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Anthropogenic aerosols enhance fog in polluted region

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Increases anthropogenic emission poses a severe environmental problem in the North China Plain (NCP), China. The WRF/Chem model coupled with the local anthropogenic emissions is used to simulate a severe fog event occurring in NCP. Sensitivity studies with five different levels of anthropogenic emission are performed to examine the comprehensive impacts of aerosols on fog microphysical, macrophysical, radiative, and dynamical properties. Fog droplet number concentration, and liquid water content all increase nonlinearly, but effective radius decreases with increasing aerosol concentrations. Aerosols also extent the fog region, height and prolong the fog duration. Aerosol reveals distinct effects on thermodynamic and dynamical conditions during different stages of fog evolution: invigorate fog formation and development by radiation- cooling-induced condensation, enhancing latent heat, longwave-induced instability, and thus promoting turbulence, but delay fog dissipation by reducing surface solar radiation, surface sensible and latent heat fluxes and thus suppressing turbulence during the dissipation stage.