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

Black carbon health impacts in the Indo-Gangetic plain: Exposures, risks, and mitigation

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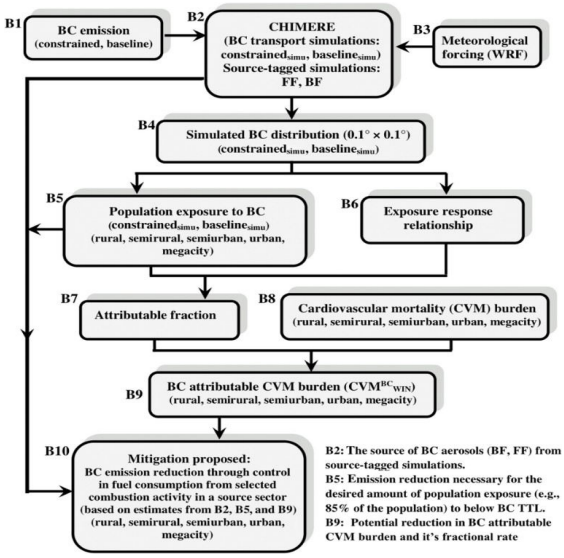

Figure. Integrated modeling framework
Flowchart of the methodology to estimate the magnitude of BC-attributable health impacts and mitigation strategies targeting sustainable BC emission reduction for health benefits. The various blocks in the flowchart are enumerated as B1, B2, B3, ..., B10. BF, biofuel; FF, fossil fuel; TTL, theoretical threshold limit; WRF, Weather Research and Forecasting model. The BC health impact metrics and the proposed mitigation analyzed domain-wide for area types (rural, semirural, semiurban, urban, and megacity) are marked in specific blocks.

Key highlights:

- A large discrepancy between simulated and observed Black Carbon (BC) surface concentrations over the densely populated Indo-Gangetic plain (IGP) has so far limited our ability to assess the magnitude of BC health impacts in terms of population exposure, morbidity, and mortality.
- Population exposure to BC is notable, with more than 60 million people identified as living in hotspots of BC concentration (wintertime mean, >20 µg m−3).
- The semiurban area comprised about 49% of the total BC-attributable cardiovascular mortality (CVM) burden over the IGP.
- More than 400,000 lives can potentially be saved from CVM

Summary of your Research:

BC aerosols are mainly emitted from incomplete combustion processes, whether it is from combustion engines in the automobile sector, residential burning of wood and coal, industrial power stations using heavy oil or coal, field burning of agricultural wastes, or forest and vegetation fires. In this study, to estimate the magnitude of BC-attributable health impacts concerning population exposure, morbidity, and mortality and targeting BC emission abatement for health benefits, an integrated modeling framework as implemented in the present study is shown in Fig. 1. We obtain a spatially and temporally fine resolved gridded distribution of surface BC concentration for the wintertime over the IGP through BC transport simulations in a chemical transport model [CHIMERE (12)].

- annually by implementing prioritized emission reduction from the combustion of domestic biofuel in the semiurban area, diesel oil in transportation, and coal in thermal power plant and brick kiln industries in megacities.

Population exposure to BC and the exposure response have been analysed. Also, to counter the CVM burden attributable to BC the mitigation approach has been proposed for rural, semirural, semiurban, and urban megacity in IGP.

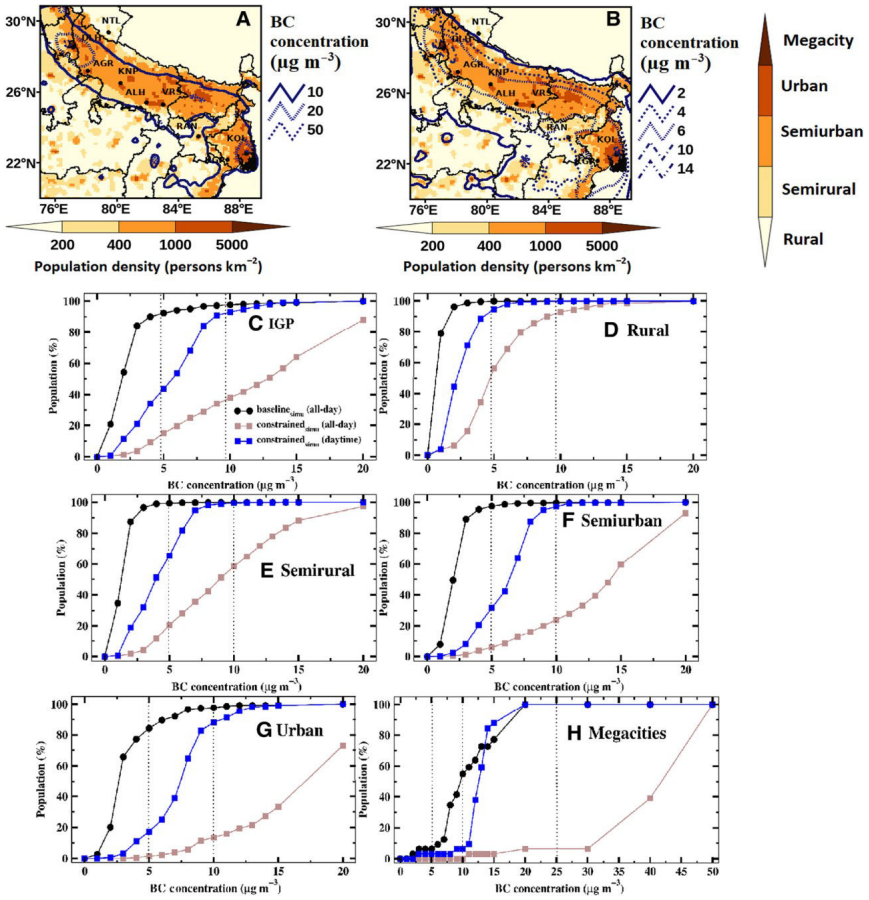

Figure. Spatially mapped population density with contours of BC concentration and area-wide cumulative population exposures to BC.

Take away/conclusion :

- This study provides the first evaluation of disease burden attributable to BC exposure over the Indian region using a successfully predicted BC distribution combined with consistent health functions for BC.
- Our study ascertains the WHO suggestion that BC should serve as an indicator, in addition to PM2.5, to quantify human exposure to airborne pollution.
- We assert BC as an additional indicator is specifically required over regions with a significant BC burden such as the IGP.
- This study pushes policy-makers toward sustainable mitigation of emissions considering the sources of combustion PM (rather than bulk PM mass) and providing health benefits to more than 300 million persons living in the IGP exposed to enormous BC concentration above the desired TTL.

Research Article citation

Verma, S., Ghosh, S., Boucher, O., Wang, R., & Menut, L. (2022). Black carbon health impacts in the Indo-Gangetic plain: Exposures, risks, and mitigation. Science Advances, 8(31), eabo4093. https://doi.org/10.1126/sciadv.abo4093

Link:

https://doi.org/10.1126/sciadv.abo4093

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