800 UTC 10 July and 0000 UTC 12 July. The convection was displaced well to the north and east by southwesterly shear, with aircraft and ship data indicating tropical storm-force winds in the convective area. Much of the motion during this time may be due to reformation of the center caused by convective bursts. The best track shows 45-50 kt winds during this period, but there is much greater than normal uncertainty about both the winds and the central pressure due to the disorganized nature of the storm.

The storm moved northwestward into the southern Gulf of Mexico on 11 July. A north-northwestward jog occurred on 12 July while Claudette became a little better organized. The storm meandered erratically northwestward on 13 July, then turned northward later that day. These track changes were likely due to a combination of 1) weakening of a mid/upper-level ridge along the northern Gulf coast caused by a developing trough over the eastern United States, and 2) reformation of the center caused by strong but asymmetric convection to the northeast. This change in motion was accompanied by some decrease in the shear, and while the center remained mostly exposed, Claudette slowly and unsteadily strengthened on 13 July.

A building deep-layer ridge over the western United States and the western Gulf coast states forced Claudette to gradually turn west-northwestward late on 14 July. This brought the storm to an area of lighter shear, which allowed an eyewall to form and for Claudette to again become a hurricane at 0600 UTC 15 July. A faster west-northwestward motion brought the center of Claudette to the Texas coast at Matagorda Island (just east of Port O'Connor) at 1530 UTC that day. Strengthening continued up to landfall, with estimated maximum winds increasing to 80 kt and the central pressure falling to 979 mb.

Claudette turned westward just after landfall and weakened to a tropical storm at 0000 UTC 16 July. It then turned west-northwestward again while moving into northern Mexico later that day. This motion would continue until dissipation. Claudette was slow to lose organization, as the radar and satellite presentations of its structure remained distinct for more than 24 hr after landfall. Surface data indicates the system maintained tropical storm strength until 0000 UTC 17 July. The low-level circulation dissipated over the mountains of northwestern Mexico later that day. However, the mid- and upper-level moisture and vorticity continued west-northwestward, eventually crossing southern California into the Pacific.

b. Meteorological Statistics

Observations in Claudette (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 flight-level and dropwindsonde observations from flights of the 53rd Weather Reconnaissance Squadron of the U. S. Air Force Reserve Command and the NOAA Aircraft Operations Center. Surface data from ships and land stations are included as well (Tables 2 and 3). Microwave data from the TRMM, DMSP, and NOAA satellites, and data from the WSR-88D Doppler radars in Houston, Corpus Christi, and Del Rio, Texas also played a significant role in determining the best track of Claudette.

The Air Force Hurricane Hunters made 52 fixes during Claudette's life, while the NOAA Hurricane Hunters made 4. The maximum flight-level winds observed by the aircraft were 85 kt at 0334 UTC 9 July (1500 ft) and at 1517 UTC 15 July (700 mb) - the latter as the eye of Claudette was crossing the Texas coast. Global Positioning System (GPS) dropsondes deployed by the aircraft reported surface winds of 73 kt at 1526 UTC 10 July and 70 kt at 1516 UTC 15 July. The latter dropsonde recorded a 96 kt wind at the 976 mb level.

At the time of the first occurrence of 85 kt winds on 9 July, the aircraft reported a central pressure of 1001 mb. Two hours later, a pass through the same part of the storm at 850 mb showed winds of only 56 kt. Based on this, it is estimated that Claudette remained a tropical storm and the best track will show 60 kt at 0600 UTC 9 July. However, there is greater than normal uncertainty about the value.

The 73-kt dropsonde surface winds on 10 July occurred during Claudette's short-lived intensification into a hurricane over the northwestern Caribbean. The aircraft reported a minimum pressure of 988 mb at 1201 UTC, then reported 76-kt flight-level winds at 700 mb at 1526 UTC. During the aborted attempt to fix the center two hours later, the maximum 700-mb winds were only 51 kt. The aircraft reported a minimum pressure of 1005 mb at the time, but this was likely not at the center and the actual central pressure is speculative. However, the weather officer on the aircraft reported that the pressure near the center was about 10 mb higher than 2 h earlier.

Aircraft and surface data indicate hurricane conditions occurred over portions of the middle Texas coast. The maximum sustained winds reported by an official observing site was a 10-min average of 65 kt at the Remote Automated Weather Stations (RAWS) site on Matagorda Island, Texas (Table 3). The Texas Coastal Ocean Observation Network (TCOON) station at Port O'Connor reported a 6-min average sustained wind 62 kt with a gust to 78 kt in the western eyewall. Victoria, Texas, reported 54-kt sustained winds with a gust to 72 kt, although that data is incomplete due to a power failure. Tropical storm conditions occurred along much of the middle and upper Texas coast and extended well inland across southern Texas. Cotulla, Texas, reported sustained winds of 36 kt with a gust to 46 kt at 0246 UTC 16 July, while Del Rio, Texas, reported a gust to 47 kt.

Tropical-storm force winds also occurred well inland over portions of southwestern Texas, including 38-kt sustained winds with a gust to 50 kt at the Terrell County airport at 1658 UTC 16 July. While this station is at an elevation of 2300 ft, there is no evidence that mountainous terrain enhanced the winds, and this report is the basis for keeping Claudette a tropical storm through 1800 UTC 16 July. Other reports of tropical storm wind gusts occurred at Mt. Locke in the Davis Mountains, and at Guadalupe Pass and The Bowl in the Guadalupe Mountains. These winds were likely enhanced by mountainous terrain.

Tropical storm conditions likely occurred over portions of the northeastern Yucatan Peninsula, but there were no reports of tropical-storm winds from that area. Winds gusted to tropical-storm force at Montego Bay, Jamaica. Winds also gusted to tropical-storm force on St. Lucia during the passage of the pre-Claudette tropical wave.

