50th Anniversary of Hurricane Gracie

by NWS Charleston, SC

Summary

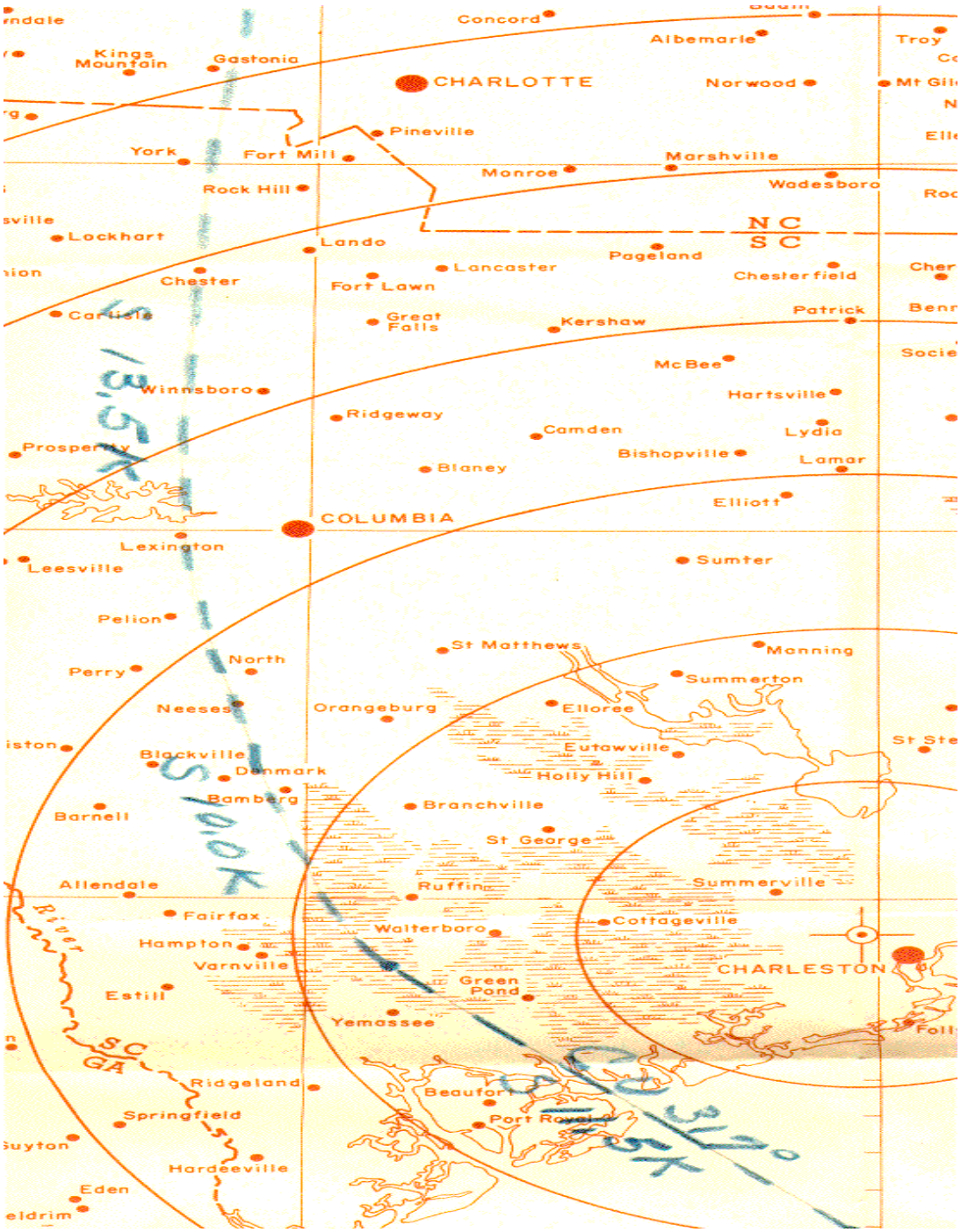
Prior to Hurricane Hugo, the last major hurricane to strike the South Carolina coast was Hurricane Gracie, a Category 3 storm which charged into St. Helena Sound 50 years ago just before noon EST on Tuesday, September 29, 1959. Wind gusts measured as high as 138 mph near Beaufort and estimated at least 150 mph along coastal sections of Beaufort, Colleton and Charleston Counties downed many trees and power lines and damaged numerous structures. A September 30 report filed from the Weather Bureau in Charleston described damage as "…widespread and extensive, estimated to be 5 to 10 million dollars and perhaps more." The preliminary U.S. Weather Bureau report published in October, 1959, stated, "Wind damage from Gracie was the worst from a hurricane in the history of Beaufort, South Carolina." In an *Island Packet* article ("Residents Recall Hurricane Gracie", published May 26, 2009), Marti Covington described a post-hurricane Beaufort County landscape where downed trees and power lines prevented travel, and where electricity and clean drinking water remained unavailable for "weeks". The National Guard helped clean up the extensive damage in Beaufort County. Across St. Helena Sound on Edisto Island, the beach was destroyed and was later rebuilt with "shell hash" which remains in place to this day.

