

# Tropical Meteorology

A COMPARISON OF THREE MAJOR NORTHWARD-MOVING GULF COAST HURRICANES - CAMILLE (1969), ELOISE (1975), AND FREDERIC (1979)

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## ABSTRACT

*The following report serves to analyze both differences and similarities of three recent major northward moving hurricanes along the Gulf Coast. Hurricanes Camille, Eloise and Frederic all severely affected the mid-Gulf Coast region, between New Orleans, LA and St. Marks, FL.*

*Also briefly touched upon is a look at the comparative weakening rates of two different intensities of storms traversing the same general geographic and physiographic regions.*

*All tide data is in feet above mean sea level (MSL; National Geodetic Vertical Datum of 1929) and is based primarily on post-storm high water mark surveys.*

*Significant wave heights are based on oil rig and NOAA data buoys, and refer to the prevailing wave heights over the sea surface in view. Wave heights were measured from trough to crest.*

### 1. HURRICANE CAMILLE, 1969.

At about 2330 EST on Aug. 17, 1969, the eye of Hurricane Camille crossed the Mississippi Gulf Coast over Bay St. Louis, where the central pressure was measured at 26.85 in. Maximum sustained winds, as indicated by eyewitness observers' reports, and a special post-storm survey team, were near 175-200 mph, with gusts to over 200 mph. A post-storm tide surveyed a peak high-water mark of 24.2 ft above MSL at nearby Pass Christian, and estimated at 31 ft above MSL.

Thus marked the passing of the most intense hurricane of record to cross the U.S. mainland. Previously, the lowest measured mainland U.S. pressure was 27.43 in during the "Okeechobee Hurricane" of 1928 at West Palm Beach, Florida.

Early on the afternoon of Aug. 16, Air Force reconnaissance aircraft measured a central pressure of 26.73 in and 700-mb (about 8000-9000 ft) flight-level winds of 160 mph 20 miles from the eye. The maximum was not recorded due to attenuation of the Doppler radar beam in the intense rainfall. Another

reconnaissance flight recorded winds of 210 mph at 30,000 ft. Maximum sustained surface winds were estimated at 200 mph when the storm was less than 100 miles south of the mouth of the Mississippi River. Maximum sustained winds at Pilottown, La. at the SE edge of the river mouth were estimated at 160 mph. Nearby, tides at Boothville, LA reached 15 ft above MSL.

Deaths totaled 146 along the Gulf Coast, and 110 in Virginia due to flooding from record rains of up to 27" within 8 hours at Nelson County and an unconfirmed report of 31" at Tye River, Virginia.

Damages totaled 1.42 billion dollars, with \$140 million in Virginia.

### 2. HURRICANE ELOISE, 1975.

The eye of Hurricane Eloise made landfall near Destin, FL at about 1200 EST on September 23, the first direct hit by a major hurricane in this area since at least 1900. Destin recorded the lowest central pressure for the storm of 28.20 in, and highest estimated sustained winds of 125 mph. A 98-ft tower 13 miles offshore of Panama City, FL measured sustained winds of 92 mph and gusts of 155 mph. At Eglin AFB, Valparaiso, FL, sustained winds of 81 mph and gusts of 115 mph were measured before the instrument failed. Five miles NW of Ozark, Alabama, 60 miles inland from point of landfall, sustained winds of 104 mph with gusts to 120 mph were measured.

A post-storm tide survey indicated a peak high-water mark of 18.2 ft above MSL at Dune Allen Beach, FL.

There were four deaths in Florida, and 15 in the northeastern part of the country, due to torrential rains of up to 10 inches over the lee side of the mountains from Virginia to southern New York.

Damages were over \$100 million in the northeastern U.S., \$100 million in Alabama and \$400 million in the northeastern U.S.

