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Atmospheric Black Carbon: Characterization and Deposition over Semiarid Region of Indo-Gangetic Basin †

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Abstract: The present study deals with the measurements of mass concentration, determination of sources and dry deposition flux, and estimation of radiative forcing of BC at Agra over the semiarid region of the Indo-Gangetic basin. The atmospheric concentration of black carbon was quite higher than earlier reported studies at different world sites while within the range reported at different sites of the Indo-Gangetic basin. BC concentration was highest in post-monsoon, followed by winter, summer, and monsoon. The results suggested temporal, diurnal, monthly, seasonal, and annual variation in BC concentration, while ANOVA revealed significant seasonal variation. The black carbon concentration was found high when wind speed was moderate irrespective of the wind direction. This suggests that meteorology plays a vital role. BC contribution towards total fine particulate matter was about 10%. Source interpretation of black carbon based on the ratio ($R_{370/880}$), absorption coefficient (ßabs), absorption angstrom exponent (AAE), and fractionation revealed the dominance of fossil fuel contribution throughout the year. SEM-EDX analysis has revealed the contribution of neighboring particles/components in the absorption properties of soot particles. Dry deposition of black carbon has been measured. The dry deposition flux was highest in post-monsoon, followed by winter, summer, and monsoon. A computational model has been developed to estimate the dry deposition velocity by the inferential method. The dry deposition flux of black carbon inferred by the present theoretical method was comparable to the value obtained by the direct measurement method. This is the first of its kind of report from India on measuring the dry deposition flux of BC. First-time study on radiative forcing due to black carbon has been estimated using the OPAC and SBDART model. Radiative forcing due to black carbon was negative at the surface while positive at the TOA (top of the atmosphere). The radiative forcing of black carbon was highest in the post-monsoon season. Black carbon contribution towards composite aerosol radiative forcing over this region was 67.8 %.

Keywords: Atmospheric Black Carbon; Indo-Gangetic Basin; SEM-EDX (List three to ten pertinent keywords specific to the article; yet reasonably common within the subject discipline.)

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Conflicts of Interest

The authors declare no conflict of interest.