Abstract Submitted
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Highly scalable parallel implementation of turbulent collision of aerodynamically interacting cloud droplets[1] HOSSEIN PARISHANI, ORLANDO AYALA, LIAN-PING WANG, University of Delaware, BOGDAN ROSA, Institute of Meteorology and Water Management, Poland, WOJCIECH GRABOWSKI, NCAR — Hybrid direct numerical simulation (HDNS) has advanced our understanding of turbulent collision-coalescence of cloud droplets. In this approach, the background fluid turbulence is simulated by a pseudospectral method and disturbance flows of droplets are treated analytically. To better realize its potential on PetaScale computers with ∼100,000 processors, here we implement and test a parallel implementation using two-dimensional domain decomposition. The purpose is to increase both the range of flow scales and the number of droplets realizable in the simulations, so the dependence of collision statistics on flow Reynolds number and droplet size can be explored. We expect that the 2D domain-decomposition HDNS code can be used to produce statistics of aerodynamically-interacting droplets with Taylor microscale flow Reynolds number R_λ up to ~ 1000 and a system of $\mathcal{O}(10^7)$ polydisperse droplets. We will present the implementation details as well as results of turbulent collision statistics (e.g., collision kernel, radial distribution function, relative velocity statistics) of sedimenting cloud droplets from our latest high-resolution HDNS.

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