#### Winter Using Regional Historical Analogs as Guidance for a Midwestern Winter Weather Event



- For effective interpretation of model output, a blend of knowledge and experience is critical. However, even experienced forecasters can fail to identify significant weather events and their resultant impacts.
- Failure to recognize these and similar events may be due to a variety of meteorological reasons, but the identification of these significant events may be the primary cause.
- Conceptual models, composite analyses, and forecast analogs can all be utilized to support in the identification and analysis of these weather events. These techniques have been proven successful because their underlying foundation is based on the quasi-repeatability of atmospheric fields and their resultant sensible weather outcomes.
- The focus of the CIPS analog guidance is not to provide a deterministic forecast, but to give the scale and intensity of historical events that are similar to the current forecast.

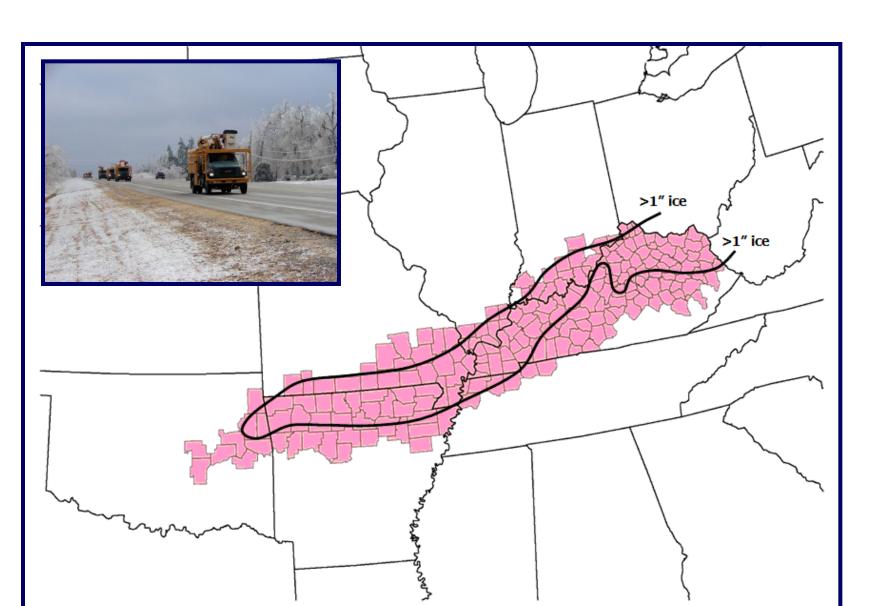
#### **Analog Methodology - The Big Picture**

- Search the 28-yr North American Regional Reanalysis (NARR) dataset against the model forecast (GFS212-40km) for
- 6 months over the winter season (OCT MAR) with a 6-h temporal resolution 20,384 potential analogs (28 winters, 6 months, 4 per day)
- Remove "duplicate" times by choosing the best analog over a 24-h period. 1984011512, 1984011518, 1984011600, 1984011606
- Refine and rank the resulting analogs using statistics from the following fields:

  300 HGHT COR, 500 HGHT COR, 700 FRNT COR, 850 HGHT COR, 850 TMPC COR, 850 TMPC MAE, 850 FRNT PMSL COR, and PWTR COR
- Create products that are useful for winter storm guidance.
- For a detailed overview of the methodology, please see the corresponding preprint manuscript.

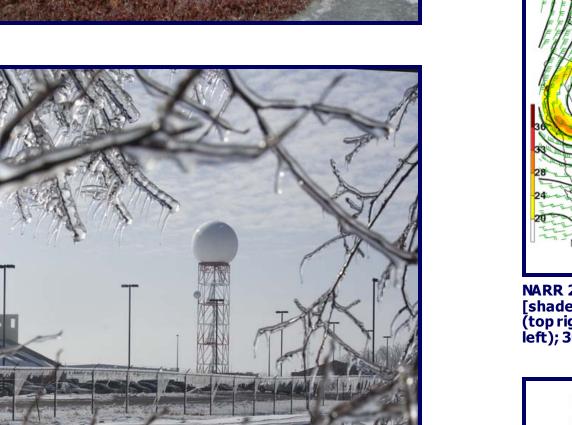
#### 26-28 January 2009 Ice Storm

- A severe ice storm affected areas from the southern Plains through the Ohio Valley on 26-28 January 2009.
- At its height, the winter storm was responsible for causing widespread outages when 1.3 million residents were left without power (700,000 residents in KY).
- 55 fatalities nationwide (24 fatalities in KY). Most deaths were attributed to traffic accidents, hypothermia, and carbon monoxide poisoning.
- Portions of 7 states (OK, MO, AR, TN, IL, IN, and KY) had Federal Disaster Declarations declared.



