# COASTAL STORM SNOW EVENT
## NOVEMBER 20-22, 2006
## OPEN-FILE REPORT

**South Carolina Department of Natural Resources**
**Land, Water and Conservation Division**
**South Carolina State Climatology Office**

Complied by: Mark Malsick
November 28, 2006

# COASTAL STORM SNOW EVENT

## Event Summary:

A transitory upper level shortwave with an embedded cut-off low triggered the formation and intensification of a vigorous, complex triple-point low off the southeast coast of South Carolina November 20-22, 2006 (Figure 1). This coastal low maintained gale force winds along the South Carolina Coast with storm force winds seaward. As this coastal low deepened offshore, heavy precipitation bands wrapped around and over the Midlands and Pee Dee counties. Favorable kinematics aloft and thermodynamic processes within the air column produced heavy rain and record setting periods of snow and sleet across portions of South Carolina and Georgia on November 21. Charleston observed morning snow for three hours with periods of unprecedented thunder snow. Areas in Orangeburg, Bamburg and Barnwell counties recorded ½-1 inch of snow accumulation prior to sunset. Observers in part of Allendale County reported 1-2 inches of snow accumulation.

This coastal storm lingered off the South Carolina coast until late on November 22 when this unnamed storm deepened to1000mb as it lumbered northwards brushing the North Carolina coast and Outer Banks with heavy rain and storm force winds. The storm forced heavy rains over South and North Carolina that primed the multiple river watersheds for minor to moderate flooding the following week.

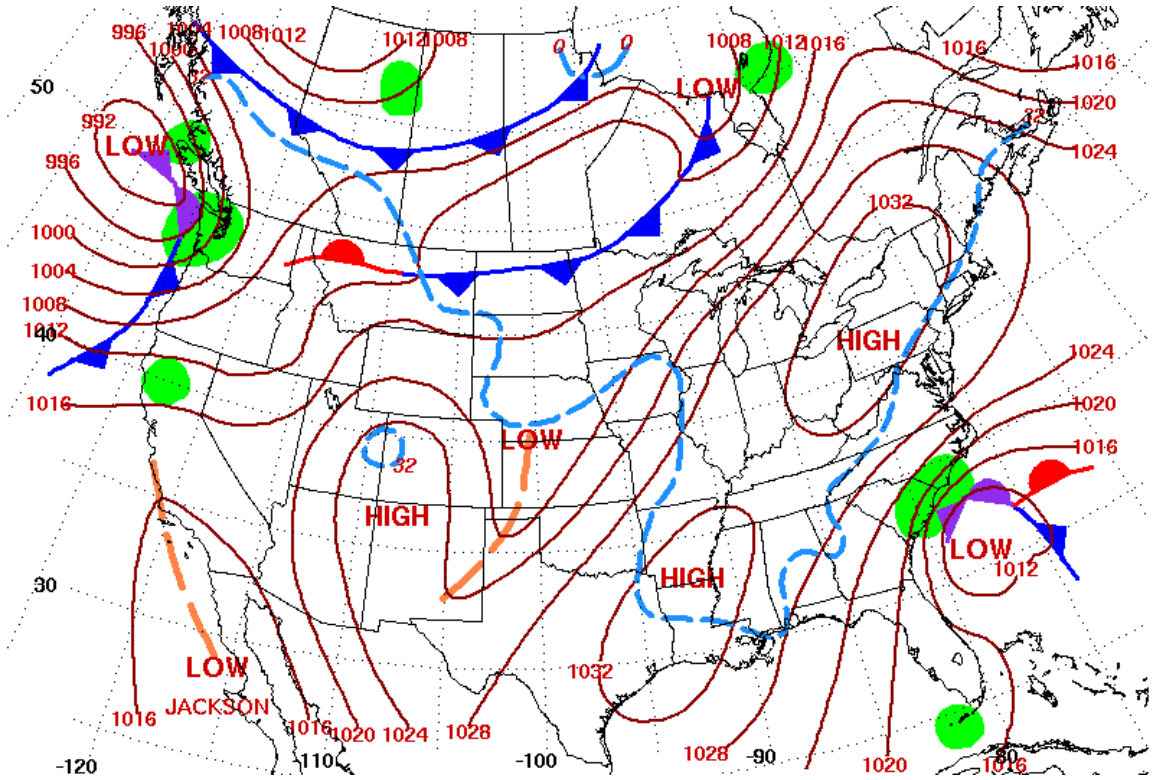


Figure 1. Synoptic situation 1200Z 21 November (NOAA, HPC).

