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Identification of Hydrometeor Mixing Ratio Retrievals Suitable for Dual-Polarimetric C-Band Radar Observations over Germany

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The assimilation of dual-polarimetric radar observations in NWP models is promising especially for shortterm forecasts of quantitative precipitation. However, directly assimilating polarimetric moments is still a challenge due to, e.g., the rather rudimentary appreciation of particle size and shape distributions in the NWP models. Consequently, pioneering studies started assimilating synthetic model state variables derived from radar polarimetric observables, such as hydrometeor mixing ratios. This study evaluates hydrometeor mixing ratio retrievals already published, and improves and adapts them for applications to the C-band dualpolarimetric radar network of the German national weather service (DWD) and later assimilation of retrievals in the ICON model. A large data set of drop-size-distributions (DSD) measured by DWD in Germany including a large variety of different rain types is investigated based on T-matrix simulations. Results show that existing, mostly simple power-law retrieval relations derived for other climate regimes are not appropriate for Germany, which underlines a set of local retrieval relations is needed for assimilation of hydrometeor mixing ratios in the ICON model. Suitable local power-law, polynomial and also rational retrievals are derived from the DSD data set. Application of the newly introduced relations to both stratiform and convective rainfall events monitored by DWD's radar network shows encouraging results.

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