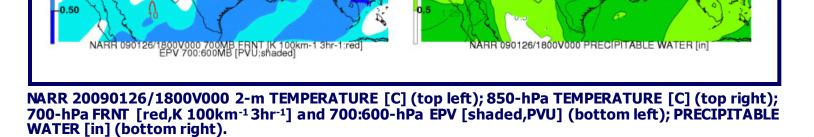
26-29 January 2009 federal disaster declarations [shaded counties] from FEMA and greater than 1" of glaze based on event summary maps from the Tulsa, OK; Springfield, MO; Little Rock, AR; Paducah, KY; Louisville, KY; and Jackson, KY NWS forecast offices. Inset photograph courtesy of the NWS Little Rock,

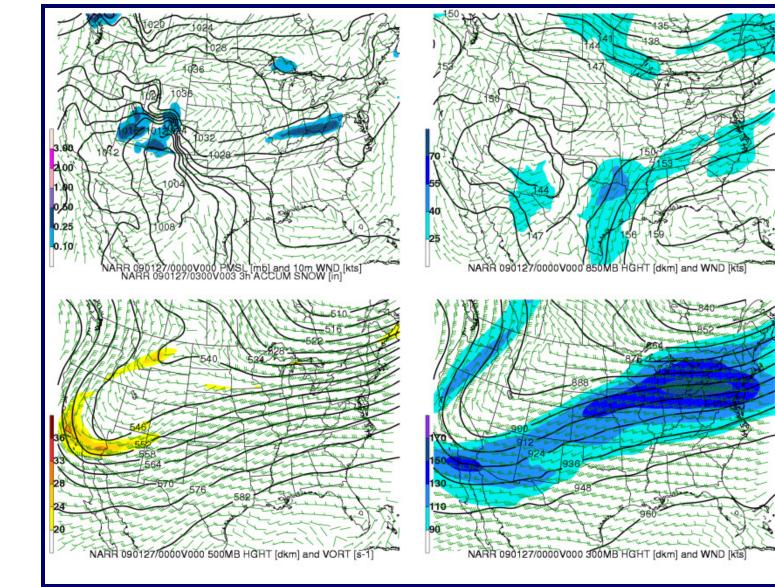


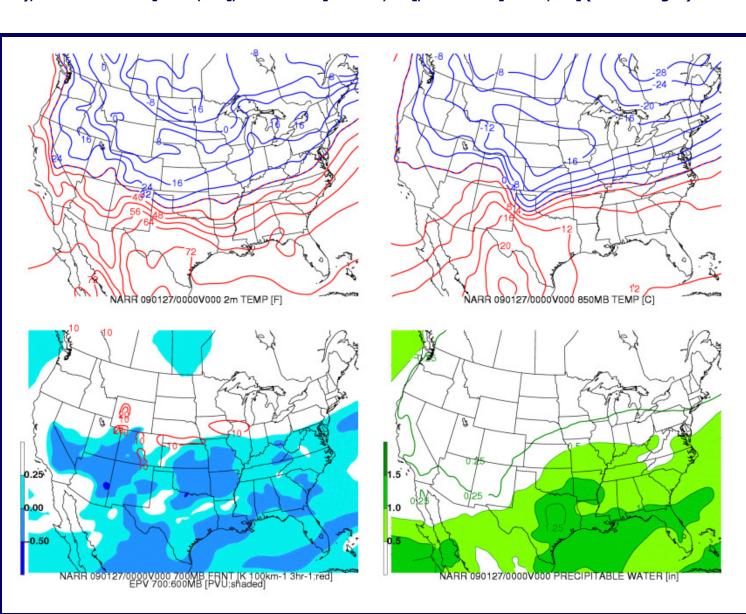