### 3. HURRICANE FREDERIC, 1979.

The eye of Hurricane Frederic crossed the Alabama-Mississippi coastline at about 2230

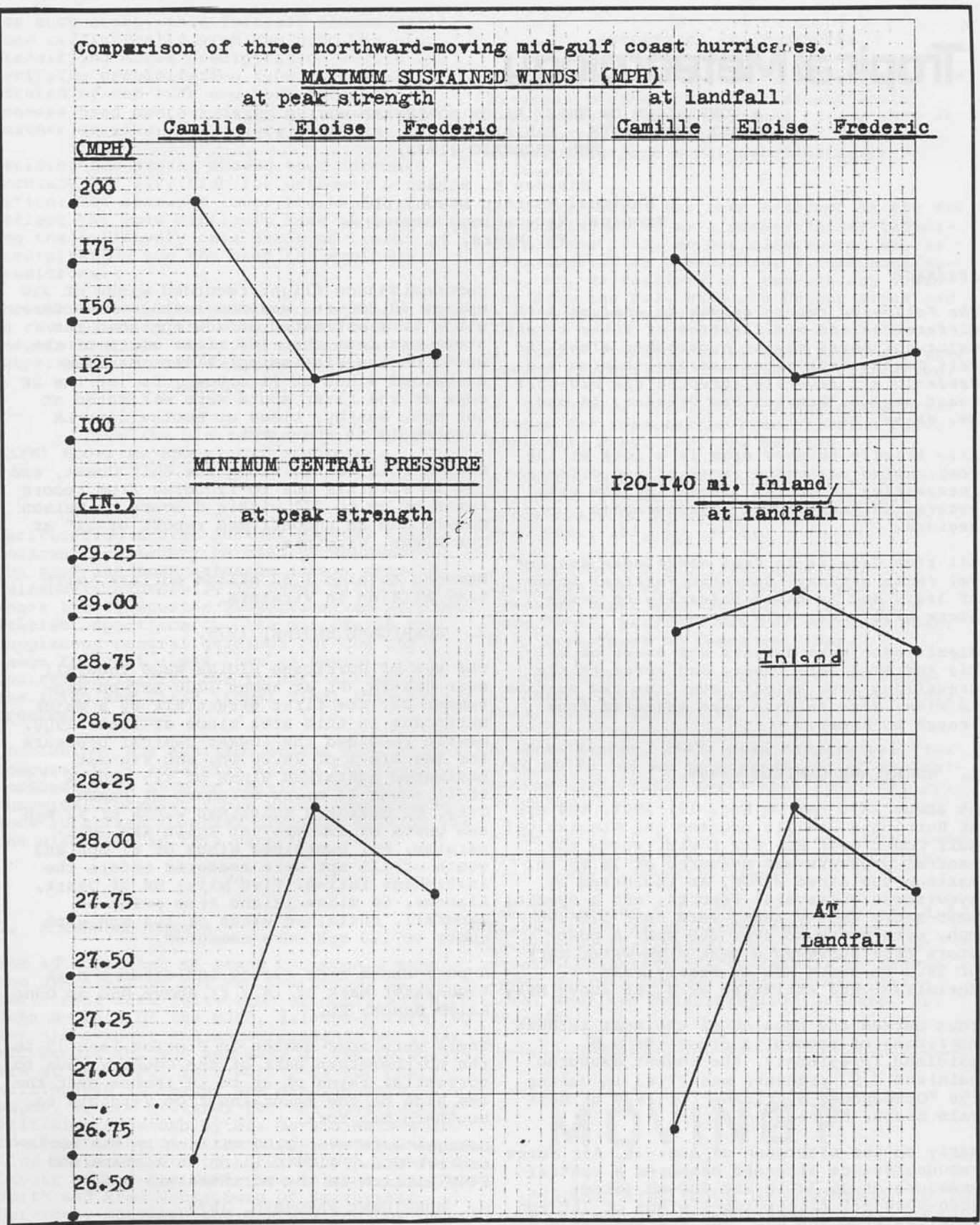


Figure 1. Comparison of three northward-moving mid-gulf coast hurricanes.

