CLIMATE

CLIMATE REPORT NO. G11

HURRICANE DAVID (1979)

STATE OF SOUTH CAROLINA
WATER RESOURCES COMMISSION
STATE CLIMATOLOGY OFFICE

MARCH 1985

HURRICANE DAVID (1979)

by
John C. Purvis
Brian R. Jarvinen

South Carolina Water Resources Commission
3830 Forest Drive
P.O. Box 4440
Columbia, South Carolina 29240

January 1985

The work that provided the basis for this study was supported by a Federal Emergency Management (FEMA) Grant in cooperation with the South Carolina Emergency Preparedness Division and the South Carolina Coastal Council.

TABLE OF CONTENTS

LIST OF FIGURES

INTRODUCTION

The purpose of this study is to provide information on the impact of Hurricane David on the South Carolina coastal area.

In 1982, the South Carolina Coastal Council contracted with the National Hurricane Center, Miami, Florida, to develop hurricane statistics for the South Carolina coast, using the recently developed Sea, Lake and Overland Surge from Hurricanes (SLOSH) computer model. During the summer of 1983, the Federal Emergency Management Agency awarded a grant to the South Carolina Emergency Preparedness Division, who contracted with the South Carolina Water Resources Commission for assistance in analyzing the SLOSH computer printouts and preparing maps and tables depicting the results. Included in that contract was the statement that at least two historical storms would be studied using the SLOSH model to calculate the areas flooded. This study is in accord with that contract.

SUMMARY

Hurricane David formed in the mid Atlantic on August 25, 1979 near latitude 12° North and longitude 26° West. David gained hurricane strength during the night of August 26th near latitude 17° North and longitude 48° West. The hurricane continued to intensify and became a very destructive storm, passing across Hispaniola on the 31th of August. On September 1, David was located along the north coast of Haiti.

The storm weakened to minimum hurricane strength crossing Hispaniola, but began to regain strength as it moved northwestward. Winds of 90 knots were reported on September 3, 1979 as David began to recurve northward along Florida's east coast, but subsided somewhat before the hurricane made final landfall near Savannah on September 4th. Damage estimates reached $1.5 billion and more than 1200 deaths were attributed to the storm during its lifetime, but only 16 of those deaths occurred in the United States. Perhaps the most significant effect of the storm to most people of the eastern United States were widespread power outages. About 25 million people were without electricity in New York City at some time during David's passage.

Hurricane David's eye entered the Georgia coast near but slightly south of Savannah on the afternoon of September 4, 1979. From that point the storm moved north and then north northeast, reaching south central North Carolina early on the 5th.

When David reached the U.S. mainland it was a minimal hurricane according to existing criteria, although it caused considerable beach erosion along the South Carolina coast. Numerous trees were felled and many areas were without power for several days. Several tornadoes were spawned along the South Carolina coast with the most damaging tornado reported in the Litchfield Beach area. Damage in South Carolina from David has been estimated at around $10 million. Rainfall of six to more than eight inches occurred over portions of the South Carolina coastal plain with the heaviest amounts in the northeastern part of the State. Substantial rises were reported on the Waccamaw, Little Pee Dee, and great Pee Dee Rivers as a result of the rainfall associated with the storm's passage. Rises were also reported on other South Carolina rivers, although the flooding was not as extensive.

HURRICANE DAVID (1979)

TRACK

David generally followed a clockwise path around the periphery of the North Atlantic subtropical high pressure ridge (Figure 1). As David began to move around the western side of the ridge, a process known as recurvature, it came into contact with the east coast of the United States. The eye of David made initial landfall just north of Palm Beach, Florida on September 3, 1979. Later the same day, the eye re-emerged into the Atlantic Ocean just south of Daytona Beach, Florida. David continued northward and again made landfall near Ossabaw Island, Georgia, about 20 miles south of Savannah, Georgia, at 1500 Eastern Standard Time (EST) on September 4 (Figure 2). The hurricane continued to recurve as it moved northward, but never re-emerged into the Atlantic.

INTENSITY

Hurricane David reached a low pressure of 924 millibars (mb) (Category 4 on the Saffir/Simpson hurricane scale) with sustained winds of 150 knots in the Caribbean Sea. However, during its passage from near Daytona Beach, Florida to Savannah, Georgia, it deepened slightly from 975 to 970 mb (category 2) with maximum sustained winds of 85 knots. As the eye of David moved north of Savannah, it began to fill and the pressure began to rise. During the first six hours after filling began, the pressure rose from 970 to 984 mb or 2.3 mb/hr. In the next 12 hours, the pressure rose from 984 to 998 mb or 1.2 mb/hr.

RADIUS OR MAXIMUM WINDS (RMW)

During its passage from near Daytona Beach, Florida to Savannah, Georgia, National Oceanographic and Atmospheric Administration (NOAA) research aircraft obtained wind velocity observations on radial legs relative to the hurricane center. An example of a radial leg is in Figure 3. Figure 3 represents the meteorological wind velocities in knots at 1500 feet parallel and just offshore of the South Carolina coast. The eye of the hurricane is over Ossabaw Island and is indicated by a hurricane symbol. The central sea level pressure is 970 mb. What is of interest is the lack of any hurricane force winds except the 65 knot value at approximately 120 miles from the center (this value is associated with a feeder band). This broad wind speed profile is representative of many other wind speed profiles obtained by the aircraft prior to, during, and after landfall. In order to represent the broad wind speed profile in the SLOSH model a RMW of 60 statute miles was selected.