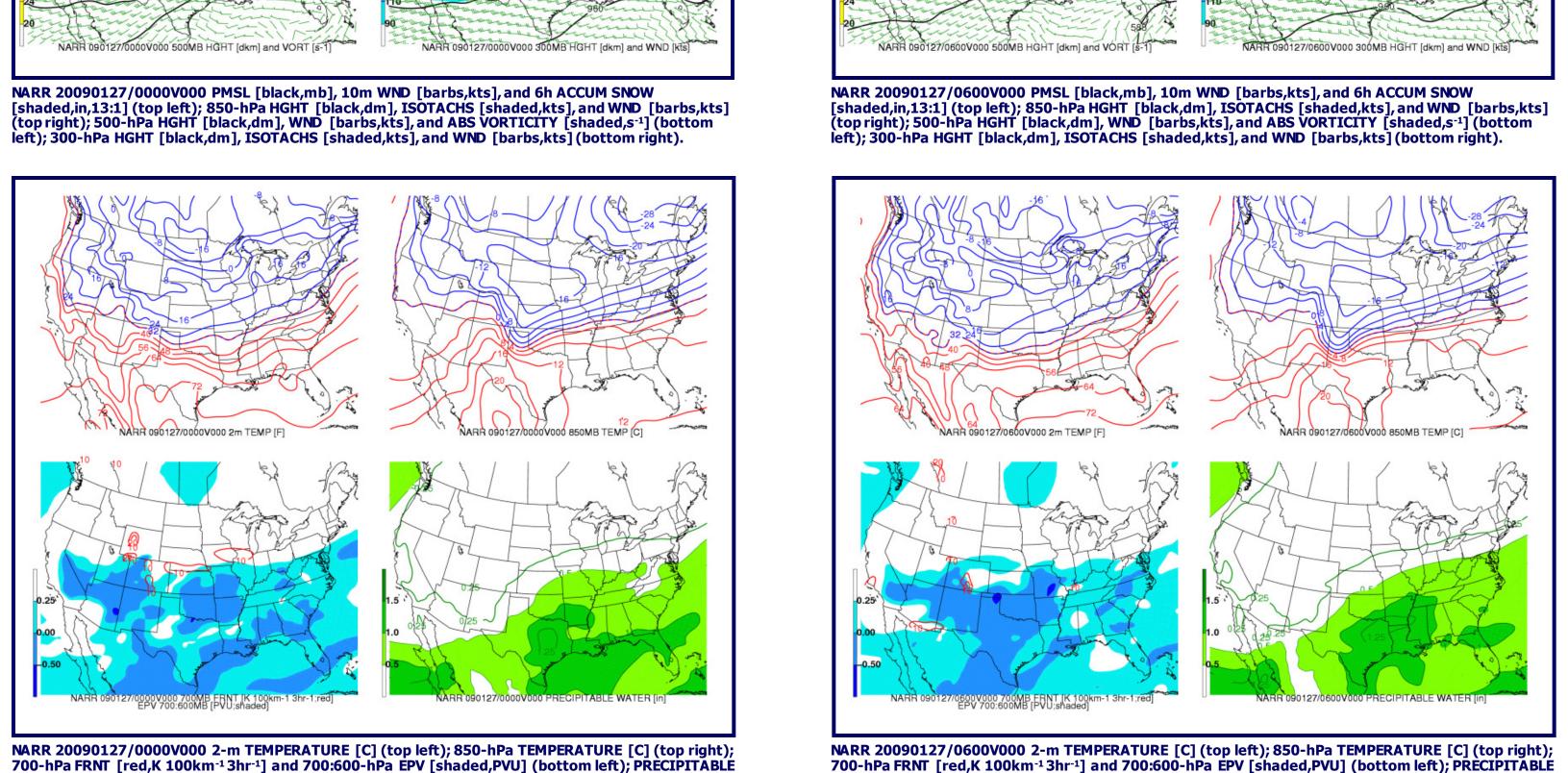


NARR 20090126/1800V000 PMSL [black,mb], 10m WND [barbs,kts], and 6h ACCUM SNOW [shaded,in,13:1] (top left); 850-hPa HGHT [black,dm], ISOTACHS [shaded,kts], and WND [barbs,kts] (top right); 500-hPa HGHT [black,dm], WND [barbs,kts], and ABS VORTICITY [shaded,s-1] (bottom left); 300-hPa HGHT [black,dm], ISOTACHS [shaded,kts], and WND [barbs,kts] (bottom right).



