

Interactive comment on “Hygroscopic properties of the ambient aerosol in southern Sweden – a two year study” by E. O. Fors et al.

Anonymous Referee #2

Received and published: 6 May 2011

This paper presents more than 2 years data taken in southern Sweden with a HTDMA and a CCNC. Diurnal and seasonal variations of aerosol hygroscopicity are presented. I recommend publication of the paper after some revisions.

General comments: The use of two models (K_p and K_r) is not needed for this paper. Presently, the K_p value is used to report the hygroscopicity and K_r is used for the CCN activation prediction. I would suggest to use only one, K_p . If the authors think it is needed to have two models, please justify.

Specific comments:

Abstract: Line 4-7: “In this work, for the first time the seasonal variation of the hygroscopic properties of a continental background aerosol has been described, based on

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more than two years of continuous measurements.” I do not fully agree with “continental background”, as the location is very close to the sea (50 km).

Line 19-21: “CCN predictions based on H-TDMA data underpredicted the activated CCN concentration with 7% for 1% water supersaturation” What does the 7% refer to? The sentence is not clear, please rephrase.

Page 6606: Line 7: “Vavihill” is not a very well known place. Indication of the Vavihill location is explained later (line 14-16), and could be moved in line 6.

Line 17: Why using PM10 inlet instead of PM1 inlet? DMPS stops at 857 nm.

Line 25: “The aerosol was dried and charged with an 85Kr diffusion charger before it entered the first DMA (DMA1),...” The aerosol was charged by the diffusion charger. But how was it dry (Silica gel? Other system?) ? At which RH? Does the dryer need any maintenance or is it self-regenerating? How long the aerosol stays dry before entering DMA1?

Page 6607:

Line 8-15: How long the aerosol was exposed to the final RH before entering the DMA2 (Residence time of the aerosol in the humidifier)?

Line 20: A butanol CPC was at the exit of DMA2 (RH 90%). Did the CPC get trouble after some times behind the DMA2 (RH 90%) with condensation of water in the butanol? As the HTDMA is made to stay for a long period, why not using a water CPC instead?

Line 28-29: “For further details regarding the H-TDMA system, see Nilsson et al. (2009).” It is important to mention in this paragraph the main specification of the HTDMA. Some are given here, some are given later in the text and some are not given:

-Temperature of HTDMA operation
-Residence time at dry condition prior DMA1
-To which RH value it is considered to be dry?
-Residence time at the target RH prior to enter DMA2
-Operating RH of the HTDMA

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Page 6608:

Line 12-13: "To increase the comparability between different scans, the GF-PDFs were recalculated to 90% (Gysel et al., 2009)." One or two lines describing this method would be useful (Basically, it is calculating the kappa from the GF measured at a certain RH (between 88-92%), and from this kappa it is calculating the GF at 90% RH).

Line 21: DMPS is measuring between 21.5 to 857 nm. Why not using then a PM1 instead of PM10 inlet?

Page 6609: 2.3: CCN counter:

1) Why the aerosol was not dry prior to enter the CCN? Would that affect the closure between HTDMA and CCN?

2) Was the CCN regularly calibrated like the HTDMA? How and how often?

Page 6609 to 6613

-Paragraphs 2.4 to 2.6 are the theory descriptions (2.1, 2.2 and 2.3 are the instrumental descriptions). Theory needs to be reorganized. It could be rearranged as follow (The needs of 2 Kappa model is not obvious to me):

2.5 Kr model 2.6 Kp model 2.7 CCN closure method (here either Kr or Kp can be used, but the method does not depend on the Kappa used) 2.8 Parameterisation of CCN concentrations

-Comments: surface tension used here is not provided. How the surface tension could explain this under prediction in the closure? -Parameterisation of CCN concentration is not too clear. Could that be explained by a simple formula? Or a simple illustrative figure?

Page 6611:

line 25: "In addition to the resolution issues of the hygroscopicity measurements, the

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closure will underestimate the activated CCN(s) concentration if there are particles present that are larger than the DMPS can detect." How the surface tension will affect the closure? A discussion would be welcome.

Page 6618:

Line 7: "... and in a hygroscopicity closure study it was concluded that..." To which study this sentence refers to?

Page 6620-6624: There is no description why the Kr model is preferred to Kp model to do the closure. Why two models are used in this paper? In table 3 and 8, Kp is presented and for the CCN activation model Kr is used. This is not clear to me, why to Kr and not Kp is used for this. Surface tension used should be mention as well.

Typos:

Page 6603:

Line 8: "et al., 2006) The light scattering of..." a dot is missing before the new sentence.

Page 6609

Line 15: "...thesvalues"...spaces are missing.

Figure 2a: In the caption it is once 2001-2010 and once 2000-2010. Check date in the text as well.

Figure 3: Ticks and number in the GF axis are not in phase. Would that be possible to use the same symbol as in figure 5 for the size selected code. In that way the figure can be read in B&W.

Interactive comment on Atmos. Chem. Phys. Discuss., 11, 6601, 2011.

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