

## **Western U.S. to Upper Midwest Winter Storm**

**24-26 December, 2016**

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### **Meteorological Overview:**

A winter storm impacted a large portion of the western and central U.S. over the Christmas weekend, producing widespread mountain snows across the West, followed by blizzard conditions and significant ice accumulations across portions of the northern Great Plains and the upper Midwest.

Late on 24 December, an amplified upper level trough moved over the western U.S., producing widespread mountain snows from the Pacific Northwest and California, through the Intermountain West and into the Rockies. A mid to upper level low developed as the trough moved over the Great Basin, assuming a negative tilt as it moved over the central Rockies on 25 December. A surface low strengthened over eastern Colorado early on 25 December and continued to intensify as it tracked into the northern Great Plains by late in the day (*Fig. 1*). As the storm began to strengthen, an intensifying low level jet directed warm, moist air from the Gulf of Mexico into the northern Great Plains. Upper air soundings taken during the afternoon and evening of 25 December measured record daily precipitable water values at Bismarck, North Dakota and Aberdeen, South Dakota. This moisture interacting with strong upward motion along the left-exit region of a 120 knot, 300 hPa jet streak supported the development of heavy precipitation across the northern Great Plains and the upper Midwest. Heavy snows developed north and west of the low and extended from the Nebraska Panhandle and eastern Wyoming northward into eastern Montana and the western Dakotas. In addition to the heavy snow, strong surface winds produced blizzard conditions across much of the western Dakotas. Farther to the east, strong warm advection aloft coupled with subfreezing surface temperatures supported freezing rains from the central Dakotas to northern Michigan. Heavy snows continued across portions of the northern Great Plains through the overnight and into morning hours of 26 December. On 26 December, the low tracked from the eastern Dakotas and across northern Minnesota. As the low moved into western Ontario during the afternoon hours, snows began to diminish; however, windy conditions persisted across the northern Great Plains and the upper Midwest.

### **Impacts:**

As the storm moved across the western U.S., snow accumulations of 8 inches or more were recorded across portions of the Cascades, Sierra and the coastal mountain ranges of southern California. Accumulations of 8 inches or more were also reported across parts of the Great Basin, Arizona's Mogollon Rim and the Rockies from northern Idaho to northern New Mexico

(Fig. 2). Some of the highest snowfall amounts occurred over northern Utah, where accumulations up to 2 feet were reported. Riverton, Wyoming reported its snowiest Christmas Day in more than 110 years of record. Many areas along the northern and central Rockies into the adjacent plains reported winds gusting in excess of 70 mph. This included the foothills west of Boulder, Colorado, where winds gusted to around 100 mph, resulting in downed trees across the area.

Across the central U.S., snow accumulations of 8 inches or more were reported from eastern Montana and northeastern Wyoming into western South Dakota and across a large portion of North Dakota. Accumulations of 12 to 18 inches were reported across much of western and central North Dakota. In addition to the snow, widespread ice accumulations of 0.10 inch or more were reported from the central Dakotas to northern Michigan. As heavy rain froze on contact, ice accumulations of 1.0 inch or more reported across portions of central and northeastern South Dakota.

The storm adversely impacted travel for many over the holiday weekend. Following multiple crashes that resulted in a 50 mile standstill, portions of Interstate 40 and other highways in Arizona's high country were closed due to the storm. Across the Dakotas, several hundred miles of interstates were closed on 25 December due to the hazardous driving conditions, with many areas remaining closed until 27 December. Whiteout conditions led to the closure of the Minot, North Dakota airport. The storm also resulted in several cancelled flights at the Bismarck, Fargo and Minneapolis airports as well.

The storm impacted the power to many across the Dakotas and upper Midwest, with several thousand customers reporting outages due to downed trees and damaged powerlines.

