EGU21-16392
https://doi.org/10.5194/egusphere-egu21-16392
EGU General Assembly 2021

Controls on the space-time variability of raindrop size distributions

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It has been stated that "the study of drop-size distributions, with its roots in both land-surface processes [e.g. interception, erosion, infiltration and surface runoff] and atmospheric remote sensing [e.g. radar meteorology], provides an important element to an integrated program of hydrometeorological research" (Smith, 1993). Although raindrop size distributions have been studied from a scientific perspective since the early 20th century, it was not until the mid-1990s that researchers realized that all parameterizations for the drop size distribution published until then could be summarized in the form of a scaling law, which provided "a general phenomenological formulation for drop size distribution" (Sempere Torres et al., 1994). The main implication of the proposed expression is that the integral rainfall variables (such as rain rate and radar reflectivity) are related by power laws, in agreement with experimental evidence. The proposed formulation naturally leads to a general methodology for scaling all raindrop size data in a unique plot, which yields more robust fits of the drop size distribution. Here, we provide a statistical interpretation of the law's scaling exponents in terms of different modes of control on the space-time variability of drop size distributions, namely size-control vs. number-control, inspired by the work of Smith and De Veaux (1994). Also, an attempt will be made toward interpreting the values of the scaling exponents and the shape of the scaled drop size distribution in terms of the underlying (micro)physical processes.

REFERENCES

Smith, J. A., 1993: Precipitation. In Maidment, D. R., editor, Handbook of Hydrology, pages 3.1–3.47. McGraw-Hill, New York.

Sempere Torres, D., J.M. Porrà, and J.-D. Creutin, 1994: A general formulation for raindrop size distribution. J. Appl. Meteor., 33, 1494–1502.

Smith, J.A. and R.D. De Veaux, 1994: A stochastic model relating rainfall intensity to raindrop processes. Water Resour. Res., 30, 651–664.