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Analysis of seasonal inorganic chemistry of aerosols with source attribution in a peri-urban landscape in lower Gangetic basin

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Aerosols play a significant role in Indian seasonal variation. In this study, inorganic chemistry of the atmospheric aerosols including the gaseous pollutants, such as SO_2, NO_2, and NH_3, were analyzed during seasonal variation (pre-monsoon, monsoon, post-monsoon, and winter seasons) in a peri-urban location in the lower Gangetic basin (LGP). The aerosol inorganic chemistry was analyzed for the surface concentration of NO_3, SO_4, and NH_4. The aerosol samples including gaseous compounds were collected using a high-volume sampler (HVS) (passive), and through dry deposition (active) on to a petri dish. The samples were collected from March 2019 to February 2020, with a sampling frequency of twice a week. The average dust flux was found around 9.85 and 15.49 ug $cm^{-2}h^{-1}$ in pre-monsoon, 5.298 and 5.432 ug $cm^{-2}h^{-1}$ in monsoon, 12.04 and 16.15 ug $cm^{-2}h^{-1}$ in post-monsoon and 12.28 and 16.84 ug $cm^{-2}h^{-1}$ in winter season through active and passive methods, correspondingly. The estimated SO_2, NO_2, and NH_3 were 14.32, 9.22, and 23.49 ug m^{-3} in pre-monsoon, 18.335, 8.277, and 22.855 ug m^{-3} in monsoon, 29.83, 5.28 and 24.85 ug m^{-3} in post-monsoon and 22.56, 10.68 and 22.46 ug m^{-3} in winter season respectively. The estimated SO_4, NO_3 and NH_4 were 0.07, 0.04 and 0.1 µg cm^{-2} in pre-monsoon, 0.1, 0.04, and 0.06 µg cm^{-2} in monsoon, 0.09, 0.04, and 0.07 µg cm^{-2} in post-monsoon and 0.08, 0.02 and 0.07 in winter season, respectively. The correlations of the gaseous components with components derived from the aerosol surface remain weak, however positive in most of the seasons, suggesting no significant uptake of the gaseous pollutant by the aerosols. The linear modeling of these chemical species with the weather parameters (temperature, RH, and wind speed) including AOD, derived from MODIS, showed dynamic relationships implying a significant modification of atmospheric properties moderated by the weather parameters. The HYSPLIT model of 3 days' back trajectory and PSCF model indicated during pre-monsoon, post-monsoon, and winter seasons 60-80% cluster and aerosol were originated from the IGP, east-coast, and eastern part of India, however during monsoons season 70-80% cluster and aerosol were originated from the Arabian sea and the Bay of Bengal, suggesting the nearby dominated local sources of these aerosol components.