PRELIMINARY REPORT CELIA

Hurricane Celia with an estimated 400 million dollars in property and crop damage has the distinction of being the costliest storm to ever strike the Texas coast. Even though Celia cannot be classified meteorologically as a great hurricane in terms of size and intensity, and must be ranked below many other Gulf hurricanes including such recent giants as Camille, Beulah, Carla, and Audrey, it inflicted a staggering blow to persons living around the Nueces and Corpus Christi bays. Measured in terms of total deaths, Celia ranks far below such disasterous storms as the Galveston hurricane of 1900 and even in the Coastal Bend region, the 1919 hurricane claimed 284 lives in Corpus Christi, yet explosive construction along exposed coastal areas in recent years makes any metropolitan community susceptible to excessive property damage. The Corpus Christi/Aransas Pass area is a prime example of this unfortunate modern day truth.

The disturbance that initiated Celia originated over Africa. On July 23 Dakar reported shifting winds of 40 kts at 10,000 ft indicating the passage of a tropical wave. The system traversed the Atlantic with an abnormally fast forward speed of 20 to 25 mph requiring only 5 days to reach the Antilles. Middle troposopheric winds in excess of 50 kts were registered at Guadaloupe and San Juan associated with the disturbance. The wave tracked rapidly westward across the eastern Caribbean on the 28th arriving in the central Caribbean at a time when pressures were falling rapidly over the southeastern U. S.

eroding the subtropical ridge. This resulted in a marked deceleration of the disturbance and permitted a closed wind circulation to organize between Swan Island and the Cayman Islands on the 30th.

The depression intensified as it moved north northwestward towards the western tip of Cuba during the night of the 30th. A recon plane reconnoitering the depression on the morning of the 31st reported a radar eye off the west coast of the Isle of Pines, but could not complete the reconnaissance to the intensity because of the close proximity to Cuba.

The strong depression moved across extreme western Cuba during the evening of the 31st with the center passing just east of Cape San Antonio. Cape San Antonio recorded a minimum pressure of 1007 mb and this is believed to be very close to the pressure at the center representing a reliable guage of the depression strength. Although, we have no evidence that sustained winds attained gale force before the circulation moved over Cuba, gusts of 40 to 45 kts raked the western provinces, the Isle of Pines and the Cayman Islands.

The first victims attributed to the storm were claimed in Cuba where 4 persons drowned due to flooding from heavy rains. One man was electrocuted when he tried to retrive a downed power line making a total of 5 deaths in Cuba.

Emerging from Cuba during the night of the 31st, the depression began feeding on the warm waters of the Gulf of Mexico and an early morning Air Force reconnaissance flight on August found winds of tropical storm intensity. Cloud motions determined from time lapse motion pictures made from ATS satellite photographs received at the

National Hurricane Center indicated the storm was becoming much better organized during the day. This was confirmed in the late afternoon when a recon plane reported a central pressure of 965 mb (28.50 inches) and 115 mph winds. However, the intensification was temporary and by the morning of the 2nd, winds had decreased to 90 mph and the central pressure risen to 986 mb.

From the time of formation, Celia swirled on a steady west northwest course aimed at the Corpus Christi area like a wild beast stalking its prey seemly oblivious to minor changes in the steering currents. As a matter of fact, Celia was one of the best behaved storms in recent years from the standpoint of motion. The remarkable presistent track was devoid of rapid fluxuations in either speed or direction making this a relatively easy storm to predict as evident from the excellent verification figures. The 12-hour and 24-hour vector errors were 38.3 and 64.0 nautical miles respectively as compared with the long term mean 24-hour vector error of slightly over 100 miles.

Another important reason for the absence of significant tracking problems was the excellent information provided by both the Air Force and Navy flight crews and by the coastal radars. The center positions provided by radar observers in Brownsville, Victoria, and Galveston were in remarkable agreement and the locations determined on reconnaissence flights of both the Navy and Air Force were some of the most consistent ever observed.

