

Interactive comment on “Hygroscopicity of organic surrogate compounds from biomass burning and their effect on the efflorescence of ammonium sulfate in mixed aerosol particles” by Ting Lei et al.

Anonymous Referee #2

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This study presents an attempt to distinguish the role of particle phase state on the hygroscopicity of biomass burning surrogates and mixtures with ammonium sulphate. I consider the addition of such studies to the literature worthwhile. However, this paper requires a number of changes and clarifications before being accepted for publication. Before these are clarified, I found it difficult to provide further critique on a number of results presented. After reading the first review, which I tend to agree with on specific points raised, I present a number of different factors the authors need to address below:

Specific comments:

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Abstract: I would recommend removing reliance on the word 'slightly'. Please quantify 'slightly' or remove entirely. This paper often feels a little too qualitative in nature, and I would recommend checking all instances like this. The authors also comment on 'similarity of hygroscopic parameter k'. Please quantify this. What range do you consider to be similar? line 35: Presume the authors mean sub-saturated 'RH'. line 35: 'at' the same environment? This is unclear. I would recommend checking all grammar throughout the document, as also noted by the other referee.

Page 7, line 176: 'Here the AIOMFAC-based thermodynamic equilibrium model is used to calculate the DRH...in the multicomponent system based on the known solubility of AS in the organic-free system.? I'm not sure why you have chosen to do this when the benefit of the AIOMFAC activity coefficient model is to account for inorganic-organic interactions. Please justify this as the proceeding equations do not necessarily correlate with this statement.

Page 8: line 209 'Differences in the density models are expected to lead to relatively small differences..' This needs a qualifying reference or a demonstration of sensitivity. What do you mean by relatively small?

Page 10, line 272: 'standard UNIFAC..'. Which set of interaction parameters are you using? A reader should be able to replicate these results.

Page 10, line 276: 'intra molecular interactions are fully considered by these models..'. What is UNIFAC based on?

Page 18, line 482: 'at RH > 95% the water content of hygroscopic particles increases dramatically with a small increase in RH, leading to the predicted change in the mixtures k parameter that is best representing the hygroscopic growth under such high-RH conditions'. This statement is not clear. Are you suggesting that variable 'k' values are required? Please rephrase and clarify.

General comments:

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Please add a brief discussion on the expected performance of activity models for 4-hydroxybenzoic acid. It would help the reader understand where sensitivities might lie.

Have the authors considered how a variable morphology would influence results? Is there no literature data on studies using AIOMFAC on this?

What is the residence time of particles in the HTDMA? If there were a phase state change from which kinetic mass transfer limitations might apply, how might this change your conclusions?

I would appreciate more discussion on how the reliance on 3 organic surrogates influences conclusions for a SOA class that is likely much more complex. Are your studies sensitive to complexity, influenced by a discrete range of solubilities and 'step-like' transitions? How would you test this?

The authors need to follow Copernicus guidelines on accessibility of data and software before this paper is accepted for publication. Please read: https://www.atmospheric-chemistry-and-physics.net/about/data_policy.html

Interactive comment on Atmos. Chem. Phys. Discuss., <https://doi.org/10.5194/acp-2017-549>, 2017.

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