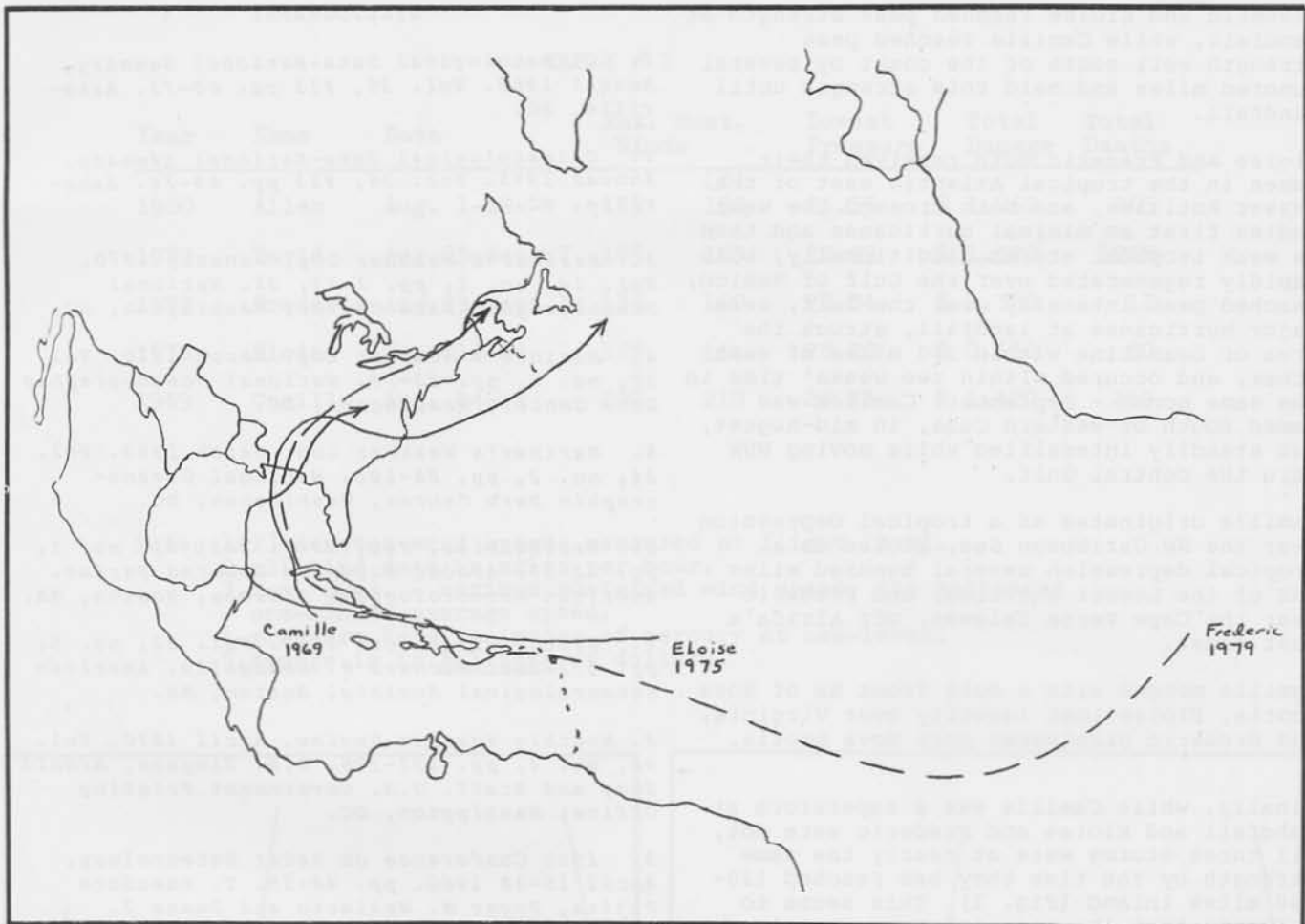


Figure 2. Tracks of Hurricanes Camille, Eloise, and Frederic.

EST on September 12, 1979. Shortly before landfall a NOAA research plane recorded flight-level winds of 160 mph. Maximum sustained surface winds were estimated at 135 mph and reconnaissance aircraft measured a minimum central pressure of 27.94 in. At the Dauphin Island (AL) Sea Lab, the lowest pressure in the storm's history was measured, 27.84 inches, along with wind gusts to 137 mph before equipment failure. At the Dauphin Island Churn station, peak gusts to 145 mph were measured along with tides of 10.0 ft above MSL. Neither station observed the eye, which passed just to the west of the island. The FAA at Grand Bay, AL reported an unconfirmed aneroid pressure of 27.49 in, and was apparently in the eye.

