UFIREG – Ultrafine particles and health

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Information on health impacts of ultrafine particles (UFP) is still limited. Only few studies have been conducted so far. Therefore, the aim of the UFIREG-project which started in July 2011 is to investigate short-term effects of different size classes of (ultra)fine particles on mortality and morbidity, especially on cardiovascular and respiratory diseases. Further objectives of UFIREG are the preparation of a cost-efficient UFP measurement strategy applicable in European cities, analyzing temporal and spatial variation of UFP among the cities and raising the overall awareness of the population as well as environmental and public health authorities.

UFP measurements within UFIREG are performed using Differential or Scanning Mobility Particle Sizer (DMPS/SMPS) in five cities: Dresden, Augsburg, Prague, Ljubljana, and Chernivtsi. In addition, two Ultrafine Particle Monitors, recently developed within the former EU project UFIPOLNET, are operated in Prague and Augsburg. Most of the measurement stations are integrated in local air quality monitoring networks and are located at urban background sites. At these sites, other air pollution parameters such as PM_{10}, $PM_{2.5}$, NO_x, SO_2, O_3, and partially black carbon as well as meteorological parameters are determined. On the basis of the measured air quality data, epidemiological studies will be carried out in all participating cities.

An extensive quality assurance program is an essential part of UFIREG aiming at a high and comparable data quality. It comprises staff training, an initial intercomparison of all SMPS used in UFIREG, frequent on-site comparisons against reference instruments and automatic control units at two sites. During the initial intercomparison and the on-site comparisons which have been carried out so far, none of the SMPS deviated more than 20 % against the reference instrument in the size range from 20 to 200 nm.

Preliminary results of the year 2012 indicate no large differences between annual averages of particle number concentrations (PNC) in a size range from 20 to 200 nm at all stations (except Chernivtsi). The annual means ranged between 6.000 and 6.500 particles per cm³. However, more pronounced differences were observed for monthly averages. First measurements in Chernivtsi where the SMPS could be installed only in January 2013 showed a greater fraction of particles larger than 100 nm in comparison to the other cities.

As shown in Table 1 for Dresden and Ljubljana the coefficients of determination between PNC and other air pollutants varied between different sites. For Dresden the highest R^2 was observed for PNC (20-200 nm) and NO_2 during the colder months (Nov to Apr, Fig.1).

Table 1. Coefficients for determination (R^2) for linear regression (y=ax+b) for Dresden and Ljubljana, April to December 2012, preliminary data

	PM_{10}	NO	NO_2
PNC Dresden	0.11	0.09	0.15
PNC Ljubljana	0.39	0.49	0.56

Further analyses of the air pollution data within UFIREG will include meteorological cluster analysis based on backtrajectories and source apportionment by applying Positive Matrix Factorization.

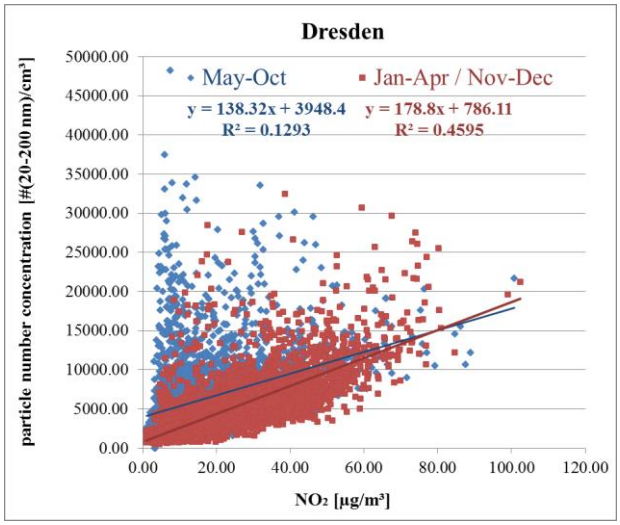

Figure 1. Correlation of PNC and NO_2 for Dresden, blue: May to October 2012, red: January to April and November to December 2012

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