SLOSH MODEL INPUT AND RESULTS

The track, intensity, and RMW data were interpolated to hourly values and used as input data to the National Weather Service SLOSH model. Figure 4 represents the envelope of high water for Hurricane David. The contours represent storm surge heights above mean sea level. Also indicated on the chart are the actual peak storm surge heights that were measured at various points relative to mean sea level (MSL).[1]

To a local inhabitant of South Carolina, who was able to observe the actual maximum height of the storm tide at a particular location, the results may seem somewhat large. In most locations, it appeared that the storm surge caused water to be only 1 to 2 1/2 feet above the high tide mark. This is correct, but near low astronomical tides were occurring at the time of peak storm surge near Savannah, Georgia and near mean tide conditions were occurring near Charleston, South Carolina. To better understand the interaction of the astronomical tide and storm surge, figures 5 and 6 were prepared.

Figures 5 and 6 demonstrate the process used to determine the storm surge from hourly tide gage observations at Ft. Pulaski, Georgia and Charleston, South Carolina, respectively.

Figures 7 and 8 compare the actual observed storm surges at the two sites mentioned and the SLOSH model generated storm surge. The results show fairly good agreement between the observed and the SLOSH computed storm surge. After 1900 EST the model deviates from the observed, significantly. This large discrepancy is due to the fact that the grid point representing Ft. Pulaski is near the boundary of the Charleston Harbor Grid and gives values somewhat higher than observed for westerly winds (winds offshore). Note: this does not affect the forecast of the peak surge.

Of interest at Charleston, is the double peak in both the observed and SLOSH predicted time histories (Figure 8). The second peak is termed a resurgence. The SLOSH model tends to over predict the magnitude of the resurgence at Charleston and predicts the peak one to two hours ahead of actual occurrence.

Also of interest is the phenomenon known as the pre-storm tide anomaly. At both Ft. Pulaski and Charleston, mean sea level is running approximately one-half foot above normal prior to onset of the storm surge. See figures 5 and 6. As can be seen in figures 7 and 8 the SLOSH model was initiated with this additional one-half foot of water.

---

[1] The actual storm surge heights were obtained by taking the predicted tide at the point of interest and subtracting it from the observed storm tide.

REFERENCES

Jarvinen, Brian, 1983, Unpublished notes: National Oceanic and Atmospheric Administration, National Research Laboratory, Miami Florida.

________, 1979, September Climatological Data For South Carolina: National Oceanic and Atmospheric Administration, Environmental Data and Information Service, Asheville, North Carolina, 16 p.

