Assimilation of Dual-Polarimetric Radar Observations with WRF GSI

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Dual-polarimetric (dual-pol) radar typically transmits both horizontally and vertically polarized radio wave pulses. From the two different reflected power returns, more accurate estimate of liquid and solid cloud and precipitation can be provided. The upgrade of the traditional NWS WSR-88D radar to include dual-pol capabilities will soon be completed for the entire NEXRAD network. Therefore, the use of dual-pol radar network will have a broad impact in both research and operational communities.

The assimilation of dual-pol radar data is especially challenging as few guidelines have been provided by previous research. It is our goal to examine how to best use dual-pol radar data to improve forecast of severe storm and forecast initialization. In recent years, the Development Testbed Center (DTC) has released the community Gridpoint Statistical Interpolation (GSI) DA system for the Weather Research and Forecasting (WRF) model. The community GSI system runs in independently environment, yet works functionally equivalent to operational centers. With collaboration with the NASA Short-term Prediction Research and Transition (SPoRT) Center, this study explores regional assimilation of the dual-pol radar variables from the WSR-88D radars for real case storms.

Our presentation will highlight our recent effort on incorporating the horizontal reflectivity (Z_H), differential reflectivity (Z_{DR}), specific differential phase (K_{DP}), and radial velocity (VR) data for initializing convective storms, with a significant focus being on an improved representation of hydrometeor fields. In addition, discussion will be provided on the development of enhanced assimilation procedures in the GSI system with respect to dual-pol variables.

Beyond the dual-pol variable assimilation procedure developing within a GSI framework, high-resolution ($\leq$1 km) WRF model simulations and storm scale data assimilation experiments will be examined, emphasizing both model initialization and short-term forecast of precipitation fields and processes. Further details of the methodology of data assimilation, the impact of different dual-pol variables, the influence on precipitation forecast will be presented at the conference.