

Interactive comment on “A comparison of water uptake by aerosols using two thermodynamic models” by L. Xu et al.

L. Xu et al.

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L. Xu, J. E. Penner, S. Metzger, and J. Lelieveld:

We appreciate the evaluation of the reviewer, which allowed us to improve the manuscript and clarify ambiguities. We address each comment below. The reviewer's comments are in bold and followed by our response.

Referee 2: However, I still recommend to the authors the addition of one more test such as a modification of bi-salts treatment in EQSAM3, in order to show the reduction of the discrepancies between the results of the two models.

Reply: Bi-salts are treated in EQSAM3, but a partitioning for example between bisulfate and sulfate is not treated in the current application. Instead EQSAM3 is non-
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mally coupled to an aqueous phase chemistry module –in atmospheric chemistry applications- that provides both HSO₄⁻ and SO₄²⁻ as separate input concentrations for EQSAM3 which then calculates the gas/liquid/solid partitioning based on the neutralization of both anions and the precipitation of their compounds.

Referee 2: I also suggest the addition of a more extensive discussion on the use of these equilibrium models in non-equilibrium conditions at the end of Section 5 since, at present, both climate and air quality models tend to run at high spatial resolution with time steps of order of minutes.

Reply: The equilibrium assumption is a good approximation for small sizes of aerosols but less so for larger sizes (Feng and Penner, 2007). The equilibrium models we compared here deal with the equilibrium conditions for small particles. We will compare the effects of using EQSAM3 for non-equilibrium conditions for larger particles in a follow on study using global model simulations.

Referee 2: I also suggest to the authors to change the title in something like in “A comparison of two inorganic thermodynamic models: EQSAM3 and EQUISOLV II” in order to reflect the content of the manuscript. The manuscript does not address only the water content predictions.

Reply: OK. However, the complaint of one comment is that EQSAM3 is not a thermodynamic model. Actually both models contain approximations and empirical coefficients. Thus, we propose changing the title to “A comparison of inorganic aerosol thermodynamic properties predicted by EQSAM3 and EQUISOLV II” in the revised version.

Referee 2: -in the first part of the manuscript, dedicated to model to model comparison, please change the word “overestimate” with something like “higher values”. The term “overestimate” is more appropriate for the comparison of model results with observations.

Reply: We changed this in the revised version.

Referee 2: -please make the graphs visible also on the paper. In the present form, the results can be seen only making 400 percent zoom on screen.

Reply: We changed these in the revised version.

Interactive comment on Atmos. Chem. Phys. Discuss., 9, 9551, 2009.

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