



Genesis of Extreme Black Carbon Events and their Impact on Atmospheric Dynamics over a Polluted Metropolis Near Land-Sea Boundary

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The present investigation outlines the aspects that influence the black carbon (BC) concentrations over an urban polluted metropolis, Kolkata (22.57° N, 88.37° E). Located in the IGP (Indo Gangetic Plain) outflow region and close to the land-ocean boundary, Kolkata is subject to contrasting seasonal maritime airflow from the Bay of Bengal (BoB) and continental air mass from the IGP, which modulates the local concentration of BC [1]. The origin of aerosol transport and atmospheric dynamics associated with high and low BC activities over Kolkata have been examined during 2012-2015 using aethalometer, multi-wavelength radiometer, ERA-5 reanalysis data, and HYPPLIT back trajectory model outputs. According to the study, high BC events are associated with enhanced atmospheric heating below the boundary layer, as well as significant negative radiative forcing at the surface compared to low BC days.

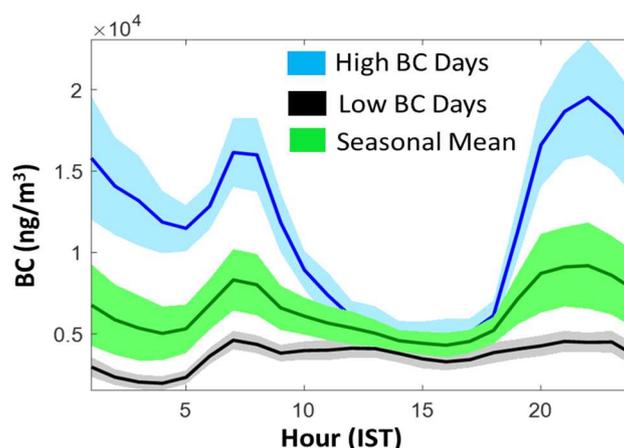


Figure 1. Diurnal mean variation of seasonal BC concentration (green) in comparison to low (black) and high BC (blue) days during pre-monsoon season.

Figure 1 shows the diurnal variation of seasonal mean BC concentration on high and low BC days during pre-monsoon period over Kolkata. Mean BC concentration of the high black carbon days (depicted in blue) are greater than $8.4 \times 10^3 \text{ ng/m}^3$ where as it is less than $5.06 \times 10^3 \text{ ng/m}^3$ for the days with low BC concentration (shown in black). The westerly wind during the pre-monsoon season from the IGP region towards the study location causes outflow of aerosol adding up the locally generated BC loading. It is found that high BC events have exclusively IGP inflow whereas low BC days are dominated by the presence of maritime component (~80%) with no airflow from the IGP region. The outflow of BC from IGP is also responsible for the anomalous increment of BC concentration during weekends /holidays when local emissions are limited. This investigation highlights the importance of long-term investigation of BC concentrations at a unique geographical location such as Kolkata, which is essential to identify appropriate mitigation strategies to reduce BC loading and assess future climate scenarios.

1. G. Rakshit, S. Jana, and A. Maitra, "Multitechnique observations on the impacts of declining air pollution on the atmospheric convective processes during COVID-19 pandemic at a tropical metropolis," *IEEE Geoscience and Remote Sensing Letters*, **19**, 1001605, January 2021, pp. 1-5, doi: 10.1109/LGRS.2021.3049887.