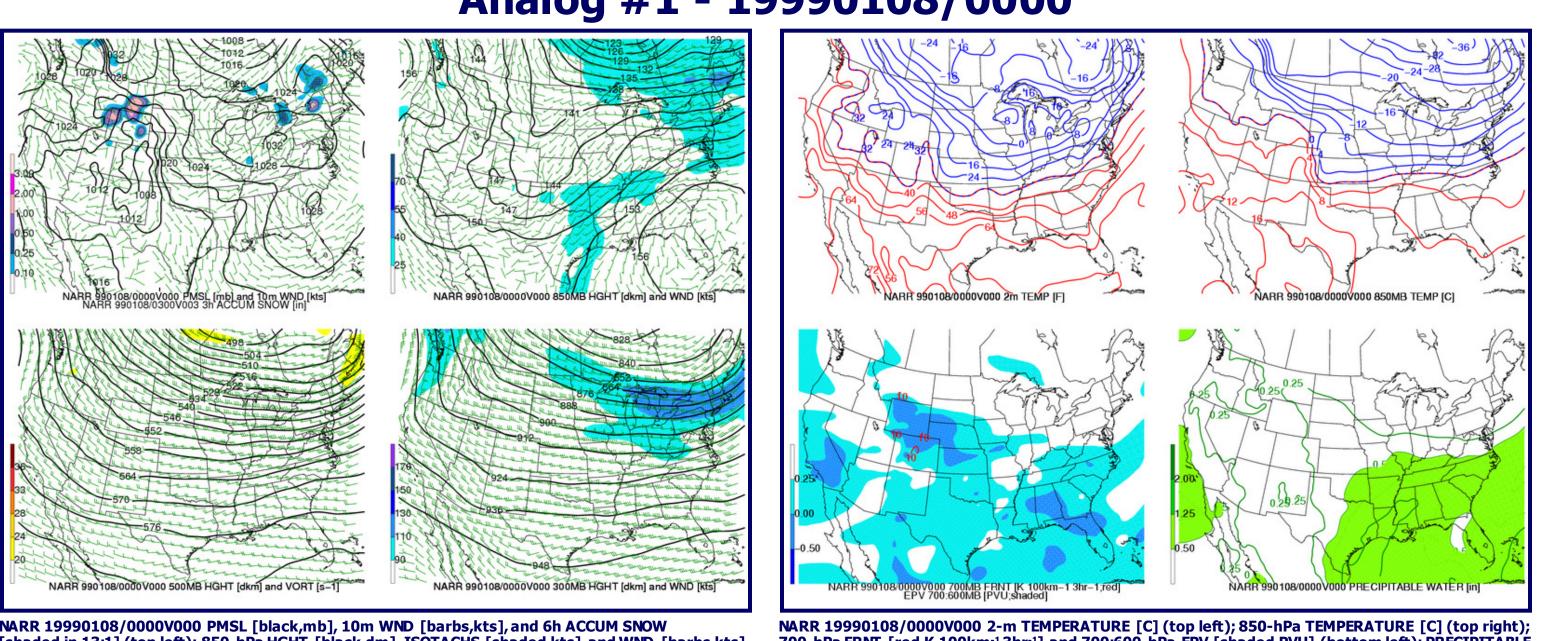






### NARR 20090127/0600V000 2-m TEMPERATURE [C] (top left); 850-hPa TEMPERATURE [C] (top right); 700-hPa FRNT [red,K 100km<sup>-1</sup>3hr<sup>-1</sup>] and 700:600-hPa EPV [shaded,PVU] (bottom left); PRECIPITABLE WATER [in] (bottom right).

