

Eastern U.S. Early Season Winter Storm

1-3 November, 2014

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Meteorological Overview: An early-season snowfall event occurred in the eastern U.S. during the first few days of November 2014 (fig. 1). Anomalously heavy snow of over 20 inches fell near Mt. LeConte in the southern Appalachians while Columbia, South Carolina received the earliest snowfall on record (fig. 2a). The upper-level shortwave trough responsible for the early-season heavy snow can be traced back to the Arctic region of northern Canada on 28 October. This shortwave initially had little or no surface reflection as it moved steadily southward across central Canada towards the Great Lakes region (fig. 3). By the time it reached the U.S. border on 30 October, a clipper type low pressure system began to form along a stationary front in Alberta, Canada (fig. 1 & 3b). Meanwhile, an arctic air mass was building over west-central Canada as a longwave ridge was amplifying aloft over the western part of North America. The large-scale anticyclonic upper-level pattern in the West in conjunction with cold air advection behind the southward-moving shortwave trough was highly favorable for further amplification of a longwave trough in the eastern U.S. (fig. 4 a-d). Under this upper-level pattern, the shortwave continued to move farther southward behind the longwave trough axis into the eastern U.S. By late on 31 October, a new surface low pressure center began to form in the southern Appalachians. Although this surface low remained rather weak early on 1 November, the associated upper-level trough had become anomalously deep (fig. 4c). As the core of cold air associated with the deep upper-level trough continued to penetrate southward, rain began to change over to snow in the early hours of 1 November in the southern Appalachians under northwesterly winds. The upslope motion associated with the northwesterly winds likely enhanced snowfall rates in the higher terrain. A highly impressive total of 22 inches was reported near Mt. LeConte (fig. 2a). Meanwhile, cold air continued to filter eastward into the lower elevations. In Columbia, SC, rain changed over to snow in the early morning hours on 1 November. A trace was recorded at the Columbia Metro Airport, making it the earliest observed snowfall in Columbia. Just west of Columbia, snow accumulations of up to 5 inches were reported in the Midlands of upstate South Carolina.

As the rain was changing over to snow in the southern Appalachians, a surface low pressure center that formed in South Carolina began deepening rapidly as it headed towards the east and then northeast off the Mid-Atlantic coast. The snow quickly ended by midday on 1 November as the low center moved farther offshore and deepened at a rate of about 8 hPa/12 hours. The precipitation shield remained offshore for the rest of the day on 1 November. However, as the low turned more northward towards the Gulf of Maine, snow began to swing onshore into the New England coastal areas during the overnight hours. By the morning hours on 2 November, heavy bands of snow were organizing across much of Downeast Maine under strong and gusty northerly winds (fig. 4f). Snow continued to fall in Downeast Maine for much of the day on 2 November before gradually tapering off during the overnight hours when the low pressure center moved further away into the Canadian Maritimes.

Impacts: This storm resulted in two distinct areas of early-season snowfall that were almost 1000 miles apart! The highest reported amount of 22 inches near Mt. LeConte was highly impressive when considering how far south and how early in the winter season it occurred. Even in the lower elevations, Columbia, SC saw its earliest snowfall on record, eclipsing the previous record of a trace on 9 November, 1913. Snowflakes were reportedly seen as far south as Charleston, SC.

In Maine, the storm brought over 10 inches of snow across eastern Maine with as much as 21 inches reported at Cary (fig. 2b). This was combined with winds gusting over 50 mph to result in areas of power outage and coastal flooding on 2 November. Bangor saw its earliest foot of snow on record. One injury was directly attributed to the event, the result of strong winds blowing a tree down on a mobile home.

