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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Reformulating atmospheric aerosol thermodynamics and hygroscopic growth into haze and clouds" *by* S. Metzger and J. Lelieveld

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This is a very disorganized, poorly-written paper. Although it is also full of mistakes, there are also some valuable interesting points. I discuss some of my many concerns with this paper below. Since the exposition is so poor, some of the errors that I identify may actually be due to that and not its scientific content.

In eqns K1, the additions should be multiplies.

Eqn K2 is wrong, but seems to form the basis for all that follows. For instance, for pure water a_w=1 and a_s=0. How does this product (to any power) give you 1? The eqns 11-14 all are somehow justifying K2, but just rehash it.

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The source of Eqn 19 is not clear, although it is key to the single solute activity model – how as this derived? Note that nu_w is a function of temperature because the solubility is; this was never discussed by the authors. And what is the value of nu_w,0 and where does it come from?

In any case, the nu_w values appear to be derived from the solubility of the compound? What is the solubility of sulfuric acid? I can't even define it at ambient T,p but somehow the authors have and find a nu_w value of 1.67 whereas the value for ammonium nitrate is 1.84. Since the authors state that higher solubility gives higher nu_w values, we have an apparent inconsistency (or I continue to not understand what they're doing).

The authors finally wind up with eqn 20 which is an approximate equation for molality as a function of RH with a single (temperature dependent) parameter fit. This is sort of like Kusik and Meissner (single parameter fit) but more directly applicable to atmospheric situations in that it is a function of RH. Why do I say it is approximate? Well, it doesn't perfectly match the data (but that could be the fault of the data) and they then derive ZSR (eqn 23) which we know is not exact (osmotic pressures do not necessarily add). Since it was so hard to follow the derivation of eqn 20, I do not understand the approximations that went into it but these should be identified by the authors.

Interactive comment on Atmos. Chem. Phys. Discuss., 7, 849, 2007.