EGU21-3192, updated on 18 Oct 2021
https://doi.org/10.5194/egusphere-egu21-3192
EGU General Assembly 2021

Diurnal and seasonal variability in VOC composition at the remote tropical high-altitude Maïdo observatory (21.1°S, 54.4°E, 2160 m altitude)

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Volatile organic compounds (VOCs) are key precursors for the formation of surface level ozone (O_3) and secondary organic aerosols, and therefore, they have a significant impact on air quality and climate. In addition, through their interaction with the hydroxyl radical (OH), they impact the atmospheric lifetime of methane, further affecting climate. Among non-methane VOCs, the oxygenated species (OVOCs) are especially relevant in remote regions where they constitute the largest OH sink. Due to the paucity of data at these locations, OVOCs sources and sinks are poorly constrained in models. This work addresses the critical need for OVOC observations at remote locations. A high-sensitivity quadrupole-based proton-transfer-reaction mass-spectrometry VOC analyzer (hs-PTR-MS) was deployed at La Réunion --- a remote tropical island located in the south west Indian Ocean, home to the Maïdo observatory --- between October 2017 and November 2019. As the observatory is located near the top of the planetary boundary layer (PBL), pristine marine boundary layer air masses, enriched with compounds emitted by mesoscale sources, reach the observatory during the day. At night, the observatory is located in the free troposphere. The variability in PBL development drives the diel concentration profiles of a variety of biogenic and anthropogenic tracers recorded with the hs-PTR-MS instrument. The seasonal variability of biogenic tracers is driven by the hot and wet versus the cold and dry seasons. Every year, biomass burning plumes originating from African and Madagascan fires reach the observatory between August and November, significantly impacting local air quality at La Réunion.

We will present both the diel and seasonal variability using the 2-year near-continuous (O)VOC dataset recorded with the hs-PTR-MS instrument. The analysis of the complete dataset is performed using the positive matrix factorization approach, complemented by back-trajectory calculations using the Lagrangian transport model FLEXPART-AROME to identify mesoscale sources.