

## **Ohio Valley to Northeast Winter Storm – December 14-15, 2013**

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### **Meteorological Overview:**

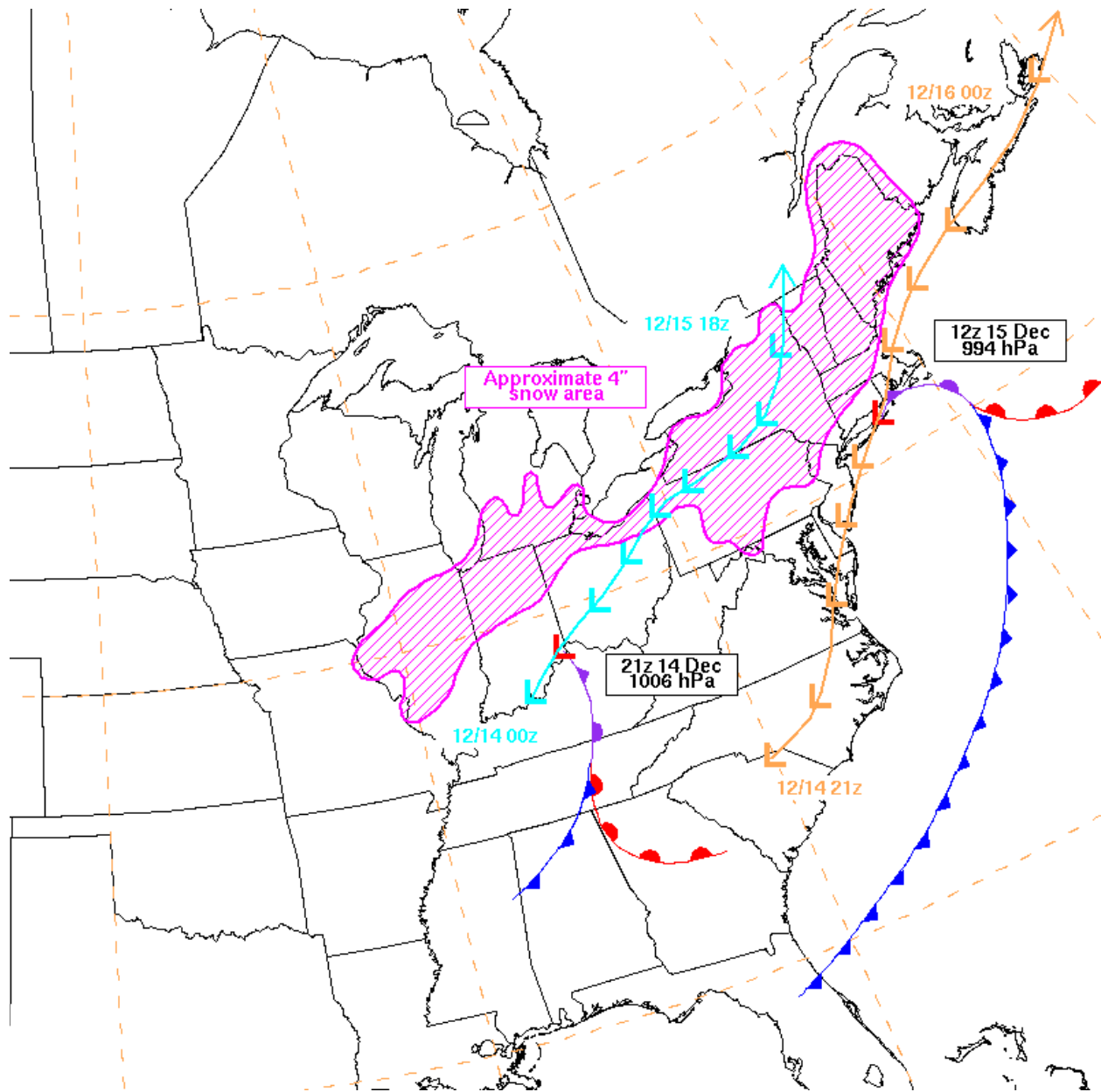
An early season winter storm impacted locations from the Ohio Valley to the Northeast on 14-15 December, 2013 (Fig. 1). An arctic boundary plunged southeastward from Canada and brought a fresh batch of subfreezing temperatures across the Midwest and Northeast. The boundary stalled before pushing through the Ohio Valley and Mid-Atlantic states, and a piece of shortwave energy ejecting out of the Southern Plains early Saturday (12 UTC 14 December) aided in spinning up a surface low along the lingering boundary (Fig. 2a). Increased moisture from the Gulf of Mexico fueled widespread precipitation in an area of warm air advection to the east of the surface low while the low steadily lifted northeastward through the Ohio Valley and towards the lower Great Lakes. Arctic air in place to north of the stalled boundary allowed for a swath of moderate snow accumulations (greater than 4") that stretched from central Illinois to western New York and northwest Pennsylvania (Fig. 3). Also, warmer Gulf air overrunning the Arctic air mass led to a narrow zone of freezing rain to the south of snow axis.

