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Vertical Variability of Rain Drop Size Distribution from Micro Rain Radar Measurements during IFloodS

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Ground based weather radars are highly used to generate rainfall products for meteorological and hydrological applications. However, weather radar quantitative rainfall estimation is obtained at a certain altitude that depends mainly on the radar elevation angle and on the distance from the radar. Therefore, depending on the vertical variability of rainfall, a time-height ambiguity between radar measurement and rainfall at the ground can affect the rainfall products. The vertically pointing radars (such as the Micro Rain Radar, MRR) are great tool to investigate the vertical variability of rainfall and its characteristics and ultimately, to fill the gap between the ground level and the first available radar elevation. Furthermore, the knowledge of rain Drop Size Distribution (DSD) variability is linked to the well-known problem of the non-uniform beam filling that is one of the main uncertainties of Global Precipitation Measurement (GPM) mission Dual frequency Precipitation Radar (DPR).

During GPM Ground Validation Iowa Flood Studies (IFloodS) field experiment, data collected with 2D video disdrometers (2DVD), Autonomous OTT Parsivel2 Units (APU), and MRR profilers at different sites were available. In three different sites co-located APU, 2DVD and MRR are available and covered by the S-band Dual Polarimetric Doppler radar (NPOL). The first elevation height of the radar beam varies, among the three sites, between 70 m and 1100 m. The IFloodS set-up has been used to compare disdrometers, MRR and NPOL data and to evaluate the uncertainties of those measurements. First, the performance of disdrometers and MRR in determining different rainfall parameters at ground has been evaluated and then the MRR based parameters have been compared with the ones obtained from NPOL data at the lowest elevations. Furthermore, the vertical variability of DSD and integral rainfall parameters within the MRR bins (from ground to 1085 m each 35 m) has been investigated in order to provide some insight on the variability of the rainfall microphysical characteristics within about 1 km above the ground.