Research BRIEFS

NCAP-COALESCE

CarbOnaceous AerosoL Emissions, Source apportionment & ClimatE impacts

Understanding scientific complexities related to carbonaceous aerosols focussing on issues underlying their origin and fate, and their role as drivers of regional climate change over India.

Evaluation of the simulated aerosol optical properties over India: COALESCE model inter-comparison of three GCMs with ground and satellite observations

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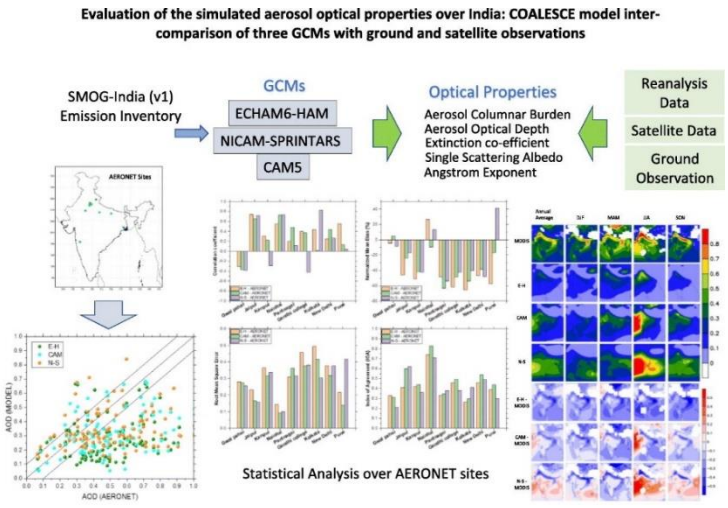

Key highlights:

- Diversity of aerosol optical properties among model simulations is observed.
- Aerosol emission, transport, and radiation models modulate optical properties.
- Prediction of columnar burden by the models is comparable to the reanalysis data.
- Vertical profile of extinction suggests improvement of emission/transport schemes.

Summary of your Research:

The objective of the present study is to evaluate the ability of global models to reproduce aerosol properties (AOD, AE, SSA) in comparison with satellite- and ground-based measurements. This study includes multi-model ensemble simulations with three GCMs using aerosol emissions from Speciated Multipollutant Generator – India for evaluation of model diversity in annual and seasonal aerosol optical properties. The temporal variations of aerosol optical properties for given locations (AERONET *in-situ* measurements) are compared with the model results.

Three GCMs coupled with aerosol transport models: NICAM-SPRINTARS (N-S), ECHAM6.3-HAM2.3 (E-H), and CAM5 (CAM) from the participating institutions of the NCAP-COALESCE project are used in this study. In the present study, a horizontal resolution of ~112 km (1° × 1°, a total of 40,962 grid points) is set up for simulation. 40 vertical layers extending up to ~40 km altitude is considered. Aerosol emissions from SMoG-India-v1 for the Indian domain nested in the global Community Emissions Data System (CEDS) dataset is used in this study for the period 2005–2014.

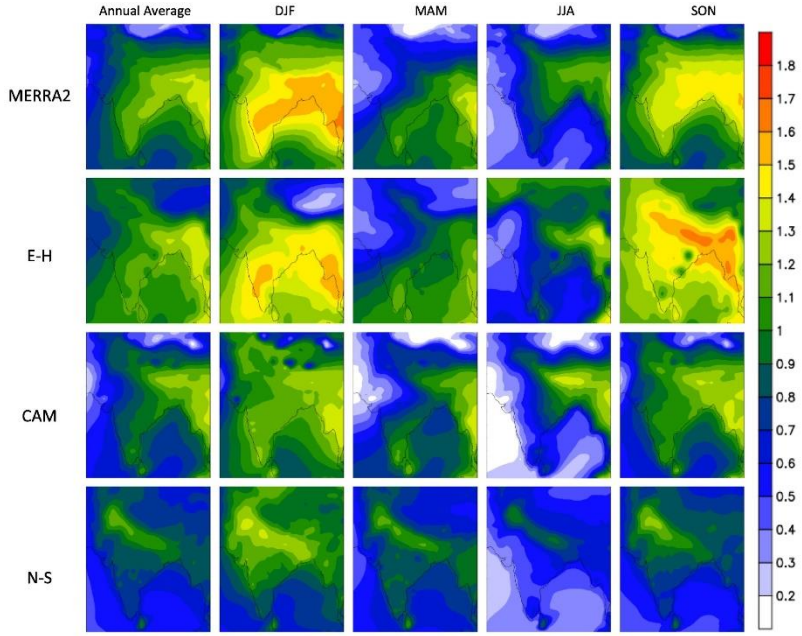

Figure: Annual/seasonal average (of 10 years) plots of Angstrom Exponent (AE) from MERRA2 reanalysis data and model simulations of E-H, CAM and N-S. Each row represents AE from reanalysis/model simulation while each column represents annual average (first column)/season.

Take away/conclusion :

- Total aerosol column burden varies (maximum) by 20 % among the models whereas AOD varies by 125 % (maximum) among the models. The prediction of columnar burden values by the models are very close although there are large differences in their AOD estimates, which implies that the difference in AOD calculation methodology between various models gives rise to a difference in total AOD.

- Aerosol species-wise contribution to AOD marginally varies among models for various seasons. A large underestimation of AOD is associated with dust and carbonaceous aerosols (particularly in the IGP region), which may be attributable to emission of anthropogenic aerosols during DJF and SON seasons, and this will be validated later when updated/improved emission data are available.

Research Article citation

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