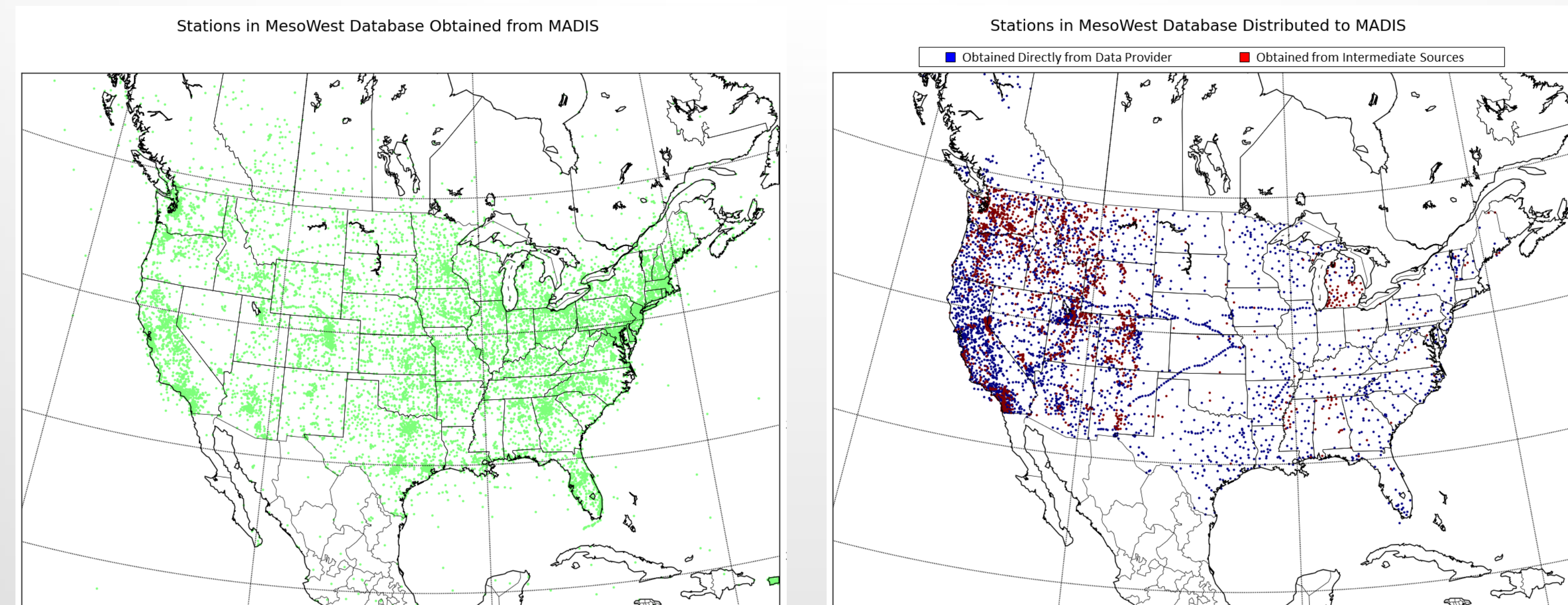


### BACKGROUND

- Surface analyses of weather parameters such as temperature, relative humidity, and wind depend on the quality of the observations used to create those analyses
- The adjoint of a two-dimensional variational analysis system of surface weather parameters covering the entire continental United States has been developed to help assess objectively the sensitivity of the resulting analyses to the observations used in the analysis
- A sample of 100 analyses during major weather events were examined and objective metrics of high impact were determined
- The objective of this study was to examine the suitability of those metrics and determine whether high impact arose due to:
  - Low observation quality,
  - Representativeness errors, i.e., observations reporting conditions on scales not resolved by the analysis, or
  - Accurate observed weather conditions not evident in the background field
- The 100 analysis cases were then rerun using a manual blacklist omitting observations judged to likely be due to low observation quality
- Differences in the analyses with and without the blacklisted stations are then evaluated

### UU 2DVAR Analysis

- A computationally efficient variational analysis system for two-dimensional meteorological fields
- The analysis system is developed using MATLAB software and takes advantage of multiple processor cores
- Background field at 5 km resolution is the same as that used for the NCEP Real-Time Mesoscale Analysis
- Over 12,000 surface temperature observations archived in real-time as part of MesoWest (<http://mesowest.utah.edu>) are used to adjust the background field
- Observations used in the analysis and obtained from MADIS are shown below to the left while observations obtained by the MesoWest team directly or indirectly from data providers and provided to MADIS are shown on the right



