

***Interactive comment on “Water activity and activation diameters from hygroscopicity data – Part I: Theory and application to inorganic salts” by S. M. Kreidenweis et al.***

**Anonymous Referee #2**

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Water activity and activation diameters from hygroscopicity data - Part I: Theory and application to inorganic salts

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The authors first review the theoretical relationship between solution water activity and particle size as well as approximations that are commonly made in evaluating critical supersaturations for cloud activation. They then discuss ways in which HTDMA data

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can be used to infer CCN properties. The methodology is then evaluated for HTDMA measurements carried out with sodium chloride and ammonium sulfate. The sensitivity of calculated CCN properties to assumptions of particle and droplet properties (shape, density, surface tension) are discussed, and it is shown that measurements are in very good agreement with expectations based on the best available theoretical methodologies. I think the paper contains original insights, is very well written, and includes a systematic analysis of the problem. Clearly, this is an important paper that will be studied carefully by future HTDMA researchers.

One limitation of the approach for atmospheric aerosols is that in some locations a significant fraction of the particles consists of chain agglomerates that are slightly hygroscopic. Without supporting information there is no way to know for certain which particles are chain agglomerates. Because shape factors for such particles can greatly exceed 1.0, substantial errors would likely occur if this approach were applied to them. The authors might should comment on this limitation.

Technical corrections:

1. I experienced some difficulty in identifying the relationship between the lines on Figs. 4 and 6 and the key.
2. 7 lines before “5 Parameterization of results”: should be “modest,” not “modestly.”

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