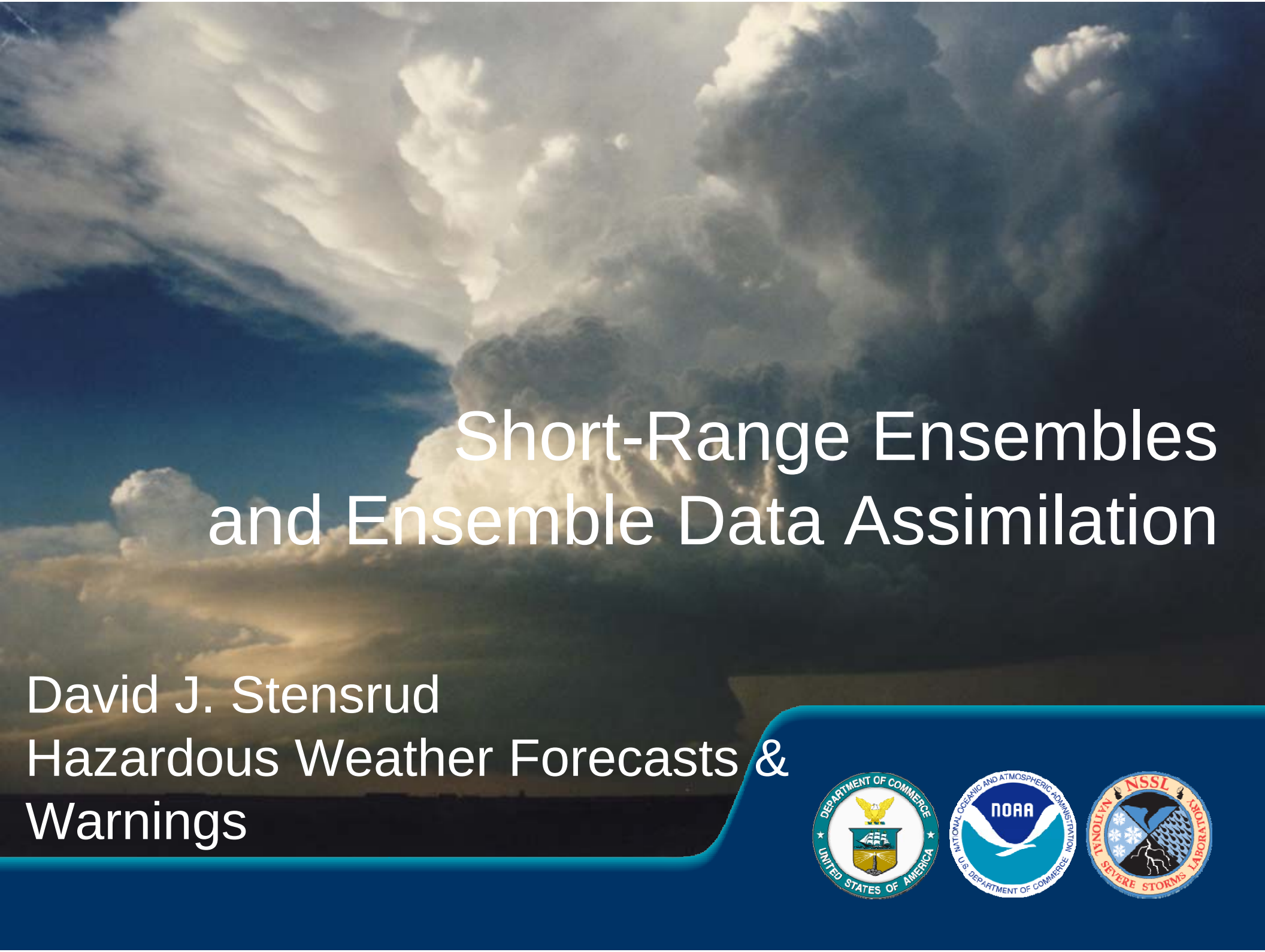


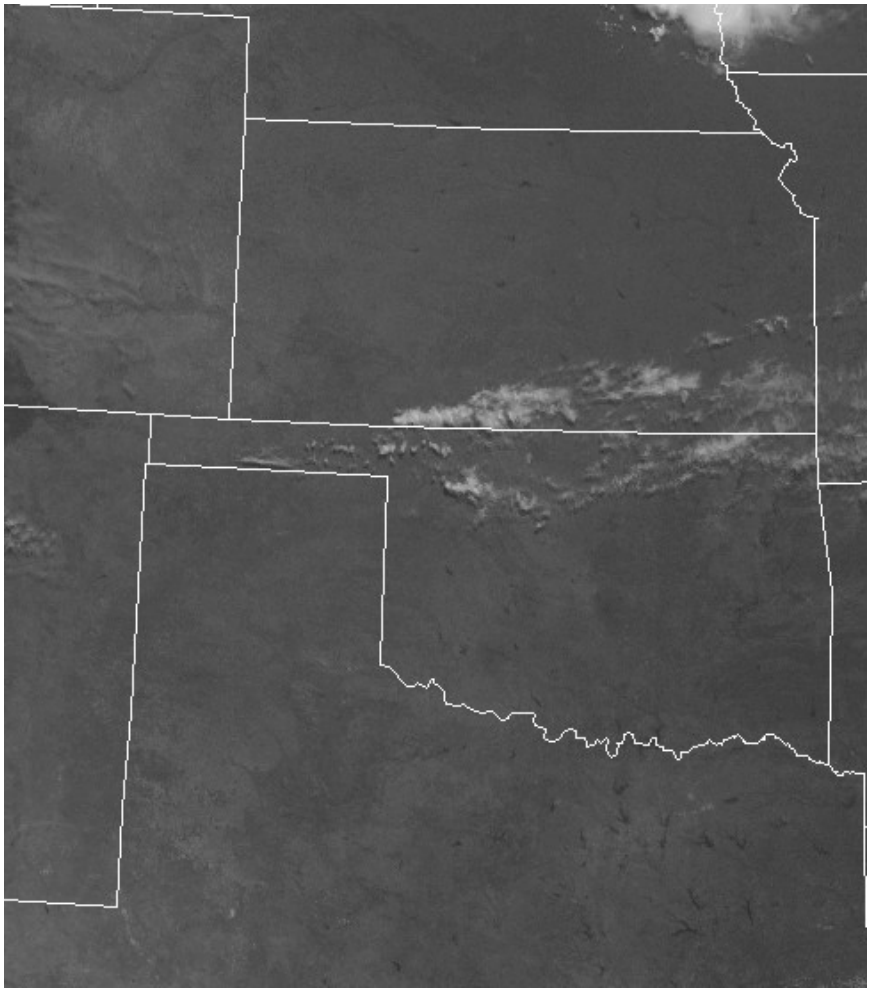
Short-Range Ensembles and Ensemble Data Assimilation

David J. Stensrud
Hazardous Weather Forecasts & Warnings

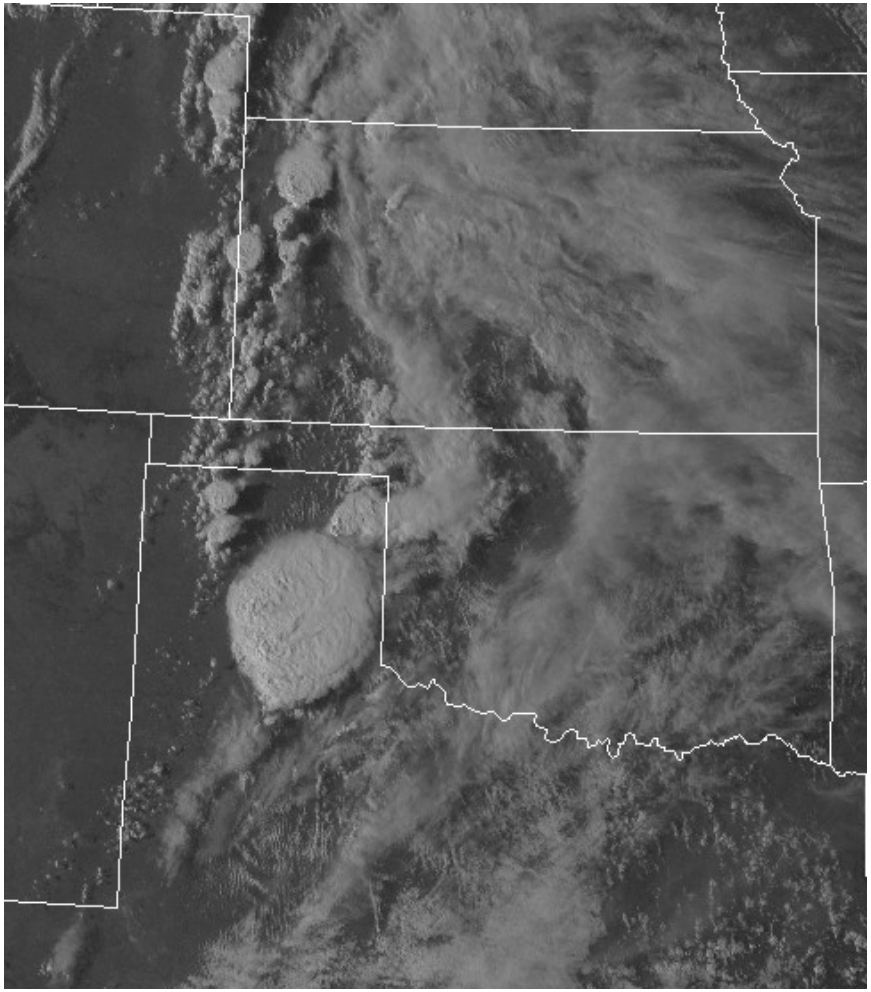
How do we provide model forecast uncertainty information to (severe) weather forecasters?

