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The effect of CCN concentration and size distribution on cloud microphysical structure and precipitation

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The effect of changes in particle concentration and size distribution of cloud condensation nuclei (CCN) on the development of cloud particles and precipitation in mixed-phase convective clouds is investigated using a dynamic cloud model with bin-resolved microphysics. Numerical simulations are conducted for CCN concentration ranging from 100 cm^{-3} to more 2000 cm^{-3} with the concentration of giant CCN changing from 0 to more than 30 cm^{-3}. A synthetic analysis of the results shows that while the increase in CCN concentration leads to a monotonic increase of drop number concentration, the changes in ice phase particles are non-linear and complex. The reasons for this are explored by analysis of the different microphysical processes responsible for ice formation. The results also indicate that increase in the concentration of giant CCN results in earlier and heavier precipitation, especially for clouds formed under more polluted conditions.