SIZE-SEGREGATED PHYSICAL-CHEMICAL CHARACTERIZATION OF TROPOSPHERIC PARTICLES IN WINTER 2003 AT MELPITZ (GERMANY)

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Keywords: particulate matter, filter sampler, impactor, ultra fine particles

INTRODUCTION

In a joint project new approach for a size-segregated physical-chemical characterization of tropospheric aerosol were tested in November and December 2003 at the research station of the Leibniz-Institut für Troposphärenforschung (IfT) in Melpitz in Germany. 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.). Under the dominating wind direction from southwest air masses from the Atlantic Ocean with integrated showers were transported, often during low pressure situations, to Melpitz. They pass the conurbation od cities Leipzig and Halle before arriving at Melpitz. The second important wind direction maximum is East. Hence, during high-pressure conditions dry air masses are transported over long distances to Melpitz, often with moderate wind velocity and without 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. Particles in the range of PM_{10} up to $PM_{0.05}$ were sampled in five size classes and analysed for mass and the content of water-soluble ions and total carbon. The particle number size distribution were measured in the range between 3 and 800 nm directly and using a thermodenuder (Wehner, et. al., 2003) for evaporation of volatile particle mass before measuring the number concentration.

METHODS

Impactor sampling was carried out over 24 hours, the start was 10:00 MEZ. For identifying air mass source region 24 hours backward trajectories (www.arl.noa.gov) for 200, 500 and 1500 m were used at 18:00 and 02:00 MEZ. The device for particle sampling is a five stage BERNER low pressure impactor with the cut-off sizes 10, 3.5, 1.2, 0.42, 0.14 and 0.05 µm (Hillamo & Kaupinen, 1991). The particle mass concentration was determined gravimetrically (at 50% relative humidity, 20 °C). Conditioning time was at least 24 hours (Mettler AT 261 Delta Range balance). The concentration of water-soluble ions was detected by ion chromatography. 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 WSOC (water soluble organic carbon) is planned to be analyzed by a Shimadzu TOC-analyzer The number size distribution of ambient and non-volatile aerosol particles were measured with a TDMPS (twin differential particle sizer).

RESULTS AND CONCLUSIONS

Two examples for a characterization of particles are compared in Figure 1: The samples transported from the Atlantic Ocean (i) shows lower particle mass concentration as the sample transported from Russia via Ukraine and Czech Republic (ii). The arrow in (i) marks the change of the source region between backward trajectories for 18:00 and 02:00 MEZ. The higher relative content of TC in the size range 3.5-10 µm in the sample (ii) transported from East results propably from anthropogenic emissions in the surroundings during lower temperatures. This sample (ii) contains also volatile material in the size range 0.05-0.14 µm with an absolute mass concentration two times larger than in

the sample transported from the ocean (i). Such small particles can be transported over long distances. In the sample transported from the ocean no noticeably volatile material was detected (graph not shown). The described two examples and measurements with complete data sets for further 10 days show the influences of different source regions on the composition of smaller particles transported over long distances and the influence of local meteorological condition on the composition of larger particles transported over shorter distances. In principle the described techniques can be used in the measuring network of UBA.

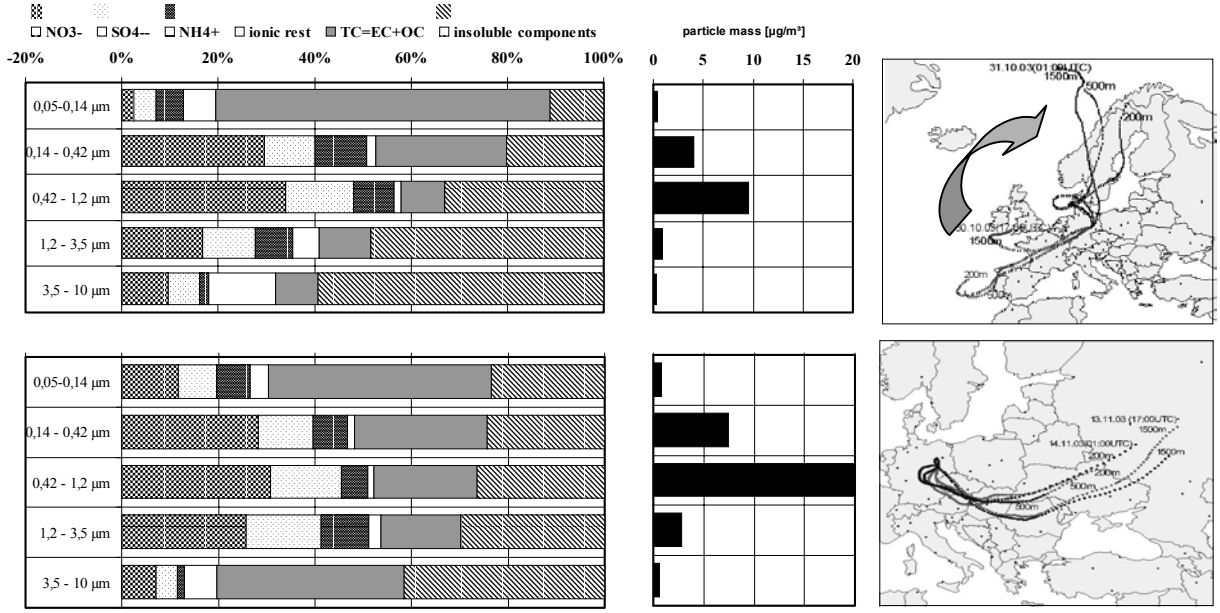

Figure 1. Example for the distribution of main ions, TC and mass at the 5 stages of the BERNER impactor for two 24 hour samples, started at 03-10-30 (i) upper plot and 13-11-13 (ii) lower plot. The trajectories on right site identify different source regions and transport lines for both days.

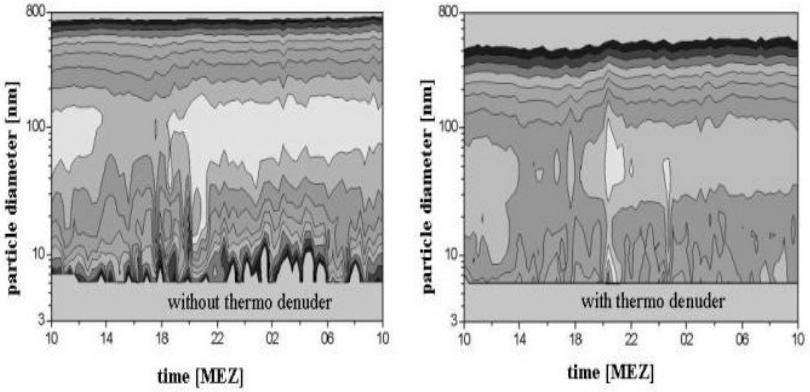

Figure 2. TDMPS-measurements of ambient and non-volatile particles taken at 03-11-13 (ii)

ACKNOWLEDGEMENTS

This work was supported by the Umweltbundesamt (project 351 01 022).

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EUROPEAN AEROSOL CONFERENCE, EAC 2004
ABSTRACT CLASSIFICATION FORM

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Health aspects of aerosols
High Temperature Aerosols
Indoor aerosols
Industrial aerosols
Nanoparticles
>PM10/PM2.5
Other:

Keywords: particulate matter, filter sampler, impactor, ultra fine particles

Preferred keywords (shown overleaf) will make easier the construction and use of the alphabetical index in the proceedings book.

Presentation Preference: (X) Oral ( ) Poster ( ) Any

Presentation Speaker: Gerald Spindler

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Classification of industrial aerosols
Study and properties

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