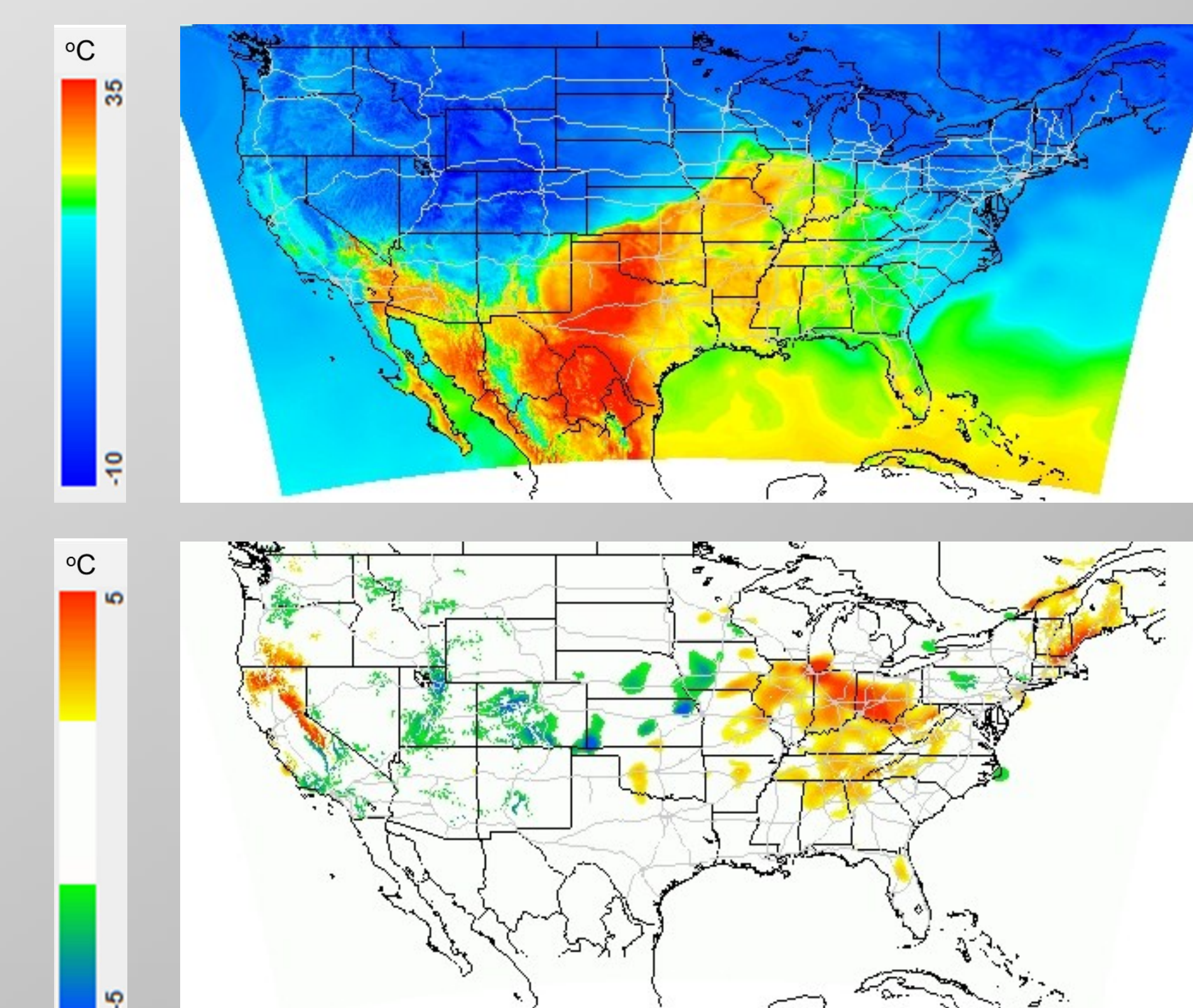
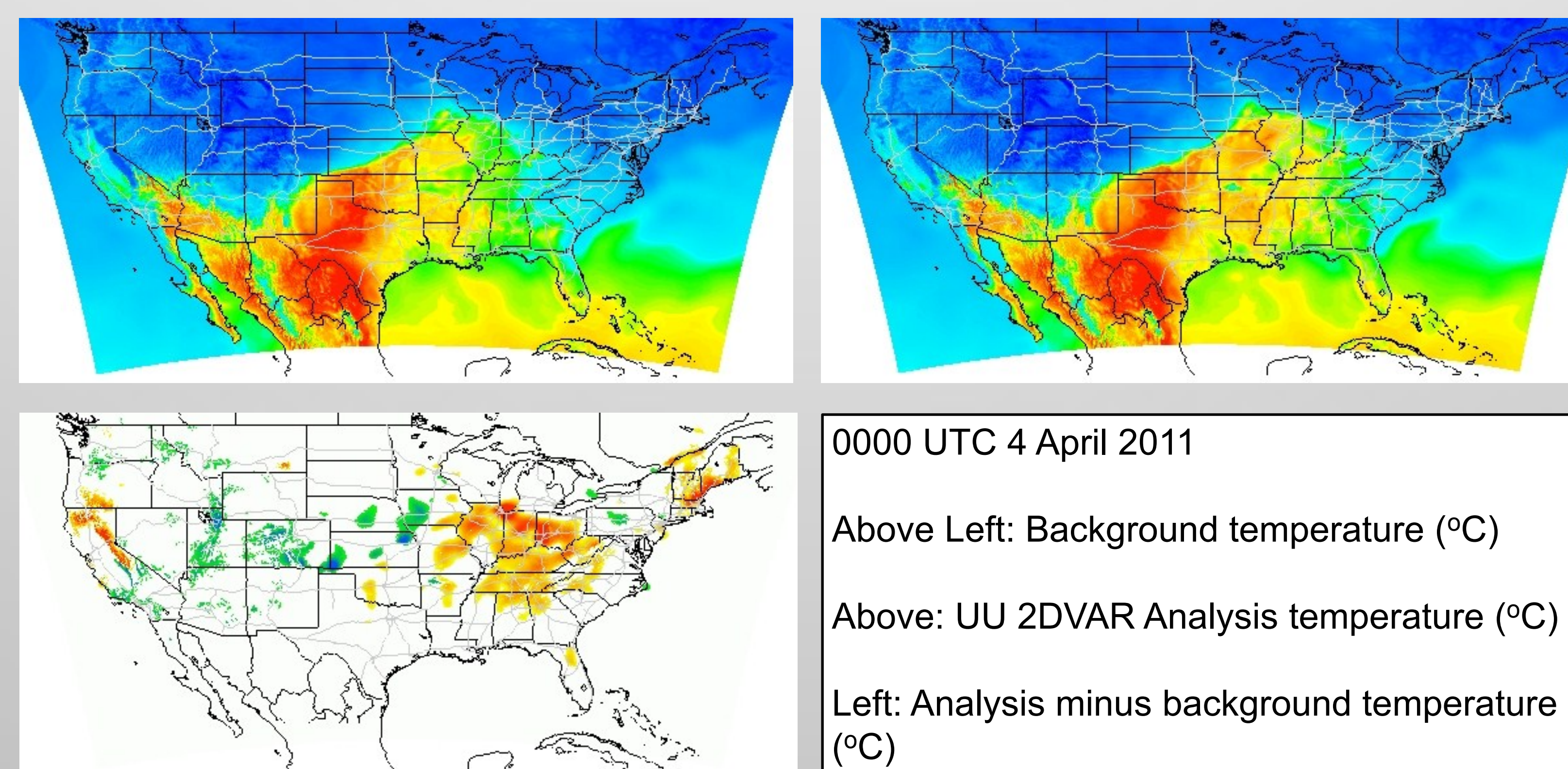
