**Atmospheric
Chemistry
and Physics
Discussions**

Interactive
Comment

Interactive comment on "Hygroscopic properties

of atmospheric aerosol particles over the Eastern
Mediterranean: implications for regional direct
radiative forcing under clean and polluted
conditions" *by* M. Stock et al.

Anonymous Referee #1

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GENERAL

The paper describes the results of a large campaign at the well-known Finokalia station in Crete. The measurements are obviously well done and the analysis is fine. I only have one a bit larger comment. The solubility model in eq 3 contains the theoretical growth factor that is calculated using the growth of inorganics. This is not quite adequate. The chemistry data shows that in all size fractions the organics contribute

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significantly to the mass. In the last 10 years there have been numerous publications on the hygroscopicity of organics (make a small literature survey and add a few references). Their growth factors are around 1.1-1.2 at RH = 80 − 90 % and it has been shown that they are soluble in water, although weakly. When I look at the results, for example figs 6, 7, and 9, the insoluble fraction is big. In the atmospheric aerosol it is mainly EC and soil dust that are insoluble and these are not contributing much to these particle sizes. Therefore claiming for instance that about 50 % of aerosol in the 30 nm size range (see Fig. 9) is insoluble, is definitely misleading even though it naturally comes out of your equation, I believe that. So, organics and their growth should be taken into account. How would that change your results?

DETAILED COMMENTS

The rest of my comments are smaller.

P25997 L25. In the H-DMA-APS system you determined the growth of two different sizes: 1.0 and 1.2 μm. Why did you select these dry sizes so close to each other? The chemical composition of 1.0 and 1.2 μm particles is essentially the same and they even get sampled at the same impactor plate. Well, you cannot change measurements you have already done, I just wonder.

P25999, L10. You have used the SDI with Q = 20 LPM. Did you have some custom-made version of it? The point is that the SDI is calibrated for Q = 11 LPM so at 20 LPM the cutoffs change. Did you correct for this and if you did, how did you do that? P26000, Eq (2) Is there some typing error here? If nfi is the number fraction of the group i then isn't the denominator SUM(nfi) equal to one? Should the equation be: nfi = ni/SUM(ni)?

P26000 L13-16: "Larger particles with multiple charges were observed as a small mode right of the main peak in the particle number size distribution measured with the dry APS. Therefore this mode was not used for the determination of hygroscopic growth." When you observe a mode after the humidification, how do you know know

that this new mode does not contain particles from the multiply charged mode that was observed in the dry APS? Isn't there a possibility that these particles might be of some hygrophobic material that wouldn't grow so much and then appear in the same mode as the smaller particles that have grown by humidity. How much would this affect ther results?

P26000 L16-18. "Small hydrophobic particles with higher shape factors and the same electrical mobility as the particles of the main peak appeared in the dry particle number size distribution left to the main peak". You write at this point about dry aerosol. How do you know from the dry size distribution that the particles on the left of the main peak were hygrophobic?

Section 3.3.2 the refractive index calculation. Have I understood right: you first calculate an effective refractive index for the whole size distribution. I think it would be good to mention this explicitly. Then you calculate the hygroscopic growth at different sizes using the size dependent chemical composition and then get a new refractive index that is size-dependent? So, is this is kind of a mixture of effective refractive index for the whole size distribution and size-dependent refractive index? Fine, just tell this. Another question: why would the refractive index not be wavelength dependent?

P26008 L 17-18: "...size distribution for elemental carbon (EC) retrieved from the size segregated chemical analysis which is centered around Dp =130nm (see Fig. 8)." Did you take the impactor collection efficiency curves into account when making the inversion from stage data to continuous size distributions? And did you use the changed cutoff sizes in case the flow rate of the impactor really was 20 LPM and the impactor was the SDI that is designed for 11 LPM?

Table 5. The refractive indices must be wrong, columns have been changed to rows, obviously just a typing error. It is now there that the real refractive index for marine air is 1.48 and for polluted air 0.01 and that the imaginary refractive index is 1.50 for marine air and 0.02 for polluted air.

Interactive comment on Atmos. Chem. Phys. Discuss., 10, 25991, 2010.

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