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# Results of the first air ion spectrometer calibration and intercomparison workshop

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Abstract. The Air Ion Spectrometer (AIS) measures mobility and size distributions of atmospheric ions. The Neutral cluster and Air Ion Spectrometer (NAIS) can additionally measure neutral particles. The number of the (N)AIS instruments in the world is only 11. Nevertheless, they are already widely used in atmospheric ion studies, particularly related to the initial steps of new particle formation. There is no standard method applicable for calibrating the ion spectrometers in the sub-3 nm ion range. However, recent development of high resolution DMAs has enabled the size separation of small ions with good mobility resolution. For the first time, the ion spectrometers were intercompared and calibrated in a workshop, held in January–February 2008 in Helsinki, Finland. The overall goal was to experimentally determine the (N)AIS transfer functions. Monomobile mobility standards, 241-Am charger ions and silver particles were generated and used as calibration aerosols. High resolution DMAs were used to size-separate the smaller (1–10 nm) ions, while at bigger diameters (4–40 nm) the size was selected with a HAUKE-type DMA. Negative ion mobilities were detected by (N)AISs with slightly better accuracy than positive, nonetheless, both were somewhat overestimated. A linear fit of slope of one to the whole dataset of mobilities suggested that (N)AISs measured the negative mobilities 1.36±0.16 times larger compared with the reference instruments. Similarly, positive mobilities were measured 1.39±0.15 times larger compared with the reference instruments. The completely monomobile mobility standards were measured with the best accuracy. The (N)AIS concentrations were compared with an aerosol electrometer (AE) and a condensation particle counter (CPC). At sizes below 1.5 nm (positive) and 3 nm (negative) the ion spectrometers detected higher concentrations while at bigger sizes they showed similar concentrations as the reference instruments. The total particle concentrations measured by the NAISs were within ±50% of the reference CPC concentration at 4–40 nm sizes. The lowest cut-off size of the NAIS in neutral particle measurements was determined to be between

1.5 and 3 nm, depending on the measurement conditions and the polarity.

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