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A scaling law for the raindrop size distribution: 25th anniversary

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A quarter century ago Sempere Torres et al. (1994) published "A General Formulation for Raindrop Size Distribution", in which they proposed "a general phenomenological formulation for drop size distribution (DSD), written down as a scaling law". Their scaling law formulation accounted for all previously published parameterizations for the DSD. The main implication of the proposed expression was that the integral rainfall variables (such as rain rate and radar reflectivity) were related by power laws, in agreement with experimental evidence. The proposed formulation naturally led to a general methodology for scaling all raindrop size data in a unique plot, which yielded more robust fits of the DSD.

In this presentation we will review 25 years of interpretations and applications of this scaling law for the DSD, with extensive references to earlier work (dating all the way back to the beginning of the 20th century) as well as an outlook to the future, including implications for ground-based and spaceborne remote sensing of precipitation. In addition, we will provide a statistical interpretation of the law's scaling exponents in terms of different modes of control of the space-time variability of DSDs, namely size-control vs. number-control. Also, ongoing work concerning the parameterization of the shape of the scaled DSD will be discussed. Finally, an attempt will be made toward interpreting the values of the scaling exponents and the shape of the scaled DSD in terms of the (micro)physical processes producing the DSD.

REFERENCE

Sempere Torres, D., J.M. Porrà, and J. Creutin, 1994: A General Formulation for Raindrop Size Distribution. J. Appl. Meteor., 33, 1494–1502, https://doi.org/10.1175/1520-0450(1994)033<1494:AGFFRS>2.0.CO;2