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Laboratory verification of Aerosol Diffusion Spectrometer and the application to ambient measurements of new particle formation

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Abstract

Information on the ambient aerosol number size distribution is essential to address various scientific questions related to aerosol particles in the atmosphere. However, due to the wide size and concentrations ranges of ambient aerosol particles, no single instrument alone is capable of measuring them all. Instruments based on different measurement principles are engaged in the measurement of atmospheric aerosols. Intercomparison of such instruments is necessary to cross-validate the reliability of obtained data. In this study, a verification of the performance of a Novosibirsk Aerosol Diffusion Spectrometer (ADS) in the size classification of aerosol particles was carried out in laboratory and via a field intercomparison with a Differential Mobility Particle Sizer (DMPS) and a Neutral cluster and Air Ion Spectrometer (NAIS). The laboratory experiments affirmed the good accuracy of the ADS on sizing and concentration measurement. The ADS was satisfactorily comparable with the DMPS and the NAIS for the measurement of ambient aerosols within the size range 3-200 nm. The differences between condensation sinks derived from the ADS and DMPS measurements were smaller on days with new particle formation (NPF) than on non-NPF days. Similar formation rates and growth rates were acquired based on the DMPS, NAIS and ADS measurements, proving a reasonable ability of the ADS in measuring the concentrations and size distribution of nucleation-mode particles.

Keywords: Aerosol Diffusion Spectrometer, Differential Mobility Particle Sizer, Neutral cluster and Air Ion Spectrometer, new particle formation

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