Southern Plains to Northeast Winter Storm
2-3 February 2014
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Meteorological Overview: A strong cold front delivered a sub-freezing air mass to the central and southern Plains by 1200 UTC 2 February, 2014. The front stretched from south Texas northeastward to the Ohio Valley. To the west, a positively tilted shortwave trough centered over New Mexico was poised to shift eastward (Fig 1). At 250 hPa, a strong jet streak across the Great Lakes put the central Plains in a favorable area for synoptic scale ascent. With an 850 hPa jet off the Gulf of Mexico over running the low level cold air and transporting moisture into the cold sector, a large area of precipitation developed over north Texas prior to 1200 UTC 2 February and began expanding north of the cold front into the Ohio Valley.

Strong ridging over the western Atlantic prevented much eastward progression of the surface cold front by 0000 UTC 3 February. The 500 hPa shortwave was now centered over Oklahoma and further progression would take it northeastward due to the strong ridging downstream. With more southward progression of the surface front, rain changed to snow from northern Arkansas into northern Kentucky. The axis of heaviest snow was just north of the 850 hPa front, which remained much further north than the surface front.

Amplification of an upstream 250 hPa trough over the western U.S. led to a further amplification of the 250 hPa trough over the eastern U.S. At 500 hPa the trough was now centered over Indiana and the 850 hPa front ran parallel and just south of the Ohio River. The ingredients for further intensification of the storm system at all levels were beginning to become colocated. What had been scattered snow showers had now become a solid precipitation shield, mostly snow, from northern Arkansas northeastward along the Ohio River. The main surface low was located in western North Carolina and a secondary low began developing off the Mid Atlantic coast.

While the trough over the western U.S. continued to deepen, the 500 hPa shortwave over the eastern U.S. was weakening and being absorbed into the fast southwesterly flow by 1800 UTC 3 February. At the surface, the low off the Mid Atlantic continued deepening and was now the main surface low for the storm system. Strong northerly winds developed north of the surface low in New England in response to the strengthening pressure gradient with strong surface highs in place in the western Atlantic and eastern Canada. The 850 hPa frontogenesis increased with the strengthening temperature gradient at the surface. At 250 hPa, the Mid Atlantic and Northeast were situated in a coupled jet entrance/exit region with two jet streaks in the vicinity. So, despite the weakening shortwave at 500 hPa, snowfall rates increased with

the strengthening frontogenesis and strong synoptic scale ascent from the favorable jet position. By 0000 UTC 4 February the storm quickly exited the eastern U.S. With the storm embedded in strong southwesterly flow aloft and strong ridging in place across eastern Canada and the western Atlantic the surface low was forced toward the northern Atlantic.

Impacts: The winter storm brought a narrow band of 3 to 6 inches of snow across the central Plains into the Ohio Valley (Fig 2). Secondary development off the Mid Atlantic coast led to higher snowfall totals of up to a foot across the northern Mid Atlantic and southern New England (Fig 2). 1 to 3 inches of rain fell from the Lower Mississippi Valley to the southern Mid Atlantic. The storm led to thousands of flight cancellations and power outages across the Northeast. Central Park in New York City set a daily snowfall record for February 3rd with 8 inches of snow.

