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Atmospheric Chemistry and Physics Discussions

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Interactive Comment

Interactive comment on "Charging and coagulation of radioactive and nonradioactive particles in the atmosphere" *by* Y.-H. Kim et al.

Anonymous Referee #1

Received and published: 28 October 2015

This paper discusses the time-dependent change in size and charge distributions of particles.

The text and figures comprise 45 pages, mostly of single-spaced text. This should make a nice paper if the authors can cut several pages from it. Given that the authors acknowledge on P. 23087 that "In our previous work (Kim et al., 2014, 2015) it has been shown that Approaches 1 and 3 can reliably simulate charging of radioactive particles. . ." there seems to be sufficient overlap with previous work to warrant reducing the size of this manuscript, including the number of figures, which stands at 16. Are all these figures really necessary to draw the conclusions about this paper? Some additional comments are given below.

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Interactive Discussion

Discussion Paper

Introduction. "Due to atmospheric dispersion, radioactive particles (e.g. 137Cs released during the Fukushima accident were sampled in situ 150 km away. . .)." 137Cs from Fukushima was found worldwide rather than just 150 km away (Figure 1 of Ten Hoeve and Jacobson, 2012).

Introduction. "Accurate understanding of the behavior of particles is necessary to predict transport of contaminants. . ." Please clarify. Do you mean "evolution of contaminants" or "removal of contaminants?" Transport of contaminants is dominated by wind speed and direction rather than the behavior of particles.

Introduction. Please briefly explain self-charging and diffusion charging in the Introduction where it is first mentioned rather than in Section 2.2.

Introduction. "Coagulation of atmospheric particles can influence their charging because the particle size distribution can highly affect the time-evolution of ion concentrations." This statement is very confusing. Do you mean, "Coagulation can affect the time evolution of the size distribution of ion concentration?"

Introduction: "Particle charging and coagulation can mutually affect each other. . ." Do you mean, "particle charging can affect coagulation rate coefficients and coagulation can affect the size distribution of charged particles?" If so, please clarify this statement.

Please clarify when you refer to "charge" that you are not referring to van der Waal's forces, which result in particles being polarized but with zero net charge.

Introduction. "Previous attempts to include charging effects include. . ." Please include Yu and Turco (2001). This and several other papers by Yu treated charging in the coagulation kernels in a sectional coagulation model. Following Equation 10, by "collision efficiency," do you mean "coalescence efficiency?"

Also by "coagulation frequency," do you mean coagulation kernel or rate coefficient? Please provide units. F does not have units of frequency (sˆ-1) but something like cmˆ3 per particle per second, analogous to a chemical reaction rate coefficient. Same thing

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with Beta in Equation 12.

References Ten Hoeve, J.E., and M.Z. Jacobson, Worldwide health effects of the Fukushima Daiichi nuclear accident, Energy and Environmental Sciences, 5, 8743-8757, doi:10.1039/c2ee22019a, 2012.

Yu, F. and R. P. Turco, From molecular clusters to nanoparticles: The role of ambient ionization in tropospheric aerosol formation, J. Geophy. Res., 106, 4797-4814, 2001.

Interactive comment on Atmos. Chem. Phys. Discuss., 15, 23795, 2015.

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