Long-term high time resolution measurements of the submicrometer aerosol chemical composition at the Central European station Melpitz, Germany

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Atmospheric aerosol particles are formed by a large number of organic and inorganic compounds. These particles may affect climate change, human health, and the ecosystem. Local air quality is often influenced by locally emitted particles from both primary and secondary anthropogenic and biogenic sources, as well as by long-range transport. Furthermore, sources of aerosol particles show also a strong seasonal dependence. Therefore, long-term measurements of the physical and chemical properties of aerosol particle are important to perform in order to better characterize changes of particles sources over a running year (e.g. seasonality) as well as over several years with different meteorological conditions. Organic aerosol (OA) might represent a large fraction of the submicrometer aerosol mass concentration; this is why there is a special interest to better follow changes on OA sources (primary and secondary) over longer time period. The recent development of the Aerosol Chemical Speciation Monitor (ACSM, Aerodyne Research Inc, Ng et al., 2011), which is designed for long-term measurements, represents a key instrument to answer these questions. The ACSM provides the non-refractory particle mass concentration of the chemical composition of submicrometer aerosol particles including OA, nitrate, sulfate, ammonium, and non-sea-salt chloride at a typical time resolution of 30 minutes.

For this purpose, an ACSM was deployed since June 2012 at the TROPOS Central European research station Melpitz (Germany) as part of the Aerosols, Clouds, and Trace gases Research Infra-Structure Network (ACTRIS) (http://www.actris.net). In order to close the chemical mass balance of submicrometer particles, the ACSM measurements are completed by adding black carbon concentration (BC) measured by a Multi-Angle Absorption Photometer (MAAP, Thermo-scientific). The data quality was assured by a systematic comparison of the ACSM measurements with co-located on-line and off-line instruments including an High-Resolution Time-of-Flight Aerosol Mass Spectrometer (HR-ToF-AMS, Aerodyne Research Inc, DeCarlo et al., 2006), a dual mobility particle size spectrometers (T-SMPS), a Monitor for Aerosols and Gases in ambient Air, (MARGA, Applikon Analytical, ten Brink et al., 2007) and daily high volume PM_1 and/or $PM_{2.5}$ filters.

For the considered measurements period (from June 2012 to May 2014), a mean submicrometer particle mass concentration of 10.7 µg m^{-3} was determined. A strong seasonality on the chemical composition was observed with the highest contribution of OA and sulfate during summertime, while nitrate contributes most as inorganic aerosol mass during wintertime (Fig. 1). In average, OA represents 41% of the total submicrometer particle mass concentration. This contribution will present preliminary results of the ACSM measurements including a study on sources apportionments of the organic aerosol particle mass fraction.

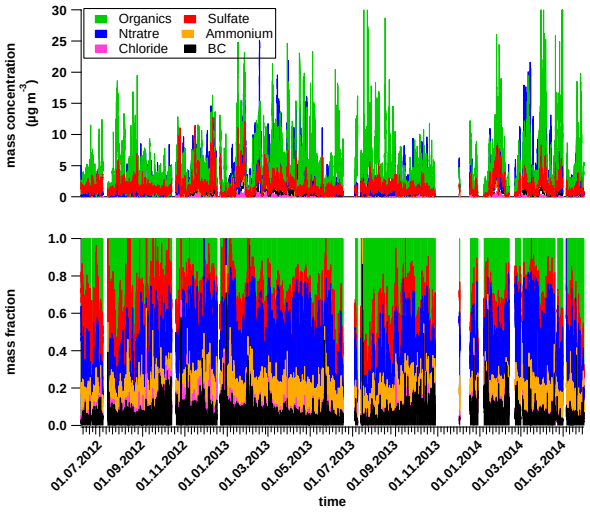

Figure 1. Long term time series of the near PM_1 chemical mass composition as measured by ACSM and MAAP (top) and the corresponding mass fraction (bottom) at Melpitz (Germany).

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