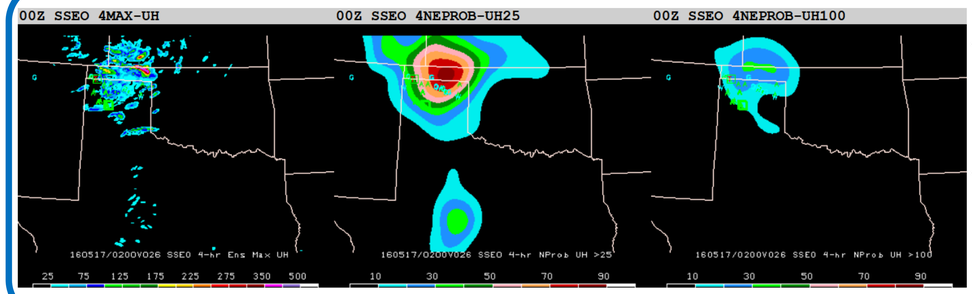
Comparison of the SPC Storm-Scale Ensemble of Opportunity to other Convection-Allowing Ensembles for Severe Weather Forecasting

Israel Jirak[1], Chris Melick[1,2], and Steven Weiss[1]
[1]NOAA/NWS/NCEP Storm Prediction Center, [2]Cooperative Institute for Mesoscale Meteorological Studies

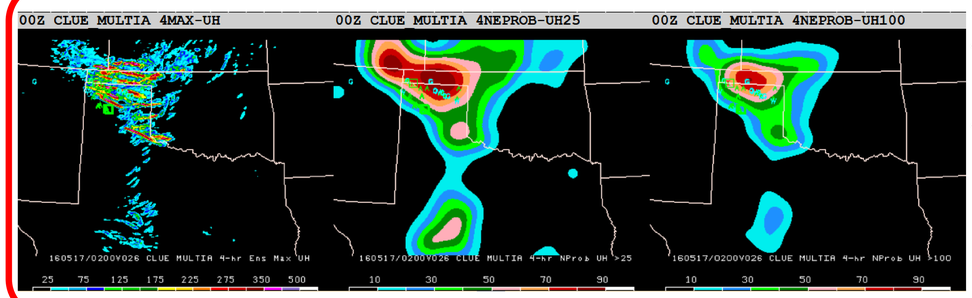
Introduction

- Three convection-allowing ensembles from the Community-Leveraged Unified Ensemble (CLUE) were compared to the SPC Storm-Scale Ensemble of Opportunity (SSEO) during the 2016 NOAA HWT Spring Forecasting Experiment (SFE2016) from 2 May – 3 June.
- The ensembles were evaluated objectively on reflectivity forecasts and subjectively on hourly maximum field (HMF) forecasts (e.g., updraft helicity) for severe weather guidance.



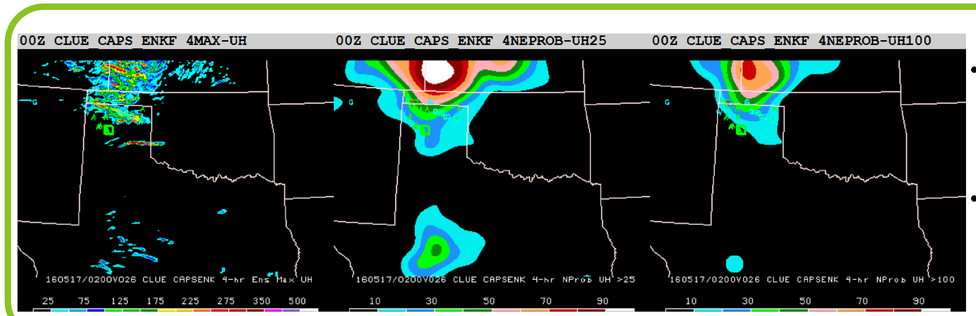
SPC SSEO

- 7-member (2 time-lagged), ~4-km deterministic CAMs w/ 36-hr forecasts at 00Z & 12Z
- Multi-model (WRF-ARW, WRF-NMM & NMM-B), multi-physics; multi-initial conditions: NAM & RAP



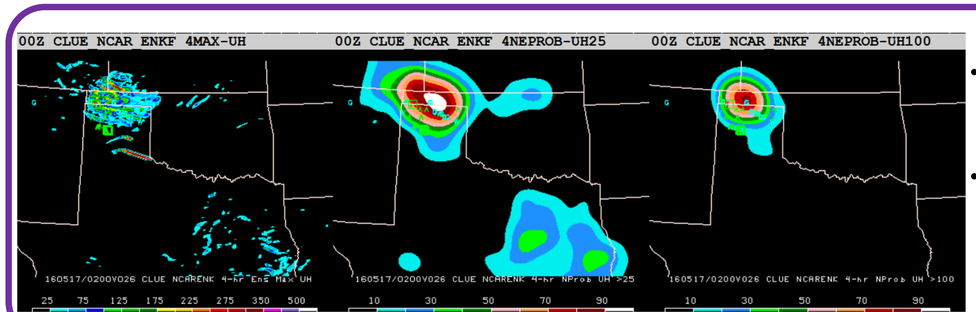
CLUE_M10

- 10-member, 3-km ensemble with 60-hr forecasts at 00Z
- Multi-model (5 ARW, 5 NMMB); single-physics; multi-initial conditions: applies SREF perturbations to NAM ICs



