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Raman microscopy of size-segregated aerosol particles, collected at the Sonnblick Observatory in Austria

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Size classified aerosol samples were collected using low pressure impactors in July 2013 at the high alpine background site Sonnnblick. The Sonnblick Observatory is located in the Austrian Alps, at the summit of Sonnblick 3100 m asl.

Sampling was performed in parallel on the platform of the Observatory and after the aerosol inlet. The inlet is constructed as a whole air inlet and is operated at an overall sampling flow of 137 lpm and heated to 30 °C. Size cuts of the eight stage low pressure impactors were from 0.1 to 12.8 μm a.d.. Alumina foils were used as sample substrates for the impactor stages. In addition to the size classified aerosol sampling overall aerosol mass (Sharp Monitor 5030, Thermo Scientific) and number concentrations (TSI, CPC 3022a; TCC-3, Klotz) were determined.

A Horiba LabRam 800HR Raman microscope was used for vibrational mapping of an area of about 100 μm x 100 μm of the alumina foils at a resolution of about 0.5 μm. The Raman microscope is equipped with a laser with an excitation wavelength of 532 nm and a grating with 300 gr/mm. Both optical images and the related chemical images were combined and a chemometric investigation of the combined images was done using the software package Imagelab (Epina Software Labs). Based on the well-known environment, a basic assignment of Raman signals of single particles is possible at a sufficient certainty. Main aerosol constituents e.g. like sulfates, black carbon and mineral particles could be identified.

First results of the chemical imaging of size-segregated aerosol, collected at the Sonnblick Observatory, will be discussed with respect to standardized long-term measurements at the sampling station. Further, advantages and disadvantages of chemical imaging with subsequent chemometric investigation of the single images will be discussed and compared to the established methods of aerosol analysis. The chemometric analysis of the dataset is focused on mixing and variation of single compounds at different stages of the impactors.