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Supplement of

Secondary organic aerosol formation from isoprene photooxidation during cloud condensation–evaporation cycles

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Table S1: Summary of the maxima increases of the total particle mass concentration observed during cloud events for control experiments.

Experiment[*]	**Increase in mass ($\mu g\ m^{-3}$)**	**Cloud lifetime (min)**
Control experiments		
C290113	1.7	7
C310113	1.3	8
C180313	1.2	7
C150113	0.9	8
C270113	1.5	9
C120313	2.2	8
C220313	1.6	7

[*] Experimental IDs starting with "C" indicate control experiments.

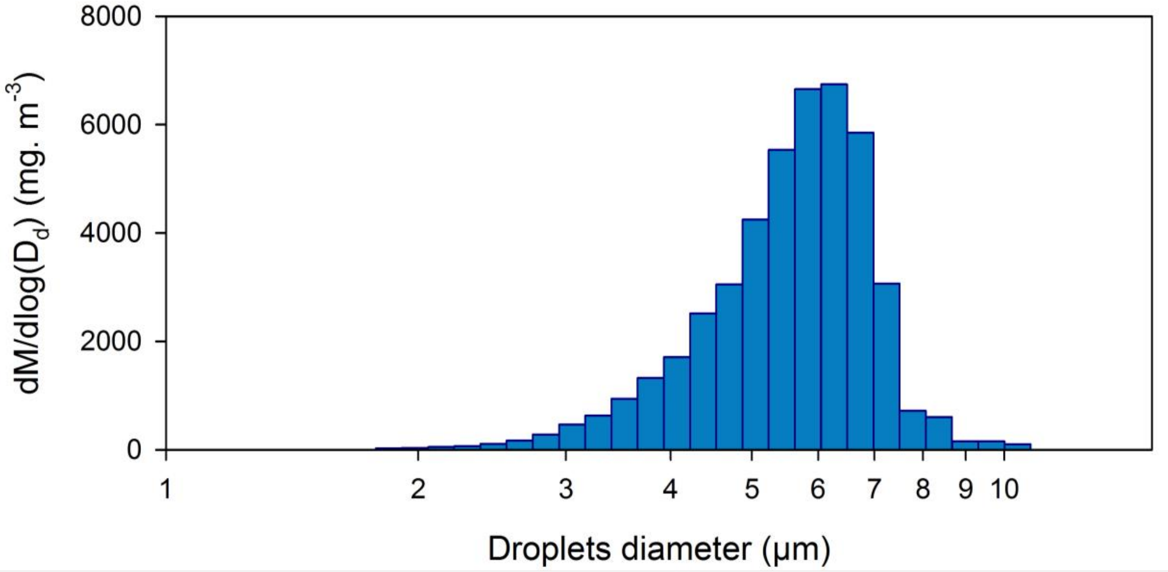

Figure S1: Droplet mass size distribution at the maximum liquid water content (LWC) during a cloud event in a diphasic experiment (D010213).

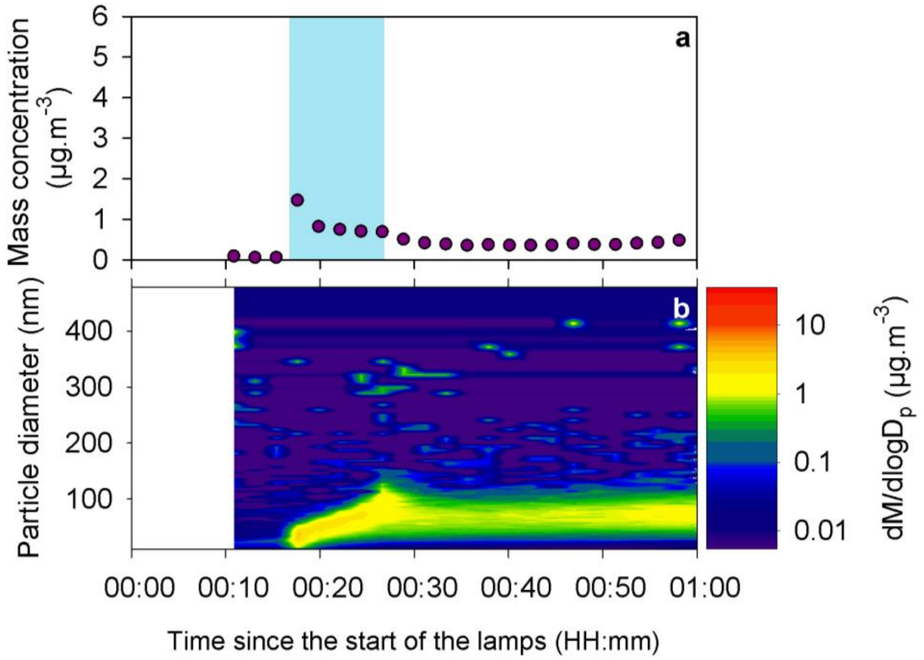

Figure S2: Time profiles of (a) particle mass concentration and (b) mass size distribution during a control experiment (C270113). Blue area indicates a cloud event.

