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Turbulence effect on microphysics of mixed-phase deep convective clouds

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The spectral bin microphysics Hebrew University Cloud Model with the spatial resolution of very high resolution is used to simulate the evolution of isolated deep mixed-phase convective clouds under different meteorological conditions and at different aerosol concentrations. The model takes into account the effects of turbulence on droplet collision rate as well as turbulence-induced collision enhancement between ice particles as well between ice particles and water drops. Turbulent collision kernels are calculated at each time step and at each grid point. The turbulence-induced collision rate enhancement is determined by means of lookup tables calculated for different values of turbulent dissipation rate and the Taylor microscale Reynolds numbers.
Deep convective clouds observed during the LBA-SMOCC campaign in the Amazon region are simulated. Turbulence intensity in the simulated clouds is spatially inhomogeneous and reaches its maximum at the tops of multiple bubbles forming the clouds. It is shown that polluted clouds are more turbulent than those developing in the clean atmosphere.
It is shown that turbulence leads to a faster formation of raindrops, especially in polluted clouds. Enhanced collisions within the mixed -phase region accelerate formation of graupel. The effects of turbulence on cloud dynamics and accumulated are estimated.