Atmos. Chem. Phys. Discuss.,
doi:10.5194/acp-2016-847-RC3, 2016

Atmospheric Chemistry and Physics Discussions

Interactive comment on "A global view on atmospheric concentrations of sub-3 nm particles measured with the Particle Size Magnifier" *by* J. Kontkanen et al.

Anonymous Referee #3

Received and published: 28 November 2016

It is a useful study because there is not enough data in the literature about the number concentrations of particles in the size range below 3 nm. The study puts together data from several locations in Europe, in the USA, and in China. All sites a located on the northern hemisphere, and, therefore, I would avoid using the word "global" in the title of the paper.

Some sites can be characterized as background while others urban, one mountain site is also presented. Not only total number concentrations were studied but also their diurnal patterns, the ratios of charged/uncharged particles, and individual size fractions within the 1-3 nm size range. At some locations longer time series were measured, covering all seasons of the year, at other locations only shorter, several weeks long

Printer-friendly version

Discussion paper

campaigns were carried out. A comparability of data between different locations and campaigns is rather limited, because different combinations of instruments were used at different locations, not only different models of particle size magnifiers (prototype, A09, A10, A11), but also different versions of mobility particle sizes (DMPS, SMPS, twin systems). Even within the class of PSM A11, different selection of size classes in the scanning mode was used. On the site with the longest time series (Hyytiala), the different versions of particle size magnifier were used subsequently as they were developed from the prototype until the most recent A11. The authors of the study are aware of the drawbacks mentioned above and tried to compensate for them by selecting the methods of data evaluation and comparison. Therefore I do recommend the paper for publication only with some minor revisions.

On page 3, lines 25-26, the authors state, that the detection limit of particle size magnifier differs for neutral and charged particles by about 0.5 nm in the d50. It would help the reader if the authors add a commentary of how they took this fact into account when they compared the particle number concentrations and concentrations of ions in the size range below 3 nm. In the size range of 1-3 nm, the uncertainty of 0.5 nm covers 25% of this size range.

In the description of individual measurement sites the authors always give a description of particle size magnifier used and usually add a description of the DMPS/SMPS systems. I would recommend that the authors unify these descriptions and add information about sites where this info is missing in the text, for example at PDD, BRH and SH.

At page 8, line 18, the authors say that low concentrations at two locations can be due to technical reasons. Are they aware of these reasons, can they be more specific?

If we take into account that typical uncertainty in the DMPS/SMPS concentration measurements after proper calibration is about 10 %, and this uncertainty can rise substantially going down below 20 nm, the differences in absolute values of number con-

centrations bellow 3 nm are not that significant, keeping in mind that these number concentrations result from subtraction of two larger numbers. At the same time the uncertainty in PSM measurement is affected by its cut diameter d50, related to chemical composition, charging state of particles, and relative humidity. The ratios of charged to neutral particles will be affected little less, while seasonal variations determined at one site using one system, and diurnal variations determined at one site by one system will not be affected by these uncertainties too much.

I would also like to recommend the authors to comment on the fact that there is also a diurnal variation of relative humidity that can also cause diurnal shifts of d50 of particle size magnifiers. Speaking about the concentrations measurements, as a reader I would like to have there some information on calibration of individual systems. I know that the PSM comes with factory calibration but how long after the last calibration was each of the campaigns performed?

Interactive comment on Atmos. Chem. Phys. Discuss., doi:10.5194/acp-2016-847, 2016.

Printer-friendly version

Discussion paper