

Seasonal variation of atmospheric aerosols and its impact on aerosol radiation forcing over Delhi

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Seasonal variability in suspended particulate matter concentration; optical properties of aerosol and radiation flux have been studied for Delhi station, India using long-term data that comprised of ground based and satellite-borne observations. Ground based measurements were taken by a hand-held portable spectrometer (MICROTOPS II, Solar Light Co. Inc., USA) operating at central wavelengths 340, 500, 675, 870, and 1020 nms (FWHM: $\pm 2-10$ nm). The global radiation flux was measured using the CM-21 pyranometer (Kipp and Zonen, Germany) for wavelength range 305-2800 nm. The flux for 290-320 nm wavelength range was measured using UV-Biometer (Solar Light Co. Inc., USA). The seasonal change in radiative forcing due to seasonal variability in number density and character of the aerosols is done using Santa Barbara Discrete Ordinate Radiation Transfer model (SBDART). Since the chemical character of the dominating aerosols for different season was not readily available, an estimation of the aerosol composition was done using Optical Properties of Aerosols and Cloud (OPAC) model. The output of the OPAC model gives the required parameters for the estimation of radiation forcing by SBDART. These include single scattering albedo and asymmetry parameter. Initial results reveal three specific seasonal characteristics of aerosols: pre-monsoon, post monsoon, and the winter (excluding monsoon period, when data is highly irregular due to predominantly cloudy conditions and heavy downpour). During pre-monsoon, high aerosol optical depth (AOD) and near zero (often negative) Angstrom exponent (α) is found, which indicates the dominance of desert aerosols. The post monsoon shows moderate-to-low AOD associated with the high α . The association indicates dominance of anthropogenic pollution. The winter, which shows moderate-high AOD associated with the moderate-high α , indicates mixed aerosols characteristics. The results may be viewed in relation to the land cover-land use changes and wind pattern around Delhi. During pre-monsoon period the land around Delhi is generally arid and barren. During post monsoon, it is covered with dense agricultural crops and during winter it is partially covered with agricultural crops and partially barren. These three phenomena of land cover change during the season are reflected in the AOD variability, and in the radiation forcing.