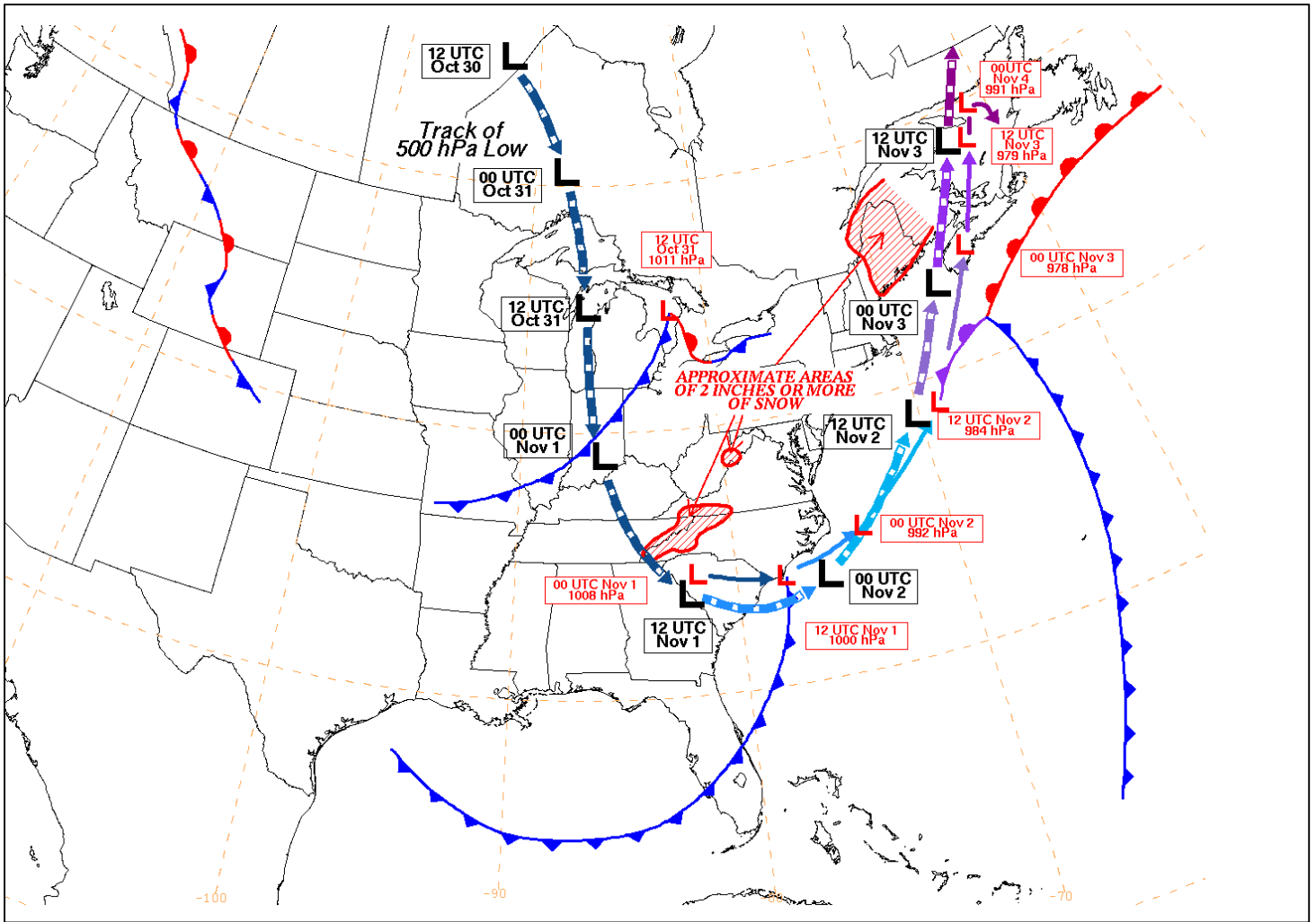


Figure 1 Summary figure showing the track and intensity of the storm at 500 hPa vs. at the surface.

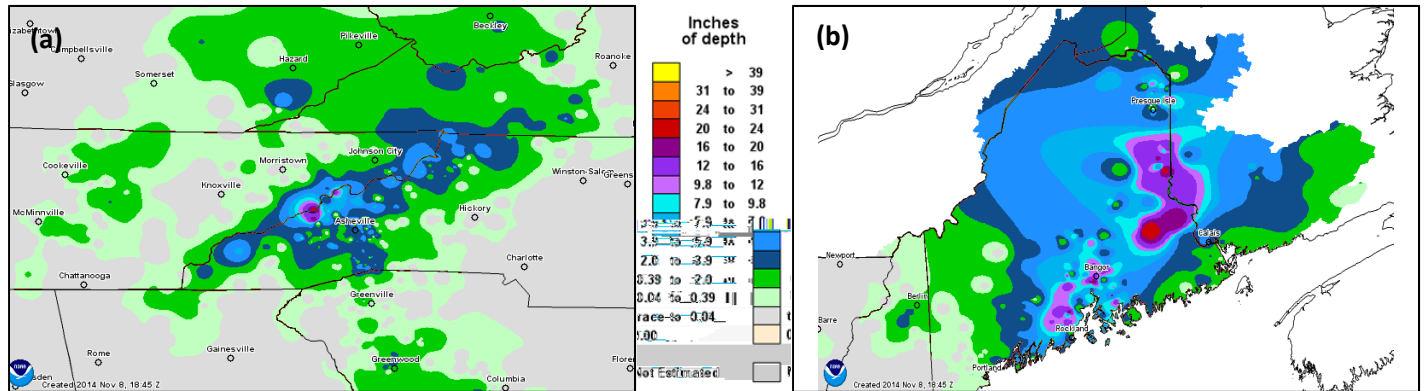


Figure 2 Detailed analyses of snowfall reports from (a) the southern Appalachians and (b) Maine.

