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Atmospheric Chemistry and Physics Discussions

Interactive comment on "CCN predictions using simplified assumptions of organic aerosol composition and mixing state: a synthesis from six different locations" *by* B. Ervens et al.

Anonymous Referee #1

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Overall comments:

The manuscript "CCN predictions using simplified assumptions of organic aerosol composition and mixing state: a synthesis from six different locations" by Ervens et al., explores the extent to which simple assumptions of composition and mixing state of the organic fraction can reproduce measured CCN number concentrations across several data sets. For this, they analyze six data sets collected at different locations and distances from source. A CCN model is initialized with measured size distributions and CCN number concentrations at a given supersaturation (S). Comparison of calculated and measured CCN number concentrations is done at one S for each study in

the range of 0.27% $\leq$ S $\leq$ 0.44%. Four assumptions are made regarding the organic fraction: i) externally mixed, insoluble organics, ii) externally mixed, soluble organics, iii) internally mixed, insoluble organics, iv) internally mixed, soluble organics.

The manuscript is very well written and is a step towards a comprehensive CCN climatology. Although both the experimental data and the modeling approach have been presented elsewhere they are also quite clearly presented in the current manuscript too. In addition, the results are presented clearly and some discussion about whether the simplified composition models lead to reasonable closure for a variety of locations and aerosol types or not is also provided. Overall, the manuscript is publishable in ACP after some issues will be addressed.

Detailed comments:

1. Although the manuscript deals with CCN closure, only few previous CCN closure studies are referenced. A comprehensive discussion on previous studies and how their results compare with the authors results would be useful.

2. As also the authors point out, the effect of using size-resolved chemical composition versus size-averaged is important when doing a CCN closure study (e.g., Broekhuizen et al., 2006; Stroud et al., 2006; Medina et al., 2007; Gunthe et al., 2009). Please, discuss the possible implications for your study given that you use a size-averaged composition.

3. Page 21248, lines 10-11 and last 3 lines of the abstract – Although the error in cloud droplet number concentrations from a factor of 2 error in CCN concentrations seems to be small there are other studies that estimate this error to be quit larger. For example, the study of Sotiropoulou et al., (2006) using size-resolved chemical composition found that the error in cloud droplet number concentrations is half the error in CCN concentrations that translates into a 0.5 Wm-2 uncertainty in indirect forcing (first order estimate) for a typical 10-25% error in cloud droplet number concentrations. Please rephrase appropriately.

4. Page 21255, Figure 2 - Please state what the dashed lines represent.

References

Broekhuizen, K., R. Chang, W. Leaitch, S. Li, and J. P. D. Abbatt (2006), Closure between measured and modeled cloud condensation nuclei (CCN) using size-resolved aerosol compositions in downtown Toronto, Atmos. Chem. Phys., 6, 2513– 2524.

Gunthe, S. S., S. M. King, D. Rose, Q. Chen, P. Roldin, D.K. Farmer, J.L. Jimenez, P. Artaxo, M.O. Andreae, S.T. Martin, and U. Pöschl (2009), Cloud condensation nuclei in pristine tropical rainforest air of Amazonia: size-resolved measurements and modeling of atmospheric aerosol composition and CCN activity, Atmos. Chem. Phys., 9, 7551-7575.

Medina, J., A. Nenes, R.-E. P. Sotiropoulou, L. D. Cottrell, L. D. Ziemba, P. J. Beckman, and R. J. Griffin (2007), Cloud condensation nuclei closure during the International Consortium for Atmospheric Research on Transport and Transformation 2004 campaign: Effects of size-resolved composition, J. Geophys. Res., 112, D10S31, doi:10.1029/2006JD007588.

Sotiropoulou, R.-E. P., J. Medina, and A. Nenes (2006), CCN predictions: Is theory sufficient for assessments of the indirect effect?, Geophys. Res. Lett., 33, L05816, doi:10.1029/2005GL025148. Stroud, C., et al. (2006), Cloud activating properties of aerosol observed during CELTIC, J. Atmos. Sci., 64(2), 441–459.

Interactive comment on Atmos. Chem. Phys. Discuss., 9, 21237, 2009.