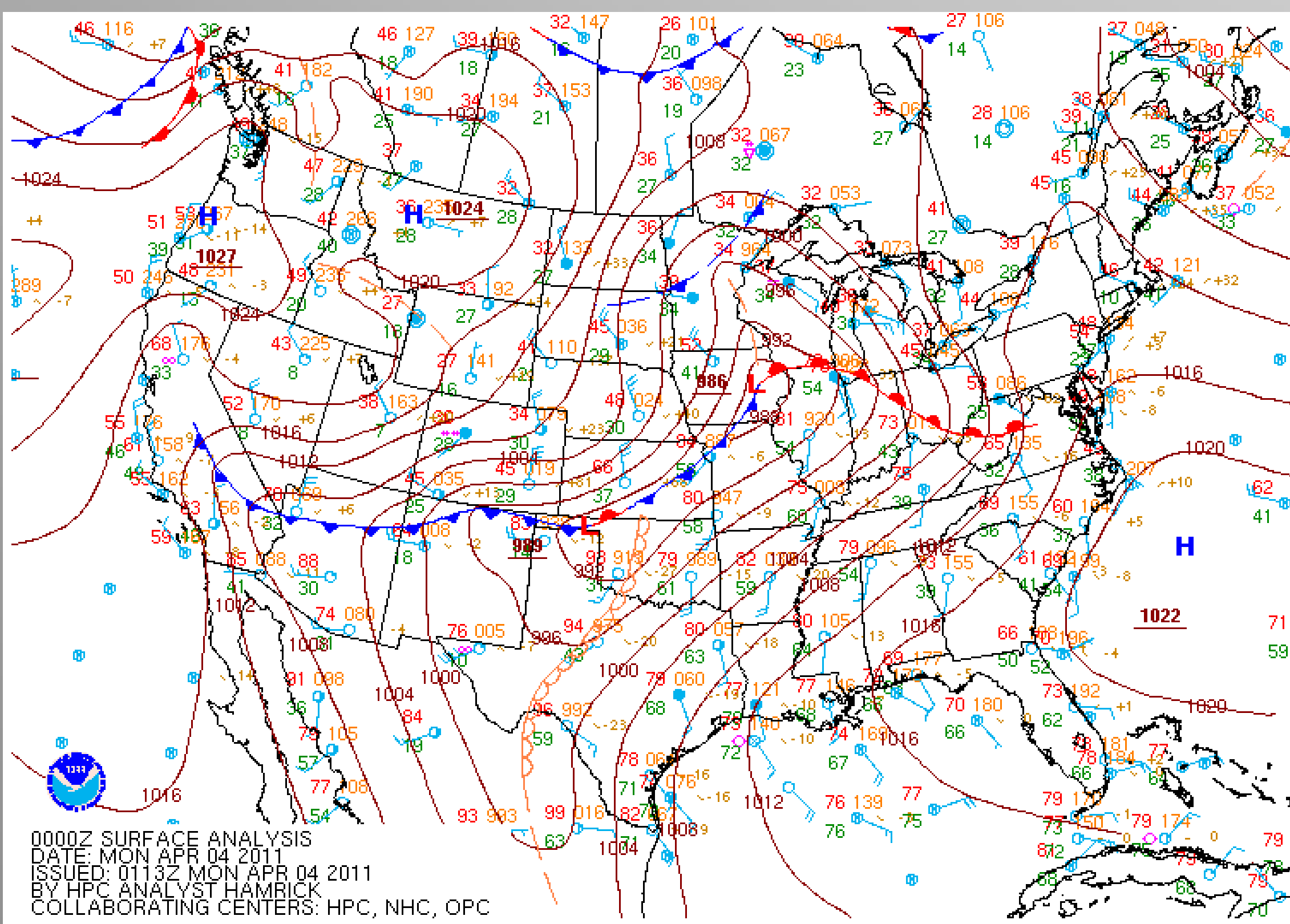
### Results and Conclusions

