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Ambient aerosol chlorine concentrations and artefacts during the MEGAPOLI Paris campaigns

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Trace elements, especially those that are toxic, can affect the environment in significant ways. Studying them is advantageous with respect to a refinement of source apportionment when measured with high time resolution and appropriate size segregation. This approach is especially useful in urban environments with numerous time-variant emission sources distributed across a relatively narrow space.

Two field campaigns took place in the framework of the MEGAPOLI project in Paris, France: one in the summer of 2009 (1-31 July), the other in the winter of 2010 (11 Jan – 10 Feb). Rotating drum impactors (RDI) were operated at an urban and a suburban site in each campaign. The RDI segregated the aerosols into three size ranges ($PM_{10-2.5}$, $PM_{2.5-1.0}$ and $PM_{1.0-0.3}$) and sampled with 2-hour time resolution. The samples were analyzed with synchrotron radiation-induced X-ray fluorescence spectrometry (SR-XRF) at the synchrotron facility of the Paul Scherrer Institute (SLS), where a broad range of elements (Na, Mg, Al, Si, P, S, Cl, K, Ca, Ti, V, Cr, Mn, Fe, Ni, Cu, Zn) 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 different weather situations and urban environments. Quality assurance was performed partly by intercomparison with independent measurements. An exceptional behavior was observed for chlorine (Cl), where periods with zero RDI concentration alternated with periods of normal load. Zero concentrations were not observed in particle-into-liquid (PILS) measurements. This identifies the observed behavior as a RDI sampling artefact. Nevertheless, the non-zero periods of Cl concentrations are still a gain in information compared to conventional sampling techniques, mainly due to the high time resolution.