Atlantic Hurricane Season of 1983

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ABSTRACT

A general summary of the 1983 hurricane season is presented. Four named tropical cyclones were tracked during the season. Three landfalls occurred. Alicia, the first cyclone of the season, ended a three-year period during which no hurricanes reached the United States coastline.

1. Introduction

The hurricane season of 1983, with a total of only four named cyclones, becomes the least active season since 1930 when only two hurricanes occurred. Maximums or minimums always have a way of producing records and the 1983 season was no exception. This year became the first since 1871 that no tropical storm or hurricane formed south of latitude 25°N. Also, the two-year period (1982–83) became the first two consecutive years since 1871 in which no tropical storm or hurricane occurred in the Caribbean.

Even though there was one more hurricane (three) this year than in the 1982 season (two), this year produced a total of only five hurricane days compared to six last year, which gives this season the least number of hurricane days since 1931. For comparative purposes, the average number of hurricane days based upon a 30-year period (1948–77) is 26.

Alicia also became the first hurricane to have probabilities used in forecasting its landfall. The probabilities provided a measure of the forecast accuracies and are designed for government officials and industrial interests to use as guidance in their decision making processes. The first probabilities were issued when Alicia became a tropical storm, approximately 60 h before landfall. Highest probabilities were consistently assigned to Galveston throughout the duration of Alicia. The last probabilities issued 18–24 h prior to landfall indicated values in excess of 20% from Port Arthur to Corpus Christi with a maximum of 51% at Galveston (Sheets, 1984).

Finally, when Alicia crossed over the western end of Galveston Island on 18 August 1983, it was the first hurricane to strike the continental United States since Hurricane Allen moved over extreme south Texas on 10 August 1980. The three years and eight days between these strikes is the longest period since 1886 that the United States mainland has gone without a hurricane landfall.

Storm tracks and statistics for the 1983 season are given in Fig. 1 and Table 1.

2. Seasonal patterns

During the last two weeks of July, the season became active when two areas of disturbed weather, which had their origins in Africa, became tropical depressions near the Lesser Antilles. However, strong vertical wind shear destroyed their deep layer convection prior to attaining tropical storm intensity. This pattern ultimately became the "norm" for the entire season. Nearly 60 trackable systems moved off the west coast of Africa during the season only to be destroyed as they approached the Lesser Antilles. Therefore, the minimal tropical storm–hurricane activity cannot be blamed on lack of "seedlings."

A likely cause for the tranquil season may be the excessive vertical shear of the horizontal winds that occurred over the western tropical Atlantic and the Caribbean Sea during the middle of the hurricane season. Fig. 2 shows the area of maximum shear over the tropics during the period from 15 August to 15 September. Use of operational shear charts during the past decade at the National Hurricane Center has shown that anytime vertical shear of the horizontal winds approaches 8 m s^{-1}, tropical development is restricted. Take note that all four systems which did develop in 1983, did so in the area of minimum shear.

3. Storm summaries

a. Hurricane Alicia, 15–21 August

1) METEOROLOGICAL HISTORY

The system which was to become Hurricane Alicia formed on the extreme western end of a frontal trough which extended from the New England coast southwestward into the north central Gulf of Mexico. Surface synoptic observations and satellite pictures indicated that a mesoscale low-pressure area moved off the Mississippi and Alabama coasts on 14 August with the weak trough and was likely the precursor of the system which developed into Alicia. Surface pressures were

