

HURRICANE ALLEN

31 July - 11 August 1980

GENERAL

Hurricane Allen was the second most severe Atlantic hurricane in modern records and will long be remembered and studied. Allen was an unusual hurricane in a number of ways.

- 1) A Cape Verde hurricane is rarely observed so early in August.
- 2) The forward motion of Allen along most of its track was unusually fast ...close to 20 knots...except for a decrease in forward speed over the Gulf of Mexico, during the two days prior to landfall.
- 3) The rapid development of Allen east of the Lesser Antilles, while moving westward at more than 20 knots, was unusual although similar to Hurricane Flora in 1963.
- 4) The movement of Allen into the Caribbean, where strong westerly shear had prevailed, appeared likely to doom the hurricane. On the contrary, Allen used the strong shear to strengthen even further. The strong anticyclone in the upper atmosphere associated with Allen's outflow moved along with the same forward speed as Allen and converted the westerlies to southerlies. This helped accelerate the outflow and allowed the hurricane to reach record strength.
- 5) Allen reached the top of the Saffir-Simpson Scale (Category 5) three times. This event had not been observed before. It obtained the lowest pressure ever recorded in the eastern Caribbean...911 mb...on 5 August while south of Puerto Rico. After weakening near Haiti and Jamaica, Allen again strengthened and a record minimum pressure of 899 mb was recorded by a NOAA reconnaissance aircraft on 7 August. This is not only the lowest pressure ever observed in the western Caribbean, but the lowest ever observed by a reconnaissance aircraft in an Atlantic hurricane, and the second lowest ever recorded in the Atlantic, Caribbean and Gulf of Mexico according to modern records. Allen began losing strength for a second time as the center passed near the north coast of the Yucatan peninsula on 8 August. Regaining strength again over the open waters of the Gulf of Mexico, Allen's central pressure dropped to 909 mb as recorded by an Air Force reconnaissance aircraft on 9 August. This is the lowest pressure ever measured in the western Gulf of Mexico.
- 6) The center of Allen did not cross land at any location until it moved inland north of Brownsville, Texas. It did a remarkable job of 'broken field running' through the Caribbean at speeds of 15 to 20 knots. The eye passed between Barbados and St. Lucia, Haiti and Jamaica, and Cuba and Jamaica. It then passed north of the Cayman islands, and between Cuba and the Yucatan peninsula. Even after reaching the Texas coast, Allen hesitated long enough to weaken to 945 mb, and then moved inland north of Brownsville with the highest tides and winds over the least populated section of the Texas coast.

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METEOROLOGICAL HISTORY.

A disturbance moved off the northwest African coast on 30 July. By 1 August the second tropical depression of the season had developed when satellite pictures indicated the consolidation of two circulation centers within the large cloud mass of the African disturbance.

Allen rapidly reached tropical storm strength in the early morning hours of 2 August and hurricane strength that evening. By the time the first reconnaissance aircraft was able to penetrate the center during the afternoon of 3 August, Allen had winds of 110 knots and a minimum pressure of 967 mb. The pressure had dropped to 951 mb by that evening as the eye passed just north of Barbados and south of St. Lucia.

The hurricane continued westward into the Caribbean at 15 to 20 knots, reaching its first milestone when the minimum pressure fell to 911 mb south of Puerto Rico during the evening of 4 August.

As the large circulation of Allen began to spread over Hispaniola on 5 August, a turn toward the west northwest brought the center just south of Haiti's southwestern peninsula that evening. This same northward jog has been observed in a number of hurricanes, and may be due to pressure falls over Hispaniola as large heat releases occur in mountain cloudbursts. The hurricane weakened as its circulation interacted with mountainous terrain of Haiti and Jamaica.

Thereafter, Allen resumed a more westerly course passing just north of Jamaica and the Cayman Islands on 6 August. Central pressure began to fall rapidly again as the circulation moved over the warm waters of the northwestern Caribbean Sea. Allen's second milestone occurred on the afternoon of 7 August when a record breaking minimum pressure of 899 mb was observed in the Yucatan Channel.

When the southern portion of Allen's circulation moved over the Yucatan peninsula during the night of 7 August, the moist southerly inflow to the hurricane's center was cut off. The minimum pressure rose very rapidly again, reaching 961 mb on the morning of 8 August.

While the hurricane continued west northwest across the warm waters of the Gulf of Mexico, rapidly falling pressures resulted in the third milestone as a minimum pressure of 909 mb was observed the night of 8 August.

Allen's course through the Atlantic and Caribbean was controlled by a large, warm high pressure system covering the western Atlantic and southern United States. This system was nearly stationary and may have been partially reinforced by the warm outflow from Allen. As the hurricane moved into the Gulf of Mexico, general pressure falls began over the southern United States, indicating that Allen should begin slowing its rapid forward speed and possibly turn more toward the north.

