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Invariance of the double-moment normalised raindrop size distribution through spatial displacement

Timothy Raupach and Alexis Berne
Ecole Polytechnique Fédérale de Lausanne, EPFL - ENAC - LTE, Lausanne, Switzerland (tim.raupach@epfl.ch)

The raindrop size distribution (DSD) quantifies the concentration in air of raindrops by size and thus describes the microstructure of rainfall. The DSD provides information that is critical to measuring and understanding rainfall processes, and it is known to be highly variable in space and time. Normalisation of the DSD allows for it to be described as a combination of its statistical moment(s) and a normalised DSD function that describes the generic DSD shape. In the ideal case, the normalised DSD is static and all DSD variability is captured by variability of the statistical moments of the DSD. We tested the stability of an existing double-moment normalisation technique (that of Lee et al, 2004) over space. Horizontal displacement was tested using networks of disdrometers in three different climatic regions, and vertical displacement was tested using three vertically-pointing radars in one region. The rainfall in which the tests were made was primarily of stratiform type. The double-normalised DSD displayed moderate varations with spatial displacement, and was more stable in the horizontal plane than the vertical. It was found that, depending on the choice of input moments, a double-normalised DSD model trained in one location could be used at a spatially distant location with acceptable performance loss. The results suggest that, depending on the input moments used and the performance requirements of the application, the double-moment normalised DSD could be assumed invariant for practical purposes in stratiform rain.