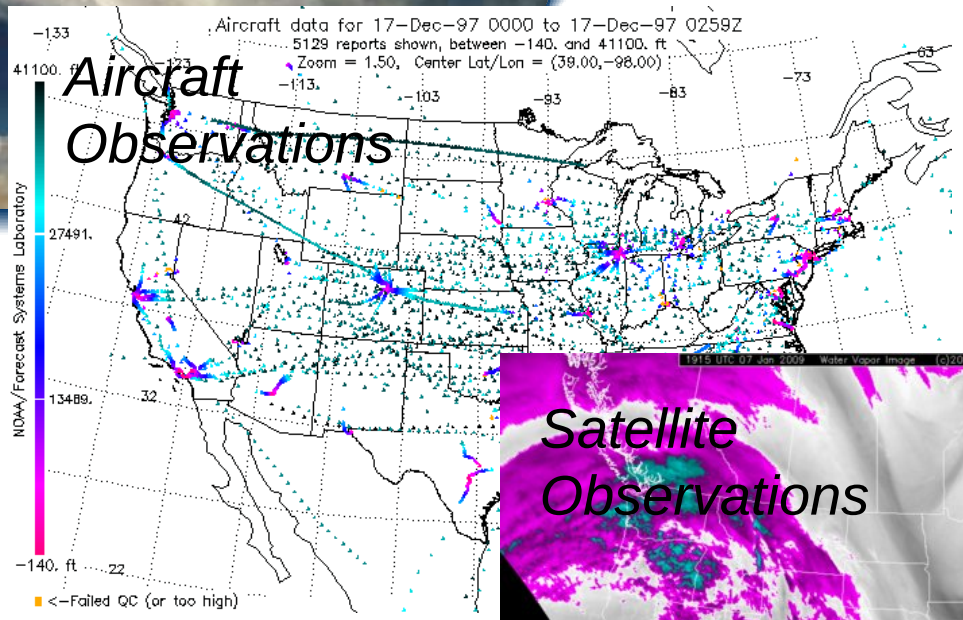
Storm Prediction Center
Norman, Oklahoma