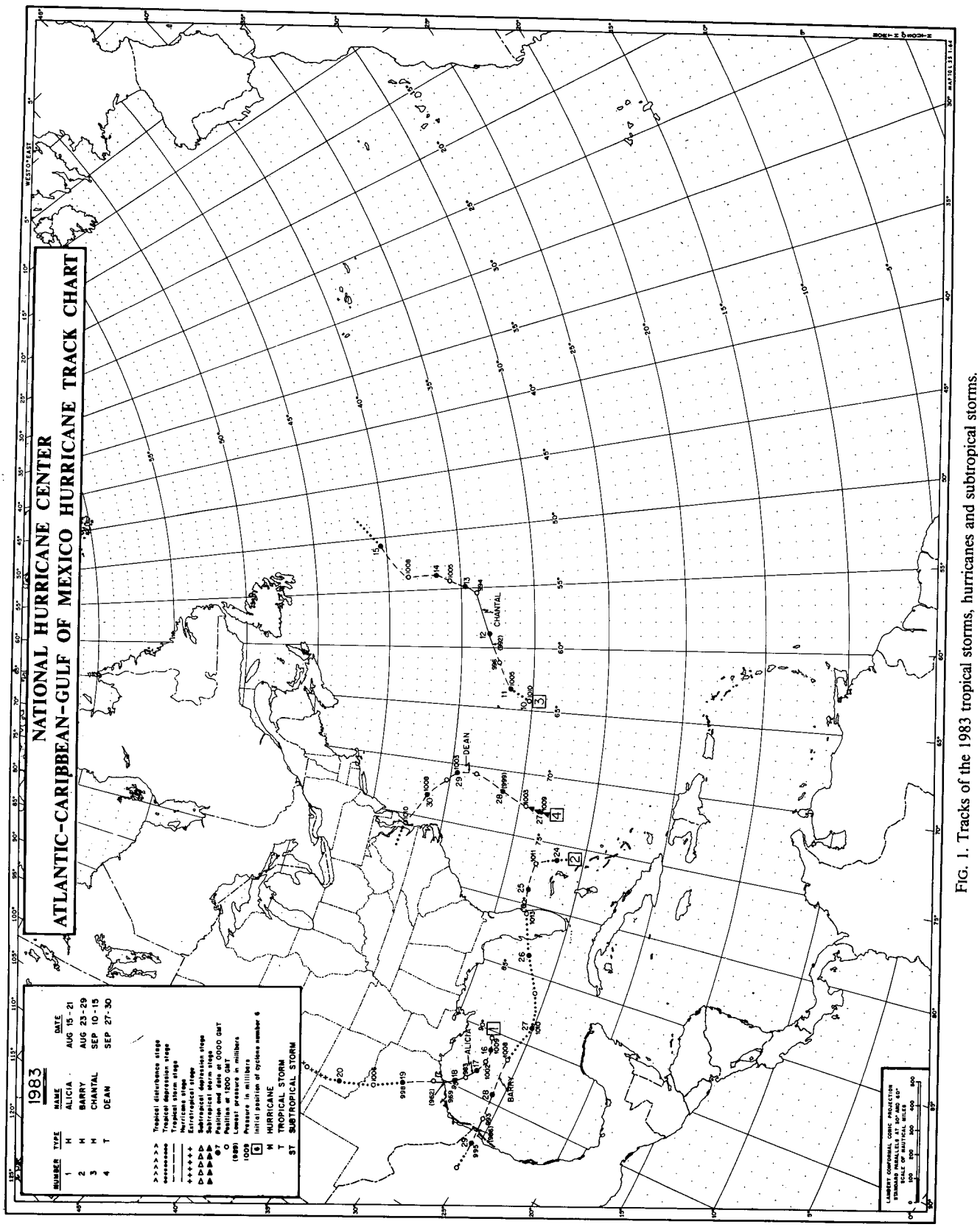

FIG. 1. Tracks of the 1983 tropical storms, hurricanes and subtropical storms.

TABLE 1. Summary of North Atlantic tropical and subtropical cyclone statistics, 1983.

Cyclone number	Name	Class*	Dates**	Maximum sustained wind*** ($m\ s^{-1}$)	Lowest pressure (kPa)	U.S. damage (millions of $)	Deaths
1	Alicia	H	15–21 Aug	52	96.2	2000	21
2	Barry	H	23–29 Aug	36	98.6		1
3	Chantal	H	10–15 Sep	34	99.2		
4	Dean	T	27–30 Sep	28	99.9		

* T—Tropical storm (winds 18–32 $m\ s^{-1}$). H—Hurricane (winds 33 $m\ s^{-1}$ or higher).
** The day starts at 0000 GMT.
*** Original values computed in knots and rounded off to nearest $m\ s^{-1}$.

high over the Gulf of Mexico and remained high during the early stages of the storm's development. Several ships located near the storm reported pressures of 101.5 to 101.6 kPa late on the 15th. However, during this time period Air Force reconnaissance found a central pressure of 100.4 kPa with surface winds estimated to be 21 $m\ s^{-1}$; therefore, the system was upgraded to a storm. With these high environmental pressures, the storm remained quite small and generated winds stronger than usually observed in storms with similar minimum central pressures.

The steering currents that the storm was embedded in were quite weak throughout most of Alicia's lifetime over the water. However, a ridge of high pressure was well established to the north of the storm and persisted until 17 August. Slight pressure rises were observed to the north of the storm center while some falls occurred along the Texas coast from 15 to 17 August. As a result, Alicia drifted toward the west through midday of 16 August and then took a turn toward the west-northwest. This track continued through the early morning hours of 18 August. Then as the ridge to the north receded toward the east, Alicia turned toward the north. During this period, an upper level anticyclone became well established over the system. This factor, combined with a slow movement over the warm

