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

Carbonaceous aerosol emissions sources – dominate India's wintertime air quality

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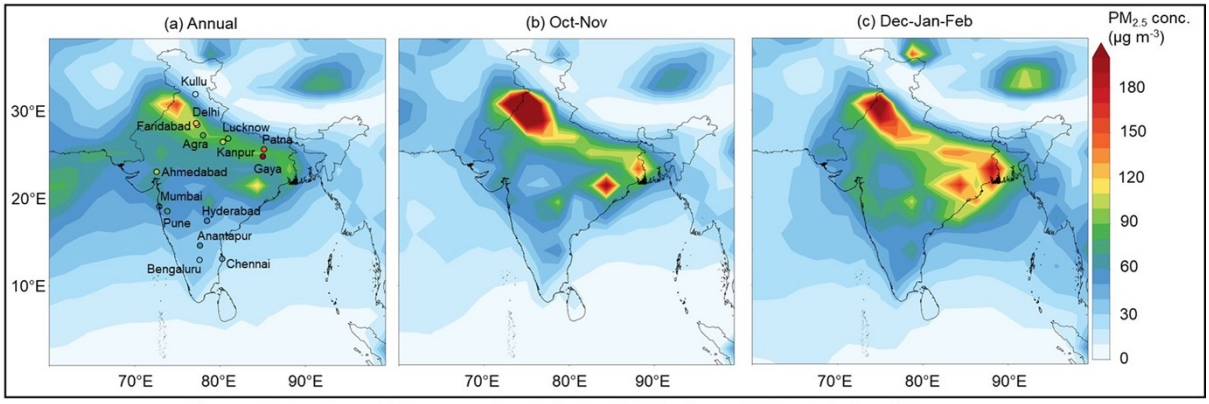

Figure 1. Simulated mean $PM_{2.5}$ concentrations for (a) Annual (b) Oct-Nov and (c) Dec-Jan-Feb periods.

Key highlights:

- Simulated wintertime air quality in Oct–Nov and Dec–Jan-Feb is significantly degraded compared to annual mean levels.
- Agricultural residue burning emissions, in north–west India, dominate in Oct–Nov, but residential biomass emissions, over the entirety of north India, dominate in Dec–Feb.
- Carbonaceous aerosol emission sources, including residential, agricultural residue burning, and brick production, dominate emissions of both primary $PM_{2.5}$ and SLCPs.

Summary of your Research:

Exposure to fine particles (particle mass with aerodynamic diameter <2.5 µm, or $PM_{2.5}$), constitutes a grave public health problem in India. Several cities, including Delhi, Raipur, Gwalior, and Lucknow, rank among the world's top 10 polluted cities (Stanaway et al., 2018). Wintertime air quality, especially in northern India, is degraded to much greater levels than the annual average from an interplay between meteorological conditions of lower surface winds and shallower mixed layer depths (Tiwari et al., 2013) and seasonal influences of biomass burning and secondary processes (Rengarajan et al.,

2011; Pant et al., 2015; Guo et al., 2017; Jain et al., 2017). The influences of "carbonaceous aerosol" emission sources (in residential, agriculture, informal industry and waste sectors) and "stationary" sources (largely industry, electricity generation and transport) on air pollution are investigated using model simulations with different emission levels. Seasonally, there is a significant contribution from carbonaceous aerosol emission sources to wintertime and post-monsoon $PM_{2.5}$ levels, ranging from 50–70% -in northern Indian states and 30-70% in peninsular India and the rest of India. The dominance of carbonaceous aerosol sources of air pollution arises from largely sources like residential-biomass cooking/heating and agricultural residue burning, which have the largest emissions. Thus, bringing carbonaceous aerosol sectors like residential, agriculture and brick production under the joint purview of clean air and climate action is crucial to achieving air quality and near-term climate change amelioration in the Indian region.

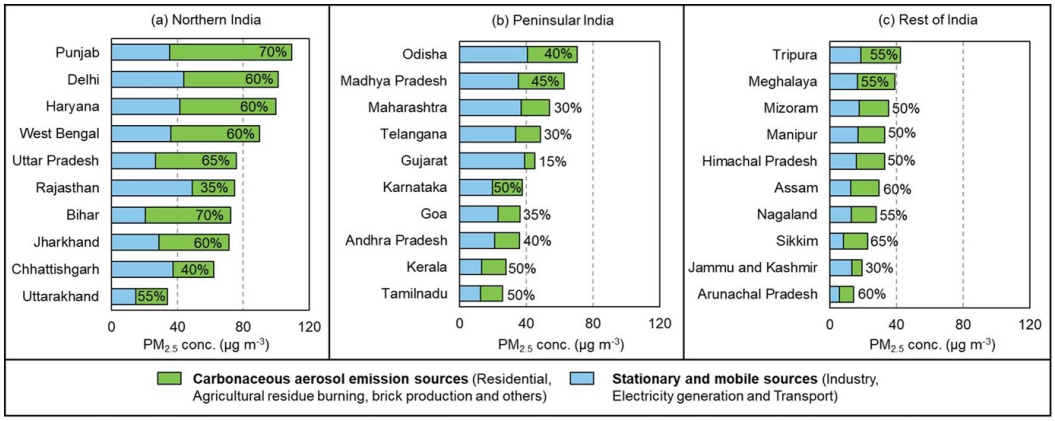

Figure 2. Annual $PM_{2.5}$ concentrations and percent contribution of carbonaceous aerosol emission sources for major states of India

Take away/conclusion :

- The existing measures addressing industrial and transportation sources and mitigating carbonaceous aerosol emission sources are important to both India's air quality and near-term climate concerns. Achieving this requires explicit mechanisms for synergy among ongoing initiatives, coordinated by different ministries and tasked to different implementing agencies to reduce emissions.
- Importantly, national and state-level of climate change action plans must be coordinated with city-level plans of the national clean air program.
- Bringing carbonaceous aerosol sectors like residential, agriculture and brick production under the joint purview of clean air and climate action is crucial to achieving air quality and near-term climate change amelioration in the Indian region.

Research Article citation

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