

Size-segregated Characterization of PM₁₀ in German low lands (EMEP site Melpitz) using a five-stage Impactor: A six year study

G. Spindler, A. Grüner, Y. Iinuma, K. Müller, S. Scheinhardt, H. Herrmann

Leibniz-Institut für Troposphärenforschung e.V., Permoserstrasse 15, 04318 Leipzig, Germany

Keywords: Berner impactor, Aerosol size distribution, organic matter, long-range transport, trajectory

Presenting author email: spindler@tropos.de

Particle sampling took place at the IfT-research station and EMEP-site Melpitz (12°56' E, 51°32' N, 86 m asl.). This site is located about 50 km northeast of Leipzig and 120 km west from the Polish border in a rural region in the German low-lands (EMEP, 2007). Particle samples were collected on ring-like aluminium foils using a BERNER impactor (van Pinxteren *et al.*, 2009) for five size classes (stages 1-5: aerodynamic cut-off diameters 0.05-0.14-0.42-1.2-3.5-10 µm, duration 24 hours, sampled air volume 108 m³). Sampling was planned following the weather forecast. Days without precipitation and with a continuous airflow from either the West or the East were preferred. Air-mass origin was rechecked after sampling based on 96-h backward trajectories (NOAA-Hysplit-Model). Between June 2004 and September 2009, 169 daily samples were taken (8.9 % of the total number of days). The sorting criteria were (i) the distinction between winter (W, November to April) and summer (S, May to October) and (ii) a distinction between air mass inflow from a sector West (W, 210° - 320°) and from sector East (E, 35° - 140°). Four categories (WW, WE, SW and SE) with 48, 18, 42 and 29 days were established. For every sampling day and all stages the mass concentrations of gravimetric mass (weighing of equilibrated aluminium foils before and after sampling), the water soluble ions (cations: ion chromatography, anions: capillary electrophoresis), the organic (OC) and elemental carbon (EC) (two-step thermographic method VDI 2465 part 2) and the PAH and n-alkanes (CPP-GC-MS, Curie point 510°C) were determined. The water content was calculated using the extended Aerosol Thermodynamics Model (E-AIM). OC was converted to organic matter (OM) using different conversion factors (1.4 for stage 1, 1.7 for stage 2 and 2 for stages 3-5).

The lowest mean particle mass concentrations have been found for SW and the highest for WE with relative mass concentration distributions (stages 1-5) of 5.9, 28.2, 36.5, 18.0, and 11.4% and 3.5, 22.7, 52.6, 16.7, and 4.5%, respectively. The mean mass closure for water soluble ions, water, OM and EC accounts for 81 to 99% in summer and 60-81 % in winter (depending on the stage). The fractions of nitrate are relatively high for WW; in contrast, sulphate is high for WE. The estimated mean concentrations of secondary organic carbon (SOA) (Castro *et al.*, 1999) on stage 3 for WW, WE, SW and SE are 0.32, 1.25, 0.27 and 0.58 µg m⁻³,

respectively. The highest difference in the percentages of SOA in OC was found between winter (WW 55%, WE 59%) and summer (SW and SE 74%), indicating photochemical processes. The mean Carbon Preference Indices (CPI) are the highest for SE (stage 4: 7.57 and stage 5: 9.82), resulting from plant wax abrasion in the surrounding forests. The mean PAH concentration for WE on stage 3 is 9.7 ng m⁻³ which is more than 4 times higher than for WW. PAHs account for about 610 and 310 ppm of the particle mass concentration for WE and WW, respectively. This indicates long range transport from emissions of domestic heating and other combustion processes (Figure 1) especially for WE.

These results are in agreement with former findings of higher fractions of sulphate, organic and black carbon during air mass transport from E (especially in winter) in particles of different size ranges at the Melpitz site (Spindler *et al.*, 2010).

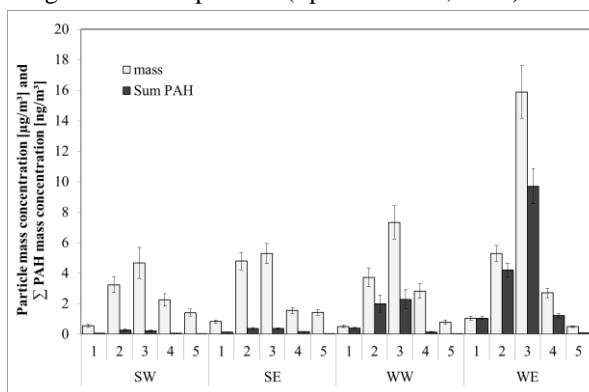


Figure 1. Sum of individual PAH and particle mass concentration for stages 1 to 5 of the BERNER-impactor in Melpitz. Means for the four categories WW, WE, SW and SE.

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