The expected decrease in forward speed did not occur until Allen approached the Texas coast on 9 August. Even though the ridge over the southern states weakened markedly, its main effect was to slow Allen's forward speed. The western portion of the ridge did not retreat far enough to allow the hurricane to turn northward. This spared the heavily populated sections of the middle and upper Texas coast from storm surge up to 15 feet.

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After moving inland on 10 August, Allen continued slowly west northwest with winds diminishing rapidly as the circulation encountered the mountains of northern Mexico. By this time the major threat was flash floods in the mountains.

RECONNAISSANCE.

Reconnaissance flights by Air Force and NOAA crews were outstanding. There was a total of 72 center fixes made on Allen. Fifty-two were made by the Air Force and 20 by NOAA crews. Many of the flights were made under difficult circumstances. On a number of occasions, flights were made into Allen's circulation when it was very near the mountainous islands of the Caribbean, where areas of severe turbulence can develop.

Prior to landfall on the Texas coast, an Air Force plane made a fix each hour for 8 hours...most of them at night. Total flight time was well over 10 hours.

Record low pressures were measured by dropsonde for both the Caribbean and western Gulf of Mexico. During the NOAA aircraft flight when the record 899 mb was measured, the aircraft measured sustained flight level winds of 165 knots and estimated surface winds of 170 knots.

WATCHES AND WARNINGS

LOCATION	TYPE	EFFECTIVE	DISCONTINUED
The islands of Barbados, St. Vincent, St. Lucia, Dominica and Grenada.	Gale warnings and a hurricane watch.	8/3/1000Z	8/3/1900Z
Martinique and Guadeloupe.	Gale warnings and a hurricane watch.	8/3/1300Z	8/3/1900Z
Antigua.	Gale warnings.	8/3/1600Z	8/4/1600Z
Barbados, St. Vincent, St. Lucia, Martinique and Dominica.	Hurricane warnings.	8/3/1900Z	8/4/1600Z
Southeast Dominican Republic.	Hurricane watch.	8/4/1600Z	8/5/1600Z
Southwest Peninsula of Haiti.	Hurricane watch.	8/4/1600Z	8/5/1300Z
Southern Dominican Republic.	Gale warnings.	8/5/0400Z	8/6/0400Z
Southern Haiti	Gale warnings.	8/5/0400Z	8/5/1600Z
Jamaica.	Hurricane watch.	8/5/1000Z	8/5/1600Z
Southwest peninsula of Haiti.	Hurricane warnings.	8/5/1600Z	8/6/1000Z

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LOCATION	TYPE	EFFECTIVE	DISCONTINUED
Jamaica.	Hurricane warnings.	8/5/1600Z	8/6/2200Z
Cayman Islands.	Hurricane watch.	8/5/2200Z	8/6/1000Z
Cayman Islands	Hurricane warnings.	8/6/1000Z	8/6/2200Z
Northeast Yucatan peninsula.	Hurricane warnings.	8/6/1900Z	8/8/1000Z
Florida Keys	Gale warnings.	8/7/0100Z	8/8/0830Z
Northeast Mexican Coast.	Hurricane watch.	8/8/1000Z	8/9/1400Z
Texas coast.	Hurricane watch.	8/8/1000Z	8/9/2200Z
Brownsville to High Island, Texas.	Hurricane warnings.	8/8/1600Z	8/9/2200Z Freeport northward 8/10/2200Z south of Freeport
East of High Island to Vermilion Bay, Louisiana	Gale warnings and a hurricane watch.	8/8/1600Z	8/9/2200Z
Northeast Mexico.	Hurricane warnings.	8/9/1400Z	8/10/2200Z
Freeport to High Island, Texas	Change hurricane warnings to gale warnings.	8/9/2200Z	8/10/2200Z
East of High Island to Vermilion Bay.	Discontinue hurricane watch.	8/9/2200Z	
South of Freeport to Brownsville.	Change hurricane warnings to gale warnings.	8/10/2200Z	8/11/1000Z

FORECAST AND WARNING EVALUATION

The issuance of hurricane warnings, gale warnings, and hurricane watches were for the most part timely and specific. The hurricane warning for Barbados and St. Lucia gave rather short notice, since Allen was not upgraded to a hurricane until afternoon, when first reconnaissance reports indicated hurricane force winds less than 150 miles east of Barbados.

Official track forecasts were verified against the estimated synoptic time locations (this is not the best track, and these are not official verifications). Errors were approximately 40, 75, 185, and 290 miles for 12, 24, 48, and 72 hours, respectively. This compares to long term averages of 60, 120, 240, and 360 mile errors for the same time period.

