Post Mortem for the November 21 Snows Across Interior Southeast South Carolina and Southeast Georgia

Summary: During the late afternoon of 21 November 2006, accumulating snows began to fall across much of interior SE SC and SE GA as a strong coastal storm meandered off the Southeast coast of the United States, approximately 140 miles east of Savannah, GA. Moderate to heavy snow fell during a 3 hour period from 5 pm until 8 pm, resulting in accumulations on grassy areas, trees as well as roadways. Snowfall totals of 1 to 2 inches were common across much of this area, stretching from Jenkins County, GA to Northern Colleton County, SC. Spotter reports east of Millen, GA suggest there was a corridor of locally heavier snow stretching from Millen through Hilltonia to just west of Allendale. Many of the spotters reported snow flakes the size of quarters to half dollars.

Actions: WFO CHS received several reports of moderate snow falling in the Lodge and Smoaks area. Initially, a series of Special Weather Statements were issued to address the situation, however a Snow Advisory was issued for Screven, Allendale, Hampton and Inland Colleton County once a report of snow accumulating on roadways in Lodge was received by the Colleton County Warning Point. The initial advisory indicated accumulations of up to 1 inch could be expected. However, we were forced to increase accumulations to 2 inches about 20 minutes later once reports of accumulations of 1 inch were received from spotters near Allendale and Lodge. The Snow Advisory was also expanded to include Jenkins County, GA at that time. All text products and grids were updated to include mention of definite moderate snow in the advisory area and a Snow Amount grid was submitted to the NDFD. This was the first time CHS has ever submitted a non-zero Snow Amount grid to the NDFD (Fig. 1).

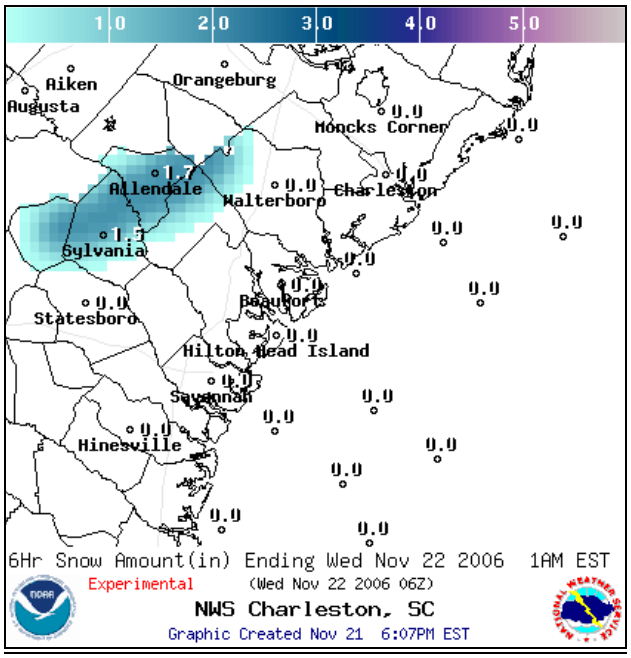

Figure 1. CHS Snow Amount Grid submitted to the NDFD

Numerous calls were made to County Warning Points and Skywarn Spotters during the 3 hour advisory time period. Frequent LSRs were issued to relay estimated and measured snowfall reports to adjacent WFO's and the local media. Chats were also sent to WFO CAE via 1-2 Planet and the event was quickly picked up by the Weather Channel.

Meteorological Review: WFO CHS had been advertising the potential for a large coastal storm to develop off the SC/GA coasts for many days. A number of possible impacts were addressed in our products, including high surf, coastal erosion, high winds, heavy rain and very hazardous marine conditions for many days leading up to the event. The potential for winter weather was occasionally highlighted our local Area Forecast Discussions, but the potential was appropriately downplayed given the various thermal profiles offered by numerical models and the climatological rarity of snow across the CWFA. Unfortunately, accumulating snows did occur in portions of the CWFA with both CHS and SAV observing their earliest snowfalls (Trace) on record (Fig. 2).