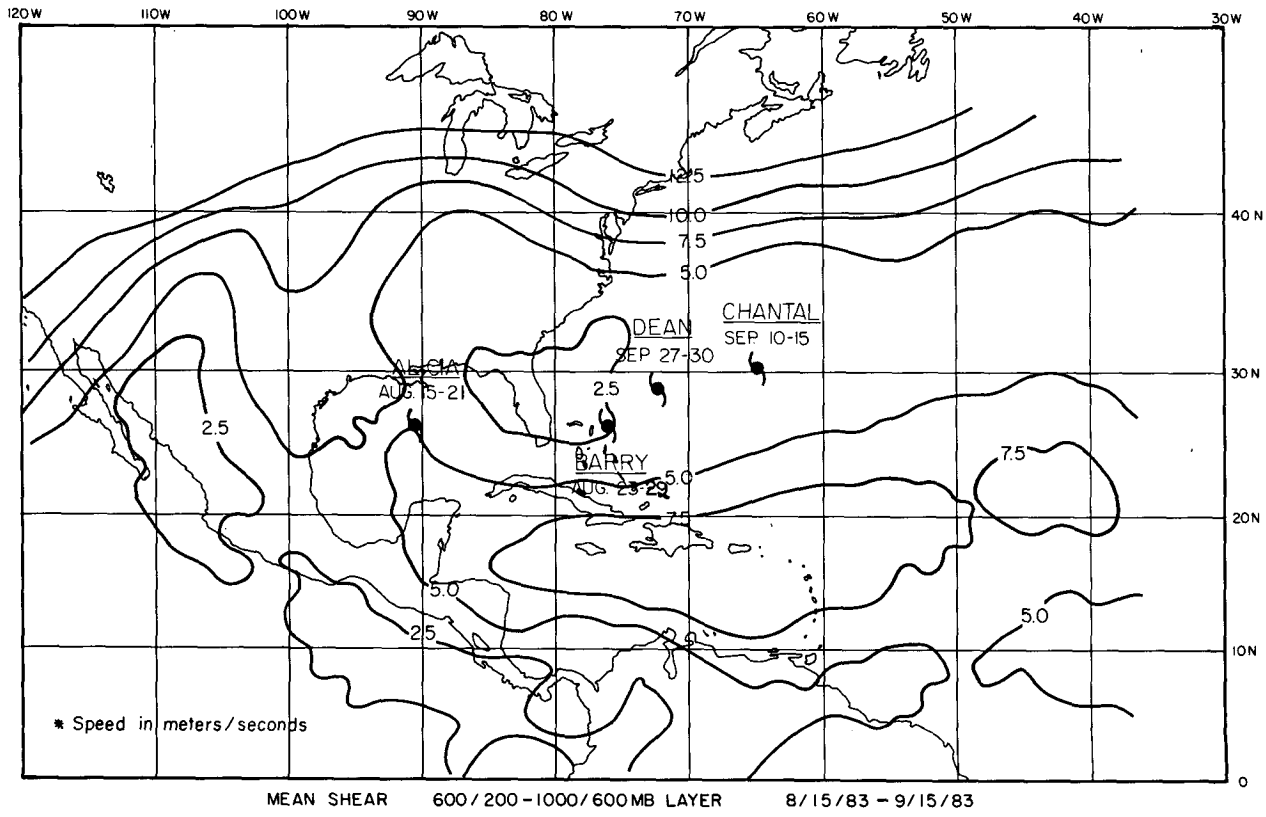

FIG. 2. Mean verticle shear of the horizontal winds over the western Atlantic basin from 15 August through 15 September.

Gulf waters (greater than 29°C), resulted in the hurricane deepening at a nearly steady rate of 0.1 kPa per hour over the 40-hour period prior to landfall. Alicia weakened rapidly after landfall, and accelerated toward the northwest across Texas then northward over western Oklahoma.

2) METEOROLOGICAL DATA, DEATHS, DAMAGE

By hurricane standards, Alicia was only a small to medium sized hurricane which reached minimum category 3 status at landfall, based upon the Saffir/Simpson scale. Fig. 3 shows Alicia located about 140 km south-southeast of Galveston. Central pressure at the time (1731 GMT 17 August) was 97.4 kPa. The center of Alicia moved over the coast about 40 km southwest of Galveston, Texas at 0800 GMT on 18 August. The minimum central pressure as determined by a NOAA reconnaissance aircraft at 0842 GMT was 96.2 kPa. The aircraft measured a wind at flight level (1.6 km) of 52 m s^{-1} along the coast 20 km east of Galveston at 0736 GMT. The wind measured 13 km south of Galveston at 0734 GMT at flight level was 37 m s^{-1}. The strongest reported wind on land was from Hobby Airport, located southeast of Houston, where personnel observed a maximum reading of 42 m s^{-1} with a gust to 48 m s^{-1}. Galveston, which remained just east of the eyewall, recorded a sustained wind of 35 m s^{-1} with a peak gust of 46 m s^{-1} at 0649 GMT. As the storm moved inland, its intensity decreased rather rapidly. Whereas Hobby Airport, southeast of Houston, reported winds of 42 m s^{-1}, the strongest winds at Houston International Airport, on the north side of Houston, were 23 m s^{-1}. As the storm moved farther inland, College Station reported winds of 18 m s^{-1}, while Waco had 13 m s^{-1} as the center passed just to the east. Fig. 4 shows the best track and wind field of Alicia.

Storm tides near the time of landfall ranged from about 0.6 near Corpus Christi to nearly 4 m on the west bay side of San Luis Pass and then down to a little more than a meter at Calcasieu Pass south of Lake Charles, Louisiana. In addition, storm tides in excess of 3 m were observed along the upper Galveston Bay in the Baytown area. Figure 4 also shows some high water marks as determined by the U.S. Army Corps of Engineers, debris lines and various tidegages.

Heavy rains, upward to 27.3 cm in Greens Bayou near State Highway 90, caused flooded conditions over many portions of the greater Galveston Bay area. Figure 5 shows an isohyetal analysis for the two-day period from 1200 GMT on 17 August to 1200 GMT on 19 August.