## Forecast Considerations:

There was general agreement amongst the global and regional numerical models as to the timing of this event, but accurate placement and magnitude of the coastal low remained inconsistent amongst forecast solutions greater than 48 hours. Figure 2 shows the Weather Research and Forecasting (WRF) model's under-estimation of the coastal pressure gradient and problematic placement of the low too far to the east at 72 hours when compared to the model's 1200Z, November 21 analysis (Figure 3).

In forecast runs prior to the storm, most models were consistent with the placement of the elongated 1032mb reinforcing high to the west and the cut-off upper-level low swinging over the southeast with an attendant 500mb cold pocket (Figure 4). This cold pocket at 500mb coupled with strong diffluence provided by the left exit region of a 300mb jet streak (Figure 5) provided lift, cooling and moisture advection responsible for the November 21 snow event.

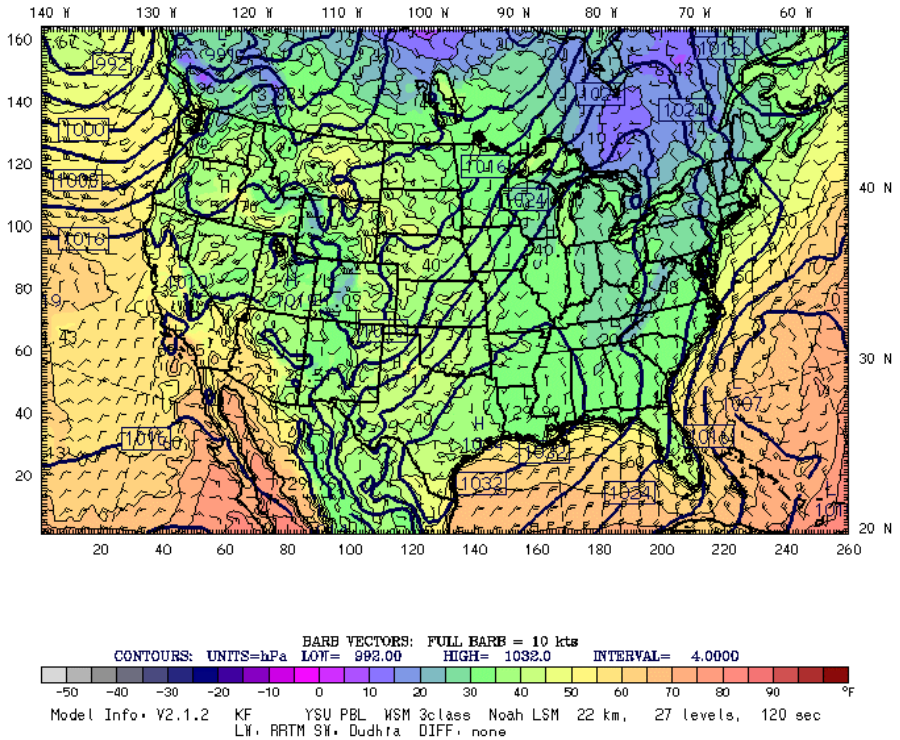


Figure 2. 1200Z November 18 72-hour WRF model forecast.