The major forecast problem concerned intensification. The sudden and explosive deepening of 39 mb during the 15 hour period prior to landfall was not anticipated. Conditions in the upper troposphere,

eventhough not unfavorable for some intensification, were not considered conducive to rapid intensification. Looking back, the key probably rests with the changes that occured in the low level inflow feeding the storm. On the 2nd, a weak high pressure system existed over Texas with a rather strong north/south pressure gradient over the Gulf of Mexico that was evacuating significant mass from the west and southwest sectors of Celia. Subtle pressure falls over Texas and rises over southeastern U. S. during the 2nd reversed this trend with a decrease of mass outflow in the western semicircle and increased inflow of warm moist air over the eastern portions of the storm on August 3. Unfortunately this change was not correctly assessed and warnings of stronger winds were somewhat late in coming.

After moving inland over Texas, Celia maintained strength for an unusually long time. Normally, small storms break up quite rapidly but not so with Celia. Locally damaging winds from thundersqualls were reported as far inland as Del Rio and Sanderson in southwest Texas.

The posting of warnings presented no serious problems. However, objective steering techniques continually predicted landfall to the north of Corpus Christi. The initial warnings reflected this influence, a hurricane watch being issued for Corpus Christi to Morgan City, with specific hurricane warnings being posted between Palacio and Port Arthur at 1100 CDT on August 2. Hurricane warnings were shifted southward to Rockport at 5 pm CDT with the final adjustment to Corpus Christi at 5 am CDT on the morning of the 3rd. The 5 am CDT advisory on August 3 called for 90 mph winds. At 11 am winds were increased to 115 mph in accord with the intensification observed by reconnaissance aircraft, and at 5 pm to 120 mph.

Celia was a unique hurricane meteorologically in that most of the damage occured in conjunction with explosive tornado-like winds that developed in the left semicircle. As Celia moved across the northern edge of Corpus Christi Bay the damage which occured to the City of Corpus Christi to the south appeared to have resulted almost entirely from a few high energy bursts of west winds, all occurring in the course of about 15 minutes. The highest sustained winds were apparently no more than 120-130 mph. However, gust speeds locally reached values in excess of 160 mph. Even to the right of the storm center the heaviest damage appeared to have occured from south or southeast winds following the passage of the center.

The highly damaging gusts in Celia provided streaky damage. Viewed from a helicopter, a succession of long streaks of heavy damage were apparent as small packets of high energy winds radially spaced from north to south at intervals of a mile or more and raked across the City from west to east. In discussion with town's people and airport personnel these bursts of high energy wind occured all across the City apparently within the space of about 15 minutes. Individual descriptions from various sectors of the town were similar and described the situation in somewhat this way. Winds were blowing at 60 or 70 mph steadily with the usual scream and whistle at such speeds and with houses quivering and shaking in response, but with little evidence of sever damage until suddenly the great gust burst like a rocket shell. At that time all the serious damage occured, and thereafter little of importance in the way of winds and wind damage was observed. Between the streaks of heavy damage there

were large areas in which even the frailest homes withstood the blow with little or no damage except to ornaments. From various inquires nearly all the electric clocks stopped within a period of 15 minutes, and in most instances power seemed to go simultaneously with the arrival of the one heavy burst of wind.

There was no evidence of rotary motion in any of the areas of heavy damage. However, long streaks of debris lines were visible from the air extending for hundreds of yards from the structures which were ruptured by the gust velocities. In the City of Corpus Christi these streaks were invariably from a westerly direction. In Port Aransas and Aransas Pass the streaks were from the south to the southeast predominately. In Rockport, Taft, and Sinton there were fewer streaks in evidence and those were visible varied in direction, but none indicated rotary motion as from a tornado.

The character of damage was primarily to roofs. In many instances the roof was cleanly lifted off and deposited at a considerable distance from the house. In some instances the roof and partitions of the upper floor were swept away leaving only the bathroom fixtures in evidence on the second floor.

A frightening evidence of wind forces involved was at the Woolco Shopping Center on South Staples Street. This new center, opened in July, was apparently of fine construction and was totally destroyed. The principal wall of the structure, about 18' high, running approximately 150 yards in length, collapsed and the roof fell in. This

main wall, with brick facing, was made of poured concrete with heavy steel reinforced rods. The wall was not simply blown over or blown in, but rather was torn in giant sections and displaced outward from the building. There was no evidence of an explosion.

