2.097 Radiative properties of aerosols over central Indo-Gangetic Plain during variable monsoon scenarios.

Early Career Scientist

Presenting Author:
Manish Kumar, Institute of Environment and Sustainable Development, Banaras Hindu University, India, manishenvi@gmail.com

Co-Authors:
Made Pushpa Raju, Indian Institute of Tropical Meteorology, Pune, India.
Ram Sharan Singh, Department of Chemical Engineering and Technology, IIT-BHU, Varanasi, India
Tirthankar Banerjee, Institute of Environment and Sustainable Development, Banaras Hindu University, India

Abstract:

Observations on atmospheric aerosols were made to evaluate their radiative properties during typical monsoon season (June-September) from 2009 to 2011, and to recognize their impacts on aerosol radiative forcing. The entire Indian sub-continent experienced a drought year in 2009 before achieving a normal monsoon in 2010 and 2011. The ground station in Varanasi over central IGP experienced minimum monsoonal rain during 2009 drought year, which gradually increased during 2010 before achieving a normal monsoon in year 2011. The BC mass loading during drought year was relatively high compared to 2010 and 2011. The increase in BC aerosols especially during drought year was associated to lower wind speed and reduced rate of wet removal, which potentially enhanced BC loading in comparison to years with normal monsoon. Columnar aerosol loading in terms of aerosol optical depth (AOD) was retrieved from space-borne MODIS sensor on-board Terra satellite. It has revealed high AOD over Varanasi during drought (2009: 1.03 ± 0.15) and deficit monsoon (2010: 1.07 ± 0.53) before being reduced during 2011 (0.89 ± 0.20). Conclusively, a radiative transfer model was run to estimate the ARF for composite aerosols for both surface (SUF), atmosphere (ATM) and top of the atmosphere (TOA). The 2009 drought year was found to have reasonably higher ATM and SUF forcing (ATM: 105; SUF: − 122 W m^{-2}) in comparison to deficit (ATM: 61; SUF: − 88 W m^{-2}) and normal (ATM: 67; SUF: − 89 W m^{-2}) monsoon scenarios. The lower atmosphere heating rates during 2009 monsoon was also recorded to be as high as 2.9 K day^{-1} in comparison to 2010 (1.7 K day^{-1}) and 2011 (1.9 K day^{-1}). Such findings provide meaningful outcomes in terms of climatic effects of BC aerosols and their associated inference on Indian summer monsoon.