Atmospheric aerosol size distribution during winter period in Ostrava-Radvanice

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Airborne particulate matter is one of the most important components of urban air pollution that affects health condition of human population. Fine aerosol particles have the highest impact on human health s, since they can bind carcinogenic substances and cause severe respiratory problems (Kim *et al.* 2007). Submicron particles are also substantial atmospheric component of urban smog. However, coarse aerosol particles contribute to air pollution level as well. With this reason, atmospheric aerosol investigation and aerosol size distribution particularly is considered to be very important. The location in the center of the Moravian-Silesian region - the city of Ostrava – was selected for measuring campaign. According to numerous studies, Ostrava is a city with the worst air quality not only in the Czech Republic, but in Europe as well (Rossnerova *et al*. 2011).

The measurement was performed using isothermal mobile container of the Laboratory for air quality measurements of the Institute for Environmental Studies, Faculty of Science, Charles University in Prague. It was located in Ostrava-Radvanice and Bartovice (49°48'40.4"N, 18°20'15.8"E) during the winter period 25.1-22.02.2012. 5 minute integrates of number size distribution of particles with aerodynamic diameter 14-10000 nm were determined, by combination of Scanning Mobility Particle Sizer (SMPS 3936L25) and Aerodynamic Particle Sizer (APS 3321). Also 5 min concentrations of gaseous components NO_x, O_3, CO, SO_2, CH_4 and NMHC and meteorological parameters: wind speed, wind direction, temperature, relative humidity and global radiation were determined.

Two periods can be distinguished within the campaign: smog and after smog. Smog period (25.01.-15.02.) is characterized by low air temperature (median T = -14.8 °C), low wind speed (median WS = 0,7 ms^{-1}) and inverse layering of atmospheric boundary layer. As results, high median concentrations of $PM_{2.5}$ = 104 μgm^{-3} were observed. Smog period continued until a warm front moved over the locality. Air temperature and wind speed increased (median T = -1.7 °C, median WS = 1.1ms^{-1}) substantially. Also heavy snow storms occurred at the beginning of the period. As result, median concentration of $PM_{2.5}$ dropped to 38 μgm^{-3}.

Particle number concentrations are dominated by particles of less than 0.6µm of aerodynamic diameter both in smog and after smog periods (Fig.1). Nevertheless, number size distribution averaged over smog period was found near monomodal with mode at 150 nm, while there was clear bimodality, the first mode at 25nm and the second at 55 nm, for the distribution in after smog period (Fig.1). Both disappearance of the first mode and the increase in particle diameter of the second mode are consequences of ultrafine particle coagulation on particles of accumulation mode produced during the smog period.

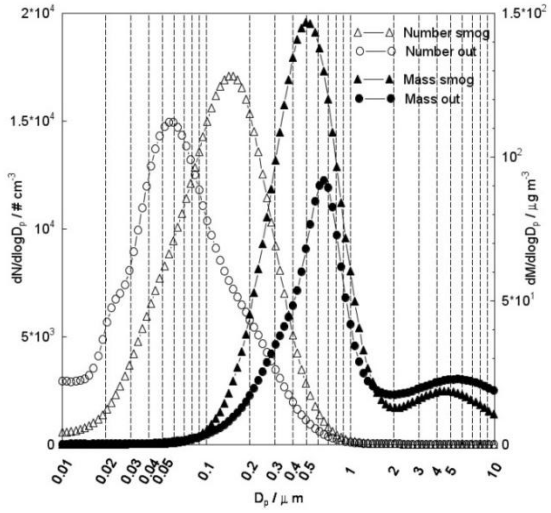

Figure.1 Aerosol particle number and mass size distributions during smog (25.1-15.2) and after smog (15.2.-22.2) periods in Ostrava-Radvanice, in winter 2012

Similarly to particle number submicron particles aerosol particles dominated the aerosol mass. But contrary to number size distributions, mass size distributions were bimodal for both the periods. The first mode was at 0.5µm for smog period and 0.65 µm for after smog period respectively while the second mode at about 5 µm was common to both the periods. The increased mass due to coarse aerosol after smog period is caused by meteorological changes when particles of greater size could be raised upwards because of increased wind speed.

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