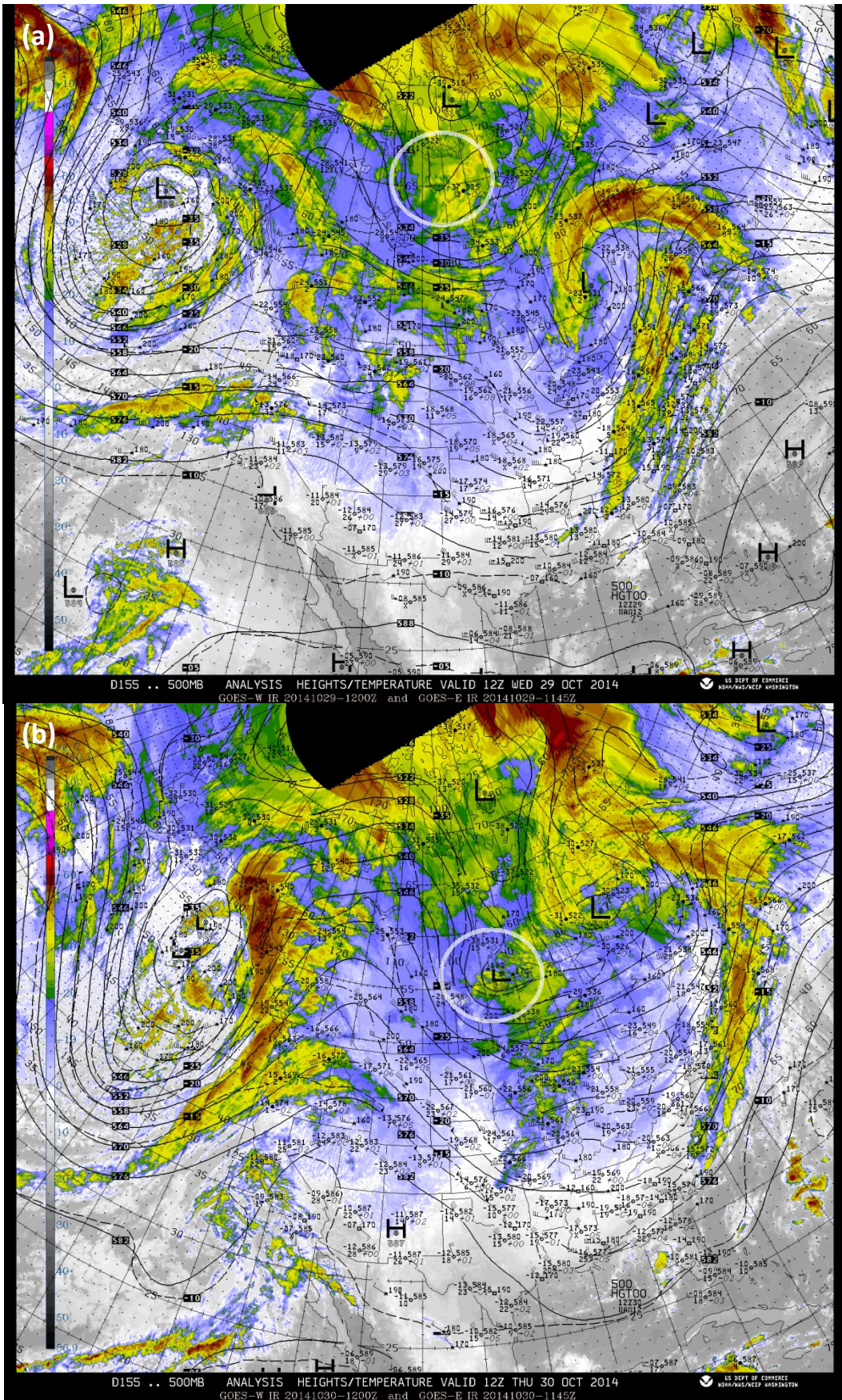


Figure 3 500 hPa analyses overlaid on GOES-east infrared images at (a) 12 UTC on 29 October, and (b) 12 UTC on 30 October, 2014.