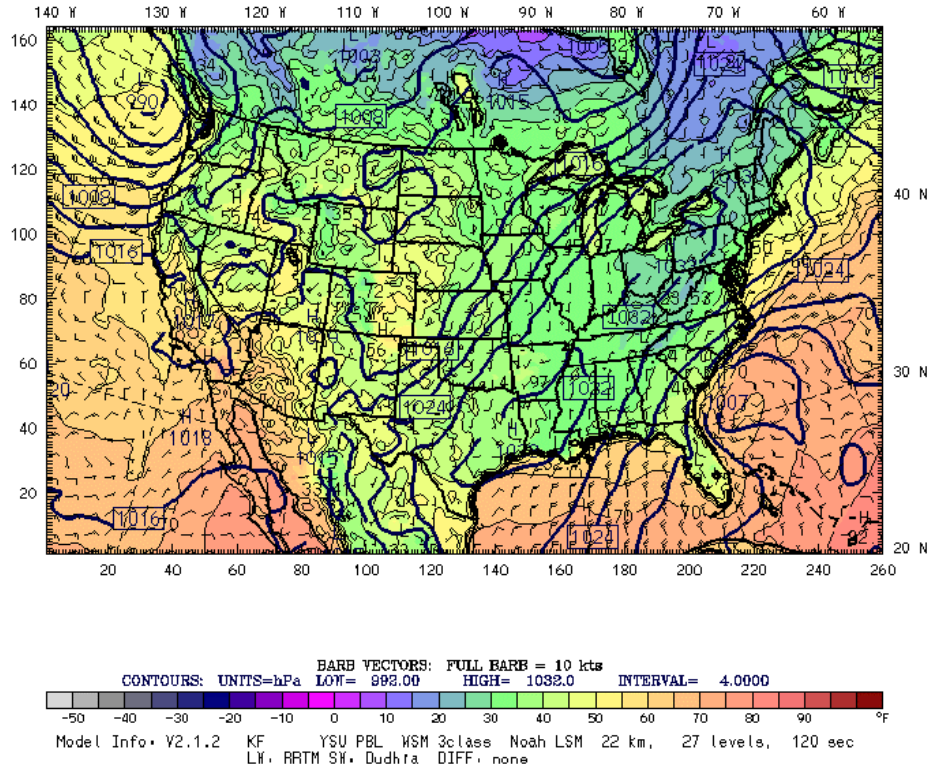


Figure 3. 1200Z November 21 WRF analysis.

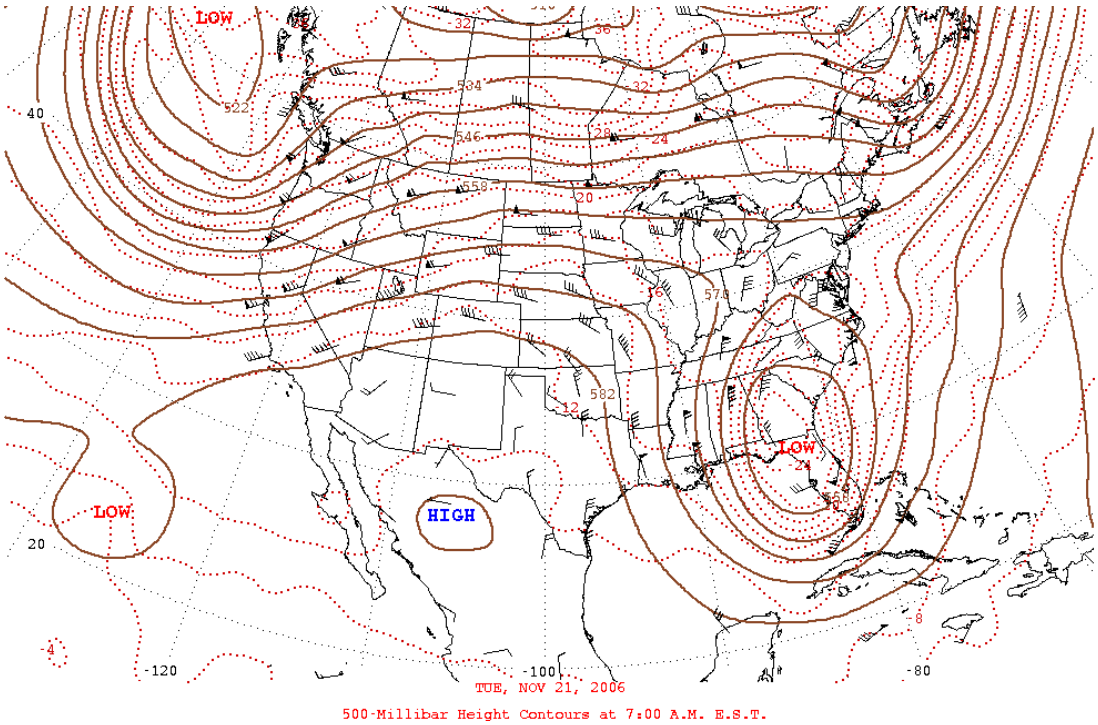


Figure 4. 1200Z November 21 500mb height analysis (NOAA, HPC)