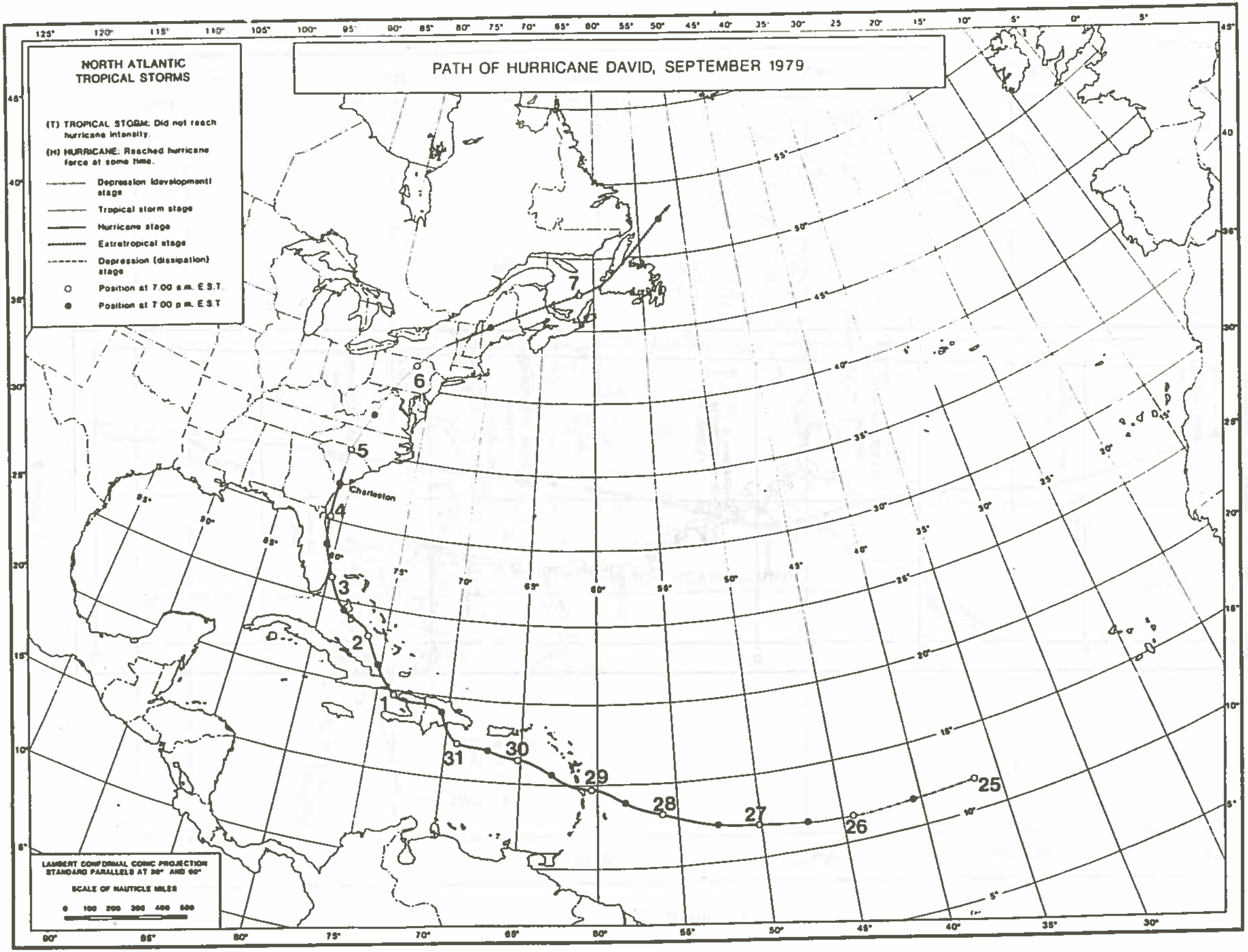

PATH OF HURRICANE DAVID, SEPTEMBER 1979
NORTH ATLANTIC
TROPICAL STORMS
(T) TROPICAL STORM: Did not reach hurricane intensity.
(H) HURRICANE: Reached hurricane force at some time.
Depression (development) stage
Tropical storm stage
Hurricane stage
Extratropical stage
Depression (dissipation) stage
Position at 7:00 a.m. E.S.T.
Position at 7:00 p.m. E.S.T.
LAMBERT CONFORMAL CONIC PROJECTION
STANDARD PARALLELS AT 30° AND 60°
SCALE OF NAUTICAL MILES
0 100 200 300 400 500
Charleston
25
26
27
28
29
30
31
1
2
3
4
5
6
7

Figure 1

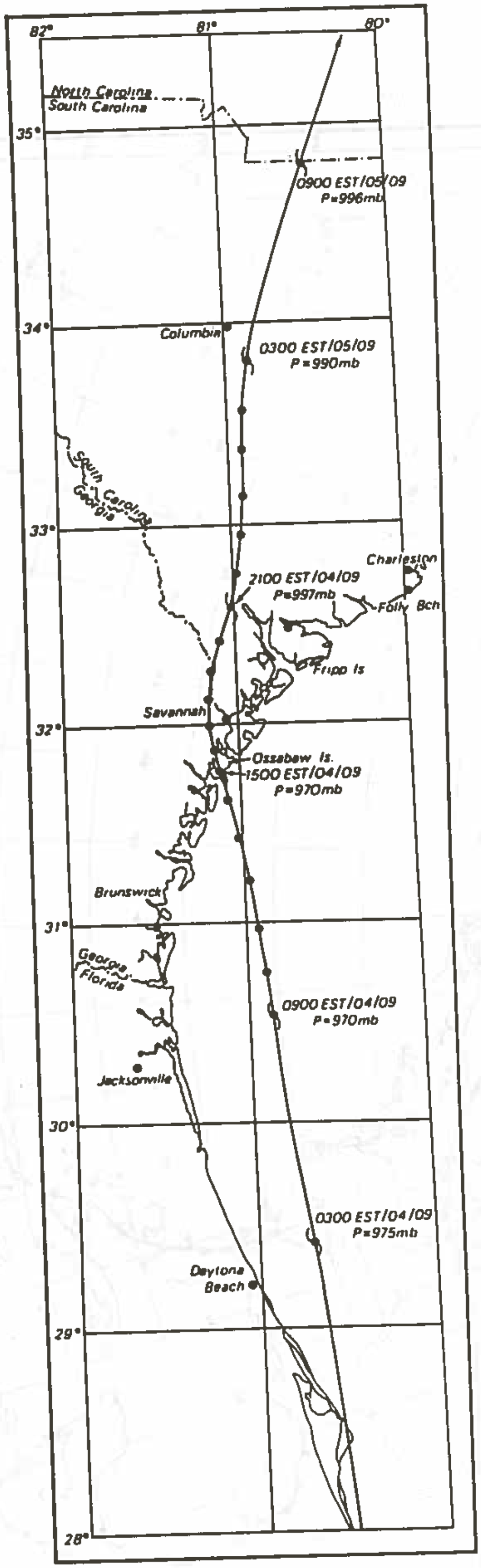

82°
81°
80°
North Carolina
South Carolina
35°
0900 EST/05/09
P=996mb
34°
Columbia
0300 EST/05/09
P=990mb
South Carolina
Georgia
33°
Charleston
2100 EST/04/09
P=997mb
Folly Bch
Fripp Is
Savannah
32°
Ossabaw Is.
1500 EST/04/09
P=970mb
Brunswick
31°
Georgia
Florida
0900 EST/04/09
P=970mb
Jacksonville
30°
0300 EST/04/09
P=975mb
Daytona
Beach
29°
28°