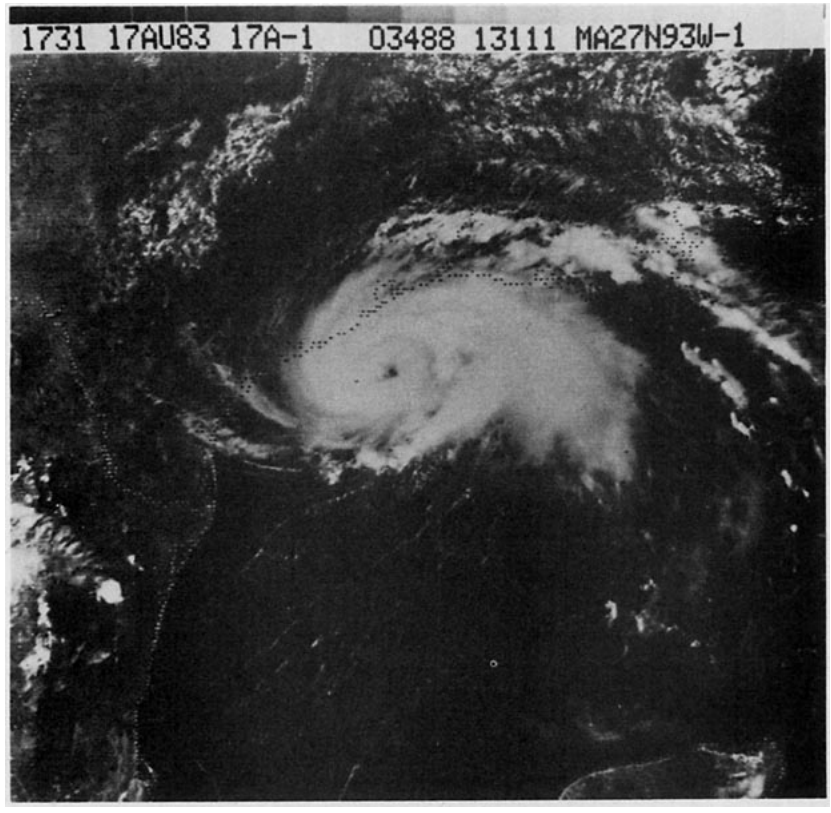

FIG. 3. GOES-East visible satellite picture of Hurricane Alicia at 1731 GMT 17 August 1983.

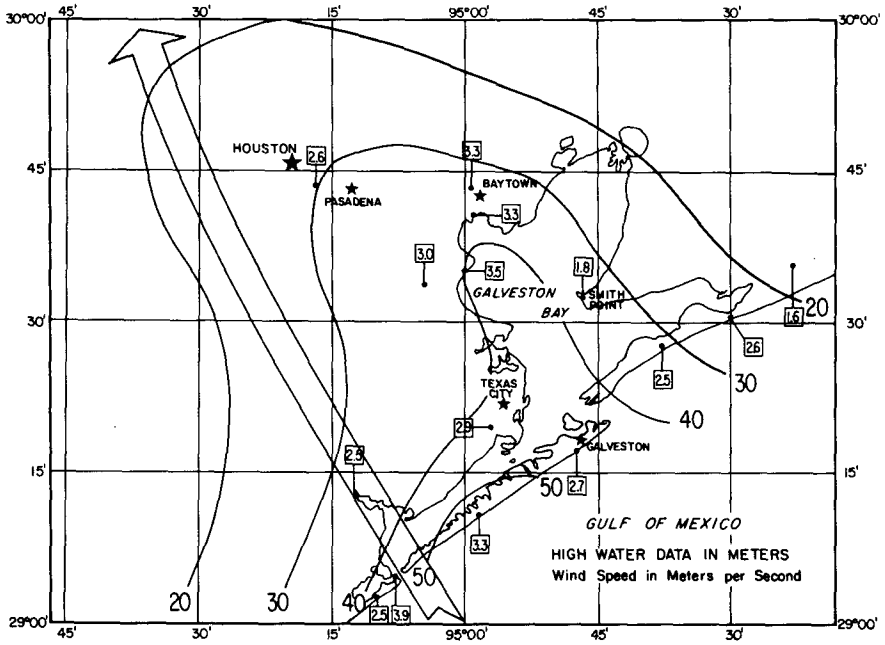

FIG. 4. Hurricane Alicia's best track, wind field (m s^{-1}) and heights of storm tides (m).