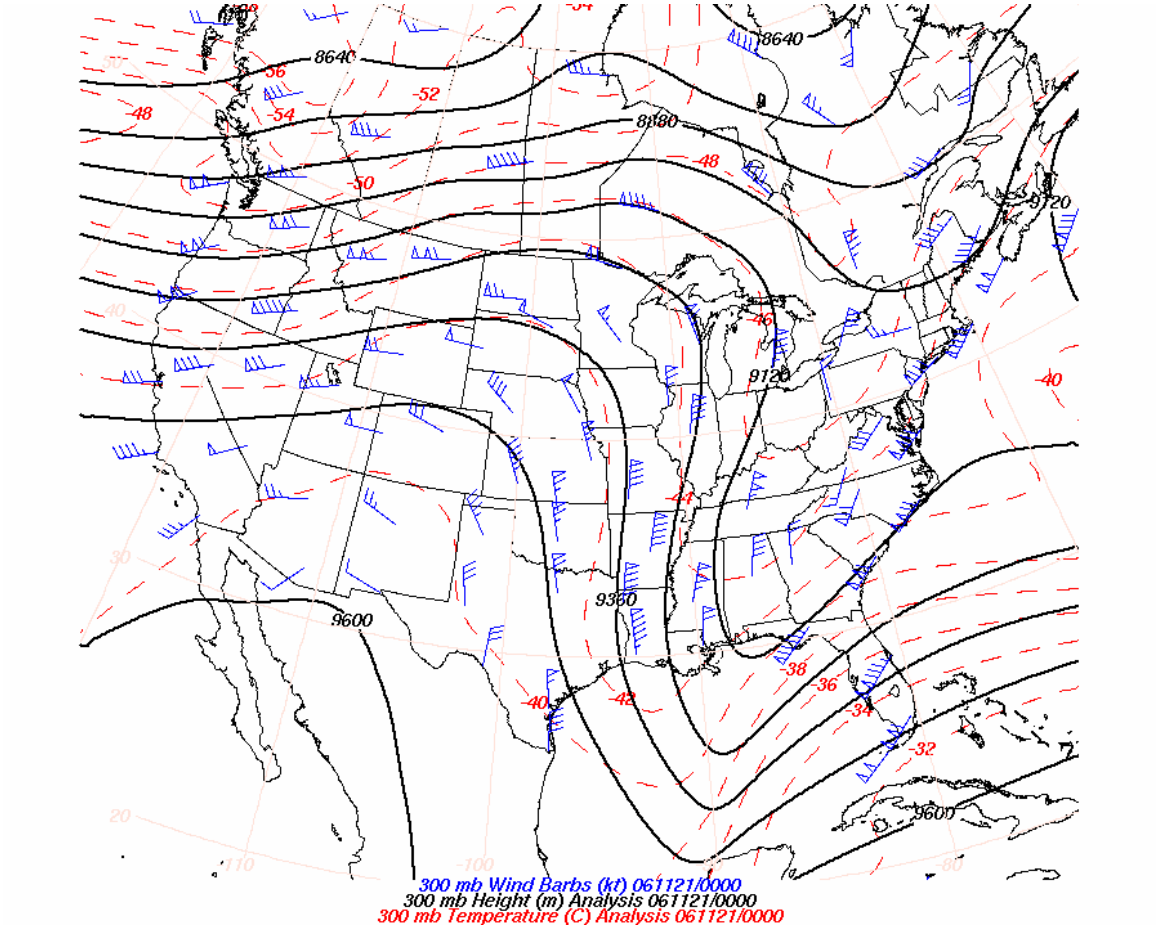

Figure 5. 1200Z 21 November 300mb height analysis (Ohio State University).

Evaporative cooling during the onset of moisture advection thermodynamically and dynamically primed the atmosphere to produce this unprecedented pre-winter coastal snow event for South Carolina. In addition to chilling the air column, evaporative cooling also induced negative buoyancy that further accelerated the cooling to the surface. Charleston's atmospheric soundings in Figures 6 and 7 show the northeasterly moisture advection and subsequent bottom-up saturation by 1200Z November 21. The soundings show the strong upper-level dynamics and the dramatic cooling from the surface to 400mb coincident with the onset of snow in Charleston.