Typical Forecast Challenge

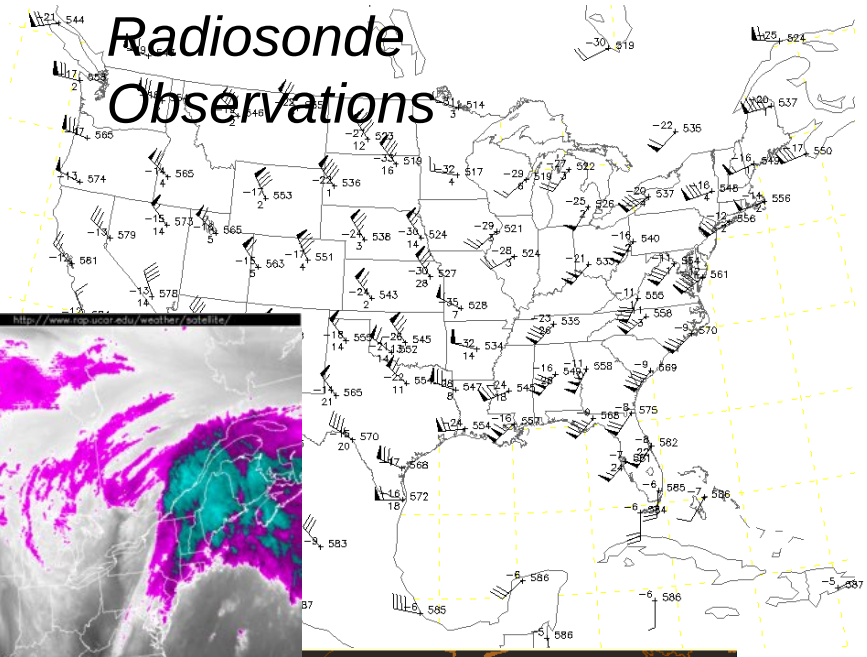


OR

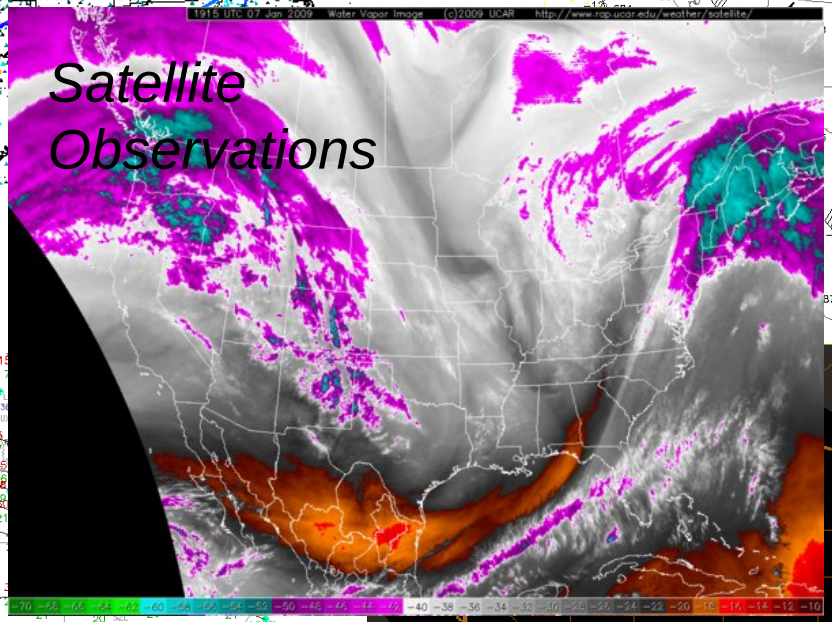




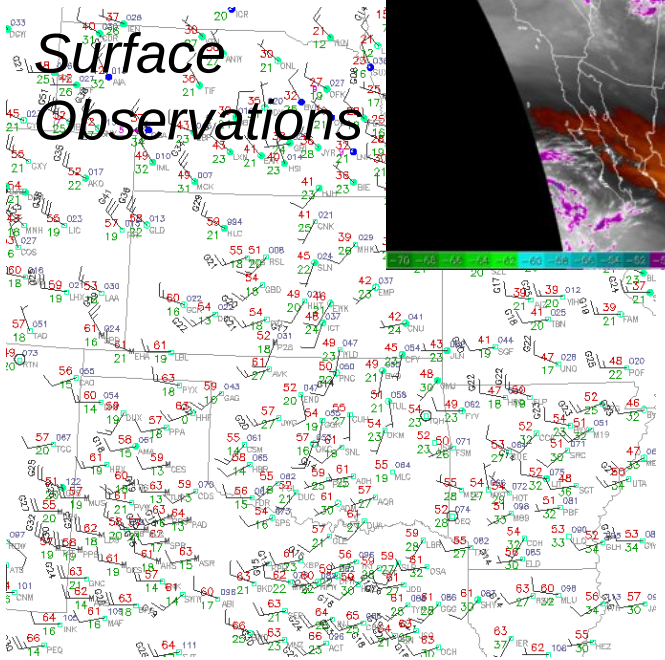
Aircraft Observations



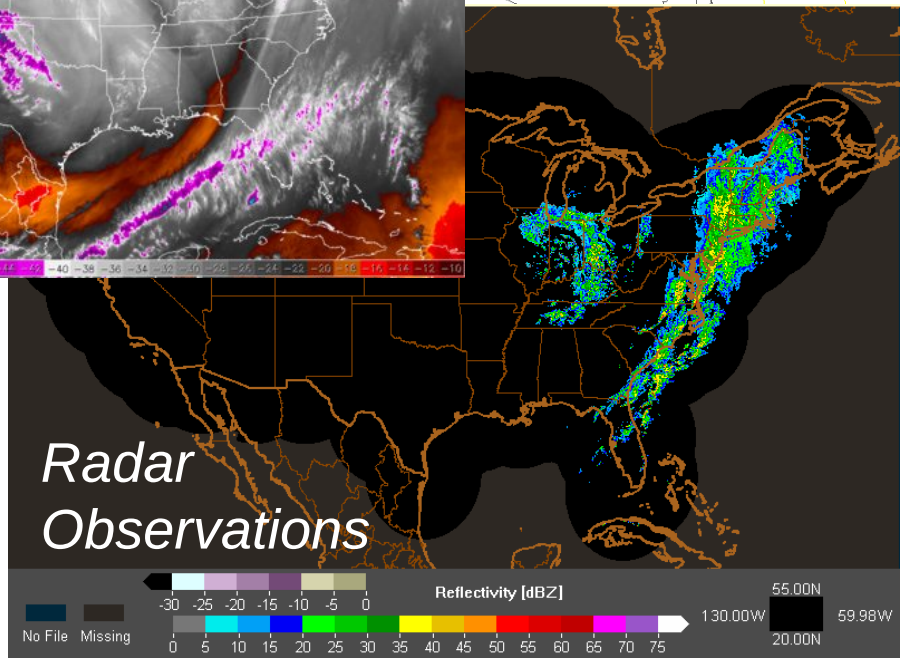
Radiosonde Observations



Satellite Observations

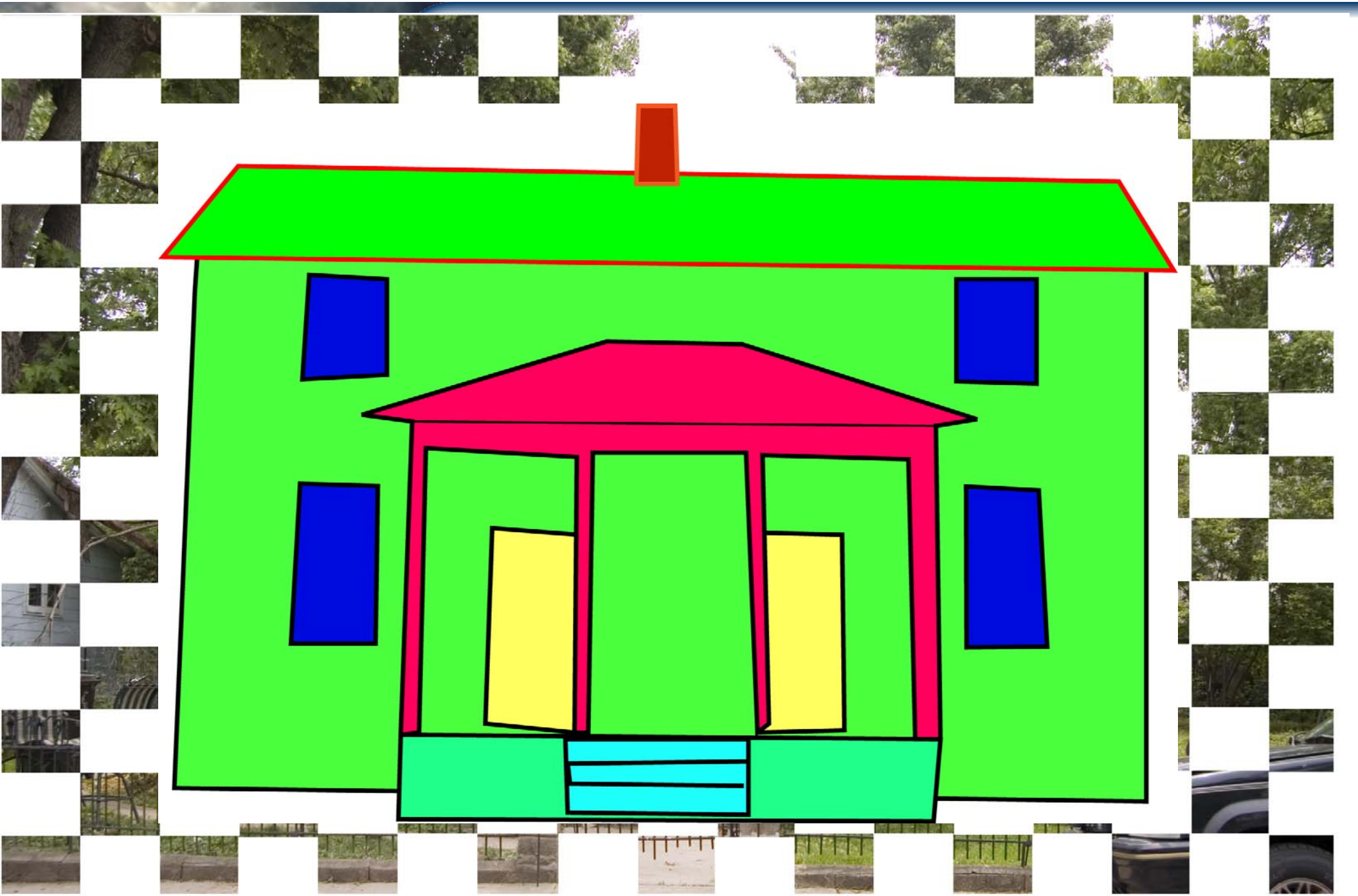


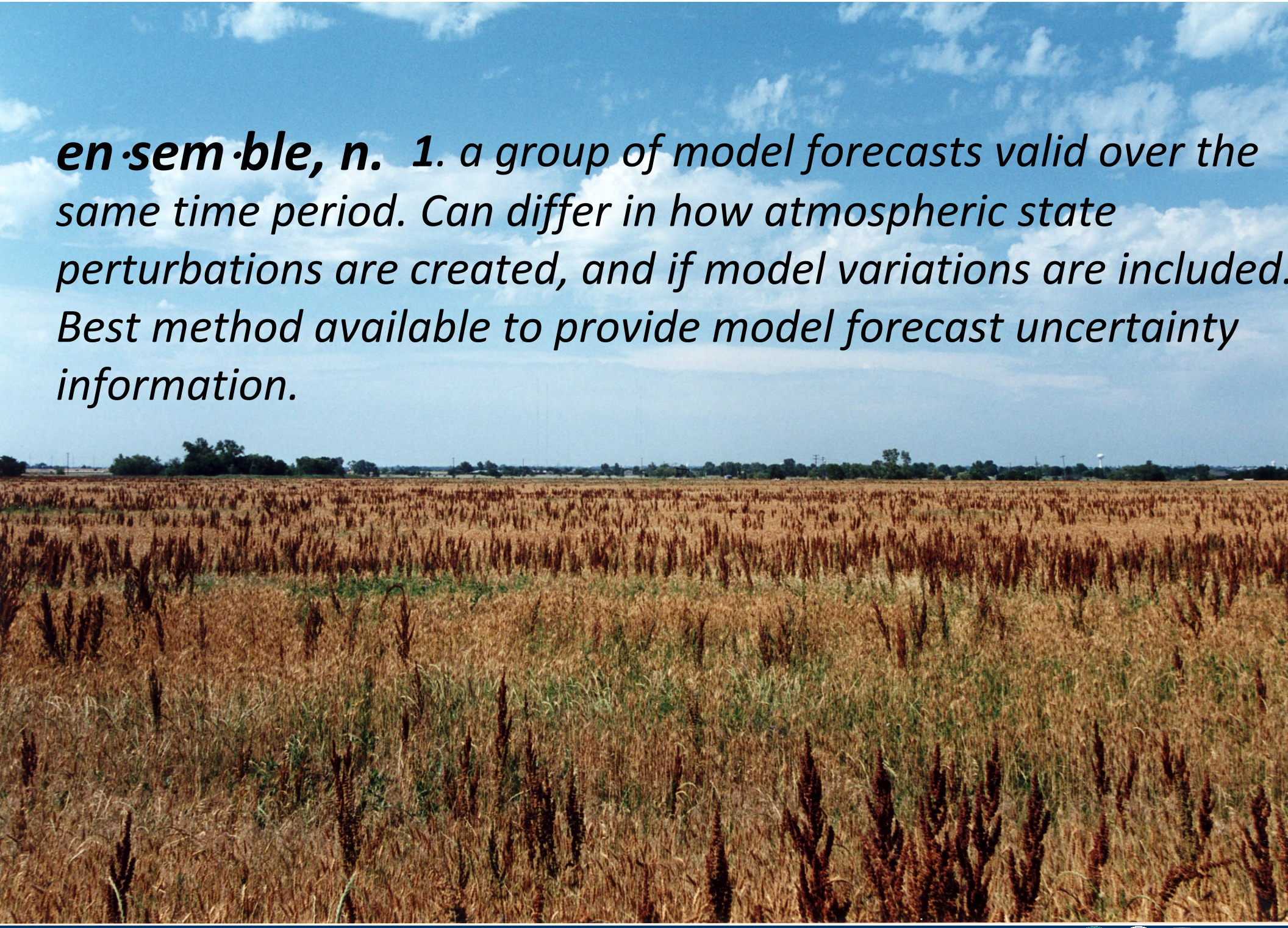
Surface Observations



Radar Observations

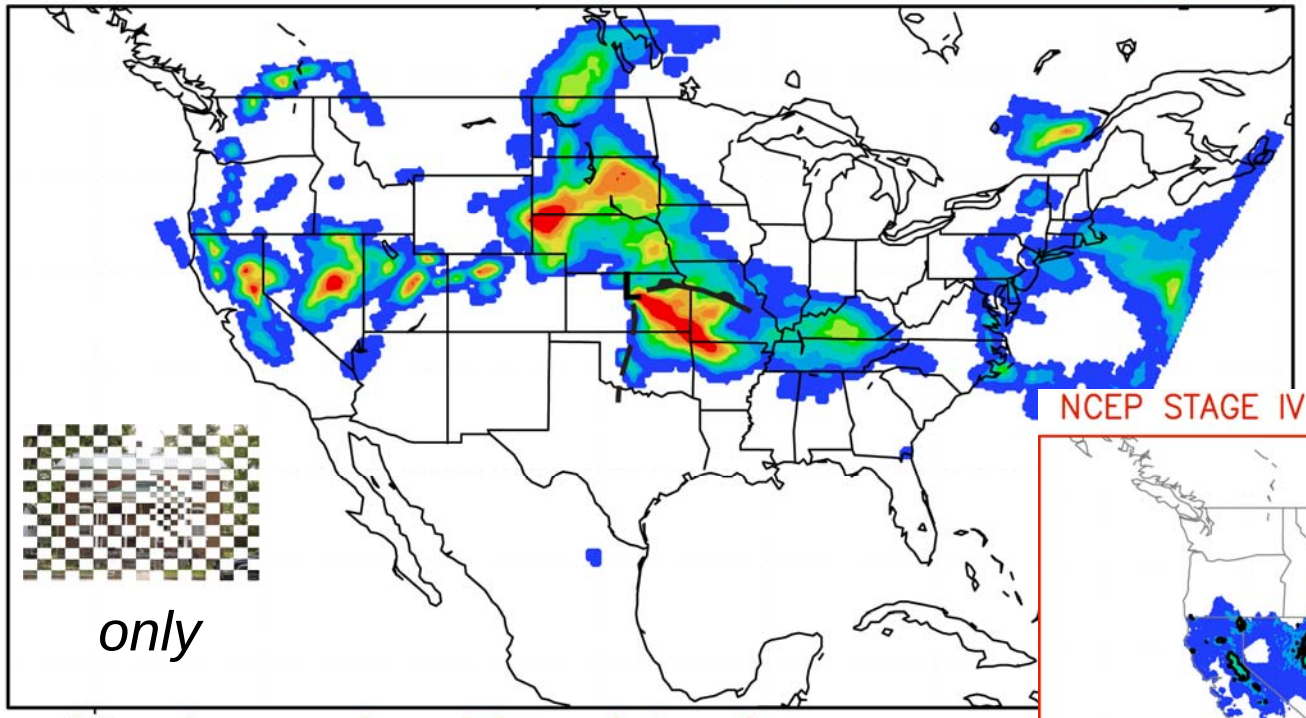
Goal: Accurate three-dimensional state of the atmosphere





