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Field measurements of formation and evolution of biogenic SOA using on-line and off-line mass spectrometric techniques in a boreal forest in Finland (HUMPPA – COPEC campaign 2010)

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The knowledge of the chemical composition of secondary organic aerosol is one essential key to understand the significance and fate of SOA in the atmosphere. However, the chemical evolution of SOA, from the very first condensing/nucleating molecules to the final oxidation products is still insufficiently understood and object of current research. Therefore, we conducted field measurements focussing on biogenic SOA formation and evolution during the HUMPPA-COPEC10 intensive campaign at SMEAR I station in Hyytiälä, Finland, in summer 2010. Two online aerosol mass spectrometric systems were run in parallel: An Atmospheric Pressure Chemical Ionization-ion trap MS (APCI/MS) and an Aerodyne ToF-AMS. APCI is a soft ionization technique which not only provides highly time resolved chemical information but also allows molecular identification of specific marker compounds. First and higher generation BSOA products were identified in the gas and particle phase. Among the higher generation products also 3-methyl-1,2,3-butanetricarboxylic acid was observed online as an oxidative processing marker of biogenic SOA. Furthermore, in-situ MS/MS studies were performed with the APCI-ion trap system, which enable a direct comparison with artificially formed SOA from chamber experiments. The APCI-MS results are compared with the AMS data, which contain less detailed chemical information, however, the AMS delivers size-segregated chemical information as well as a more reliable quantification than online APCI-MS. In addition to the two online aerosol MS systems, off-line filter sampling followed by high performance liquid chromatography mass spectrometry (HPLC-MS) was used to receive quantitative information about individual organic aerosol components in the particle phase. The results were analysed based on the history of the air masses during the sampling periods to learn more about formation and ageing of biogenic SOA as well as their relative contribution to the total organic aerosol fraction under different meteorological conditions.