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Scale Dependence of Radar-Rainfall Uncertainty Based on the New Super-Resolution Data of NEXRAD

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Quantitative estimation of radar rainfall is necessary for various hydrologic applications such as flood forecasting models, hydrosystem operation and control, and design of hydraulic structures. Different applications may require different resolution in space and time of the rainfall input. Thus, quantifying rainfall uncertainties with respect to scale is essential to provide better understanding in using higher-resolution precipitation data.

In summer of 2008 NEXRAD's WSR-88D S-band weather radars commenced providing enhanced base data. The new data, called super-resolution, have higher resolution than the legacy-resolution of a 1 km in range by 1 degree in azimuth of Level II volume scans. The super-resolution data are produced for "split cuts" that depend on Volume Coverage Pattern and the grid spacing of reflectivity data are reduced to 0.5° in azimuth and to 250 m in range. Although super-resolution data may capture small scale features of precipitation with more reliability, NEXRAD Precipitation Processing System still operates based on recombined (legacy-resolution) data. Therefore, the authors tested the potential provided by the new data using the off-line precipitation estimation algorithms of the Hydro-NEXRAD system. The algorithms allow obtaining rain maps with the resolution about 0.5 km.

Since super-resolution data have been implemented only in recent months, the authors evaluate the super-resolution precipitation estimates with recombined legacy products and rain gauge data for several rain events that led to extreme flooding in the Iowa River and Cedar River basins in June of 2008. They discuss the spatial scale dependence of uncertainties for gauge representativeness and radar rainfall estimation based on spatial averaging schemes.