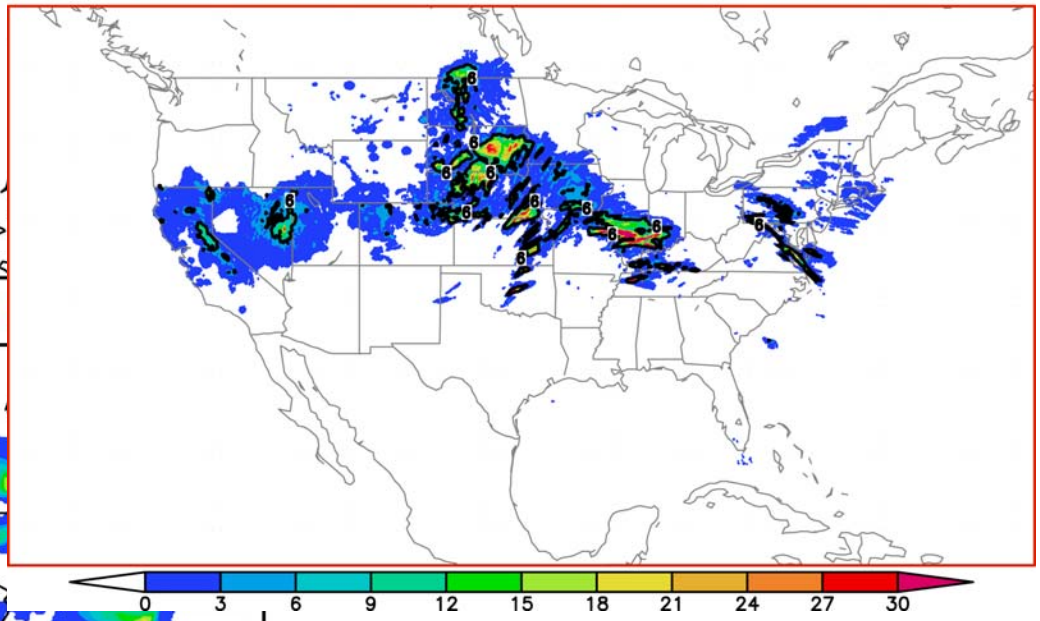
en·sem·ble, n. ***1****. a group of model forecasts valid over the same time period. Can differ in how atmospheric state perturbations are created, and if model variations are included. Best method available to provide model forecast uncertainty information.*

Initial Condition Variability 6h Precipitation Probability (%)

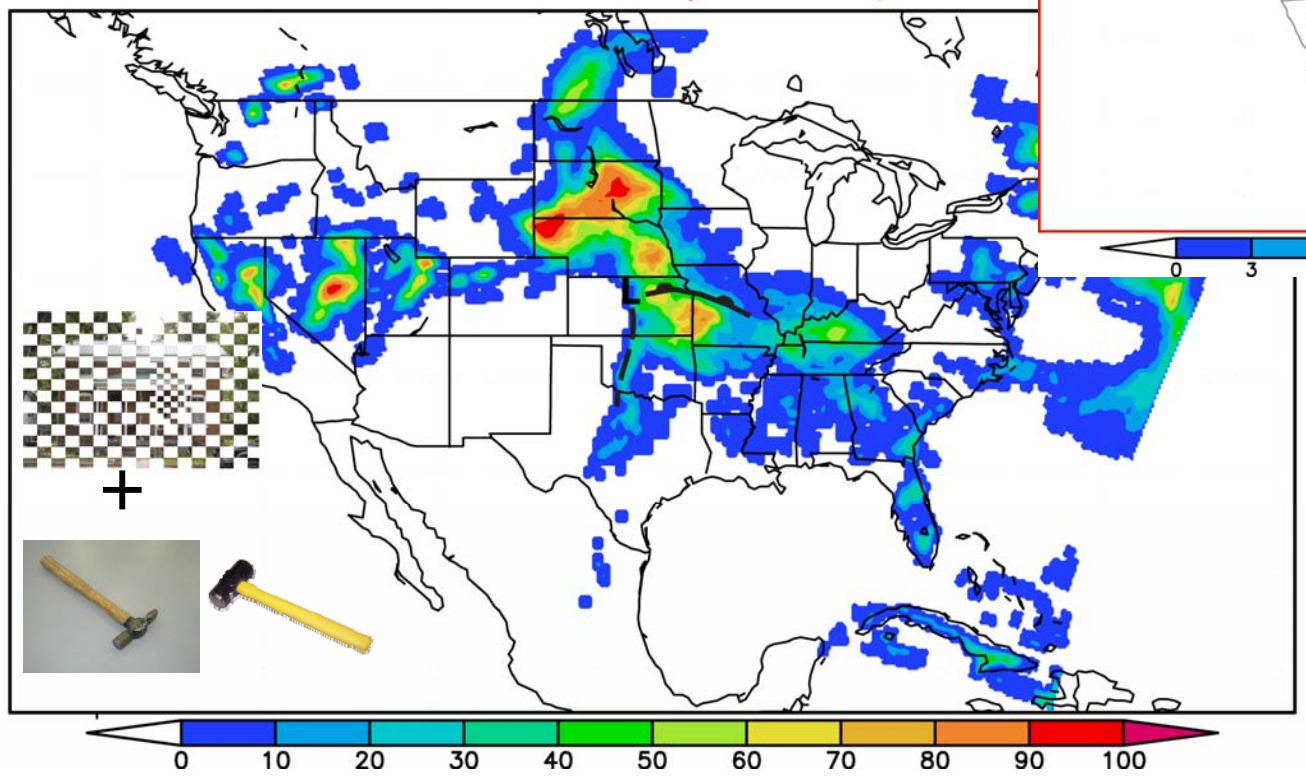


only

NCEP STAGE IV 2003050900 6h accumulated rainfall (mm)



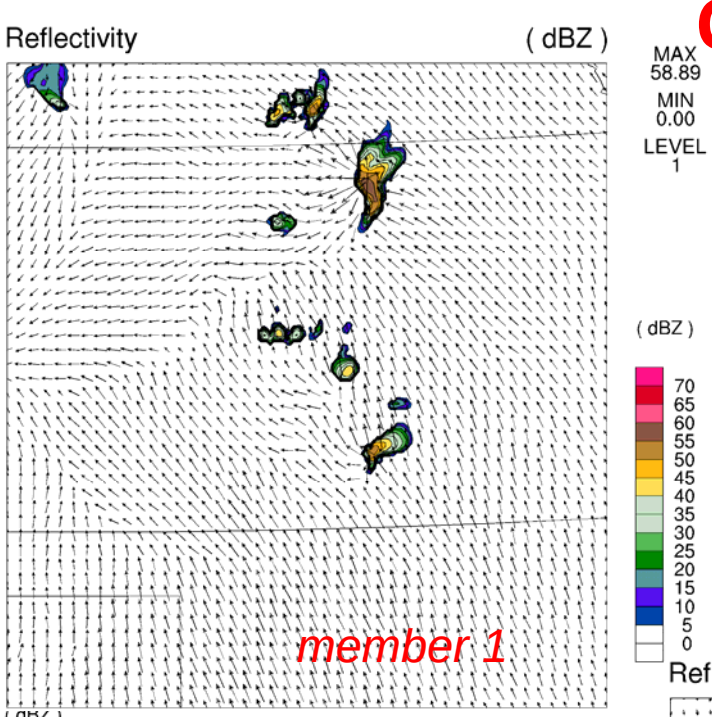
Initial Condition and Model Variability 6h Precipitation