- A manual blacklist of stations was created eliminating 99 temperature reporting stations; 261 dew point temperature reporting stations; and 11 wind reporting stations
- Many of these stations exhibited errors consistent with poor siting or malfunctioning equipment, and were frequently stations operated by weather enthusiasts
- Reran all 100 cases omitting the blacklisted stations
- Stations exhibiting representativeness errors were maintained despite having large systematic differences from the background
- Eliminating stations due to low quality leads to small changes over the domain as a whole with larger changes in the immediate vicinity of those stations
- Dew point temperature analyses were more affected by omitting the blacklisted stations since ~twice as many stations were blacklisted compared to temperature
- The overall result of the analysis does not change; low quality stations that produced spotty errors have been removed, resulting in a cleaner analysis

See also: Tyndall & Horel: Evaluating the Impact of Surface Observations From Heterogeneous Networks. Wed 5:15pm, Room 357  
Contact info: zach.hansen@utah.edu

### Case Study: April 4<sup>th</sup> 2011 00 UTC

- Two day severe weather period: 03 and 04 April 2011
- Numerous tornadoes in AR, KY, LA, MS, OH, and TN with hail and high wind reports over much of the Midwest and southeastern United States
- Severe storms associated with prefrontal conditions ahead of the cold front stretching from Iowa to Arizona



Top: Temperature analysis (°C) after removing blacklisted stations

Second from top: Corrected temperature analysis minus background (°C)

Third from top: Initial temperature analysis minus the corrected analysis (°C)

Bottom: Initial dew point temperature analysis minus the corrected dew point analysis (°C)

### QUALITY CONTROL PROCEDURE

- The impact of all observations during 100 analysis hours during 25 major weather episodes was assessed objectively
- The bias (observation minus background) was computed for the sample of 100 analyses
- Percentile ranking of observation sensitivity and impact at each station computed from the adjoint of the variational surface assimilation system
- Subjective evaluation: Examined 561 stations with high percentile impact in the 100 case sample to distinguish between:
  - high impact observations located in regions of significant weather where the background field fails to describe the actual weather (high percentile impact and low bias) or
  - Low quality observations or representativeness errors (high percentile impact and high bias)

Station Location	Analysis Variable	Bias	Impact (%)	Subjective Evaluation
Pike's Peak, CO 4,300m	Temperature	-4.2°C	61.2	Representativeness
Winnfield, LA 92m	Temperature	-8.2°C	100	Bad

### ACKNOWLEDGEMENTS

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