Geophysical Research Abstracts
Vol. 20, EGU2018-477-1, 2018
EGU General Assembly 2018

Aerosol-Cloud interaction over the Bay of Bengal during polluted winter season: A modelling perspective.

Puneet Sharma (1) and Dilip Ganguly (2)

(1) Indian Institute of Technology Delhi, Centre for Atmospheric Sciences, New Delhi, India (puneet.988@gmail.com), (2) Indian Institute of Technology Delhi, Centre for Atmospheric Sciences, New Delhi, India (dilipganguly@cas.iitd.ac.in)

Critical evaluation of complex parametrization schemes such as for aerosol–cloud interaction (ACI) implemented in global climate models (GCMs) is crucial not only for model improvement purposes but also for reducing the uncertainties associated with climate change projections made using these models. In this work, we evaluate the performance of the atmospheric component of the Community Earth System Model, that is the Community Atmosphere Model version 5 (CESM1-CAM5) in simulating aerosols, clouds and their interactions using the Moderate Resolution Imaging Spectroradiometer (MODIS) Aqua satellite observations over the northern Bay of Bengal region. Quantification of total indirect effect (TIE) and its decomposition into first indirect effect (FIE) and second indirect effect (SIE) based on statistical relationships of clouds and aerosols are examined for liquid clouds and aerosol parameters from the GCM and satellite observations for a period of 5 years (2006-2010) over the northern Bay of Bengal (BoB) for winter season (DJF). The season of this study is when the prevailing surface level wind flow is predominantly from polluted Indo-Gangetic basin toward the ocean and characterized by high aerosol loading as well as dominance of stratocumulus and cumulus clouds, thereby providing ideal conditions for understanding ACI. Two sets of simulations, one with predicted meteorology and the other with prescribed meteorology based on MERRA-2 for the same period are carried out in order to ascertain the impact of meteorology on the sensitivity relationships between cloud and aerosol variables. CFMIP Observations Simulator Package (COSP) output for cloud variables is used to make the comparison more robust. Simulation of cloud fraction with prescribed meteorology shows high agreement with the observations compared to the simulation results involving predicted meteorology indicating some deficiencies in the model simulated meteorology. Aerosol optical depth (τ_a) is underestimated in model simulation by almost a factor of 2 when compared with observation suggesting a compelling need for improving the aerosol inventories over the region. CAM5 simulates mostly cumulus clouds during the study period whereas both cumulus and stratocumulus clouds are clearly evident in the observations, which may contribute to the bias in ACI between model and observations. Cloud droplet number concentration (N_c) computed using identical formulation applied on model simulations and observation is noted to be higher in model simulations than in observations revealing a stronger ACI in model simulations. TIE, FIE, and SIE simulated by CAM5 using prescribed meteorology are comparatively closer to observations than in the simulation involving predicted meteorology indicating that the confounding influence of model simulated meteorological quantities on aerosol-cloud relationship in CAM5 needs to be resolved through more detailed assessment of ACI for making any realistic assessment of the impacts of aerosols on climate not just over South Asia but also globally. More results with greater details will be presented.

Keywords: Aerosol-cloud interaction, aerosol indirect effect, global climate model