Many unofficial observations were received from the landfall area, with a selection included in Table 3. A storm chaser (Tony Whitener) in Port O'Connor reported 83-kt sustained winds with a gust to 93 kt measured at the top of a vehicle with good exposure. While this observation is included in Table 3, it is notable that the winds are 15-20 kt higher than the nearby TCOON station and thus appear unrepresentative. A report from Seadrift indicated 84-kt sustained winds with a gust to 96 kt. However, an inspection of the site by National Weather Service (NWS) personnel showed that the anemometer placement may have caused funneling of the winds across the instrument. Thus, the report is not included in Table 3.

The 84-kt and 83-kt unofficial observations suggest the possibility that Claudette strengthened to a Category 2 hurricane as it was making landfall. This was not supported by the aircraft data, which suggest maximum sustained winds of 75-80 kt as the eye crossed the coast. Data from the NWS WSR-88D Doppler radars indicated winds of 95-105 kt between 5,000-10,000 ft in the northwest eyewall after Claudette made landfall. It is uncertain how to convert these winds to sustained surface winds over land. However, reduction factors derived from GPS dropsonde data over water suggest 85-90 kt sustained surface winds. A further reduction for land friction would reduce the radar winds to at or below the 75-80 kt range suggested by the aircraft data.

Damage surveys were conducted by the staffs of NWS forecast offices in Corpus Christi and Houston in order to help define the surface winds at landfall. These surveys concluded the damage was consistent with Category 1 sustained winds. Unpublished information from a damage survey by a wind engineering expert with the commercial engineering firm Haag Engineering supports this determination.

Based on the surveys, the data, and uncertainties (i. e., the possibility that the aircraft did not sample the strongest winds), the landfall intensity of Claudette is estimated to be 80 kt - at the high end of Category 1 on the Saffir-Simpson Hurricane Scale.

Several ships encountered Claudette during its life (Table 2). The most significant observations included: 1) the **Explorer of the Seas**, which reported 49-kt sustained winds in the Yucatan Channel at 0356 UTC 11 July; 2) the **Rhapsody of the Seas**, which reported 56-kt sustained winds at 0600 UTC 14 July; 3) the **James N. Sullivan**, which reported 55 kt winds at 1500 UTC 14 July; and 4) the **Galveston Bay**, which reported 54-kt sustained winds at 2100 UTC 14 July. Several oil rigs in the northwestern Gulf of Mexico reported hurricane-force winds 100-200 ft above the surface (Table 3). Not included in Table 3 is a wind gust of 119 kt reported at the rig C337 which appears unrealistic.

The lowest pressure reported by reconnaissance aircraft was 979 mb just before landfall at 1414 UTC 15 July. The lowest observed pressure on land was 980.0 mb observed by the Port O'Connor storm chaser when the eye passed over.

Storm-surge flooding of 3-6 ft above normal tide levels occurred near where the eye of Claudette made landfall. Storm tides (storm surge plus astronomical tide) of 6-9 ft were measured in the Galveston-Freeport area (Table 3). Tides were 1-2 ft above normal as far north as the southwestern Louisiana coast and as far south as the Baffin Bay, Texas area.

Claudette moved quickly westward after landfall, which limited rainfall totals. The highest storm-total rainfall was 6.5 in four miles south-southeast of Tilden, Texas (Table 3a), and there are other reports of 3-6 in amounts along the storm track. NWS WSR-88D radar data estimates that as much as 8 in may have fallen in some areas. These rains caused minor flooding in southern Texas and some flash flooding in southwestern Texas. Rainfalls of 1-3 in also occurred over portions of the Yucatan Peninsula and the Cayman Islands, with 3.22 in reported in Cancun.

Two tornadoes were reported during Claudette. One was an F1 that damaged several buildings in Palacios, Texas. The other touched down in Port Lavaca, Texas, causing damage to some homes.

c. Casualty and Damage Statistics

Claudette is responsible for one direct and two indirect deaths. The direct death was a 13-year old boy crushed by a falling tree in Jourdanton, Texas. The first indirect death was a 33-year old woman who was hit by a falling limb after the storm was over. The second indirect death was at Navarre Beach, Florida when a 71-yr old man died after being pulled from surf generated by Claudette. Press reports suggest the man suffered a heart attack while swimming.

The American Insurance Services Group reported that Claudette caused \$90 million in damage to insured property in the United States. The total damage estimate is twice this or \$180 million. The damage includes five stations of the TCOON and Texas Automated Buoy System (TABS) networks destroyed by the hurricane. No significant damage was reported from Mexico, the Cayman Islands, or Jamaica. Minor damage was reported in St. Lucia from the pre-Claudette tropical wave.

d. Forecast and Warning Critique

The track forecast errors for Claudette were generally small compared to normal. Average official track errors (with the number of cases in parentheses) were 36 (30), 57 (30), 89 (28), 117 (26), 140 (22), 154 (18), and 154 (14) n mi for the 12, 24, 36, 48, 72, 96, and 120 h forecasts, respectively¹. These errors are much lower than the average official track errors for the 10-yr period

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.

1993-2002² (45, 81, 116, 150, 225, 282, and 374 n mi, respectively) (Table 4). These errors are also much lower than those of the Climatology-Persistence methods, indicating the track forecasts had considerable skill. The track forecast philosophy was quite good overall. From Claudette's beginnings, the storm was forecast to move westward to the western Caribbean, northwestward into the Gulf of Mexico, and then westward toward the western Gulf coast. However, the extent of the northward motion over the Gulf was not fully anticipated, nor was the westward acceleration as Claudette approached the western Gulf coast.

