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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Relating the hygroscopic properties of submicron aerosol to both gas- and particle-phase chemical composition in a boreal forest environment" *by* J. Hong et al.

Anonymous Referee #2

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This manuscript provides an important contribution to the literature by relating chemical composition measured by HR-AMS with hygroscopic growth factor (HGF). In particular, the authors have explored the size dependence of this relationship for ambient aerosol in a boreal forest environment, and have shown that Aitken and accumulation modes behave very differently from the nucleation mode.

Major comment:

This study makes extensive use of O/C elemental ratio measurement with a HR-AMS. In a recent publication (Canagaratna et al., Atmospheric Chemistry and Physics 15,

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253-272, 2015), such measurements have been evaluated by the developers of the AMS method. They conclude that an “Improved-Ambient” method provides a more accurate and precise measure of O/C ratio than the commonly used “Aiken-Ambient” method. The authors of the current manuscript should take this publication into account, since they base their study almost entirely on O/C measurements.

The authors should explicitly state the method used to determine O/C measurements (I’m guessing Aiken-Ambient) and put these measurements in the context of the Canagaratna publication. They should confirm that the Massoli paper they reference their results to performed the calculation in the same way.

Given the potential for confusion about O/C ratio going forward, I think it is highly advisable that the authors provide results using both calculations for O/C ratio (the current set could be included in the main manuscript and the alternative method could be put in supplementary information). I doubt that using Improved-Ambient vs. Aiken-Ambient will change the main conclusions of this manuscript, but given the importance of O/C ratio to this study, the authors must explore this possibility fully. Alternatively, the authors may want to recast their results in terms of carbon oxidation state (OSc), since the Canagaratna paper suggests that this is a more robust output of AMS measurements than O/C ratio.

Minor comments:

Do the nucleation mode particles have a higher sulfate volume fraction than Aitken/accumulation mode particles, and could this be related to the higher correlation between nucleation mode HGF and gas phase sulfuric acid concentration? Inorganic volume fraction is a less informative parameter for this correlation since it includes species other than sulfate.

Hansen et al., 2015 is mentioned a few times in the text, but no reference is included.

Page 15522 line 10: should be “non-additive”.

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Interactive comment on Atmos. Chem. Phys. Discuss., 15, 15511, 2015.

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