Mineralogical and geochemical study of PM10 in Strasbourg

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Studies of airborne particulate matter are increasingly important, because of the need to understand their behaviour and their impact on humans. This investigation was focused on the mineralogical and geochemical characteristics of airborne particulates (PM_{10}), which were collected with three different devices in June 2007 near the centre of Strasbourg (France) at 30m above ground. An active sampler (Digitel DHA-80) was used to collect PM_{10} on a teflon filter, which allowed for the subsequent analysis of the bulk chemical composition by ICP-MS (VG PQ 2+). The results obtained for one of the samples (collected on June 13/14) reveal a distinctly higher mass concentration of metals, e.g., Pb, Fe and Zn, relative to all other samples (e.g. approximately 3x higher than on June 7/8). Another active sampler collected particles on carbon filters, which were then analysed by SEM using an automatic single-particle analysis system (Genesis, EDAX). Evaluation of the EDS spectra permitted a mineralogical classification of the particles and a statistical evaluation of each mineral class (500-1000 particles per sample). This method showed that the number of anthropogenic particles, which include transition metal-bearing particles, like MnO, TiO_2, Fe- and Zn- sulphates and oxides, increased by up to 7-fold on June 13/14 compared to June 7/8. In a third sampler, a passive sampler (Sigma-2), particulate matter $>2.5\mu$m was collected on a foil, which was analyzed by light microscopy using quantitative single-particle analysis (IMATEC) (Dietze et al., 2006). This method revealed a 5-fold (wt %) increase in anthropogenic particles with grain sizes of 2.5-10μm during a similar sampling time. This considerable difference between the two sampling periods was caused by different meteorological conditions, especially wind direction (N-NE on June 7/8 vs. S-SW on June 13/14), as confirmed by backward trajectories (calc. by NOAA, HYSPLIT MODEL). Similarly, Pb and Sr isotope data also suggest that S-SW winds are more enriched in anthropogenic particles (Lahd Geagea et al. 2007, 2008).

References:

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