#### **Ice Storm Analogs Analog #1 - 19990108/0000**





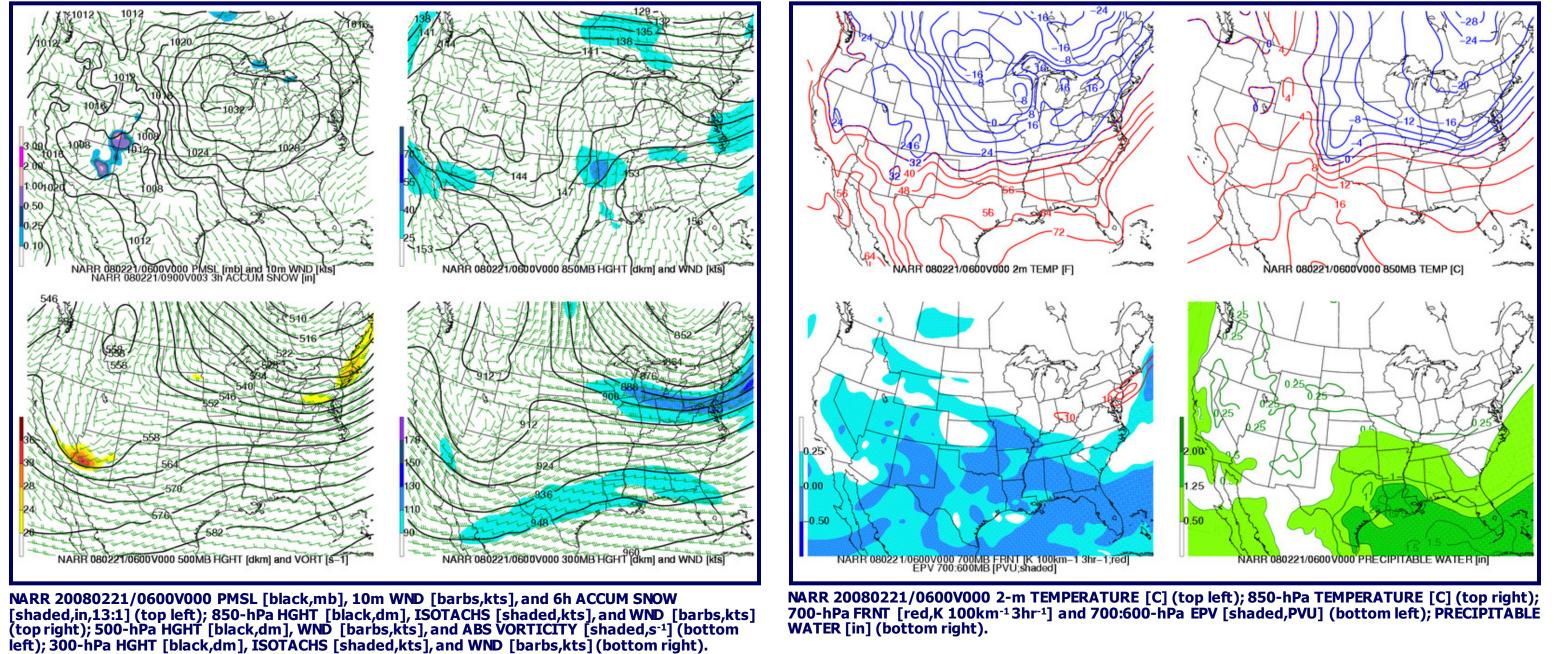


# Analog #4 - 20080212/0000

 In the Springfield, Missouri area, up to 0.75" of FZRA occurred with 35,000+ without power.

