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Turbulence effect on coagulatioinal growth of cloud droplets[1]
XIANG-YU LI, AXEL BRANDENBURG, NORDITA, GUNILLA SVENSSON, Department of Meteorology, Stockholm University, NILS HAUGEN, Department of Energy and Process Engineering Norwegian University of Science and Technology (NTNU), IGOR ROGACHEVSKII, Department of Mechanical Engineering, Ben-Gurion University of the Negev — Bottleneck problem of cloud droplet growth (a rapid growth of initially small micron-size droplets to the $50\,\mu$m in radius to form rain) is one of the most challenging problems for cloud physics. Cloud droplet growth is neither dominated by condensation nor gravitational coagulation in the size range of $15\,\mu\text{m} \sim 50\,\mu$m in radius. Turbulence-initiated coagulation is argued to be the mechanism to bridge the size gap. This study investigates the turbulence effect on coagulational growth of cloud droplet. We found that the coagulation rate strongly depends on the small-scale properties of turbulence. The coagulation rate is enhanced with increasing energy dissipation rate, therefore, broaden the size spectra of cloud droplets. Consistent with the previous studies, the coagulation rate is insensitive to the Taylor micro-scale Reynolds number.

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Xiang-Yu Li
NORDITA

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