

Interactive comment on “Thermodynamic properties and cloud droplet activation of a series of oxo-acids” by M. Frosch et al.

M. Frosch et al.

mia@kiku.dk

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We thank the Referee for the useful comments. We have made changes and added information, as requested. A detailed list of corrections is given below:

Comment: The quoted k value for ammonium sulfate is incorrect ($k = .53$ applies to hygroscopic growth measurements). A value of ~ 0.6 is more appropriate for CCN measurements.

Reponse: Page 3772, line 17 and Page 3777, line 13: The quoted κ value of ammonium sulphate has been changed to 0.61 and a reference to Petters and Kreidenweis (2007) has been added here.

Comment: Since the reported data, and the derived k -values, are referenced against
C2820

the value of ammonium sulfate through the supersaturation calibration in the instrument, I would like the authors to quote their calculated supersaturation from their model. This could be done in form of a table with pairs of dry diameter and calculated supersaturations, or in form of a k -value range. This is important since different groups choose different reference models (with AIM being the recommended model to achieve longitudinal consistency between studies (Rose et al. ACP, 2008)). Reporting the reference values will allow others to properly adjust the data against any reference point chosen.

Response: As suggested, a table with calibration data has been added to supplementary material. The following text is added (page 3767, line 2): “More information about the calibration is available in the Supplementary Material.”

Comment: In several places the authors argue that “all molecules have a high solubility” and thus conclude that limited solubility does not need to be taken into account. Although this is likely correct, I believe that the authors should attempt to make a more quantitative argument. Using the equations in Bilde and Svenningsson, or one of its cousins, the authors should establish or quote a lower limit of solubility where it becomes important. Finally the authors should provide some argument why the oxoacids do not fall inside the sparingly soluble regime, e.g. through dissolving this minimal amount in water in their lab, or using the E-AIM model/Unifac (<http://www.aim.env.uea.ac.uk/aim/model3/model3a.php>) approach to estimate the water activity of the saturated solution for the oxoacids, and from that whether solubility should play a role.

Response: A more quantitative discussion regarding the importance of solubility has been added to Section 2.2. We have made the following changes (page 3760, lines 10–11):

Old version: “Critical supersaturations were calculated using Köhler theory. All molecules studied have a high solubility in water and limited solubility was not ac-

counted for.”

New version: “Critical supersaturations were calculated using Köhler theory. Limited solubility was not accounted for. Following the equations provided in Bilde and Svenningsson (2004), the minimum solubility necessary for particles with diameters in the range 30-130 nm to be fully dissolved was calculated for each of the studied compounds. The solubilities of the dicarboxylic acids are available in literature (e.g. Saxena and Hildemann, 1994; Lide, 2004) and the solubilities of the oxo-acids were tested in the laboratory simply by dissolving known amounts (larger than the calculated minimum amount) of acid in water. For each compound, the actual solubility was found to be above the calculated solubility limit.”

Please also note the supplement to this comment:

<http://www.atmos-chem-phys-discuss.net/10/C2820/2010/acpd-10-C2820-2010-supplement.pdf>

Interactive comment on Atmos. Chem. Phys. Discuss., 10, 3755, 2010.