

PM_{2.5}/PM₁₀ ratio characteristics over urban sites of India

Abstract

The PM_{2.5}/PM₁₀ ratio (PM_{2.5} and PM₁₀ 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}/PM₁₀ ratio estimates from eight Indian urban sites with varying levels of urbanization. Five years (2015–2019) of collocated PM_{2.5}, PM₁₀, 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}/PM₁₀ ratio at different scales and to investigate its relationship with meteorological parameters. Over the study sites, the seasonal mean PM_{2.5}/PM₁₀ ratio varied between 0.31 ± 0.08 (mean \pm standard deviation) and 0.65 ± 0.13 . Seasonally, the highest PM_{2.5}/PM₁₀ ratio was observed during winter and post-monsoon seasons. Sites in the Indo-Gangetic Plain (IGP) exhibited higher PM levels (PM_{2.5} and PM₁₀) and higher PM_{2.5}/PM₁₀ ratios than the corresponding values recorded at other sites. The seasonal mean PM_{2.5}/PM₁₀ 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}/PM₁₀ 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}/PM₁₀ ratio showed low variability.

Keywords

MERRA-2; Air-pollution; Fine-mode