

Photochemical formation and microphysics of aerosols from real plant emissions

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By emission of volatile organic compounds (VOC) which on oxidation form secondary organic aerosols (SOA) the vegetation is coupled to atmosphere and climate. We investigated new particle formation from tree emissions in a new setup: a plant chamber housing the trees coupled to a reaction chamber for oxidizing the plant emissions and for forming SOA (Jülich Plant Aerosol Atmosphere Chamber, JPAC).

Boreal, temperate Midlatitude, and Mediterranean tree species were studied and α -pinene was used as reference compound to characterize the specifics of JPAC and to study humidity and OH dependence of new particle formation. The strength and the pattern of the tree emissions were varied by increasing the temperature for the plants, thus mimicking the higher frequency of occurrence of warmer days in a future climate.

Under the experimental conditions OH radicals were essential for inducing new particle formation, although O₃ (\leq 80 ppb) was always present and a part of the monoterpenes and the sesquiterpenes reacted already with ozone before OH was generated. Formation rates of 3 nm particles were linearly related to the carbon mixing ratios of the VOC, as were the maximum observed volume and the condensational growth rates. The threshold of new particle formation was lower for the tree emissions than for α -pinene.

Hygroscopic growth factors and activation to cloud droplets were measured to characterize climate relevant properties of the resulting aerosols. Overall the hygroscopic properties of the biogenic SOA from the highly mixed tree emissions are similar to those found for individual monoterpenes and sesquiterpenes. However, changes of emission pattern from species to species or induced by heat stress is reflected in the hygroscopic properties of the resulting SOA. The biogenic SOA revealed close to ideal Köhler behavior with significantly reduced surface tension at activation compared to pure water.

¹⁰Be and ³⁶Cl interlaboratory comparisons: Implications for terrestrial production rates?

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Driven by the progress in accelerator mass spectrometry (AMS) and its spreading application within geosciences, the number of samples with low isotopic ratios will increase. Therefore, we have examined the linearity of ¹⁰Be/⁹Be as a function of isotope ratio by distributing three secondary standards (dilutions of NIST4325: 10⁻¹²-10⁻¹⁴) to nine AMS labs. The problem of low ratio samples is even more crucial for ³⁶Cl. Thus, we have prepared large quantities of three ³⁶Cl/Cl solutions from a certified ³⁶Cl activity (NIST4943) by dilution with NaCl. AgCl precipitated from these solutions (10⁻¹¹-10⁻¹³) has been distributed to nine AMS labs. We are still awaiting some final results, but first results from eight labs for each nuclide show that these interlaboratory exercises are very valuable, as they show maximum differences between individual AMS labs up to 35% for ¹⁰Be, and 25% for ³⁶Cl, respectively.

Our data indicate that actual ³⁶Cl measurements at LLNL, PRIME Lab and ANU can differ by more than 10%. The implications of this for ³⁶Cl *in situ* production rates, determined earlier at these facilities, cannot be ignored. Some, although not all, of the current disagreement concerning ³⁶Cl production rates may result from these discrepancies. However, we are assuming that our new data at the 10⁻¹²-10⁻¹³ level are still representative for earlier measurements of *in situ* samples at that level.

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