Figure 2

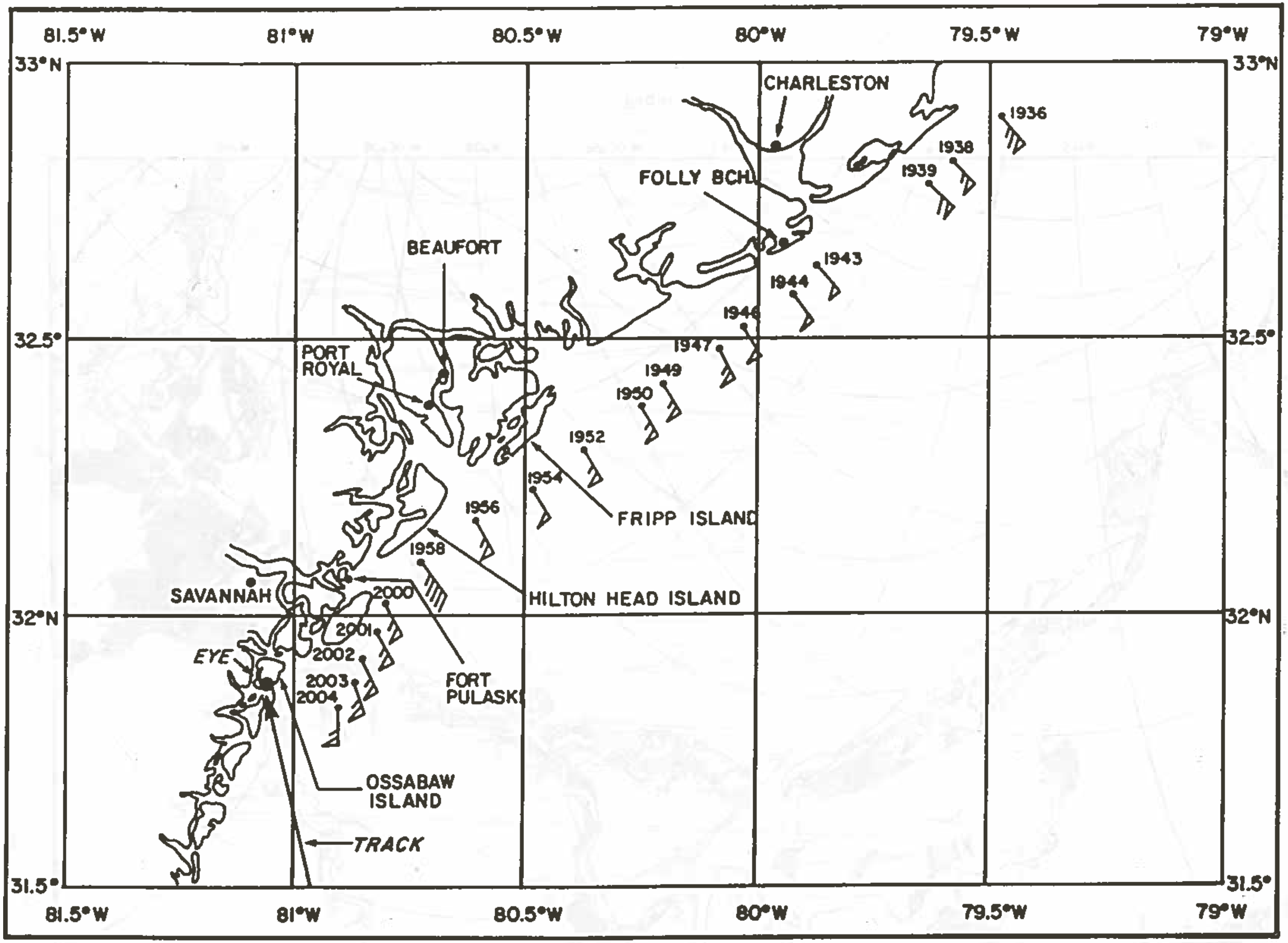

81.5°W
81°W
80.5°W
80°W
79.5°W
79°W
33°N
32.5°
32°N
31.5°
CHARLESTON
FOLLY BCH
BEAUFORT
PORT ROYAL
FRIPP ISLAND
HILTON HEAD ISLAND
SAVANNAH
FORT PULASKI
OSSABAW ISLAND
EYE
TRACK
1936
1938
1939
1943
1944
1946
1947
1949
1950
1952
1954
1956
1958
2000
2001
2002
2003
2004

