

Interactive comment on “Aerosol mass closure and reconstruction of the light scattering coefficient over the Eastern Mediterranean Sea during the MINOS campaign” by J. Sciare et al.

Anonymous Referee #1

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General comments :

This paper presents interesting results and methodology. The subject is totally relevant for publication in ACP, and the presentation is of good enough quality (see specific comments). However, the discussion should put more emphasis on the implications of the finding and on the application of such a simple methodology. Also, 1)The English of the paper could be improved in many instances. 2)There are some sections that are not really necessary and could be shortened or removed (see below). 3)There should be a discussion on the implications of the fact that a simple method (considering only

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sulfate and OC, and no RH-dependence of OC) can lead to a proper reconstruction of the scattering coefficients.

More general comments

Page 2432, line 8 : How is the cut off performed at the inlet of the nephelometer ? Page 2433, line 7 : “an uncertainty of 10 ppb” in the water extract ? Same : a table including the values of the field blanks and detection limits would be good Page 2434, line 22 : what is the meaning of a correlation including all chemical species ? Page 2435 : what is the purpose of the section on ionic balance ? I don't see the point it makes in the scope of the paper. Page 2435 : there is no argument that justify the choice of the EC obtained with the thermo optical method for use in the mass closure. What is changed if the other series is used ? I do not understand equations 2 and 3 : what are the % ? Also, what is the reason to present equation 3 since you do not use it in the following ? You should gather sections 4.3 and 4.5 If nss-K is mainly from biomass burning, there should be some associated Cl ? Sections 4.4 and 4.6 do not bring in much information. They could be combined and shortened. Section 4.6 : Instead of making averages of the concentrations of the 6 MOUDI impactors, it may be more relevant to performed averages of the concentrations normalized to the total concentrations of each MOUDI. Figure 2 : there are 2 categories in very close blue colors. Table 1 : in the second part of the table, there are several “ $\mu\text{g}/\text{m}^3$ ” that are not correct. Same : are the second digits in the reconstructed and measured masses really meaningful ? Page 2440, line 19 : you should present the equations of the regressions between the measured and reconstructed masses, since it is one of the main points of the paper. Section 5.1 : you need to give the complete equations of the regressions. It is correction affecting more the samples that were previously out of the 10% limit ? Section 5.2 : there is a need for a figure or a table comparing the results using the two series of OC measurements (1st paragraph) Page 2442, lines 7-11 : how do you reconcile the fact that bound water can have some influence and that a CF of 2.1 is the best one to fit the data (without taking into account the influence of bounded water) ? Page 2442, lines 23-25 : it should

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be possible to calculate the most appropriate CF deduced from these values. Page 2443 : the second paragraph of section 5.3 is rather descriptive and is leading to strong conclusions Figure 5 : there is no caption to tell what is the line with circles Section 5.4 : all of this section is not bringing useful information. The only interesting point (the association of carbonaceous aerosol with a biomass burning factor) is not discussed in depth. Page 2445, line 6 : the reference by Ouimette and Flagan is rather old for this kind of work. Page 2446, section 6.1 : what is the impact of the changing RH during the course of each 12h period of sampling ? Since the relation is not linear between RH and scattering, what is the bias introduced by using 12h averaged RH ? Could you show the range of variation of RH ? Page 2446, lines 18 and 19 : what are the ranges (at the 95% confidence limit) associated with the values of σ_{AS} and σ_{POM} ? End of section 6.1 and figure 6 : you should have a short discussion on the episodes with significant deviation between measured and reconstructed scattering coefficients (around 10/8 and 20/8) Section 6.1 (and conclusion) : there should be a discussion on the implications of this work. It seems possible to reconstruct the scattering coefficient with simple hypotheses : measuring sulfate and OC is enough, and the hydrophilic or hydrophobic nature of OC is not important.

Specific comments

Page 2428, line 20 : "...vertical gradient for fine PM..." Page 2429, line 12 : "...to reduce the uncertainties in the knowledge of both the direct..." Page 2430, line 3 : "...campaign is used..." Page 2430, line 5 : "...here, as it can be used..." Page 2430, line 7 : "...serve later on for the calculation of the direct..." Page 2430, lines 15 and 16 : detail FT and MBL Page 2430, line 18 : "...respectively within the two..." Page 2430, line 20 : quotation for unpublished results ? Page 2430, line 22 : "...occurred in the west and north of the Black Sea for almost..." Page 2431, line 13 : "...was estimated to be on the order of..." Page 2431, line 20 : "...using two cascade impactors in parallel..." Page 2431, line 35 : delete "using the thermal protocol developed by Cachier et al." Page 2432, lines 20/21 : "...fine and coarse fractions for the MINOS

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campaign.” Page 2433, line 21 : “. . .Sunset company. . .” Same : “. . .estimated to be on. . .” Page 2436, line 4 : give 2 digits for the slope Page 2436, line 8 : give a reference for that. Page 2436, line 20 : improve the English Page 2437, lines 8 and 9 : “. . .([Fe]=0.67*[Al]. . .n=22, with concentrations in $\mu\text{g.m}^3$) Page 2437, line 10 : the reference by Tuncel et al. is not really complete in the list. Page 2437, line 17 : “. . .calculate the mass fraction. . .” Page 2437, line 22 (eq 4) : what are the units? Give 2 digits. Page 2438, line 23 : “. . .taken in the range from. . .” Page 2442, lines 7-8 : “. . .if we vary. . .do not change. . .Second, . . .” Page 2442, line 11 : “. . .the validity of this conversion factor for OC to POM.” Page 2442, line 12 : “However, the use. . .” Page 2442, lines 17-18 : “. . .explained by a parallel change in combustion sources, anthropogenic. . .observed both before and. . .” Page 2446, line 21 : what is the number of samples used for the regression ? Page 2448, line 3 : “. . .reconstruction does not significantly. . .” Page 2448, line 13 : “. . .closure results are used. . .” Page 2448, lines 17-18 : “. . .responsible for about one third on average of the. . .” Page 2449, line 19 : “The results obtained in this study will be used in a radiative transfer model to calculate. . .”

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