

The new UFP 330: Ten months of continuous measurements

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Several epidemiological studies have shown a relationship between high number concentrations of ultrafine particles (< 100 nm) and adverse health effects. However, most routine measurements of particulate matter are limited to the mass concentration, e.g. PM10 or PM2.5. One major reason for this is that commercially available measurement technique is relatively expensive and needs more maintenance than in the routine network operation can be provided. Within the frame of the project UFIPOLNET a new instrument to measure ultrafine particle number concentrations has been developed which is easy to handle and needs less maintenance than e.g. available SMPS systems.

The new instrument (Ultrafine Particle Monitor, UFP330) consists of a Corona Charger, a DMA, and an electrometer. The measured current is online transferred to a number size distribution (20 – 800 nm) and locally stored as number concentration within 6 size channels.

Within the frame of UFIPOLNET 4 prototypes of the instrument have been built and are operated at 4 stations in Europe since February 2007: Dresden, Prag, Augsburgs, and Stockholm. The first 10 months of data have been used for a detailed analysis and conclusions. The data availability for Prag, Augsburg, and Stockholm was between 93.8% and 99.2% for the whole period. The system in Dresden has been regularly checked in the laboratory, therefore the availability is much lower there and not comparable.

Data, stored in a common database, include not only those from the UFP but also trace gases, meteorological data, and DMPS, if available. The data have been analysed for the first 10 months with regard to diurnal, monthly and seasonal cycles, but also the correlation with trace gases has been calculated. Here, especially at traffic-dominated sites such as Prag, but also Stockholm a good correlation between number concentration < 100 nm and NO has been found.

Figure 1 shows exemplarily monthly averages for number concentration in the range 20-30 nm (N1), 50-70 nm (N3), and 100-200 nm (N5). During most of the time the site in Prag shows highest number concentration followed by Stockholm during certain periods, while Augsburg and Dresden show lowest concentrations.

These differences can be explained mainly by the location within the selected city.

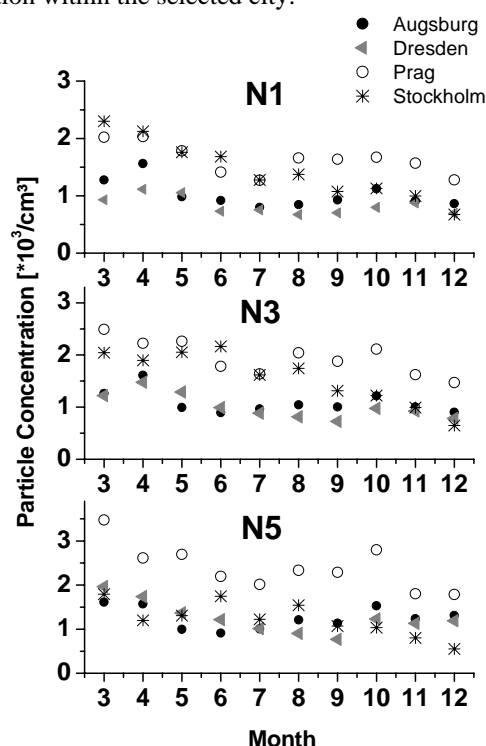


Figure 1: Monthly mean number concentrations in the size ranges N1 (20-30 nm), N3 (50-70 nm), and N5 (100-200 nm) at the 4 stations.

In January 2008 all 4 instruments were sent to IfT laboratory and were compared among each other but also against a TDMPS. Results showed significant differences in the beginning, but a complete instrument check and cleaning reduced the differences to < 10%. Thus, this long term operation of the 4 prototypes had the major conclusions:

- instruments provide high data availability with little maintenance
- define maintenance intervals for the instrument
- show needs for further improvements in the final version.

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