Twenty-three tornadoes were reported to the Severe Local Storms Forecast Center in Kansas City during Alicia. Fourteen reports were received between 1200 GMT August 17 and 1200 GMT August 18. The reported tornadoes were concentrated in the area south of Hobby Airport and north of Galveston. The other

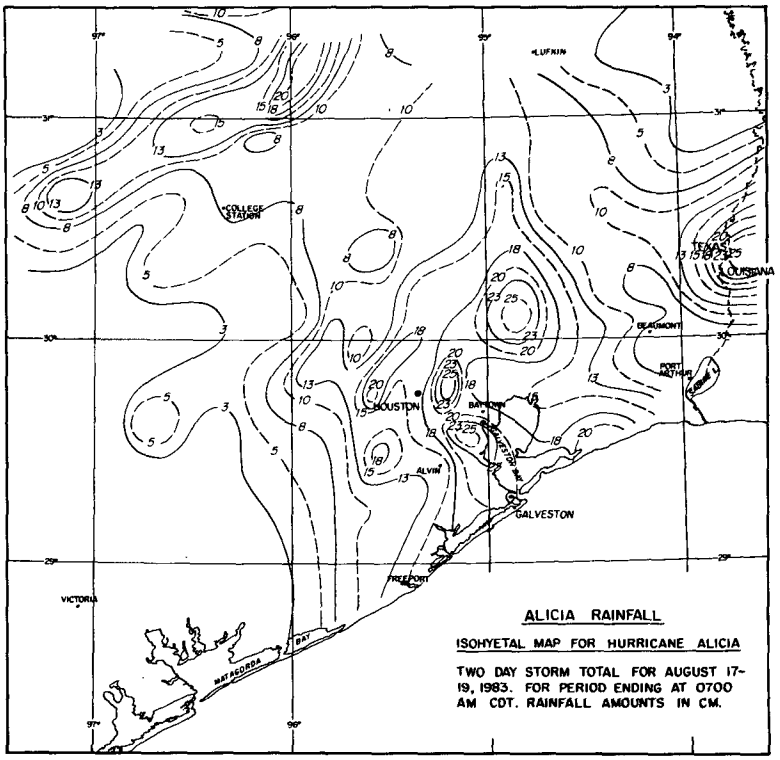

FIG. 5. Map of Hurricane Alicia rainfall (cm) from 1200 GMT 17 August to 1200 GMT 19 August 1983.

nine reports were received during the next 24 hours and were scattered over an area extending from north of Houston to Tyler, Texas. Information from the Weather Service Forecast Office in San Antonio, published in *Storm Data,* indicated that 22 of the tornadoes were verified (NOAA, 1983). Table 2 gives the meteorological data for Alicia.

Although Alicia was rather small in size and a minimal category 3 hurricane at landfall, it became the costliest in Texas history. The estimated total damage

TABLE 2. Meteorological data of Hurricane Alicia, 15–21 August 1983. Data are based on information available and may not represent extreme values which occurred.

		Pressure (kPa)		Wind ($m\ s^{-1}$)				Tide	Rainfall
Location	Date	Low	Time (GMT)	Fastest	Time (date/h)	Gust	Time date/h	Highest tide (m, MSL)	Storm total (cm)
Corpus Christi	18	100.98	0748	07	17/2150			0.61	00.0
Port O Connor	18	100.78	1550	13	1500			1.37	
Victoria	18	100.78	1050	08	18/1550				00.0
Freeport									
Dow plant A	18			27	18/0750	39	0820		18.75
Dow plant B	18			26	18/0740	42	0840		
West bay side San Luis Pass								3.85	
Galveston									
WSO	18	98.95	0800	35	18/0639	45	18/0649		19.71
Airport	18			27	18/0720	46	18/0640		
Pleasure Pier								2.64	
Pier 21 (bay)								1.71	
USCG Cutter *Buttonwood* (E End Gal Island)				43	18/1000	56	18/0730		
Alvin (NWS)	18	96.68	1025	22	18/0725	32	18/0750		14.30
Ellington AFB	18	98.34	1155	25	18/0755 and 1155	33	18/0755 and 1155		
Seabrook	18							3.45	
Baytown	18							3.24	17.04
Exxon	18			32	18/1500	45	18/0900		
Hobby Aprt	18			42	18/1300	48	18/1300		
Houston									
Intrnl	18	98.58	1348	23	18/1350	35	18/1350		
WSCMO	18			23	18/1353	35	18/1353		
College Station	18	99.63	1851	18	18/1638	22	18/1638		8.53
Waco	19	100.14	0152	13	18/2338	19			
Fort Worth	19	100.47	0201	14	19/0500	20	19/0149		
Wichita Falls	19	100.95	1500	08	19/1000				
Greens Bayou									27.31
Liberty									24.13
Centerville									20.96
Normangee									19.30
Mexia									19.00
Louisiana Lake Charles	18	101.12	1149	11	18/1621	18	18/1829		0.91
Calcasieu Pass								1.06	

of nearly $2 billion is the largest dollar damage ever recorded for a hurricane striking Texas. Carla then became the second most costly hurricane to strike Texas with an estimated 1983 dollar value of $1.8 billion. Carla was a much larger and more intense hurricane than Alicia, but Alicia struck a more populated area than Carla. If a hurricane the size and strength of Carla were to strike the same area today that Alicia did, the losses would be two to three times larger than those caused by Alicia. In any case, the losses caused by Alicia were staggering.

