Bright Band Delineation and Radial-Dependent AVPR Corrections for QPE Improvements in MRMS

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Radar-based quantitative precipitation estimation (QPE) in the Multi-Radar Multi-Sensor (MRMS) system is derived from the reflectivity field when radar observations are within or above the melting layer (ML). To minimize errors associated with a bright band and when radar beam overshoots the ML, an apparent vertical profile of reflectivity (AVPR) correction was implemented. The correction was based on reflectivity only and assumed a spatially uniform bright band structure. When the bright band structure becomes highly nonuniform such as in situations when the melting process is disturbed by underlying terrain or by variable vertical motions, this isotropic AVPR correction becomes less effective.

Using dual-polarization radar variables, more accurate estimations of bright band areal extent can be obtained and a non-isotropic AVPR correction has been developed in the MRMS framework. Radially-dependent bright band top and bottom heights and AVPR models are calculated and reflectivity fields are corrected based on the radially-dependent AVPR models. The algorithm was tested on multiple cases ranging in geographic locations with bright bands of various heights and intensities. The non-isotropic AVPR correction provided a more accurate delineation of bright band areas and more effective reduction of QPE errors within and above the bright band than the old isotropic AVPR, especially for precipitation events with a low melting layer or with strong variability of vertical motions.