The initial shortwave and surface wave began to weaken while lifting farther northeastward Saturday night (00 UTC 15 December), but a second batch of height falls ejecting from the Southern Plains started to intensify a surface low tracking from the Carolinas to the Delmarva Peninsula (Fig. 2b). An expansive area of moderate to heavy precipitation spread over the northern Mid-Atlantic states and Northeast as the deepening surface low lifted northeastward up the New England coastline and low level winds surrounding the storm brought increasing amounts of Gulf and Atlantic moisture inland over the region. Arctic high pressure that set up over Quebec kept temperatures low enough for snow, resulting in a wide axis of greater than 6 inch snowfall accumulations from central Pennsylvania to the Northeast, with over a foot of snow reported in locations across Vermont, New Hampshire, and Maine (Fig. 3). Similar to the precipitation shield that set up with the initial surface wave tracking through the Ohio Valley, a narrow zone of freezing rain developed to the south and east of the heavy snow axis, where warmer air off the ocean was overrunning the Arctic air in place.

### **Impacts:**

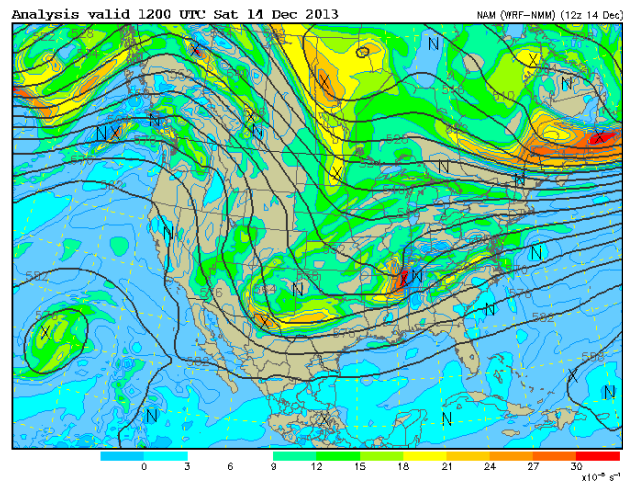
This December storm was not necessarily a blockbuster event, but it was the first big snowfall to impact the Northeast during the 2013-2014 winter season. Ice and snow accumulations caused multiple motor vehicle accidents and forced several flight delays and cancellations across major airports of the Ohio Valley and Northeast. Cold air filling in behind the storm made clearing roads and sidewalks a challenge for snow removal crews. Also, the storm occurred on one of the first weekends of the holiday shopping season, which led to above average congestion on streets and in parking lots.