After landfall along the South Carolina coast, Gracie continued to push inland toward the northwest and north, producing heavy rain and tornadoes. A tornado in Ivy, VA, near Charlottesville, caused 12 fatalities.

The fact that the storm came ashore at low tide limited the impact of the storm surge and could have prevented an epic storm surge disaster along the South Carolina coast.

Satellite imagery was not yet available to Meteorologists, but reconnaissance aircraft and coastal radars helped track the storm.

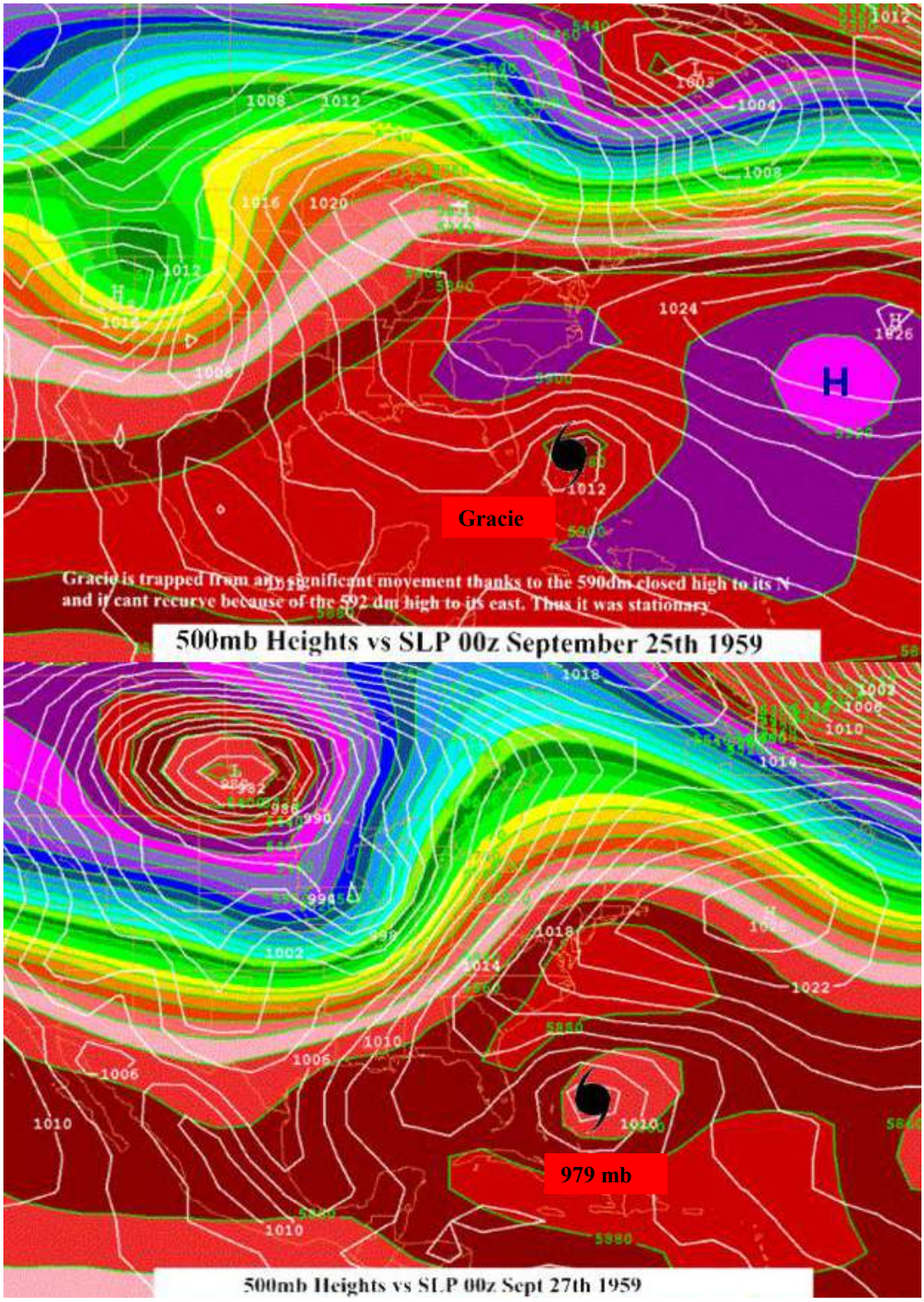
The winding path of Gracie (image courtesy of NOAA's Coastal Services Center). Gracie became a tropical depression on the morning of 9/20 (green line), a tropical storm on the evening of 9/21(yellow line) and a hurricane on the afternoon of 9/22 (red line). After a period of erratic movement and waning intensity, Gracie turned toward the South Carolina coast, then became a major (Category 3) hurricane on the afternoon of 9/28 (dark red line). Gracie was briefly classified as a Category 4 storm, with 140 mph winds, during the early morning hours of 9/29.

