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Radiative Effect of haze on regional surface energy budget and summertime convective precipitation over North China

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Haze, due to high aerosol load and bad weather condition, is commonly seen in the region of North China. The haze radiative effects (HRE) on regional surface energy budget and convective precipitation are investigated using a Weather Research and Forecast (WRF) Model. An idealized aerosol optical profile is employed with vertically uniformed single-scattering albedo (SSA) of 0.9. HRE reduces surface shortwave fluxes and increases longwave fluxes. Sensible heat and latent heat are both decreased, as the haze reduces shortwave radiation at the surface. Overall, haze aerosols reduce the net surface energy, especially in the daytime. Due to its modification of atmospheric profile, HRE has a strong effect on summertime convective precipitation. Regional-averaged daily precipitation is increased by 27%. However, modification of precipitation is of spatial discrepancy. Precipitation over areas with large amount of daily precipitation (>50 mm) has a tendency to decrease when aerosol is loaded. Convective available potential energy (CAPE) and relative humidity (RH) in these areas are relatively higher than elsewhere before the beginning of precipitation. Although aerosol radiative effects decrease CAPE and RH in these areas, domain-averaged CAPE and RH are increased by aerosol optical properties. The model results suggest that during summertime haze condition in North China, large precipitations are suppressed, while precipitation of small amount is enhanced.