

## **Upper Midwest Snow**

**03– 05 April, 2014**

**By: Rich Otto, WPC Meteorologist**

### **Meteorological Overview:**

The beginning of April featured an early spring storm which impacted the Colorado Rockies into eastern Colorado with 6 to 12 inches of snow on 3 April, before intensifying over the Upper Midwest on 4 April, producing between 12 and 18 inches from Minnesota into the Upper Peninsula of Michigan (Fig. 1). Temperatures across Kansas and Nebraska were near or above freezing for the duration of the storm, limiting snow accumulations to 3 inches or less for the central plains (Fig. 2). While the storm didn't break records, it added onto snowfall totals which were already well above average for the winter season for much of the Upper Midwest.

On 2 April, a mid-level low embedded within a large, positively tilted mid-upper level trough was present over central California with the upper trough axis extending northeastward toward Idaho. Over the next 24 to 36 hours, the low translated eastward while the upper trough axis became oriented more neutrally. The eastward advancement of the upper level trough was coincident with deepening low pressure at the surface over southeastern Colorado. Periods of moderate to heavy snow developed across the Colorado Rockies with upslope flow in place at the surface by 0000 UTC on 3 April for locations east of the Continental Divide. The passage of the upper trough axis allowed colder air to filter down the central High Plains which dropped surface temperatures to near or just below freezing, allowing 2 to 6 inches of heavy/wet snow to accumulate by the afternoon of 3 April from the Denver metro area to northeastern Colorado.

After passing over the plains, the mid-upper level trough axis took on a negative tilt with an embedded closed low passing about 100 miles south of Minneapolis, Minnesota by 1200 UTC on 4 April. The passage of the upper trough across the plains corresponded with the organization of a surface low along an east-west oriented frontal boundary in place across the center of the country, which deepened while tracking northeastward, reaching southern Wisconsin by 1200 UTC on 4 April. Low level cold advection increased to the west of the surface low as it continued to deepen, drawing colder air into Minnesota and Wisconsin. A zone of strong frontogenesis centered near 700 hPa (Fig. 3), developed late in the day on 3 April along with a narrow axis of heavy precipitation aligned from southwest to northeast. Temperatures south of Minneapolis remained mostly above freezing which limited snowfall south of the city (Fig. 4) but resulted in a sharp gradient of snowfall from north to south.

### **Impacts:**

While this was a significant snowfall for April, the impacts were not severe and only prolonged an already above average snowfall season for the region. Snow covered roads created slick conditions which resulted in numerous accidents across the Upper Midwest, but no fatalities were reported. Schools were delayed or closed for the day in locations that received heavier snowfall, but forecast warming of temperatures following this storm system and a higher sun angle for April led to rather quick melting. For example, high temperatures soared into the 60s and 70s in the 2 to 7 day range following this event in Minneapolis, which was a contributing factor in causing the city not to declare a snow emergency for the event given the relatively rapid degree of melting expected.

