SOA production from isoprene ozonolysis at low and high RH

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The formation of secondary organic aerosol (SOA) via reactions occurring in hydrated aerosol and cloud droplets is estimated to be of a similar magnitude to that formed by gas phase reactions (Ervens et al., 2011). However, SOA formation by this pathway is poorly understood so far.

Within the CLOUD (Cosmics Leaving OUtdoor Droplets) project, the formation of SOA from the ozone initiated oxidation of isoprene was investigated. Aerosol growth was studied at high relative humidities (RH ≈ 80 - 95 %) as well as during cloud cycles (droplets were formed by adiabatically reducing chamber pressure); results were compared with measurements performed at an RH of 40%. Experiments were performed at temperatures between -10°C and 10°C, using both acidic (sulphuric acid) and partly to fully neutral (ammonium sulphate) seed aerosol, and varying the mixing ratio of NO_x in the chamber. Additional experiments without any seed aerosols particles were performed by nucleating and subsequently growing SOA particles.

Aerosol growth was measured using a scanning mobility particle sizer (SMPS), and the chemical composition of the particles was studied with an high-resolution aerosol mass spectrometer (HR-AMS). The gas phase composition was determined with a proton transfer reaction time of flight mass spectrometer (PTR-ToF-MS), a chemical ionisation atmospheric pressure interface time of flight (CI-APi-TOF) mass spectrometer and trace gas analysers (for NO_x, O_3 and SO_2).

Fig. 1 illustrates the change in dry particle size distribution during a typical experiment. Steady aerosol growth was observed during sub-saturated periods, with more rapid, but partially reversible growth during cloud periods.

Observed SOA yields will be presented for the range of conditions studied, and the mechanisms behind the observed aerosol growth will be discussed, contrasting high and low RH experiments.

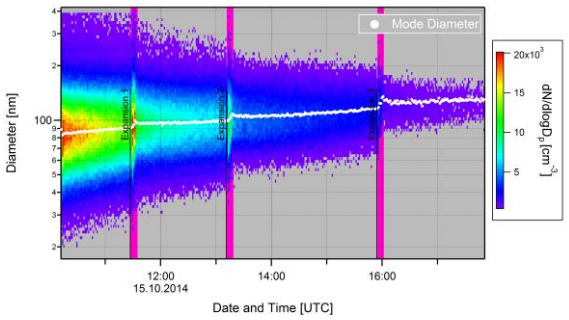

Figure 1. Evolution of the dry particle size distribution due to reactive uptake and condensation of isoprene oxidation products within simulated clouds (pink) and during periods with RH < 95 % (grey).

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