Summer Monsoon Rainfall over India and Aerosol Radiative Forcing During Deficit Monsoon Years

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The below normal or deficit monsoon rainfall years over India has increased in the last decade. The year 2009 experienced lowest rainfall during the last 35 years with AISMR (All India Summer Monsoon Rainfall) was 23% below the long period average. Though the El Niño-Southern Oscillation (ENSO) variability in the Pacific Ocean and Indian Ocean Dipole produces a response in the Asian monsoon variability, increasing green house gas emissions and aerosols loading could influence the seasonal rainfall distribution in the monsoon regions. The present study is motivated by the finding that the aerosol loading over the Indo-Gangetic plane, especially over the monsoon trough region was found to be enhanced during the deficit monsoon years.

Satellite derived aerosol optical depth (AOD) from MODIS and MISR for the years 2002, 2004 and 2009 were used to study the aerosol forcing during the deficit monsoon years. The Shortwave Radiative Forcing (SWARF) is computed over the Indian Ocean. It was found that during deficit monsoon years amount of short wave radiation reaching the surface is reduced by about 10-35 Wm^{-2} over the northern Indian Ocean (NIO) region. Numerical simulation with an Ocean General Circulation Model was performed with and without SWARF to understand the SST cooling in the presence of aerosol forcing in the NIO. The results showed that aerosol forcing is effective in reducing the shortwave radiation reaching the surface and reducing the SSTs in the NIO.

Keywords: Monsoon, Aerosol, Radiative forcing, SST