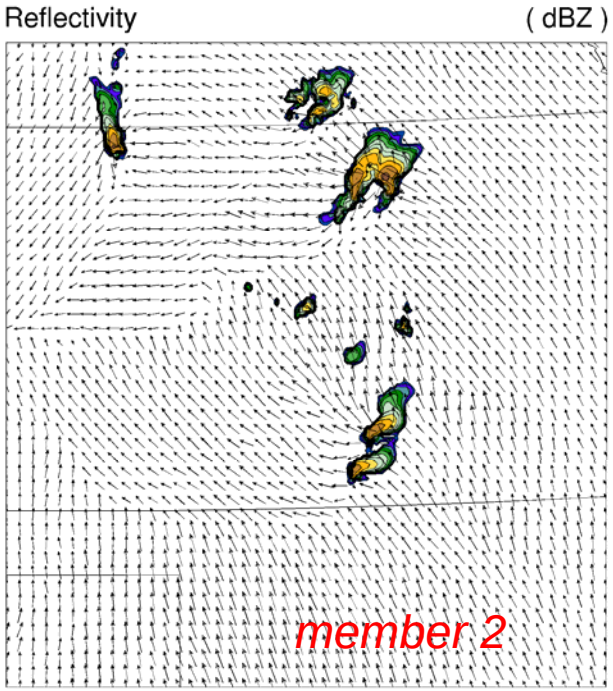


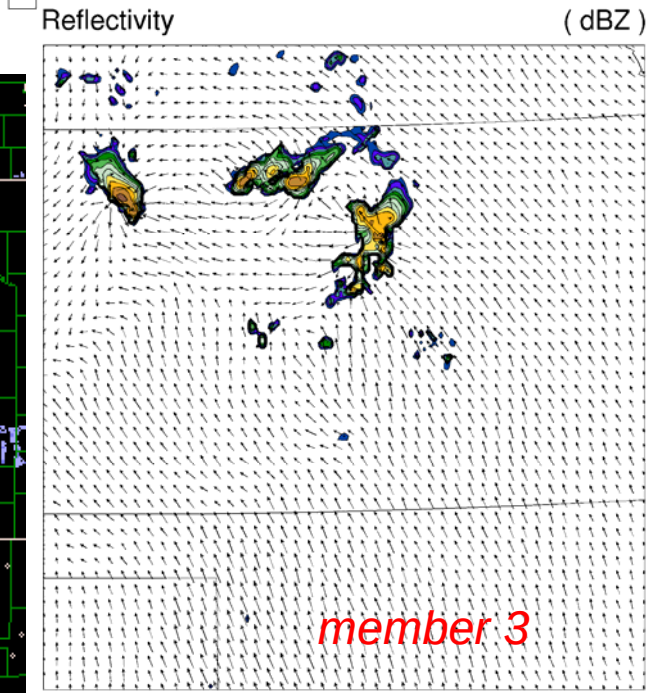
+

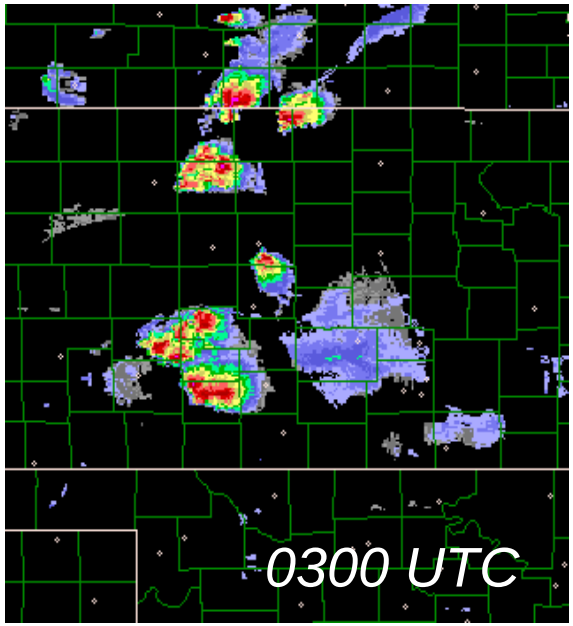
NSSL scientists led initial evaluation and helped design the NCEP Short-Range Ensemble Forecasting (SREF) system

Convection-resolving ensembles



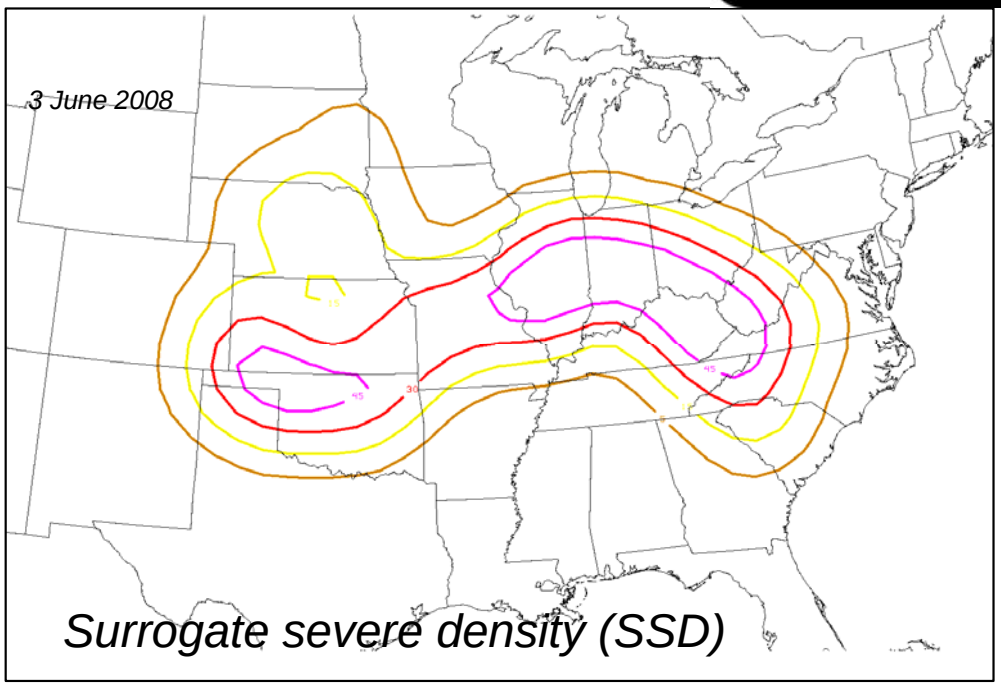




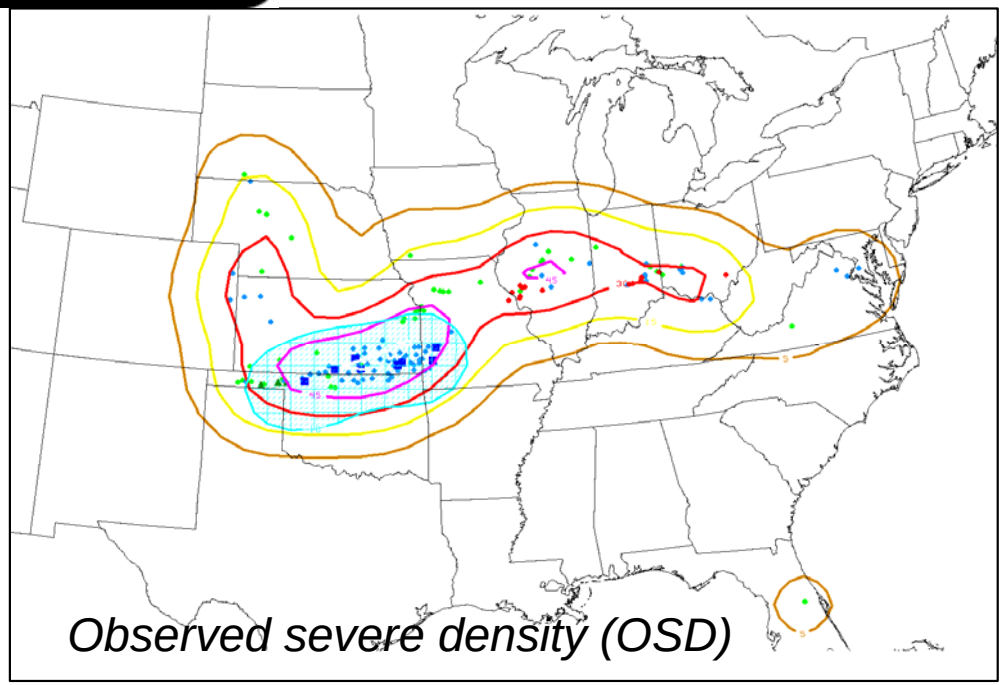


HWT's evaluation of convection-allowing model forecasts influenced NCEP/EMC planning

