**Implementing and improving convective microphysics parameterization in E3SMv1**

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A two-moment four-class (cloud water, cloud ice, rain and snow) convective microphysics scheme is implemented in the deep convection parameterization scheme in E3SMv1. The microphysics scheme is linked to stratiform cloud parameterization through convective detrainment of cloud ice and water, and to aerosols through cloud droplet activation and ice nucleation parameterization. Several improvements are further developed for convective microphysics scheme: 1) A new hydrometeor species, graupel, and associated microphysical processes are introduced into the scheme to improve the representation of ice phase microphysics for convective clouds. 2) Convective detrainment of snow is represented, which influences the stratiform cloud microphysical processes, snow cloud optics and radiation. 3) The interaction between convective microphysics and cumulus thermodynamics is parameterized by representing the impacts of drag forces of hydrometeor loading and ice-phase latent heating on buoyancy and hence the strength and depth of convective updraft. The simulations show the simulated cloud microphysical property is reasonable. The cloud water path and high-level cloud fraction are increased, which make simulations closer to the observations. The cold and dry biases in tropical troposphere are also mitigated with the new convective microphysics scheme.