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Synergy of ground-based active (micro rain radar) and passive (multiwavelength polarimetric radiometer) sensors for partitioning rain and cloud water content

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During the EUCAARI (European Integrated Project on Aerosol cloud climate air quality interactions) campaign the radiometer ADMIRARI (Advanced Microwave Radiometer for Rain Identification) has been continuously measuring in synergy with a Micro Rain Radar at the CESAR (Cabauw Experimental Site for Atmospheric Research) observatory in the Netherlands. Both instruments measured at a fixed 30 degrees elevation angle. A data set including V-H polarization brightness temperature at three frequencies (10.65, 21.0 and 36.5 GHz) and radar reflectivity at 24 GHz has been collected.

The two instruments provide complementary information about the slant volume under observation: while the micro rain radar (MRR) gives an insight into the rain structure, ADMIRARI exploits the uneven effects of small droplets and large raindrops on brightness temperatures and polarization differences to partition the liquid water path into its rain and cloud components. In this work a retrieval of such quantities based on a Bayesian inversion algorithm is applied to our multisensor dataset. A set of synthetic brightness temperatures at the three ADMIRARI frequencies has been simulated by a 3D backward Monte Carlo code for hydrometeor profiles extracted from different Cloud Resolving Model runs. In order to produce the observed polarization signal rain particles are assumed to be oblate spheroids with preferential orientation. In addition MRR reflectivities corresponding to each slant profile have been computed considering Mie theory.

The potential of a Bayesian algorithm has been widely exploited by several authors (e.g. to the retrieval of surface rainfall and cloud parameters from space borne suite of microwave instruments). The present work is a first attempt to tackle the retrieval of rain/cloud parameters from combined active and passive slant observations during rain conditions.