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Sources of ambient submicron aerosol in the Zurich metropolitan area

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For the data presented here, two Aerodyne aerosol mass spectrometers (AMS) (Canagaratna, 2007) were deployed together with additional instrumentation in the metropolitan area of Zurich in winter 2007-8 and 2008-9. A low mixing layer height and stable air masses due to thermal inversions (typically occurring during winter time) often lead to an accumulation of particulate matter (PM) emissions in the region of Zurich. The quantification of various types of aerosol components is important for source identification which in turn is the basis of mitigation activities. A high-resolution time-of-flight AMS was stationed at an urban courtyard in the center, shielded against direct traffic emissions. A quadrupole-based AMS was deployed in a mobile van allowing for on-road measurements and investigations into the spatial variability of aerosol concentration and composition.

Contributions of different source types to ambient submicron aerosol mass were analyzed using factor analytical modelling results. Positive matrix factorization (PMF) was applied to the organic mass spectral matrix (Lanz, 2007) to determine source profiles and strengths. Results indicate that traffic emissions are the main contributor to primary submicron aerosol mass concentrations measured on-road, followed by emissions from domestic wood burning for heating purposes. Oxygenated organic aerosol (OOA), most of which is secondary, represents the remaining fraction. At the urban site, the measured aerosol composition is more strongly influenced by secondary species. The relative mass contributions of OOA, sulphate, nitrate, and ammonium contributions are higher than on-road.

An important task in terms of local mitigation activities is the distinction and quantification of contributions of local emissions versus regional background to ambient particulate matter. We will present a new method to estimate local contributions based on mobile measurements data.

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Lanz, V. A., et al. (2007). Atmos. Chem. Phys., 7: 1503-1522