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

Meteorological Influence and Chemical Compositions of Atmospheric Particulate Matters in an Indian Urban Area

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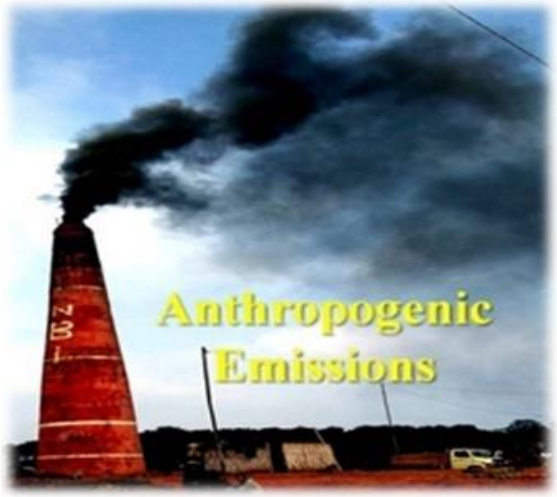

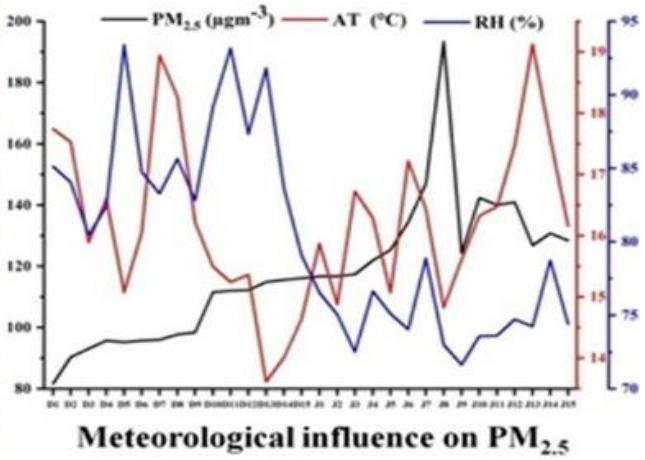

Key highlights:

- Sampling and chemical analysis of $PM_{2.5}$ were carried out for two winter months to determine their chemical components and possible emission sources
- Average concentration $PM_{2.5}$ was found to be 117.75 μg m^{-3}, exceeding NAAQS standard of 60 μg m^{-3}
- Formation of NH_4NO_3 and $(NH_4)_2SO_4$ as major ammonium products with high ammonium concentration was identified as reason of $PM_{2.5}$ alkaline nature
- Coal and biomass burning identified as the main contributor to higher $PM_{2.5}$ concentration

Research Summary:

Meteorological conditions essentially impact the emission, distribution, formation, and characteristics of particulate matter in the atmosphere. In this study, sampling and chemical analysis of $PM_{2.5}$ were carried out for about two winter months during December 2018 and January 2019 to determine their chemical components and possible emission sources in a Northeast Indian urban area (Jorhat). $PM_{2.5}$ mass concentrations were observed to be varying from 81.65 to 193.34 μg m^{-3} with an average of 117.75 μg m^{-3}, exceeding the permissible limit (60 μg m^{-3}) of the National Ambient Air Quality Standards (NAAQS) of India.

The average total water-soluble ions account for 12.27% of total $PM_{2.5}$ mass, of which anions contributed up to 50.52% and cations contributed 49.48%. The correlations among the water soluble ionic species indicate the formation of NH_4NO_3 and $(NH_4)_2SO_4$ as major ammonium products with high ammonium concentration (30.73% of the total water-soluble aerosol mass) making the $PM_{2.5}$ alkaline. A high concentration of acenaphthylene and naphthalene was also found out of the 16 US EPA poly-aromatic hydrocarbons (PAHs). The correlation study between the chemical components and the meteorological parameters pointed out coal and biomass burning as the main contributor to such high winter loading in Northeast India. Also, the formation of secondary organic carbon up to 21.84 μg m^{-3} was observed due to suitable meteorological conditions during winter.

