Evaluation of Ozone Exceedances and NOx-VOC Production Regimes in Delhi using Ground Measurements and TROPOMI Extracts

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Abstract

Air pollution in Delhi is famous as it topped the global (IQair) rankings chart for most polluted capital city in 2023. This interpretation is based on the measurements of ambient PM2.5 (particulate matter with aerodynamic diameter < 2.5 μm) pollution from a network of at least 40 continuous monitoring stations in the city. In addition to PM2.5, surface-level ozone (O3), a secondary air pollutant, also has adverse effects on human health, approximately a tenth of estimated premature deaths, according to the global burden of disease study. Based on the ambient monitoring data, the number of days with O3 exceedances is also increasing, along with the PM2.5 pollution. In an urban environment, O3 goes through complex cycles of photochemical reactions involving nitrogen oxides (NOx) and volatile organic compounds (VOCs). Knowing if O3 levels can be managed by lowering NOx emissions ("NOx-sensitive"), VOC emissions ("VOC-sensitive"), or both ("the transition zone") is critical for the city like Delhi, which is pushing a holistic clean air action plan that can result in reducing the health effects associated with all the key pollutants and achieve more "good" air days in a year. In this presentation, we explore these sensitivities for the period covering 2019-2023, using the data from the ground measurements, airshed level emission inventories for all primary pollutants, and TROPOMI satellite retrievals for formaldehyde (HCHO) and nitrogen dioxide (NO2) as proxies for VOC and NOx. The COVID period restrictions in 2020, the change in the vehicle exhaust emissions since the introduction of BS6 standards, and trends in the agricultural residue fires had direct impact on the NOx-VOC-O3 sensitivity regimes.

Early Career Scientist

NO, I am not an early career scientist.

IGAC Activities

GEIA: Global Emissions Initiative, MAP-AQ: Monitoring, Analysis and Prediction of Air Quality, TOAR: Tropospheric Ozone Assessment Report, AMIGO: Analysis of eMIssions usinG Observations