SUN-SKY RADIOMETER STUDY OF MONSOON ACTIVITY OVER PUNE, INDIA

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Abstract

Aerosol-cloud-radiation interactions modulate monsoon activity, and related studies could serve as indicators for possible prediction and assessment of weather and climate on different spatial and temporal scales through circulation. Besides several thematic campaigns utilizing a variety of platforms including satellites, ground-based networks have been established to improve our understanding of the role of aerosols in the changing monsoon climate. Two such widely known networks over the globe are 'SKYNET' and 'AERONET' with Sun-sky radiometer as the principal equipment that characterizes aerosols and gases over different geographical locations under varied air mass conditions. Pune ($18^{o}43'$ N, $73^{o}51'$ E, 559 m above mean sea level), a fast growing urban city in India, is one of the sites where Prede (POM-01L, SKYNET) and Cimel (CE-318, AERONET) Sun-sky radiometers have been in operation since 2004. These radiometers have been extensively used in several studies related to stand-alone and coupled aerosol-cloud-climate processes. The Prede instrument at this site is being augmented to the network of Global Atmospheric Watch (GAW) program of World Meteorological Organization (WMO) to facilitate data coordination through the World Data Center for Aerosols (WDCA).

The present study envisages to understand the response of atmospheric constituents, through simultaneous operation of the radiometers amongst others, to the rainfall activity over Pune during two contrasting monsoon years of 2008 (active / normal, 98% of long period average (LPA) rainfall over the whole country) and 2009 (break / drought, 78% of LPA). The synthesis of data indicates that, apart from excellent agreement between the direct sun

observations, both radiometers capture well the monsoon features within the instrument density and efficacy of data retrieval algorithms involved. The aerosol products from satellite data, meteorological fields from NCEP/NCAR re-analysis and NOAA-HYSPLIT air-mass trajectory analysis during the study period have also been utilized. The chief results of the study include the following:

- Relatively higher aerosol optical depths (AODs) associated with larger Angstrom exponents (dominance of smaller particles) during 2009 by both Sun-sky radiometers, which corroborate lower precipitable water content, higher ground temperature and lower rainfall amount during the period.

- Relatively greater asymmetry factor (g) and lower single scattering albedo (SSA) during 2008 and vice-versa during 2009 observed by the Prede radiometer and converse in the case of Cimel radiometer, which coincide with smaller real and imaginary parts of aerosol refractive index of Prede as compared to those of Cimel during 2008 and 2009.

- Similar contribution to the monsoon activity from fine-mode segments of volume size distribution observed by Prede and Cimel, while significantly larger contribution from coarse-mode segment in the case of Prede during both years under study.

- The association between AOD and Angstrom exponent revealed abundance of desert dust (about 25 per cent), next to urban industrial aerosols (about 70 per cent), over the experimental station during drought year (2009) as opposed to the active monsoon year (2008).

More results of the analysis of data, extending to other monsoon years, from both Prede and Aeronet Sun-sky radiometers and *in-situ* observations will be presented. Such results would be useful for multi-parameter mapping of aerosols and their role in climate change.