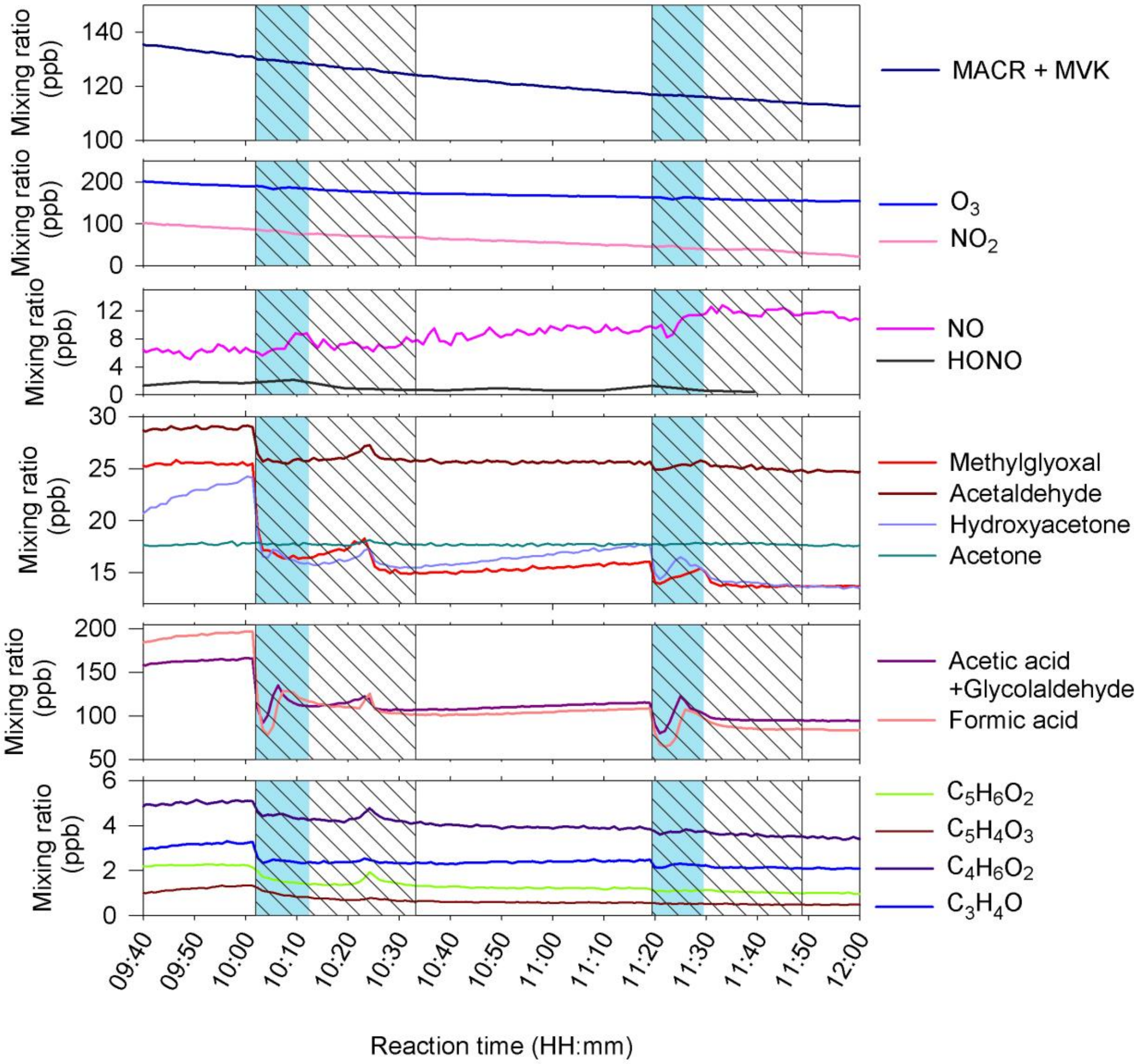

Figure S3: Time profiles of the gas phase reactants and isoprene oxidation products during a triphasic experiment (T280113). Blue areas indicate cloud events and hatched areas indicate time needed for PTR-ToF-MS stabilization after the start of cloud generation (droplet and memory effects in the sampling line).

