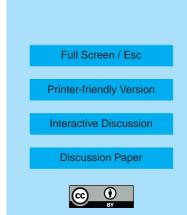**Atmospheric
Chemistry
and Physics
Discussions**

Interactive
Comment

Interactive comment on "Towards closing the gap between hygroscopic growth and activation for secondary organic aerosol – Part 2: Theoretical approaches" *by* M. D. Petters et al.

Anonymous Referee #2

Received and published: 21 January 2009

This paper is a second part of a study where hygroscopic growth and cloud droplet forming potential of secondary organic aerosol is explored. Compared to previous studies hygroscopic growth is successfully studied at RH's between 95% and 99.6%, and it has been found that information from that range can be used to estimate supersaturation needed to activate those particles. The authors have chosen two models to explain observations, and especially usage of a non-ideal model and relating discussion merits publication. I found this manuscript very interesting, and suitable to be published in Atmospheric Chemistry and Physics after minor revision. However, as the manuscript is the second part and uses data presented in the first part, I can not recommend publication before the first part is also published as a separate paper.

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Interactive Discussion

Discussion Paper

Overall comments:

1) Why did you choose to use two-component system with ideal model. I did not find any proof that it would behave clearly better than the single-component system. Related to that, why have you chosen to use two components also in case of non-ideal model for type 2 aerosol but only one component for types 1 and 3. At the moment it seems that the choice of the number of components is quite arbitrary.

2) Could you please use more clear notation in the equations. After careful reading it is clear that gf^3 means cube of growth factor, but as g is also Gibbs free energy and f is defined by equation 7, the notation gf^3 is not so clear.

Minor comments:

What does x_i stand for in Eq 5.? If it is a mole fraction, how could it even get values larger than 1.

page 20840, lines 6-7: Why is the system non-ideal at RH less than 98%. It is quite contradicting if you state in the next sentence that both models, ideal and non-ideal, give equally good agreement with the measurements .

page 20846, line 4: What effect?

page 20848, line 19: Woult it be better to say that "SOA can be comprised of hundreds of componends" as you do not know it for sure based on your experiments.

page 20849, line 25: Water activity coefficient is always dependent on mole fractions for non-ideal solutions.

Interactive comment on Atmos. Chem. Phys. Discuss., 8, 20839, 2008.