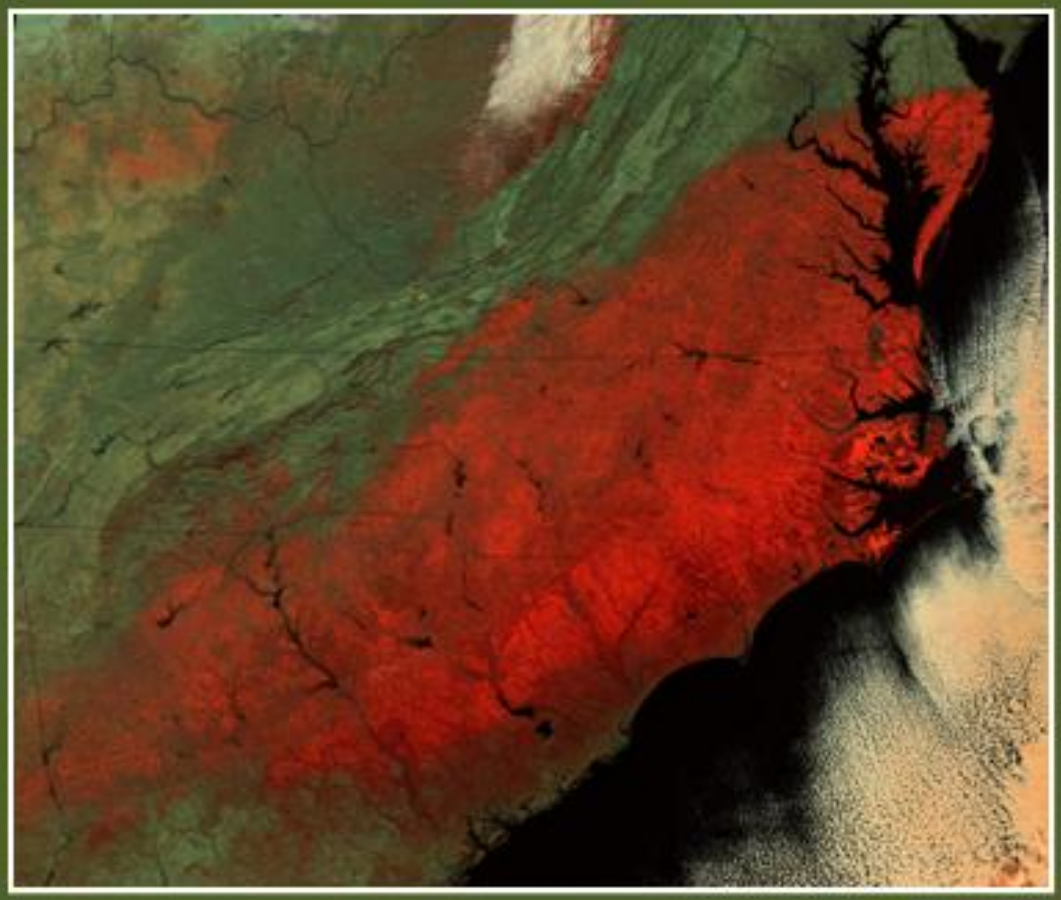
Southeastern United States Under Snow

January 4, 2002

SeaWiFS Image

True Color



January 4, 2002

MODIS Image

False Color

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Location: Southeastern United States: Georgia, Maryland, North Carolina, South Carolina, and Virginia
Date: January 2 and 3, 2002
Image Sources: SeaWiFS: GeoEye's OrbView-2 Satellite and MODIS: NASA's Terra Satellite

Snow Storm Blankets Southeastern United States

Southeastern United States rarely experiences a major snowfall. The average annual total snowfall for Columbia, South Carolina, situated on the Piedmont Region, is only 2.1 inches and for Charleston, on the Coastal Plain, barely .8 inches of snow per year occurs. Thus, for the people of South Carolina and the other states of the Southeast the January 2-3, 2002 snow storm was a surprise and created temporary chaos in their lives. The storm brought heavy snow, with large areas receiving more than a foot in less than two days. Some of these areas were basking in 70°F temperatures just a couple of weeks earlier. Daffodils, crocuses, and cherry blossoms were tricked into believing spring had already arrived. Atlanta's Hartsfield-Jackson International Airport, the nation's busiest airport, was basically shutdown with about 600 flights canceled, resulting in thousands of stranded passengers. Unlike Chicago's O'Hare or New York's LaGuardia–airports that anticipate large amounts of snow every winter–Hartsfield did not have enough equipment necessary to keep the runways open and the planes de-iced. Schools and businesses across the region were closed and power outages resulted in thousands of dark and cold homes.

