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2014

COMPARISON OF SUMMER AND WINTER SUBMICRON AEROSOL COMPOSITION STUDIED BY THE AEROSOL MASS SPECTROMETER

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Keywords: Atmospheric aerosols, Chemical composition, AMS, PM1

INTRODUCTION

Aerosol particles are proven to affect climate change, visibility, and human health. To gain a better understanding of their origin and behavior, it is necessary to describe their chemical composition and number size distribution with a high time resolution. In the Czech Republic or any of its neighboring countries except Germany, no results have been published from such measurement yet.

This abstract summarizes the results of two measurement campaigns conducted at a Prague background station Suchdol with focus on data from the compact-Time of Flight-Aerosol Mass Spectrometer (c-ToF-AMS). The data were collected during summer 2012 and winter 2013.

EXPERIMENTAL SETUP

The measurements were done at Prague Suchdol suburban site, which is located approximately six kilometers north west from the Prague city center. During the two measurement campaigns, we deployed the c-ToF-AMS, field Organic Carbon/Elemental Carbon (OC/EC) analyser and PM1 filter sampling analysed by Ion Chromatography (IC). The c-ToF-AMS provides us with highly time resolved chemical composition and size distribution of aerosol particles (Drewnick, 2005). The aerosol was analyzed with one minute time resolution and the vaporization and ionization occurred at 600°C and 70eV, respectively.

RESULTS AND CONCLUSIONS

To obtain correct mass concentration using the AMS, it is necessary to set correct Collection Efficiency (CE), i.e. the fraction of particles that are detected by the instrument from all particles introduced to the system. In order to determine an appropriate value of CE for our measurement we compared AMS data with results from Ion Chromatography (IC). We found that for our summer and winter campaign the appropriate CEs were 0.29 and 0.35, respectively. This result was justified by further comparison of AMS data with measurement from Scanning Mobility Particle Sizer (SMPS) and field OC/EC analyzer.

By comparison of the c-ToF-AMS data with the results of the HYSPLIT model (Draxler and Hess,1998), we found a clear inverse relation between the boundary layer

thickness and the level of pollution. Further, we selected episodes of significantly higher and lower pollution level from the whole measurement campaign and compared them with the air mass trajectories. Episodes of higher pollution were connected with arrival of continental air masses whereas episodes of lower pollution with arrival of marine air masses.

Further, we calculated the diurnal cycles and wind roses using the OpenAir Software. The diurnal cycles of compounds measured by the c-ToF-AMS were influenced by the daily traffic, boundary level height, mixing with upper atmospheric layers, and winter heating.

We also carried out the analysis of organic fragments f43, f44, and f60, i.e. the ratio of particular mass to charge fragment versus the total organic mass. The values of f43 and f44 point to the oxidation state of the aerosol, whereas the value of f60 indicates the influence of biomass burning. We found that winter organic aerosol was influenced by biomass burning (unlike the summer one) and it was of more local origin.

ACKNOWLEDGEMENT

The authors of this work gratefully appreciate financial support by the Czech Science Foundation under project No. CSF P209/11/1342.

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