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Five Years of Aerosol Particles Growth Rate Measurements at Four Background Stations in the Czech Republic

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Introduction

Atmospheric aerosols as ubiquitous particles in the atmosphere influence Earth's climatic system, environmental interactions and human health.^{1,5,7} The role of aerosols in climatic system still includes uncertainties strongly influencing model simulations.⁷ One of the uncertainties is caused by secondary aerosol formation and their consequent growth. Although new particle formation (NPF) events were considered to be more favoured in rural and remote areas compared to urban sites³, this events were observed in many different types of environments (urban, rural, remote, marine, arctic, free troposphere etc.) during last several decades (e. g. in ref.⁴). In this work we used data on aerosol particle number size distribution to investigate if there are any differences or similarities in the growth rate at four background stations located in different types of environment (urban, industrial, agricultural and suburban).

Methods

Aerosol particle number size distribution (PNSD) data were recorded at four stations in the Czech Republic: Ústí nad Labem, Lom, National Atmospheric Observatory Košetice and Prague-Suchdol. Each station is equipped with aerosol spectrometers SMPS (IFT TROPOS), the size range of measurement is from 10 to 800 nm (500 nm at Suchdol station). PNSD were used for NPF event days determination (according to Dal Maso et al. 2005 method) and the growth rate (GR) calculation. Recorded data were evaluated from March 1 to October 31, 2013–2017.

Results and discussion

NPF events were observed in 40–33% of measured days (highest frequency at Ústí n/L, lowest at Suchdol). The monthly variability of GR shows similarity in high median values in May and October ($4.0\text{--}5.0\text{ nm}\cdot\text{h}^{-1}$) and low values in April ($GR\ 3.2\text{--}3.5\text{ nm}\cdot\text{h}^{-1}$) at each station except Ústí n/L. Ústí n/L is characterized by stable GR from July to September ($GR\ 4.0\text{--}4.3\text{ nm}\cdot\text{h}^{-1}$). Growth of particles most frequently began at 10:00–12:00 at Lom and NAOK, and at 10:00–14:00 at Ústí n/L and Suchdol (at Suchdol, frequent particles growth was observed also at 16:00–18:00). These periods were linked to times of decrease in SO_2 concentrations. High GR were also connected with wind directions bringing air masses from pollution sources (Ústí n/L – busy crossroad, Lom – thermal plant and chemical plant, NAOK – wood processing factory and highway, Suchdol – residential heating area).

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