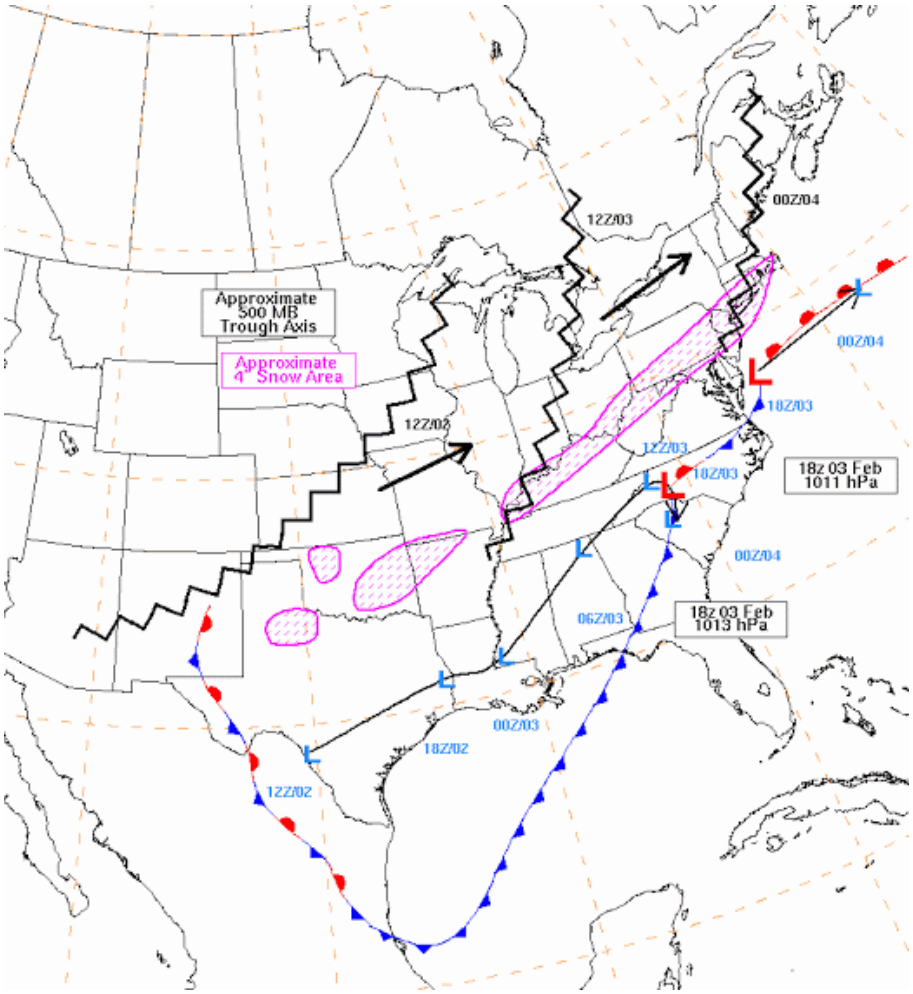

Figure 1. Surface low track (light blue), approximate 500 hPa trough axis location (black), surface analysis from 1800 UTC 3 February, 2014, and approximate area of 4" snowfall (pink).

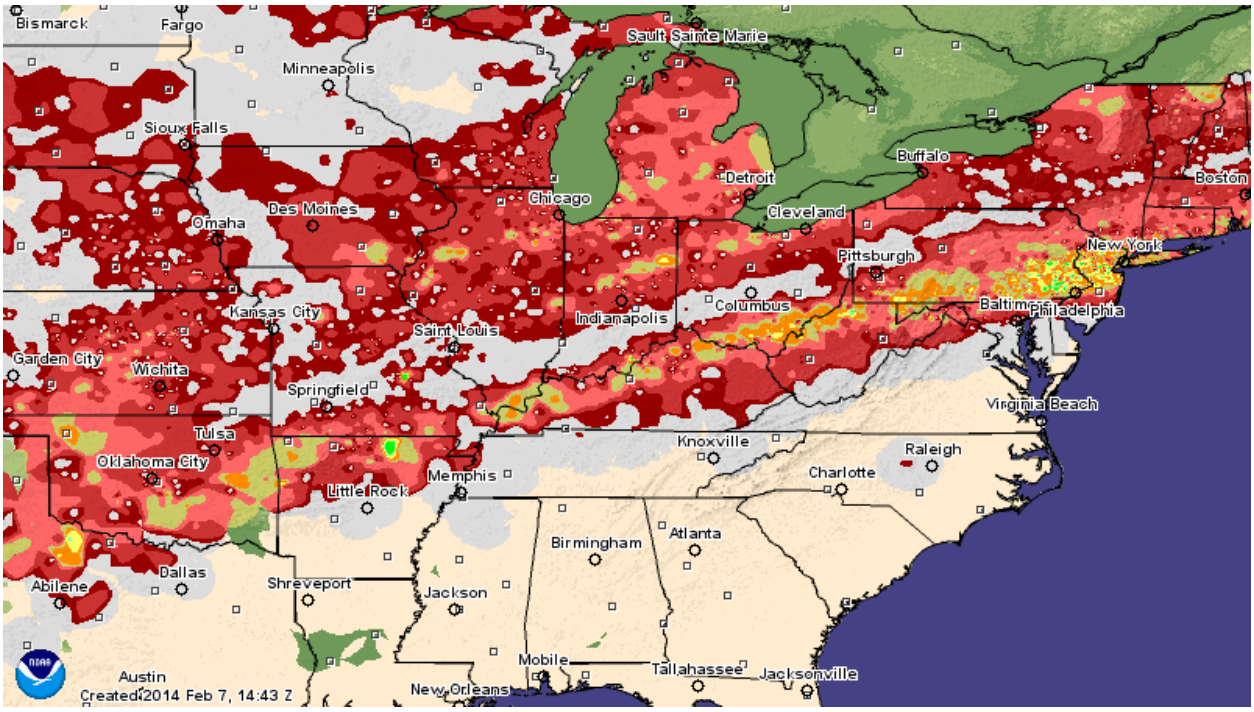

Figure 2. 72 hour snowfall ending 1200 UTC 4 February, 2014 (National Operational Hydrologic Remote Sensing Center)