**PM$_{2.5}$/PM$_{10}$ ratio characteristics over urban sites of India**

**Abstract**

The PM$_{2.5}$/PM$_{10}$ ratio (PM$_{2.5}$ and PM$_{10}$ are defined as mass concentration of particles having aerodynamic diameter less than 2.5 and 10 µm respectively) is one of the important parameters in understanding the severity of the fine mode surface particulate matter pollution. The present study characterises PM$_{2.5}$/PM$_{10}$ ratio estimates from eight Indian urban sites with varying levels of urbanization. Five years (2015–2019) of collocated PM$_{2.5}$, PM$_{10}$, and meteorological (ambient temperature, relative humidity (RH), and wind speed) measurements are used to understand the spatial and temporal variability in the PM$_{2.5}$/PM$_{10}$ ratio at different scales and to investigate its relationship with meteorological parameters. Over the study sites, the seasonal mean PM$_{2.5}$/PM$_{10}$ ratio varied between 0.31 ± 0.08 (mean ± standard deviation) and 0.65 ± 0.13. Seasonally, the highest PM$_{2.5}$/PM$_{10}$ ratio was observed during winter and post-monsoon seasons. Sites in the Indo-Gangetic Plain (IGP) exhibited higher PM levels (PM$_{2.5}$ and PM$_{10}$) and higher PM$_{2.5}$/PM$_{10}$ ratios than the corresponding values recorded at other sites. The seasonal mean PM$_{2.5}$/PM$_{10}$ ratio estimated (over the study sites) using MERRA-2 (Modern-Era Retrospective Analysis for Research and Applications, version 2) ranged between 0.25 ± 0.08 and 0.77 ± 0.16, and exhibited consistent overestimation (when compared to values derived from measurements) during winter and pre-monsoon seasons. Grossly, the PM$_{2.5}$/PM$_{10}$ ratio exhibited a weak association with meteorological parameters. Interestingly, despite variations in geography, population, anthropogenic activities and PM concentrations across seasons and sites, the PM$_{2.5}$/PM$_{10}$ ratio showed low variability.

**Keywords**

MERRA-2; Air-pollution; Fine-mode