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Source apportionment of ambient aerosol applying PMF on AMS mobile and stationary data

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Ambient aerosols are divided into the categories “primary” and “secondary”, referring to particles directly emitted into the air, or formed out of precursor species such as volatile organic compounds, respectively. Main sources for primary urban aerosol and precursor species are traffic emissions, but also wood burning for domestic heating purposes especially in winter time (Alfarra et al., 2007). The quantification of various types of aerosol components is important for source identification which in turn is the basis of all mitigation activities.
Positive Matrix Factorization (PMF) is a statistical based source apportionment tool that uses constrained, weighted least squares estimation to determine source profiles and strengths. PMF has been applied recently for the first time on highly time resolved organic mass spectra (Lanz et al., 2007) measured by an Aerodyne aerosol mass spectrometer (AMS) (Canagaratna et al., 2007).
For the data presented here, two AMS were deployed together with additional instrumentation in the metropolitan area of Zurich in winter 2007/2008. The high-resolution time-of-flight AMS was stationed at an urban background site in the center, 30 meters from and shielded against direct traffic emissions. The quadrupole-based AMS was deployed in a mobile van allowing for on-road submicron aerosol composition measurements, and investigations into the spatial variability of aerosol concentration and composition.
Results indicate that traffic emissions are the main contributor to submicron aerosol concentrations measured on-road. Hydrocarbon-like organic aerosol (HOA), a marker for traffic emissions (Lanz et al. 2007), dominates the primary aerosol mass, together with black carbon (BC). BC was monitored with the MAAP (multi angle absorption photometer). Another significant contributor to primary organic aerosol mass in downtown Zurich is domestic wood burning for heating purposes. Traffic and wood burning emissions make up roughly 50% of the total organic mass. Oxygenated organic aerosol (OOA), most of which is secondary, represents the remaining fraction.
At the background site, the measured aerosol composition is more strongly influenced by secondary species, since this site is less exposed to primary emissions. The relative OOA contribution is higher than on-road, as well are particulate sulphate, nitrate, and ammonium contributions.
Calculations of particulate sulphate ratios suggest that differences in absolute background and on-road concentration levels are mostly due to meteorological transport processes, but local emissions play a major role.
Additional PMF analysis of AMS data from other regions and recent mobile AMS measurements will also be presented.

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