

Aerosol variability over the Indian subcontinent using CMIP5 models and satellite data

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Aerosols continue to contribute to one of the largest uncertainties in quantifying climate forcing at regional scale, especially in the Indian subcontinent where long-term consistent aerosol data are not available at the required space-time frequency. In the study here, we analyze 24 years (1982-2005) of satellite-retrieved aerosol optical depth (AOD) record archived in global aerosol climatology project (GACP) over the oceans surrounding the Indian landmass, in particular Arabian Sea (AS) and Bay of Bengal (BoB) and assessed the fidelity of 15 CMIP5 (Coupled Model Inter-comparison Project) models in simulating AOD in this region. The strong seasonality in AOD as depicted by GACP data is not captured by the CMIP5 models. Quantitatively, all the models underestimate AOD with the largest bias observed in the pre-monsoon season. During the winter and post-monsoon seasons, we observe an overestimation of AOD over the Bay of Bengal (BoB). Further, we examined the CMIP5 AOD for RCP4.5 and RCP8.5 scenarios in this region. Comparison with MISR (Multiangle Imaging SpectroRadiometer) AOD for the period 2006-2015 reveals that CMIP5-AOD for even RCP8.5 scenario is underestimated by >50% over the Indian region. This clearly implies that emission inventory is not the only problem for the poor performance of the models. The model physics and the representation of aerosol processes in the models also need to be examined critically to improve the model performance so that they can be used for regional scale climate impact assessment.