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Investigation of atmospheric aerosols over semi-urban and urban areas in Eastern Indo-Gangetic Plain: seasonal variability and source apportionment using PMF

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The study investigates the chemical composition and source of aerosol origin at a semi-urban (Kharagpur–Kgp) and urban (Kolkata–Kol) region during the period February 2015 to January 2016 and September 2010 to August 2011 respectively. Major water-soluble inorganic aerosols (WSII) were determined using Ion chromatography and carbonaceous aerosols (CA) using OC–EC analyser. A multivariate factor analysis Positive Matrix Factorization (PMF) was used in resolving source of aerosols at the study locations. Seasonal analysis of WSII at Kgp and Kol indicated relative dominance of calcium at both the places followed by sodium, chloride, and magnesium ions. Non-sea salt potassium (nss–K⁺), a biomass burning tracer was found higher at Kol than at Kgp. Sum of secondary aerosols sulphate (SO₄²⁻), nitrate (NO₃⁻) and ammonium (NH₄⁺) was higher at Kol than Kgp with relative concentration of SO₄²⁻ being higher than NO₃⁻ at Kgp which was vice-versa at Kol. Examination of carbonaceous aerosols showed three times higher concentration of organic carbon (OC) than elemental carbon (EC) with monthly mean of OC/EC ratio > 2, indicating likely formation of secondary organic carbon formation. Seasonal influence of biomass burning inferred from nss–K⁺ (OC/EC) ratio relationship indicated dissimilarity in seasonality of biomass burning at Kgp (Kol). PMF resolved sources for Kgp constituted of secondary aerosol emissions, biomass burning, fugitive dust, marine aerosols, crustal dust and emissions from brick kilns while for Kol factors constituted of burning of waste, resuspended paved road dust, coal combustion, sea spray aerosols, vehicular emissions and biomass burning.