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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Hygroscopicity, CCN and volatility properties of submicron atmospheric aerosol in a boreal forest environment during the summer of 2010" *by* J. Hong et al.

Anonymous Referee #1

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The hygroscopic, CCN, and volatility properties of atmospheric aerosols were studied in Hyytiala, Southern Finland. Although these properties have been investigated widely, the study brings new information about the hygroscopic and CCN properties of the non-volatile part of the aerosol particles, by using the VH-TDMA techique. Therefore I recommend this manuscript to be considered for publication in ACP, but after some revision.

The gap of knowledge, which this study strives to fill, could be written out more explicitly both in the introduction and conclusions. According to this, the main goals of the study, given in the end of the introduction, should be revised. At least the goals (1) and (2)

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are not discussed in the manuscript at all. Also, more discussion about how the results obtained in this study would contribute to, e.g., estimating the radiative forcing, should be added, because this is given as a motivation for this work in the introduction. Also, the literature could be rechecked for the last 2-3 years.

The conclusions are more like a summary: Please consider making the section more compact with only the conclusions in it, or rename it “Summary and conclusions”.

Minor comments:

P29100, L11-13: Please add appropriate references.

P29100, L25-27: The introduction of different measurement techniques can be limited.

P29100, L28-29: Repetition of P29100, L23-24.

P29101, L11-14: Five references for thermodenuder; are all these necessary?

P29101, L22-25: Some evaporate below 300 °C – some not, this is trivial. Please rephrase.

P29103, L22: Does the 45 min scan time include all particle sizes?

P29103, L23: Do Villani et al. and Johnson et al. refer to the accuracy of your instrument?

Subsection 2.2.2: Please give the supersaturation(s) that were used in the CCNc analysis.

Subsection 2.2.3: The DMPS and VDMPS have different size ranges; any comments on this?

Subsection 2.2.3: The particle losses in the thermodenuder are given but how about the particle losses in the other instruments?

P29105, L1: Are there other refractory compounds than BC and sea salt that should be taken into account?

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P29105, L3: The aethalometer measured $PM_2.5$ but the AMS only $PM_1.0$, could you comment on this?

Subsection 2.2.5: The trace gases were measured at several heights. Is there variation in the concentrations between the different heights? Which of these was used when the aerosol (at which height was the aerosol measured?) and trace gases were compared in Figure 3?

P29106, L12: The median temperatures could be listed here.

Equation 1: GF(90% RH) can be omitted.

Equation 2: GF(T) can be omitted.

Equation 3: GF(90% RH, T) can be omitted.

Equation 4: GF(90% RH, T, aerosol residual) can be omitted. Also, could this be written as $GF_{H,residual} = GF_{VH}/GF_V$, and further the GF_{VH} and GF_V could be substituted into the equation.

Equation 5: The substitution of $D = D_pGF_H$ could be written out for clarity. Should $S(D)$ be now $S(D_p, GF_H)$, and can you substitute $S(D_p, GF_H) = 0.9$?

Subsection 2.3.4: Can the same κ value be used for subsaturation (VTDMA) and supersaturation (CCNc)?

P29110, L10: There is fluctuation in the BC mass fraction (Figure 2) during the measurement period, could you give, e.g., the average and standard deviation here?

P29110, L12: Please give justification for the assumption that the BC mass was solely in submicron particles. Was this true also during the biomass burning period?

P29110, L21-27: What is your interpretation of the positive correlation between the GF_H and sulphate?

P29111, L17-19: This might be the answer to my previous comment for subsection

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2.3.4. Could one reason for the failure of the comparison be that Equation (5) is for a droplet and Equation (6) is for a wet particle, so the sizes of these and therefore the amount of water on them and their composition are quite different?

P29112, L8-10: An unclear sentence, please clarify.

P29112, L14-15: The CCNc data in Figure 5 shows the opposite (larger particles have lower hygroscopicity).

P29112, L23-27: This paragraph belongs to the Methods.

P29113, L3-6: Can you use the AMS results to discuss the differences in the particle chemical composition?

P29113, L12: Can you give an estimation, how much more the aerosols would evaporate during the extra 9 seconds in the VTDMA?

Subsection 3.3: This subsection could be moved to the Methods section.

P29116, L5: Talking about evaporation, should this be $GF_{V,BC} = 1$?

P29116, After Equation (10): The values of the parameters could be inserted here instead of Table 2.

P29118, L6: An unclear sentence, please clarify.

P29118, L20-27: This discussion could be in the Results section, not in Conclusions.

Table 1: The structure of the table is unclear. Please consider separating the three last rows.

Table 2: This table is unnecessary, if the values are given in the text after Equation (10).

Figure 4: By writing "too few data points for 50 nm and 110 nm", should these plots be removed?

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Figure 5: Please consider changing either the red or magenta; they are easily mixed.

Figure 6: Is Hakkinen et al. data from VTDMA or VDMPS measurements? Please indicate in the legend or the caption.

Interactive comment on Atmos. Chem. Phys. Discuss., 13, 29097, 2013.

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