In the entire area of Corpus Christi Bay, Port Aransas, Aransas Pass, and Copano Bay there was no evidence of major damage due to storm surge alone. Not a single house was washed off its foundation. At Port Aransas many modern expensive homes built on pilings 10 or 12' off the ground were virtually a total loss but not due to water. In most instances the roof had gone, together with some of the partitions, without loss of the building base at the top of the pilings. Not a single home was blown off its piling base. At Rockport a coastal road had been had been destroyed by high water, and the evidence was that water had cascaded inland a block or more. At Aransas Pass the shrimp fleet, which had sought safety in Conn Browns Harbor, had been driven by a strong south wind against the north bulkhead and some of the ships had been blown up on top of others.

In the Corpus Christi business district several tall buildings, some of whose exterior was faced mostly with glass, suffered heavily due to broken glass. In some buildings not a single pane of glass was left unbroken above the first two floors.

At the Corpus Christi Airport two hangers heavily constructed with I-beams and steel trusses were totally destroyed with the heavy beams twisted and mangled in an unbelievable fashion.

Celia provided a most dramatic example of what can happen to a trailer camp. Just northeast of the airport several hundred mobile homes, many of them of new modern design, were mangled and completely destroyed as if by a meat grinder with the debris being carried hundreds of yards eastward from the park. At one corner of the park four mobile homes not so completely destroyed were left stacked one upon the other. While it must be conceded that mobile homes are here to stay, cities urgently need ordinances which require trailer parks to secure all mobile homes with cables anchored in concrete footings.

The American Red Cross estimates 65,000 families suffered losses in Texas. 8,950 homes were destroyed, 13,850 severly damaged and another 41,800 sustained minor damage. 252 small businesses, 331 boats and 310 farm buildings were either demolished or severely damaged. Hardest hit was Corpus Christi where property damage was estimated at 233 million dollars. In Aransas Pass the estimate was 20 million.

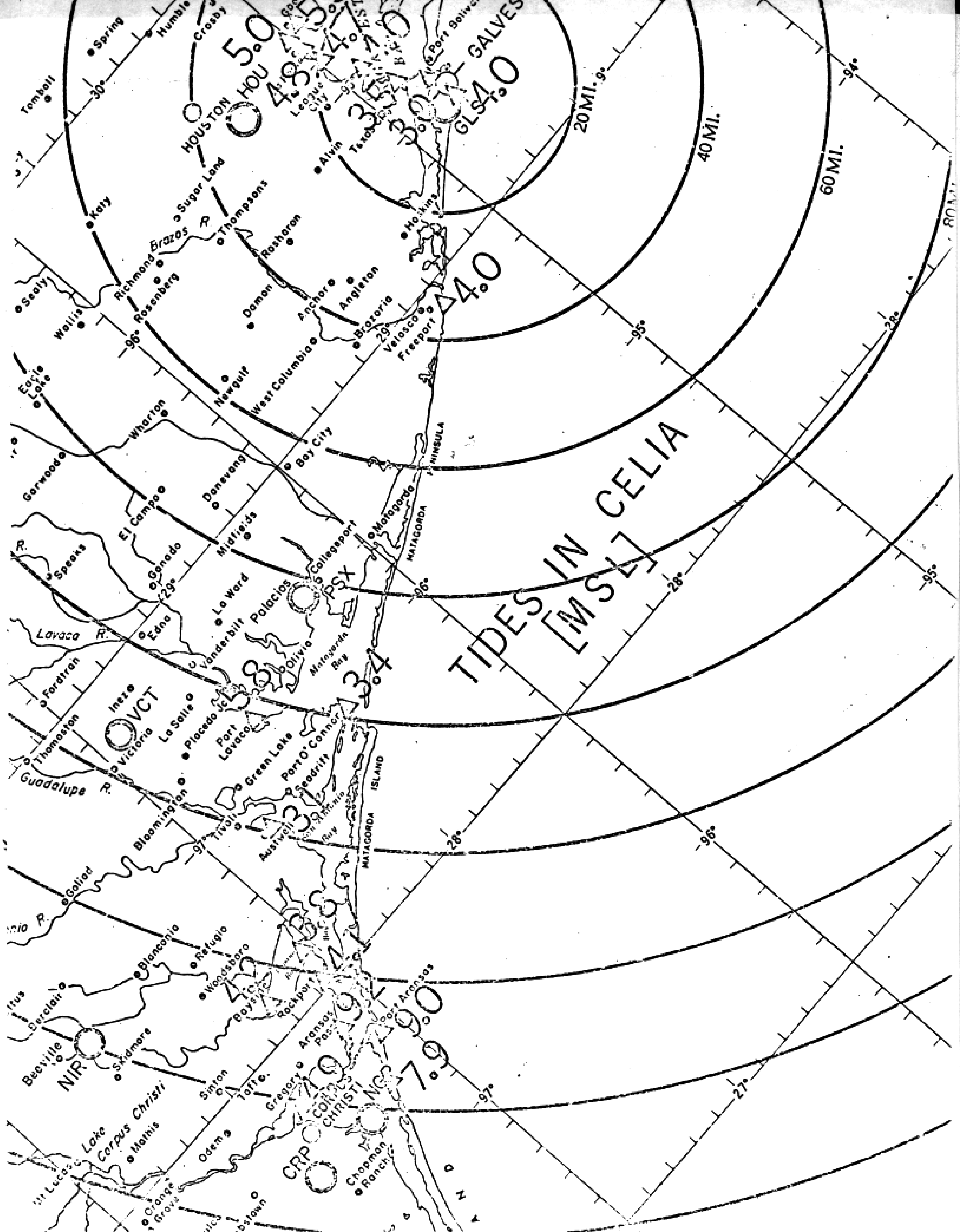
In Corpus Christi nearly 90 percent of the businesses and 70 percent of the residences were damaged. Officials in Aransas Pass reported one half of the structures in that city were severly damaged. All of the buildings in Port Aransas suffered damage and about 55 percent had severe damage.

