

# **Diurnal and Seasonal Variability of PM<sub>2.5</sub> Under Different Geographical Locations over Indian Region**

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## **Abstract**

Present study is an attempt to analyze the variability and trend of PM<sub>2.5</sub> concentration in four Indian megacities (Delhi, Mumbai, Vishakhapatnam and Shillong) for five years i.e. 2018–2022. The study reveals that Delhi experienced maximum days having the worst air quality followed by Mumbai and Vishakhapatnam. Distinct diurnal, seasonal, and annual variations are observed in selected cities due to different geographical locations and prevailing local meteorology. It was noted that all locations show clear seasonality having the highest concentrations in winter and lowest in monsoon season. Statistical analysis suggests a decreasing trend during 2018-2020 for all observing stations due to prevailing COVID-19 lockdown conditions. Also, each city shows morning (~08:00–10:00h) and evening peaks (~21:00–23:00h) due to traffic movement along with lowest level in late afternoon hours (~15:00–16:00h). The coastal cities i.e., Mumbai and Vishakhapatnam show sharp peaks during morning traffic hours, whereas Delhi and Shillong have higher values of PM<sub>2.5</sub> during night-time. This suggests that day-time maxima in coastal areas is possibly due to high local emissions and less dispersion due to high humid conditions. However, increased traffic emissions, cooking and residential heating along with nocturnal boundary layer conditions i.e., surface inversion and low wind speed restricts the dispersion of PM<sub>2.5</sub> pollution leading to high levels in night-time over Delhi. Whereas, the single early evening (~18:00-21:00h) peak observed over Shillong (high-altitude location) might be due to sudden decrease in boundary layer height, a common phenomenon over such locations. Also, local emissions from anthropogenic sources are responsible for an early evening high peak over Shillong. The study also observes that the PM<sub>2.5</sub> levels over the considered cities exceed Indian NAAQS for 50-60% of days in a year except for Shillong due to its geography and climate. Overall study concludes that meteorology has a complex role in PM<sub>2.5</sub> concentration of selected areas.

## **Early Career Scientist**

YES, I am an early career scientist.

## **IGAC Activities**

ACAM: Atmospheric Chemistry and the Asian Monsoon, MAP-AQ: Monitoring, Analysis and Prediction of Air Quality