Mesoscale estimation of precipitation efficiency and its relationship to QPE accuracy across the United States

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Abstract

The National Mosaic and Multisensor QPE Project’s Q2 product is a fully automated, high resolution, multisensor QPE that incorporates data from radar, rain gauges, and numerical weather prediction (NWP) model analyses. The various inputs are used to segregate different types of precipitation (stratiform and convective rain, hail, tropical rain, and snow) and assign different Z-R relationships at each grid point.

Identification of tropical (warm rain) precipitation for Q2 is currently based on vertical profiles of reflectivity (VPR) calculated at each radar location. If a VPR is identified as tropical, the tropical Z-R function is then applied to all locations within a distance from the radar where reflectivity exceeds a predetermined threshold. While the addition of the tropical precipitation type has improved Q2 accuracy, systematic biases still exist between Q2 and independent gauge rainfall accumulations. In this study, a large-scale analysis was conducted over the central and eastern U.S. comparing Q2 rainfall accuracy to VPR structure and thermodynamic characteristics of the ambient environment. The goals were twofold: to determine whether the Q2/gauge bias trends observed have a significant and predictable relationship to environmental properties (precipitation efficiency, relative humidity, etc.), and to assess what connection the “tropical” VPR characteristics have with the midlatitude storm environments. Being able to identify tropical rainfall based on the environmental data alone would improve the skill of the tropical algorithm in areas between radars where the VPRs are not available.