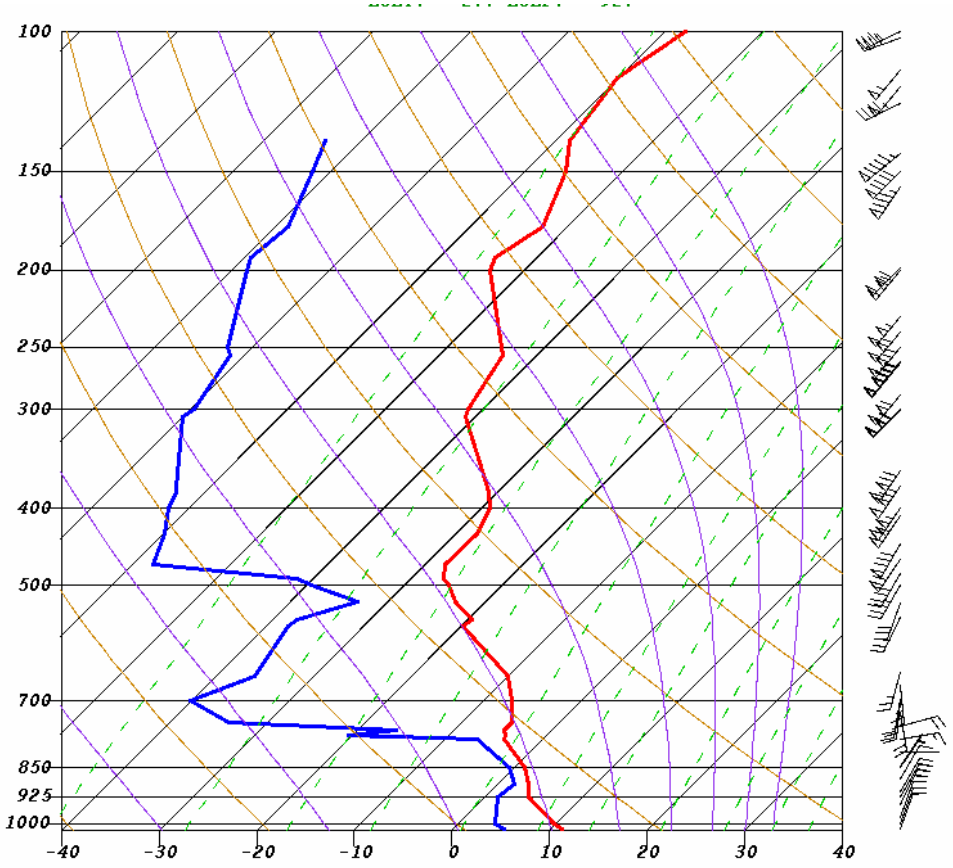


Figure 6. Charleston SC 0000Z 21 November sounding (Ohio State University)

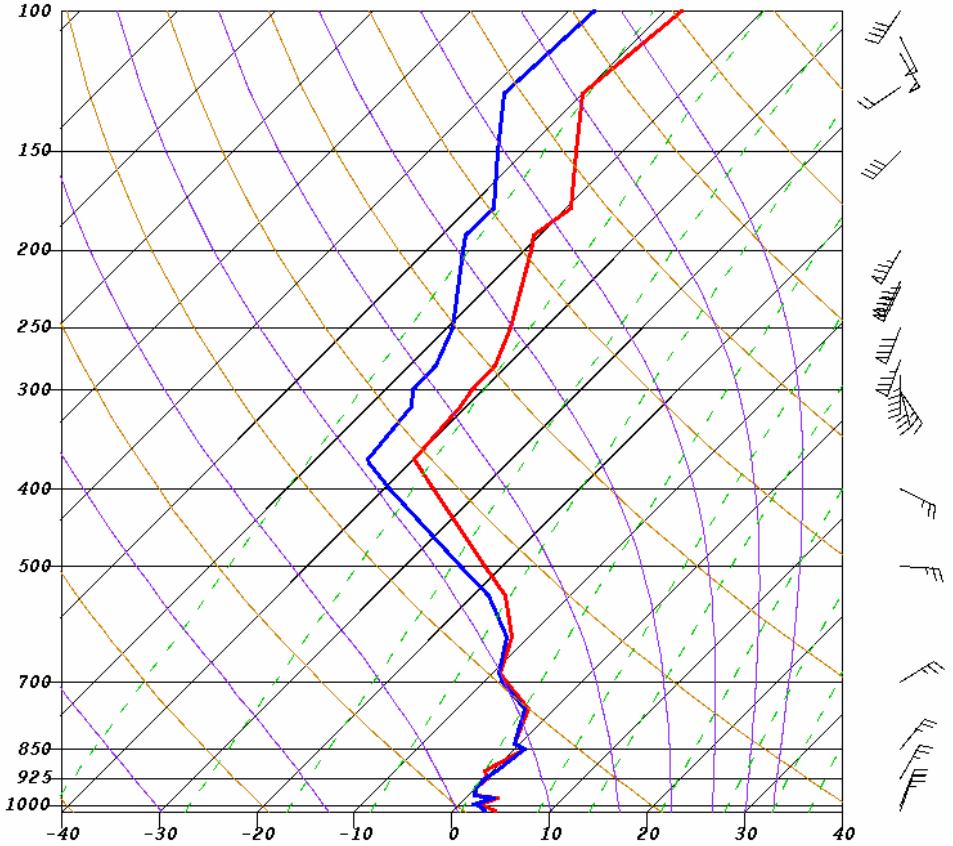


Figure 7. Charleston SC 1200Z 21 November sounding (Ohio State University)

## South Carolina Effects:

The November 21 coastal storm gave South Carolina a mixed bag of precipitation, strong coastal winds, beach erosion and riverine flooding. The most remarkable storm event was snow that fell in Charleston and inland counties during the morning and afternoon of November 21. NWS Doppler radar showed high reflectivity cells of mixed precipitation aloft in the vicinity of the areas in South Carolina and Georgia that received the rare pre-winter snow (Figures 8-10). Thunder snow, a result of the strong upper level forcing, was reported at several areas in and around Charleston. Snow accumulated on roofs and grassy areas with "dustings" in Charleston to 1-2 inches inland. Snowflakes mixed with sleet were observed falling on the grounds of the State House in Columbia at noon.

