Size-segregated physical-chemical characterization of particles depending from air mass origin at Melpitz (Germany)

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The present joint investigation (supported by the Umweltbundesamt, project 351 01 022) for a size-segregated physical-chemical characterization of tropospheric aerosol has started in July 2004 at the research station of the Leibniz-Institut für Troposphärenforschung (IfT) in Melpitz. This spot is also one site in the air quality measuring network of the Umweltbundesamt (UBA). Melpitz is an air chemistry and physics station (Spindler *et al.*, 2004) situated in the vicinity of the city of Torgau in the river Elbe valley (12°56' E, 51°32' N, 86 m asl.).
24 hour samples for PM_{10}, $PM_{2.5}$ (every day) and PM_1 (at least every six days) were collected at quartz fibre filters (Munktell, S) using high volume samplers (DHA-80, DIGITEL Electronic AG, CH).
Particle mass concentration was determined gravimetrically (Mettler AT 261 Delta Range balance, Mettler Toledo GmbH, D) under constant conditions (24 hours: 50% relative humidity, temperature 20°C), compare Figure 1.

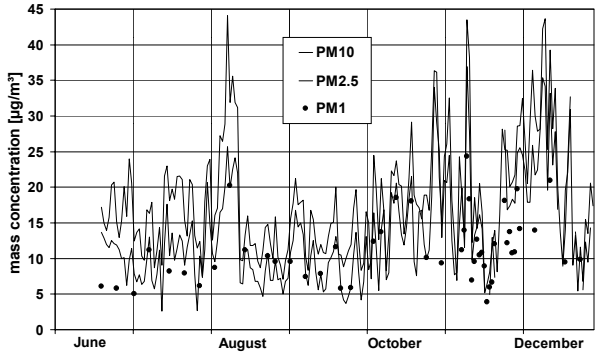

Figure 1. Particle mass concentration in 2004 at Melpitz site (daily means)

The concentration of water-soluble ions was detected by ion chromatography (Metrohm, D). Total carbon was quantified as sum of organic and elemental (TC=OC+EC) by a thermographic method applying a Ströhlein C-mat 5500 carbon analyzer (Spindler *et al.*, 2004). The particle number size distribution was measured directly in the range 3 to 800 nm and using a thermodenuder for evaporation of volatile particle mass before measuring the number concentration (Wehner, *et. al*., 2003). During selected days with distinct air mass origin (at least 10 per summer or winter) particles in the range of PM_{10} up to $PM_{0.05}$ were sampled in five size classes with BERNER low pressure impactor and analysed for mass, the content of water soluble ions, organic and black carbon, heavy metals and selected organic species.

Under the dominating wind direction southwest to northwest (W) air masses from the Atlantic Ocean with integrated showers are transported, often during low pressure situations, to Melpitz. They pass large parts of Germany. The second main wind direction is East (E). Hence, during high-pressure conditions dry air masses are transported over long distances to Melpitz, often with moderate wind velocity and low precipitation. The main sources for these air masses are Russia, Poland, Belarus, Ukraine, and the North of Czech Republic. In these areas coal heated power plants sometimes with little exhaust treatment, old industry, and older cars still exist as air pollution sources. The mean particle distribution for these main air mass origins are given in Table 1.

Table 1. Mean particle distribution in summer and winter 2004 for two air mass origins at Melpitz site

amo	PM	*n*	mass	SO_4^{2-}	NO_3^-	NH_4^+	TC
W_{summer}	1	*12*	7.6	1.9	0.3	0.8	1.6
W_{summer}	2.5	*69*	8.7	1.9	0.4	0.8	1.7
W_{summer}	10	*69*	13.8	2.2	1.1	0.8	2.6
E_{summer}	1	*1*	20.2	3.3	0.1	1.3	4.8
E_{summer}	2.5	*14*	17.5	3.7	0.2	1.4	4.4
E_{summer}	10	*14*	25.0	4.0	0.5	1.5	6.4
W_{winter}	1	*21*	10.8	1.5	2.4	1.3	2.4
W_{winter}	2.5	*50*	14.9	2.2	3.1	1.6	3.1
W_{winter}	10	*58*	18.4	2.4	3.9	1.8	3.4
E_{winter}	1	*3*	18.0	3.4	2.2	1.9	4.7
E_{winter}	2.5	*6*	21.6	4.2	3.1	2.3	5.4
E_{winter}	10	*6*	25.7	4.6	3.6	2.4	5,6

summer: June 19 to September 30, **winter**: October 1 to December 31; **amo**, air mass origin; **n**, number of measurements; for mass, ions and TC all data in µg/m³

For identifying air mass source region 96 hours backward trajectories (www.arl.noa.gov) for 200, 500 and 1500 m were used at 10:00 and 18:00 MEZ.

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