Multi-Scale Data Assimilation of the June 13, 2010 VORTEX2 Tornadic Supercell

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On June 13, 2010 VORTEX2 collected observations in the eastern Texas and Oklahoma Panhandles. Convection developed early in the afternoon on the cool side of an approximately South-Southwest to North-Northeast boundary. The sub-severe convection slowly moved to the Northeast. An approximately east-west outflow boundary was also present from overnight convection. One storm, located near the intersection of the two boundaries, intensified and became tornadic. The complex mesoscale environment and the tornadic storm were not captured well with conventional observations.

The WRF model and DART assimilation system are used to obtain an accurate representation of the mesoscale environment that produced the tornadic storm. Data assimilation cycles every six hours beginning four days prior to the event were performed on a 15 km horizontal grid covering the contiguous US with a 3 km horizontal grid nest over the convective region. These analyses capture the large-scale flow pattern however, do not contain an accurate representation of the mesoscale boundaries.

More frequent cycling is done on the 13^{th} to determine which observations and at what frequency is data assimilation required to capture the boundaries in the environment. Hourly data assimilation cycles beginning at 0 UTC on the 13^{th} improve the analyzed mesoscale environment. The inclusion of radar observations in the hourly cycling produces an environment that supports rotating storms. If the hourly cycling is started later in the day, at 12 UTC, the environment does not fit the observations as closely. This result indicates the importance of assimilating observations of the overnight convection in order to reproduce the observed boundaries. Sensitivity of the forecast skill to the mesoscale environment reconstruction will be presented. The environment will be verified against conventional observations as well as special observations collected during VORTEX2.

The mesoscale background is used to nest down to a 1 km storm-scale grid. The environment and storm forecasts are further refined on the storm-scale with finer observations and more frequent cycling. Preliminary storm forecasts will also be presented.