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Universal functional form of 1-minute raindrop size distribution?

Katia Cugerone and Carlo De Michele
Politecnico di Milano, DICA, Milano, Italy (katia.cugerone@polimi.it)

Rainfall remains one of the poorly quantified phenomena of the hydrological cycle, despite its fundamental role. No universal laws describing the rainfall behavior are available in literature. This is probably due to the continuous description of rainfall, which is a discrete phenomenon, made by drops. From the statistical point of view, the rainfall variability at particle size scale, is described by the drop size distribution (DSD). With this term, it is generally indicated as the concentration of raindrops per unit volume and diameter, as the probability density function of drop diameter at the ground, according to the specific problem of interest. Raindrops represent the water exchange, under liquid form, between atmosphere and earth surface, and the number of drops and their size have impacts in a wide range of hydrologic, meteorologic, and ecologic phenomena. DSD is used, for example, to measure the multiwavelength rain attenuation for terrestrial and satellite systems, it is an important input for the evaluation of the below cloud scavenging coefficient of the aerosol by precipitation, and is of primary importance to make estimates of rainfall rate through radars.
In literature, many distributions have been used to this aim (Gamma and Lognormal above all), without statistical supports and with site-specific studies. Here, we present an extensive investigation of raindrop size distribution based on 18 datasets, consisting in 1-minute disdrometer data, sampled using Joss-Waldvogel or Thies instrument in different locations on Earth's surface. The aim is to understand if an universal functional form of 1-minute drop diameter variability exists. The study consists of three main steps: analysis of the high order moments, selection of the model through the AIC index and test of the model with the use of goodness-of-fit tests.