Trace metals in ambient air: Hourly size-segregated mass concentrations determined by Synchrotron-XRF

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Author(s) Bukowiecki, Nicolas; Hill, Matthias; Gehrig, Robert; Zwicky, Christoph N.; Lienemann, Peter; Hegedus, Ferenc; Falkenberg, Gerald; Weingartner, Ernest; Baltensperger, Urs
Author(s) at UniBasel Bukowiecki, Nicolas ;
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Trace metals are ubiquitous in urban ambient air, with mass concentrations in the range of a few mu g/m(3) down to less than 100 pg/m(3). To measure such low concentrations represents a challenge for chemical and physical analysis. In this study, ambient aerosol was collected in Zurich (Switzerland) in 1-h intervals and three size fractions (aerodynamic diameters 0.1-1 mu m, 1-2.5 mu m, and 2.5-10 mu m), using a three-stage rotating drum impactor (RDI). The samples were analyzed by energy-dispersive Synchrotron radiation X-ray fluorescence spectrometry (SR-XRF) to obtain size-segregated hourly elemental aerosol mass concentrations for Cr, Mn, Fe, Cu, Zn, Br, and Pb, along with S, Cl, and Ca under the selected experimental conditions. The high sensitivity of SR-XRF allowed for detection limits of <50 pg/m(3) for most of the above elements, with a net analysis time of only 15 s per sample. The data obtained with this technique illustrate that there is a considerable gain of relevant information when time resolution for measurements is increased from 1 day to 1 h. The individual size fractions of a specific element may show significantly different short-term patterns.
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