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# Effects of biomass burning emissions on clouds and precipitation over the Amazon Basin

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Biomass burning (BB) aerosols, the largest source of anthropogenic aerosols in the South America, potentially have substantial impact on the regional energy balance and hydrology through aerosol-radiation-cloud interactions. The effects of the BB aerosol emission intensity on cloud microphysics, dynamics and precipitation over the Amazon Basin during dry season were characterized using the WRF-Chem model. Model runs were performed with different emission scenarios by scaling the original emission rate up or down, respectively (referred to as EMISS*0.01, EMISS*0.1, EMISS, EMISS*2, EMISS*5, EMISS*10). The responses of domain-averaged cloud water content and accumulated precipitation by modifying emissions from EMISS to EMISS*10 are more than 7% and 10% respectively, implying a strong dependence of cloud and rainfall formation on the atmospheric aerosol load. Aerosol radiative effects and microphysical effects tend to act oppositely in terms of modifying cloud properties. By scattering and absorbing radiation, BB aerosols suppress low-level clouds while boost high-level clouds formation, which results in overall reduced cloud fraction. Acting as cloud condensation nuclei, the microphysical effects of a high BB aerosol load give rise to higher cloud droplet number and increase total cloud amount. Both effects lead to diminished precipitation. The relative significance of aerosol-cloud interaction versus aerosol-radiation interaction effects vary with aerosol concentration. While the former dominates at lower aerosol loading, the latter is more important at higher concentration. These nonlinear effects of aerosol–radiation-cloud interactions call for integrated estimations of aerosol effects with multi-annual aerosol emission scenarios, especially for regions with significantly varying emission rates.