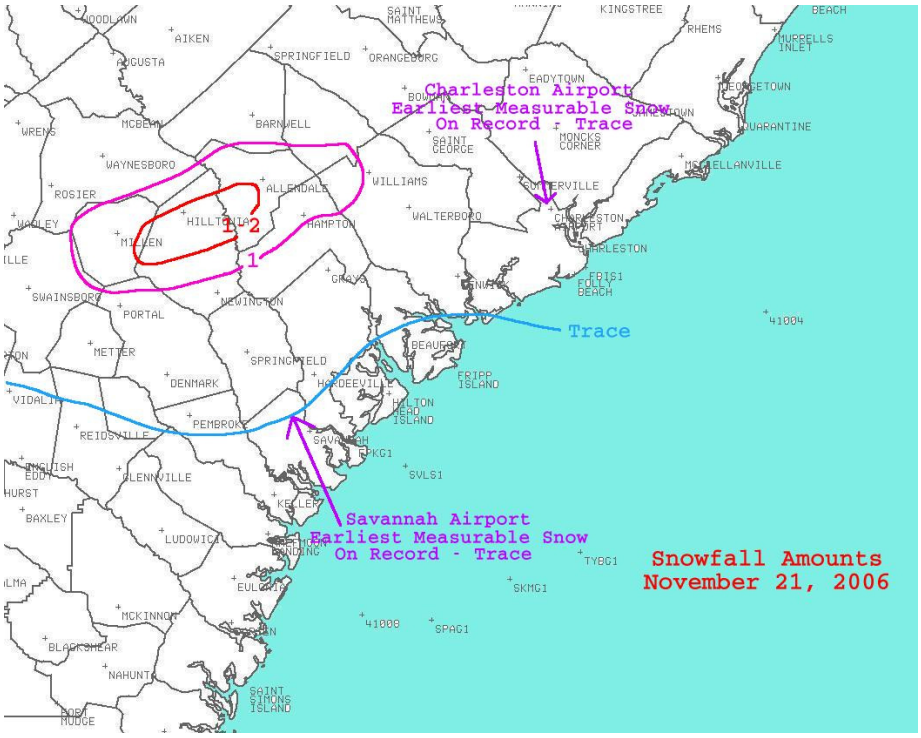


Figure 8. Observed Snow Totals November 21, 2006 (NWSFO Charleston)

South Carolina snowfall amounts:

| | |
|---|---|
| Lodge | 1 inch |
| Martin | 1 inch |
| Smoaks | 1 inch |
| Daniel Island | ½ inch |
| Hampton | ½ inch |
| Moncks Corner | Trace |
| Awendaw | Trace |
| Charleston | Trace |