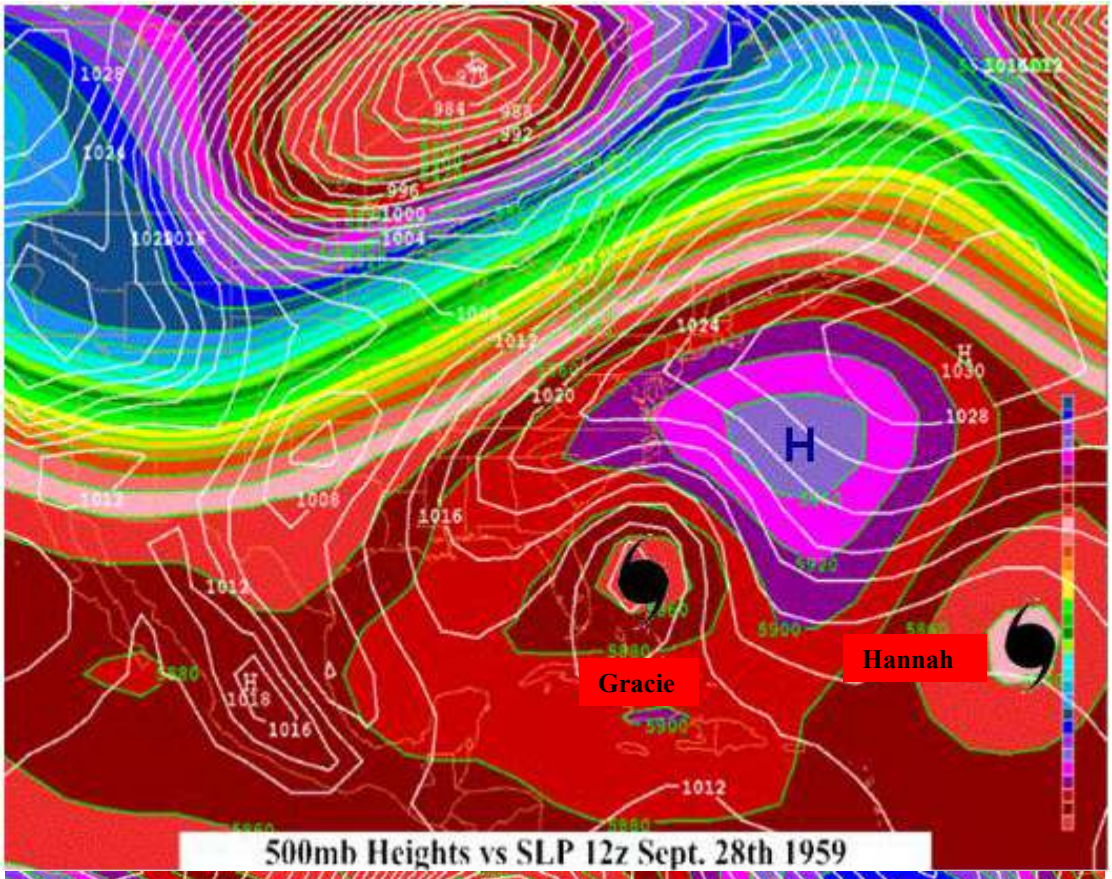


Hand drawn chart of Gracie's path through SC (from the TPC/NHC archives).