The intensity forecast errors for Claudette were also well below the long-term means. Average official intensity errors were 5, 7, 7, 9, 9, 8, and 8 kt for the 12, 24, 36, 48, 72, 96, and 120 h forecasts, respectively. For comparison, the average official intensity errors over the 10-yr period 1993-2002 are 6, 10, 13, 15, 19, 21, and 22 kt, respectively. The intensity forecast errors were lower than those of the Statistical Hurricane Intensity Forecast System (8, 11, 14, 17, 22, 19, and 16 kt for the 12, 24, 36, 48, 72, 96, and 120 h forecasts, respectively), indicating that the intensity forecasts had considerable skill. The intensity forecasts were generally correct in anticipating that southwesterly vertical shear would slow development until Claudette was near the western Gulf coast. However, significant overforecasts occurred when Claudette briefly reached hurricane intensity on 10 July, as the intensity forecasts at the time incorrectly called for continued strengthening. Additionally, the amount of intensification near the Texas coast was underforecast by 5-10 kt.

Table 5 lists the watches and warnings associated with Claudette. Hurricane warnings for the Texas coast were issued about 24 h before the center made landfall. A hurricane watch was issued for the area from Port O'Connor southward about 48 h before Claudette made landfall, while a hurricane watch was issued for the remainder of the landfall area about 30 h before the center made landfall. The first tropical storm warnings for the northeastern Yucatan Peninsula were issued 37 h before the center made landfall. Hurricane warnings issued on 10 July for the Yucatan Peninsula proved unnecessary, because Claudette weakened rapidly after being a hurricane for a few hours.

Acknowledgements

Much of the data from the affected area was provided by the NWS Weather Forecast Offices at Houston, Corpus Christi, San Antonio, and Midland, Texas, and Lake Charles, Louisiana. NOS data were provided by the NOAA National Ocean Service. RAWS data were provided by the National Interagency Fire Center. TCOON data were provided by the Division of Nearshore Research at Texas A&M University-Corpus Christi. TABS data were provided by the Geochemical and Environmental Research Group of Texas A&M University. Other data were provided by the NOAA Forecast Systems Laboratory and the Weather Underground web site. Data from Mexico, the Cayman Islands, and Jamaica were provided by the meteorological services of those countries.

² Errors given for the 96 and 120 h periods are averages over the two-year period 2001-2002.

Table 1. Best track for Hurricane Claudette, 8-17 July 2003.

Date/Time (UTC)	Latitude (°N)	Longitude (°W)	Pressure (mb)	Wind Speed (kt)	Stage
07 / 0000	11.1	53.5	1010	25	tropical wave
07 / 0600	11.8	55.3	1010	30	"
07 / 1200	12.6	57.5	1010	30	"
07 / 1800	13.2	59.8	1010	35	"
08 / 0000	13.7	62.0	1009	35	"
08 / 0600	14.0	64.8	1009	40	"
08 / 1200	14.4	67.6	1009	40	"
08 / 1800	14.8	70.0	1006	45	tropical storm
09 / 0000	15.0	72.0	1001	50	"
09 / 0600	15.1	74.4	1003	60	"
09 / 1200	15.3	76.5	1004	55	"
09 / 1800	15.8	78.6	1002	55	"
10 / 0000	16.1	80.3	1002	55	"
10 / 0600	16.6	81.7	998	55	"
10 / 1200	17.5	82.8	988	70	hurricane
10 / 1800	18.6	84.1	1003	55	tropical storm
11 / 0000	19.7	85.5	1010	50	"
11 / 0600	20.4	86.3	1009	50	"
11 / 1200	21.1	87.2	1009	50	"
11 / 1800	21.8	88.2	1009	45	"
12 / 0000	22.6	89.2	1008	45	"
12 / 0600	23.3	90.2	1007	45	"
12 / 1200	23.9	90.7	1006	45	"
12 / 1800	24.6	90.9	1008	45	"
13 / 0000	24.9	91.5	1003	45	"

Date/Time (UTC)	Latitude (°N)	Longitude (°W)	Pressure (mb)	Wind Speed (kt)	Stage
13 / 0600	24.9	91.9	1005	45	"
13 / 1200	25.1	92.1	999	50	"
13 / 1800	25.3	92.2	995	50	"
14 / 0000	25.6	92.2	991	55	"
14 / 0600	26.0	92.3	993	55	"
14 / 1200	26.7	92.6	991	55	"
14 / 1800	27.3	93.0	989	60	"
15 / 0000	27.7	93.6	988	60	"
15 / 0600	27.9	94.6	987	65	hurricane
15 / 1200	28.3	95.5	982	75	"
15 / 1800	28.6	96.9	984	70	"
16 / 0000	28.5	98.2	995	50	tropical storm
16 / 0600	28.5	99.4	999	40	"
16 / 1200	28.8	100.8	1003	35	"
16 / 1800	29.3	102.6	1007	35	"
17 / 0000	29.9	104.3	1014	30	tropical depression
17 / 0600	30.5	106.0	1016	25	remnant low
17 / 1200	30.9	107.7	1016	25	"
17 / 1800					dissipated
15 / 1530	28.3	96.2	979	80	minimum pressure
11 / 1000	20.8	86.9	1009	50	landfall at Puerto Morelos, Mexico
15 / 1530	28.3	96.2	979	80	landfall at Matagorda Island, Texas

Table 2. Selected ship reports with winds of at least 34 kt for Hurricane Claudette, 8-17 July 2003.