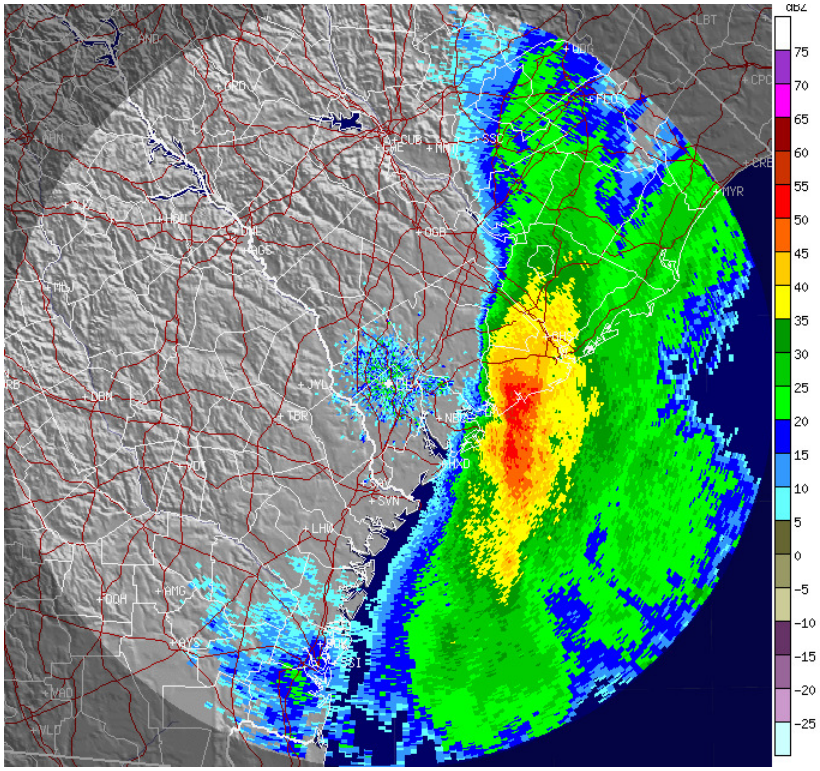


Figure 9. 1200Z Radar reflectivity of Charleston snow event. (NWSFO Charleston)

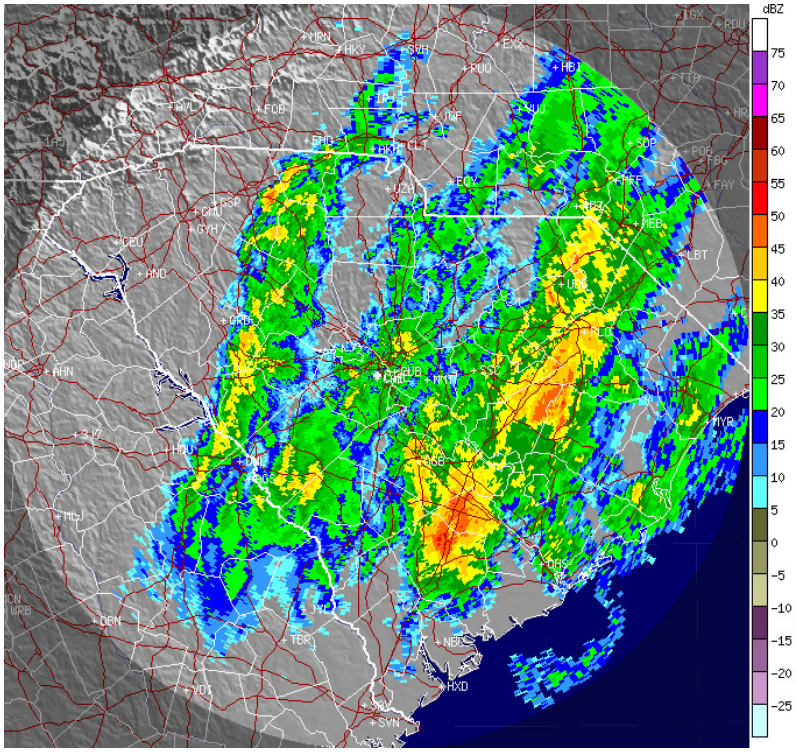


Figure 10. 1900Z Radar reflectivity of Colleton-Bamburg-Barnwell-Allendale afternoon snow event. (NWSFO Columbia)

High winds along the South Carolina coast downed trees and caused scattered power outages. The Edisto buoy recorded 61 mph wind gusts (Figure 11). High surf and heavy coastal beach erosion was reported at Hunting Island, Folly Beach and Isle of Palms. Reported wind gusts November 21:

| | |
|---|---|
| Folly Beach | 44 mph |
| Charleston Waterfront Park | 44 mph |
| Charleston Airport | 40 mph |
| Hilton Head | 39 mph |
| Pineville | 37 mph |
| Edisto Beach | 35 mph |
| Springmaid Pier | 37 mph |

