Enhanced Simulation of Secondary Organic Aerosols (SOA) in a Global Chemistry-Climate Model with a New Regional Emissions For India

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Abstract

In this study, we utilize locally developed Speciated Multi Polluter Generator (SMoG)-India emission data specific to the Indian region. The SMoG-India inventory was constructed by integrating 113 activities from various sources. This emission dataset is coupled with CMIP6 emissions for global regions within a chemistry-climate model framework. We employed two versions of the chemistry-climate model, CAM6-Chem and CAM4-Chem, incorporating SMoG-India emissions alongside CMIP6 and CMIP5 emissions. The CAM6-Chem (SMoG-India) simulations reveal elevated levels of volatile organic compounds (VOC) and secondary organic aerosols (SOA) compared to global emission inventories. Monthly mean aromatic VOC simulations from CAM6-Chem (SMoG-India) closely align with in-situ observations, with CAM6-Chem (CMIP6), CAM4-Chem (CMIP6), and CAM4-Chem (CMIP5) showing similar trends. However, CAM6-Chem (SMoG-India) exhibits discrepancies in benzene concentrations during certain months (May, September, and October), particularly over major urban centers like Hyderabad, Mumbai, and Bengaluru. The SMoG-India inventory captures sources from these urban hot spots comprehensively, unlike global inventories that may lack regional specificity. Furthermore, differences in SOA concentrations between CAM6-Chem and CAM4-Chem are attributed to distinct chemistry schemes (MOZART-TS1 for CAM6-Chem and MOZART-4 for CAM4-Chem). Notably, CAM6-Chem (SMoG-India) demonstrates higher SOA concentrations over the Indo-Gangetic Plain (IGP) and North-Eastern regions compared to other model configurations. Moreover, CAM6-Chem (SMoG-India) effectively simulates surface ozone formation hotspots over India and exhibits a positive correlation between simulated free radicals, oxidized intermediate compounds, and major emission sources within the country. More results with detailed findings from these simulations will be presented.

Early Career Scientist

NO, I am not an early career scientist.

IGAC Activities

CCMi: Chemistry Climate Model Initiative, ACAM: Atmospheric Chemistry and the Asian Monsoon, BBURNED: Biomass Burning Uncertainty: ReactioNs, Emissions and Dynamics, GEIA: Global Emissions Initiative

IGAC Regional Working Groups

MANGO: Monsoon Asia and Oceania Networking Group