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Influence of Brown Carbon Aerosols on Absorption Enhancement and Radiative Forcing

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This study presents aerosol mass and optical properties measured during winter-spring months (February-March) of two consecutive years (2013-2014) from Kanpur, India located inside Gangetic Plain. Spectral absorption and scattering coefficients (405, 532 and 781 nm) of both atmospheric and denuded (at 300° C) is measured using a 3 wavelength Photo Acoustic Soot Spectrometer (PASS 3). Ratio between the atmospheric and denuded absorption is reported as enhancement in absorption (Eabs). Eabs values shows presence of large quantities of Brown Carbon (BrC) aerosols in the location. Diurnal trend of Eabs shows similar patterns at 405 and 532 nm. But at 781 nm Eabs values increased during day time (10:00 to 18:00) while that 405 and 532 nm decreased. Positive Matrix Analysis (PMF) of organic aerosols measured using HR-ToF-AMS shows factors with different trends with total absorption. Semi-volatile factor (SV-OOA) show no correlation with absorption but other factors such as Low-volatile (LV-OOA), Hydrocarbon (HOA) and Biomass burning (BBOA) organic aerosols shows a positive trend. All factors shows good correlation with scattering coefficient. Also a strong dependence of absorption is observed at 405 and 532 nm and a weak dependence at 781 nm is observed during regression analysis with factors and mass loading. We also present direct radiative forcing (DRF) calculated from measured optical properties due to total aerosol loading and only due to BrC. Total and BrC aerosol DRF shows cooling trends at top of atmosphere (TOA) and surface and warming trend in atmosphere. Days with biomass burning events shows increase in magnitude of DRF at atmosphere and surface up to 30 % corresponding to clear days. TOA forcing during biomass burning days shows increase in magnitude indicating change from negative to less negative.