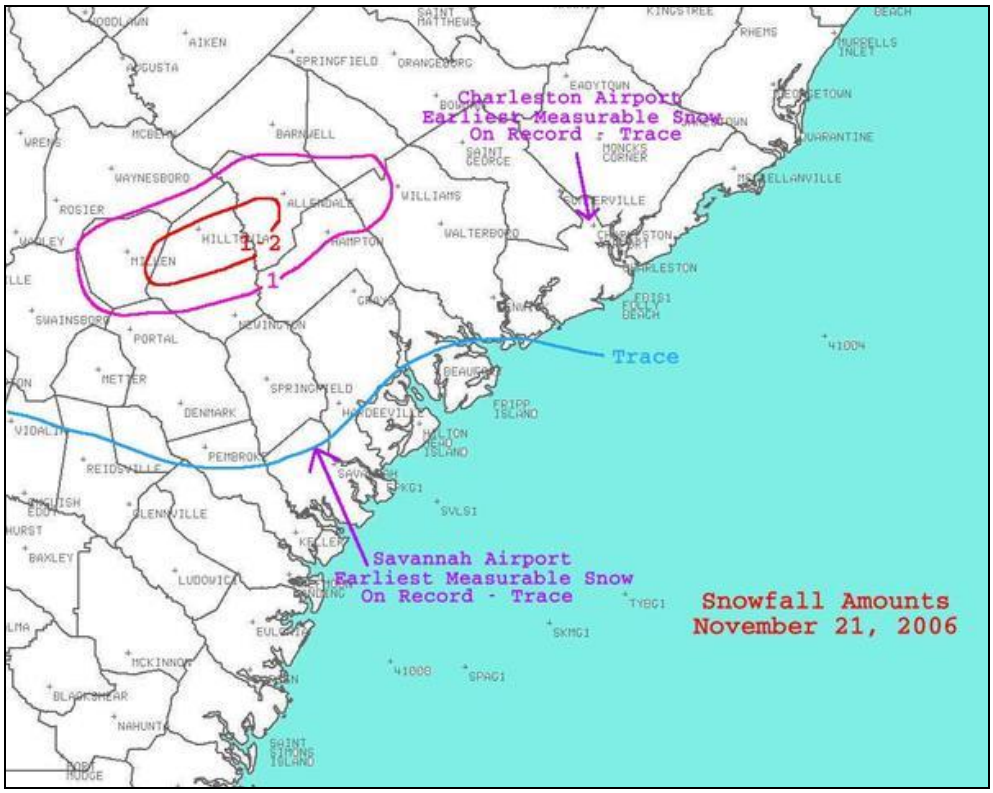

Figure 2. Storm Snowfall Totals.

This event was extremely difficult to forecast. However, a reanalysis of some model data, particularly off the RUC, showed that there were several factors present for the development of accumulating convective snows.

Presence of Slant-wise Convection (CSI)

Slant-wise convection, also known as Conditional Symmetric Instability (CSI), is almost unheard of in coastal South Carolina and Georgia. However, a look at the RUC 850-700 mb QG Frontogenesis Fields (Fig. 3), suggest strong vertical motion was occurring during the late afternoon hours due to the presence of an indirect ageostrophic circulation. This upward motion aided in the redevelopment of a large precipitation field across much of the region. CSI is generally found in areas of strong Frontogenesis.

