1.8 VERTICAL VARIABILTIY RAIN DROP SIZE DISTRIBUTION FROM DISDROMETER AND MICRO RAIN RADAR MEASUREMENTS

E. ADIROSI[1,2], A. TOKAY[3 4], N. ROBERTO[2], E. GORGUCCI[2], M. MONTOPOLI[2], L. BALDINI[2]
[1]Consorzio Nazionale Interuniversitario per le Telecomunicazioni (CNIT), Italy
[2]CNR - Institute of Atmospheric Sciences and Climate, Rome, Italy
[3]Joint Center for Earth Systems Technology, University of Maryland Baltimore County, Baltimore, MD
[4]NASA Goddard Space Flight Center, Greenbelt, Maryland
elisa.adirosi@artov.isac.cnr.it

Vertical variability of rain drop size distribution (DSD) affects in many ways the accuracy of radar quantitative rainfall obtained by radar. For conventional scanning weather radar, rain estimation is obtained at a certain altitude that depends on the radar elevation angle and on the distance from the radar. If rain at ground is the measurement of interest, radar rainfall estimate suffers from the time-height ambiguity between the altitude of radar measurement and rainfall at the ground. Although gauge adjustment is often used to mitigate this issue, the knowledge of the vertical variability of the precipitation between the height of the radar measurements and ground is a key factor to address this issue. Moreover, variability of DSD within the radar resolution volume (typically more extended along the vertical than along the range) affects in different ways dual-polarization measurements that are associated to a radar sampling volume and, in a non-trivial way, the rain estimates obtained from them. As the distance from the radar increases, the radar sampling volume increases and assuming homogeneous beam filling becomes likely incorrect. This condition is known as non uniform beam filling (NUBF). For satellite borne radar, such as the GPM Dual Frequency Precipitation Radar, the impact of NUBF within the footprint has recently been addressed. However, assessing NUBF along the vertical is also needed, being a potential source of uncertainty.

To investigate vertical variability of rain, vertically pointing radars are a valuable tool, being able both to support investigations of the variability of precipitation within the radar sampling volume, and to fill the gap between the ground level and the first available radar elevation. Among these systems, the Micro Rain Radar (MRR), 24 GHz system using the continuous-wave frequency-modulated scheme, has become popular both for fixed installations and for the use in field campaigns where it is often co-located with disdrometers. A Doppler velocity based method for determining vertical profiles of drop size distributions and, consequently, DSD moments taking advantage from the availability of collocateddisdrometer measurements have been developed. Data collected by MRRs and co-located disdrometers are available from different field campaigns. For the GPM Ground Validation Iowa Flood Studies (IFloodS) field experiment an interesting and unique set up was adopted: in three different sites, clusters of co-located Parsivel2, 2D Video Disdrometer and MRR (with 35 m vertical resolution) were almost aligned along a radial at different distances from the NASA NPOL radar. This set-up has been used first to evaluate MRR drop size distribution estimates closer to the ground with respect to available disdrometers. Then MRR data, resampled onto the NPOL resolution volumes are used to evaluate the uncertainties of the different dual-polarization measurements along the vertical. The vertical variability of DSD and integral rainfall parameters within the MRR coverage is finally investigated to provide some insight on the variability of the rainfall microphysical characteristics within about 1 km above the ground in the different precipitation regimes.