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The parameterization of the general raindrop size distribution by the gamma probability density function

Nan Yu (1), Pieter Hazenberg (2), Guy Delrieu (1), Brice Boudevillain (1), and Remko Uijlenhoet (2)

(1) Laboratory of Transfers in Hydrology and Environment , Grenoble, France (nan.yu@ujf-grenoble.fr), (2) Hydrology and Quantitative Water Management Group, Wageningen University, Wageningen, Netherlands (Pieter.Hazenberg@wur.nl)

The raindrop size distribution (DSD) is crucial for understanding the relationships which link the radar reflectivity factor to rainfall rate. In this study, we propose a dimensionless gamma probability density function (*pdf*) with two parameters to model the general distribution of the DSD. A relationship between two parameters in the gamma *pdf* is derived based on self-consistency. As a result, only one shape parameter, called μ, is necessary to describe the variability of the general distribution. For each DSD spectrum, we apply a new method, which uses the ratio of consecutive moments to estimate μ. For the whole DSD time series data, with a global value of μ, this gamma *pdf* model can be easily adapted to both the one- and two-moment normalisation approach presented in the literature. Our theory has been implemented for a four-month DSD time series observed in the Cévennes region, France. Results show the gamma *pdf* and its self-consistency to be a good approximation to the observed general distribution. The uncertainty in the moment estimations (e.g. the Z-R relationship) is partly explained by the variability of the general distribution. Thus, a classification of the DSD spectra by μ can improve the quality of moment estimation. Further research is needed to investigate the physical meaning of the variability of the general distribution.