Atmospheric Mineral Dust, Chemistry and Temporal variability in western India

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The mass fraction of atmospheric mineral dust, its chemical characteristics and temporal variability have been studied based on PM_{10} and $PM_{2.5}$ sampling from a high-altitude site (Mt. Abu) in semi-arid region of western India. A uniform and dominant contribution (60 – 80 %) of mineral dust in PM_{10} is a conspicuous feature of the year- round temporal data. The Fe/Al ratio averages around 0.5 in the coarse fraction, somewhat similar to their ratio in the upper continental crust (0.44). However, Ca/Al and Mg/Al weight ratios show relative enrichment of Ca and Mg, indicating their dominant contribution from carbonate minerals [1]. The impact of anthropogenic sources is significantly pronounced in the fine mode during Nov-Feb (winter), as evident from increase in the concentrations of nss-SO_4^{2-} and NH_4^+ as well as enrichment of Fe (Fe/Al ratio: 0.5 to 1.0). This is attributed to the down-wind advective transport of pollutants from large-scale biomass burning, industrial and fossil-fuel emission sources in the Indo-Gangetic Plain (northern India). The water-soluble ionic species (WSIS) constitutes 50 % of the $PM_{2.5}$ mass during winter with dominant contribution from SO_4^{2-} and NH_4^+. In the coarse mode, WSIS contribution to aerosol mass is consistently low (average ~ 20 %) with predominance of Ca^{2+} and HCO_3^-. The neutralizing capacity of mineral dust for acidic species (SO_4^{2-} and NO_3^-) is near quantitative (95 %) in the coarse mode; whereas NH_4^+ is a major neutralizing constituent in the $PM_{2.5}$ [2]. The nature of atmospheric transformation processes occurring in the arid and semi-arid region could, thus, play an important role in climate-chemistry interactions.

References

[1] A. Kumar and M.M. Sarin, *Atmos. Env.*, **43**, 4005-4013 (2009), doi: 10.1016/ j.atmosenv.2009.05. 014.
[2] A. Kumar and M.M. Sarin, *Atmos. Env.*, **44**, 1245-1254 (2010), doi: 10.1016/ j.atmosenv.2009.12. 035.