It is estimated that 21 people lost their lives as a result of the hurricane, 25 people were hospitalized, and 3094 were injured. There were 116 shelters opened and an estimated 21 227 people took refuge therein. Mass care services (primarily shelter or feeding) were given to 63 000 people and 17 000 families were assisted financially. There were 1209 houses, 633 apartments or condominiums and 455 mobile homes destroyed. There were 2308 houses, 419 apartments or condominiums and 281 mobile homes that received major damage. A total of 18 660 families were affected by these damages (American Red Cross, 1983). Total insured losses are estimated at $700 million by the American Insurance Association and the Federal Emergency Management Association reports that the total Federal disaster assistance was about $166 million.

b. Hurricane Barry, 23–29 August

Barry was the season's only named tropical cyclone that began from an African disturbance. The disturbance moved off the African coast on 13 August and showed little signs of development as it crossed the tropical Atlantic. By 22 August, as it approached the Bahamas, a weak trough caused the disturbance to turn toward the north where it came under an area of decreasing upper winds. By the evening of 23 August, the disturbance had developed into a depression located just east of the northern Bahamas. The depression quickly strengthened into Tropical Storm Barry during the night of 23 August. On the 24th, a surge of high pressure moved off the eastern United States coast and turned Barry toward the west. Strong upper level winds from the northeast also forced most of the heaviest convection associated with Barry to the southern semicircle of the storm, thus diminishing the storm's intensity (See Fig. 6). Barry was downgraded to a depression as the center reached the Florida coast just south of Melbourne on the morning of 25 August. After crossing central Florida, the depression, still under the influence of the strong upper level flow, moved toward the west-southwest. More favorable upper atmospheric conditions existed over the central Gulf of Mexico; therefore, by the time (1200 GMT 27 August) the depression reached the central Gulf, it had once again attained tropical storm strength. Thereafter, Barry returned to a westerly course and intensified to minimal hurricane strength just prior to making landfall on the upper Mexican coast 55 km south of Brownsville, Texas (Fig. 7).

As the storm approached Florida, environmental surface pressures surrounding Barry were unusually high. Minimum pressures reported by reconnaissance on 24 August were only 101.1 kPa, while at the same time, maximum winds of 25 m s^{-1} were measured just east of the center. Minimum pressures did not show any marked decrease until Barry moved into the western Gulf of Mexico on 27 August. Lowest pressure reported at landfall by Air Force reconnaissance was 98.6 kPa with maximum sustained winds of 36 m s^{-1}. A storm tide of slightly over 1 m was observed along the Mexican coast near where the center made landfall. Thousands of tourists on South Padre Island for the last big summer weekend were evacuated prior to Barry's landfall. But, tides of less than 1 m caused only minor beach erosion. Damage from Barry was estimated to be minimal in Florida and Texas. However, there was some structural damage and road washouts reported from Mexico.

c. Hurricane Chantal, 10–15 September

The disturbed weather which ultimately became Hurricane Chantal, began in a large envelope of low pressure centered about 200 km south of Bermuda. On the morning of 10 September, Air Force reconnaissance found a circulation with sustained winds of 13 m s^{-1} and a pressure of 101.0 kPa near latitude 30°N and longitude 64°W.

During the afternoon and evening hours of 10 September, the system slowly intensified and moved toward the northeast at less than 5 m s^{-1}. As the center passed within 160 km of Bermuda, it spread some cloudiness, a few showers and northeast winds of 8 m s^{-1} over the island. Late on the afternoon of 10 September, reconnaissance aircraft found that the depression had deepened to 100.6 kPa with winds of 18 m s^{-1} and the system was named Tropical Storm Chantal.

Chantal continued to intensify during the night and by the morning of 11 September, the final reconnaissance observation reported winds of 28 m s^{-1} with a central pressure of 99.6 kPa. Satellite pictures on 11 September showed that the storm gradually became isolated from adjacent frontal trough clouds, developed convective feeder bands, increased the amount of deep convection near the center and formed a weak cirrus outflow (see Fig. 8). Based upon the previous reconnaissance information from the morning flight and the continued improvement in the organization of the storm, Chantal was upgraded to a minimal hurricane with winds of 34 m s^{-1} that evening. However, in retrospect, hurricane status was most likely reached by 1800 GMT 11 September. Little change was observed in the hurricane during the next 24 hours. Thereafter (1800 GMT 12 September), Chantal's deep

