

Size-segregated analysis of PM₁₀ at a tandem urban – rural site combination



J. K. Gietl^{1*}, T. Tritscher^{1,2}, and O. Klemm¹



¹University of Münster, Institute for Landscape Ecology, Germany
² now Paul Scherrer Institute, Laboratory of Atmospheric Chemistry, Switzerland

Introduction

In January 2006, size segregated measurements and analysis of the chemical composition of PM₁₀ samples, collected twice daily with Berner type impactors, were made to determine its source patterns. The measurements were performed at two sites in Münster, NW Germany. One of the sites was located in the centre of Münster, next to a four- to six- lane main road. The second one was set up in a bird nature protection area 6 km to the North.

Method

The samples were taken with two five stage Berner type impactors. They were collected on Tedlar® foils and on quartz fiber filters (Whatman) taken simultaneously, with sample integration time being 6 hours.



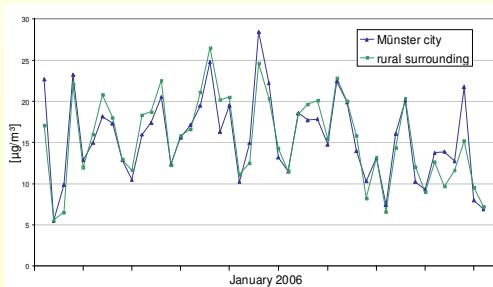
Sample on impactor stage equipped with Tedlar® foil and quartz fibre filter on top

Analysis

The carbon analysis was made with an OCEC Lab Analyser. The main ions (Cl⁻, NO₃⁻, SO₄²⁻) were analyzed with an ion chromatograph. NH₄⁺ was detected with a flow injection analyser and Ca²⁺, Mg²⁺, and Na⁺ with an atom-absorbing spectrometer.

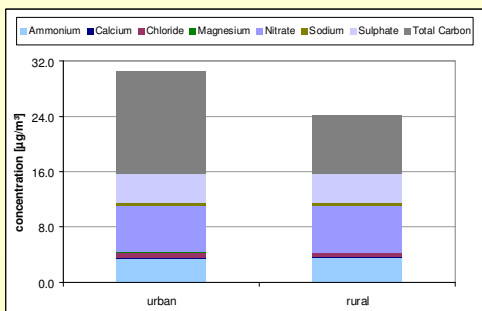
Results

The mean mass concentration, calculated as the sum of ions plus carbon, was clearly higher at the roadside than in the surrounding (31 µg/m³ to 24 µg/m³). Between the two sites, there was no significant difference in ion mass concentration, correlation coefficient of 0.92.



Comparison of the total analysed ion concentration in January 2006

The main difference between these sites was caused by carbon, due to traffic and other combustion processes like domestic heating. Daytime values were significantly higher than the concentrations during nighttime.

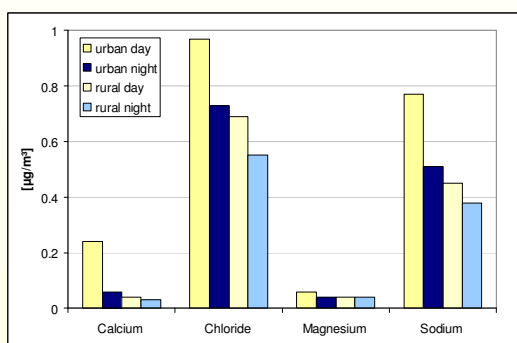


Acknowledgement

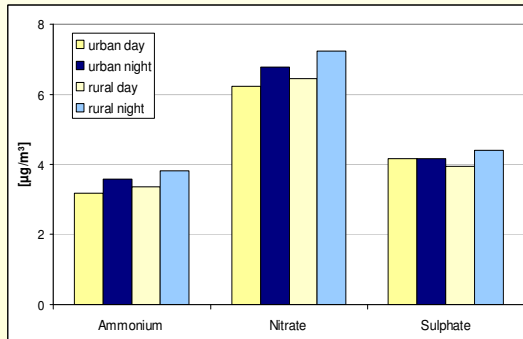
This study was financially and logistically supported by the municipality of Münster, the Biological Station, Rieselfelder Münster, gave logistic support, and data access was granted by the Landesamt für Natur, Umwelt und Verbraucherschutz NRW (former Landesumweltamt NRW).

For further information please contact: johanna.gietl@uni-muenster.de
<http://kli.uni-muenster.de>

There were slight differences in ion concentrations. Additional NaCl lead back to de-icing salt in the city. The accessorily calcium at the roadside is due to dust dispersion from road traffic.



Mean mass concentrations of the ions in January 2006



The secondary ions NH₄⁻ and NO₃⁻ increased during nighttime due to the light sensitive reactions of nitrogen. NO₂ is not photolyzed during night, and so can react with OH forming HNO₃.

Ammonium was high, compared to other components, which is typical for sites near agricultural activity.

Conclusions

Carbon made the main difference between the two sites in Münster. The difference between the two sites averages 7 µg/m³, meaning about 23 % coming from traffic and 77% originating from background concentration.

In contrast, no clear difference was found between the mean ion concentrations.