Comparison of Particle Number Size Distributions in Three Central European Capital Cities

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Health aspects of ultrafine aerosol particles in urban environment have been studied extensively in recent years (Salma *et al.*, 2011; Putaud *et al.*, 2010; Qian *et al.*, 2007 etc.). Three main sources of the ultrafine particles have been defined – traffic, biomass burning, and atmospheric nucleation. However, the diurnal changes in intensities of individual sources are of considerable extent, similarly to the scale of variations in particle number concentrations due to meteorological phenomena.

In order to quantify the variability in all the aspects mentioned above, to reveal differences and similarities, as well as common or specific features, we compared different properties of particle number size distributions in three cities (Budapest, Prague and Vienna) that belong to the same region, type of climate, and are of comparable size. The three cities are situated in Central Europe in a relatively narrow band oriented in parallel with one of the prevailing wind directions that is NW in the region.

Number size distributions of atmospheric aerosol particles were determined over the mobility diameter range from 10 to 1000 nm in each of the three capitals for a one-year-long period. We derived and compared particle number concentrations in various size fractions, their diurnal and seasonal variations, and frequencies of new particle formation events.

Annual median particle number concentrations for Budapest, Prague and Vienna were 10.6×10^3, 7.3×10^3, and 8.0×10^3 #/cm^3, respectively. Differences may be related to the different pollution levels of the cities, and/or to the different measurement environments and local conditions (Borsos et al., 2012).

Furthermore, it has been found that contributions of the cumulative concentrations of particles smaller than 100 nm in diameter to the total number concentration were 80%, 84% and 74% for Budapest, Prague and Vienna, respectively. Thus, in each of the cities, the particles under 100 nm contribute decisively to the total number concentrations.

Diurnal variations of submicron particles larger than 100 nm, exhibited similar shape for all the cities (Fig. 1). The diurnal pattern with a peak at about 8 AM and another maximum at about 9 PM was related to the time-activity pattern of inhabitants and regional influences (traffic, heating etc.).

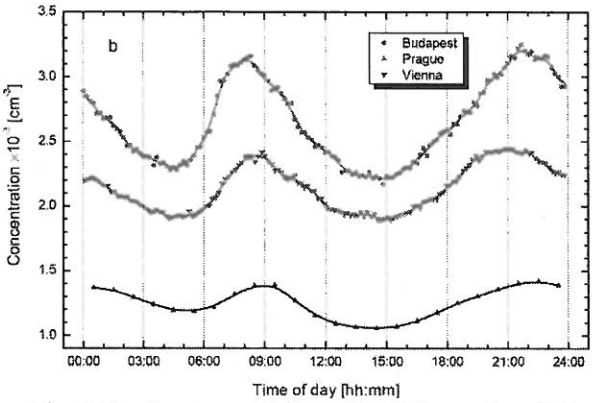

Fig. 1 Yearly averaged diurnal variations of particle number concentrations in Budapest, Vienna and Prague (particles between 100 and 1000 nm in diameter).

The structure of the diurnal variation for ultrafine particles (smaller than 100 nm in diameter) was similar to those in sizes between 100 and 1000 nm with an exception related to the position of the second peak. That peak was shifted from late evening to afternoon. This can be due to daily cycling in meteorological parameters, due to the character of the measurement site, and mainly due to the presence of new particle formation and subsequent growth in urban environments.

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