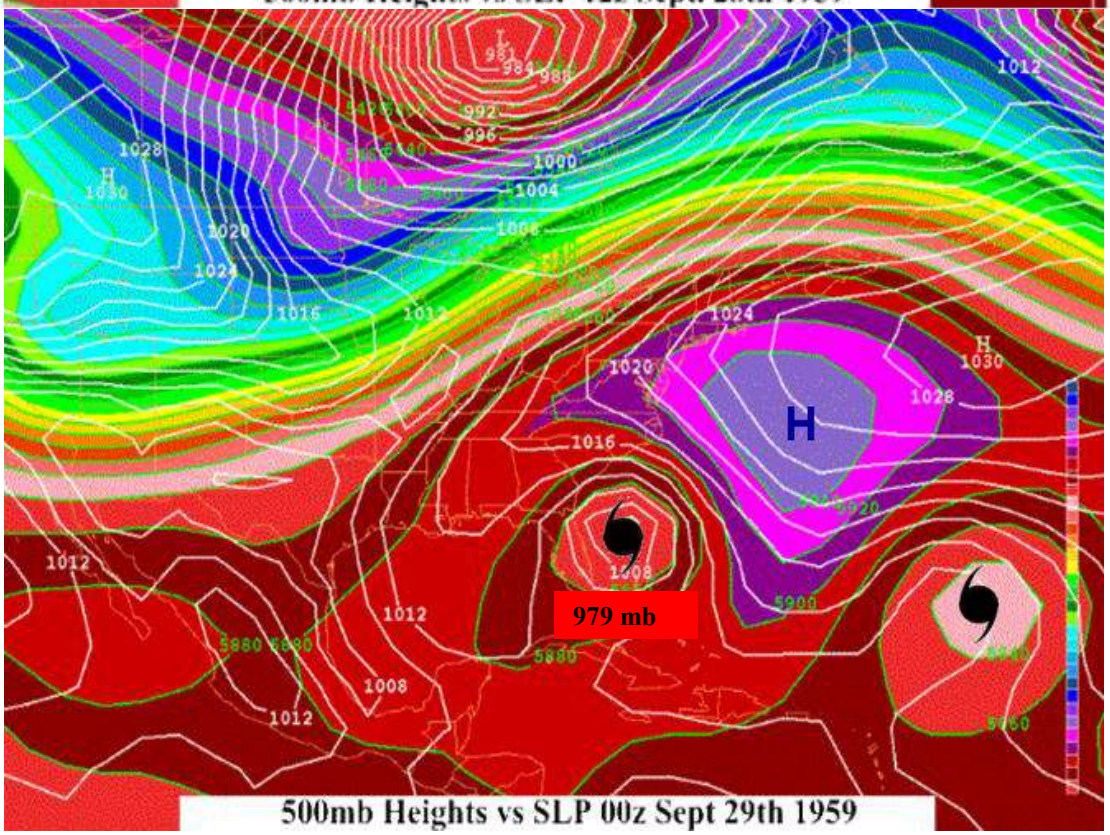
Synoptic Overview

The following Unisys analysis charts, adapted from Allan Huffman's web site www.raleighwx.easternuswx.com/gracie.html, depict the evolution of the surface (white contours) and 500 mb (green contours and shading) pattern from September 25 to September 30. Keep in mind that this analysis illustrates Gracie's path well but greatly underestimates the central pressure of the hurricane. Until September 27, a weak steering pattern allowed Gracie to drift erratically northeast of the Bahamas. Then, deep layer high pressure strengthened northeast of the hurricane and drove Gracie on a steady west-northwest path toward the South Carolina coast. In a similar fashion 30 years later, another strong Atlantic high pressure pushed Hurricane Hugo on a steady path into the Charleston area.



