Fog and Cloud Processingof SMPS Spectra

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FOG AND CLOUD PROCESSING OF SMPS SPECTRA

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INTRODUCTION

Atmospheric aerosols have been studied extensively due to the confirmed influence of aerosols on global climate, aerosol – clouds interactions, atmospheric visibility, human health etc. (Kerminen et al., 2005; IPCC, 2007; Wichmann et al., 2000). However, the uncertainties connected to the effects of aerosols on phenomena in the atmosphere are considerable – there are various sources of aerosol particles, having different chemical compositions and particle size distributions (PSD). Moreover, the atmospheric aerosol is exposed to both dry and wet deposition, which further inflences the PSD. In this work, we have focused on cloud and fog processing of aerosol PSD.

METHODS

The evaluated data were twofold. Firstly, data from a measurement campaign at Milešovka observatory (station of Institute of Atmospheric Physics of the ASCR) were considered. At the observatory, particle number size distributions (PNSD) in the size range from 10 nm to 20 μm were collected and compared to the detailed meteorological observations, together with chemical composition of the water content of fog. The PNSD were measured with collocated SMPS (Scanning Mobility Particle Sizer) and APS (Aerodynamic Particle Sizer), sampling from a common whole air inlet. Secondly, data collected during five years of continuous measurements (2008 - 2013) at Košetice observatory were evaluated. PNSD data from SMPS in size ranges 10 – 800 nm were considered, and compared to the contiuous meteorological observations.

The meteorological records consist of the exact times of starts and ends of individual meteorological phenomena (with one minute precision). The records longer than 90 minutes were considered, and corresponding SMPS spectra were evaluated.

RESULTS

Evaluation of total number concentrations showed considerably lower concentration during fog periods compared to the period when no meteorological phenomenon was recorded. It was even lower than average concentration during presence of hydrometeors (not only fog, but rain, drizzle, snow etc.).

Typical PNSD computed from all the data recorded during fog events in the five years is in Figure1. Not only median and 1st and 3rd quartiles are depicted, but also 5th and 95th percentiles are plotted, to see the variability of the concentrations in individual size bins. The most prevailing feature is the accumulation mode, which seems to be least influenced by the fog presence. On the contrary, the smallest aerosol particles (diameter under 40 nm) are effectively removed, as well as the largest particles (diameter over 500 nm).

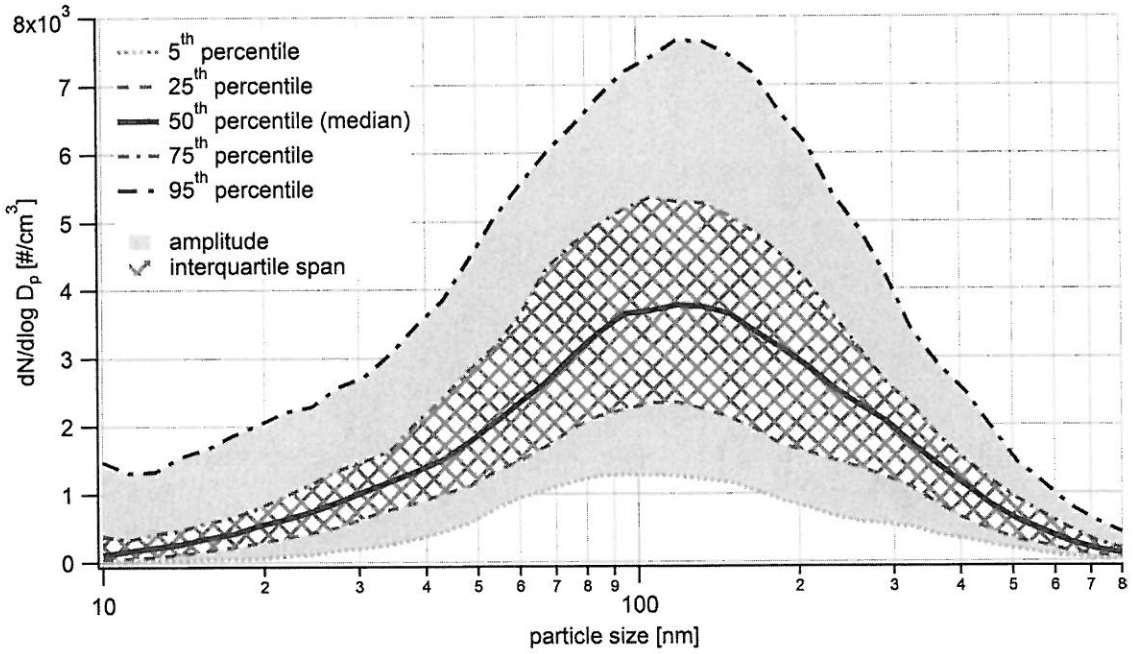

Figure 1. 5th, 25th, 50th, 75th and 95th percentile of aerosol particle number size distributions recorded during fog events.

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LITERATURE

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