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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Estimating neutral nanoparticle steady state size distribution and growth according to measurements of intermediate air ions" *by* H. Tammet et al.

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The manuscript by Tammet et al. gives some theoretical estimations about number size distributions and growth rate of atmospheric neutral nanoparticles, focusing on periods when no significant particle formation bursts are going on. The theoretical estimations given are based on experimental field data on intermediate sized (1.5-7.5 nm) air ions obtained in Estonia during by authors' own ion spectrometers. For the whole measurement period of 1.5. years, only one average size spectrum is derived, and parametrized (as a function of size). In the theoretical estimations, furthermore also some practical parametrisations, given in literature e.g. for calculating coagulation sinks, are used. When calculating the coagulation sinks, the authors use average number concentra-

tions for particles in the size range of 50-500 nm, measured at some other time in some other place. Furthermore, to support their analysis, the authors assume a constant (as a function of size, and time) growth rate for charged intermediate ions. Thus, several courageous approximations are made all the way. Finally, as a result of the analysis, an estimate for average size distribution function of neutral nanoparticles is obtained. Also a value for the assumed constant growth rate for neutral particles is obtained, together with an estimate for apparent formation rate of neutral 3 nm particles and 7 nm particles. The value for apparent formation rate of 0.5 particles per cc per sec for 3 nm is very high, although at 7 nm it is estimated to be 0.08 particles per cc per sec (5 particles/cc/min), due to scavenging.

The result of the paper is that a non-zero size distribution of neutral nanoparticles seems to exist, and their formation and growth seem to occur even during periods when no significant intensive particle formation bursts are taking place, as if continuous nanoparticle formation would be occurring all the time, no matter what. This conclusion is fairly strong, even though the estimation is based on several daring approximations.

The paper has several weaknesses in its approximations. Using almost like a literature value for N50-500 instead of measuring true number concentrations, assuming a constant value for GR1, not only as a function of size but also as a function of time. More generally, dealing with only average size distributions and other averaged values is not very solid either. Making on-line measurements on e.g. particle size distributions and sink terms and repeating the analysis allowing the values to change dynamically in time, would gain much more valuable information on the neutral nanoparticles during quiet periods. But since this study is first of its kind, I'm supporting publication of the paper in the present form.

Interactive comment on Atmos. Chem. Phys. Discuss., 13, 13519, 2013.