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Comparison of different fittings of experimental DSDs

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The knowledge of drop size distribution (DSD) of rain, namely the frequency distribution of drop equivolume diameters, has a wide range of applications in earth sciences such as precipitation physics, hydrology and agricultural and soil sciences, it is also important in precipitation remote sensing, especially in radar meteorology for relationships among rainfall rate and radar measurements such as the radar reflectivity factor. In general, retrieval of parametric DSDs would aim to best model the largest portion of measured drop spectra, as a consequence, there is no guarantee that the selected distribution will adequately model some DSD portions, such as the tail. However, for characterising physical quantities such as the liquid water content and radar reflectivity, the right tail is critical because large drops play a much more important role than small droplets. In order to study the influence of various tail-types, four different one-sided continuous distributions (the Pareto, the Lognormal, the Gamma and the Weibull distributions) have been fitted both to the large drops only and to the entire sample of the measured spectra. Observational data consist of 1-min spectra collected by two-dimensional video disdrometer (2DVD). One dataset was measured during the first special observation period of the hydrological cycle in the Mediterranean experiment (HyMeX) field campaign in Rome from September to November 2012, while the second one during the Mid-latitude Continental Convective Clouds Experiment (MC3E) field campaign in Oklahoma from April to June 2011. The results obtained for the two different datasets are consistent. Results of this preliminary analysis show that considering the whole fitting the Weibull distribution seems to fit the highest percentages of the measured drop spectra (37% for HyMex and 42% for MC3E), on the other end this distribution is closely followed by the Gamma and the Lognormal distribution, with approximately 30% of success. While for the tail fitting the performances of the Weibull and Lognormal distributions increase to the detriment of the Gamma distribution; the Weibull distribution has the highest percentage of success for the Hymex dataset, while for the MC3E dataset the Lognormal distribution fits the highest number of measured spectra. For both the datasets, when the Weibull distribution performs the best fitting, the shape parameter of the distribution is greater than one.