Atmos. Chem. Phys. Discuss., 14, C3671–C3673, 2014
www.atmos-chem-phys-discuss.net/14/C3671/2014/

Atmospheric Chemistry and Physics
Discussions

Interactive comment on "Experimentally measured morphology of biomass burning aerosol and its impacts on CCN ability" *by* M. Giordano et al.

Anonymous Referee #2

Received and published: 16 June 2014

The paper submitted by Giordano et al. has investigated CCN activity of biomass burning particles using a CCN counter, an aerosol particle mass analyzer (APM), and electron microscopy technique. Combination of those techniques allowed the authors to investigate impact of particle morphology on CCN activity. Not many studies on CCN activity have employed particle morphology measurements regardless of its importance.

Overall, the authors have conducted the experiment well, and the result will attract interest of readers of the journal. I suggest the paper to be published in ACP after addressing the following comments, especially those related to discussion about particle morphology.

Major comments: Symbols for parameters Symbols must be clearly defined in papers discussing particle morphology, since many of similar (but slightly different) concepts are employed, such as volume equivalent diameter, dry diameter, mobility diameter. In the case of effective density and shape factor, there are a few different definitions, as discussed in DeCarlo et al. (2004). Thus, the readers need to know which definitions the authors are using to understand the paper correctly. I suggest the authors to make a table summarizing those parameters used in this study.

Meaning of Dd in kappa-Kohler theory and abscissa for Figures 6-9 Related to the above comment, it was not clear to me what the authors are trying to tell by figures 6-9. The authors explain Dd in equation (1) as follow: 'Dd is the dry particle diameter.' Then, conclusions of this paper include the following sentence 'These mobility diameters are relevant for CCN activation and therefore represent an underestimation of kappa since the volume of particle that is being activated is smaller than assumed.' Do the authors define Dd in equation (1) as volume equivalent dry diameter, and hence use of mobility diameter leads to underestimation of kappa? In that case, please clearly define Dd as dry volume equivalent diameter when this value appears in the paper for the first time. Meanings of figures 6-9 would not be easy to understand in that case. Why mobility diameter is plotted in those figures if Dd indicates volume equivalent dry diameter? (a similar statement would also be applied if Dd is defined as dry mobility diameter). This is an important question since it affects basic concepts of CCN study on non-spherical particles.

Minor comments: P12563 More detailed description about the chamber experiment is necessary. Especially, description about change in size-distribution and mass concentration would be useful in interpreting Figure 5.

P12564L17 'CPC,TSI 3084' Would you check if it is the right model number?

P12566L3 'Once the mean volume of an aggregate at a certain mass was found with the above analysis, the diameter of the sphere with that volume was used as the volume- equivalent diameter for that particle.' Estimation of volume equivalent diameter by this method contains some assumptions and artifacts. For instance, material condensed in between primary particles would not be included in calculation of total particle volume. Would the authors be able to discuss potential errors of the method or uncertainties in volume equivalent diameter? One potential option is to estimate material density of biomass burning particles using APM and TEM data, and compare it with literature values of density for elemental carbon and organic compounds. The value should be reasonable if volume estimation is accurate.

P12572L18 'The presence of black carbon (BC) in biomass burning may act as the sparingly soluble species for biomass burning generated aerosol.' Is black carbon insoluble or sparingly soluble? Please define insoluble and sparingly soluble materials clearly, and describe how the property of BC is related to those definitions.

References DeCarlo, P.F.,Slowik, J.G., Worsnop,D.R. Davidovits, P., and Jimenez, J. L.: Particle morphology and density characterization by combined mobility and aerodynamic diameter measurements. Part 1: Theory, Aerosol Science and Technology 38 (12), 1185-1205, 2004.

Interactive comment on Atmos. Chem. Phys. Discuss., 14, 12555, 2014.