



Impacts of Direct and Indirect Effects of Anthropogenic Aerosols on Indian Summer Monsoon

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Recent studies have suggested that persistent direct forcing of anthropogenic aerosols, especially absorbing aerosols over Indian subcontinent, can alter the circulation and rainfall pattern besides quantity of Indian summer monsoon. Question also arises on whether the indirect aerosol effects would create an impact opposite to that of direct forcing. To better answer these questions, we have incorporated a multimodal, size and mixing dependent aerosol model (MARC) in the Community Earth System Model (CESM) of NCAR and US DOE. Besides the direct effect, aerosol indirect effects have also been included by coupling the MARC with the two moment Morrison and Gettelman cloud microphysical model in CESM. Several sets of long simulations using CESM with MARC and dynamical ocean GCM driven by interactively predicted aerosol and forcing or by prescribed forcing have been conducted, the pattern and quantity changes caused by both direct and indirect effects of aerosols are identified, the mechanisms behind these impacts are analyzed. Detailed analyses from our study on the aerosol-precipitation causal relations of Indian summer monsoon system will be presented.