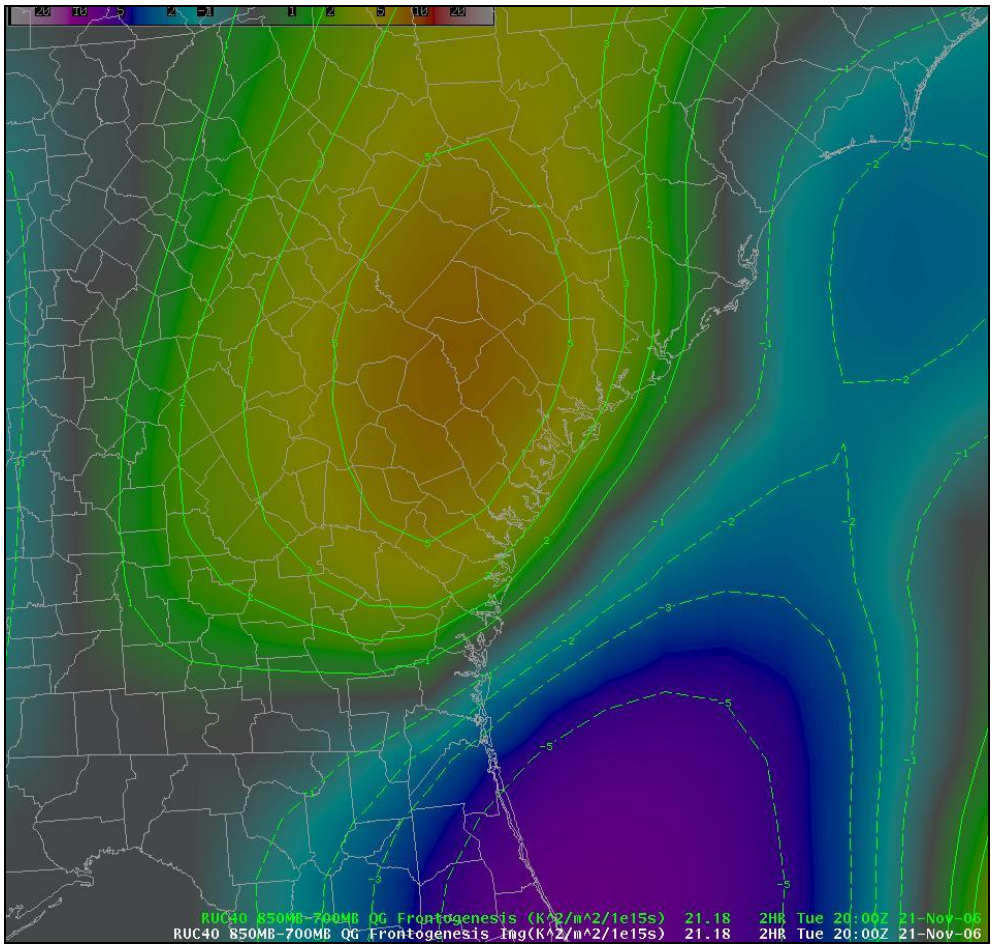

Figure 3. RUC 850-700 mb QG Frontogensis. Noted the bulls eye of values greater than 10 $K^2m^{-2}(1x15s)^{-1}$ across interior areas of Southeast SC and Southeast GA.

A RUC cross section at 21Z of equilvant potential vorticity and saturated equivalent potential temperature (Fig. 4) appears to verify that the potential for CSI did exist across interior SE SC and SE GA. Notice how the area where values of saturated potential temperature decreased slightly with height aligns perfectly with areas of negative equivalent potential vorticity. This suggests the atmosphere was unstable with respect to slant wise convection when saturated. It should be noted that RH values in this layer were around 80 percent (nearly saturated).