Date/Time (UTC)	Ship name/ call sign	Latitude (°N)	Longitude (°W)	Wind dir/speed (kt)	Pressure (mb)
09 / 0300	R. Hal Dean	16.9	72.3	090 / 40	1014.5
09 / 0600	R. Hal Dean	16.6	72.0	090 / 36	1012.0
11 / 0356	Explorer of the Seas	21.2	86.2	080 / 50	1009.6
11 / 2100	Saudi Abha	26.1	87.6	120 / 35	1017.2
13 / 2100	C6FM7	25.6	89.6	060 / 41	1014.0
14 / 0000	Discoverer Spirit	27.3	91.1	095 / 55G67	N / A
14 / 0600	Cleveland	26.6	90.8	090 / 37	1009.0
14 / 0600	Rhapsody of the Seas	28.1	92.8	050 / 56	1010.0
14 / 0900	Rhapsody of the Seas	27.6	92.0	010 / 53	1006.0
14 / 1100	Ocean Valiant	27.3	92.0	180 / 40G53	N / A
14 / 1200	Sargasso	27.1	90.8	150 / 44	1010.6
14 / 1200	Cleveland	27.9	92.6	090 / 37	1008.0
14 / 1500	Sargasso	27.0	90.5	150 / 44	1013.0
14 / 1500	James N. Sullivan	27.6	92.8	080 / 55	1003.7
14 / 1800	Discoverer Deep Seas	27.2	90.8	140 / 40	1012.8
14 / 1800	Overseas New Orleans	28.1	91.2	120 / 38	1012.0
14 / 2100	James N. Sullivan	27.5	92.6	150 / 50	999.7
14 / 2100	Galveston Bay	28.3	93.1	080 / 54	1005.0
15 / 1200	Celebration	26.4	94.0	200 / 35	1008.0

Table 3. Selected surface observations for Hurricane Claudette 8-17 July 2003.

Location	Minimum Sea Level Pressure		Maximum Surface Wind Speed			Storm surge (ft) ^c	Storm tide (ft) ^d	Total rain (in)
	Date/time (UTC)	Press. (mb)	Date/time (UTC) ^a	Sustained (kt) ^b	Gust (kt)			
Texas								
Alice (KALI)	15/2242	1003.3	15/2103		35			0.36
Angleton (KLBX)	15/1253	1005.6	15/1331		43			2.60
Aransas RAWS			15/1857		64			4.67
Bay City (KBYY)	15/1448	1002.1	15/1528	36	50			1.67
Clear Lake TCOON							5.63	
Copano Bay TCOON							2.43	
Colorado River Bypass USGS							5.56	
Corpus Christi Airport (KCRP)	15/2031	1004.2	15/2018		34			0.38
Corpus Christi NAS (KNGP)			15/2141		36			0.65
Corpus Christi Bob Hall Pier NOS			16/0800		44	2.75		
Cotulla (KCOT)	16/0146	997.9	16/0246	36	46			1.81
Del Rio (KDRT)			16/1253	31	47			
Eagle Point NOS	15/0924	1008.8	15/1124	38	46	4.22		
East Matagorda Bay TCOON ^e			15/1500	51	71			
Freeport NOS						5.14		
Freeport TCOON			15/1354	40	56			
Freeport USGS			15/1200		44		9.15	
Galveston Bay/Moses Lake USGS							4.90	
Galveston Airport (KGLS)	15/1052	1008.7	15/1253	38	47			2.01
Galveston North Jetty NOS	15/1224	1007.6	15/0830	40	54	4.00		
Galveston Pier 21 NOS	15/1224	1008.6				3.71		
Galveston Pleasure Pier NOS	15/1030	1007.3	15/1048	42	54	5.28		
Galveston South Jetty TCOON ^e			15/0600	35	52		8.74	
George West RAWS			15/2218		55			2.86
Guadalupe Pass (KGDP)			17/0451	38	45			
Highland Bayou Diversion Channel USGS							6.15	
Highland Bayou/Hitchcock USGS							5.77	
Hondo (KHDO)	16/0151	1008.4	16/0625		44			

Location	Minimum Sea Level Pressure		Maximum Surface Wind Speed			Storm surge (ft) ^c	Storm tide (ft) ^d	Total rain (in)
	Date/time (UTC)	Press. (mb)	Date/time (UTC) ^a	Sustained (kt) ^b	Gust (kt)			
Houston Clover Field (KLVJ)	15/0853	1010.0	15/0942		34			
Houston Hobby Airport (KHOU)	15/1153	1010.6	15/1104		35			1.10
Houston Port USGS							7.40	
Ingleside TCOON ^e			15/1900		39		2.54	
Jamaica Beach NWS COOP	15/1215	1008.0	15/0744	36	48		5.70	2.49
Kemah USGS			15/1200		35		5.94	
LaMarque USGS							5.00	
Marfa (KMRF)			16/2115		36			
Matagorda Colorado River Locks*							8.00	
Matagorda RAWS			15/1800	65				
McMullen Cnty			16/0218		53			
Mesquite Point TCOON ^e			15/1000	31	38		3.74	
Morgans Point NOS	15/1118	1009.8	15/1148	39	46	4.96		
Mt. Locke			16/1820		46			
NWS Station 1 TCOON	15/1642	1002.7	15/1912		47			
Orange Grove			15/2245		35			
Palacios ^e (KPSX)	15/1153	1003.1	15/1153		35			
Pearland (KLVJ)	15/1053	1010.0	15/1039		34			1.66
Port Aransas TCOON ^e			15/1748		37		3.40	
Port O'Connor TCOON			15/1506	62	78		6.13	
Rockport (KRP)	15/1800	999.7	15/1800		36			2.01
Rockport NOS						1.83		
Rollover Pass TCOON							3.69	
Round Point TCOON ^e	15/1100	1009.8	15/1200		40		5.25	
S. Bird Island TCOON ^e			16/0800		35			
Sabine Pass North NOS						2.55		
San Antonio Stinson Arpt (KSSF)			16/0053		42			
San Bernard RAWS			15/1200	35				2.65
Seadrift TCOON ^e			15/1600	41	53		3.66	
Terrell County Arpt (K6R6)			16/1658	38	50			
The Bowl			17/0604		61			
Victoria ^e (KVCT)	15/1800	994.9	15/1818	54	72			
Victoria RAWS			15/1830	53	71			
West Galveston Bay TCOON	15/1100	1004.4	15/0848	41	58		5.23	
White Point TCOON			15/2006		38		2.23	

