

Central Plains to Northeast U.S. Winter Storm

19-22 December, 2012

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Meteorological Overview:

This storm will be remembered as the first major, widespread snowstorm of the 2012-2013 winter season to impact locations in the central U.S., bringing an end to record-length snowless days for a number of U.S. cities in the Upper Midwest. The storm spanned several days in length and impacted locations from the central plains to the Upper Great Lakes with blizzard conditions from 19-20 December, before moving eastward into the northern Appalachians and Northeast on 22 December (see Fig.1). Widespread snowfall totals of 6-12 inches, with locally higher amounts, and strong winds were reported in a swath extending from the Kansas-Nebraska border to the upper Great Lakes forcing numerous closures of schools, businesses and major highways. The storm made a second, although lesser, impact on the Northeast producing up to 6 inches of snow within higher elevations of the region.

The storm developed with the arrival of an upper level trough into the Great Basin from the Pacific Ocean on 19 December, and generated light to moderate snow across the higher elevations of the Intermountain West. A corresponding surface low organized east of the Rockies and tracked from the southern high plains during the afternoon of 19 December to northern Illinois 24 hours later while significantly strengthening as the upper trough emerged into the Plains. Once reaching the plains, the upper level trough axis began to acquire a negative tilt, favoring upper level diffluence out ahead of it, coincident with the surface low deepening 15 hPa from 997 hPa to 982 hPa in the 24 hour period ending 18 UTC on 20 December (see Fig. 2). As the storm was strengthening, an outbreak of severe storms occurred throughout the lower Mississippi valley, mainly in the form of straight line winds but a few tornadoes were also reported early in the morning on 20 December. As severe storms were impacting the lower Mississippi valley, the heaviest snow was falling just northwest of the surface low track from eastern Nebraska into southern Wisconsin. In addition to the favorable synoptic scale setup for heavy snow, mesoscale factors were present that led to the formation of narrow bands of heavy snow. Strong frontogenesis in the lower levels of the atmosphere coupled with strong vertical ascent within the favored dendritic growth zone, allowing the formation of 15-25 mi wide bands. These bands of heavy snow lasted roughly 6 to 12 hours over any given location from Iowa into southern Wisconsin throughout the morning and afternoon of 20 December, and were responsible for the majority of the heaviest snow accumulations from the storm.

As the main surface low began to weaken in the Upper Great Lakes early on 21 December, a second surface low formed along the system's triple point in the Middle Atlantic States, and began to deepen as it tracked north northeast through eastern upstate New York. However, the inland track of the surface and 850 hPa lows allowed warmer air to be drawn in from the south and east, causing most of the precipitation to fall as rain for the Northeast with snow staying confined to higher elevations of the Appalachians, and Green and White Mountains. As the surface low lifted into Quebec, moisture and cold air wrapping around the surface low produced snow totals on the order of 6 to 12 inches into favored locations downwind of Lakes Erie and Ontario as well as the upslope favored terrain of the central Appalachians. However, these additional accumulations were more of an indirect impact from the storm.

Impacts:

The greatest impacts from this storm occurred across the Upper Midwest from Iowa into Wisconsin due to heavy snow and wind. Since the initial precipitation type with this storm was rain or wet snow, once temperatures lowered, a changeover to all snow occurred and a layer of ice formed on trees and power lines with additional snow adding weight. Strong winds of 40 to 60 mph caused numerous power outages and the combination of snow and wind closed major highways, along with schools and businesses. There was a fatal 25 car pileup on Interstate 35 in Iowa, and the storm was responsible for deaths in Nebraska, Kansas and Wisconsin. Des Moines, Iowa received 5.6 inches of snow on 19 December and Madison, Wisconsin picked up 13.3 inches on 20 December. Both of these were new records for the day, with Madison gaining the second highest one day snowfall total for the city.

Figure 1: Total snowfall from 1200 UTC 19-22 December, 2013
(Image courtesy – www.srh.noaa.gov/ridge2/snow)

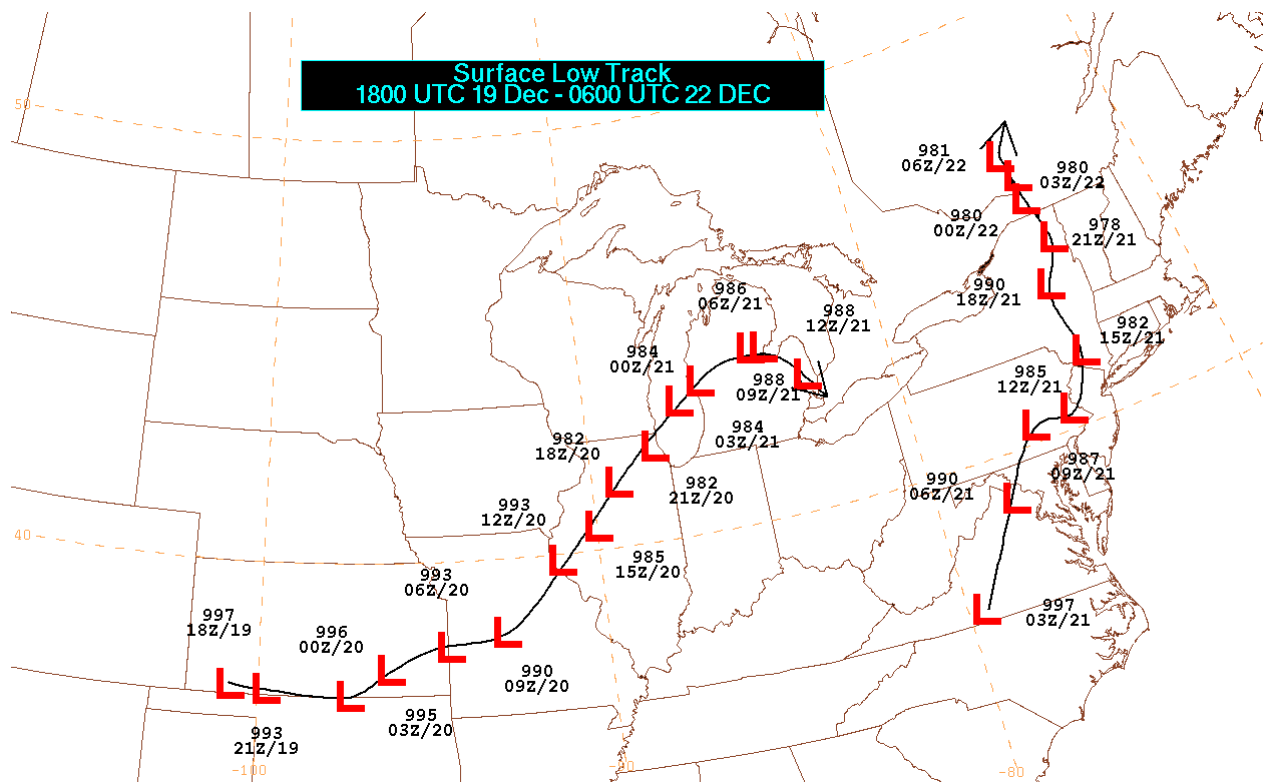


Figure 2: Primary and secondary surface low tracks from 1800 UTC 19 to 0600 UTC 22 December, 2013