Abstract
The Advanced Regional Prediction System (ARPS) model is used to simulate a Mesoscale Convective System and Comparison with EnKF Results
Alexander D. Schenkman, Ming Xue, and Nate Snook
Center for Analysis and Prediction of Storms and School of Meteorology
University of Oklahoma

3DVAR-based Data Assimilation for the 8-9 May 2007 Oklahoma Tornadic Mesoscale Convective System and Comparison with EnKF Results

2 km Results
- Experiments that assimilate radar data produce a highly accurate forecast of the 9 May 2007 LEV.
- The simulated LEV evolves in a way that closely resembles the observed evolution of the LEV.
- Qualitative comparison between reflectivity observations and model forecasted reflectivity reveals remarkable correspondence between observed and modeled features (Fig. 2 and Fig. 3).

In addition to revealing great accuracy, examination of the analysis and forecast for the experiments shows a small but important impact from assimilating CASA data. Namely, assimilated CASA data leads to a more accurate analysis of the low-level wind field in the CASA domain (not shown). This in turn likely led to a more accurate evolution of the MCS and LEV in experiments that used CASA data.

400 m Results
The most important result at 400-m resolution is the large positive impact that CASA radial velocity (Vr) data had on the analysis and subsequent prediction of the low-level wind fields and cold pool. CASA Vr data led to substantial improvements in the analyzed low-level shear profile ahead of and associated with the cold pool. These improvements continued into the forecast portion of the experiments, manifested in more accurate predictions of mesovortices when compared to experiments that did not use CASA radial velocity. Figure 4 presents an example of the improvement in gust front position when CASA Vr data are assimilated.

3DVAR Vs. EnKF
EnKF has been used to produce analyses and forecasts of the 8-9 May 2007 case. Because of computational expense, only 2-km resolution EnKF experiments are available for comparison with the 3DVAR assimilation and forecast experiments. Results from the deterministic forecast initialized from the ensemble mean show that 3DVAR produces a much more accurate depiction of the convective system and LEV (Fig. 7).

The reasons for the poor performance of EnKF compared to 3DVAR have yet to be determined. It should be noted, however, that the EnKF forecast presented here did not assimilate conventional surface and upper-air observations. Additionally, the EnKF probabilistic forecasts show great accuracy when compared to observations (see Nate Snook’s talk). Future work will examine the advantages of each method in more detail. In addition, to provide a more thorough comparison, the assimilation techniques will be applied to other case studies.