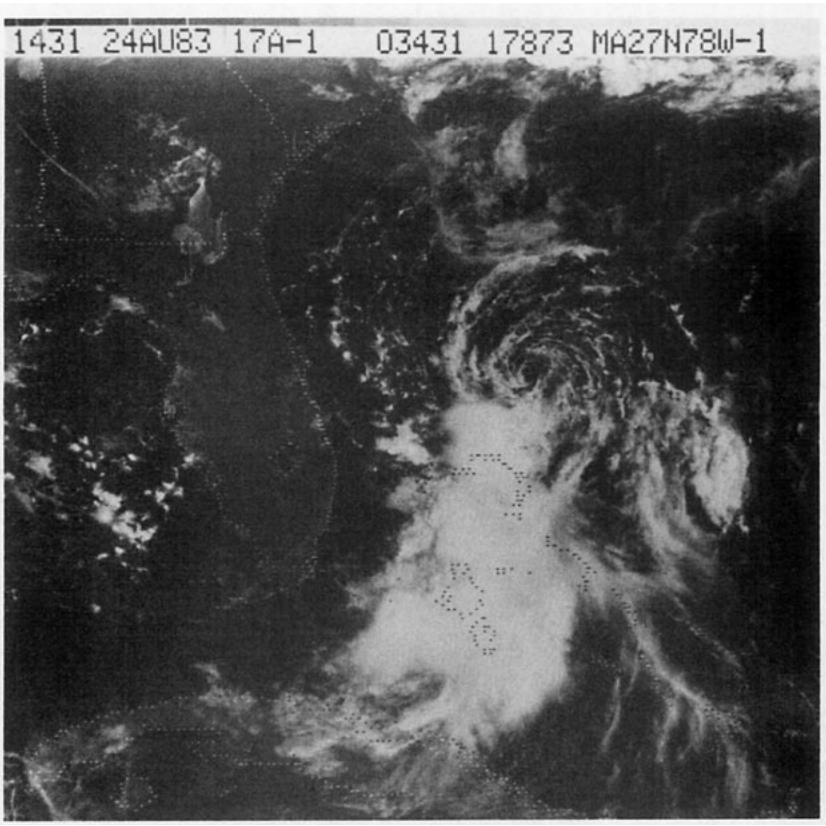

FIG. 6. GOES-East visible satellite picture of Tropical Storm Barry at 1431 GMT 17 August 1983.

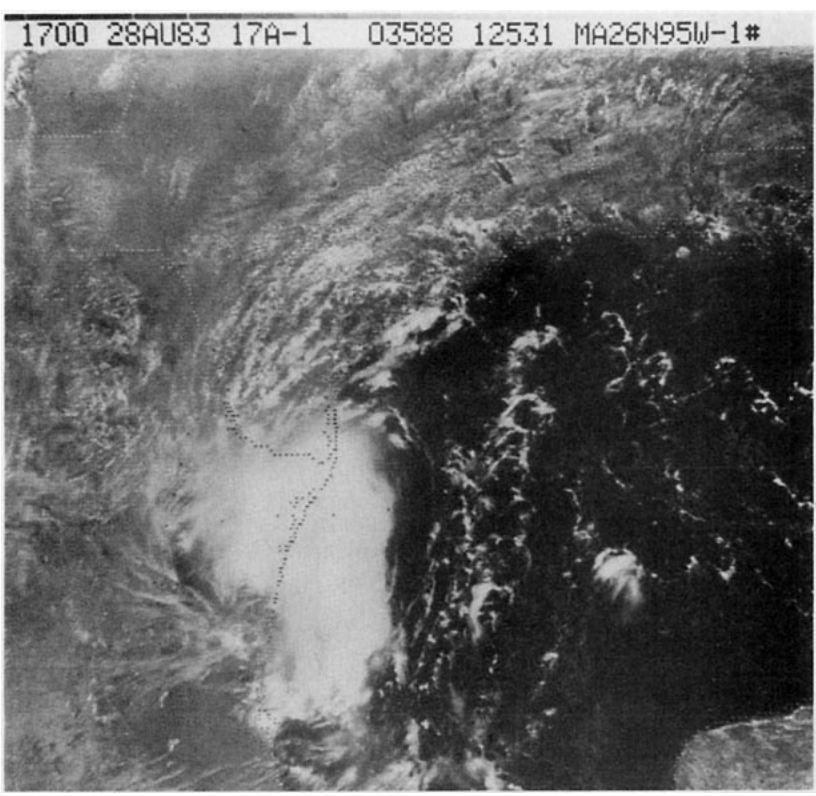

FIG. 7. GOES-East visible satellite picture of Tropical Storm Barry at 1700 GMT 28 August 1983.

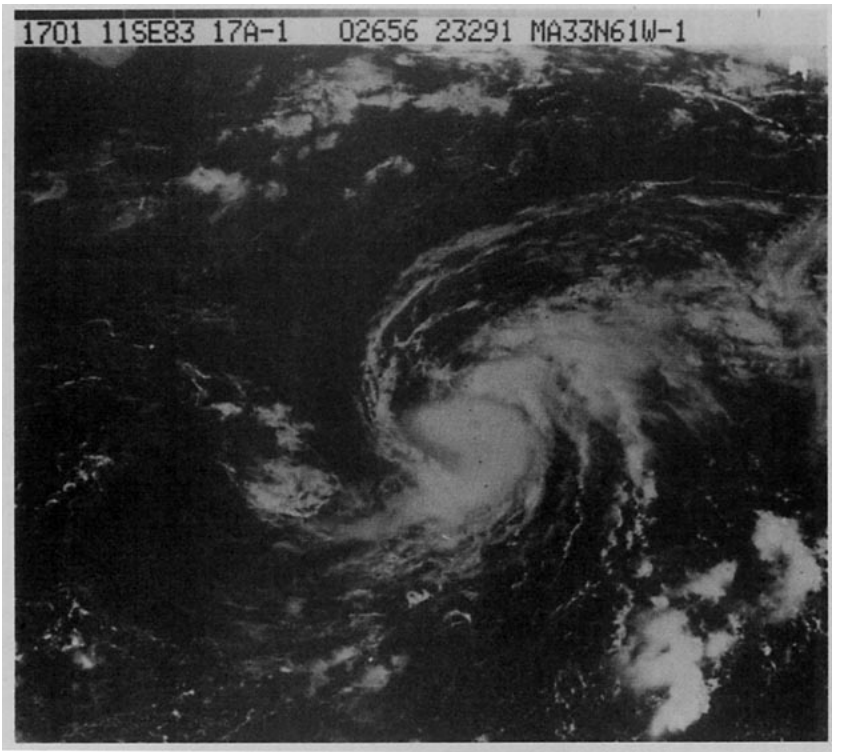

FIG. 8. GOES-East visible satellite picture of Hurricane Chantal at 1701 GMT 11 September 1983.