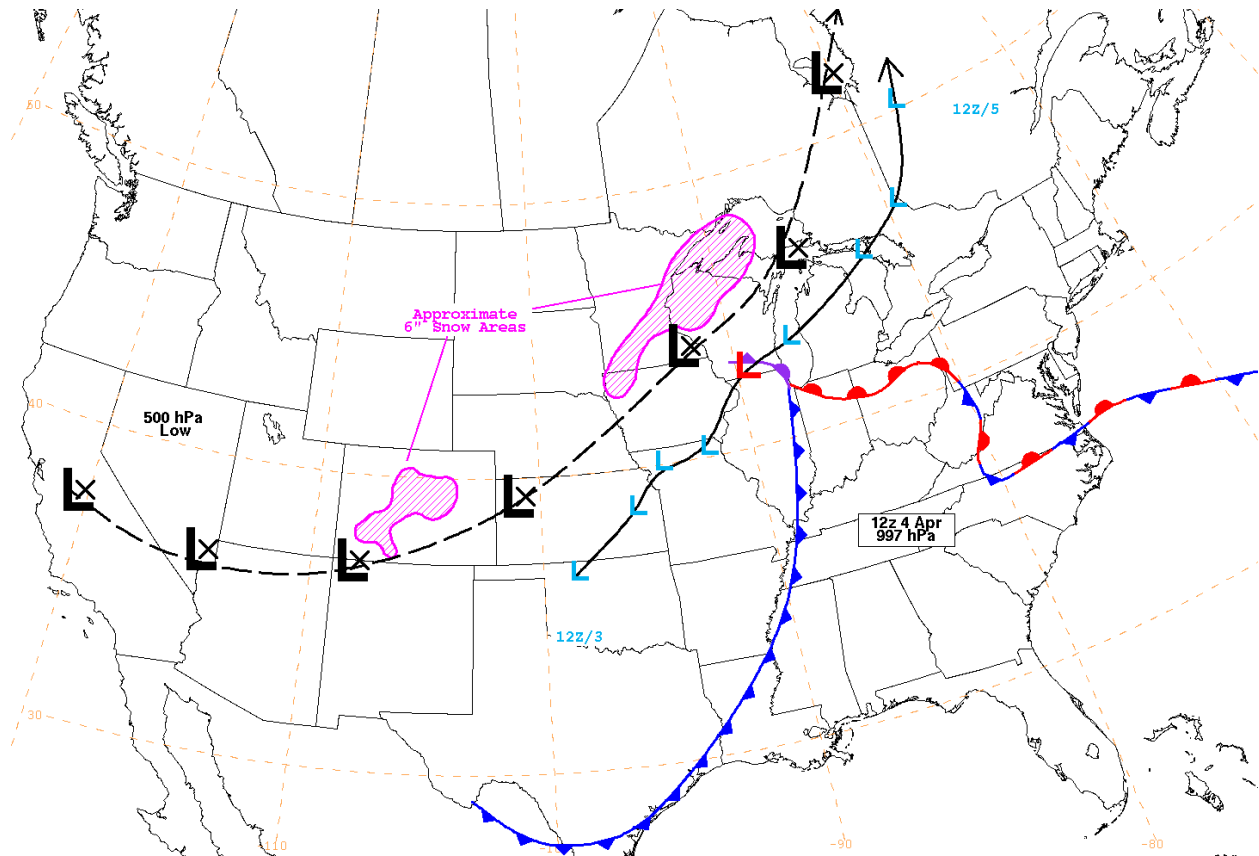


Figure 1: 500 hPa low track every twelve hours starting 12Z on 2 April (black), surface low tracks every six hours (light blue), surface analysis near height of storm (12Z on 4 April) and approximate areal coverage of locations receiving 6 inches or more of snow (pink).

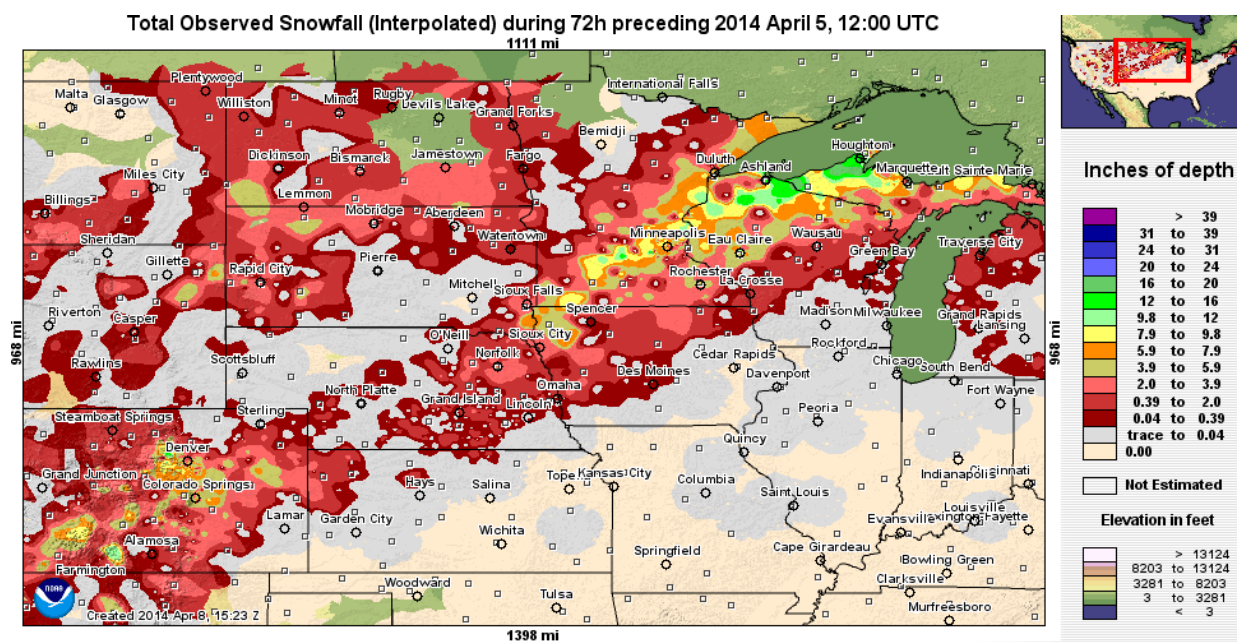
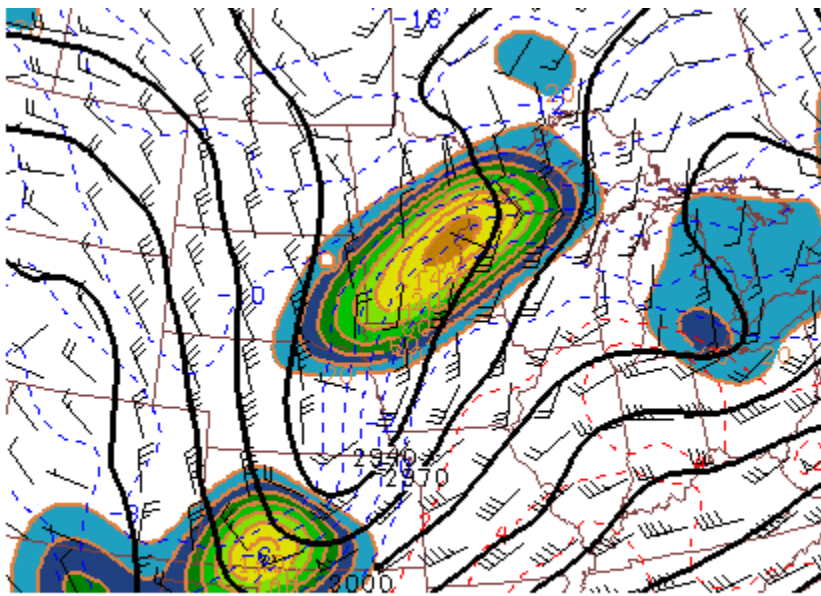