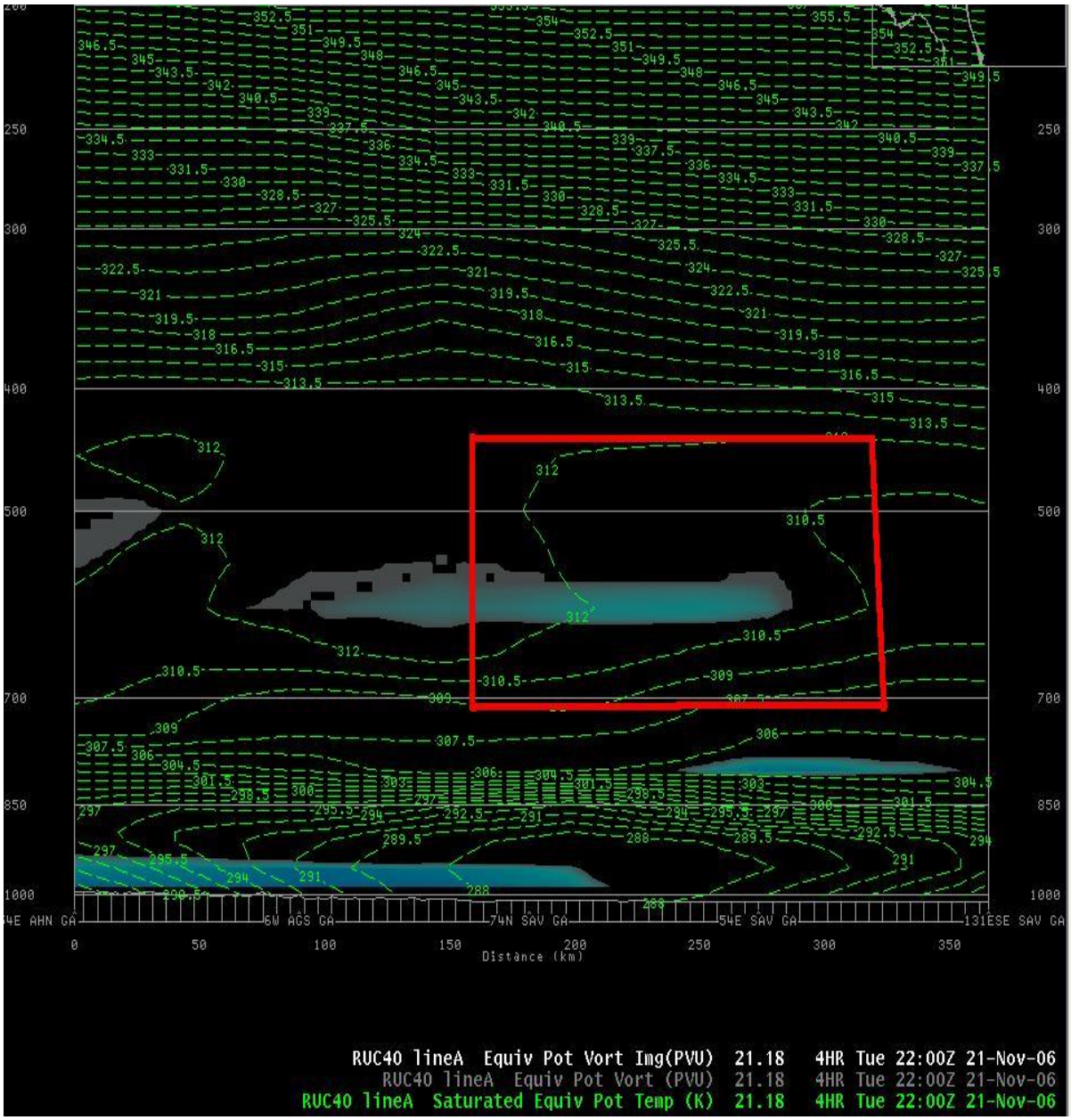

Figure 4. 21Z RUC cross section of equivalent potential vorticity (EPV) and saturated equivalent potential temperature. Shaded areas are where EPV values are less than 0 PVU. The red box shows area where saturated equivalent potential decreases with height. This box is located across interior SE SC and SE GA where accumulating snows fell.

KCLX 0.5 degree base reflectivity at 22Z (Fig. 5) also suggested CSI induced convective rolls were present. Notice the presence of convective roll features across Screven County, GA with KJYL reporting 2 ½ miles visibility in Snow. These convective rolls likely contributed to the presence of locally enhanced snow rates, especially where localized web-bulbing was maximized.