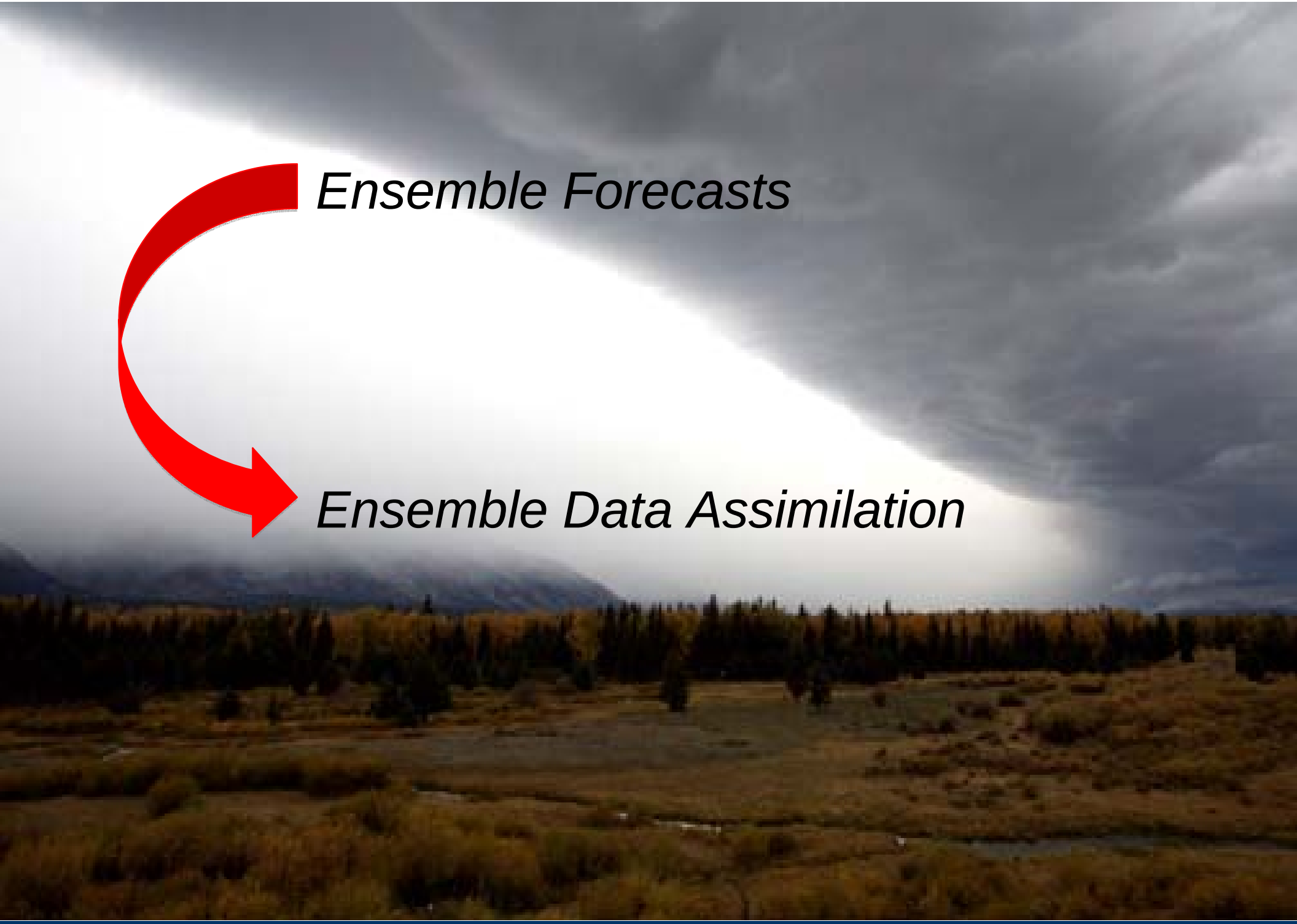
Center for Analysis and Prediction of Storms
University of Oklahoma

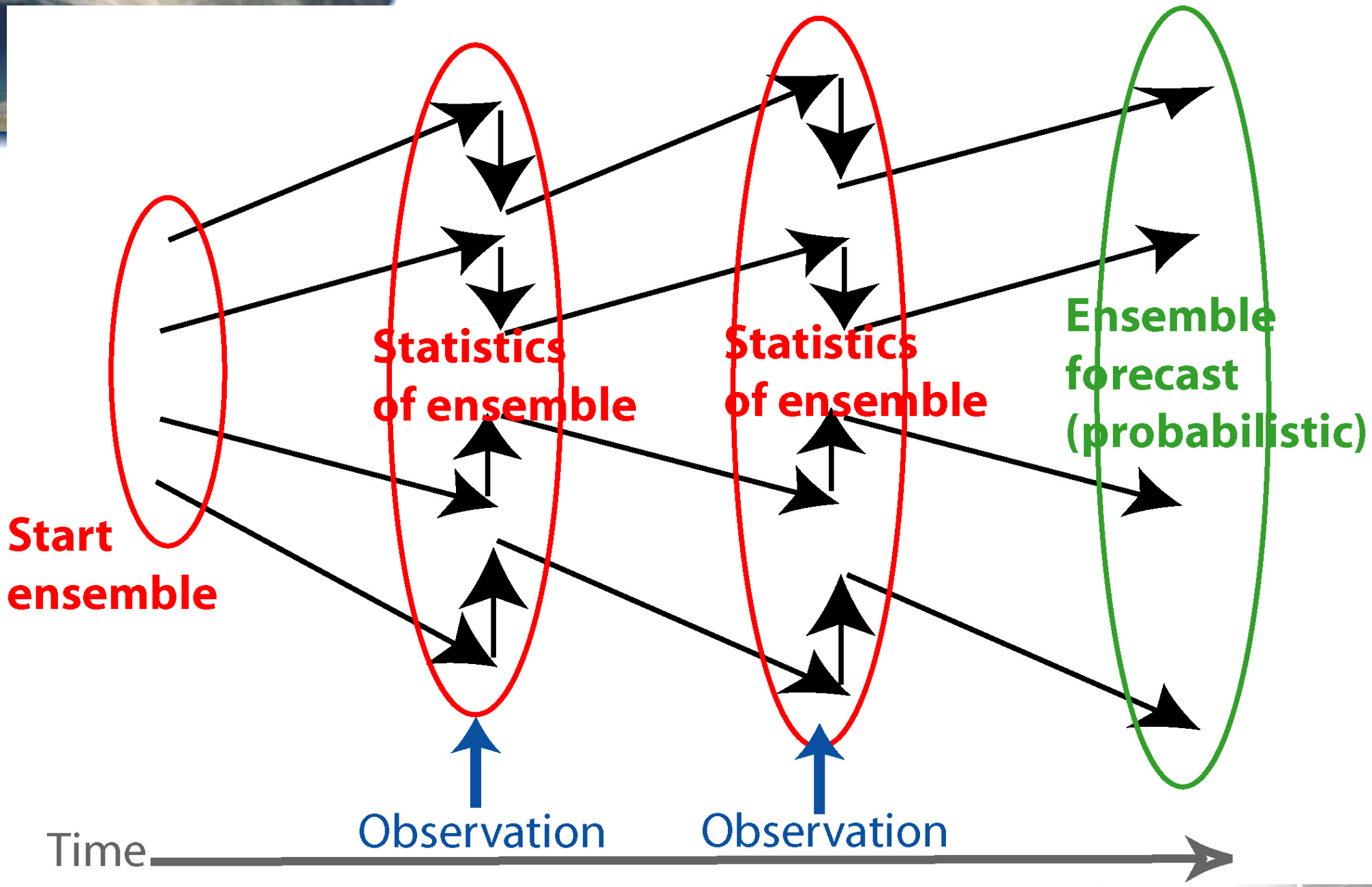


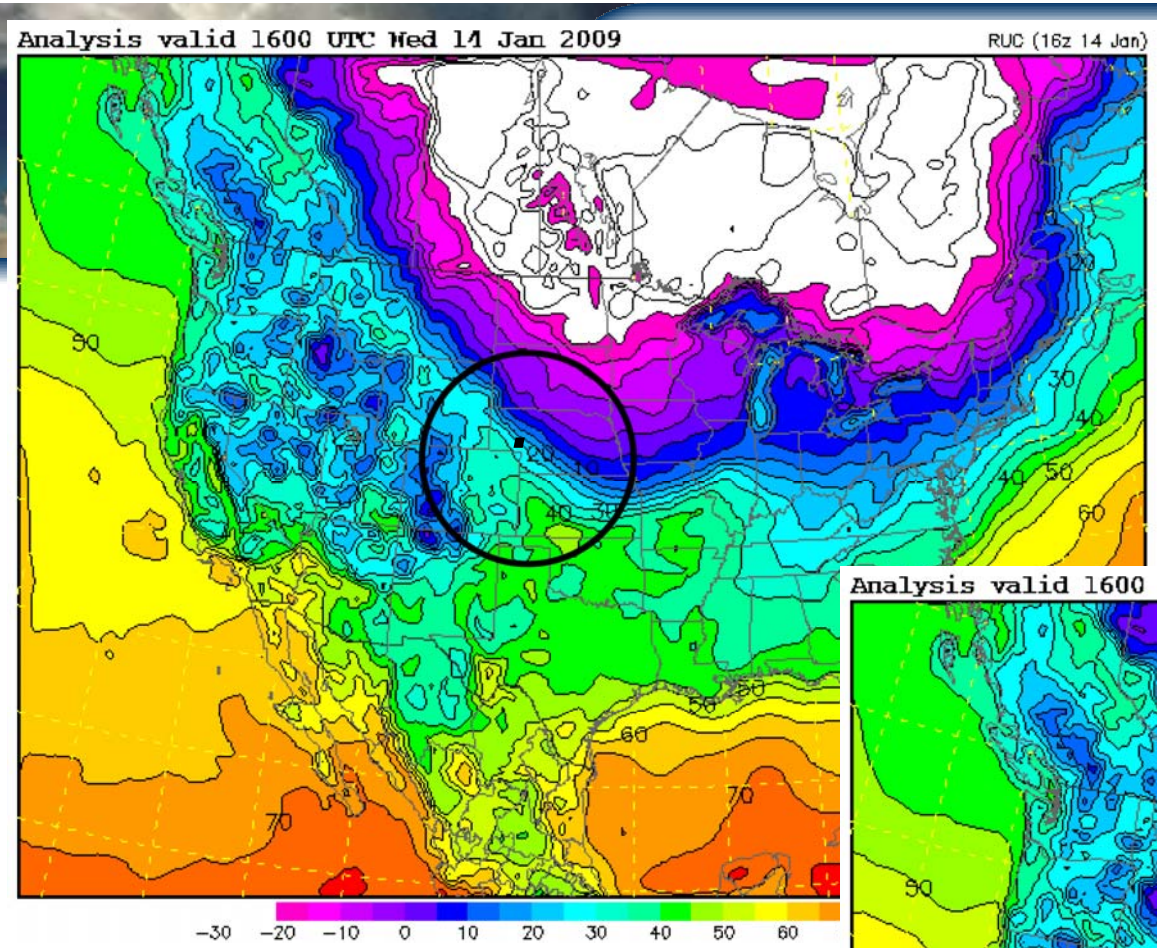
Surrogate severe density (SSD)