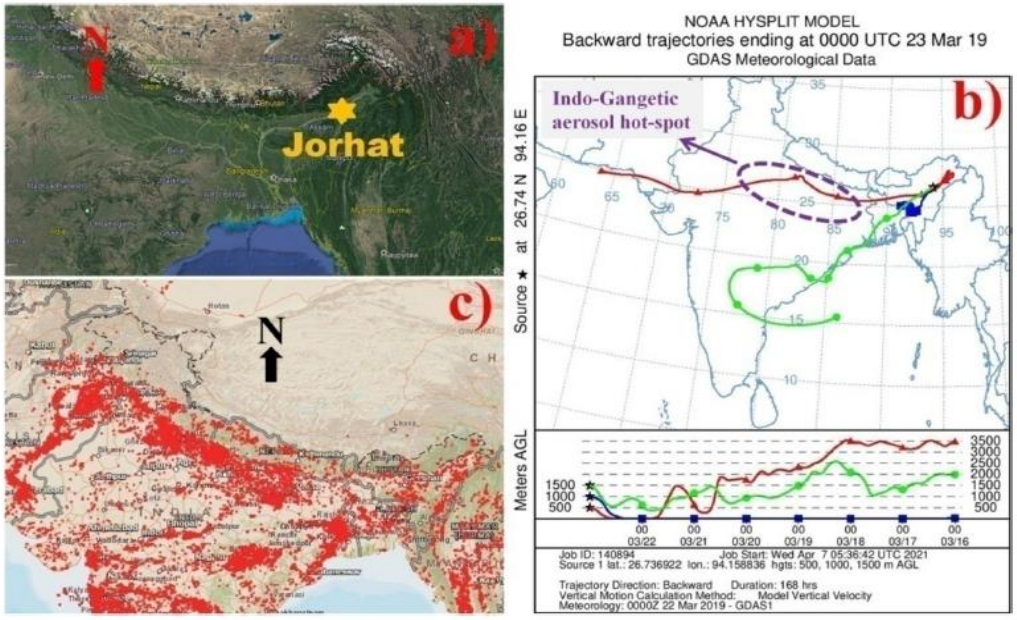

Figure 1. Sampling location: (a) Jorhat city is located at the center of the Brahmaputra valley; (b) seven day back trajectories (representative) reconstructed by the HYSPLIT model for every sampling day showing the long-distance movement of air-masses from the Indo-Gangetic aerosol hot-spot region to the sampling site (red: 500 m AGL, blue: 1000 m AGL, green: 1500 m AGL); (c) fire count map (during December 2018) retrieved from NASA FIRMS showing fire episodes around the sampling site.

Take away/conclusion :

- To determine the chemical components of $PM_{2.5}$ and its possible emission sources in a Northeast Indian urban area (Jorhat), sampling and chemical analysis were carried out for two winter months
- $PM_{2.5}$ mass concentrations ranged from 81.65 to 193.34 μg m^{-3} with an average of 117.75 μg m^{-3}, exceeding the permissible limit of 60 μg m^{-3} of National Ambient Air Quality Standards (NAAQS) of India.
- Total $PM_{2.5}$ contains 12.27% of average total water-soluble ions, of which anions contributed up to 50.52% and cations contributed 49.48%
- The obtained $PM_{2.5}$ is alkaline in nature due to formation of NH_4NO_3 and $(NH_4)_2SO_4$ as major ammonium products with 30.7% ammonium concentration
- Coal and biomass burning identified as the main contributor to such high winter loading in Northeast India

Research Article

Citation

Rabha, S., et al., Meteorological Influence and Chemical Compositions of Atmospheric Particulate Matters in an Indian Urban Area. ACS Earth and Space chemistry

Link:

https://doi.org/10.1021/acsearthspacechem.1c00037

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