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Spatial Variability of Raindrop Size Distribution at small scales

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The retrieval of raindrop size distribution (DSD) from dual frequency precipitation radar (DPR) on board the NASA's Global Precipitation Measurement (GPM) core satellite is one of the key objectives of GPM mission. The DPR algorithm developers adopted three-parameter gamma distribution and suggested methodologies for the DSD retrieval process. The footprint of the DPR is nearly circular with approximately 5 km diameter and the DSD variability within the footprint is one of the uncertainties of the retrieved size distribution. The highly variable nature of DSD is also evident in retrieved precipitation estimates from ground-based radars.

This study investigates the spatial variability of DSD at two different spatial scales. The small-scale variability of DSD was studied through disdrometer measurements at NASA-MC3E (Mid-latitude Continental Convective Clouds Experiment) and compared with results from NASA Wallops Flight Facility (WFF) disdrometer measurements. Seven two-dimensional video disdrometers (2DVD) were installed, and the distances between each couple of instruments ranges from 0.4 to 9.2 km. A three-parameter exponential function was used to investigate the spatial variability of fifteen DSD parameters. The correlation distance and the shape parameter of the function was estimated for each parameter. The RMSE gives an indication about the goodness of the fit. The results were compared with which obtained at WFF, where the twelve disdrometers installed (six 2DVD and six Parsivel2) had a maximum distance of 2.3 km.

The results obtained are the first present in literature from high quality disdrometer network at two different small scales. The results show that the most of DSD parameters are correlated within a satellite footprint or radar pixel. The DSD integral parameters (i.e. RR, LWC, Z, etc.) have, generally, lower correlation distance than DSD parameters (i.e. Dmass, Dmax, Nw, etc.).