Geophysical Research Abstracts
Vol. 20, EGU2018-2470-1, 2018
EGU General Assembly 2018

Simulated driving forces for displacements in the Gamma phase-space

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This research employs the phase-space constituted by the three parameters of the gamma function (Gamma phase-space) as a tool to track the evolution of the droplet size distribution (DSD) of a cloud simulated by bin microphysics, following theoretical considerations from previously published studies. By interpreting microphysics processes (e.g. water vapor condensation and collision-coalescence) as "pseudo-forces" in the Gamma phase-space, the evolution of the cloud-top microphysics is analyzed. It is shown that the pseudo-forces are modulated by environmental factors such as aerosol number concentration, which determines the cloud-top-DSD trajectory in the Gamma phase-space. As the intensity of the pseudo-forces also depends on the DSD itself, a feedback effect is observed. Differences in the pseudo-forces determine changes in the evolution of bulk properties of the cloud, such as droplets effective diameter and number concentration.