EGU24-3572, updated on 21 May 2024
https://doi.org/10.5194/egusphere-egu24-3572
EGU General Assembly 2024

Impact of deep convection on biogenic volatile organic compounds in the upper troposphere over the Amazon Rainforest

Nidhi Tripathi, Achim Edtbauer, Nijing Wang, Akima Ringsdorf, Bianca Krumm, Thomas Klüpfel, Jos Lelieveld, and Jonathan Williams
Max Planck Institute for Chemistry, Atmospheric Chemistry, Mainz, Germany (n.tripathi@mpic.de)

Biogenic volatile organic compounds (BVOCs) play an essential role in tropospheric chemistry, forming secondary organic aerosol and influencing ambient ozone. Since particles produced from BVOCs may grow to form cloud condensation nuclei (CCN) and influence cloud properties, BVOCs also indirectly affect the global radiation budget. The terrestrial biosphere is a significant source of BVOCs, with the emissions from the tropical forests (mainly the Amazon) contributing about 80% to the global BVOC budgets. Our understanding of BVOC emissions and chemistry, particularly their role in particle formation over the Amazon rainforest, is incomplete. Therefore, a comprehensive suite of atmospheric instruments was used to measure BVOCs, particles and other trace gases over the Amazon rainforest using the High Altitude and Long-range Observation (HALO) aircraft from Dec 2022 to Jan 2023. The main focus of the field campaign was to investigate how tropical convection affects the atmospheric chemistry of BVOCs using measurements made from 300m to 15km altitude. The measurements of BVOCs were performed using PTR-ToF-MS and fast GC-MS.

Isoprene was found to be the dominant BVOCs in the Amazon boundary layer. Interestingly, as a result of the regional strong convection, we observed elevated mixing ratios of isoprene (>1ppb), its oxidation products, and the sum of monoterpenes (MTs) in the upper troposphere (~10-12 km). This shows that despite the fast reaction rate of isoprene with OH (lifetime 1 hour) significant amounts can reach the outflow regions of the upper troposphere. The diel (24-hour) profile of isoprene mixing ratios, its oxidation products, and MTs in the upper troposphere were observed to change markedly with altitude. Near the surface (300m) BVOC emissions including isoprene varied with light and temperature peaking at circa 13:00 local time. However, between 10-12km, isoprene mixing ratios rose during the night and peaked before dawn and the onset of photochemical oxidation. This suggests that the nocturnal convection of residual isoprene is an effective vertical transport mechanism that primes the upper troposphere for particle production the following day. The boundary layer isoprene mixing ratios were also found to vary spatially with the strongest gradient found between the forested and deforested regions. The mean mixing ratios of isoprene (2.96 ±0.72 ppbv) and MTs (0.31±0.09 ppbv) in the forested regions were ~4 times higher than their values measured in the deforested regions. In both the boundary layer and outflow regions of the tropical Amazonian troposphere isoprene is a key player in the atmospheric chemistry. Preliminary results of the spatio-temporal variation and vertical profiles of other

selected BVOCs will be presented.