Abstract

Over the last decades, it has become clear that the size and chemical composition of atmospheric aerosol (AA) has a major impact on both human health and a number of processes in the atmosphere. Although there are increasing efforts to describe the behavior of AA, many phenomena are still not sufficiently understood to be able to predict aerosol behavior and associated phenomena to a satisfactory degree.

This PhD thesis describes aerosol behavior at high temporal resolution within three main topics. The first topic is the description of the chemical and size composition of the non-refractory PM_1 (NR-PM_1) fraction at the Prague – Suchdol suburban station and the study of the influence of meteorological phenomena on the behavior of this aerosol. In order to identify seasonal effects, measurements were carried out in summer and winter. Positive Matrix Factorization (PMF) analysis was performed in connection with the aerosol description at the station, which identified chemically resolved mass profiles of aerosol sources and their temporal evolution.

The second topic is the penetration of aerosol particles from the outdoor to the indoor environment. The influence of particle size and chemical composition on the penetration of particles from the outdoor to the indoor environment was investigated by simultaneous measurements outside and inside the building. The effect of meteorological conditions and seasonality on penetration rates was also investigated. During this experiment, a source of monoethylamine (MEA) in the indoor environment was identified, for which a new methodology for MEA identification using an aerosol mass spectrometer (AMS) was first developed.

The third topic was the description of the aerosol particle activation process, i.e. the size characteristics of the particles that serve as condensation nuclei of cloud droplets and the definition of the conditions under which activation occurs. The measurement campaign was carried out at the Milešovka Observatory with a long term very frequent occurrence of fogs. The size spectra of activated particles were identified and the activated fraction for each size class was calculated. Furthermore, the conditions in the atmosphere under which particle activation occurs were described and the air masses at which activation occurs most frequently were identified.