

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 #1

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This paper discusses the measurements of hygroscopic growth of mixed biomass burning related organic proxys and AS using a HTDMA. The technique and data analysis approach are very standard. The highlight to me is the discussions of liquid phase change using AIOMFAC in interpreting the data and the relevance to BBOA. The scope of the paper suits ACP. My major concerns of the paper are on issues related to clarity and novelty.

1. Overall, the English is acceptable but some sentences, especially those in the abstract and the result discussions, are quite awkward. 2. A lot of these types of labora-

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tory experiments have been carried out, dating back to when HTDMA was first developed by Peter McMurry. The authors should emphasize the novelty of the paper in the revision. The systems they chose have been somewhat studied by others in laboratory experiments. Comparison with the literature results are encouraged when appropriate. 3. Give justification (and references) to why 4-hydroxybenzoic acid was chosen as one of the chemicals studied. 4. Lines 29 and 30: It is an overstatement to say that the measurement-model agreement is due to composition-dependent consideration of crystallization of AS in the model prediction. Rather, it is only that such consideration can possibly explain the results. 5. Line 32-33 is awkward. Need to rewrite 6. Line 35-36: the authors claim that the consistency between measurements and predictions suggests “the similar O:C ratios and ammonium sulfate mass fraction in the laboratory and field observation conditions”. This argument is misleading. The logic is wrong. 7. Has the HTDMA system been evaluated? More information of its performance is useful. 8. Line 330-333. While levoglucosan is deliquescent, the ERH of AS was found to shift to HIGHER RH when the mass fraction of levoglucosan increases. This appears to be a contradiction to the deliquescent nature of levoglucosan. Any explanation? 9. How are the current results compared to those of Chan et al. (2005) who also studied levoglucosan Chan and Chan (2006) who also reported the GF of humic like substances? 10. Line 341-343: The authors attributed the delaying or suppressing AS efflorescence to increased viscosity at moderate and low RH. I hope the authors can elaborate more on this. Conceptually delaying and suppressing can have slightly different meaning. Delaying implies a transport limitation while suppressing can imply a thermodynamic consideration. It seems that the authors mean delaying due to mass transfer effects of highly viscous droplets. By citing Zardini et al. (2008) is not adequate. More discussion of the conditions and time scale comparison would be useful. Chan and Chan (2006) examine the limitations of HTDMA system when there are mass transfer limitations in water uptake. 11. Line 377-379: These are only modeling predictions. The exact role of the acid on deliquescent properties of AS needs to be addressed better. The sentence needs to be rephrased. 12. Page 15: They authors

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attempt to rationalize Figure 4 by two-liquid-to-solid phase transition. Subsequent discussion uses the term “liquid phase”. What liquid phase do the authors refer? Organic or aqueous. I cautioned that without additional information, it is rather speculative to attempt to explain the behavior of the mixed particles, especially that the difference between the experimental data and either model predictions is not that large. 13. 3.3.1 Give more explanation on why the chosen mixtures would represent Amazon BBOA in dry and wet seasons. 14. Line 448-450. Cheung et al have examined GF of ambient atmospheric particles as a function of RH. They conclude that Kappa at high RH (like 90%) can be different from those at 50% or below. The authors can elaborate more on whether their observation is general for ambient measurements or just a characteristic of BBOA/AS. 15. The difference between Kappa based on subsaturated and supersaturated measurements can be due to sparingly soluble materials. See Huff Hartz et al (2006) and Chan et al. (2008) for more details. Does 4-hydroxybenzoic acid represent a sparingly soluble organic?

References: a. Chan and Chan (2005), EST, 37 (22), 5109-5115 b. KE Huff Hartz (2006), AE 40 (4), 605-617 c. Chan and Chan (2005), ACP, 5 (10), 2703-2712 d. Chan et al. (2005), EST, 39 (6), 1555-1562 e. Chan et al. (2008) EST, 42 (10), 3602-3608. f. Cheung et al. (2015) AST, 49 (8), 643-654.

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