Northern Rockies to Upper Great Lakes Early-Season Winter Storm
10-12 November, 2014
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Meteorological Overview:

An upper-level shortwave entered the Pacific Northwest around 00 UTC on 10 November, promoting the development of a surface low pressure system across the northern Intermountain States. A pre-existing Arctic front at the surface was banked against the terrain from Montana into Wyoming, extending into the plains and the Midwest as a cold front. North of the front, temperatures ranged from the 10s to the 30s Fahrenheit, while south of the frontal boundary, a relatively warm air mass was in place with temperatures in the 50s and 60s. At this time, generally light snow was falling north of the Arctic boundary from central and eastern Montana into western North Dakota. The surface low continued to develop along the Arctic front as the low moved into the central plains and deepened to 990 hPa at 12 UTC on 10 November. By this time, light to moderate and occasionally heavy snow had spread eastward across the Dakotas and into Minnesota and Wisconsin. As the Arctic front surged southward on the west side of the deepening surface low, snow also began to fall over much of Wyoming as a large 1046 hPa surface high centered over the Northwest Territories continued to funnel frigid air into the northern plains. Enhanced upper-level divergence associated with the right entrance region of a 300 hPa jet streak centered over Lake Superior aided upward vertical motion and snowfall intensity across Minnesota at this time.

During the day on 10 November, the Arctic cold front continued to surge rapidly southward across the plains, reaching the southern plains by 00 UTC on 11 November. By this time, the surface low over the Midwest had begun to weaken slightly, with a pressure of 997 hPa near the Mississippi River over extreme eastern Iowa. The aforementioned area of heavier snowfall associated with enhanced upper-level divergence shifted eastward across northern Wisconsin during the day on 10 November and reached the Upper Peninsula of Michigan during the late afternoon. Additional snowfall enhancement occurred due to the lake effect downwind of Lake Superior, particularly across the Upper Peninsula of Michigan. By 12 UTC on 11 November, the best upper-level divergence and upward vertical velocities had moved northeastward into Ontario; however, generally light snow lingered across much of the Upper Midwest behind the surface low. Light snow persisted across the Upper Midwest and Great Lakes (with continued lake effect enhancement across the Upper Peninsula of Michigan) through the day on 11 November. The light snow began to taper off across most of the region early on 12 November. In the wake of the storm, frigid temperatures continued to spread into the region as the Canadian surface high moved south toward the northern plains, dropping temperatures below zero in some areas.

Impacts:

The heaviest snowfall accumulations occurred in a band from central Minnesota (just north of Minneapolis-St. Paul) across northern Wisconsin and the Upper Peninsula of Michigan, where the most favorable mid/upper-level dynamics to support heavy snow occurred. The lake effect provided additional enhancement across the Upper Peninsula of Michigan. Storm total accumulations of 1 to 2 feet were widespread in this band, with the heaviest report of 36.1 inches near Ishpeming, MI. Farther west, areas of the Dakotas, Wyoming, and Montana received relatively lighter snowfall amounts of 3 to 8 inches (with localized higher amounts). Additionally, wind gusts of 50 to 80 mph occurred over portions of the Intermountain States as the

storm system traversed those areas. Heavy snowfall led to numerous vehicle accidents, including an overturned semi carrying a load of live turkeys in Minnesota, and a school bus crash in Wisconsin (Associated Press). Schools were closed in many areas.

