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In-cloud scavenging influence on atmospheric aerosol as measured in fogs

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Atmospheric aerosol (AA) influences cloud formation, lifetime and other properties; at the same time, however, it is influenced by the cloud processing as well. Processes between AA and clouds, source of large uncertainty in weather and climate changes estimations, can be described on fogs, or on low clouds present at a suitable station. An example of such a station is Milešovka in Czechia, Central Europe, where fog is present for almost 55 % of the time, giving a great opportunity to explore the changes in the aerosol particle size distributions due to the cloud processing, and vice versa.

The measurements took place at the meteorological observatory of the Institute of Atmospheric Physics of the Czech Academy of Sciences, located on the top of the Milešovka Mtn. At the station, full meteorological data are measured continually, with additional measurements on fog/cloud characterization and vertical cloud profile. For the description of the AA properties, online measurement of outdoor particle number size distributions (PNSD) in the size range 10 nm – 20 μm was conducted using SMPS and APS spectrometers. The PNSD were measured as dry, after passing diffusion dryer. Total number AA concentration, concentrations of equivalent black carbon (EBC), and CO were also recorded as a proxy for air mass history. The sampling system consisted of a heated whole air inlet, and PM2.5 sampling head, being switched by an automatic valve. The time resolution was set up to 5 min, to be able to describe the real-time changes in the PNSDs. First data were sampled during a month-long autumn/winter campaign and another campaign is foreseen during spring.

From the difference between PNSD sampled by whole air inlet and by PM2.5 inlet, dry PNSD of activated particles nuclei can be calculated. During fog, a significant mode ($\sim$600 #/ccm) with mean diameter of 230 nm was found in submicron sizes, and a secondary peak ($\sim$0.5 #/ccm) was located at about 1.5 μm. For non-fog periods, the sub-micron mode is missing, suggesting its connection to fog processing of AA.

Preliminary results (the campaign has finished at the end of the year, so most of the analyses are still ongoing) also suggest a connection between the mode intensity and air mass history/fog type. This will be confirmed/rejected by back trajectories analysis and synoptic classification, as well as by application of Positive Matrix Factorization and by comparison with auxiliary data (total concentrations, EBC, CO, and fog properties).

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