A post-storm high-water mark of 16.2 ft above MSL was found near Gulf Shores, AL on the south shore of Mobile Bay. Frederic was the strongest hurricane in this area this century. There were 5 deaths and 2.3 billion dollars in damages in the U.S.

Data from oil rigs in the Gulf indicated significant wave heights during Hurricane Camille of 47 ft, and extreme heights of 72 ft. In Hurricane Eloise, significant wave

heights were observed to 37 ft, and waves to 29 ft were measured in Hurricane Frederic while it was still a minimal hurricane in the southern Gulf of Mexico.

Hurricanes Camille, Eloise and Frederic all passed inland on the mid-Gulf Coast within 200 miles of each other, and within an 11-year time span. All three were major hurricanes at landfall - category three or higher on the Saffir-Simpson scale; that is, sustained winds over 110 mph, or central pressure 27.91 in or less. In fact, Camille was a 5, Eloise a 3, and Frederic a strong 3.

All three crossed each other's paths over the central Gulf some 250-350 miles south of the Mobile Bay, AL area while travelling primarily in a northerly direction.

Camille and Frederic both followed nearly identical, parallel tracks from the west coast of Cuba until they were well inland from the Gulf Coast. Their tracks varied from 60 to 120 miles apart. Eloise crossed over the NE coast of the Yucatan Peninsula; then it turned north, then NE before landfall.

Frederic and Eloise reached peak strength at landfall, while Camille reached peak strength well south of the coast by several hundred miles and held this strength until landfall.

Eloise and Frederic both received their names in the tropical Atlantic east of the Lesser Antilles, and both crossed the West Indies first as minimal hurricanes and then as weak tropical storms. Additionally, both rapidly regenerated over the Gulf of Mexico, reached peak intensity over the Gulf, were major hurricanes at landfall, struck the area of coastline within 250 miles of each other, and occurred within two weeks' time in the same month - September. Camille was named south of western Cuba, in mid-August, but steadily intensified while moving NNW thru the central Gulf.

Camille originated as a tropical depression over the NW Caribbean Sea, Eloise as a tropical depression several hundred miles ENE of the Lesser Antilles, and Frederic near the Cape Verde Islands, off Africa's west coast.

Camille merged with a cold front SE of Nova Scotia, Eloise lost identity over Virginia, and Frederic dissipated over Nova Scotia.

Finally, while Camille was a superstorm at landfall and Eloise and Frederic were not, all three storms were at nearly the same strength by the time they had reached 120-140 miles inland (Fig. 1). This seems to indicate that the more intense a hurricane is at landfall, the more rapid will be its filling rate the first few hours after landfall, until weakening to at or just below minimal hurricane strength (central pressure around 29.0 in).

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TABLE # 1

Year	Name	Date	Max. Sust. Winds	(f)	Lowest Pressure	Total Damage	Total Deaths
1980	Allen	Aug. 1-12	195	190	26.55	\$ 1.062	265
1979	David	Aug.25-Sept.7	175	183	27.29	\$ 1.320	1268
1979	Frederic	Aug.29-Sept.14	135	160	27.84	\$ 2.300	12
1975	Eloise	Sept.13-24	125	164	28.20	\$ 0.650	80
1969	Camille	Aug. 14-22	200	210	26.73	\$ 1.420	259

Notes;1(f) denotes wind speeds measured at flight level.  
 2.all wind data in miles per hour.  
 3.Max. Sust. - maximum sustained wind speed, the estimated one-minute average speed.  
 4.pressure data in inches of mercury at sea-level.  
 5.damage is in Billions of dollars.

