Advantages and challenges of a specific attenuation based radar QPE for operations

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Polarimetric weather radar have provided much improved depictions of the size, shape, phase and concentration of various scatterers in the atmosphere over the single-polarized weather radar and showed a better discrimination between hydrometeors and non-hydrometeors and a more accurate quantitative precipitation estimation (QPE). A number of studies using disdrometer data indicated that specific attenuation, a polarimetric radar derived variable, was more linearly related to the liquid water content than reflectivity and was less sensitive to calibration errors and partial beam blockages. A specific attenuation-based QPE (“RA”) was implemented across the United States NEXRAD network in a real-time experimental system at the National Severe Storms Lab in Oct. 2016. The RA QPE was evaluated and refined for 2 years and a relatively stable version was implemented in mid-Sept. 2018. The RA scheme assumed a relatively uniform drop size distribution (DSD) in areas where radar observations were below the melting layer. But the key parameter in the RA scheme, a, was dynamically updated to reflect the temporal change of DSD.

The Sep. 2018 version of RA was evaluated against quality controlled gauge observations and compared with a reflectivity-based QPE (“RZ”) for over 50 events from different regions of CONUS. RA provided consistent improvements over RZ for moderate to extreme rain. RA also showed less sensitivity to partial beam blockages and calibration biases than RZ. For light to very light stratiform rain, RA had a dry bias due to insufficient attenuation. RA scheme also had some local under- and overestimation errors where the spatial variations of DSD were large. How to account for such local DSDs in an efficient and automated way remains a challenge for operational RA applications.

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