CAPS EnKF

- 9-member, 3-km WRF-ARW ensemble with 60-hr forecasts from 00Z
- Multi-physics, multi-initial conditions: from 40 3-km GSI-EnKF members initialized at 18Z

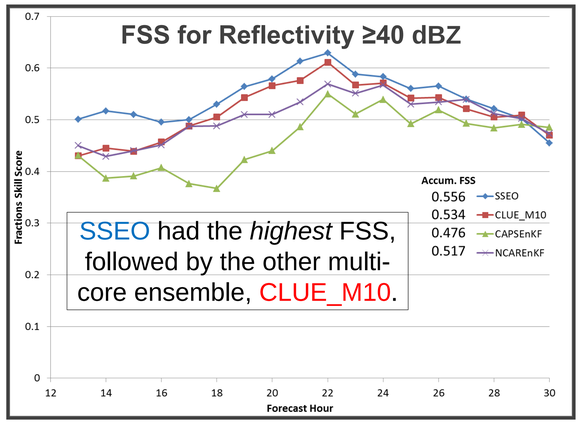


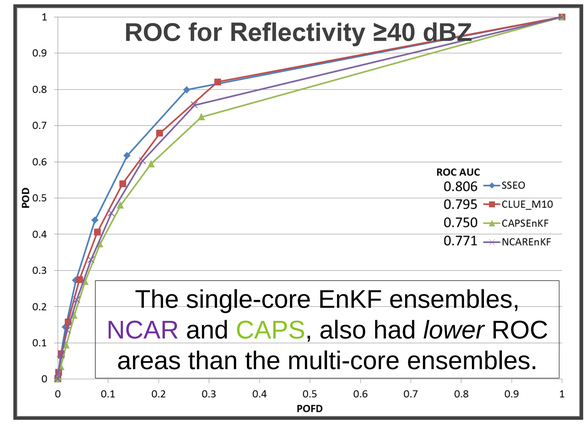
NCAR EnKF

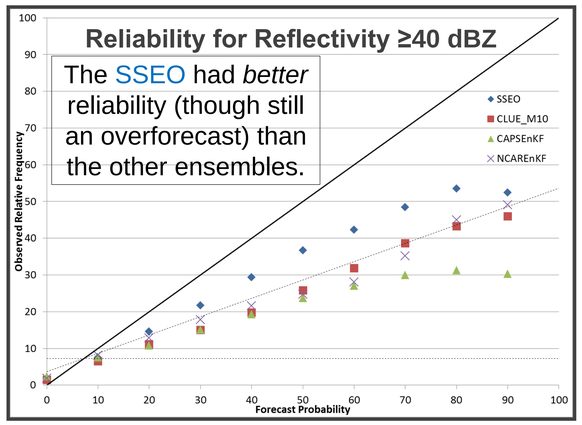
- 10-member, 3-km WRF-ARW ensemble with 48-hr forecasts at 00Z
- Single-physics, multi-initial conditions: downscaled from 50 15-km EAKF members

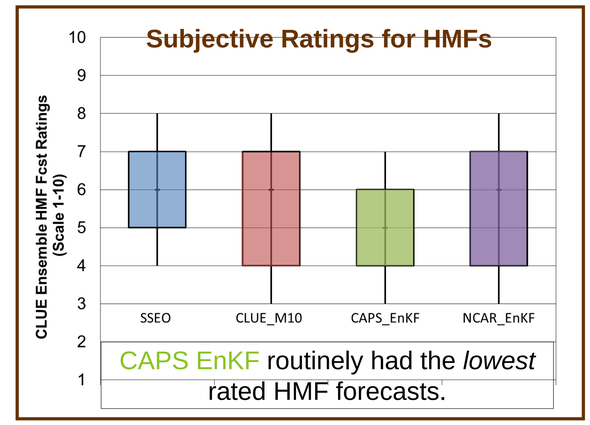
Results of Ensemble Forecast Verification and Evaluation

- Objective verification was performed for the ensemble neighborhood probability of 1-km AGL simulated reflectivity ≥40 dBZ using observed radar reflectivity for verification.
- Ensemble maximum and neighborhood probabilities of HMF fields (typically UH) were subjectively evaluated for correspondence with severe weather reports from 18-02Z.









Summary and Conclusions

- Three convection-allowing ensembles from the CLUE were compared to the SSEO in real time during the five-week HWT SFE2016.
- The SSEO verified better objectively than any CLUE subset, including EnKF systems, for probabilistic reflectivity forecasts ≥40 dBZ during SFE2016.
- The diversity of the SSEO appears to help in reducing the overforecast bias (i.e., under-dispersive nature), leading to improved probabilistic forecasts over other ensembles.
- The SSEO can serve as a meaningful baseline for the performance of a future operational convection-allowing ensemble.

Acknowledgements

- National Severe Storms Laboratory (NSSL): Adam Clark, Jack Kain, Kent Knopfmeier, Scott Dembek
- National Center for Atmospheric Research (NCAR): Glen Romine, Craig Schwartz, Ryan Sobash
- Center for Analysis and Prediction of Storms (CAPS): Ming Xue, Fanyou Kong, Kevin Thomas