Geophysical Research Abstracts, Vol. 9, 01317, 2007
SRef-ID: 1607-7962/gra/EGU2007-A-01317

Elemental composition of winter PM10 aerosols at rural and urban sites determined with synchrotron X-ray fluorescence spectrometry

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The analysis of the elemental composition of ambient aerosols can be used for the identification of their sources, and this in turn is a prerequisite for developing appropriate strategies for reducing their environmental and health impact. One inherent difficulty in determining the elemental composition is the small aerosol mass sampled during short time intervals. For example, during a 1-h sampling interval, elemental masses of the order of a few pg may be collected. For many trace elements the sensitivity of laboratory X-ray fluorescence (XRF) spectrometers is not sufficient for this low amount of material. By using high-flux synchrotron X-ray radiation higher sensitivity is achieved, which allows for the detection of additional trace elements within a shorter irradiation time.

During three field campaigns in Switzerland in winter 2005/2006, ambient air was sampled with a rotating drum impactor (RDI) at 2-h time resolution. The sites were within a village close to a freeway in an alpine valley, at a rural site close to another freeway, and near the city center of Zurich. RDI measurements were complemented by other instruments, e.g. an aerosol mass spectrometer, an aethalometer, and also by high volume filter samplers for subsequent off-line ^{14}C analysis. Accidentally two of the three field campaigns coincided with heavy pollution episodes, where the legal thresholds of 50 $\mu g/m^3$ (daily average) were exceeded by up to a factor of 3.

The elemental compositions did not differ much between the sites in northern Switzer-

land. Heavier elements were found mainly in the largest size fraction, while the smaller particle size fraction showed high amounts of carbonaceous material not detectable with our XRF setup. K, Si, Fe, Ca, Al, Na, Mg, Ba, Zn were identified as the important metallic contributors, while Ti, Cu and Cr were found in traces.