

Central U.S. Winter Storm – February 20-22, 2013

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Meteorological Overview: A multi-day winter storm brought wintry precipitation across a large portion of the Great Plains through the Middle/Upper MS Valley and into the Great Lakes region. Early in the period (20 February 2013, 12 UTC), the synoptic pattern featured a highly amplified 500-hPa flow with a ridge centered over the middle of the U.S. while a closed low anchored the lower Great Lakes and a strong shortwave was located over Southern CA (Figure 1a). The progressive nature of the mid-latitude flow allowed the shortwave to reach the TX/OK panhandle within 24 hours while becoming negatively-tilted (Figure 1b). At this point, radar imagery indicated an expansion in the moderate to heavy precipitation as the 300-hPa flow became increasingly diffluent over the Central Plains.

During this synoptic-scale deepening process, low-to-mid level frontogenetic forcing significantly increased and was vertically collocated with an axis of slightly negative equivalent potential vorticity (EPV) values (Figure 2, area circled in black). Local Doppler radar and surface observations suggested a large axis of banded precipitation with temperatures well below freezing thus supporting snow as the dominant hydrometeor type. As the broad shield of precipitation worked its way toward MO/AR, the storm transitioned into a mixed precipitation event. A large flux of above freezing air between 900-650 hPa (as referenced from soundings at Little Rock, AR (LZK) and Springfield, MO (SGF)) overrode a still subfreezing boundary layer which led to widespread freezing rain/sleet reports. Some of the precipitation became convective in nature as soundings showed sufficient mid/upper-level instability associated with steep vertical lapse rates. Consequently the highest ice accumulations were reported in this region with 0.25 to 0.50 inches including some isolated higher amounts (Figure 3a).

Ahead of the intensifying shortwave, low-level moisture continued to overrun a surface warm front near the Gulf Coast (Figure 4) with mixed precipitation reported over much of the OH Valley. Locations further north across the Middle MS Valley and Upper Great Lakes featured vertical temperature profiles completely below freezing thus maintaining snow throughout the event. While 6 to 12 inches of snow was commonplace over this region, a heavier band associated with the deformation zone/comma-head set up across Central KS. As the parent upper low rapidly strengthened and became more negatively-tilted over OK/KS during the afternoon of 21 February 2013, mesoscale banding resulted in snowfall rates nearing 3 inches per hour including numerous reports of thundersnow. This heavier snow band occurred just north and west of the surface low (Figure 4) in association with the strongest mesoscale ascent. Local snowfall measurements indicated a broad region of one foot across Central KS with a maximum ranging from 19 to 22 inches just north and south of interstate 70 between Hays and Russell, KS (Figure 3b). Some locations reported near record amounts with Mid-Continent Airport in Wichita, KS measuring 14.2 inches of snow which ranked second highest from an individual storm. As a whole, it was a rather wet snow for the region with snow-to-liquid ratios (SLR) ranging from 8:1 to 12:1 across several locations in KS. The SLR climatology from 1971 to 2000 for the winter months suggest values closer to the 13:1 to 15:1 range according to the Cooperative Institute for Precipitations Systems (CIPS).

Impacts: The widespread snow and ice impacted a significant portion of the Central U.S. and caused numerous societal impacts including a pair of fatalities from automobile accidents on snow-covered/icy roads across OK and NE. The reduced visibility within the heavier snow bands caused sections of interstate 70 to be closed in KS/MO on Thursday, 21 February 2013. Many other roads were littered with stalled/abandoned vehicles as the intense snowfall rates led to very hazardous driving conditions. Additional impacts included the closure of Kansas City

International Airport through early Friday morning (22 February 2013) and states of emergency issued for KS and MO.

