

## Observationally constrained simulation of aerosol optical properties over East Asia

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Aerosol chemical composition over East Asia, a mixture of natural dust, sea salt, biomass burning, and air pollutants, is more diverse than other regions. There are still large uncertainties to simulate the aerosol composition and its associated optical properties in aerosol models. The aerosol optical properties simulated by a flexible high resolution global to regional air quality model (NICAM-Chem) are evaluated using the space-based and ground-based observations. The aerosol processes over East Asia including emission, transport, and deposition are compared between multiple aerosol models, and the general similarities and differences are found. Based on Local Ensemble Transform Kalman filter (LETKF) method, the aerosol assimilation system for the NICAM-Chem is further developed to improve the model performances. Assimilation leads to significantly positive effect on the simulated AOD field, improving agreement with all of the 12 AERONET sites over the Eastern Asia based on both the correlation coefficient and the root mean square difference (assimilation efficiency). Meanwhile, better agreement of the Ångström Exponent (AE) field is achieved for 8 of the 12 sites due to the assimilation of AOD only.

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