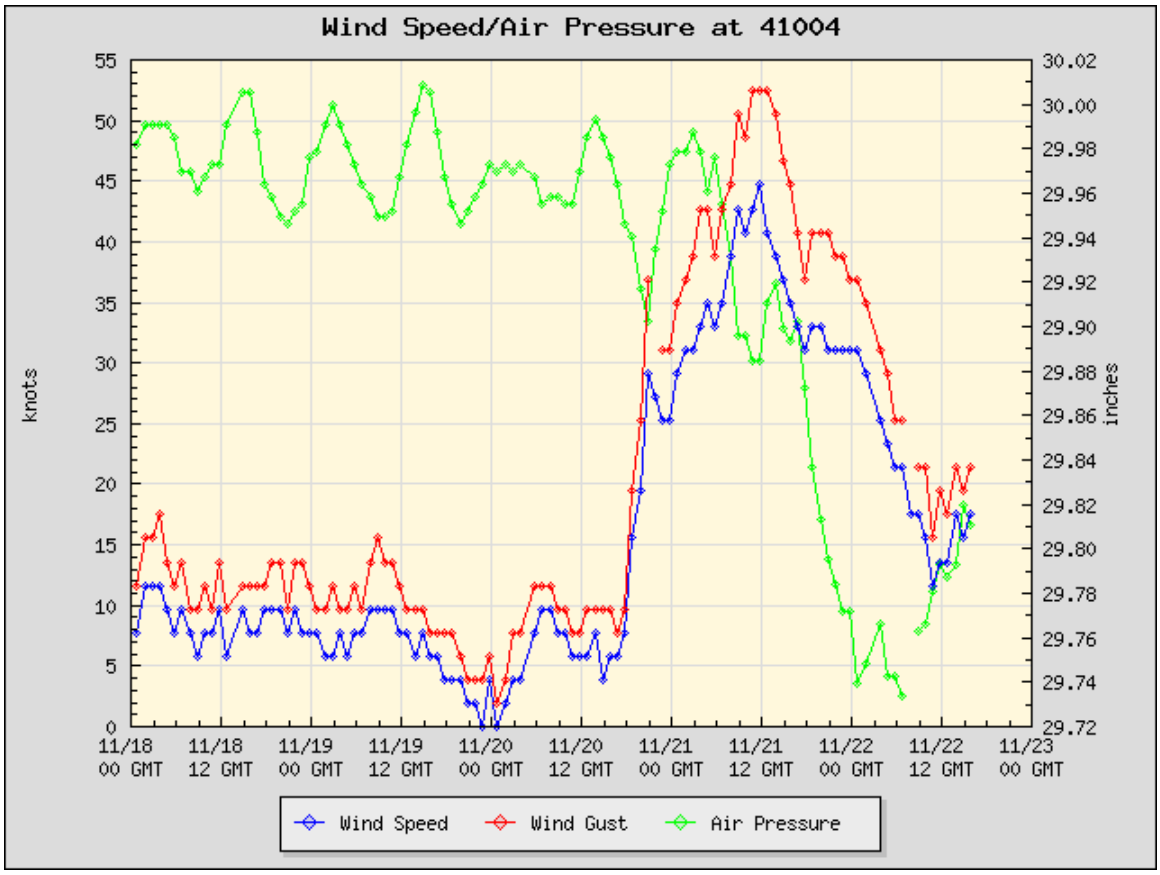

Figure 11. Wind speeds and air pressure recorded by Edisto Buoy. (NDBC)

Heavy rainfall over the Midlands and Pee Dee caused immediate localized flooding in Lexington, Lancaster and Chesterfield counties. Heavier rainfall over North Carolina forced flood waters to crest on the Pee Dee, Little Pee Dee and Lower Santee Rivers November 28-29. November 21-22 rainfall amounts:

| | |
|---|---|
| Aiken (SRS) | 1.30 inches |
| Anderson County AP | 0.42 inches |
| Beaufort MCAS | 0.71 inches |
| Blythewood | 3.25 inches |
| Carolina Sandhills | 5.07 inches |
| Charleston AFB | 2.08 inches |
| Chester | 4.13 inches |
| Clemson-Oconee | 0.11 inches |
| Columbia Metro | 2.79 inches |
| Columbia Downtown | 2.53 inches |
| Darlington | 3.43 inches |
| Dillon | 3.96 inches |
| Florence Regional | 1.85 inches |
| Galivants Ferry | 2.45 inches |
| Greer | 0.65 inches |
| Hartsville | 3.35 inches |
| Jamestown | 2.05 inches |
| Kings Mountain | 2.20 inches |
| Mullins | 2.52 inches |
| North Myrtle Beach | 1.19 inches |
| Orangeburg | 1.27 inches |
| Pageland | 5.67 inches |
| Sandhill (SAHS1) | 3.20 inches |
| Santee NWR | 1.79 inches |
| Shaw AFB | 2.13 inches |
| Summerville | 2.38 inches |
| Whitmire | 3.62 inches |

## Climatological Perspective:

The November 21, 2006 snow event was the earliest, heaviest pre-winter snow accumulation measured in Charleston, SC, and Savannah, GA. The previous Charleston snowfall record occurred on November 25, 1950, when just a trace of snowfall was observed. Thunder snow had never been observed at the Charleston Airport before this November 21, 2006 coastal storm.

## ACKNOWLEDGEMENTS:

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