Evolution of the Snow Storm

On January 1 a strong arctic high pressure centered over the Northern Great Plains was developing and moving eastward across the Ohio Valley toward the Middle Atlantic Region. By noon January 2, the center of high pressure was over West Virginia and its cold, dry air started flowing down the mountains and expanding south along the eastern slopes of the Appalachians. This cold air advection coupled with existing stable low level warm humid air across the coastal Carolinas set-up a cold air damming event. Cold air advection occurs when wind blows from a cold air region to a warmer air region. When the warm air region has stable air at low elevations the cold air can become dammed between the mountains that it has just crossed and the stable air. Eventually the cold air advection forces the warmer region's temperatures to decrease resulting in the relative humidity in the air to increase and the likelihood of precipitation to materialize. During this period when the cold air remains dammed the precipitation becomes trapped over an area, producing heavy amounts of precipitation. For this particular storm, light snow began falling during the morning on January 2. By late afternoon, the snow was heavy at times, with accumulations of up to 16 inches of snow in areas of Georgia, the Carolinas, and Virginia. Around noon on January 3, the precipitation changed to freezing rain and ice pellets.

Snow Storm Imagery

By January 4, the skies had cleared, and two different remote sensing satellite systems were able to observe the snow coverage. First, SeaWiFS (Sea-viewing Wide Field-of-view Sensor) on the GeoEye's OrbView-2 satellite obtained a synoptic view of Eastern United States that included the snow impacted area. SeaWiFS was specifically designed to monitor ocean characteristics, such as chlorophyll and water clarity, but has been frequently used to capture land events. The sensor collected images, simultaneously, in eight bands of the electromagnetic spectrum (EMS), namely in the visible and near infrared portions of the spectrum. Three of the visible bands were combined to create a color composite, which is called a true color image since it portrays the landscape in colors familiar to the human eye.

As the SeaWiFS image shows, the snow cover extended from Georgia to Virginia along the eastern edge of the Blue Ridge Mountains, part of the larger Appalachian Mountains range. The greatest concentrations were on the Piedmont stretching into the Coastal Plain of the Carolinas and Virginia. A well defined snow line can be observed cutting across the Delmarva Peninsula. A thin patch of snow also is visible in West Virginia below the clouds. A closer examination of the image reveals that dense blankets of snow existed along the western sections of the Piedmont and the Coastal Plain. The snow cover appears to thin out on the eastern portion of the Piedmont. The Fall Line, an area of rapid elevation change between the Piedmont and the Coastal Plain, can be detected due to the change in snow intensity. The remnants of the winter storm can be seen over the Atlantic Ocean. Due east of South Carolina a portion of the characteristic spiral shape of a low pressure system can be viewed.

The second image, also acquired on January 4, was taken by the MODIS (Moderate Resolution Imaging Spectroradiometer) sensor on NASA's Terra Satellite. MODIS records images, concurrently, in 36 spectral bands of the EMS, seven of which are used to study land surface conditions. The MODIS image is a false color composite with one visible band being assigned to the color red and two near-infrared bands to the colors green and blue. In the near-infrared wavelengths of light, snow cover absorbs sunlight and appears much darker than clouds, and therefore shows the snow cover more clearly. Consequently, snow in this image appears red, not white that the human eye normally expects to see. The red separates clouds from snow as in the area over West Virginia. It also differentiates vegetation patterns based on snow. The Tidewater region of North Carolina illustrates this situation. The areas around the edge of the Tidewater sounds are brownish red identifying wetland conditions. The areas inland and slightly higher in elevation are bright red indicating agricultural fields, mainly grain and turf farms. Adjacent and west of the agricultural fields are areas of dark red where pines and other evergreen trees are grown. Although the amount of snow to fall on all three areas was basically the same, the type of vegetation surface in conjunction with the snow created the different red tones. To have two remote sensing satellites monitoring an event on the Earth's surface at the same time helps in visualizing, comprehending, and analyzing the event, especially when one satellite provides a synoptic view and the other a detailed image.

Interpretive Learning…

1) Locate the Blue Ridge Mountains, the Piedmont, the Coastal Plain, the Fall Line, the North Carolina Tidewater, and Delmarva Peninsula. A good atlas of the United States might help.
2) Using Google Earth zoom in on the Fall Line area of North Carolina and South Carolina. The MODIS image shows bright red areas on the southeast side of the Fall Line and dark red areas on the northwest side of the Fall Line. Use Google Earth to identify what land cover mainly exists on both sides of the Fall Line and discuss how the land cover combined with the snow creates different reds to show the Fall Line.
3) How does this snowstorm compare to the January 8-13, 2011 blizzard that stretched from eastern Texas to North Carolina.
4) List the impacts of a heavy accumulation of snow in the South.

Explore More…

Snowstorms - Forces of Nature - Library
http://library.thinkquest.org/C003603/english/snowstorms/casestudies.shtml#4

Sources:

McAvoy, B. P., 2011. *The 2-3 January, 2002 Snow Event over the Western Carolinas and Northeast Georgia.* NOAA/National Weather Service Greer, South Carolina

Petrolito, A.W., 2005. *The 2-3 January 2002 Winter Storm Across Central South Carolina and East Central Georgia: A Precipitation Type Case Study.* Eastern Region Technical Attachment No. 2005-02. NOAA/National Weather Service Forecast Office Columbia, South Carolina

NASA Earth Observatory, 2002. *Snow Storm Blankets Southeastern US - Image of the Day.* http://earthobservatory.nasa.gov/IOTD/view.php?id=2080

Acknowledgements:

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