

## ***Interactive comment on “Particle hygroscopicity during atmospheric new particle formation events: implications for the chemical species contributing to particle growth” by Z. Wu et al.***

### **Anonymous Referee #2**

Received and published: 28 June 2012

Wu et. al, present a case study on particle water uptake during two nucleation events. Distinctly different particle hygroscopicity is observed during the two events. The authors interpret the hygroscopicity measurements in terms of parameterisations of the nucleation process, the so-called “soluble fraction”, supporting measurements and in the light of other recent field observations of nucleation events.

The main weakness of this manuscript is that the main conclusions are based more on expert judgement as to why the simple “models” used to interpret the behaviour fail. There is little direct measurement evidence or behaviour that backs up the conclusions reached.

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## General Comments

The term “solubility” is used incorrectly throughout the manuscript. The authors appear to confuse solubility with particle hygroscopicity on a number of occasions. E.g. a compound may be infinitely soluble, but a particle comprised of such a substance may exhibit little hygroscopic growth at 90

In estimating the soluble volume fraction the authors state how they derive the water activity of different diameter particles. How is the Kelvin Effect taken into account when calculating the ammonium sulphate growth factor? In the 25 nm to 50 nm diameter range the Kelvin effect is quite large, if it is not accounted for adequately the conclusions reached in this study might be quite different, i.e. the measured growth factor to ammonium sulphate growth factor ratio will be biased low.

The interpretation of the HTDMA measurements is not supported by any direct measurement of the 25 to 50 nm particle composition. As the authors acknowledge the aerodyne AMS cannot focus the 25 to 50 nm particles of interest, given that all the conclusions in Section 4 are based on an interpretation of the AMS data this makes them difficult to accept.

Standard of English falls below that required by ACP throughout the manuscript. This makes the article difficult to follow and in a number of places ambiguous. This must be resolved before any resubmission.

## Specific Comments

Page 11419, line 16: The authors state that the inversion method is “based on the TDMA<sub>inv</sub> method”, in what way(s) does the inversion technique differ from TDMA<sub>inv</sub> or is it the same?

Page 11420, line 18: Studies have shown SOA is typically not hydrophobic, in contradiction to the statement here. Indeed, the authors point this out on lines 21-23.

Page 11425, line 15: What is meant by a “perfect” mode as opposed to an “imper-

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fect” mode? A measure of the spread of the distribution might be more informative, combined with a test of the robustness of the retrieval (see Gysel et al 2009)

#### Technical Comments

- Use consistent date format rather than switching between yyyy/mm/dd and yyyy-mm-dd etc.
- Consistent use of indices e.g.  $1/A$  or  $A^{-1}$ .
- Figure 1: I believe it is conventional for a vertical colour scale to have the high values at the top. Label all axes in a consistent manner e.g. Name [units]

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Interactive comment on Atmos. Chem. Phys. Discuss., 12, 11415, 2012.

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