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Overview of the field measurement campaign in Hyytiälä, August 2001 in the framework of the EU project OSOA

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Abstract. As part of the OSOA (Origin and formation of Secondary Organic Aerosols) project, two intensive field campaigns were conducted in Melpitz, Germany and Hyytiälä, Finland. This paper gives an overview of the measurements made during the Hyytiälä campaign, which was held between 1 and 16 August 2001. Various instrumental techniques were used to achieve physical and chemical characterisation of aerosols and to investigate possible precursor gases.

During the OSOA campaign in Hyytiälä, particle formation was observed on three consecutive days at the beginning of the campaign (1 to 3 August 2001) and on three days later on. The investigation of the meteorological situation divided the campaign into two parts. During the first three days of August, relatively cold and clean air masses from northwest passed over the station (condensation sink – CS: <0.002 s^{-1}, NO_x: <0.5 ppb). Daily particle bursts of one fraction of the nucleation mode aerosols (3–10 nm) with number concentrations between 600–1200 particles cm^{-3} were observed. After this period, warmer and more polluted air from south-west to south-east arrived at the station (CS: 0.002–0.01 s^{-1}, NO_x: 0.5–4 ppb) and during these 13 days only three events were observed. These events were not as apparent as those that occurred during the earlier period of the campaign. The chemical analyses from different institutes of PM_2, $PM_{2.5}$ and PM_{10} particles confirmed the assumption that organic matter from the oxidation of various terpenes contributed to the formation of secondary organic aerosols (SOA). Concerning these conclusions among others, the ratio between formic (oxidation product of isoprene and monoterpenes by ozone) and acetic acid (increased by anthropogenic emissions) (ratio=1 to 1.5) and concentration of different carboxylic acids (up to 62 ngm^{-3}) were

investigated. Gas/particle partitioning of five photo-oxidation products from α- and β-pinene resulted in higher concentrations of pinonic, nor pinonic and pinic acids in the particle phase than in the gas phase, which indicates a preference to the particle phase for these compounds. The average growth factors (GF) from 100 nm particles in water vapour gave a diurnal pattern with a maximum during daytime and values between 1.2 and 1.7. On average, the amount of secondary organic carbon reached values around 19% of the sampled aerosols and we speculate that formation of SOA with the influence of photo-oxidation products from terpenes was the reason for the observed particle bursts during the campaign. However, correlations between the precursor gases or the favourable condensing species with the monitored nucleation mode particles were not found. For the investigated time period other factors like the condensation sink of newly formed particles to the pre-existing aerosols, temperature and solar irradiance seem to be more important steering parameters for the production of new aerosols.

Another open question concerns the vertical distribution of the formation of SOA. For this reason measurements were conducted at different altitudes using a tethered balloon platform with particle sampling and particle counting equipment. They were incorporated with eddy covariance (EC) flux measurements made at 23 m above ground level. The results give first indications that production of new aerosols happens throughout the planetary boundary layer (PBL), whereby different parameters e.g. temperature, CS, solar irradiance or concentration of monoterpenes are responsible for the location of the vertical maximum.

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