Fifteen fatalities were attributed directly to Celia in Texas and at least 466 injured including hundreds of cuts from flying glass that occured when windows were blown in. Including the 5 deaths in Cuba, the total death count for Celia was 20.

The highest tides were recorded at Port Aransas Beach and Port Aransas jetty where waters reached 9.2 ft and 9.0 ft M.S.L. respectively. The lowest official pressure reported was 949 mb (28.03 inches) at Aransas Pass by a cooperative weather observer where a lull of 30 minutes was experienced in the eye. Reading of 941 mb (27.80 inches; unchecked) and 945 (27.89 inches; checked and correction applied for 29.95 inches) were registered on small private barometers in Corpus Christi.

Tornadoes were reported north of Kay, near Falfurrias and near Eagle Pass.

Celia's small size combined with the rapid forward motion prohibited wide spread heavy precipitation. As a matter of fact, the limited rainfall that occured was more than welcome since large portions of Texas, particularly the central sections, were experiencing severe drought conditions. Heaviest rainfall was in the immediate Corpus Christi area where 6 to 7 inches fell. General rains of 3 to 4 inches accompanied the storm along its path across south Texas. The rainshield was very small with towns only 30 to 40 miles north of the center receiving essentially no rain.


TIDES IN CELIA
[MSL]
20 MI.
40 MI.
60 MI.
HOUSTON
HOU
GLS
VCT
PSX
CRP
NIR
Tomball
Spring
Humble
Crosby
League City
Alvin
Sugar Land
Katy
Thompsons
Rosharon
Brazos R.
Richmond
Rosenberg
Sealy
Wallis
Damon
Anchor
Angleton
Brazoria
Velasco
Freeport
West Columbia
Newgulf
Eagle Lake
Wharton
Bay City
Garwood
Danevang
El Campo
Midfields
Matagorda
Collegeport
Ganado
Speaks
La Ward
Palacios
Edna
Lavaca R.
Vanderbilt
Olivia
Matagorda Bay
Fordtran
Inez
La Salle
Placedo Jc.
Port Lavaca
Thomaston
Victoria
Guadalupe R.
Green Lake
Port O'Connor
Seadrift
Bloomington
Tivoli
Austwell
Matagorda Island
Goliad
Blanconia
Refugio
Woodsboro
Berclair
Beeville
Skidmore
Sinton
Taft
Gregory
Aransas Pass
Rockport
Port Aransas
Corpus Christi
Lake Corpus Christi
Mathis
Odem
Chapman Ranch
Orange Grove
Peninsula
50
40
30
38
34
39
90
79
4.0
95°
96°
97°
28°
29°
27°