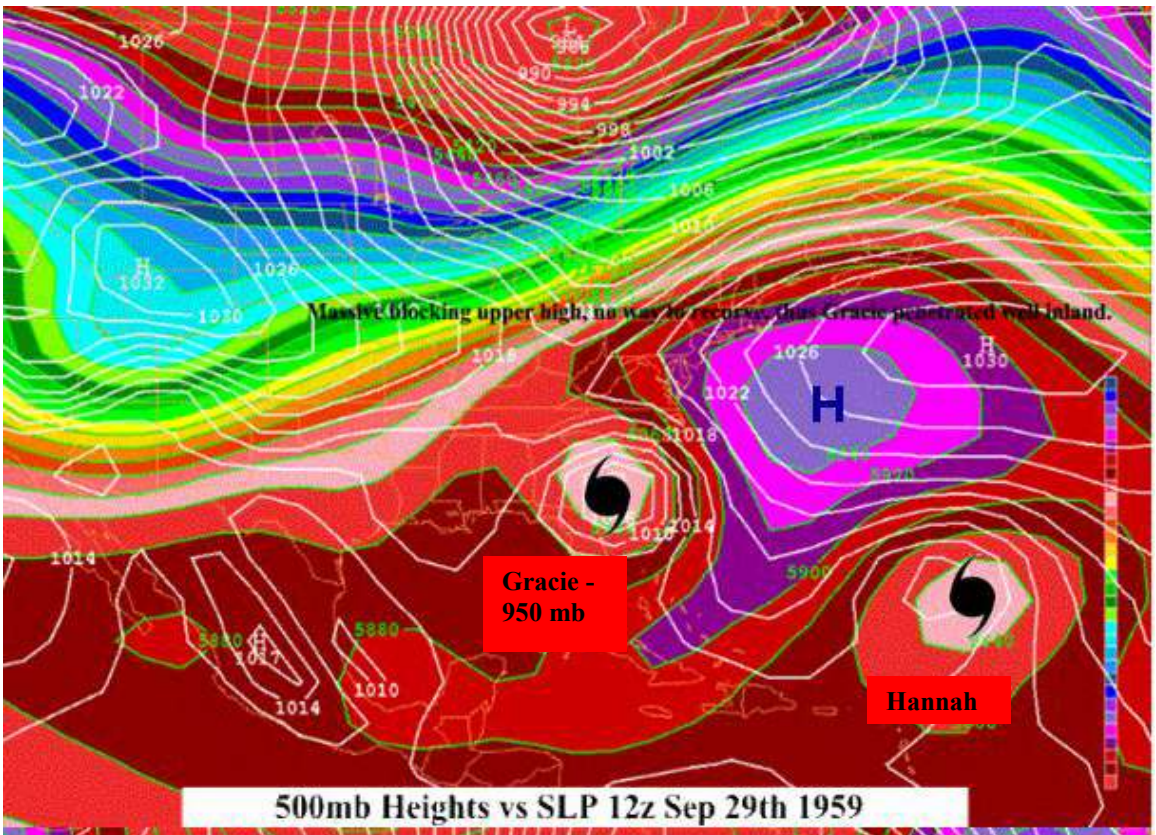


500mb Heights vs SLP 12z Sept. 28th 1959

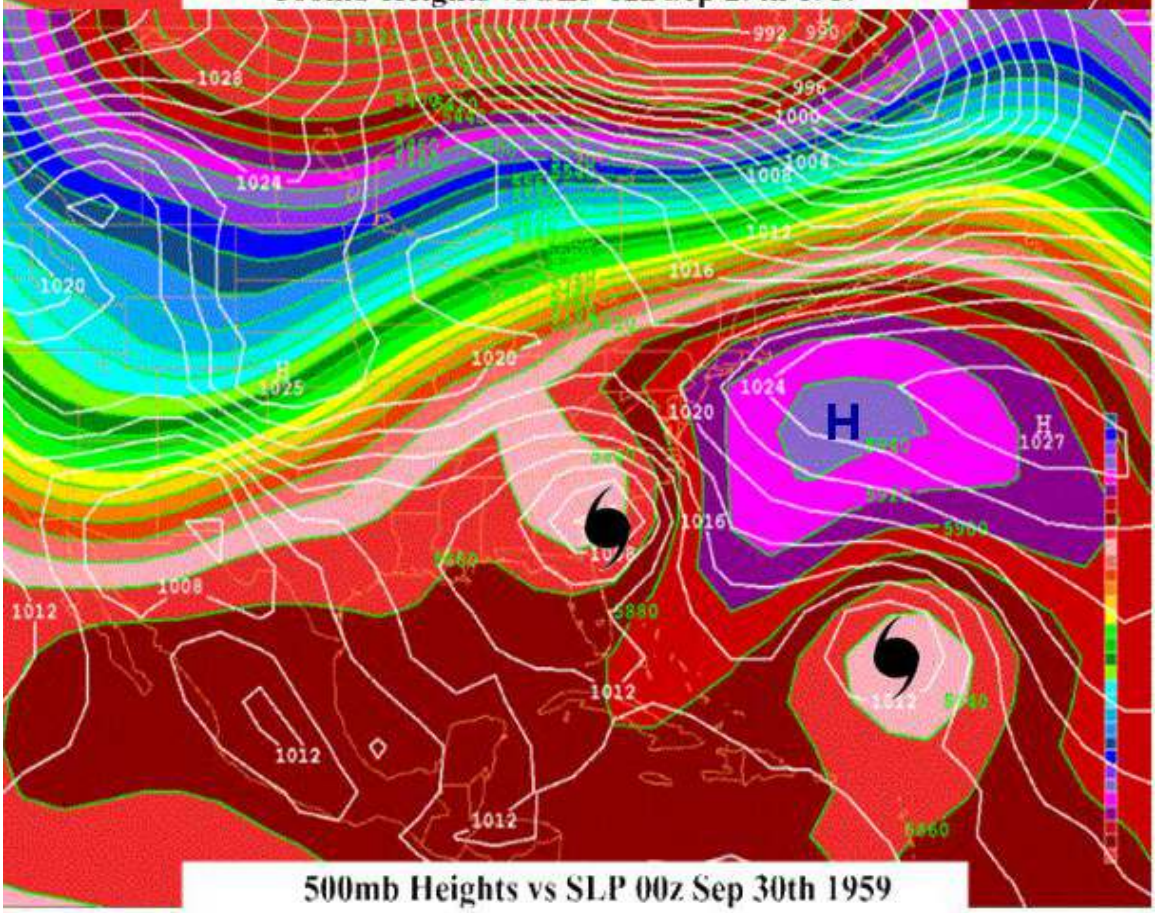


500mb Heights vs SLP 00z Sept 29th 1959

As the west-northwest movement of Gracie became unambiguous Monday, September 28, a Hurricane Watch was issued by midday from Savannah, GA, to Wilmington, NC. This was quickly upgraded to a Warning that very afternoon. Meanwhile, trailing Hurricane Hannah eventually curved away from the coast west of 70 degree west latitude.



