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Atmospheric Chemistry and Physics Discussions

Interactive comment on "A single parameter representation of hygroscopic growth and cloud condensation nucleus activity" *by* M. D. Petters and S. M. Kreidenweis

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Review of "A single parameter representation of hygroscopic growth and cloud condensation nucleus activity" by M. D. Petters and S. M. Kreidenweis

This is a very nice paper that provides a straightforward parameterization for the equilibrium cloud activation of multi-component aerosol particles. Although essentially empirical in nature, it fits into the kinetic growth equation enabling the important feedback of water uptake at cloud base on the cloud supersaturation to be modelled. The connection made between CCN activation (i.e. water supersaturation) and hygroscopic growth factors (i.e. water subsaturation) is very important as is the ability to simplify

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the formulation to a single value of the surface tension (that of water). While there are still significant unknowns and uncertainties that need to be addressed, as discussed in the paper, and application to ambient aerosols is needed, the framework presented here could become a significant advancement in reducing the uncertainties associated with cloud activation of aerosols in large-scale models. I have a few specific comments.

Page 2 - “but it was recognized some time ago that less- and non-hygroscopic organic compounds can contribute substantially to, and sometimes even dominate, atmospheric aerosol mass concentrations.” Reference needed.

Page 5 - equation labelled (9) should be (8)

Page 5 and Table 2 - It appears that you use one sigma for your uncertainty estimate. Assuming the sample size is large enough, this encompasses only about 67% of the variation - two sigma would be better.

Page 6 - “to apply bulk sample-based parameterizations to curved droplets.” Presumably, the authors are referring to measurements of surface tension of bulk solutions. This should be stated a little more precisely.

Page 6-7 - section 4 - It is first stated that “In general, however, the experimental data for water activities over the full range of solution concentrations cannot be well-fit with Eq. (2) using a constant Ě.” Two sentences later it is stated that “Extrapolated Sc’s using this or similar methods (Ě) are in good agreement with measured Sc’s for many, but not all, particle types studied thus farĚ”. I have trouble reconciling these two statements, i.e. they seems to me to be a bit contradictory. Please explain, and revise as necessary.

Page 7-8 - First, it is stated that there are no measurements of the HGF for adipic or succinic acid, and that a  of <0.006 is based on the detection limit of the HGF method. Two sentences later, it is stated that “the hygroscopicity of succinic and adipic acid is fairly large (>0.1),Ě” I think I understand how the first estimate

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is made, but I see no reference or data for the second of these statements. Again, please explain.

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