Figure 3

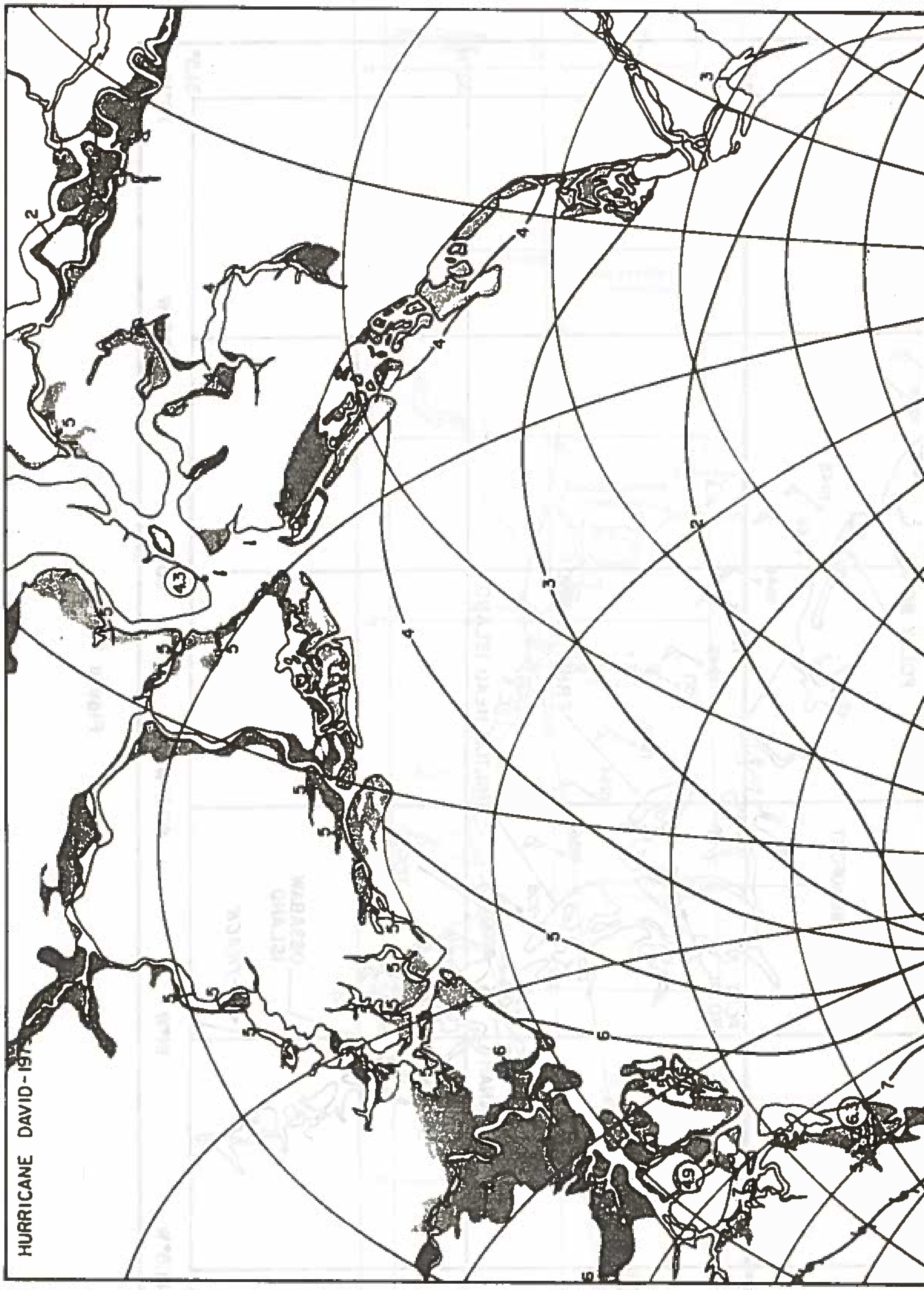

HURRICANE DAVID-197
81°W
80°30'W
80°W
79°30'W
79°W
32°N
32°30'N
33°N
30°30'N

Figure 4

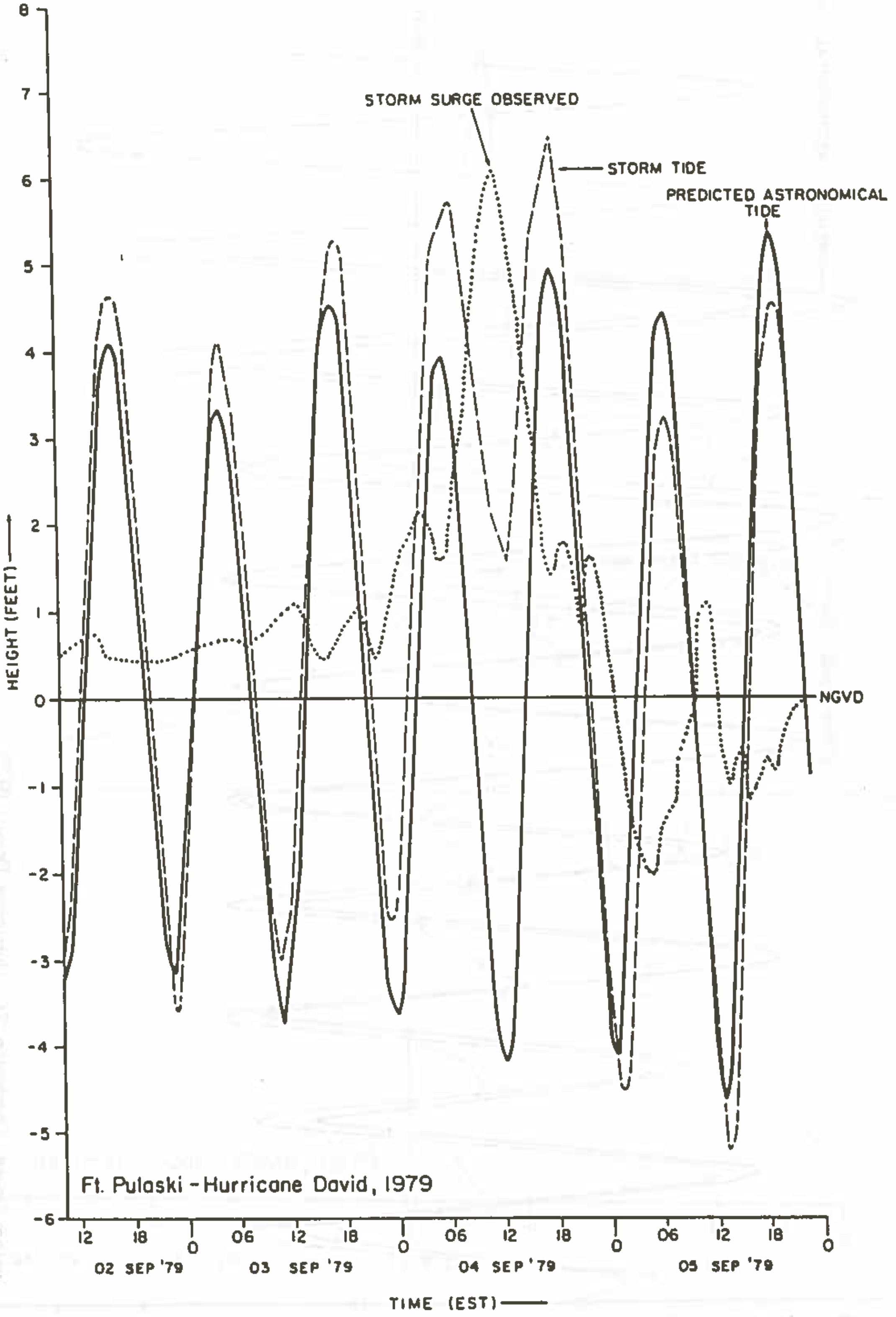

STORM SURGE OBSERVED
STORM TIDE
PREDICTED ASTRONOMICAL TIDE
NGVD
HEIGHT (FEET)
8
7
6
5
4
3
2
1
0
-1
-2
-3
-4
-5
-6
Ft. Pulaski - Hurricane David, 1979
12 18 0 06 12 18 0 06 12 18 0 06 12 18 0
02 SEP '79
03 SEP '79
04 SEP '79
05 SEP '79
TIME (EST)

