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Microphysical properties of SOA from tree emissions

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Atmospheric oxidation of VOCs emitted by plants in particular that of mono- and sesquiterpenes leads to low volatile products that form secondary organic aerosols (SOA). There are discussions if and how biogenic particle production contribute to a feed back between air chemistry, climate and vegetation. Laboratory studies focus on single compounds or simple mixtures. We used plants as complex emitters and investigated the formation of organic particles and their hygroscopic properties.

The experiments were performed using plants kept under well defined conditions in the plant chamber in Juelich (Research Center Juelich, ICG-3) . Mediterranean oak, spruce, pine and birch were used as model plants. Changing temperature in the plant chamber led to changes of the amount and the mix of VOC emissions.

Air from the plant chamber was transferred to a reaction chamber and SOA formation was initiated there by UV-photolysis of ozone. The vapor phase was monitored by PTR-MS (Ionicon), the composition of the particles by aerosol mass spectrometry (AMS, Aerodyne Research). As soon as the particles were larger than 50 nm growth factors Gf as a function of the relative humidity RH were measured by an HTDMA. Moreover, the CCN activity of the particles was monitored by a combination of a CCN spectrometer (DMT), SMPS and a CPC. GfRH90 for all tree species were around 1.1 as observed in laboratory studies for monoterpenes. In the case where emissions were dominated by sesquiterpenes the smallest GfRH90 of 1.08 was observed.