

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.

J. Sciare et al.

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The authors acknowledge the reviewer #3 for his/her positive review of the manuscript. Following his/her recommendations, corrections have been done in the revised version of the paper.

General comments of referee #3

+ “What is the cut size of the $0.4\mu\text{m}$ pore size filters - would it cause you to miss mass contributing to scattering?” This kind of filters probably misses part of nanoparticles (below $0.1\mu\text{m}$). On the other hand, as shown in figure 2 (mass size distribution), this will not affect significantly our chemical mass closure since the particulate mass

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of nanoparticles consists only in 1-2% of the mass in the fine mode. Hence these nanoparticles are not efficient in terms of scattering and will not either contribute significantly to the scattering coefficient measurements performed by the nephelometer.

+ “How was the 1-2 μm cut-off for the nephelometer achieved? (Impactor? Cyclone?)” Impactor plate. Information given in the revised version of the paper.

+ Is the variation in cut-off due to changes in relative humidity? Yes for a part of it. Most probably a minor part since (as shown in Figure 2) a minor fraction of PM is located in the range 1-2 μm . The variation comes also from the shape of the impactor plate which does not provide a sharp cut-off. That’s the reason why we gave such range 1-2 μm for the cut-off of the nephelometer.

+ What uncertainty does this non-sharp cut-off introduces when trying to reconstruct scattering? The different cut-offs (nephelometer + SFUs) are changing similarly when RH is changing in the course of the day. Then RH is most probably not one of the factors controlling the uncertainties in the cut-off. PM located in the range 1-2 μm contributes roughly to 10 percent of the PM in the fine mode. It can be considered as the maximum error done in the fine PM and due to non-sharp cut-off. Also particles in the range 1-2 μm (10 percent of the fine PM) are less efficient to scatter light than the particles in the range 0.1-1 μm (85 percent of the fine PM). As a result, uncertainties due to non-sharp cut-off must be probably much lower than 10 percent.

+ “Nephelometers often heat their sampled aerosol due to the nephelometer light source...” We do agree that this might change ambient RH. Several lines were added in the revised manuscript on this point. In order to minimize any RH discrepancies resulting in the heating of air from the nephelometer light source, an air flow of 1m³/h was applied at the inlet of the nephelometer. Comparison between RH data from the nephelometer and from the meteo station of the sampling site have shown a good agreement ($r^2=0.71$, $N=585$) with a slope of 1.03.

+ “I’m confused by the discussion of the sea salt reactions...” Several lines have been

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added/removed in the revised version of the paper. The use of Na to calculate ss-SO₄, ss-K and ss-Ca is not altered by possible HCl volatilization from sea salt particles. On the other hand, the equation sea salt=3.27Na assumes that HCl is not volatilized. That's the reason why we cannot use this equation in our paper.

+ “In the discussion of inorganic ions, the authors used the following to describe [Ammonium Sulphate] ...”. As reported in the Ionic balance section, sulphate is not (by far) completely neutralised by ammonium. As a matter of fact, the use of the term “(NH₄)₂SO₄” cannot be used to describe the molecules made with ammonium and sulphate. On the other hand, these 2 molecules cannot be taken separately since they are most of the time associated ($r^2=0.99$ for MOUDI impactor results). The term “[Ammonium Sulphate]” should then be considered (as written by the referee) as representative of various molecules containing ammonium and sulphate in different concentrations.

+ “I felt that the free troposphere (FT) site got short shrift in this paper...” It is true and due to limited data available at the FT site. However, aerosol mass closure has been done at this site and is reported in the text (page 2440, lines 25-227), in Table 1, and in Figure 3b (which gives the equation between mchem and mgrav for fine and coarse size fractions at the FT site).

+ I could not tell from the text which gravimetric mass measurements were used for the mass closure experiments ...” Two lines were added in the revised version to make it clearer.

+ “The authors suggest that the OC to POM conversion factor changed over the course of the study...” Two paragraphs were added in the revised version which present separate conversion factors as well as their influence on the reconstructed scattering coefficient.

+ “This is a niggling comment but I don't think that the authors are ‘reconstructing scattering’ so much as deriving mass scattering coefficients”. We are indeed a little bit lost in this story. We have been asked by one of the referees to replace (in the title

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of our paper) “derivation” by “reconstruction”. IMPROVE network is also dealing with “reconstruction”. Personally, I would prefer “reconstruction”. It sounds more ... French ;-)

+ Technical corrections: Corrections done in the revised version of the manuscript

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