Three-Dimensional Spatially Variable Advection Correction: Concept and Potential Uses

*Joshua G Gebauer[1], Alan Shapiro[1,2], Corey Potvin[3,4], Nathan Dahl[3]

1. School of Meteorology, University of Oklahoma, 2. Center for Analysis and Prediction of Storms, 3. Cooperative Institue for Mesoscale Meteorological Studies, 4. National Severe Storms Laboratory

Radar advection correction is concerned with shifting of non-simultaneously collected radar data to a common analysis time. These techniques are critical for accurate dual-Doppler analysis when the radar volume times are not synchronized. One advection correction technique that has been previously developed is spatially variable advection correction, which allows for variable advection velocities within the analysis domain. This technique is based on the frozen turbulence hypothesis, that is, the technique considers that the field being corrected does not evolve, but is instead only advected. Previous versions of this technique, however, only operated on two-dimensional horizontal planes. This means that only the horizontal components of the advection can be considered using the original technique. Additionally, since vertical advection cannot be account for, any vertical advection that is present results in errors in the horizontal advection velocities. A three-dimensional spatially variable advection correction technique was developed to correct for these problems. The concept behind three-dimensional spatially variable advection correction is similar to the two-dimensional technique, but vertical advection is now considered. Additionally, the three-dimensional technique requires more complex smoothing of the advection velocities to account for vertical shear and realistic scales of vertical advection. Analytical and real data tests show that three-dimensional spatially variable advection correction results in more continuous advection velocities in the vertical dimension and reduced advection velocity errors.