

Spatial and temporal variability of ultrafine particles within an urban agglomeration, the Ruhr-Area, Germany

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Keywords: ultrafine particles, urban aerosols, vehicles emissions

Due to the large number and heterogeneity of pollutant sources in urban environments, particle number concentrations and size distributions are subject to significant spatial and temporal variability. While recent research indicated some correlation between number concentrations of larger particles across cities, the spatial-temporal variation of ultrafine particle number concentrations is significantly larger (Costabile et al., 2008; Tuch et al., 2006). Additionally, differences in aerosol size distributions between multiple urban measurement sites are much less understood.

The present study analyses ongoing measurements of particle number and particle size distributions in the size range $14 < D_p < 740$ nm from three different sites within the urban agglomeration 'Ruhr-Area'.

Measurement locations comprise: An urban background site (Mülheim-Styrum), situated in a light traffic residential zone and a traffic site close to a major road (Gladbeckerstrasse) with about 50,000 vehicles per day.

The outcomes of the measurements reflect the traffic flow of the different areas. The total number concentration provide an indication that there is a significant difference between the two areas (Fig.1), caused by the higher traffic flow.

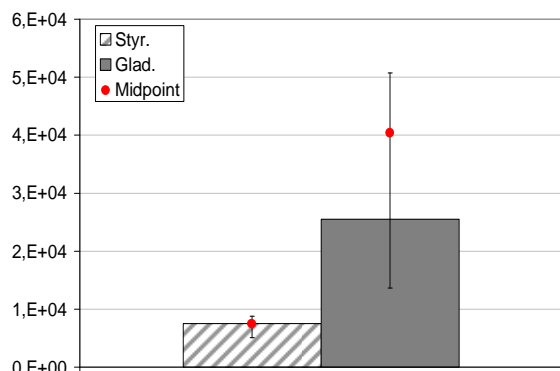


Fig. 1: Median (error bars represent 25 and 75 percentiles) and Midpoint (red circle) of Total Number concentration of particles at the two different areas, urban background (Styr.) and traffic zone (Glad.)

Fig. 2 demonstrates that the values for traffic station are clearly higher than the values for the urban background. Mainly the ultrafine particles illustrate a clear aggrandisement and the values suggest that higher concentrations are due to traffic.

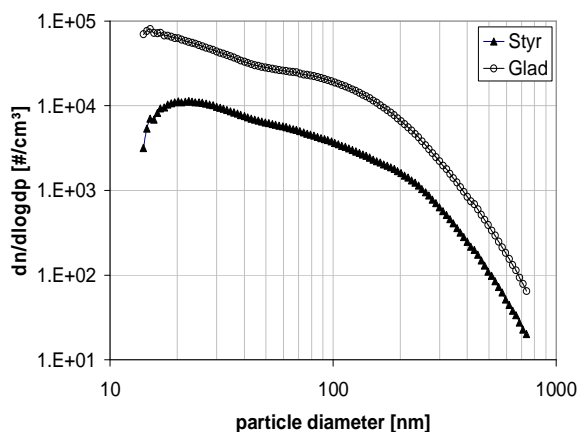


Fig 2: Average of the number size distribution for the two stations.

In the vicinity to the latter site a 'near-traffic' site is installed to evaluate especially the spatial differences coupled to temporal changes in concentrations and size distributions. The representativeness of the stationary measurements are backed up by mobile measurements of particle number concentrations by handheld condensational particle counters ($D_p > 10$ nm). First results indicate a good correlation between total number concentrations and distance of the measurement to road traffic. Further data interpretations in view of, e.g. absolute number concentrations, temporal patterns, small scale representativeness all in view of relevance for exposure of the population, will be presented and discussed.

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 Tuch, T.M., Herbarth, O., Franck, U. Peters, A., Wehner, B., Wiedensohler, A., Heintzenberg (2006). *Journal Expos Sci Environ Epidemiol*, 16(6): 486.