

Historical radiative forcing of anthropogenic aerosols using the CEDS emissions for CMIP6

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We use the historical (1750–2014) anthropogenic emissions of reactive gases and aerosols from the Community Emission Data System (CEDS) as input to the chemistry-transport model OsloCTM3 and present updated time series for the pre-industrial to present-day direct aerosol forcing. The OsloCTM3 is an update of the OsloCTM2, with several key changes compared to its predecessor. The simulated present-day aerosol distributions (BC, OA, nitrate, sulfate and AOD) is evaluated against a range of observations before the model is used to establish the historical evolution of anthropogenic aerosols. A range of sensitivity simulations are performed to examine the importance of the emission inventory, scavenging assumptions, meteorological data and resolution for the aerosol distributions and model performance.

The OsloCTM3 generally performs well compared with measurements of surface concentrations and AERONET AOD retrievals, with correlation (normalized mean bias) on the order 0.7 - 0.8 (-0.2 - 0.5). The poorest agreement is found for Asia; however, the higher emissions in CEDS compared to the CMIP5 inventory results in a notable improvements. We also identify improvements compared to the OsloCTM2, most notably for vertical distribution of BC. We estimate a total net RFari in 2014 relative in to pre-industrial of -0.17 W m⁻², notably weaker than the IPCC AR5 2010-1750 estimate despite generally higher emissions in CEDS than the CMIP5 inventory.