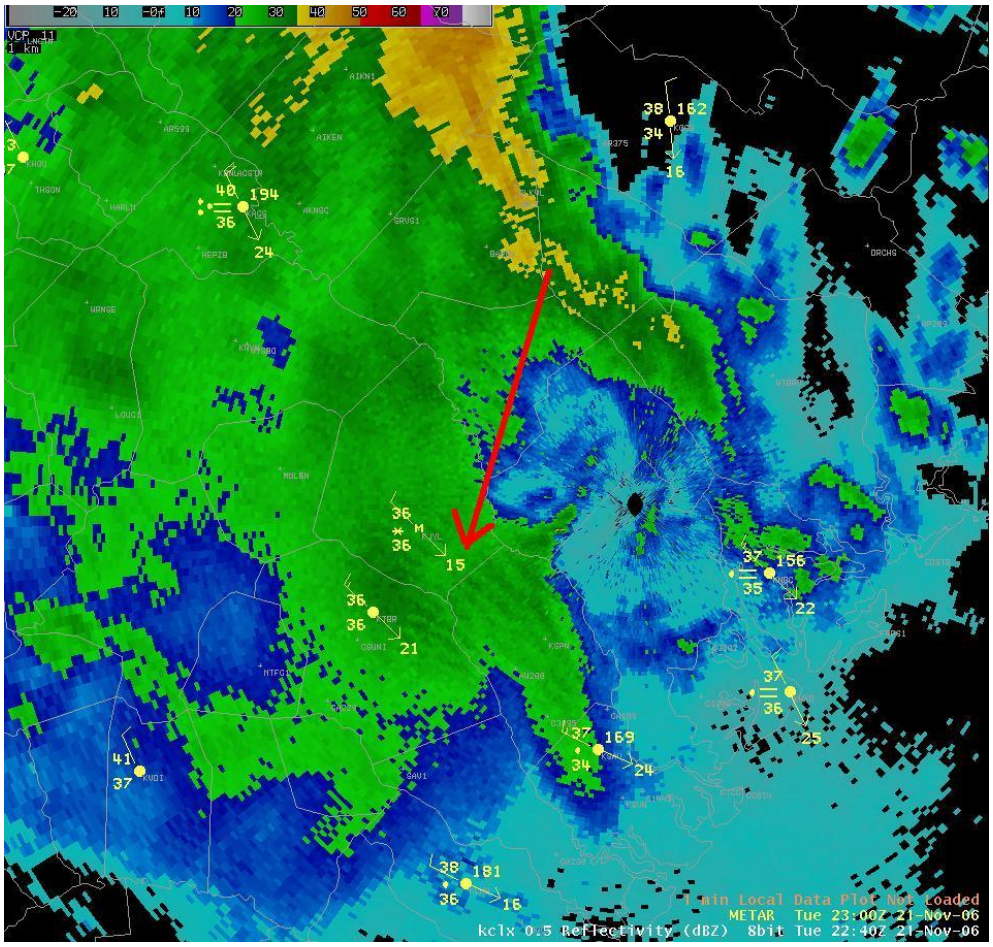

Fig 5. KCLX 0.5 degree reflectivity at 22Z. The red arrow depicts an area of CSI induced convective rolls.

Top-Down Method

Applying the Top-Down Method to the 21z RUC forecast sounding at Sylvania, GA yielded some interesting results, most of which are summarized on Fig. 6. Based on RH cross sections, the top of cloud layer was located around 550 mb, where temperatures were forecasted to be around -33 ^{o}C with RH values between 80-90 percent. These conditions typically yield a 90 percent chance of ice nucleation at the top of cloud layer.

Farther down the sounding, temperatures between -10 ^{o}C and -20 ^{o}C were located between 675 mb and 725 mb with similar humidity of 80-90 percent. As flakes began to fall into this saturated region, the presence of ice and super cooled water droplets yielded ideal conditions for large dendritic growth. An elevated warm layer with a temperature near 0 ^{o}C was forecasted to occur near 800 mb, but this is usually cold enough for flakes to survive (T must be < 1 ^{o}C).

