

Measurements of Vocs at A Rural Site in India: Variability, Sources and Their Impact on OFP, SOAP and VOC/NO_x Sensitivity

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Abstract

Volatile Organic Compounds (VOCs) measurements in tropical rural environments are very sparse and in urgent demand to better understand their role in tropospheric chemical processing. They serve as precursors for tropospheric ozone (O₃) and Secondary Organic Aerosol (SOA) formation which are the direct indicators of the oxidative capacity specific to a given chemical environment. Many factors influence the oxidative capacity and it differs between urban and rural atmospheres. The current study investigates the oxidizing capacity of the less explored tropical rural atmosphere Gadanki in southern peninsular India using VOC measurements and OH loss rates. Continuous diel VOC measurements have been carried out using the GC-FID technique. A total of 31 potential ozone precursor VOCs have been measured. There is a strong seasonal and diurnal variability among the VOC composition. The source apportionment using Positive Matrix Factorisation (PMF) analysis resulted in four potential emission source factors: biogenic, biomass burning, fossil fuel, and natural gas emissions. Further using the measured VOC data, the potentials for O₃ (OFP) and SOA formation (SOAP) along with the source contribution have been estimated. The aromatic VOCs exhibit the highest OFP as compared to alkanes and alkenes. Among seasons, the post-monsoon period exhibits the highest OFP. The increased presence of biogenic VOCs, likely due to heightened vegetation cover, could account for the elevated OFP. The long-chain alkanes show the highest SOAP as compared to alkenes and aromatic VOCs. The summer season has the highest SOAP, owing to the enhanced concentrations and photochemistry initiated by OH radicals. Within the sources, biomass-burning VOCs make a substantial contribution to both OFP and SOAP, distinguishing the rural atmosphere from its urban counterpart, where traffic emissions predominantly influence OFP and SOAP. Further, ozone production regime indicator and ozone isopleths diagrams have been utilized to understand the VOC/NO_x sensitivity of the site.

Early Career Scientist

YES, I am an early career scientist.

IGAC Activities

GEIA: Global Emissions Initiative

IGAC Regional Working Groups

MANGO: Monsoon Asia and Oceania Networking Group