Comparison of mass size distribution of PM and ions in Prague and Vienna in winter and summer

J. Schwarz[1], N. Zíková[1] , P. Vodička[1], I. Ševčíková[1], J. Kugler[1], A. Wonaschuetz[2], R. Wagner[2], I. Aschauer[2], W. Ludwig[2], R. Haindl[2], G. Zecha[2], R. Hitzenberger[2] and V. Ždímal[1]

[1]Department of Aerosol and Laser Studies, Institute of Chemical Process Fundamentals, Prague, 16502, Czech Republic
[2]Faculty of Physics, University of Vienna, Vienna, 1090, Austria

Keywords: urban environment, mass size distribution, water soluble ions.
Presenting author email: schwarz@icpf.cas.cz

Aerosol mass size distribution is an important factor that influences aerosol behavior both on local and global levels. The content of water soluble ions is the most important factor controlling hygroscopicity of aerosol particles. Hygroscopicity influences the dependence of particle size on relative humidity and therefore it is a substantial parameter for particle deposition in lungs, particle – cloud interactions, aerosol optical effects etc. Therefore, the size distribution of PM and water soluble ions was studied in two Central European capitals – Prague and Vienna both in summer and winter.

The measurements were done at an urban background site (Suchdol) located in the residential area in NW suburbs of Prague on the campus of the Institute of Chemical Process Fundamentals (ICPF) at 285 m a.s.l. The road with traffic density 10-15000 car per day is located in about 200m from the site. The closest house is placed about 30 m from the site. The sampling point was about 4 m above ground, on the roof of a sampling container. The sampling period was from 27th June to 7th July 2012, and from 6th to 15th February 2013. 11 samples were obtained in summer and 9 in winter. Each sampling took 23 hours.

The Vienna urban site was located on the roof of Faculty of Physics about 35 m above ground, close to the inner court of the building. The building is located in downtown Vienna but the roads next to the building have low traffic densities. The Vienna sampling period was from 17th to 30th July 2012, and from 14th to 30th with 9 samples in summer and 12 in winter. Each sample in Vienna took 23 hours except the weekend samples. Those two samples took 71 hour each.

The instrument used for size selective sampling followed by ion chromatography analysis of samples was a small deposit area cascade impactor (SDI) that has 12 stages and 11 l/min flow rate. The cut diameters of the stages were 0.041, 0.087, 0.15, 0.23, 0.34, 0.52, 0.73, 0.99, 1.5, 2.4, 4.2, and 8.0 µm (Maenhaut et al. 1996). The samples were extracted using 30 min ultrasonic bath and 1 hour shaking and analyzed using Dionex 5000 system both for cations and anions in parallel.

PM mass size distributions were determined using a Berner rotational cascade impactor with a flow rate of 25 l/min and calculated cut diameters of the stages 0.016, 0,032, 0.065, 0.13, 0.25, 0.5, 1, 2, 4, 8 µm.

The results we obtained on mass size distributions of mass and water soluble ions exhibit common basic features of ambient aerosols in Central Europe. E.g., mass size distributions in winter were dominated by a fine mode (see an example in Fig. 1). Sulfates and ammonium were almost exclusively present in the fine mode, fine nitrates were mostly low in summer (see an example in Fig. 2) due to high summer temperatures, but they had always a distinct coarse mode. Normal size distributions of ammonium and sulfates were often almost identical in summer due to low nitrates.

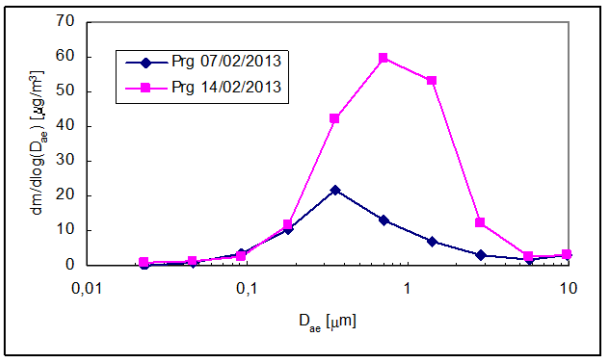

Fig. 1: An example of mass size distributions in Prague in winter

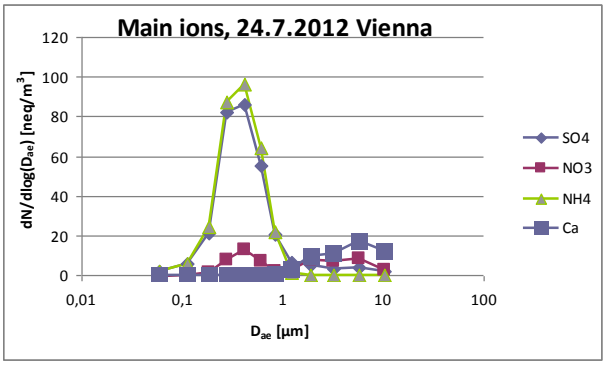

Fig. 2: An example of mass size distribution of ions in Vienna in summer.

This work was supported by the ÖAD, WTZ grant No. CZ 03/2012, the MEYS MOBILITY grant No. 7AMB12AT021, and the Czech Science Foundation grant No. P503/12/G147. We also thank to Prof. Willy Maenhaut for providing us with SDI impactors.

Maenhaut W., Hillamo R., Mäkela T., Jaffrezo J.-L., Bergin M.H., Davidson C.I., (1996)., *Nucl. Instrum. Methods B*, **109/110** 482-487