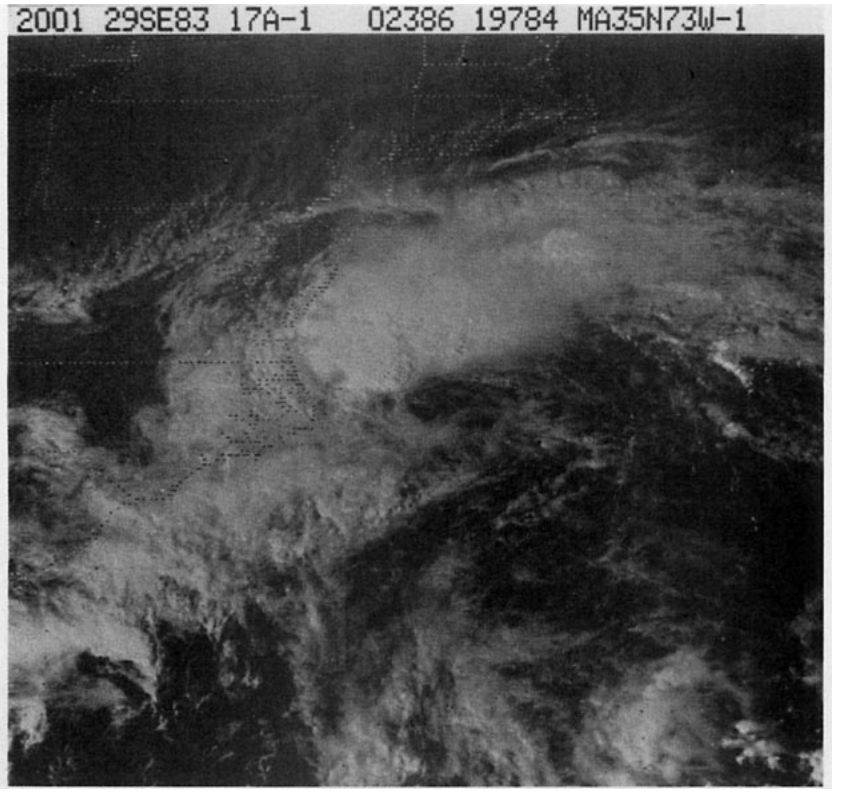

FIG. 9. GOES-East visible satellite picture of Tropical Storm Dean at 2001 GMT 29 September 1983.

convection became disorganized and it was downgraded to a tropical storm that evening. A major trough in the westerlies upstream from Chantal turned the storm toward the north on the 14th. As the trough filled and moved off as a short wave, Chantal was accelerated off to the northeast where its circulation was lost in a frontal system the night of the 14th.

d. Tropical Storm Dean, 27–30 September

Dean was a storm of subtropical origin that developed within a frontal cloud band that had moved off the east coast of the United States on 22 September. During the next few days, the frontal system became stationary and extended from the Bahama Islands northeastward beyond Bermuda. At the same time, a 103.5 kPa high pressure center settled over the northeastern United States, resulting in a strong surface pressure gradient and northeasterly winds to near gale force along portions of the eastern seaboard.

On 26 September, a low-level circulation developed within the frontal band approximately 750 km east of central Florida. On 27 September, an Air Force reconnaissance airplane found winds of 18 m s^{-1} and a central pressure of 99.9 kPa, which indicated the system was intensifying. In addition, satellite pictures showed that the storm's cloud structure was separating from the remainder of the frontal cloud band. This evidence supported the idea that the system was beginning to acquire tropical characteristics. Thus, Tropical Storm Dean was named late on 27 September while centered about 800 km east of Jacksonville, Florida and moving toward the north-northeast. Dean turned toward the northwest on 29 September, moved onshore across the Virginia eastern shore on 30 September and dissipated a few hours later. Evidence that this northwest turn would occur was provided by several objective track forecast techniques including the MFM, the LFM, the NHC73 and a U.S. Navy tropical cyclone model.

Dean was not a classical tropical storm. Figure 9 shows the disorganization associated with the storm as it approached the Virginia coast. Gale force winds were reported by numerous ships over a large area extending outward over 325 km from the storm's center. This was the result of the strong pressure gradient produced by the storm center in combination with the high pressure system to its north. Gale warnings were issued for the United States east coast from North Carolina to Rhode Island as the storm approached the coast. However, the effects of Dean were minimal and confined to minor beach erosion and flooding along portions of the mid-Atlantic coastal states.

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