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Biogenic Volatile Organic Compounds (BVOCs) and their oxidation products at two Mediterranean background sites

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In the framework of the ChArMEx (Chemistry Aerosol Mediterranean Experiments) program, this work aims at providing a better characterization of the sources and fate of VOCs impacting the Mediterranean region as well as conducting a parallel between organic aerosol and gas phase composition. To reach these objectives, on-line measurements of a large number of VOCs were conducted by flame ionization detection/gas chromatography and proton transfer reaction mass spectrometry at two Mediterranean receptor sites, Cape Corsica in summer 2013 and the Cyprus Atmospheric Observatory (CAO) in March 2015. Additionally, off-line air samples were collected on cartridges. On-line submicron aerosol chemical composition was performed in parallel with an aerosol mass spectrometer. VOCs Sources were identified using positive matrix factorization (PMF) tool and discussed in previous studies (Michoud et al., submitted, Debevec et al., submitted). This work focuses on BVOCs measured at these sampling sites (especially on their levels, speciation, variability and processes). Different speciation of monoterpenes was noticed at these sites. Even if monoterpenes were mainly composed of β-pinene at both sites (34 % - 38 % of the total monoterpenes mass concentration), α-terpinene was observed in higher proportion at Cape Corsica (21 %) than CAO (2 %) while lower proportion of α-pinene was measured (Cape Corsica: 24 %, CAO: 35 %). Biogenic sources were found to be significant contributors to the VOCs concentrations observed at these sampling sites (Cape Corsica: 20%, CAO: 36 %) but have shown different variabilities. At Cape Corsica, a primary and a secondary biogenic factor were identified, both correlating with air temperature and exhibiting a clear diurnal profile. At CAO, two different biogenic factors were identified with distinct diurnal profiles, the first one driven by isoprene was correlated with air temperature and the second one, driven by monoterpenes, showed maxima during nighttime. This nocturnal variability could be driven by nighttime emissions, chemical decay or dynamical processes; all these assumptions will be discussed here. From PMF factors identified, measured oxygenated VOCs were apportioned among their potential different origins (either biogenic or anthropogenic and either primary or secondary). Finally, a parallel between organic aerosol and gas phase composition was conducted to better highlight the relationship between the two phases. The diurnal variability of secondary organic aerosol appeared to be influenced by biogenic contributions.

References.

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