Location	Minimum Sea Level Pressure		Maximum Surface Wind Speed			Storm surge (ft) ^c	Storm tide (ft) ^d	Total rain (in)
	Date/time (UTC)	Press. (mb)	Date/time (UTC) ^a	Sustained (kt) ^b	Gust (kt)			
Louisiana								
Cameron USGS ^e			15/1000		37		2.98	
Jamaica								
Montego Bay			09/1622		40			
Buoy/C-MAN								
NOAA Buoy 42001	14/0800	1011.4	12/1710	36 ^g	50			
NOAA Buoy 42019	15/1100	990.3	15/0810	47 ^g	60			
NOAA Buoy 42035	15/0900	1008.0	15/0700	37	49			
NOAA Buoy 42041			14/1117		39			
Port Aransas C-MAN (PTAT2)	15/2000	1003.8	15/1930	33 ^g	44			
Sea Rim State Park C-MAN (SRST1)	15/1000	1010.7	15/1000	45	54			
TABS Buoy N ^f	14/2009	1007.9	14/2039		56			
TABS Buoy V ^f	14/1709	1010.6	14/1609		46			
Oil Rigs^h								
East Cameron 312			14/1830	65				
East Cameron 377			14/1830	74				
ENSCO 7500			14/0600	39				
Eugene Island 322A			14/1100	65	83			
Garden Banks 128			14/1545	65	80			
Garden Banks 298			14/1830	80				
Garden Banks 426			14/1300	68	74			
Garden Banks 657			14/2000	40	48			
Green Canyon 158			14/1203	36				
KW60			14/1700	40	44			
Texas Unofficial Reports								
Bloomington Dow Chemical			15/1650	60				
Brazos TXDOT			15/1430	38				
Clear Creek TXDOT			15/1400	35				
Clear Creek at Seabrook							5.67	

Location	Minimum Sea Level Pressure		Maximum Surface Wind Speed			Storm surge (ft) ^c	Storm tide (ft) ^d	Total rain (in)
	Date/time (UTC)	Press. (mb)	Date/time (UTC) ^a	Sustained (kt) ^b	Gust (kt)			
Fort Davis Weather Underground			15/2208		37			
Galveston Causeway TXDOT			15/1100	37				
Hartman TXDOT			15/1200	34				
Kemah TXDOT			15/0830	47				
Long Mott Dow Chemical			15/1827	68	83			
Point Comfort Formosa Plastics			15/1545	70	87			
Port Lavaca Co-op			15/1800		63			
Port O'Connor (Whitener)	15/ N/A	980.0	15/ N/A	83	93			
Rawlings Bait Camp							3.40	
Schroeder Skinner Ranch Weather Underground	15/1900	993.1	15/1900	37	57			3.20
Tivoli Co-op			15/ N/A		57			
Victoria (Sudduth)			15/ N/A	54	65			
Wadsworth South Texas Nuclear Plant			15/1400	44	73			

*Note - Colorado River Locks at Matagorda reading was taken from a high water mark in a boat house referenced to mean lower low water (MLLW)

^a Date/time is for sustained wind when both sustained and gust are listed.

^b Except as noted, sustained wind averaging periods for C-MAN and land-based ASOS reports are 2 min; buoy averaging periods are 8 min; NOS and TCOON stations averaging periods are 6 min; RAWS stations report 10 min average sustained winds.

^c Storm surge is water height above normal astronomical tide level.

^d Storm tide from TCOON stations is water height above MLLW. For other stations it is water height above National Geodetic Vertical Datum (1929 mean sea level) unless noted.

^e Incomplete record - more extreme values may have occurred

^f Station destroyed - more extreme values may have occurred

^g 10-min average

^h Oil rig anemometer heights are generally 100-200 ft; wind averaging periods are unknown

Table 3a. Selected storm rainfalls for Texas from Hurricane Claudette, 8-17 July 2003.

Location	Total	Location	Total
Texas			
Big Wells 2W	3.20	Hondo	3.57
Campbellton 3NE	4.50	Langtry	4.34
Charlotte 5NNW	3.10	Pearsall	3.37
Derby - Frio River	3.10	Pearsall 10SE	3.70
Dilly	4.89	Pleasanton	3.51
Edna	3.48	Refugio 2NW	5.63
Falls City 7WSW	3.10	Refugio 3SW	5.11
Floresville	3.05	Rowe Ranch	3.54
Fowlerton	3.48	Speaks	3.30
Galveston CG	3.70	Tilden 4SSE	6.50
Goliad 1SE	3.01	Tilden 9S	3.30

Table 4. Preliminary forecast evaluation (heterogeneous sample) for Hurricane Claudette, 8-17 July 2003. Forecast errors (n mi) are followed by the number of forecasts in parentheses. Errors smaller than the NHC official forecast are shown in bold-face type. Verification includes the depression stage.

