Atmos. Chem. Phys. Discuss., 11, C10836–C10838, 2011
www.atmos-chem-phys-discuss.net/11/C10836/2011/

Atmospheric Chemistry and Physics Discussions

Interactive comment on "Aerosol hygroscopic growth parameterization based on a solute specific coefficient" *by* S. Metzger et al.

Anonymous Referee #1

Received and published: 25 October 2011

The results from the presented method to determine the HGF for inorganic salt particles seems promising since the results for single salt particles compare fairly well with the E-AIM model. However, as the authors mention there are other simplifying methods to determine the HGF for particles. Hence, if this article should be published in ACP the authors need to show clear evidence that this method is superior the other methods in some important way (e.g. computation time or accuracy). For this to be the case there are a few important results and clarifications which I think needs to be included in the article before I can completely evaluated if the article could be published in ACP or not.

Major comments:

As I understand it, one of the main advantages of this method compared to earlier methods (e.g. the kappa-method) is that it should be more computationally efficient

because the water activity correction coefficients are independent of the water activity. Could you please demonstrate this by giving values of the CPU-time for the new parameterizations, the kappa-method and E-AIM.

Page 24827, line 13-15: You write that: "Here, A and B have been empirically determined to best match the reference results of E-AIM – the explicit derivation is beyond the scope of this work and will be presented separately." As referee you want to check the accuracy of the empirically determined A and B coefficients. Hence, you need to describe how these coefficients have been derived e.g. in a supplementary material.

Page 24828, line 15-19, point 4. You write that when you derive vi you assume that Ke=1. I guess that this assumption introduces errors for the smallest particles? You need to clarify this in the text and illustrate this with some results.

You present results for single solute solutions but if the method should be useful for atmospheric aerosols it need to work for mixed solute solutions as well. Hence, I suggest that you include a figure which compares the HGF calculations from E-AIM and the simplified parameterizations for a mixed solution of ammonium sulfate and sodium chloride.

For most atmospheric conditions the model also need to consider nitrate (e.g. NH4NO3 and NaNO3). I want to know why this is not included in the model. You should at least ad a short discussion about this and the limitations with a model which do not consider nitrate.

Line 24-25 page 24817. You should not refer to a publication which is not published. Either you simply refer to the ACPD manuscript from Xu et al. (2009) or you actually submit a revised manuscript which then will be referred to as Xu et al. (2011). As referee I want to have access to this paper. Is this the paper you call the companion paper or is it the Metzger et al., 2010 paper which is the companion paper? I cannot find any reference in the text to Metzger et al., 2010. If this is the companion paper you should refer to this paper in the text.

Minor comments:

Page 24816, line 6-10. Consider reformulating the sentence ”The aerosol HG can be determined for certain solutes from laboratory aw measurements (e.g. Tang and Munkelwitz, 1994), or calculated by considering the vapor pressure reduction that occurs by dissolving a salt solute in water – known as Raoult's law (Raoult, 1888) – if non-idealities of solution are taken into account (e.g. Warneck,1988; Pruppacher and Klett, 2007).”

Line 1, first two words on page 24817. Change from “both methods” to e.g. none of the methods.

Line 11, page 24817. A reference to the companion paper is missing. It is not clear to me which the companion paper is.

In eq. 16b and on line 11 and line 18 on page 24825: Should ws be Xs?

Interactive comment on Atmos. Chem. Phys. Discuss., 11, 24813, 2011.