OBJECTIVE GUIDANCE
SEE ATTACHED

STORM SURGE FORECASTS AND OBSERVATIONS

The SPLASH I (Special Program to List the Amplitude of Surges from Hurricanes) Storm surge model is the official guidance for the high water portion of the hurricane landfall forecast. Splash I is a Dynamic Model which numerically integrates the linearized shallow water equations on the IBM/360/195 computer at the National Meteorological Center. The program produces a printout showing the predicted storm surge envelope along the coastline. The usefulness of SPLASH I forecasts depends on accurate forecasts of input parameters such as storm intensity and size, speed of motion, and landfall point.

On 8 August SPLASH I runs were made for the Texas coast based on a 930 mb hurricane which gave a forecast maximum storm surge ranging from near 8 feet at Brownsville to 18 feet at Galveston. However, late that evening reconnaissance indicated Allen was again deepening and reached 909 mb during the night. SPLASH I runs were made using pressure values of 910 mb and 890 mb. This produced a forecast maximum storm surge of 16 to 20 feet where the center reached the coast. The forecast 10 to 15 feet maximum storm surge carried in the earlier advisories was then adjusted upward to 15 to 20 feet on the morning of 9 August.

Subsequently, the hurricane weakened with a decrease in forward speed as it approached the lower Texas coast during the evening of 9 August. Allen was apparently headed for the lower Texas coast where storm surges are normally much lower than on the upper Texas coast. SPLASH I using a minimum pressure adjusted to 920 mb and a slower forward speed, produced a storm tide of less than 10 feet for landfall. After reconnaissance reports indicated Allen had a large radius of maximum winds, the SPLASH I was rerun with the larger radius producing approximately 15 feet of storm surge. This figure was used for maximum storm surge in advisories prior to landfall. From visual estimates the following have been obtained. (Values with respect to MSL.)

- 8 to 9 feet inside Bay at Port Isabel.
- 8 to 10 feet on Gulf side of South Padre Island.
- 12 feet at Port Mansfield on Laguna Madre.
- 7.5 feet at City of Corpus Christi.
- 7.5 feet at Aransas Pass.
- 7.0 feet at Rockport.
- 5 to 7 feet along the Gulf coast near Galveston

METEOROLOGICAL STATISTICS, DEATHS, AND DAMAGE.

- A) Northern Windward and southern Leeward Islands strongest winds were on the north coast of Barbados and the south coast of St. Lucia. Heavy rains caused flash flooding on St. Lucia. Preliminary damage estimates in Barbados total \$1.5 million. About 500 houses were damaged or destroyed. There were no reports of deaths. Eighteen people were killed on St. Lucia which sustained heavy damage. The only other death reported in the Islands was on Guadeloupe. Except for Barbados, preliminary

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damage reports have not been received from the Lesser Antilles.

B) HAITI AND JAMAICA.

Allen passed a short distance south of the extreme southwest coast of Haiti producing extensive damage from winds and flash floods. Two hundred twenty people were reported killed and 835,000 left homeless. Damage was estimated to be more than 400 million dollars. About one half of the nation's coffee crop was destroyed.

There was extensive damage along the immediate northeast coast of Jamaica, but only minor damage elsewhere. Eight people were reported killed. Damage figures for the Island have not been received.

C) CUBA AND THE CAYMAN ISLANDS.

There were no reports of significant damage from Cuba although 3 people died. Allen passed north of Cayman Islands but Cayman Brac was raked by winds in excess of 100 knots and sustained considerable property damage, but no casualties.

D) MEXICO (YUCATAN AND NORTHEAST GULF COAST)

No reports of significant damage have been received from Mexico. The extreme northeast coast of the Yucatan peninsula was very near the center of Allen but remained on the weak side. The northeast Mexican Gulf coast was also on the weak side. Both of these areas are sparsely populated.

E) UNITED STATES.

Allen did only a fraction of the damage that had been feared, because it weakened just prior to reaching the coast, and its path sent the highest storm surge and strongest winds over the sparsely populated coastal section between Brownsville and Corpus Christi, Texas. There were only two deaths directly attributed to Allen, and these were drownings in the Corpus Christi area. The reported indirect deaths were: 13 in an oil company evacuation helicopter which crashed while taking workmen from the Louisiana offshore oil rigs. Four in an offshore oil rig collapse off the Louisiana coast, three fishermen swept off the jetties by large swells in the Galveston area, and two victims of heart attacks. There were also several deaths in automobile accidents during the period of evacuation. Estimated total damage caused by high tides, strong winds, flooding and tornadoes was \$600 million in Texas.

