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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Relating hygroscopicity and composition of organic aerosol particulate matter" *by* J. Duplissy et al.

Anonymous Referee #1

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Review of Atmos. Chem. Phys. Discuss., 10, 19309–19341, 2010 "Relating hygroscopicity and composition of organic aerosol particulate matter J. Duplissy, P. F. DeCarlo, J. Dommen, M. R. Alfarra, A. Metzger, I. Barmpadimos, A. S. H. Prevot, E. Weingartner, T. Tritscher, M. Gysel, A. C. Aiken, J. L. Jimenez, M. R. Canagaratna, D. R. Worsnop, D. R. Collins, J. Tomlinson, and U. Baltensperger.

Major comments:

1. This is a well organized and well written paper discussing the relationship of hygroscopicity of the organic component of aerosol particles with the relative level of oxygenation of those particles as defined by the ratio of m/z44 to the total organic mass concentration based on AMS measurements. The observations include both chamber data and ambient data. The approaches to the analyses are clearly presented. Overall,

I find it to be a strong paper with the exceptions of the apparent motivation and conclusions and as per comment 2 below. The abstract and particularly the conclusions do not describe the results of the paper well and tout the concept of using these data in models as a parameterization for the hygroscopicity of the organic component of the atmospheric aerosol. This concept could be an important application, but it's unclear that models are currently able to adequately predict the mass concentration of the organic aerosol let alone the level of oxygenation. The paper simply and nicely discusses processes and chemistry, and some of that should show up in the conclusions. The most important contribution is the summary of the KappaOrg with f44 for a variety of conditions.

2. The authors compare their results with those of Chang et al. (2009):

- The authors acknowledge that their data are for subsaturated conditions whereas the Chang et al data were for supersaturated conditions. However, they do not attribute any of the differences (primarily slope) to this fundamental difference. For example, could not solute-solute interactions, which the authors state are neglected in their model (P19318, lines 5-6), be of some consequence? The droplets for the subsaturated conditions will obviously be more concentrated than for the supersaturated conditions. Previous comparisons for chamber SOA have found Kappa estimated from HTDMA to be different than Kappa estimated from CCN (Duplissy et al., 2007; Prenni et al., 2007; Wex et al., 2009). It is important to discuss these discrepancies as well as provide readers with a more complete perspective on the issue.

- It appears that the authors refer to the discussion paper of Chang et al. rather than the ACP version (Volume 10, pp. 5047-5064, 2010). In their ACP paper, Chang et al. state that the range for their KappaOrg to O/C relationship is only valid for 0.3 to 0.6. At the bottom of page 19323, you refer to the relationship from Chang et al as KappaOrg = 0.30 O/C whereas in Chang et al. it is given as KappaOrg = 0.29 O/C.

Minor comments:

P 19312, line 19 – define UNIFAC

P 19313, line 1 – Hegg et al. (Hegg, D. A., S. Gao, W. Hoppel, G. Frick, P. Caffrey, W. R. Leaitch, N. Shantz, J.Ambrusko, and T. Albrechcinski, 2001: Laboratory studies of the efficiency of selected organic aerosols as CCN. Atmos. Res., 155-166.2001) and Shantz et al. (Shantz, N.C., W.R. Leaitch, Peter F. Caffrey, 2003: Effect of organics of low solubility on the growth rate of cloud droplets. J. Geophys. Res., 108, 4168-4177.2003) looked at the hygroscopicity of a-pinene oxidation products in a chamber.

P 19313, line 4 – clarification of this statement is needed. Was the higher yield due to increased SOA mass concentration or some other factor?

P 19315, section 2.2 – Consistent with the Mexico discussion, a brief outline here of the instrumentation at the Jungfraujoch would be helpful.

P 19316, lines 4-8 – have these three HTDMAs been compared?

P 19317, line 6 – as follows

P 19319, line 11 – lower

P 19320, lines 10-11 – SOA from a-pinene being discussed here. The reference needs to be clarified.

P 19340, Figure 7 – “sup” should be super.

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