**Images:**

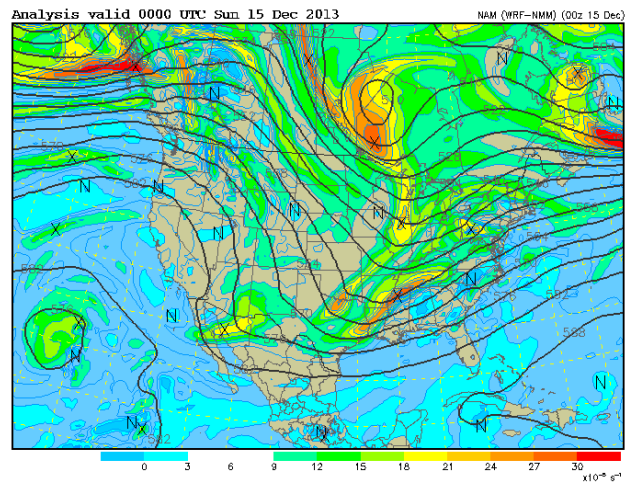


**Figure 1:** Summary of the Ohio Valley to Northeast winter storm (14-15 December, 2013) depicting the surface low tracks (cyan and orange), approximate area of greater than 4 inches of snow (magenta), and select surface analysis during the storm (21 UTC 14 December, 2013 and 12 UTC 15 December, 2013).

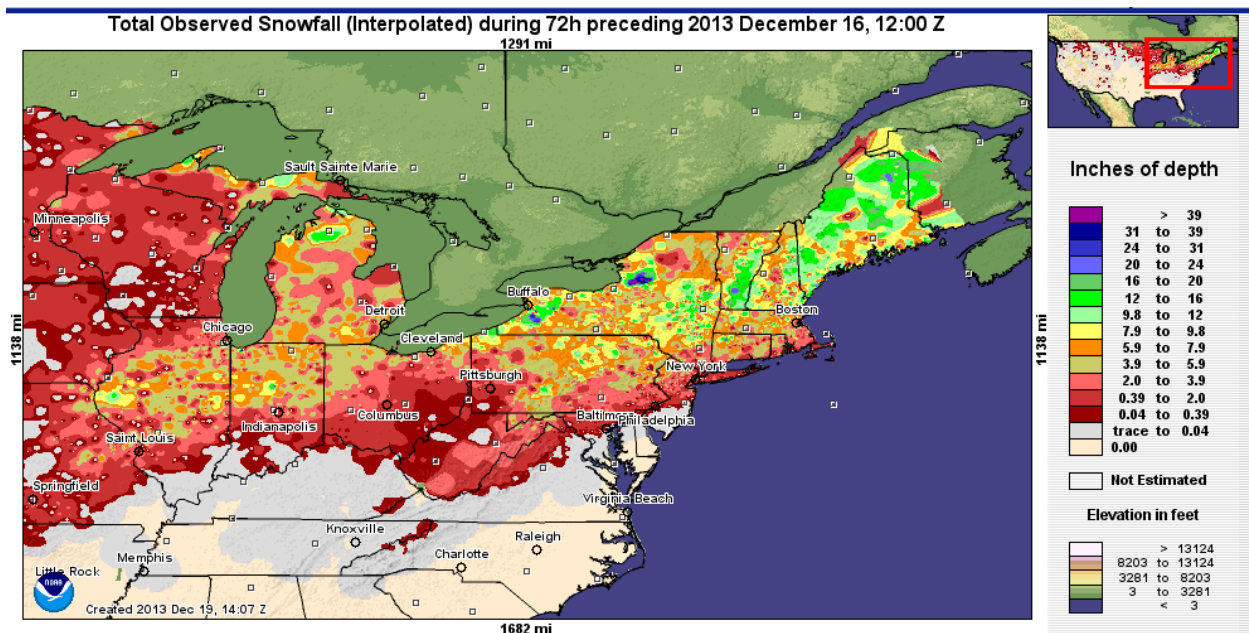
500 mb Heights (dm) / Abs. Vorticity ( $\times 10^{-5} \text{ s}^{-1}$ )



500 mb Heights (dm) / Abs. Vorticity ( $\times 10^{-5} \text{ s}^{-1}$ )



**Figure 2:** 500 hPa heights (dm) and absolute vorticity from 12 UTC 14 December, 2013 (a) and 00 UTC 15 December, 2013 (b) (Images courtesy of UCAR).



**Figure 3:** Snowfall analysis for 72 hours preceding 1200 UTC 16 December, 2013 (image provided by NOHRSC).