The major damage in Louisiana was the destruction of two \$30 million oil drilling platforms and damage to other platforms off the Louisiana coast. It has been calculated that nearly a half million people evacuated the coastal sections of Texas and Louisiana.

While Allen was passing south of Cuba winds of gale force swept the Lower Florida Keys. However, there was no significant damage.

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Tides reached levels of 3 to 5 feet above normal along the upper Texas and western Louisiana coasts, with higher levels in the area of maximum storm surge from Corpus Christi southward. There is no way of estimating the maximum storm surge, since it occurred over the unpopulated section of Padre Island between Brownsville and Corpus Christi. A survey by aircraft the day after Allen moved inland showed numerous cuts and wash-outs over a 50 mile stretch of Padre Island north of where the center moved inland. It is believed so much water crossed the Island that water levels in the Laguna Madre were much higher than might be expected. Some of the reported levels of storm surge can be found in an earlier section of this report.

The strongest measured winds were 120 knot gusts at Port Mansfield on the west side of Laguna Madre about 40 miles north of Brownsville. The peak gust was only 68 knots at Brownsville Airport. An oil rig 50 miles east of Brownsville recorded 120 knot sustained winds. Elsewhere, gusts to 80 knots occurred at Corpus Christi Airport and 95 knots at nearby Aransas Pass.

Rainfall of 10 to 15 inches fell over south Texas along the track of Allen for up to 150 miles north and 50 miles south of the center (See attached map). More than 16 inches was measured at Falfurrias, and over 15 inches at Raymondville and Alice. As the remnants of Allen moved through northern Mexico, orographic lifting produced 5 to 10 inch rains north of Del Rio. Dryden, Texas recorded over 10 inches. The satellite interpretation method for rainfall estimates, developed by Woodley and Griffith, was quite successful with Allen. Twenty four hours prior to landfall this system indicated a maximum rainfall of 16 inches.

There were at least a dozen tornadoes reported around south and central Texas. Two were confirmed in Brownsville which damaged 30 houses. More than 8 tornadoes were observed over inland areas west and north of Corpus Christi. The only significant damage was in Bishop where several businesses sustained heavy damage and part of the high school roof was blown off. Tornadoes in central Texas injured about 20 people at a campground near San Marcus and caused an estimated \$50 million damage at the Austin Airport, primarily to hangars and corporate jets.

PRELIMINARY BEST TRACK

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31 July - 11 Aug. 1980

DATE	TIME (GMT)	POSITION		PRESSURE (MB)	WIND (KT)	STAGE
		LATITUDE	LONGITUDE			
7/31	0000					
	0600					
	1200	11.0	30.0		25	Disturbance
8/01	1800	10.9	32.2			
	0000	10.8	34.3	1010	30	Depression
	0600	10.7	36.4	1009	30	
	1200	10.7	38.6	1008	30	
8/02	1800	10.7	40.7	1006	30	
	0000	11.0	42.8	1005	35	Tropical storm
	0600	11.4	44.8	1000	45	
	1200	11.9	46.9	995	55	
8/03	1800	12.3	49.1	990	60	
	0000	12.4	51.4	985	65	Hurricane
	0600	12.6	53.6	980	70	
	1200	12.8	55.6	975	80	
8/04	1800	12.9	57.5	965	95	
	0000	13.3	59.1	950	110	
	0600	13.6	61.0	948	115	
	1200	14.0	63.0	945	125	
8/05	1800	14.4	64.9	930	130	
	0000	14.8	66.7	911	140	
	0600	15.4	68.6	916	145	
	1200	15.9	70.5	932	155	
8/06	1800	16.5	72.3	940	150	
	0000	17.8	73.8	945	140	
	0600	18.3	75.9	955	115	
	1200	19.2	78.0	955	115	
8/07	1800	20.0	80.1	955	125	
	0000	20.1	81.9	945	135	
	0600	20.4	83.6	935	145	
	1200	21.0	84.8	910	155	
8/08	1800	21.8	86.4	899	165	
	0000	22.2	87.9	920	155	
	0600	22.8	89.2	945	130	
	1200	23.4	90.5	960	115	
8/09	1800	23.9	91.8	940	130	
	0000	24.5	93.0	912	145	
	0600	25.0	94.2	909	155	
	1200	25.2	95.4	916	140	
8/10	1800	25.4	96.1	925	125	
	0000	25.8	96.8	935	110	
	0600	26.1	97.2	945	100	Landfall
	1200	26.7	98.1	960	85	
8/11	1800	27.3	99.0	970	70	
	0000	27.7	99.8	990	60	Tropical Storm
	0600	28.0	100.9	1000	45	
	1200	28.5	101.9	1005	30	Depression
	1800	28.9	102.9	1008	30	