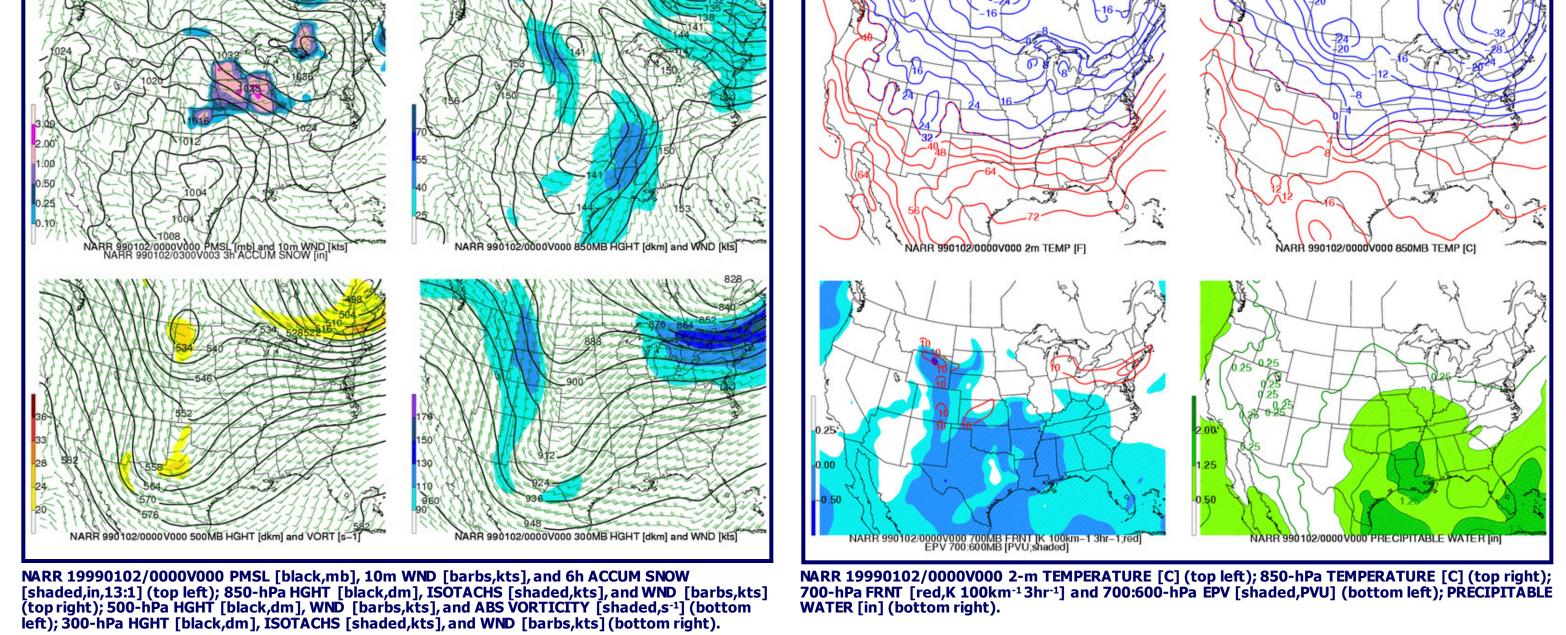
- In southern Illinois an 1.00" FZRA and glaze was reported. The area was declared a disaster area. Power outages lasted over 1 week.
- Along the Ohio River in southern Indiana, 0.50" FZRA and 3-4" of sleet occurred.

#### Analog #8 - 20080221/0600



- In southwestern Missouri, up to 0.75" of FZRA was reported.
  - Along the Ohio River in southern Indiana and northern Kentucky, 0.25" - 0.50" of glaze occurred with power outages.

## **Analog #12 - 19990102/0000**

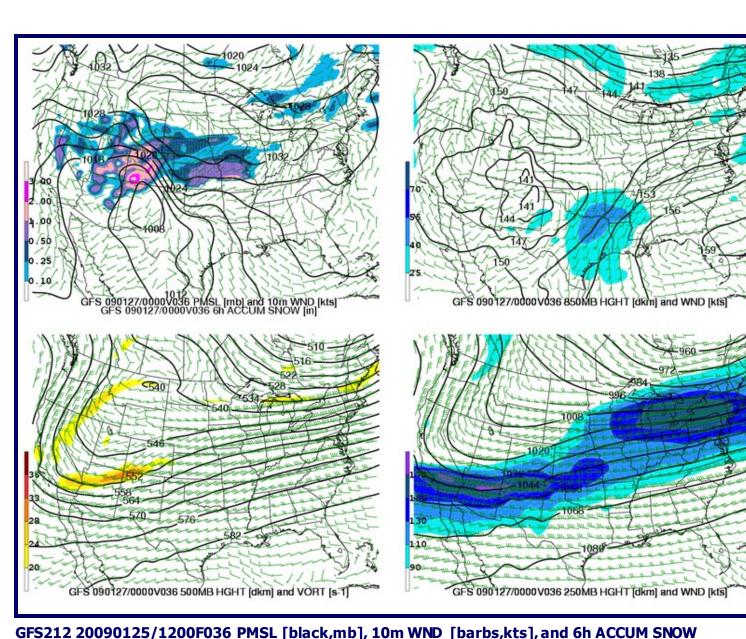


## Ice storm and freezing rain reports [shaded counties] from NCDC storm data for the 1-day period ending on 1 January 1999.

