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Characterisation of secondary organic aerosol formed during cloud condensation-evaporation cycles from isoprene photooxidation (CUMULUS project)

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Biogenic volatile organic compounds (BVOCs) undergo many reactions in the atmosphere and form a wide range of oxidised and water-soluble compounds. These compounds could partition into atmospheric water droplets, and react within the aqueous phase producing higher molecular weight and less volatile compounds which could remain in the particle phase after water evaporation (Ervens et al., 2011).
The aim of this work is the characterisation of secondary organic aerosol (SOA) formed from the photooxidation of isoprene and the effect of cloud water on SOA formation and composition. The experiments were performed during the CUMULUS project (CloUd MULtiphase chemistry of organic compoUndS in the troposphere), at the 4.2 m3 stainless steel CESAM chamber at LISA (Wang et al., 2011). In each experiment, isoprene was injected in the chamber together with HONO under dry conditions before irradiation. Gas phase compounds were analyzed on-line by a Proton Transfer Reaction Time of Flight Mass Spectrometer (PTR-ToF-MS), a Fourier Transform Infrared Spectrometer (FTIR), NO_x and O_3 analyzers. SOA formation and composition were analysed on-line with a Scanning Mobility Particle Sizer (SMPS) and an Aerodyne High Resolution Time of Flight Aerosol Mass Spectrometer (HR-ToF-AMS).
Particular attention has been focused on SOA formation and aging during cloud condensation-evaporation cycles simulated in the smog chamber. In all experiments, we observed that during cloud formation water soluble gas-phase oxidation products readily partitioned into cloud droplets and new SOA was promptly produced which partly persisted after cloud evaporation. Chemical composition, elemental ratios and density of SOA, measured with the HR-ToF-AMS, were compared before, during cloud formation and after cloud evaporation. Experiments with other precursors, i.e. methacrolein, and effects of the presence of seeds were also investigated.

Ervens, B. et al. (2011) Atmos. Chem. Phys. 11, 11069 11102.
Wang, J. et al. (2011) Atmos. Measur. Tech. 4, 2465 2494.