Forecast Technique	Forecast Period (h)						
	12	24	36	48	72	96	120
CLP5	43 (29)	89 (29)	145 (27)	191 (25)	262 (21)	334 (17)	381 (14)
A90E	40 (21)	77 (21)	135 (19)	174 (17)	221 (13)	220 (8)	368 (8)
A98E	43 (27)	79 (27)	127 (25)	159 (23)	208 (19)	245 (15)	347 (14)
A9UK	36 (14)	67 (14)	107 (13)	142 (12)	227 (10)		
LBAR	40 (27)	65 (27)	99 (25)	124 (23)	119 (19)	138 (15)	251 (14)
BAMS	44 (27)	77 (27)	110 (25)	142 (23)	235 (19)	356 (15)	443 (14)
BAMM	37 (27)	61 (27)	82 (25)	96 (23)	145 (19)	217 (15)	292 (14)
BAMD	43 (27)	73 (27)	104 (25)	118 (23)	146 (19)	209 (15)	335 (14)
COAI	25 (4)	42 (4)	99 (4)	177 (4)			
COAL*	30 (5)	49 (5)	63 (2)	116 (2)			
COEI	40 (22)	77 (22)	125 (20)	167 (19)			
COCE*	39 (14)	72 (14)	101 (14)	142 (13)			
AFII	80 (23)	168 (23)	270 (23)	358 (21)	499 (19)		
AFW1*	100 (13)	172 (13)	276 (12)	385 (11)	532 (10)		
GFNI	41 (26)	75 (26)	115 (24)	152 (22)	220 (18)		
GFDN*	40 (14)	67 (14)	106 (13)	146 (12)	213 (10)		
GFDI	32 (25)	56 (25)	86 (23)	119 (20)	163 (15)	226 (9)	273 (8)
GFDL*	43 (26)	64 (25)	87 (22)	122 (19)	160 (15)	191 (10)	289 (8)
UKMI	33 (26)	56 (26)	81 (24)	93 (21)	120 (18)	171 (14)	295 (10)
UKM*	42 (14)	59 (14)	79 (14)	88 (13)	93 (11)	163 (9)	262 (7)
NGPI	36 (29)	60 (29)	89 (27)	112 (25)	127 (21)	143 (14)	203 (12)
NGPS*	40 (29)	60 (29)	83 (28)	114 (26)	133 (22)	124 (14)	175 (12)
AVNI	38 (27)	65 (27)	92 (25)	120 (23)	188 (19)	249 (15)	299 (11)
AVNO*	43 (26)	66 (26)	93 (25)	122 (23)	180 (20)	229 (13)	275 (10)
AEMI	37 (18)	70 (18)	85 (16)	92 (15)	133 (13)		
AEMN*	58 (12)	80 (12)	103 (12)	119 (11)	133 (9)		
GUNS	29 (23)	48 (23)	73 (21)	88 (17)	110 (13)	136 (7)	177 (6)
GUNA	29 (23)	50 (23)	73 (21)	92 (17)	122 (13)	147 (7)	191 (6)
FSSE	34 (13)	59 (13)	82 (13)	103 (12)	135 (9)		
OFCL	36 (29)	62 (29)	93 (27)	118 (25)	147 (21)	156 (17)	155 (13)
OFCL	36 (30)	57 (30)	89 (28)	117 (26)	140 (22)	154 (18)	154 (14)
NHC Official (1993-2002 mean)	45 (2985)	81 (2726)	116 (2481)	150 (2230)	225 (1819)	282 (265)	374 (216)

* Output from these models was unavailable at time forecast issued.

Table 5. Watch and warning summary for Hurricane Claudette, 8-17 July 2003.

Date/Time (UTC)	Action	Location
8 / 2100	Tropical Storm Watch issued	Cayman Islands
8 / 2100	Tropical Storm Warning issued	Jamaica
9 / 0300	Tropical Storm Warning issued	Grand Cayman
9 / 1500	Hurricane Watch issued	Chetumal to Cabo Catoche, Mexico
9 / 2100	Tropical Storm Warning issued	Chetumal to Cabo Catoche, Mexico
10 / 0000	Tropical Storm Warning discontinued	Jamaica
10 / 1500	Hurricane Warning issued	Chetumal to Cabo Catoche, Mexico
10 / 1500	Tropical Storm Warning extended westward	Cabo Catoche to Campeche, Mexico
10 / 1500	Tropical Storm Warning issued	Belize City to Belize/Mexico Border
10 / 2100	Tropical Storm Warning extended westward	Progreso to Campeche, Mexico
10 / 2100	Hurricane Warning changed to Tropical Storm Warning	Chetumal to Progreso, Mexico
11 / 0300	All coastal watches/warnings discontinued	Cayman Islands
11 / 0300	Hurricane Warning changed to Tropical Storm Warning	Chetumal to Campeche, Mexico
11 / 0300	Tropical Storm Warning discontinued	Belize coast
11 / 1500	Tropical Storm Warning discontinued	West of Progreso, Mexico and south of Tulum, Mexico
11 / 2100	Tropical Storm Warning discontinued	Mexican coast
13 / 1500	Hurricane Watch issued	Rio San Fernando to US/MX border, Mexico, and Port O'Connor to Brownsville, Texas
14 / 0900	Tropical Storm Watch issued	Matagorda to High Island, Texas
14 / 0900	Hurricane Watch extended northward	Port O'Connor to Matagorda, Texas
14 / 1500	Hurricane Warning issued	Baffin Bay to San Luis Pass, Texas

14 / 1500	Tropical Storm Warning issued	San Luis Pass, Texas to Cameron, Louisiana
14 / 1500	Hurricane Watch discontinued	Rio San Fernando to US/MX border, Mexico
14 / 2100	Hurricane Warning extended northward	San Luis Pass to High Island, Texas
14 / 2100	Tropical Storm Warning extended eastward	Cameron to Intracoastal City, Louisiana
14 / 2100	Hurricane Warning modified	Baffin Bay to High Island
15 / 1500	Tropical Storm Warning discontinued	Louisiana coast
15 / 1500	Hurricane Watch discontinued	Brownsville to Baffin Bay, Texas
15 / 2100	Hurricane Warning changed to Tropical Storm Warning	Port Aransas to Freeport, Texas
15 / 2100	Tropical Storm Warning discontinued	East of Freeport, Texas and south of Port Aransas, Texas
16 / 0300	All coastal warnings discontinued	Texas coast

