Chemical Aerosol Characterization at two Sites in Central Europe – a Comparison: 1993 - 1995 and 1998 - 2000

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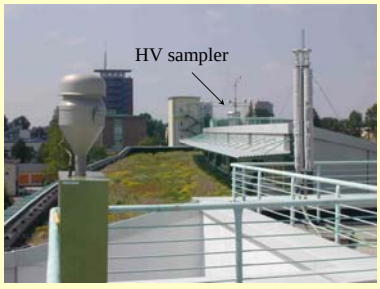
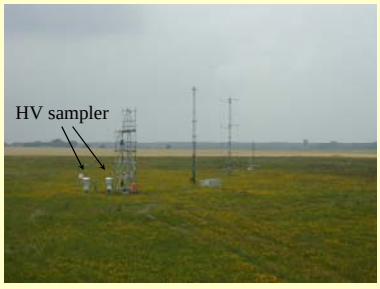
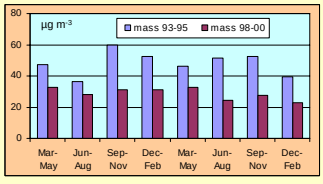
Motivation

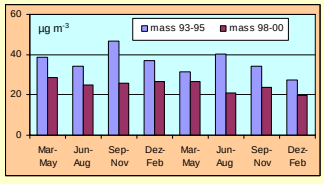
During two different projects the chemical characterization of PM 10 high-volume filters took place in parallel at the grounds of the IfT (northeasterly outskirts of Leipzig) and at the research station Melpitz (41 km from Leipzig in northeasterly direction – mean wind direction). The region around Leipzig was characterized by opencast brown coal mining, chemical industry and brown coal fired power plants. Important changes in the air quality above the five new countries of Germany were predicted after the re-unification. Daily PM_{10} quartz filter samples were collected in Melpitz from summer 1992 on. Important changes were observed during this decade. The modernization of power plants and the reconstruction of the chemical industry are important factors leding to better air quality. The individual heating technology changed from brown coal briquette heating to natural gas and oil heating systems. An opposite development was observed for the road traffic. The number of passenger cars and heavy duty diesel trucks increased enormously. Nevertheless the increase in nitrate was low because the passenger car fleet is equipped now to over 95% by catalytic converters. Further important sources of PM are long range transports, agricultural activities and reemission of deposited particles by the traffic.

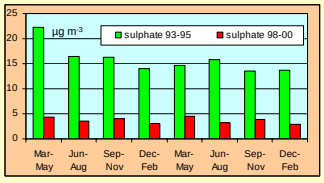


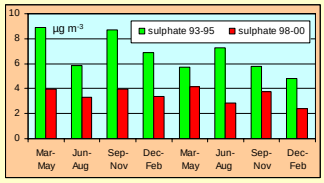


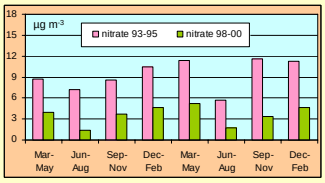
Leipzig - IfT **Melpitz – Research Station**

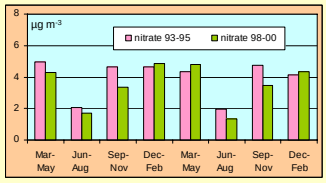


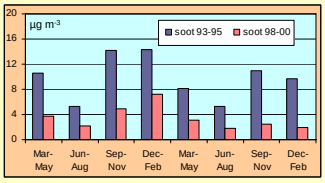


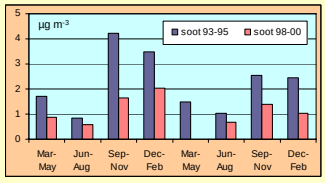


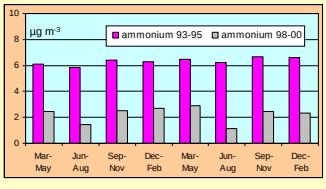


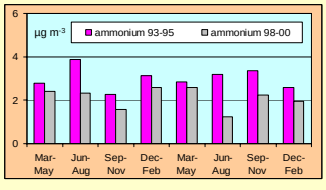








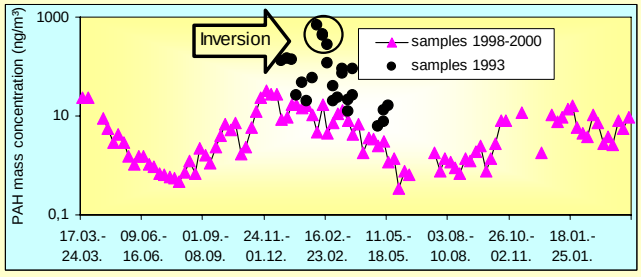




Sampling and analytical Methods

- For the PM collection two identical Sierra-Andersen High Volume Samplers (General Metal Works, Atlanta, USA) with PM10 inlet were used. The filters were MK 360 quartz fibre material (Munktell, Grycksbo, Sweden).
- The mass determination was made after 24 hours equilibration under constant consitions (20°C and 50% relative air humidity).
- The chemical analyses were carried out using DX 100 (Dionex, Sunnyvale, USA) standard ion chromatography after extraction of filters in the eluent of the IC.
- The black carbon content was detected by an optical reflectance method (Müller, 1997) and by a two step thermographic method.
- PAH were determined only from Leipzig samples after toluene extraction and HPLC – fluorescence detection.

The Figure about the sum of the measured PAH demonstrates the significant changes in the air quality during the heating period, especially. We had to use a logarithmic scale to compare the data from 1993 and 1998 - 2000!!



Results

- There has been a strong decrease in nearly all anthropogenic aerosol components as a result of political and economical changes in Eastern Germany!
- PAH´s had their most important sources in the domestic brown coal briquette heating which decreased enormously! Dust emissions by domestic heating decreased from 7 kt/a in 1991 to 1kt/a in 1998. VOC emissions decreased from 14 kt/a to 1 kt/a.
- A decrease of the nitrate content in PM_{10} was observed only for summer and autumn in the rural and city samples. Whereas for Leipzig a decrease was observed in Melpitz the concentration is nearly constant.
- The modernization of power plants and the decreasing individual consumption of brown coal briquettes had lowered the SO_2 emissions (decrease in concentration from 40 µg/m³ in 1995 to 6 µg/m³ in 1999)! Hence, Sulphate concentrations decreased strongly.
- Emissions in Poland and Czech Republic were lowered in the same way, so the long range transports of pollutants decreased, too.

Acknowledgements

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