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The effects of biomass burning aerosols on the formation of convective mixed-phase clouds and precipitation

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Vegetation fires can induce deep convection, and deep convective clouds play an important role in the vertical redistribution of energy and moisture, which has a great influence on the weather and climate change from regional to global scales. Within this work, the ATHAM (Active Tracer High Resolution Atmospheric Model) model was used to study the properties of the pyro-convective clouds and precipitation in 2- and 3-dimensional simulations. The two-moment microphysical scheme of Seifert (2002), which includes the hydrometeor categories cloud water, rain water, cloud ice, snow, graupel and hail, was utilized to investigate the interaction between atmospheric aerosols and cloud microphysics. The Chisholm fire that occurred in Alberta, Canada, in May 2001 was used as a base case. By assuming typical aerosol concentration conditions, we calculated the cloud droplet number concentrations under different fire intensity conditions and evaluated the effects of aerosol concentration and fire intensity on the formation of precipitation. The simulation results showed different control regimes for cloud and precipitation formation, including an aerosol-limited regime, a fire intensity-limited regime and a transitional regime, which are consistent with the results from a recent parcel model study (Reutter et al., 2009).

Reference:
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