Effect of turbulent enhancement of collision-coalescence on warm rain formation in maritime shallow convection

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This paper will discuss application of the parameterized turbulent collection kernel derived from direct numerical simulation of droplet-laden turbulent flows to the large-eddy simulation of shallow convective cloud field applying warm-rain bin microphysics. The strategy is to conduct simulations with the turbulent kernel and to compare results with simulations without collision-coalescence and with the gravitational kernel. Sensitivity studies using four different concentrations of the cloud condensation nuclei (30, 60, 120, and 240 per cubic centimeter) were conducted. These represent a range of conditions, from extremely clean to weakly polluted, expected in marine boundary layer shallow cumuli. The results provide quantitative comparison between cloud statistics together with the statistics of the cloud water and drizzle/rain, as well as radar reflectivity. The simulations show a significant influence of the turbulent enhancement of the gravitational collision-coalescence on the drizzle/rain formation.