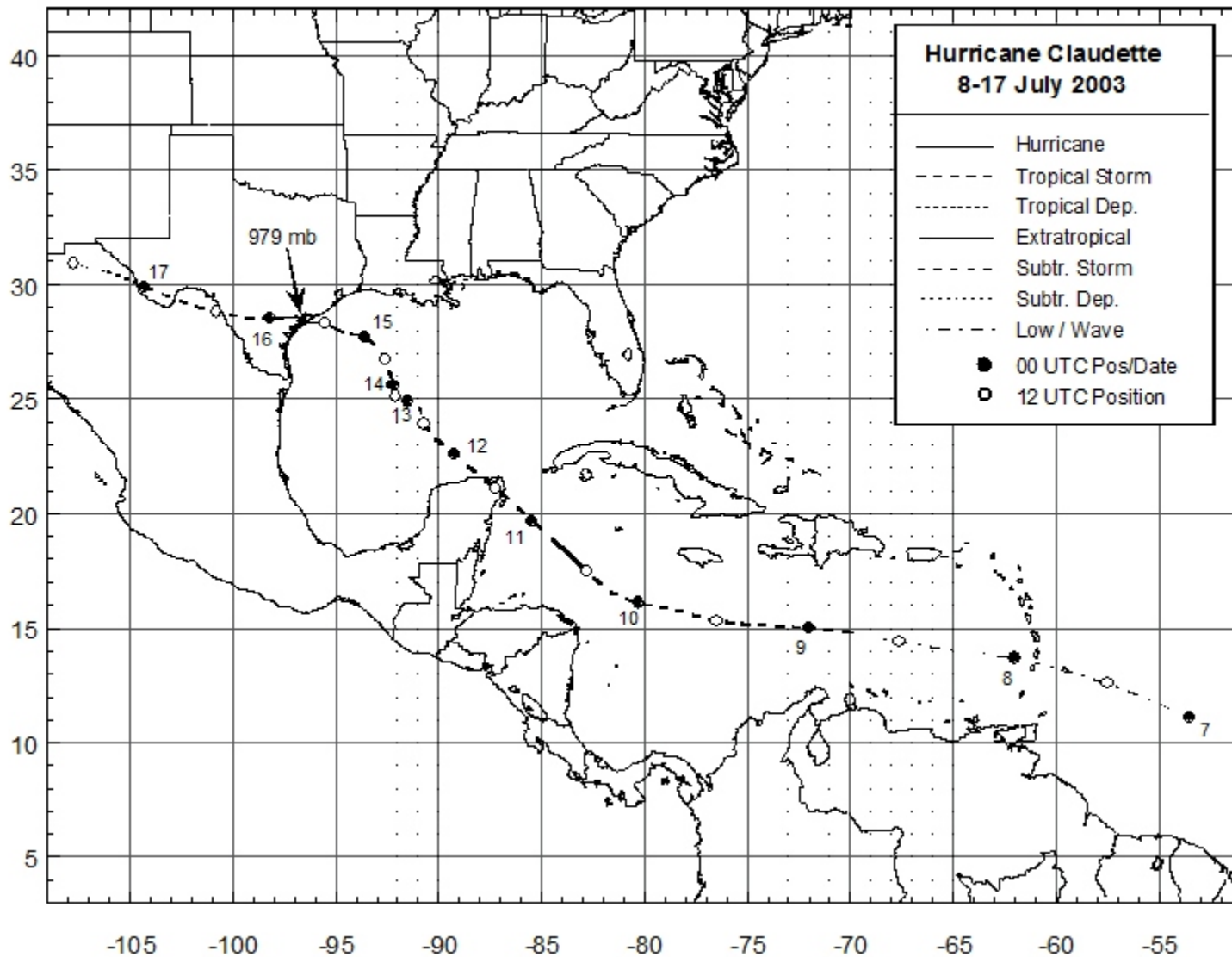


Figure 1. Best track positions for Hurricane Claudette, 8-17 July 2003.