500mb Heights vs SLP 12z Sep 29th 1959

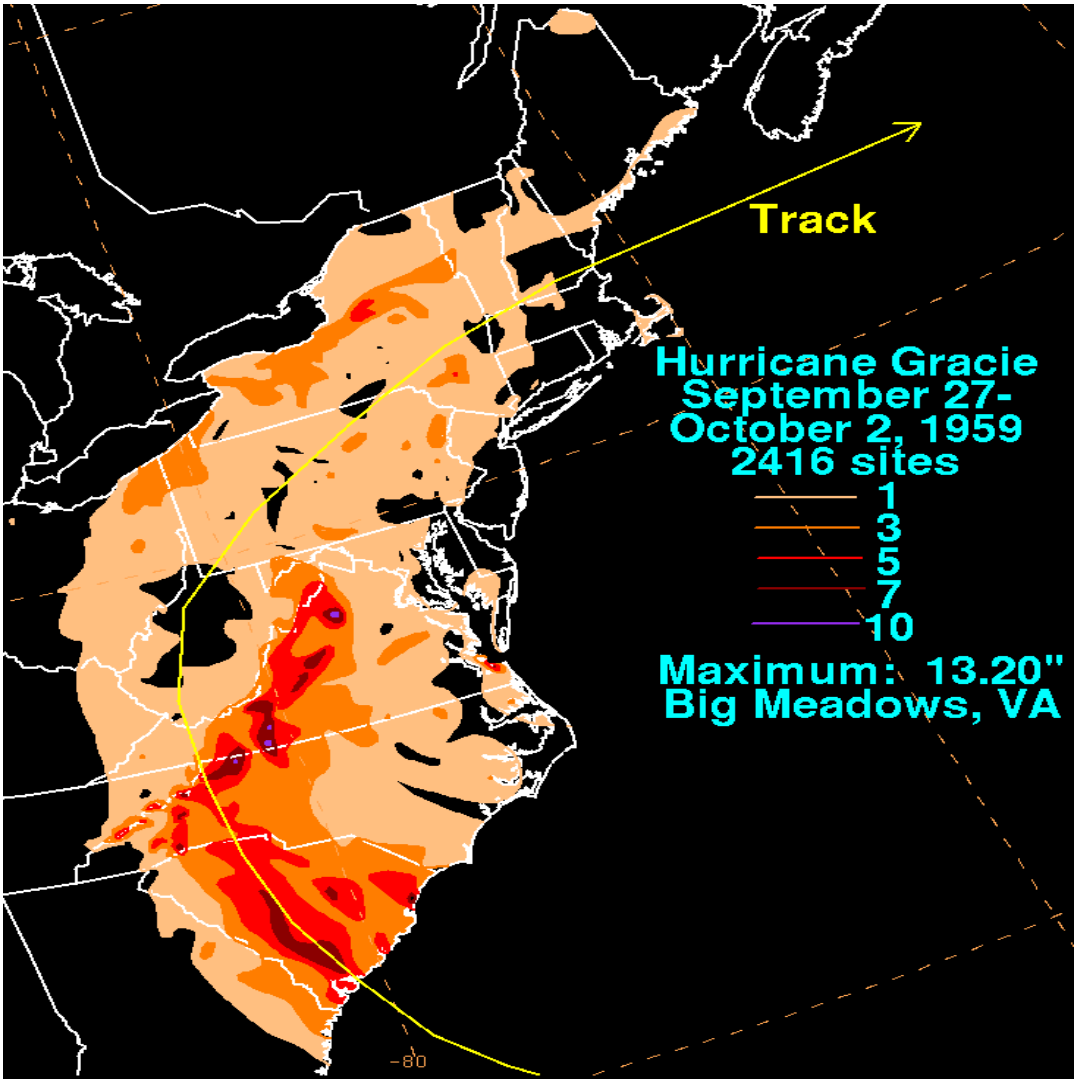


500mb Heights vs SLP 00z Sep 30th 1959

On the morning of September 29 (12Z – top figure on previous page), Gracie was poised to make landfall on the South Carolina coast. Reconnaissance aircraft measured a central pressure of 951 mb three and a half hours after the valid time of this map. Gracie briefly attained Category 4 strength with 140 mph winds during the morning hours of 9/29 – until less than 4 hours prior to landfall. However, unlike Hugo, Gracie weakened slightly to a Category 3 storm before coming ashore.

Rainfall

Gracie produced 4.9 inches of rain at the Marine Corps Auxiliary Air Station in Beaufort between 6:50 am and 12:50 pm EST.



Rainfall produced by Gracie (compiled by HPC). The Appalachian region had been experiencing a drought, and the rain produced by Gracie was considered "beneficial".

Tides

Gracie struck at low tide, which greatly limited the impact of the storm surge. However, the surge still produced an impressive rise in water. Exact figures vary, but the highest reliable measurement placed the peak water level at 9.7 feet above mean low water on Charleston Harbor early Tuesday afternoon. We now use mean lower low water as the reference for tide levels, and 1959 water levels would be reported a bit higher today. Thus, the tide level peaked close to 10 feet above mean lower low water on Charleston Harbor as Gracie pushed the storm surge into the coast**.** Today, we issue Coastal Flood Warnings when tides are expected to reach 8 feet or more above mean lower low water. Thus, Hurricane Gracie easily produced coastal flooding, including 1 to 2 feet of salt water in parts of Charleston, **at low tide.** Landfall at high tide could have pushed salt water to catastrophic flooding levels along the South Carolina coast. With a landfall south of Charleston, at high tide Gracie's storm surge in Charleston Harbor would have significantly exceeded the surge produced by Hugo.

The following charts use mean sea level as the reference level; thus, indicated water levels are several feet below mean low water and mean lower low water levels. Of greatest interest, note how the storm surge overwhelmed the trough normally associated with the low tide on Charleston Harbor (red circle).