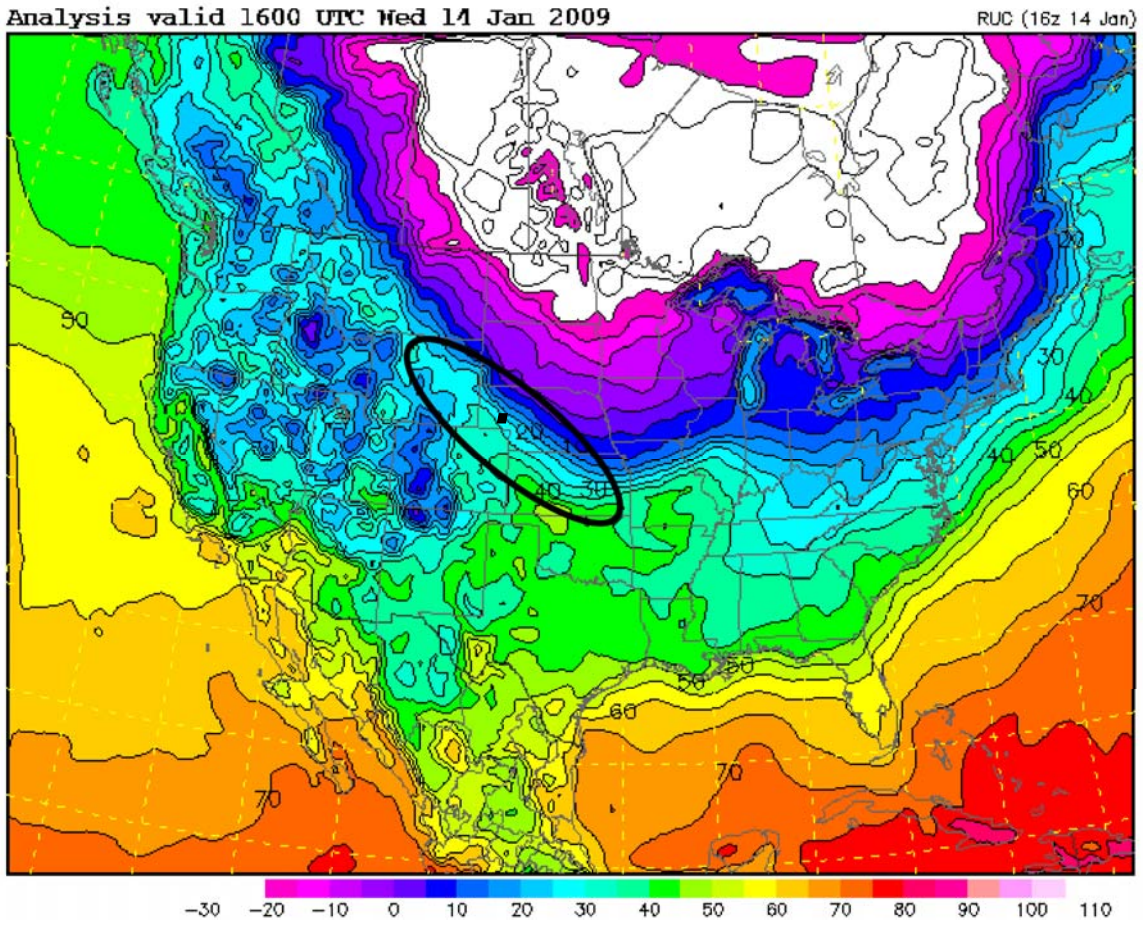


Observed severe density (OSD)

