# Aerosol simulations using a new chemistry-climate model (GRIMs-Chem)

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We analyze the effect of aerosols on regional climate in East Asia using a new chemistry-climate coupled model system (GRIMs-Chem), which is developed by coupling the Global/Regional Integrated Model system (GRIMs) with an offline aerosol module from GEOS-Chem, a global 3-D chemical transport model developed at Harvard university. This coupled model includes inorganic $SO_4^{2-}$-$NH_4^+$-$NO_3^-$, elemental carbon, organic carbon, sea salt, and soil dust aerosols whose concentrations are calculated at each model time step. The instantaneous aerosol concentrations are used in the radiative transfer calculation in the model to account for the direct radiative effect of aerosols on meteorology. We conduct two 29-year model simulations from 1980 to 2008 with and without interactive aerosol effects in the model to investigate the interactions of aerosols and regional climate in East Asia. We first evaluate the simulated aerosols by comparing with observations from the Acid Deposition Monitoring Network in East Asia. The comparison shows that the model successfully reproduces the observed seasonal variations of aerosol concentrations, giving us some confidence in the model capability. We analyze the effect of aerosols on regional climate by comparing the two simulation results and find that aerosols in East Asia cause a warming in the atmosphere but a significant cooling at the surface, resulting in the increases of atmospheric stability and the decreases of precipitation.

Key words: aerosols, chemistry, climate, model, radiative forcing