Ice storm and freezing rain reports [shaded counties] from NCDC storm data for the 3-day period ending on 12 February 2008.

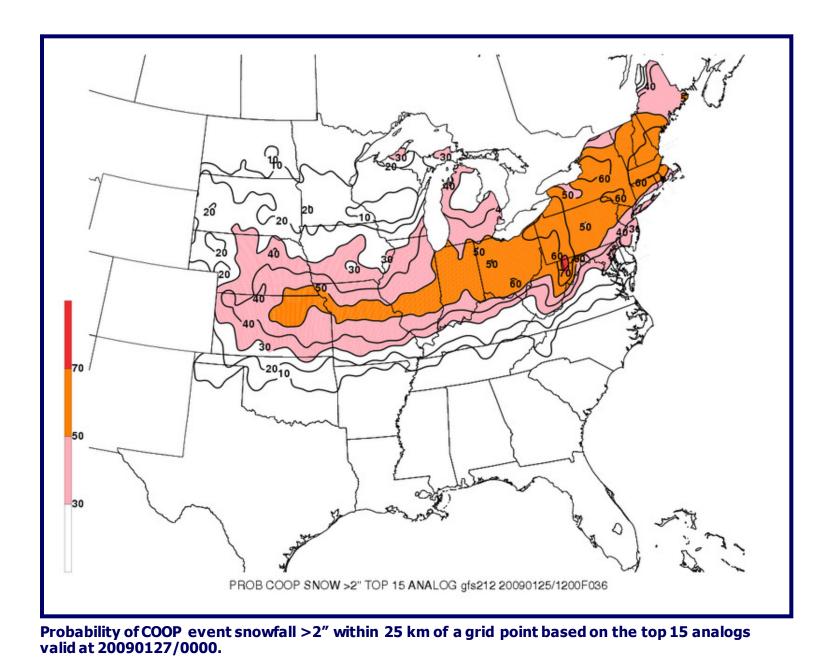
- In southern Missouri, up to 2.0" FZRA with 40,000 without power. Some power outages lasted longer than a week.
- 1.0" FZRA with extensive tree and power line damage occurred in northern Arkansas. Over 100,000 without power during the height of
- Southern Illinois was declared disaster area with FZRA amounts close to 1.0".

