NCAP-COALESCE
CarbOnaceous AerosoL Emissions, Source apportionment & ClimatE impacts
Understanding scientific complexities related to carbonaceous aerosols focussing on issues underlying their origin and fate, and their role as drivers of regional climate change over India.

Research BRIEFS

Year-long evaluation of aerosol chemistry and meteorological implications of $PM_{2.5}$ in an urban area of the Brahmaputra Valley, India

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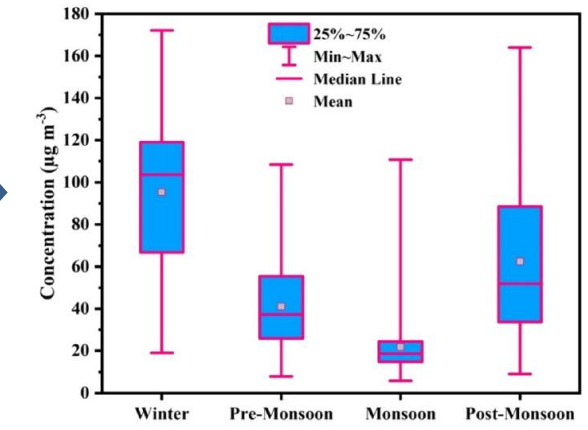

Fig. 2 Box–whisker plot showing the seasonal variation of $PM_{2.5}$

Key highlights:

- Analyses mass concentrations and chemical compositions of $PM_{2.5}$ in an urban area of Northeast India
- The annual mean $PM_{2.5}$ concentration of 48.9 ± 37.7 mg m^{-3} observed; approximately ten times higher than the prescribed WHO safe limit
- $PM_{2.5}$ mass is mainly contains WSIs (~30%), carbonaceous matter (~21%), and inorganic elements (~9%)
- High concentrations of SO_4^{2-}, NO^{3-}, and soot-EC found during the winter
- Need to consider local emission sources and meteorological conditions in small and growing urban areas to improve air quality

Research Summary:

Atmospheric particulate matter contributes to deteriorating air quality, causes respiratory and cardiovascular diseases, and risks human health. This study evaluates the mass concentrations and chemical compositions of $PM_{2.5}$ in an urban area of Northeast India to determine their seasonal variations and the influence of meteorological factors on $PM_{2.5}$. The water-soluble inorganic ions (WSIs), elemental compositions, and organic carbon (OC)-elemental carbon (EC) were determined by using an ion chromatograph, an energy dispersive X-ray fluorescence spectrometer, and a multi-wavelength thermo-optical carbon analyzer, respectively.

The annual mean $PM_{2.5}$ concentration (48.9 ± 37.7 mg m^{-3}) was observed to be approximately ten times higher than the prescribed WHO safe limit. The results show that the $PM_{2.5}$ mass is mainly contributed by WSIs (~30%), carbonaceous matter (~21%), and inorganic elements (~9%). Seasonal analysis also shows the highest concentration of $PM_{2.5}$ in the winter season (95.3 ± 37.9 mg m^{-3}), which was mainly contributed by the WSIs (22.7 ± 8.1 mg m^{-3}) and carbonaceous matter (26.9 ± 13.9 mg m^{-3}). High concentrations of SO_4^{2-}, NO^{3-}, and soot-EC were found during the winter, indicating the dominance of coal combustion and vehicular source emissions in the region. Meteorological factors such as humidity, wind speed, and temperature along with the transport of regional air masses significantly influenced the PM concentrations of the Brahmaputra Valley in Northeast India. The study implies the necessity of paying attention to the local emission sources and the meteorological conditions in such growing urban areas for improving air quality.

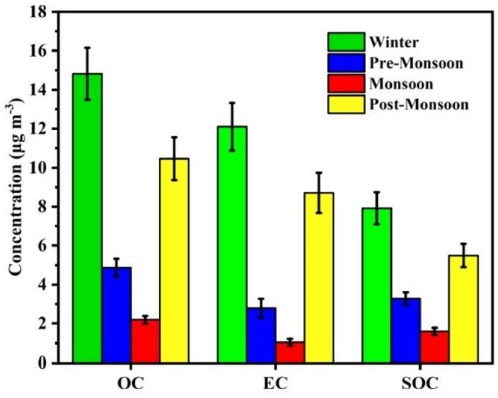

Fig. 6 Seasonal variation of OC, EC, and SOC during the year 2019

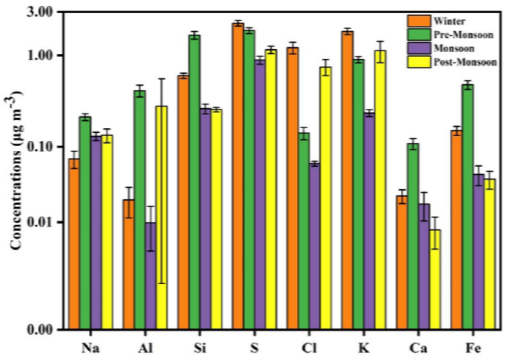

Fig. 4 Seasonal variation of major inorganic element concentrations

Take away/conclusion :

- To determine seasonal variations and the influence of meteorological factors on $PM_{2.5}$, this study uses ambient aerosol sampled data of one year and evaluate its mass concentrations and chemical compositions in an urban area of Northeast India
- Annual mean $PM_{2.5}$ concentration of 48.9 ± 37.7 mg m^{-3} was observed
- WSIs (~30%), carbonaceous matter (~21%), and inorganic elements (~9%) are major contributors of $PM_{2.5}$ mass
- Highest concentration of $PM_{2.5}$ is in winter season (95.3 ± 37.9 mg m^{-3})
- High concentrations of SO_4^{2-}, NO^{3-}, and soot-EC found during the winter, indicating the dominance of coal combustion & vehicular source
- Meteorological factors such as humidity, wind speed, and temperature along with the transport of regional air masses significantly influence the PM concentrations of the Brahmaputra Valley
- It is necessary to consider local emission sources and meteorological conditions in small and growing urban areas to improve air quality

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