(33-240329-A) **Spatiotemporal Variations (2017-2022) in Non-methane Hydrocarbons in the Central Himalayas and Foothills Regions: Role in Ozone Formation and Health Risk**

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South Asia is home to the ecologically rich Himalayan region, which serves as a lifeline for millions of people and is also influenced by emissions from a highly polluted Indo-Gangetic Plain (IGP). Despite this, there are very limited studies on trace gases, particularly NMHCs, in this region. This work presents five years long online observations of NMHCs (8 light NMHCs and 6 aromatic hydrocarbons) using a GC-TDS-FID setup from a mountain site (Nainital: 1958 m) in the Central Himalayas. Air samples were also collected from other mountain sites (Devasthal: 2500 m; Munsayari: 2200 m; Badrinath: 3000 m), an IGP foothill site (Pantnagar: 244 m; Haldwani: 554 m) and a mountain valley site (Dehradun: 700 m) to better understand the source region and regional variations. Surface ozone observations were also made at a few sites. Diurnal variations in NMHCs show daytime higher values at the mountain site, which is typical for a pristine location. Conversely, IGP foothill and valley sites exhibit urban characteristics with lower values in the daytime. The major role of biomass burning at the Himalayan sites and Liquefied Petroleum Gas (LPG) emissions, automobile and domestic combustion were found at the IGP site. The anthropogenic influences are found to reach the Himalayan site, mainly in spring, which is confirmed by the concentrated weighted trajectory (CWT) analysis. Such influences are limited to the IGP site in winter, primarily due to the shallower boundary layer. The estimated photochemical age varies from about 9 days in winter to about 16 days in summer-monsoon. The hydroxyl radical reactivity, ozone formation potential (OFP) and secondary organic aerosol formation potential (SOAFP) are 4-6 times higher at the IGP foothill site compared to the Himalayan site. Propylene, ethylene and n-butane are major contributors to these at both sites. Ethane is found to be most abundant (40%) at the Himalayan site, while propane (27%) at the IGP site. In aromatics, xylene emerges as the most abundant at the Himalayan site, while toluene is at the IGP foothill site. Benzene and ethylbenzene exceed the standard limits (USEPA and WHO), indicating significant health risks to the population of the Himalayan as well as foothill regions. The surface ozone is found to be higher than NAQS limit (50 ppbv) throughout the year, except in July and September. About 9-50% enhancement in spring maximum is attributed to biomass burning. In-situ photochemical ozone production and loss are estimated at ~41ppbv and ~8ppbv, respectively. Ozone observations from foothills indicate an annual loss of 27-37 kilotons of wheat and 14-32 kilotons of rice production. Further details of the present studies will be presented.

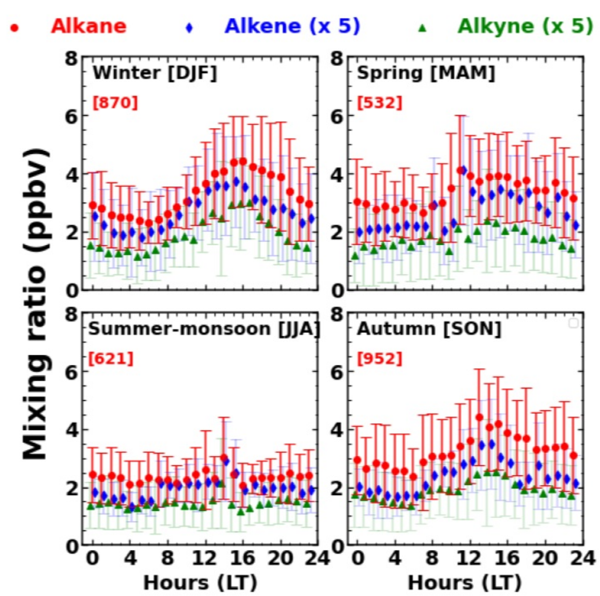

Figure 1. Diurnal variations in hourly averaged NMHCs groups: alkanes (ethane, propane, i-butane, n-butane and i-pentane), alkenes (ethylene and propylene) and alkyne (acetylene) with a 1-sigma (1-σ) spread during four seasons of January 2017 - December 2020 at the mountain site (Nainital) in the Central Himalayas. The reported time is in the local Indian time (GMT+5.5), and the number of samples analysed for each season is written in parentheses.