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Study of Biogenic Volatile Organic Compounds at the French Guiana Tropical Forest

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Biogenic volatile organic compound (BVOCs) emissions play an important role in regional air quality and global atmospheric chemistry. In addition, these natural VOC emissions serve important biological functions including attracting and repelling pollinators and herbivores. Some biological organisms use ambient air as a communication medium and the oxidation of these compounds brings about the concentration gradients sensed by insects and other organisms. Isoprene is the predominant BVOC emitted by vegetation and tropical forests are the dominant global source. This compound is very reactive in the atmosphere and contributes to the reactions that control tropospheric oxidant concentrations and thus the concentrations and lifetimes of longer-lived species. This paper presents a study on the seasonal variations in isoprene and some other significant BVOCs such as α-pinene, β-pinene, limonene, e-β ocimene and longifolene, measured at the Guyaflux Tower located in a wet tropical forest in Paracou French Guiana ($5^o16´54´´$N, $52^o54´44´´$W), during the year of 2011, using the Relaxed Eddy Accumulation technique at approximately 20 meters high above the canopy. The results show a lower concentration of isoprene during the month of February and March which correspond to the wet season with an average of 0,545 μg/m^3 and 0,341 μg/m^3, respectively followed by a slight increase in middle April (still wet season) and a higher concentration later in mid-June. The same behavior was observed for α-pinene with higher concentrations for the same periods as isoprene however with a smaller increase. All the other compounds had concentrations below 1 μg/m^{3}during the whole year. The monoterpene, e-β ocimene, was observed and is known as a stress compound but the vegetation at the site did not face any known severe stress condition such as excessive drought or flooding. Concerning the fluxes, the results showed that just a small amount of BVOCs were deposited by wet or dry process and the majority of them were released in the atmosphere. Isoprene was by far the biogenic volatile organic compound with the highest concentration and flux, followed by alpha-pinene. The lowest concentration and flux rate for all the studied compounds was observed during the months of March and late July and beginning of August indicating a lower production of those BVOCs by vegetation during those periods. Previous limited studies in Amazonia and the Congo suggested that a higher concentration and flux rate of isoprene and α-pinene should be expected during the dry season with lower emissions during the wet season, which is in relative agreement with what was observed at this tropical forest site in French Guiana. The exceptions were observed in April and June which correspond to a long wet period in which the concentration of isoprene and α-pinene increased more than it was expected for this time of the year. The observations will be compared to output from the global chemistry transport model CAM-chem, which includes the MEGAN biogenic emissions model.