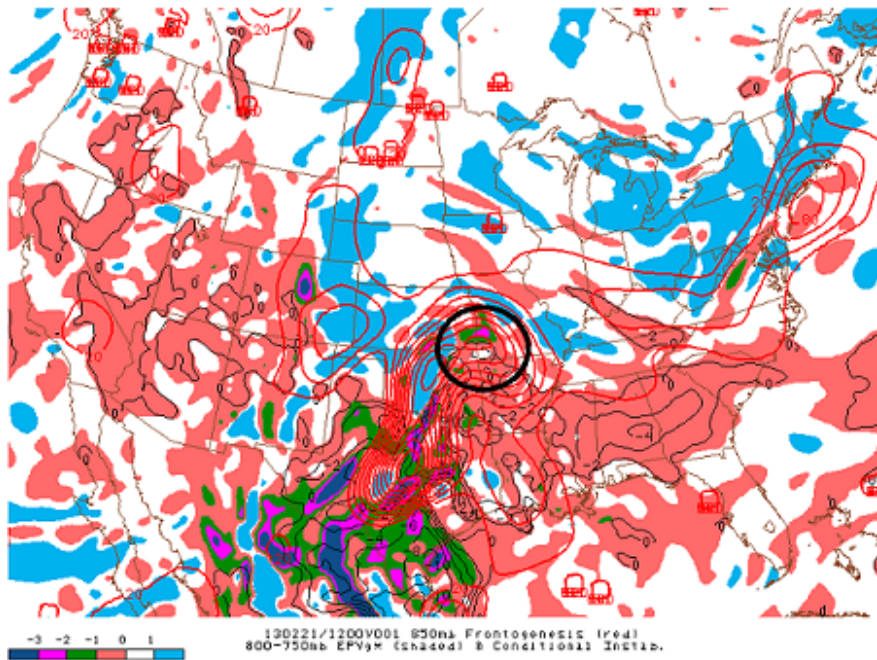


Figure 2: 850 mb frontogenesis (red) & 800-750 mb EPV (shaded), courtesy of the SPC
Valid time: 21 February 2013-1200 UTC

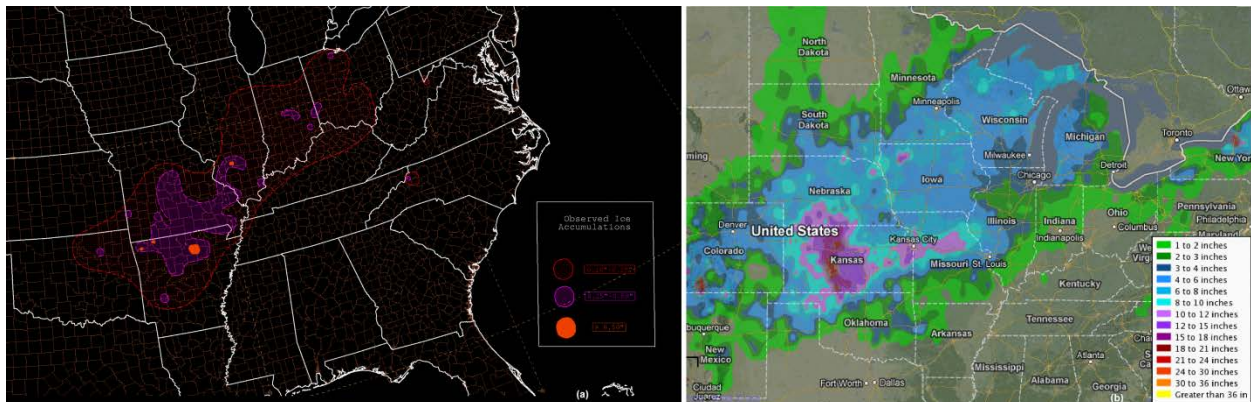


Figure 3: (a) Ice accumulations (in) from local storm reports, public information statements, and CoCoRaHS
(b) Snowfall analysis (in) courtesy of Southern Region HQ

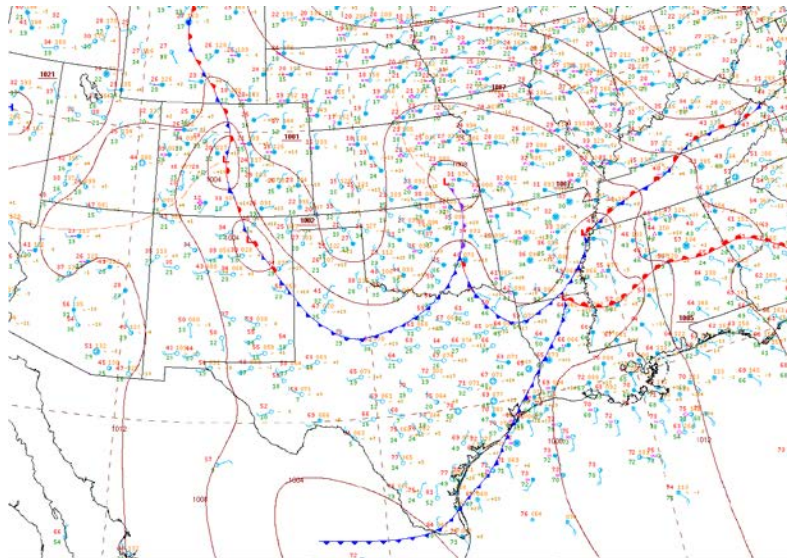


Figure4: Hydrometeorological Prediction Center (HPC) surface analysis:22 February 2013-0000 UTC