Spatial interpolation of point measurements of the raindrop size distribution

Timothy Raupach
École Polytechnique Fédérale de Lausanne, Switzerland
Alexis Berne (École Polytechnique Fédérale de Lausanne, Switzerland)

E-mail: tim.raupach@epfl.ch

We present a method for the spatial interpolation of the drop size distribution (DSD) measured by disdrometers. Traditional interpolation of bulk rainfall parameters, such as rain rate or radar eflectivity, treats each parameter individually and thus fails to take into account interrelationships between the parameters.

We use principle component analysis to find orthogonal components of the log of the experimental DSD that are hence guaranteed to be independent. Variograms for each independent component are calculated, and we then use univariate geostatistics to interpolate the components over the domain of interest. Through this interpolation we can reconstruct the interpolated experimental DSD at any point. The DSD then provides bulk rainfall variables that are properly interrelated.

The technique has been applied to drop size distributions recorded by seven Parsivel disdrometers deployed over a GPM-pixel sized area in Mediterranean France, within the framework of the Hydrological Cycle in the Mediterranean Experiment (HYMEX; see http://www.hymex.org for more information). Leave-one-out testing shows that DSD interpolation using the new method provides better results for bulk rainfall variables than the use of univariate geostatistics to interpolate variables individually.

Accurate interpolation of bulk rainfall parameters is important for model verification, and the study of the effects of scale-change and of sub-grid variability of the drop size distribution in rainfall measured by radar and estimated by numerical weather prediction models.