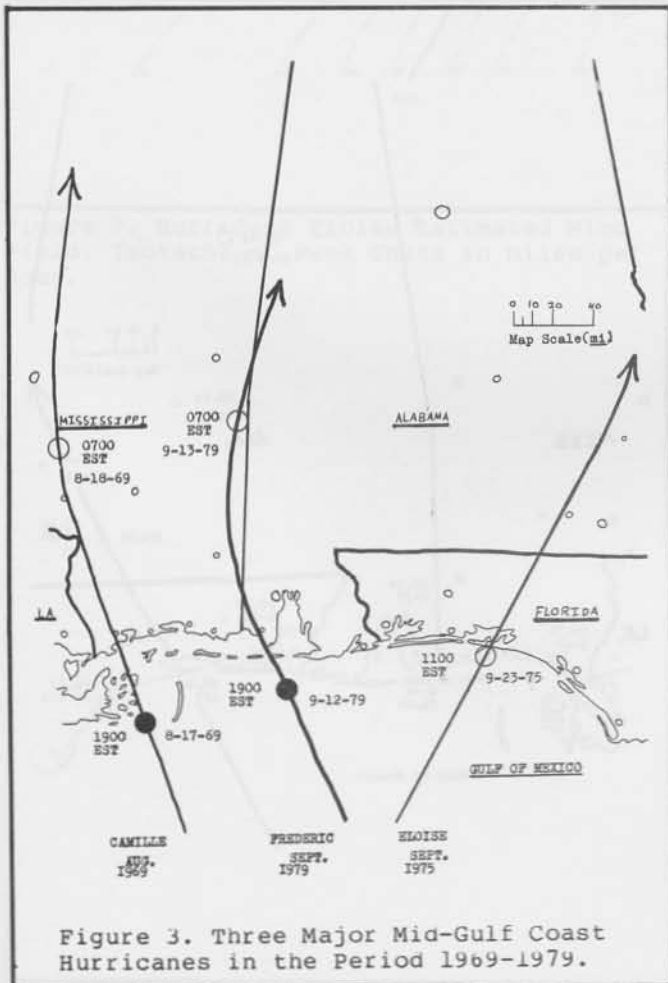


Figure 3. Three Major Mid-Gulf Coast Hurricanes in the Period 1969-1979.

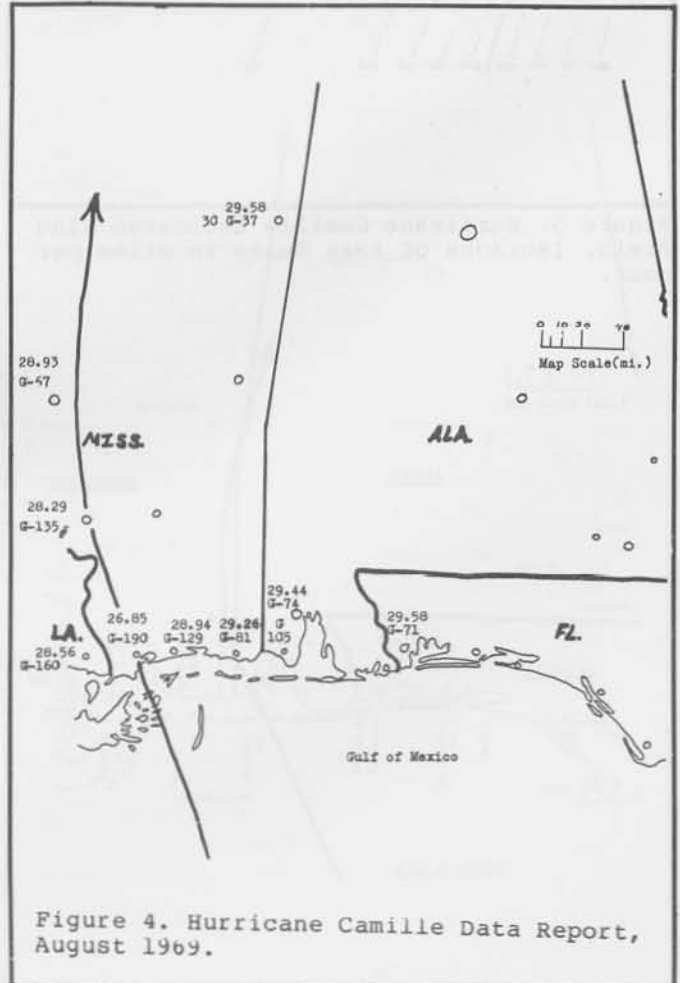


Figure 4. Hurricane Camille Data Report, August 1969.