Figure 2: 72 hr snowfall accumulation ending 12Z on 5 April, 2014 (National Operational Hydrologic Remote Sensing Center)



140404/0000V001 700 mb Petterssen frontogenesis (#111)  
 140404/0000V001 700 mb height, temperature and wind

Figure 3: 700 hPa height (m), wind (kt), temperature (C), and Petterssen frontogenesis (shaded) (K / 100 km / 3hr ) valid 00Z on 4 April. (Storm Prediction Center)

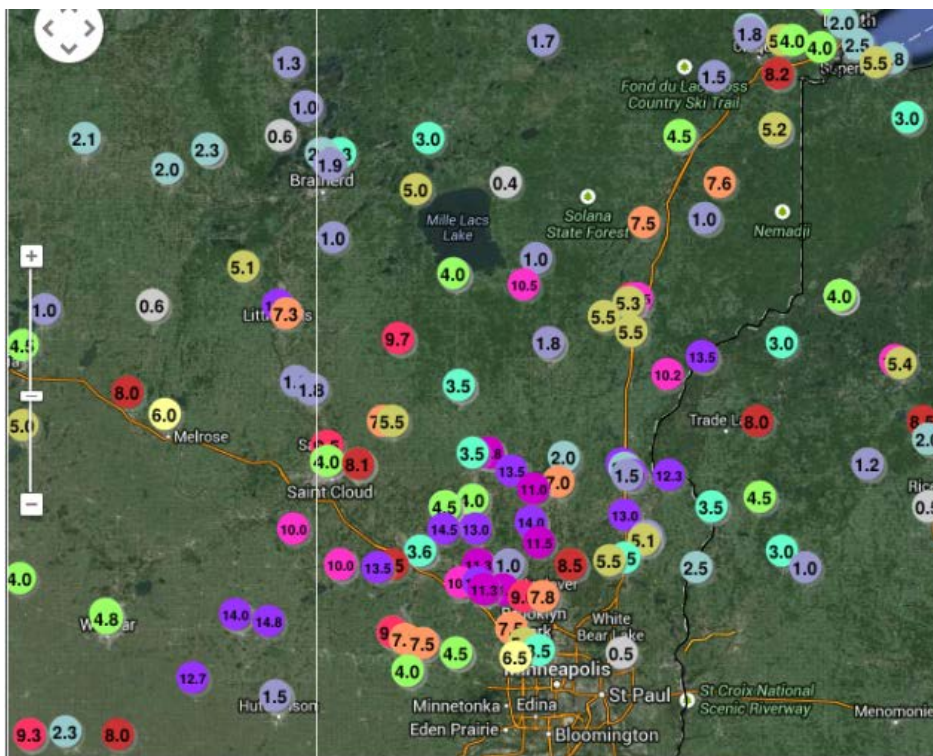


Figure 4: Plotted snowfall totals near and north of Minneapolis, MN, early in the morning on April 4, 2014 (Twin Cities National Weather Service)