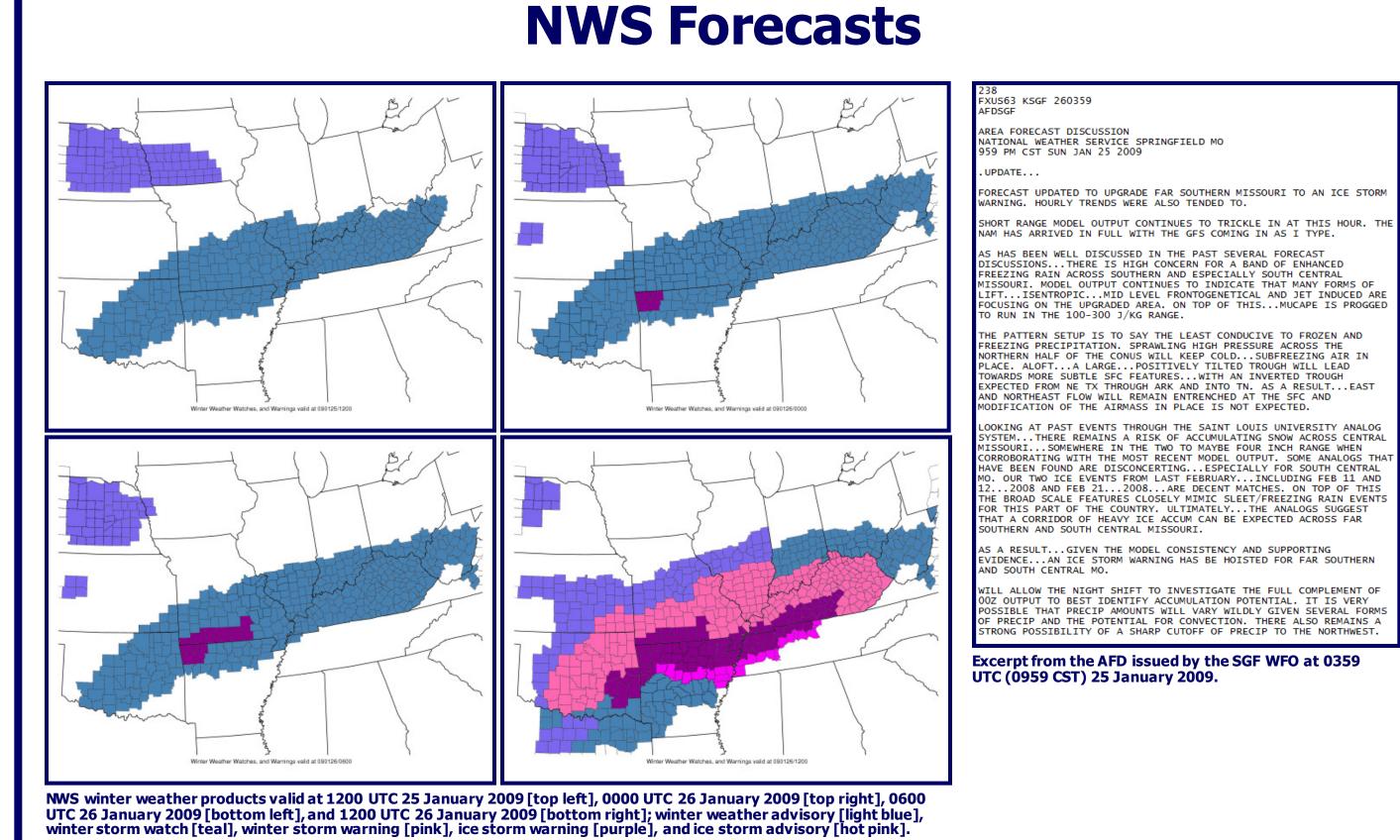
#### 20090125/1200F036 Analog Guidance



[shaded,in,13:1] (top left); 850-hPa HGHT [black,dm], ISOTACHS [shaded,kts], and WND [barbs,kts] (top right); 500-hPa HGHT [black,dm], WND [barbs,kts], and ABS VORTICITY [shaded,s-1] (bottom left); 300-hPa HGHT [black,dm], ISOTACHS [shaded,kts], and WND [barbs,kts] (bottom right).

Top 15 analogs based on the GFS 36-h forecast valid at 20090127/0000. Inset figure shows the domains used to find the top 15 analogs.





#### **Summary of Analog Results**

- 4 major ice storms occurred in the top 15 analogs 8 January 1999 (OK, KS, AR, MO, IL, IN, and KY)
- 21 February 2008 (OK, AR, MO, IL, IN, and KY) 2 January 1999 (OK, KS, AR, MO, IL, IN, and KY)
- The 4 major ice storms occurred from Missouri and Arkansas through the Ohio Valley which was similar

- 9/15 analogs had reports of FZRA in NCDC Storm Data
- 12 February 2008 (OK, AR, MO, IL, IN, and KY)

Ice storm and freezing rain reports [shaded counties] from NCDC storm data for the 1-day period ending on 21 February 2008.

Ice storm and freezing rain reports [shaded counties] from NCDC storm data for the 2-day period ending on 8 January 1999.

#### Conclusions

- The analog procedure, though tailored for heavy snowfall, selected cases which captured past ice storm/freezing rain events. This suggested that the analog system can be applied to additional winter weather phenomena
- The NCDC storm data helped determine the range of potential solutions/impact of the upcoming event.
- The number of analogs with FZRA in NCDC Storm Data (with 4 major ice storms) gave the SGF NWSFO ded confidence to issue an ice storm warning for the southern tier of Missouri counties (28 hour lead

