Origin of Atmospheric Aerosol Based on Data with Different Time Resolution at the National Atmospheric Observatory Košetice.

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ORIGIN OF ATMOSPHERIC AEROSOL BASED ON DATA WITH DIFFERENT TIME RESOLUTION AT THE NATIONAL ATMOSPHERIC OBSERVATORY KOŠETICE

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INTRODUCTION

To improve the air quality the underlying causalities must be well understood, particularly when it comes to aspects such as PM concentration, sources and their origin (Minguillón et al., 2012). The aim of this work was to determine air pollution origin at NAOK based on atmospheric aerosol (AA) data of different time resolution measured during intensive summer campaing.

MEASUREMENT AND METHODS

An intensive sampling campaign was carried out in July and August 2019 at the National Atmospheric Observatory Košetice (NAOK). 5-min integrals of particle number concentration (PNC) and number size distribution (PNSD) data were recorded by a Scanning Mobility Particle Sizer (size range 10 – 800 nm, SMPS, IFT TROPOS, Leipzig, with CPC 3772 (TSI USA)) and size-resolved PM chemical composition was measured by a Compact Time of Flight Aerosol Mass Spectrometer (C-ToF-AMS, Aerodyne, USA). Also 4-h $PM_{2.5}$ organic and elemental carbon (OC/EC) concentrations (Sunset Laboratory Inc., USA) were measured and 12-h PM_1 samples by a sequential Leckel LVS-3 (Sven Leckel Ingenieurbüro, Germany) for a subsequent chemical analysis were collected. Additionally, 1-h $PM_{2.5}$ concentrations were measured using beta-gauge and 10-min average of SO_2, NO_2, NO_x and CO concentrations along with the values of meteorological parameters were recorded. Positive Matrix Factorization (EPA PMF 5.0) was applied on PNSD data and R Openair Package was used for a data treatment.

RESULTS AND CONCLUSIONS

In this contribution preliminary results from July 2019 are presented. The campaign was characterized by prevailing westerly winds with average wind speed of 3±1.5 ms^{-1}, temperature of 18.5±4.7°C and 161 mm precipitation in total. The average PM concentrations were 10.9±6.0 μgm^{-3} ($PM_{2.5}$, beta attenuation), 9.6±4.5 μgm^{-3} ($PM_{0.01\text{-}1}$ SMPS, particle density 1.5 gcm^{-3}) and 14.6±6.7 μgm^{-3} (PM_1, filter samples). The differences in PM concentrations are caused by diverse PM fractions and uncertainties by recalculation and filters weighing since low atmospheric aerosol concentrations.

The OC/EC comprised in average 2.5±0.9 μgm^{-3} and 0.2±0.1 in $PM_{2.5}$. There is a good agreement between organic matter (OM) calculated from OC in $PM_{2.5}$ multiplying by a factor of 1.6 (Turpin and Lim, 2001) and Org in PM_1 by AMS, 4.0±1.7 μgm^{-3} and 3.5±1.7 μgm^{-3}, respectively. The campaign average concentrations of SO_4 and NO_3 in PM_1 by AMS were 0.8±0.4 μgm^{-3} and 0.3±0.1 μgm^{-3}. During the first week of the campign, period from 3.7. 12:00 to 10.7. 11:50, the average concentrations of Org, SO_4 and NO_3 were 1.3±0.3 μgm^{-3}, 1.3±0.3 μgm^{-3} and 0.2 μgm^{-3}. The Org dominated by SW-S-SE winds of 2 to 4 ms^{-1}. The period mass size distribution (MSD) of Org, SO_4 and NO_3 was at 263 nm, 336 nm and 312 nm (Figure 1). The polar plot for SO_4 shows well distributed contribution from NE-N-NW of regional origin, however the NO_3 plot points localized pollution sources of local as well regional origin.

The PMF resolved six PNSD factors linked to new particle formation (NPF), traffic related (fresh and different aged level; local and regional origin) and regional secondary aerosol. Further and more complex data analysis is needed to precisely assess the AA origin at NAOK.

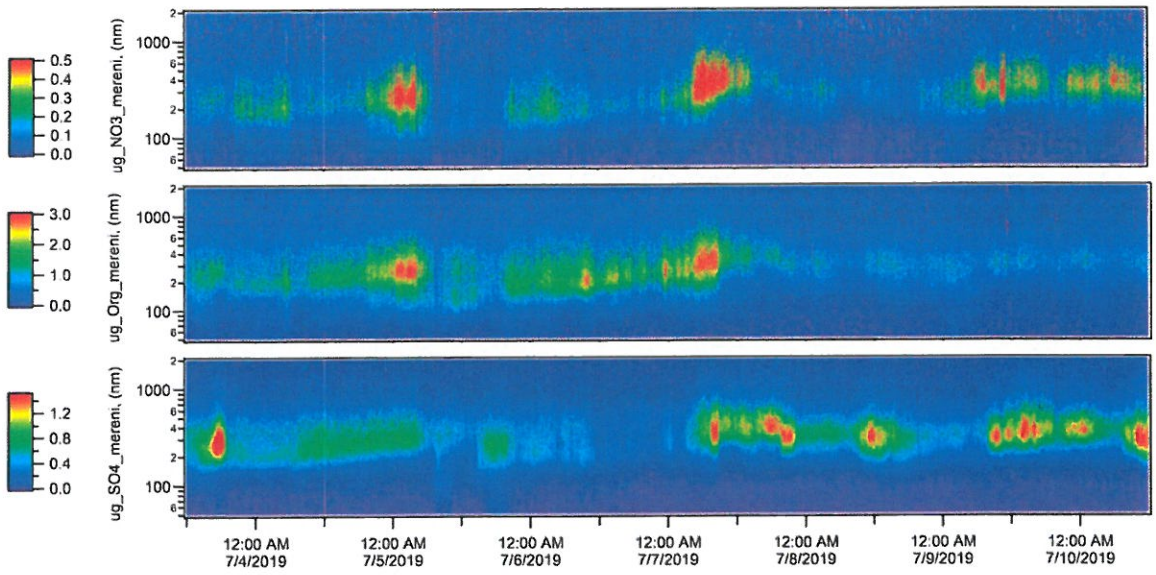

Fig. 1: Particle mass size distribution for Org, SO_4 and NO_3 for period 3. – 10.7. 2019.

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