

Understanding the Variability of Ambient Particulate Matter Pollution in Delhi NCR: Controlling Factors of Various Biomass Burning Sources

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Abstract

The Indo-Gangetic plains more particularly the National Capital Region, Delhi (NCR), despite every year suffering from severe smog during the post-monsoon season, lack adequate quantitative understanding regarding the sources of volatile organic compounds (VOCs) and particulate matter (PM). In this study, we leveraged measurements of VOC tracers, $PM_{2.5}$, PM_{10} , and positive matrix factorization (PMF) model to source-apportion both gaseous and aerosol pollutants from the RASAGAM field campaign in 2022. 111 VOCs were measured by PTR-ToF-MS 10k. By contrasting clean-monsoon and polluted-post-monsoon air, we could distinguish between various sources of VOCs using source chemical profiles and molecular information. A key highlight was distinguishing paddy residue burning from other similar types of biomass-burning sources for the first time. The primary contributors to PM_{10} were 25 % from fresh paddy residue burning and 23 % from residential heating and waste burning. To the $PM_{2.5}$ the major contributors were 23 % from fresh paddy-residue burning and 24 % from residential heating and waste burning. While daytime solid fuel cooking contributed to <4% of PM pollution, it accounted for 10 % of the VOC mass loading which in contrast, fresh paddy residue and residential heating and waste burning contributed only 6 % and 7 % to the total VOC mass loading respectively. The PM mass loading was also influenced by both heating demand and the geographical location of fire activity, through air mass histories. A comparison of region-wise air mass back trajectory analyses and global emission inventories showed that EDGARv6.2 better represented emissions within Delhi-NCR than REASv3.2.1. While REASv3.2.1 completely missed direct VOC and PM emissions from the agricultural sector, EDGARv6.2 underestimated the agricultural residue burning emissions better captured by the FINNV2.5 inventory.

Early Career Scientist

YES, I am an early career scientist.

IGAC Activities

BBURNED: Biomass Burning Uncertainty: ReactionS, Emissions and Dynamics, GEIA: Global Emissions Initiative

IGAC Regional Working Groups

MANGO: Monsoon Asia and Oceania Networking Group