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Randomness in the amount of rain in LES with Lagrangian microphysics

Piotr Zmijewski, Piotr Dziekan, and Hanna Pawlowska
Institute of Geophysics, Faculty of Physics, University of Warsaw, Warsaw, Poland (p.zmijewski2@fuw.edu.pl)

Lagrangian, particle-based models are an emerging method for detailed modeling of cloud microphysics. In these models, a relatively small number of "super-droplets" is used to represent all hydrometeors. Each super-droplet represents vast number of hydrometeors that have the same properties. The most popular method for solving collision-coalescence in these particle-based models is the all-or-nothing algorithm. In this algorithm, collision-coalescence of droplets within a spatial cell is modeled with a stochastic process. The number of trials is proportional to the number of super-droplets, which is significantly lower than the number of hydrometeors. Therefore the variance of the number of hydrometeors with a given size is higher in the super-droplet algorithm than it would be if every droplet was modeled separately. The increase of this variability depends on the number of super-droplets. We use the University of Warsaw Lagrangian Cloud Model (UWLCM) to analyse how the randomness in the collision-coalescence algorithm affects the amount of precipitation in large eddy simulations of warm clouds.