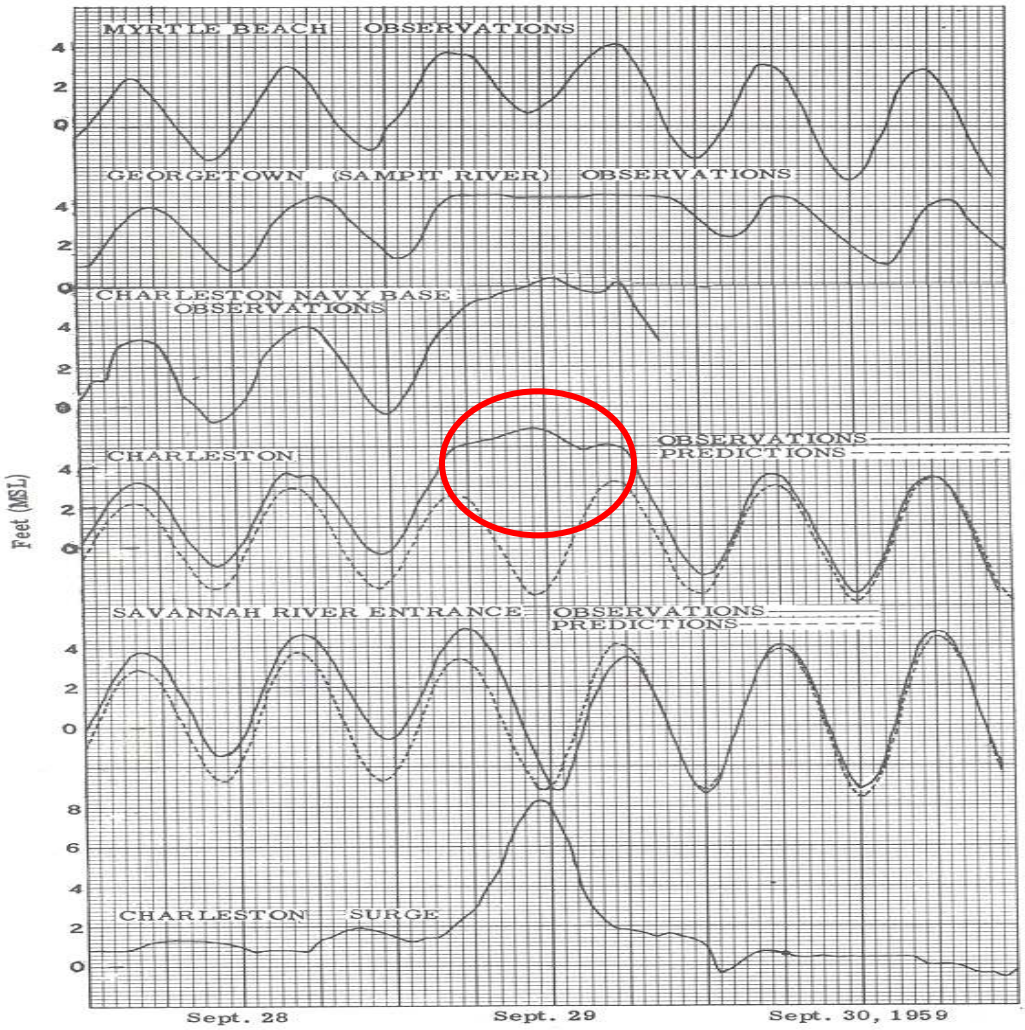


FIGURE 4.—Observed and predicted tides along the South Carolina coast preceding, during, and following hurricane Gracie, September 1959.

Gracie tides (from the Monthly Weather Review, December, 1959).

Gracie's Impact

Reconnaissance aircraft measured the lowest pressure in Gracie's eye as 951 mb (28.08 inches) at 10:30 am EST – shortly before landfall. The Marine Corps Auxiliary Air Station in Beaufort measured a minimum pressure of 950 mb (28.05 inches) at about 12:30 pm EST. The 950 mb pressure establishes Gracie as one of the 50 strongest hurricanes to make landfall in the U.S. since 1851 (*NOAA Technical Memorandum TPC-5, updated 15 April 2007*).

The weather observer at Churn Station at Edisto Beach evacuated the beach (as did the rest of the community) and gathered observations from a location 6 miles northeast of the beach. Here, the observer measured a lowest pressure of 965 mb (28.49 inches) between 11:35 and 11:40 am EST. The observer also reported peak winds near 150 mph – an estimation, since the anemometer was damaged. The Meteorologist In Charge of the Charleston Weather Bureau office also reported, "No casualties known to observer but wind damage worst known. Reports warnings and advisories well timed and well heeded".

Well north of the eye of the hurricane, a Navy ship on Charleston Harbor reported a peak wind gust of 71 mph at 1:48 pm EST.

In a report filed November 12, 1959, the Commanding Officer of the Marine Corps Auxiliary Air Station in Beaufort relayed this graphic description of Gracie's eye as provided by the Beaufort County sheriff:

> *"The eye of Gracie passed over my home located on Coffin Point near the town of Frogmore, South Carolina. A dead calm lasted 35 minutes. During this time, there was absolutely no wind. It quit as suddenly as it began and the sun appeared and was extremely hot. There was a thin veil of cirrostratus covering the entire sky. As the rear of the eye approached, you would see a very dark cloud filled with dust and flying debris."*

The publication, "*A History of Storms on the South Carolina Coast"*, by Laylon Wayne Jordan, Robert Dukes and Ted Rosengarten of the South Carolina Sea Grant Consortium, provides details of storm impacts outside Beaufort County. Because of strong winds, three-quarters of Charleston County lost power, and the power failed at the Charleston city waterworks. On Folly Beach, "…200 people 'rode out' the hurricane, and all front row houses were damaged. Roads on the east side of the island were washed away". Inland, 100 mph winds lashed Walterboro. Farther north, a tornado damaged homes in Garden City, near Myrtle Beach. The publication also related details of a Red Cross Areal Survey conducted October 2: " Between Beaufort and Charleston, inland as far as Walterboro, 48 homes were destroyed, 349 homes suffered major damage and 4,115 homes suffered minor damage".