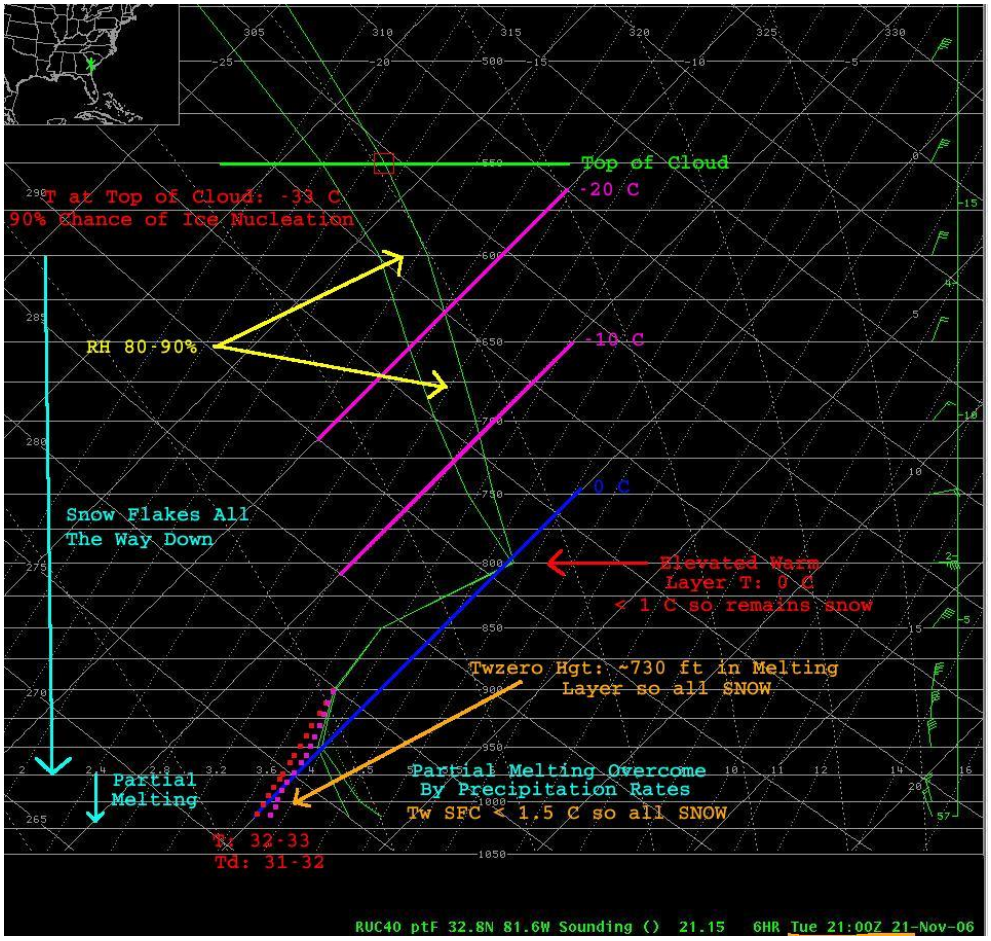

Fig 6. Top-Down Method applied to the 21z Forecast Sounding for Sylvania, GA

An initial glance at the surface layer suggests conditions were too warm for flakes to survive all the way to the ground as surface temperatures were forecast to be in the upper 30s with a WBZ height near 2000 ft (usually need WBZ height to be <1500 ft to get flakes to survive). However, spotter reports during the period of heaviest snow, suggested the temperature was considerably colder--between 31-32 ^{o}F. Therefore if you modify the surface layer to match these conditions, the sounding would have been sufficiently cold enough to support snow all the way to the surface (WBZ height lowered to 730 ft).

The presence of CSI and the associated increased precipitation rates were key to the development of accumulating snows across interior areas. Without the presence of convection, the dominate precipitation type would have most likely remained rain, with snow and sleet occasionally mixing in at times.

Summary/Conclusions: Accumulating snows fell across portions of interior Southeast SC and Southeast GA during the late afternoon and early evening hours of 21 November in association with a strong coastal storm. Moderate to locally heavy snows fell during a 3 hour period resulting in accumulations of 1-2 inches. Although forecasters believed

snow and/or sleet could mix in at times with rain, snow was not expected to be a dominate precipitation type. High situational awareness of the unfolding winter weather event allowed forecasters to act quickly to changing conditions, including the issuance of a rare Snow Advisory.

A review of model data suggested several clues were present that suggested accumulating snows could occur. RUC cross sections indicated conditions were favorable for the development of Slant Wise Convection within an area of strong mid-level frontogenesis. The Top-Down method initially suggested any snow would quickly melt in the surface layer, but the presence of CSI and corresponding increased precipitation rates quickly augmented the surface layer enough to support snow reaching the ground.

As a whole, WFO CHS forecasters did an outstanding job with this event.