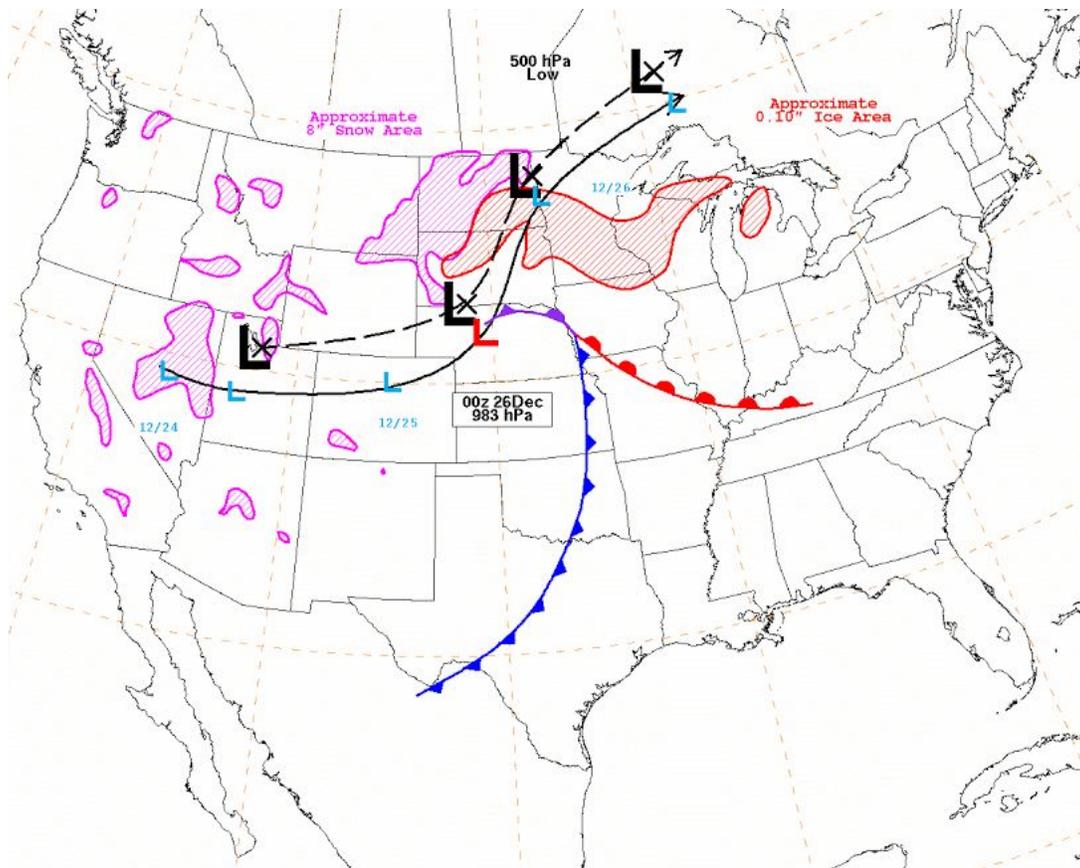


Fig 1: Upper low (black) track, surface low (blue) track, areas of snow (magenta) and area of ice (red).

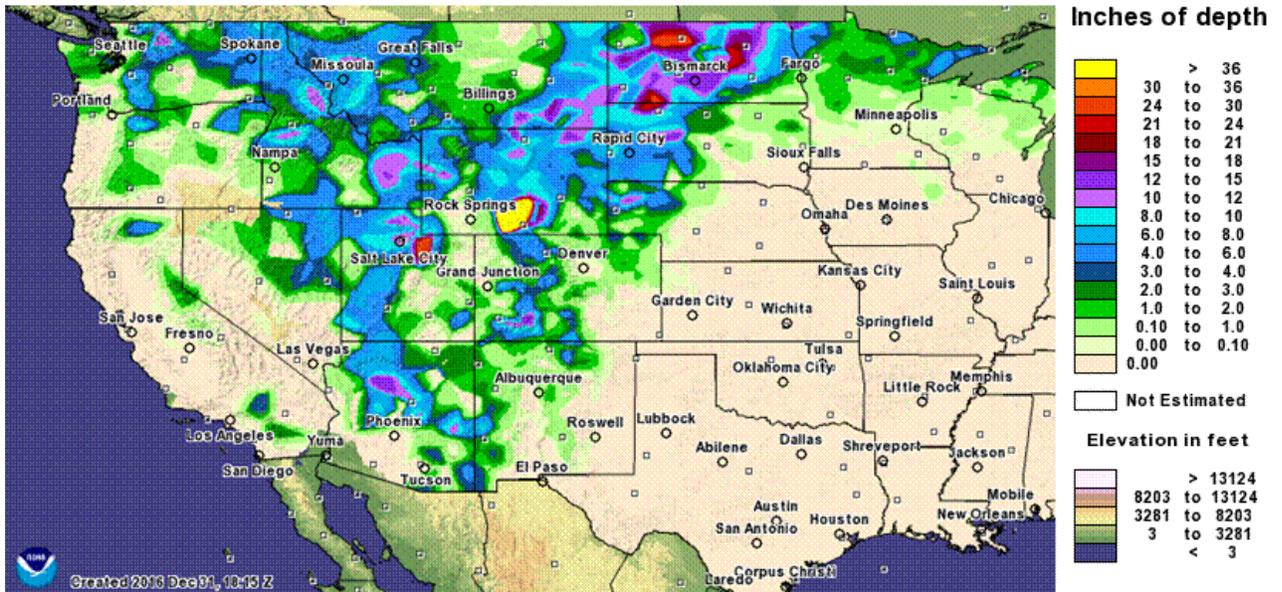


Fig 2: Total observed snowfall (interpolated) during 72h preceding 12 UTC on 27 December, 2016 (NOHRSC)