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Highly time-resolved trace element concentrations in aerosols during the Megapoli Paris campaigns

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Trace elements contribute typically only a few percent to the total mass of air pollutants, however, they can affect the environment in significant ways, especially those that are toxic. Furthermore, they are advantageous with respect to a refinement of source apportionment when measured with high time resolution and appropriate size segregation. This approach is especially advantageous in an urban environment with numerous time-variant emission sources distributed across a relatively narrow space, as is typically the setting of a megacity.
Two 1-month long field campaigns took place in the framework of the Megapoli project in Paris, France, in the summer of 2009 and in the winter of 2010. Rotating drum impactors (RDI) were operated at two sites in each campaign, one urban, the other one suburban. The RDI segregated the aerosols into three size ranges (PM10-2.5, PM2.5-1 and PM1-0.1) and sampled with 2-hour time resolution. The samples were analyzed with synchrotron radiation induced X-ray fluorescence spectrometry (SR-XRF) at the synchrotron facilities of Paul Scherrer Institute (SLS) and Deutsches Elektronen-Synchrotron (HASYLAB), where a broad range of elements (Na, Mg, Al, Si, P, S, Cl, K, Ca, Ti, V, Cr, Mn, Fe, Ni, Cu, Zn, Se, Sr, Zr, Cd, Sn, Sb, Ba, Pb) was analyzed for each size range.
Time series of the analyzed elements for the different sites and campaigns were prepared to characterize the aerosol trace element composition and temporal behavior for the different weather situations and urban environments. They allow for the distinction of regional vs. local sources and transport, and provide a basis for source apportionment calculations. Local and regional contributions of traffic, including re-suspension, break wear and exhaust, wood burning, marine and other sources will be discussed. Indications of long-range transport from Polish coal emissions in the city center of Paris were also found.