

Temporal variability in aerosol composition at an urban site, Varanasi in the eastern Indo-Gangetic Plain

Kirpa Ram (1), Stefan Norra (2), Chen Yuan (2), Rangu Venkata Satish (3), and Neeraj Rastogi (3)

(1) Banaras Hindu University, Institute of Environment and Sustainable Development, Varanasi, India (kirpa81@gmail.com), (2) Institute of Applied Geosciences, Karlsruhe Institute of Technology, Karlsruhe, Germany, (3) Physical research Laboratory, Ahmedabad-380009

PM_{2.5} aerosol samples (n=31) were collected from an urban site, Varanasi (25° 28'N, 83°0' E) in the eastern Indo-Gangetic Plain during May 2015 to March 2016 using a mini-volume sampler (Leckel GmbH, Germany) at a flow rate of 200 l/hr. The PM_{2.5} samples were integrated for 7 days and were analyzed for organic and elemental carbon (OC & EC), water-soluble OC (WSOC), organic and inorganic nitrogen (ON & IN) and water-soluble inorganic species (WSIS) to study the geochemical behavior of aerosols. The mass concentration of OC and EC varies from 4.2 to 105.2 (average: 32.8) $\mu\text{g m}^{-3}$ and 1.2 to 7.0 (average: 4.6) $\mu\text{g m}^{-3}$ during the study period with total carbonaceous aerosols (TCA=1.6*OC+EC), on an average, accounting for ~59% of PM_{2.5} mass. Relatively high WSOC/OC ratio (average: 0.55±0.18; range 0.18-0.86) indicate a significant contribution from the secondary organic aerosols at Varanasi. The concentration of ON varies from less than detection limit to 5.3 (average: 2.4) $\mu\text{g m}^{-3}$ which contribute to ~12% of WSOC highlighting the presence of nitro-organic compounds in aerosols at Varanasi. The average WSIS contribution to PM_{2.5} is only 17% with a strong seasonal variability (range: 4-36%). Generally, carbonaceous and inorganic aerosol concentration is higher during winter, fall and post-monsoon than those in the summer when dust aerosol contribution is significant (as high as 75% of PM_{2.5} mass). This study highlights the role of nitro-organic compounds in secondary organic aerosols which is lacking in Indian aerosols. Furthermore, these aerosol samples could be very important for the study of particle morphology and composition using scanning-electron Microscope-Energy Dispersive X-ray due to lower impaction in the mini-volume sampler.