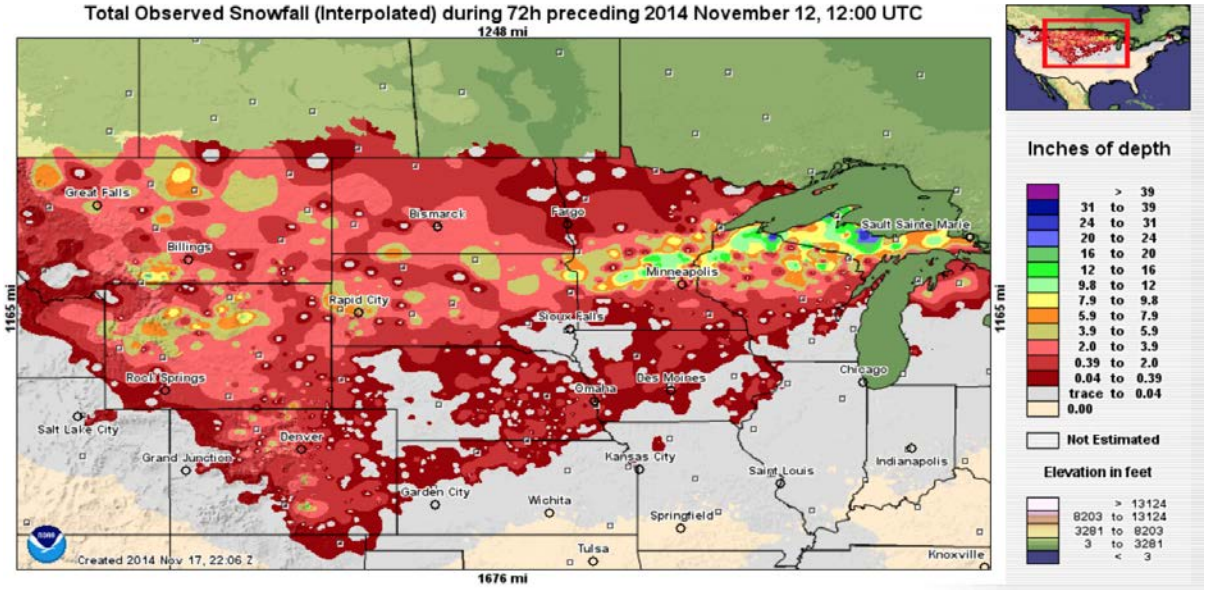

Figure 1: Total snowfall accumulation for the 72 hour period ending at 12 UTC on 12 November, 2014 (NOHRSC).

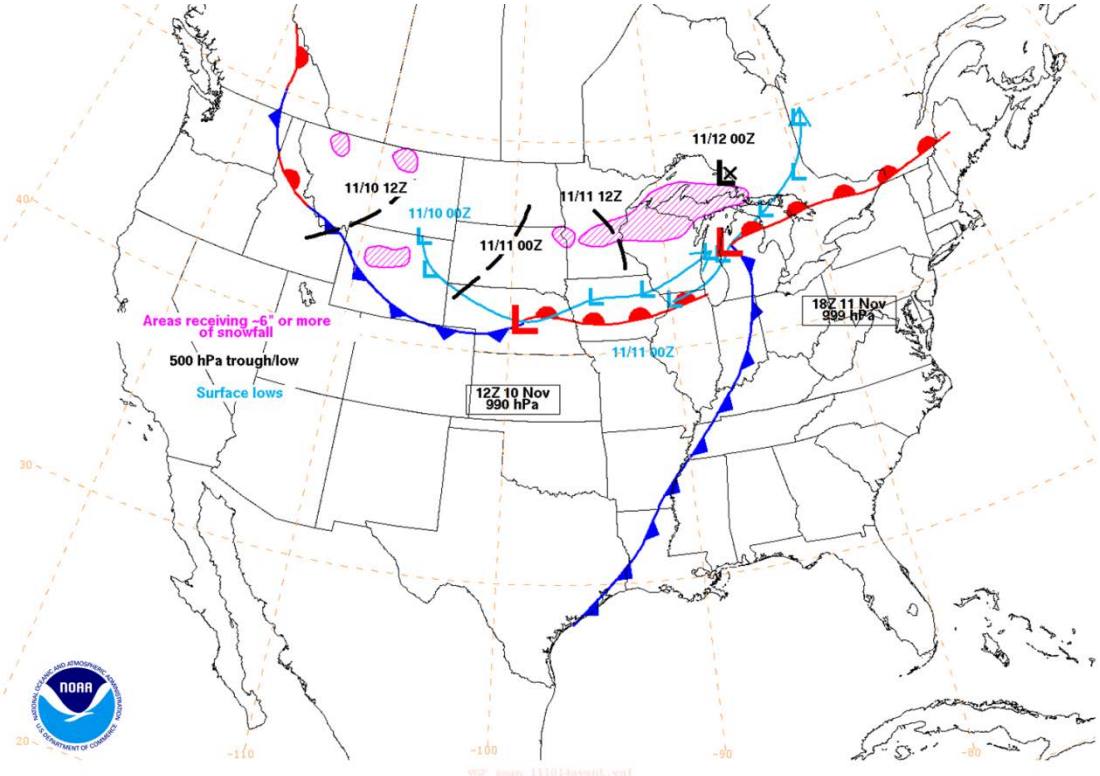

Figure 2: Surface low tracks (blue), 500 hPa trough/low (black), and approximate areas that received 6 or more inches of snowfall (magenta). Surface frontal analyses shown are at the deepest point for each surface low.