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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Direct Lagrangian tracking simulation of droplet growth in vertically developing cloud" *by* Yuichi Kunishima and Ryo Onishi

Anonymous Referee #2

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Report on "Direct Lagrangian tracking simulation of droplet growth in vertically developing cloud" (acp-2018-328) by Yuichi Kunishima and Ryo Onishi

This paper reports the numerical study of evolution of the warm-rain process in a vertically developing cloud from microscopic view points. The simulation includes almost all processes such as cloud condensate nuclei (CCN) activation, condensational growth, collisional growth, and droplet gravitational settling, hydrodynamic interaction among the droplets. The obtained results are compared with the results of the conventional

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Discussion paper

spectral-bin simulations, and reasonable agreement is obtained. Particular feature of this study is to track the Lagrangian dynamics of all droplets within a extremely vertically elongated domain, almost one-dimensional domain. From the Lagrangian simulation the authors successfully obtained the history of evolution of the rain drops that reach the ground, as to how one rain drop is formed from many cloud droplets from the nucleation, condensation, collision-coalescence. The paper is well written and the results are very interesting and useful to the community. Therefore I would recommend the publication to the Atmos. Chem. Phys. when the point raised below is properly addressed.

1. The domain is almost one dimensional. The computational grid for the Navier-Stokes and transport equations is very elongated in the vertical direction. The aspect ratio is more than 12 from Table 2. The number of the grid points in the horizontal direction is only about 10, while more than 76,000 in the vertical direction. In this case, are the fluid variables properly solved? Is it necessary to solve these fluid equations? The fluids could simply be replaced by the one dimensional model.

2. In recent studies of micro physical processes, the importance of the turbulence is stressed. In the present simulation, no turbulence effects are taken into account. Could the authors comment on its effects on the results?

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