The new UFP 330 (TSI 3031): One year of continuous measurements

B. Wehner[1], A. Wiedensohler[1], A. Zschoppe[2], C. Peters[2], A, Rudolph[2], L. Hillemann[3], M. Pitz[4,5], J. Cyrys[4,5], J. Nowak[6], C. Johansson[7], H.-G. Horn[8], R. Caldow[9], G.J. Sem[9] , H. Gerwig[10]

[1]Leibniz-Institute for Tropospheric Research, 04318 Leipzig, Germany
[2]Topas GmbH, 01279 Dresden, Germany
[3]UBG – Staatliche Umweltbetriebsgesellschaft, 01445 Radebeul, Germany
[4]Helmholtz Center München,German Research Center for Environmental Health, 85764 Neuherberg, Germany
[5]Center for Science and Environment, University of Augsburg, 86159 Augsburg, Germany
[6]CHMI – Czech Hydrometeorological Institute, 14306 Prague, Czech Republic
[7]ITM – Department of Applied Environmental Science, Stockholm University, 106 91 Stockholm, Sweden
[8]TSI Gmbh, 52068 Aachen, Germany
[9]TSI Inc., Shoreview, Minnesota, 55126, USA

birgit@tropos.de

Objectives

- development of a measuring device for number size distributions of ultrafine particles:
- suitable for residential areas in Europe
- affordable and easy to use for routine network operation
- stable delivery of reliable data
- reduced data amount per time
- high data availability
- little maintanance

Measurement Sites in UFIPOLNET

Stockholm:

- located next to the busy road Hornsgatan (inner city) with 35 000 cars/day
- street canyon
- inlet height: 3.5 m above ground

Augsburg:

- located in the vicinity of city center
- urban background, 50 m to a main road
- inlet height: 4 m above ground

The instrument: UFP 330

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. For routine networks, number size distributions are usually replaced by integral concentrations within certain size classes. For the UFP 330 the size classes have been defined as follows:

name	range
N1	20 - 30 nm
N2	30 – 50 nm
N3	50 – 70 nm
N4	70 – 100 nm
N5	100 – 200 nm
N6	> 200 nm

Size classes of UFP330

Dresden:

- 5 m from a busy road with 50 000 cars/ day
- traffic dominated site
- inlet height: 3.5 m above ground

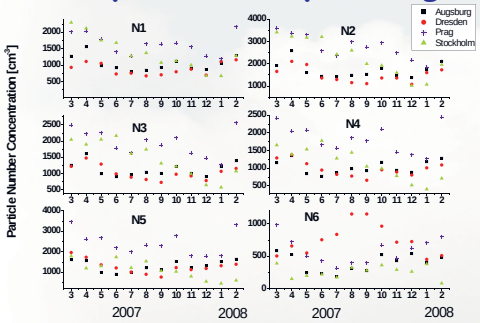
Prag:

- located in a garden above a tunnel with a busy road with 50 000 to 70 000 cars/ day
- mainly traffic influenced site
- inlet height: 3.5 m above ground

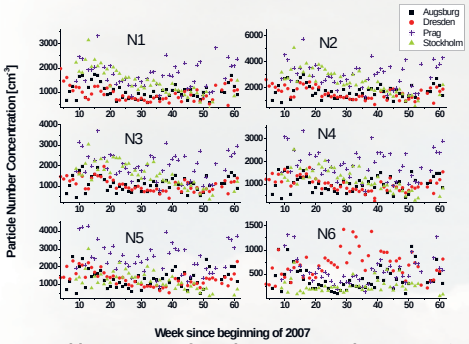
First Measurements

Four prototypes of the instrument were built and are operated at 4 stations in Europe since March 2007. The first year of data has been evaluated for this study. Monthly and weekly averages were calculated to evaluate the evolution of number concentrations. Mean weekly and diurnal variations illustrate different particle sources at the sites.

Monthly and weekly averages

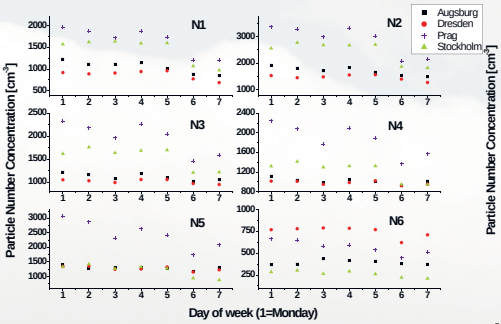


Monthly averages of number concentrations N1 – N6 at all four stations from March 2007 – February 2008.

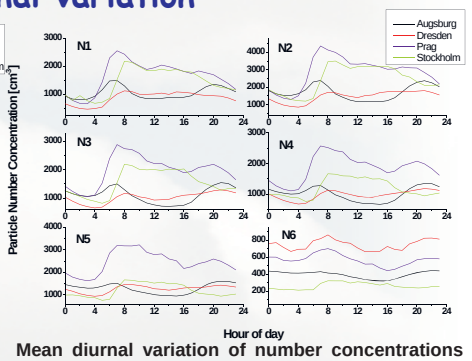


Weekly averages of number concentrations N1 – N6 at all four stations from March 2007 – February 2008.

Weekly and diurnal variation



Mean weekly variation of number concentrations N1 – N6 at all four stations from March 2007 – February 2008.



Mean diurnal variation of number concentrations N1 – N6 at all four stations from March 2007 – February 2008.

Conclusions and Outlook

- Four instruments were operated continuously at four sites for one year
- Instruments provide high data availability (>93%) with little maintenance
- Long term operation demonstrated stable measurements under field conditions
- Instrument capable to measure under different urban pollution levels
- Long term operation also helps to define maintenance intervals for the instrument and to show needs for further improvements in the final version.
- **A commercial version of the UFP 330 is now available:**

TSI Ultrafine Particle Monitor - Model 3031

Leibniz Institute for Tropospheric Research
Physics Department/ Aerosol Group

Acknowledgements:

This project (www.ufipolnet.eu) is financed by the LIFE financial instrument of the European Community under No. LIFE04 ENV/D/000054.