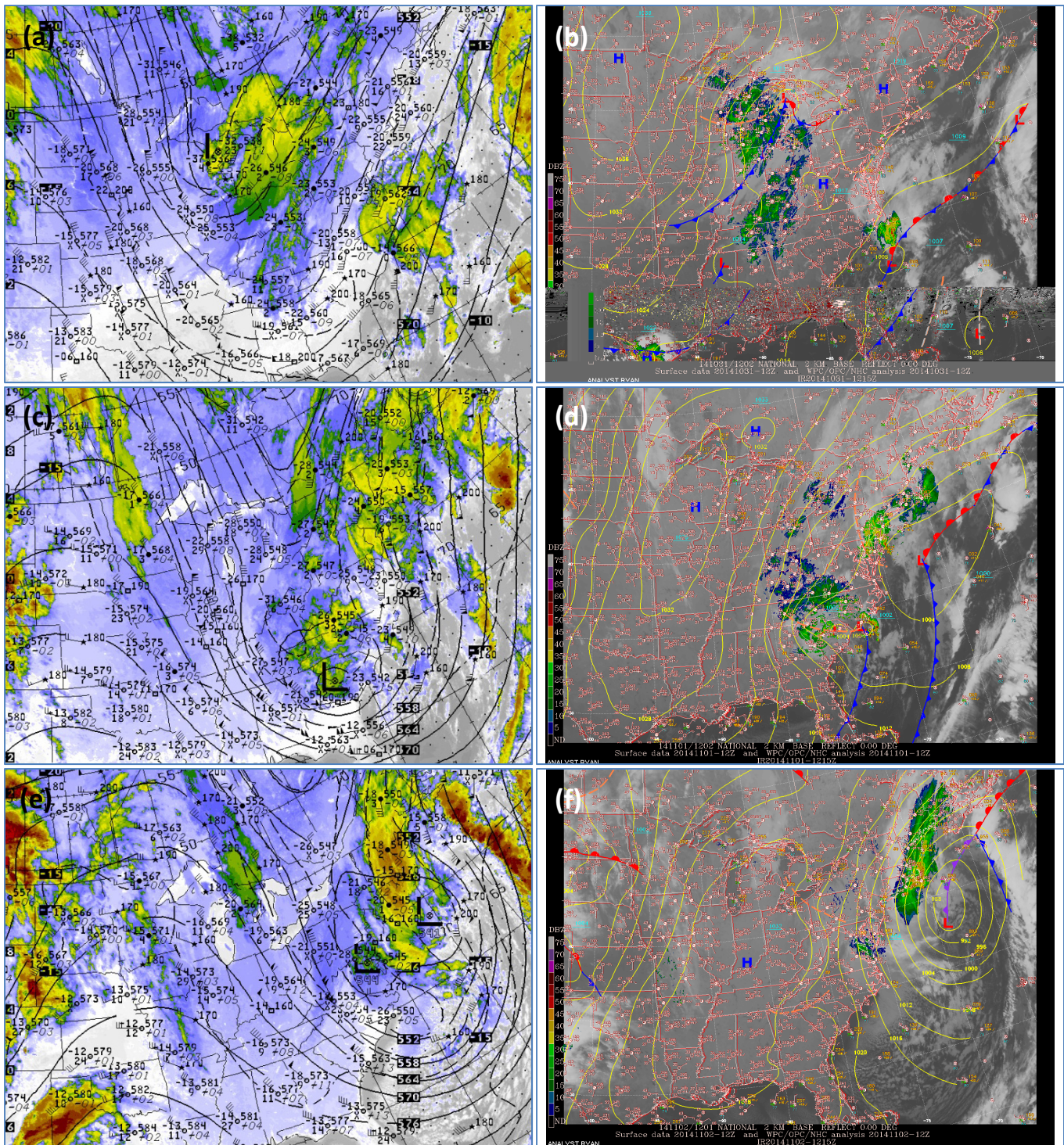


Figure 4 500 hPa analyses overlaid on color-enhanced GOES-east infrared images (left column) and WPC surface analyses overlaid on GOES-east infrared and radar reflectivity composites (right column) at (a) & (b) 12 UTC on 31 October, (c) & (d) 12 UTC on 1 November, and (e) & (f) 12 UTC on 2 November, 2014.

References:

- <http://www.weather.gov/cae/november2014climatesummary.html>
- <http://www.washingtonpost.com/blogs/capital-weather-gang/wp/2014/11/01/incredible-early-season-snow-slams-the-southeast-impacts-felt-across-eastern-u-s/>
- <http://thevane.gawker.com/explaining-south-carolinas-freak-record-breaking-snows-1654043454>
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