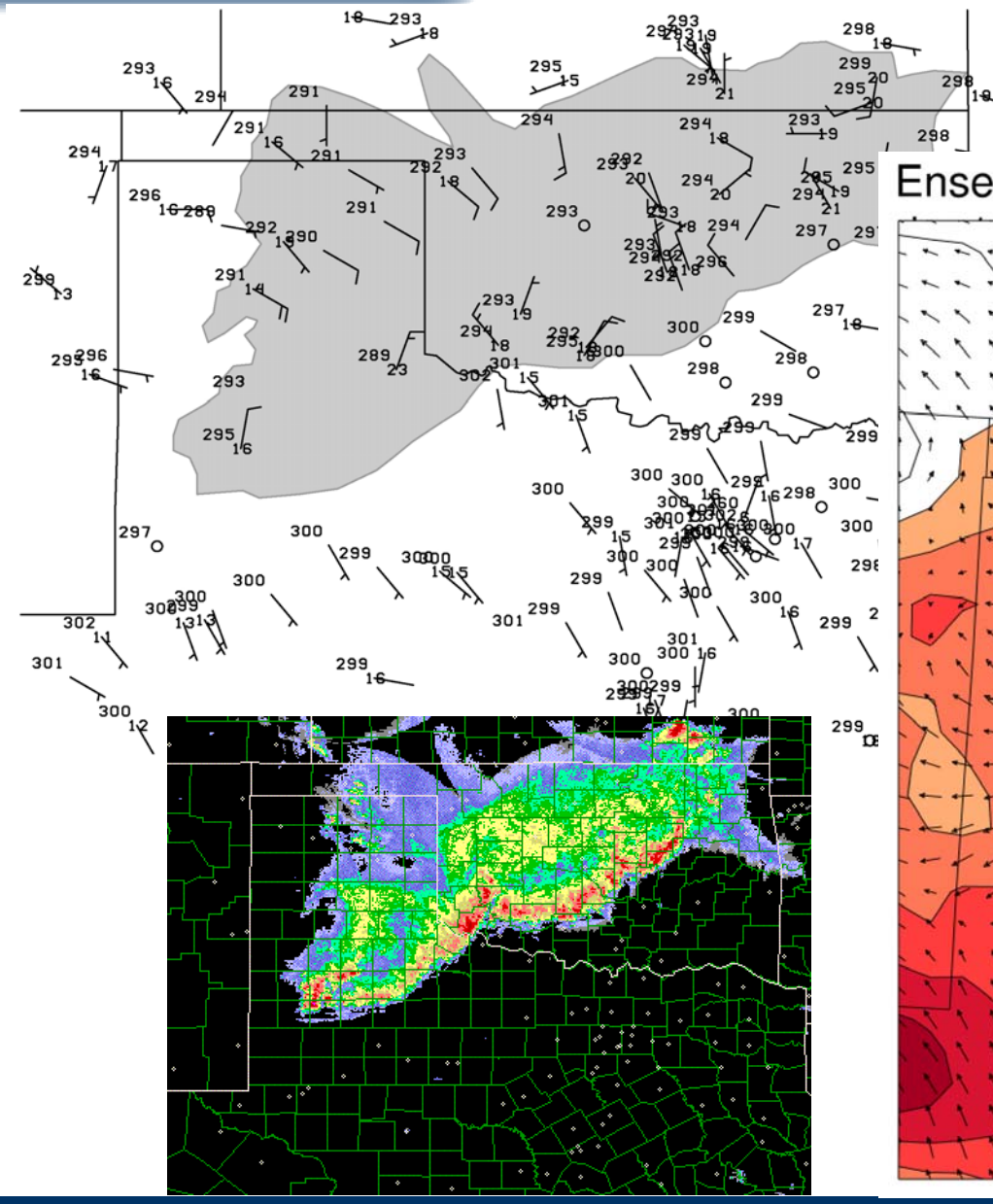

Ensemble Forecasts
Ensemble Data Assimilation

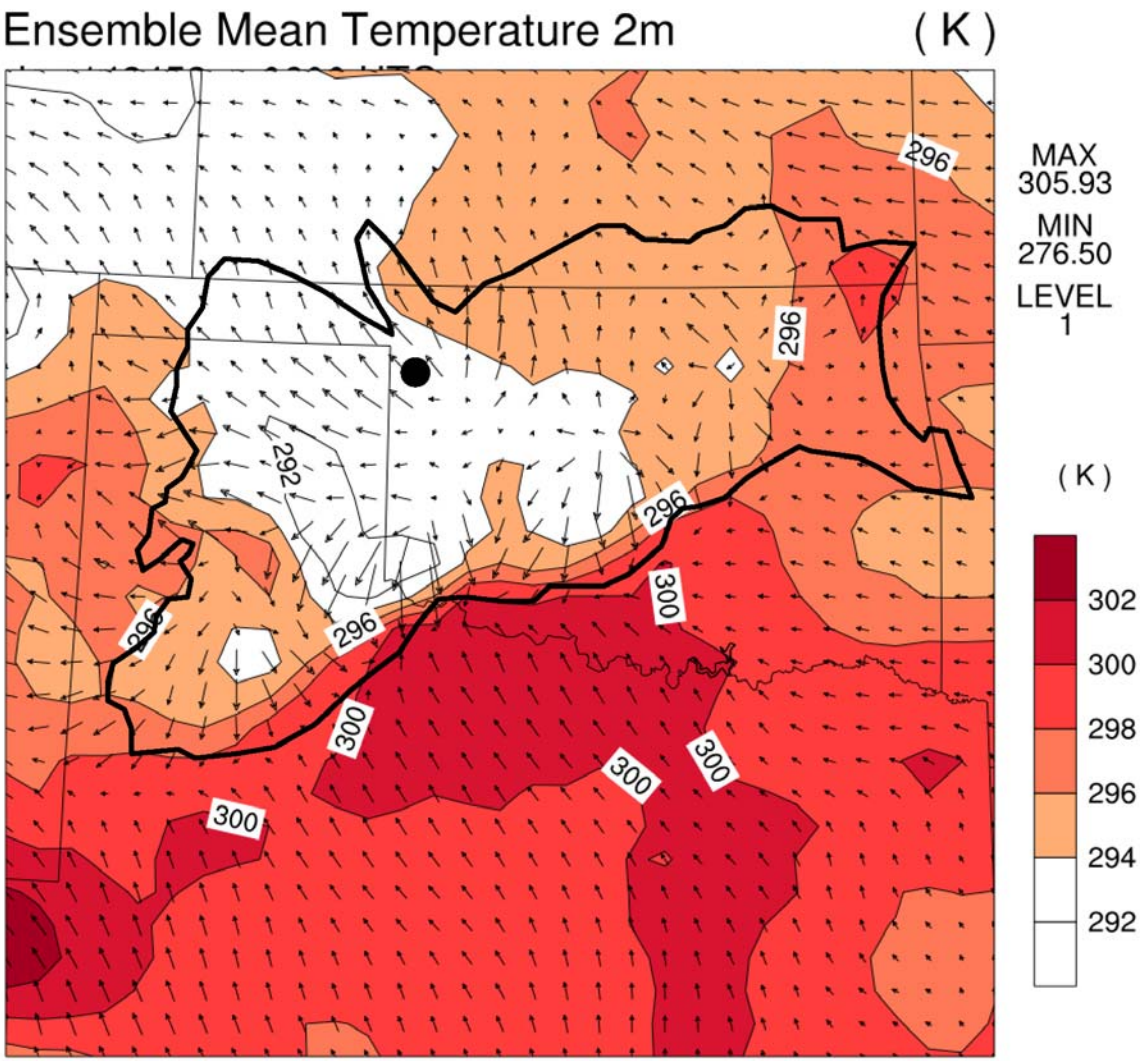

Start ensemble
Statistics of ensemble
Statistics of ensemble
Ensemble forecast (probabilistic)
Observation
Observation
Time


Analysis valid 1600 UTC Wed 14 Jan 2009
RUC (16z 14 Jan)
−30 −20 −10 0 10 20 30 40 50 60

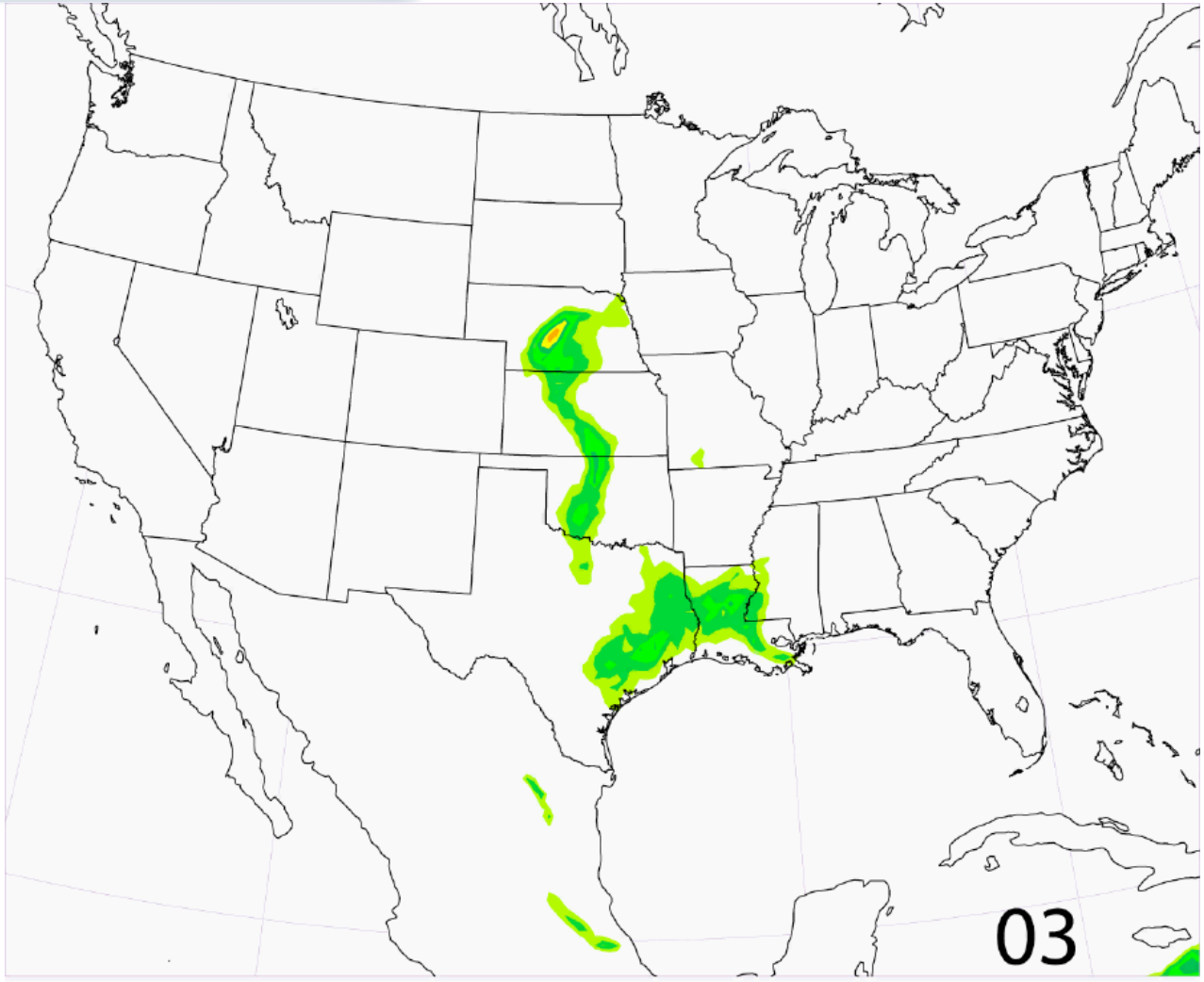

Analysis valid 1600 UTC Wed 14 Jan 2009
RUC (16z 14 Jan)
−30 −20 −10 0 10 20 30 40 50 60 70 80 90 100 110

Ensemble Data Assimilation





Challenges remain



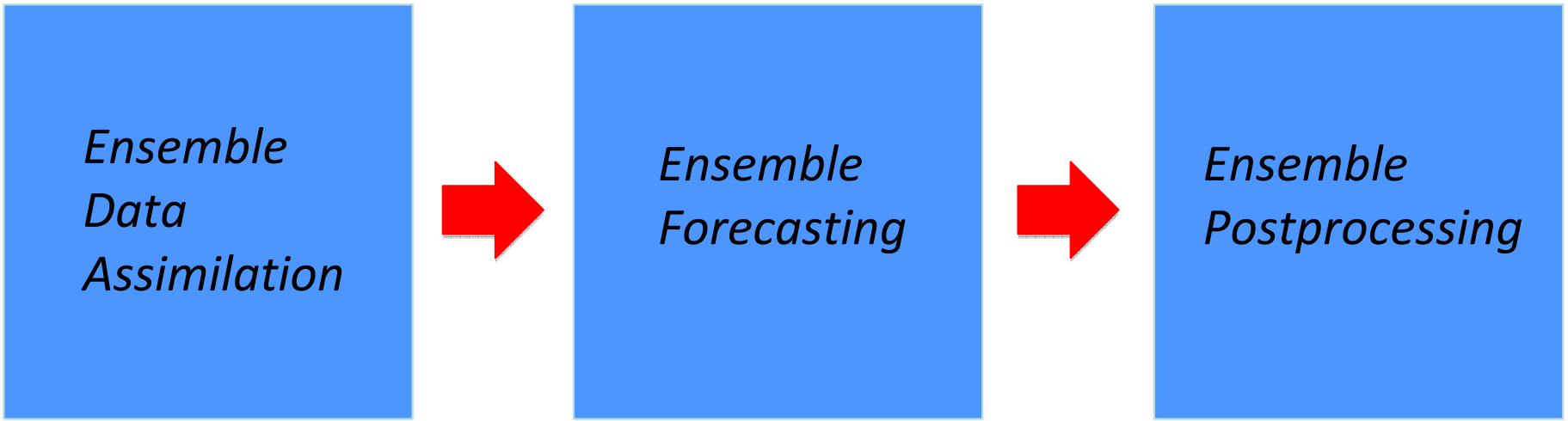
4-5 May 2007

3-h Probability of Significant Tornado Parameter > 1

Future

For mesoscale and storm-scale

- Ensemble creation
- Ensemble data assimilation
- Ensemble postprocessing and use in operations



Better, quicker, and more valuable weather and water information to support improved decisions.