13.23 REGIME-DEPENDENT RADAR REFLECTIVITYRAIN RATE RELATIONSHIPS AND THEIR POTENTIAL TO IMPROVE RADAR RAINFALL ESTIMATES

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Quantitative estimates of current rainfall fields are of central importance for hydrological processes and commonly obtained from weather radar measurements. Large parts of the uncertainty in this estimation can be assigned to the variability of the drop size distribution (DSD) that determines the relationship between radar reflectivity and rain rate (ZR relationship). Since the classical stratiform/convective classification is related to characteristic properties of the DSD, the use of different ZR relationships for the respective type provides a feasible technique to account for the inherent microphysical variability of rainfall.

In order to quantify the potential of double ZR relationships to improve radar rainfall estimates, high resolution observation data of micro rain radars in Northern Germany are analyzed. The stratiform and convective rainfall regimes are separated with the help of two methods, establishing threshold definitions for the rain rate-dependent mean drop size and the prefactor of the power-law ZR relationship. For reference, the double ZR relationships adjusted for the two separation methods are tested against a standard MarshallPalmer and a single adjusted ZR relationship.

The comparison of the DSD-based and reflectivity-derived rain rates shows that applying two different ZR relationships roughly halves the long-term estimation error of the rainfall accumulation compared to a single ZR relationship. The correlation coefficient between the instantaneous rain rates increases by around 20% while the root mean square error reduces by between 15 and 25%, dependent on the separation method.

According to the presented results, the use of separate ZR relationships for stratiform and convective rainfall is a simple and promising technique to improve radar rainfall estimates. Especially in operational and hydrological applications this approach avoids potentially dangerous underestimations of local rainfall intensities by single ZR relationships.