THE LONG-TERM TREND OF PM 10, PM 2.5 AND PM 1 PARTICLE CONCENTRATION AT THE RURAL MELPITZ SITE IN SAXONY (GERMANY)

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INTRUDUCTION

For a period of eight years (1993 to 2000) daily filter pack samples PM10 (since 1993) were collected by a high volume sampler (HV) and weekly filter pack samples PM 10, PM 2.5 (since 1995) and PM 1 (since 1999) by a low flow sampler (LF) at the IfT-research station Melpitz in the downstream plume of the Leipzig conurbation in Central Europe. The samples were taken on quartz fibre filters (HV) and Teflon-filters (LF) and for the particle size separation virtual impactors were used. Aerosol characterization for this area was performed to describe the influence on atmospheric chemistry (Heintzenberg et al. 1998, Spindler et al. 1999) and for health effects. The distinction of particles with regard to their aerodynamic diameter has a human toxicological background. Particles smaller than 10 µm are able to pass the larynx whereas particles smaller than 2.5 µm reach the pulmonary aveoli. Since 1999 also PM 1 samples at quartz filters are available for the quantification of organic and elemental carbon (OC and EC). During the last years traffic increased significantly in eastern Germany whereas the output of aerosols and possible precursors from power plants and from individual household heating systems strongly decreased (Müller 1998).

EXPERIMENTAL

Daily filter samples were collected at the IfT-research station in Melpitz with a High Volume Sampler (HV)(Anderson Samplers Inc., Atlanta, Georgia, USA). The sampling volume was 1370 m^3 and the average filter face velocity 39,4 cm/s. Filter samples were collected at 25,4 x 20,3 cm quartz fibre filters (Munktell Filter AB, Grycksbo, Schweden, type MK 360. Weekly filter samples were taken in Melpitz with the "Partisol 2000" Air Sampler (Rupprecht and Patashnik Co. Inc., Albany, New York, USA). The sampling volume was 84 m^3 and the average filter face velocity 18,3 cm/s. Filter samples at 47 mm diameter Teflon filters (Millipore, Type 4700, 3 µm pore size) for PM 10, PM 2.5 (since 1995) and PM 1 (since 1999) are available.
The sampled particle mass was weighted under constant environment conditions (50 % relative humidity, temperature 20 °C). The condition time for each weighing was 24 hours. The ion concentration was detected by ion chromatography. At the PM 1 quartz filters the OC and EC was quantified by a Ströhlein c-mat 5500 carbon analyzer separating the OC (590 °C, nitrogen) and EC (650 °C, oxygen).
Sampling was performed at the research station Melpitz, situated in the vicinity of the town Torgau in the river Elbe valley (Altitude 87 m, Latitude 51°32' N, Longitude 12°54' E). The station is located on a flat meadow surrounded by agricultural land. Plant cover exceeds 95 %. The nearest road is a national road (B 87) passing by of about 1.5 km to the North of the site. Edges of forest are located 2.5 km north and south of the station.

RESULTS

Weekly filter pack measurements PM 10 (LF) for mass and main ions were compared with weekly means from daily quartz fibre filter pack measurements (HV) at the Melpitz site. For the detected particle mass the coefficient of correlation is $r^2 = 0.88$ (1995 to 2000, n = 248) and the slope (0.88 ± 0.01). That means the LF-sampler shows in the mean a lower mass. The reason can be losses of volatile compounds during the sampling time witch is seven times longer as for the HV-sampler. The

part of PM 2.5 and PM 1 from PM 10 (100%) reflects table 1. Most of the PM 2.5 mass is PM 1. The coarse mode (PM 10 - PM 2.5) dominates in the summer from the resuspension from soil.

PM	summer 1999	summer 2000	winter 1999	winter 2000
PM 2.5	56,7 %	56,8 %	82,0 %	76,4 %
PM 1	46,2 %	62,9 %	47,4 %	56,6 %

Table 1: Part of PM 2.5 and PM 1 from PM 10 (100%) distinguished between winter (October to March) and summer (April to September) for the whole years 1999 and 2000

The ratio of OC/EC in PM 1 varied within summer and winter at site Melpitz. Figure 1 shows the PM 10 time course from HV (daily means, 1993 to 2000) and LF (weekly means, 1995 to 2000). The particle mass concentration shows a decreasing trend. High values have been observed in the winters before winter 97/98. In the following winters no pronounced concentration peaks were found. A reason is the decreasing number of coal heating systems in the Leipzig conurbation and the surroundings. Additionally, in the last winters high pressure systems with transport of dry continental air masses and low mixing heights relatively seldom occured. The time slot for the INTERCOMP 2000 experiment is marked.

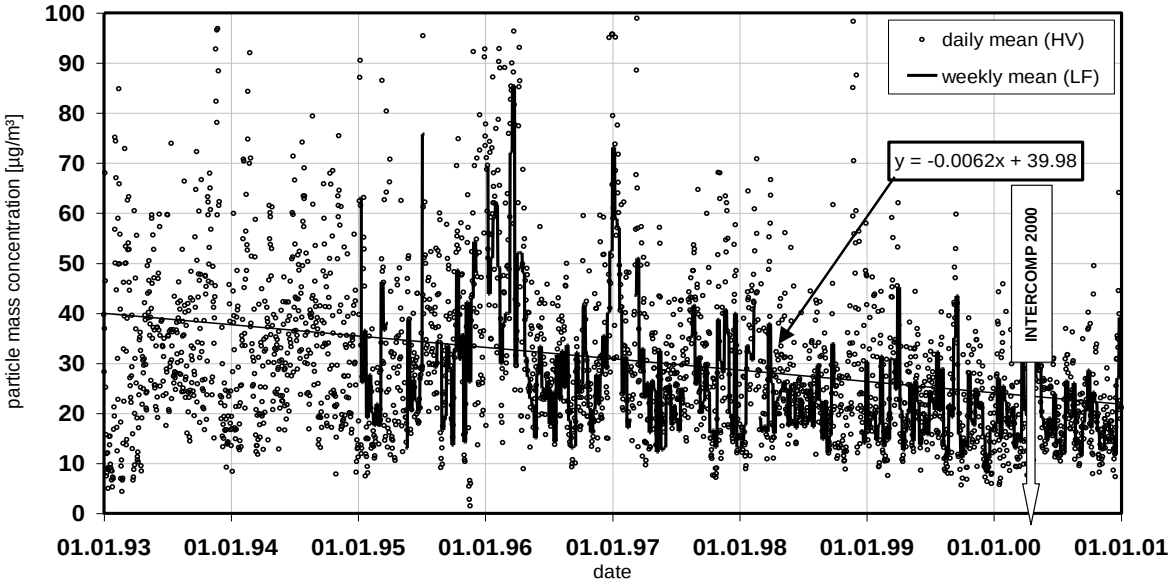

Figure 1 PM 10 course at the Melpitz

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