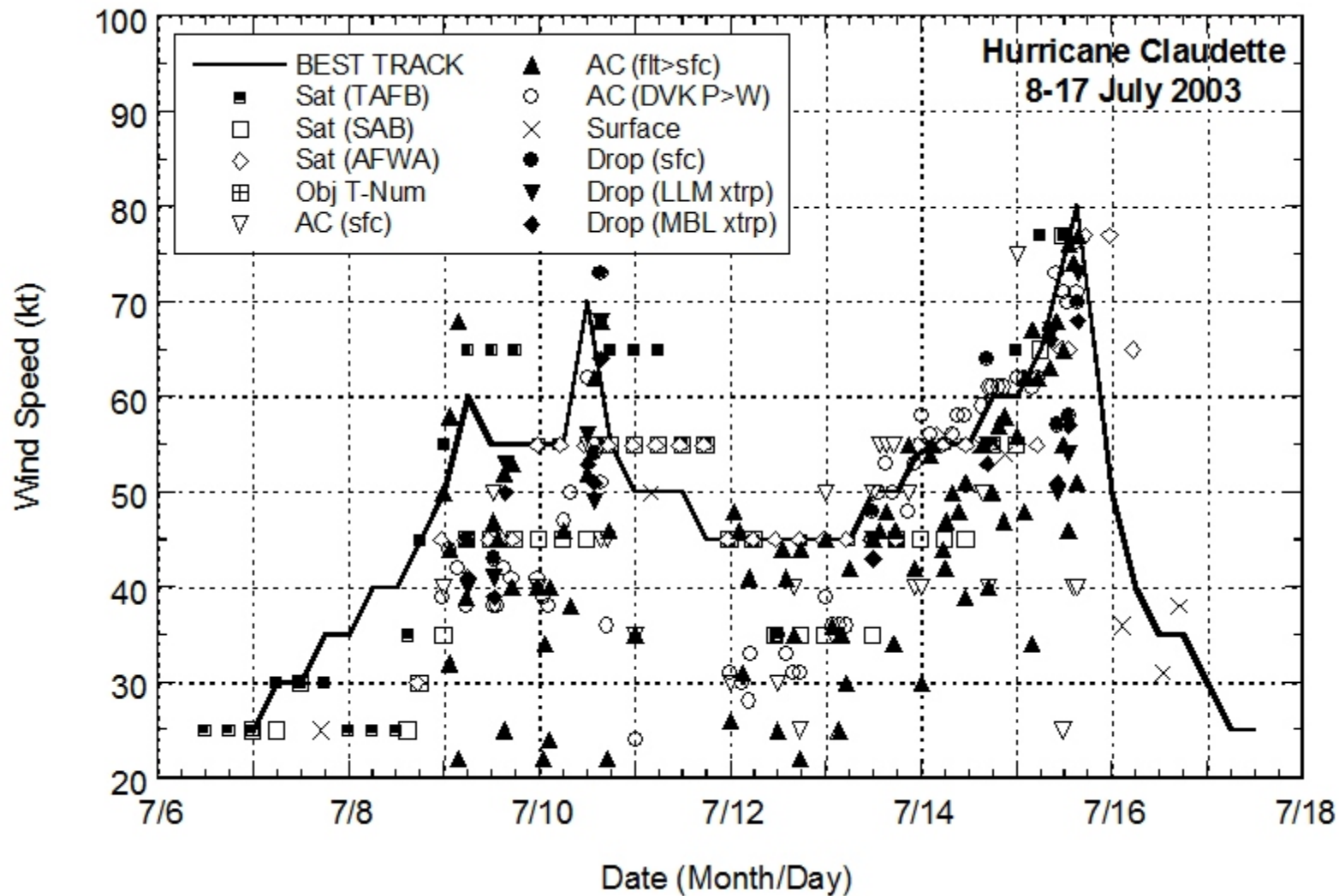


Figure 2.

Selected wind observations and best track maximum sustained surface wind speed curve for Hurricane Claudette, 8-17 July 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. Dropwindsonde observations include actual 10 m winds (sfc), as well as surface estimates derived from the mean wind over the lowest 150 m of the wind sounding (LLM), and from the sounding boundary layer mean (MBL).

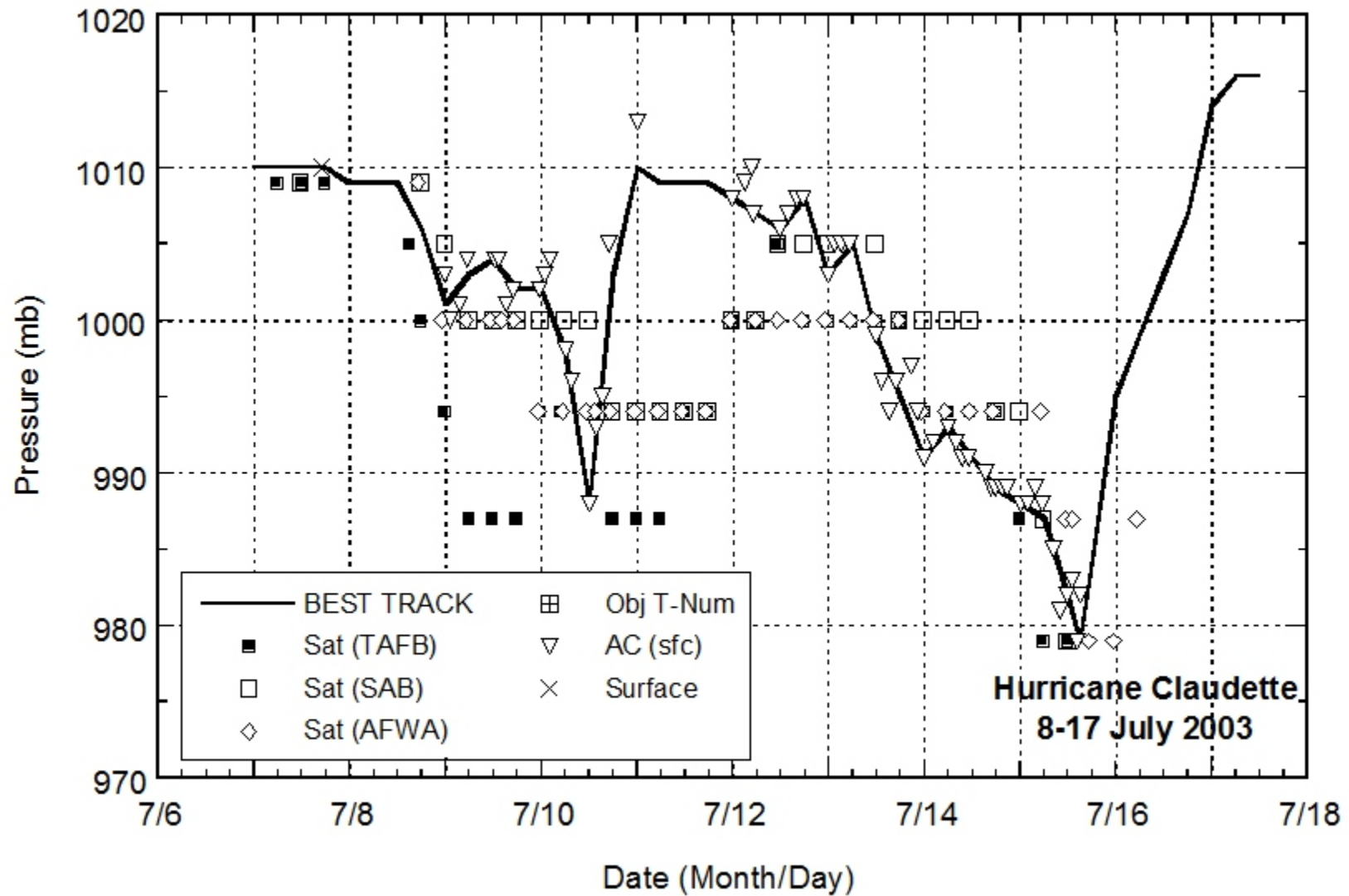


Figure 3. Selected pressure observations and best track minimum central pressure curve for Hurricane Claudette, 8-17 July 2003.