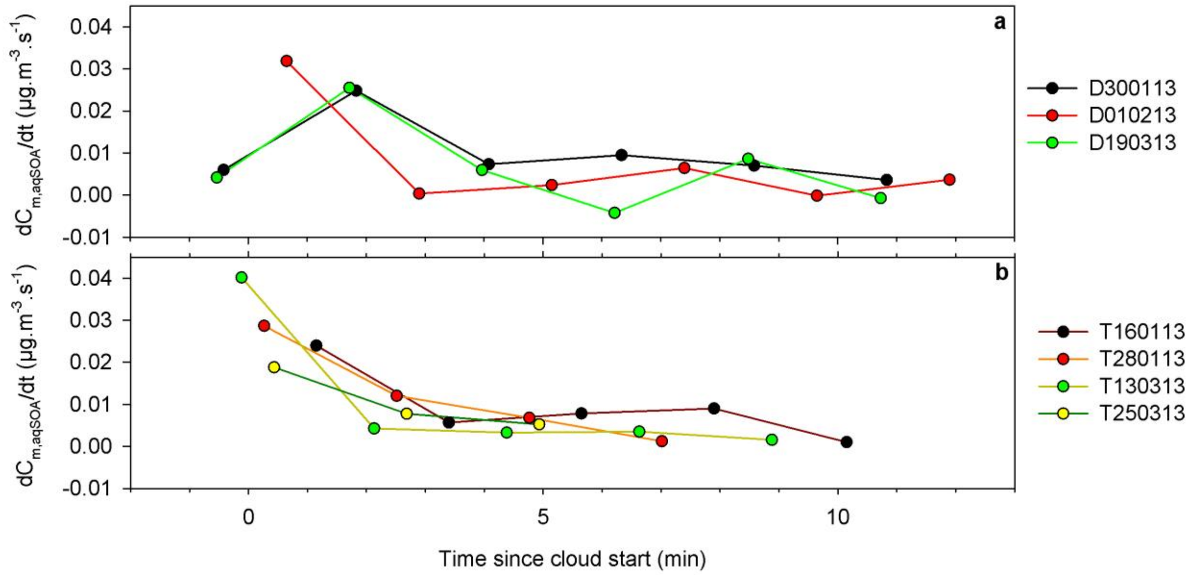

Figure S4: Time profiles of aqSOA production in (a) diphasic and (b) triphasic experiments.

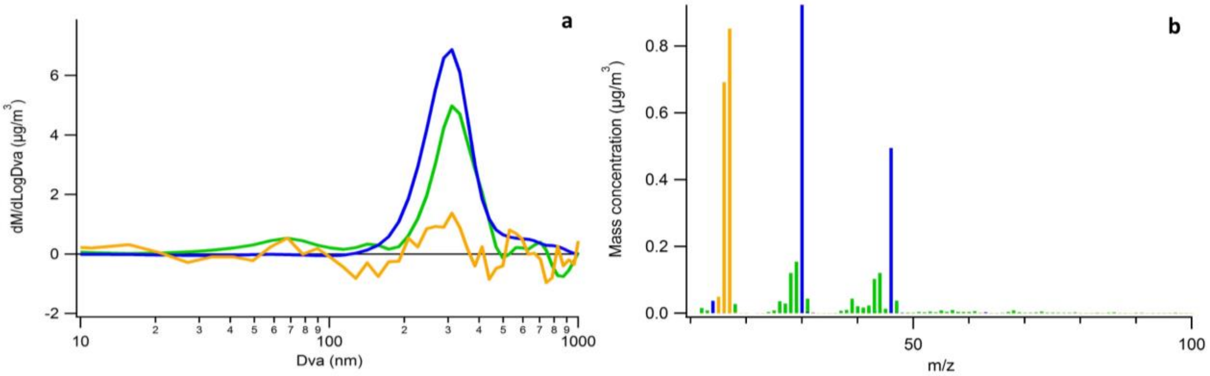

Figure S5: SOA chemical composition measured during a cloud event by an HR-ToF-AMS in a diphasic experiment (D300113): (a) dried aerosol mass size distributions; (b) mass spectra of dried aerosol (organic fragments are in green, nitrate fragments in blue and ammonium fragments in orange).

Supplement Sect. 1: Expected VOCs dissolution in water at cloud start: calculation

Following a hypothesis based on the kinetic determination of the mass-transport of VOCs from the gas phase to water droplets (Schwartz, 1986), Henry's Law equilibrium was considered immediate at the start of cloud generation. This hypothesis was used to estimate the theoretical mass of individual VOCs transferred into the aqueous phase. The estimation was done using the experimental data of each gaseous VOC concentration prior cloud formation (C_{before}) and using the measured LWC.

$$K_H = \frac{C_{i,a}}{p_i}$$

Where K_H is the Henry's law constant, expressed in M atm^{-1}; $C_{i,a}$ is the concentration in the aqueous phase of a species *i*, expressed in M; and p_i is the partial pressure of the species *i* in the gas phase under equilibrium conditions, expressed in atm.

Hence : $C_{i,a} = K_H \times p_i$ with $p_i = \frac{n_i \times R \times T}{V} = \frac{C_{before} \times R \times T}{101325}$

Where C_{before} is expressed in mol m^{-3}; R is the gas constant (8.314 m^3 Pa K^{-1} mol^{-1}); and *T* the temperature, expressed in K.

$C_{i,a}$ was converted in mass concentration ($C_{i,\,m}$; expressed in µg L^{-1}) using the molar mass M_i of the species *i*, expressed in µg mol^{-1}:

$$C_{i,m} = C_{i,a} \times M_i$$

$C_{i,\,m}$ was then converted in order to express the concentration of the species *i* in the gas phase ($C_{i,\,g}$, expressed in µg m^{-3}) using the liquid water content (*LWC*) of the generated cloud, expressed in L m^{-3}:

$$C_{i,g} = C_{i,m} \times LWC$$

The theoretical total mass of VOCs transferred into the aqueous phase was then determined by summing the $C_{i,\,g}$.