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Influence of aerosol-radiation interactions on air pollution in East Asia

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Black carbon (BC) aerosol emission is an important contributor to particulate matter (PM) pollution in China, leading to adverse health effects and premature deaths. BC aerosols can also affect boundary layer meteorology by heating the atmosphere, due to the unique property of BC to absorb solar radiation. In contrast, sulphate aerosols reflect solar radiation and thus cool the surface. How individual aerosol pollutants influence boundary layer meteorology on a multi-year timescale is not well known. A particularly important aspect of this influence is a potential feedback process, where changed boundary layer conditions may influence present aerosol concentrations, potentially exacerbating near-surface pollution levels. In this work, we use the Weather Research and Forecasting model with Chemistry (WRF-Chem) at 45 km horizontal resolution covering East and South Asia, and at 15 km resolution covering East China. Simulations are driven by the ECMWF Reanalysis v5 (ERA5), and anthropogenic emissions are from the latest version of the Community Emissions Data System (CEDS). Multi-year simulations are evaluated against observations of meteorological parameters and air quality data for China. Preliminary results show that aerosol-radiation interactions due to BC lead to higher annual near-surface PM concentrations, underscoring the importance of mitigating black carbon aerosol emissions. The elevated PM concentrations can be explained by a shallower boundary layer and reduced turbulent mixing near the surface associated with BC. Possible effects of aerosol-radiation interactions on extreme pollution events, including not only extreme PM events but also extreme ozone (O3) events, will be examined.