Figure 5

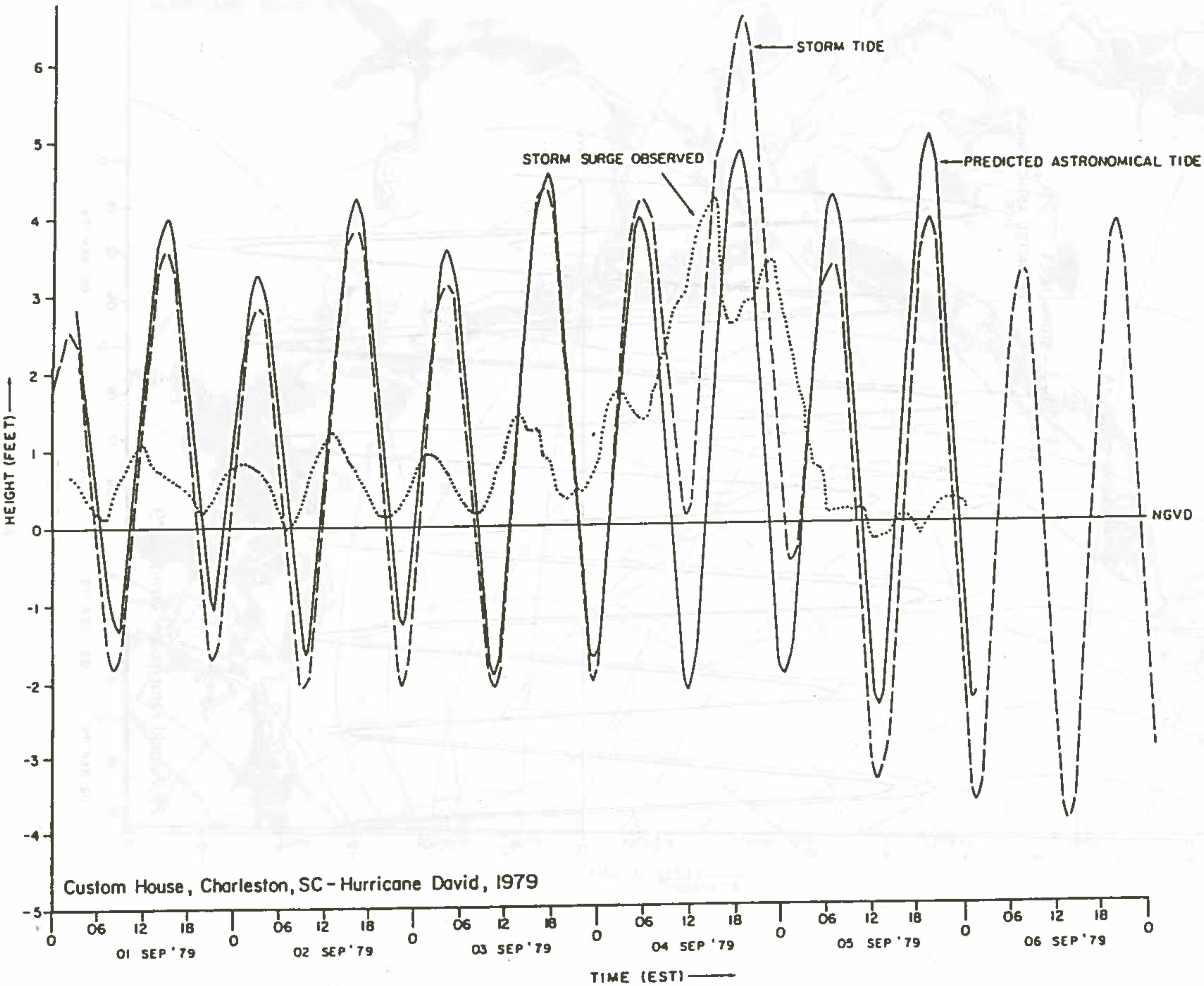
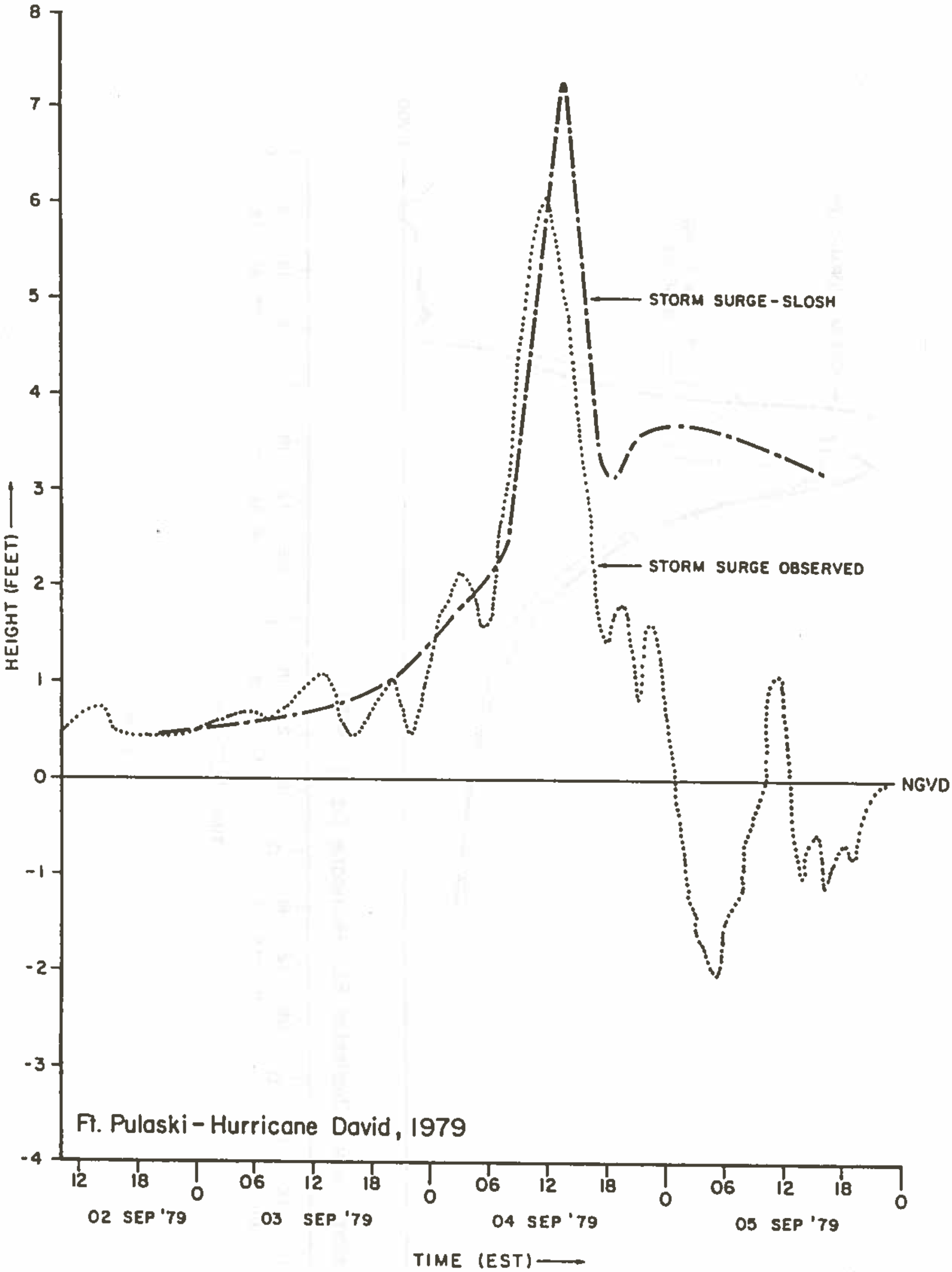
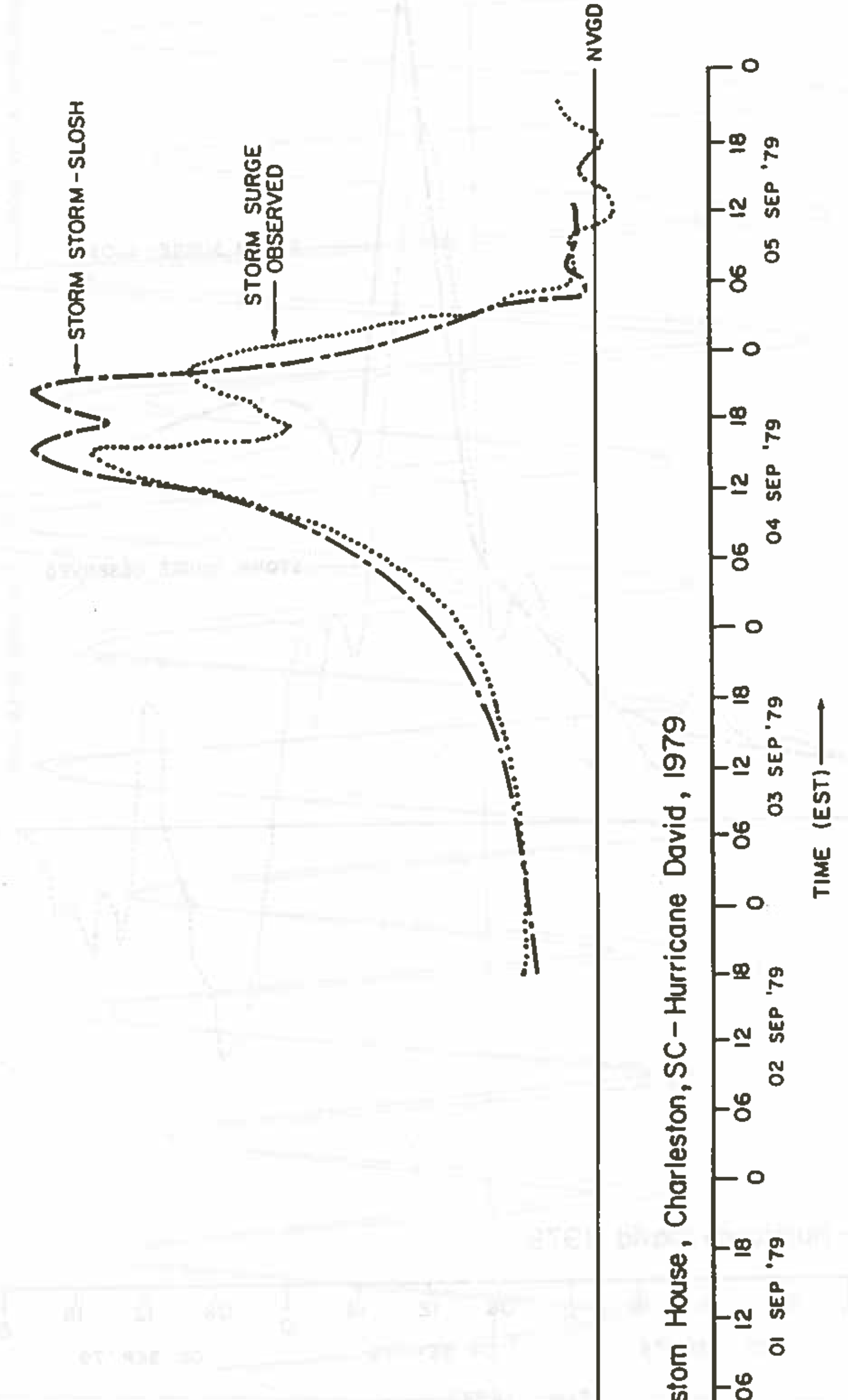

STORM TIDE
STORM SURGE OBSERVED
PREDICTED ASTRONOMICAL TIDE
NGVD
HEIGHT (FEET)
TIME (EST)
01 SEP '79
02 SEP '79
03 SEP '79
04 SEP '79
05 SEP '79
06 SEP '79
Custom House, Charleston, SC - Hurricane David, 1979

Figure 6



8
7
6
5
4
3
2
1
0
-1
-2
-3
-4
HEIGHT (FEET)
STORM SURGE-SLOSH
STORM SURGE OBSERVED
NGVD
Ft. Pulaski-Hurricane David, 1979
12
18
0
06
12
18
0
06
12
18
0
06
12
18
0
02 SEP '79
03 SEP '79
04 SEP '79
05 SEP '79
TIME (EST)

Figure 7



Custom House, Charleston, SC–Hurricane David, 1979
STORM STORM-SLOSH
STORM SURGE OBSERVED
NVGD
HEIGHT (FEET)
5
4
3
2
1
0
-1
0
06
12
18
0
06
12
18
0
06
12
18
0
06
12
18
0
06
12
18
0
01 SEP '79
02 SEP '79
03 SEP '79
04 SEP '79
05 SEP '79
TIME (EST)

Figure 8