Gracie was actually the second hurricane to make landfall on the southern coast of South Carolina in 1959. During the evening of July 8, Hurricane Cindy swept through Bull's Bay and pushed onshore near McClellanville as a Category 1 storm.

SPECIAL STATEMENT FOR PRESS RADIO AND TELEVISION ON HURRICAN GRACIE

HURRICANE GRACIE HAS GROWN INTO AN EXTREMELY DANGEROUS HURRICANE AND ISLAND BEACHES AND WATERFRONT AREAS MUST BE COMPLETELY EVACUATED ALL ALONG THE SOUTH CAROLINA COAST IF LOSS OF LIFE IS TO BE AVOIDED.

THE GREATEST DANGER WILL BE NEAR AND NORTHWARD OF THE CENTER WHERE TIDES OF NEAR 12 FEET ABOVE MEAN LOW WATER AND WINDS UP TO 125 MILES PER HOUR ARE EXPECTED SOMETIME BETWEEN DAYLIGHT AND NOON TUESDAY

J. A. CUMMINGS
WEATHER BUREAU OFFICE
CHARLESTON S.C.

MIAC A CHS

TIDE STATEMENT CHARLESTON SAXXX S.C. 2.30 PM SEPT 29 1959

THE CREST OF THE STORM TIDE ALONG THE COAST IN THE VICINITY OF CHARLESTON S.C. HSXXX HAS BEEN REACHED. FROM 120 NOON TO 2.30 P.M. THE HIEHGT OF TIDE IN THE CHARLESTON AREA WAS APPROXIMATELY 9 AND 1/2 FEET ABOVE MEAN LOW WATER.
THIS WAS THE HIGHEST TIDE FOR CHARLESTON SINCE 1940 WHEN A HEIGHT OF 10.7 ABOVE MEAN LOW WATER WAS REACHED AT THE CUSTOM HOUSE.

FLOODING WILL PRESIST FOR SEVERAL MORE HOURS AND PROBABLY WILL NOT FALL BELOW THE FLOOD PLANE OF 7 FEET MEAN LOW XXXX MEAN LOW WATER UNTIL AFTER 7 P.M. TNOXXX TONIGHT.

WEATHER BUREAU CHARLESTON S.C. DEVERAUX

LOCAL STATEMENT
WEATHER BUREAU
CHARLESTON S.C.

HURRICANE GRACIE CROSSED THE COAST OVER ST. HELENA SOUND AT THE SOUTH END OF EDISTO ISLAND AT 11.25 A.M. EST. THIS ABOUT 25 MILES STOR TO THE LEFT OF THE COURSW WHICH OUR 8.30 A.M. STATEMENT GAVE. EXPECT FOR THIS MORE SOUTHERLY POINT OF CROSSING THE COAST THE PATHE OF OUR 8.30 A.M. STATEMENT VERY WELL COVERS THE COURSE OF THIS STORM ACROSS THE STATE. THE CENTER WILL NOW PASS OVER OR NEAR COLUMBIA S. C. AND GASTONIA N.C.

Hurricane Gracie statements issued by the Weather Bureau in Charleston, SC (from the NHC archives).

COORDINATION SHEET

Hurricane Gracie #29

Date and Time Sept 29, 1959 1100E

	INITIAL PREFERENCE OF CENTERS			
	WBO Miami	Coord		FWC Miami
Present Position	32.5 N 80.2 W	32.5 N 80.2 W	N W	32.4 N 80.2 W
Present Movement	Course NW	Course NW & NNW	Course	Course NW NNW
	Speed 12 mph	Speed 14 mph	Speed mph	Speed 14 mph
	Speed kts	Speed 12 kts	Speed kts	Speed 14 kts
Maximum Winds	125 mph	mph	mph	mph
	kts	kts	kts	kts
Present Radius of 75 mph Winds	75-N 50-S	Same		
Present Radius of 40 mph Winds	200 N 125 S			
Forecast: 12-hours	° mph	° mph	° mph	015° 10 mph
12-hour position	34 N 80.5 W	34.2 N 80.0 W	N W	34.5 N 79.5 W
24-hour position	36.5 N 78.5 W	36.5 N 78.0 W	N W	36.5 N 77.5 W

Coordinated data for warnings

Present Position N W. Present Course and Speed

Maximum Winds: Present Forecast

Radius of hurricane winds: Present Forecast

Radius of 40 mph winds: Present Forecast

Course and speed next 12 hours ° mph kts

12-hour position at Time N W

Present radius of 50 knot winds for Air Force

24-hour forecast at Time N W

Forecast radius of 50 knot winds for Air Force

Coordination began Completed

Comments:

400-8/20/58

Hurricane Gracie data logged just before landfall September 29 (from the NHC Archives).

Damage from Gracie at Beaufort Elementary School (from the Hipp family collection posted on Flickr).

Damage from Gracie on Lady's Island near Beaufort SC (from the Hipp family collection posted on Flickr).