Gradients of PM10 mass concentrations analysed for major German conurbation areas

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An evaluation of the spatial variations observable for PM10 mass concentrations in the area of nine major German conurbations¹ was conducted for the years 2003-2005.

**Data base**

As far as possible for two measurement sites per area type [regional (=least influenced by local sources), rural (= influenced by local, mainly agricultural activities), urban background, urban traffic, and industrially influenced sites] were selected per agglomeration area. Time resolved measurement data for the years 2003 to 2005 provided by the German Environmental Agency (UBA) from the selected sites were used. Overall, 17 (regional and rural background), 18 (urban background and traffic) and 3 (industry) sites were used in this study.

**Results**

Average weekly variations were calculated for each site, then 24h-averages calculated per site type. (Figure 1, left graph). Separate averages for working (Mo-Fri) and weekend (Sa-Su) days were also computed (Figure 1, right graph).

![Figure 1. Average weekly variation of PM10 mass concentrations at different types of sites.](image)

The variability of the PM10 concentrations in dependence of day and site type was also investigated. The results based on average weekly variations (per calendar year) are shown in Figure 2 as box-plots indicating minimum, 25-,50-,75-percentiles and maximum concentration values found.

![Figure 2. Box-plot showing the variability of PM10 mass concentrations for different site types, compared for weekend and working days](image)

The expected gradients between remote sites and urban hot-spots could be verified for nearly all agglomeration regions investigated, except for one case with PM10 at the rural exceeding those measured at the urban background site. The PM10 increment from one site type to the next more polluted one is generally about 5 µg/m³, in case of traffic hot spots ca. twice that value. However, the increments for the three industrial sites included in the study are less pronounced.

The traffic-urban increment contributes by ca. 22% on weekends and ca. 28% on workdays to the PM₁₀ concentrations found at traffic sites. This is complemented by the contributions from regional (48/42%), rural (18/16%) and urban (12/14%) background. These relations do not significantly vary between the considered years.

**Conclusion**

Analysis of time resolved air quality measurement data from the German Länder networks proves that PM10 concentrations in the areas of various urban agglomerations exhibit common features regarding the weekly pattern and spatial profile. From these results the possibilities and the limitations for reducing exposure to particulate matter by local measures can be inferred.

**Outlook**

PM10 chemical composition data available from Germany will be used to obtain information on the spatial gradients of main chemical compounds.

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