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Using raindrop size distributions from different types of disdrometer to establish weather radar algorithms

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Radar precipitation retrieval uses several relationships that parameterize precipitation properties (like rainfall rate and liquid water content and attenuation (in case of radars at attenuated frequencies such as those at C- and X-band) as a function of combinations of radar measurements. The uncertainty in such relations highly affects the uncertainty precipitation and attenuation estimates. A commonly used method to derive such relationships is to apply regression methods to precipitation measurements and radar observables simulated from datasets of drop size distributions (DSD) using microphysical and electromagnetic assumptions. DSD datasets are determined both by theoretical considerations (i.e. based on the assumption that the radar always samples raindrops whose sizes follow a gamma distribution) or from experimental measurements collected throughout the years by disdrometers. In principle, using long-term disdrometer measurements provide parameterizations more representative of a specific climatology. However, instrumental errors, specific of a disdrometer, can affect the results. In this study, different weather radar algorithms resulting from DSDs collected by diverse types of disdrometers, namely 2D video disdrometer, first and second generation of OTT Parsivel laser disdrometer, and Thies Clima laser disdrometer, in the area of Rome (Italy) are presented and discussed to establish at what extent dual-polarization radar algorithms derived from experimental DSD datasets are influenced by the different error structure of the different type of disdrometers used to collect the data.