Extreme Tides--Celia

	MSL (ft)
Port Arthur Ship Channel	2.8
Sabine Pass	2.5
Baytown	5.3
Morgan Point	5.0
La Porte	4.8
KEMAH...Seabrook	4.7
San Leon	4.0
Texas City	3.5
Galveston Channel	3.0
Galveston Pleasure Pier	4.0
Freeport Coast Guard	4.0
Lavac Bay	5.8
Port O'Conner	3.4
Austwell	3.1
Bayside	4.2
Capano Bay (Hwy 35 bridge)	3.8
Rockport	4.1
Port Aransas Beach	9.2
Port Aransas Jetty	9.0
Mustang Island	7.9
Corpus Christi (downtown)	4.9
Brownsville	1.5

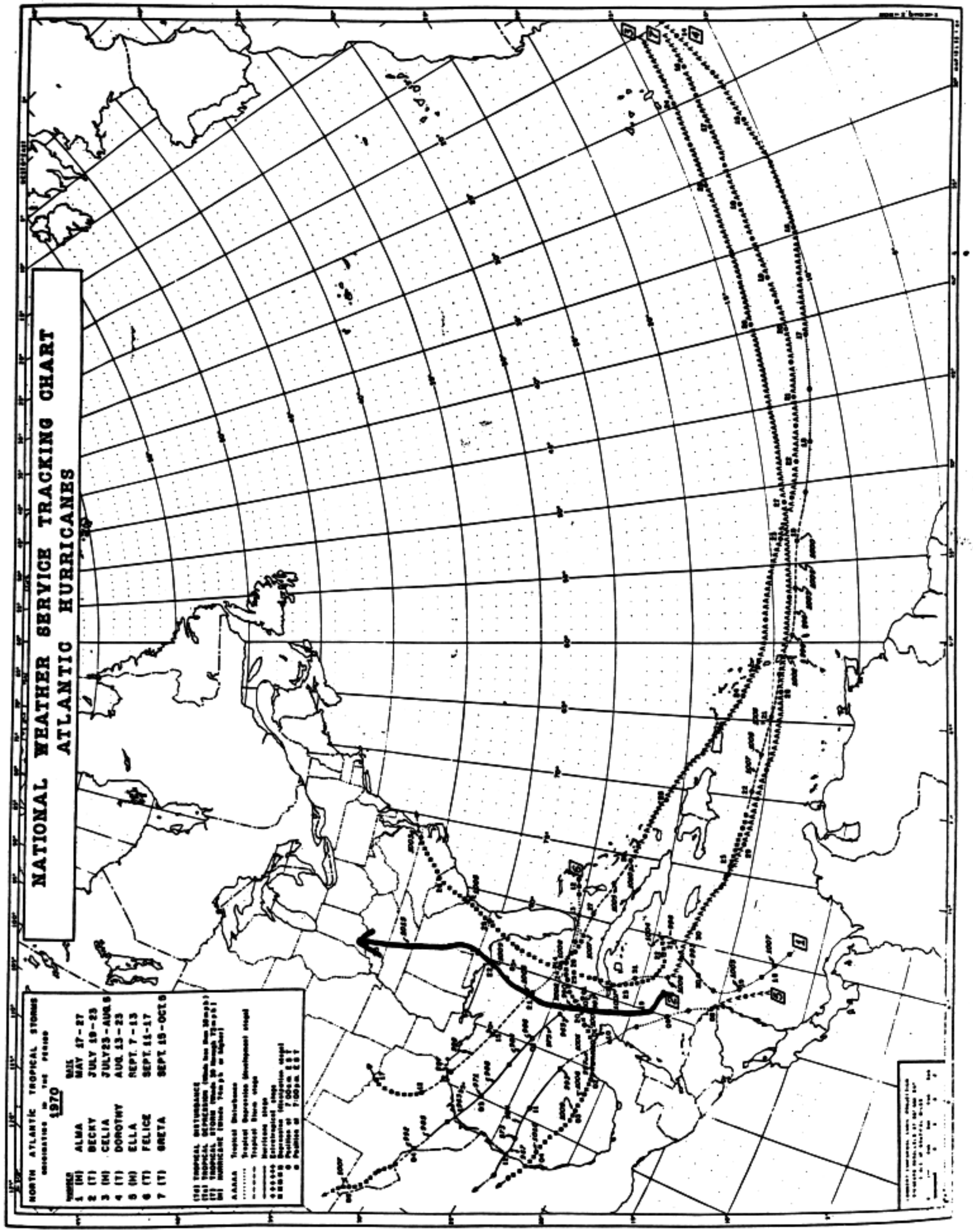


Figure 1.—Atlantic hurricane and tropical storms of 1970.