

Interactive comment on “Multi-wavelength Raman lidar, sunphotometric and aircraft measurements in combination with inversion models for the estimation of the aerosol optical and physico-chemical properties over Athens, Greece” by R. E. Mamouri et al.

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The authors would like to thank the reviewers for the helpful comments and technical corrections:

Major comments: 1. The reviewer's main question is on the estimation of chemical composition. Following authors description, they assumed firstly the content of Sulfate,

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Dust and Ammonium sulfate, and then reverse ISORROPIA-II to fit refractive index and yield the improved estimation of fraction of these 3 components. Except lidar-based refractive index, the only inputs are temperature and water vapor profile information. Considering this is main interesting point of this manuscript, authors should clearly illustrated the procedure (e.g. a scheme diagram) and discuss the efficiency and feasibility of this estimation, for example which kind of a priori values are used, how about the estimation affected by the a priori values etc.

Reply: The reviewer is right. A Plate (Plate 1) has been added and a better description of the procedure implying ISORROPIA II model has been implements in the revised version of the manuscript (section 2.4).

2. The data selection criteria are not clear enough in the manuscript. For example, when comparing effective radius retrieval results, Fig. 7 shows lidar-based results only at 3 days and results shows good agreement with reference data. Meanwhile, Fig. 2 showed complex refractive indices and single scattering albedo retrieved from lidar measurements for the whole period (12 days). Why authors do not show comparison of effective radius retrieval results at all period in Fig.7? Even authors claimed that the 3 days are selected, but the reviewer still thinks it is important that authors show all results and comparison during the whole period with all measurement data.

Reply: In this point there is a misunderstanding. In Figure 2 the complex refractive indices and single scattering albedo retrieved from sun-photometer measurements are presented, while in Figure 7 lidar-based retrievals are given in comparison with the AERONET ones. Lidar inversions are provided only for the 3 presented (selected) days. In the revised version of the manuscript, this point is more clearly presented to the readers.

Minor comments: 1. Table 1, I am strange for such kind of big different on refractive index results ($1.56+0.051i$ vs. $1.31+0.01i$) at 2.8 km layer, while very close results on effective radius (0.4 vs. 0.37) and single scattering albedo (0.63 vs. 0.698) presented.

The authors should give a more vigorous explanation on this difference and details on both measurements (in situ and lidar retrievals).

Reply: Concerning the lidar retrievals the used inversion method tends to deliver a solution space which is described by a low-absorbing case and a high absorbing case. The low-absorbing case is connected to low values of the real part refractive index, whereas the high-absorbing case is connected to high values of the real part refractive index. Based on our analysis of the lidar data and the air mass back trajectory analysis, we consider more likely that strong light-absorbing particles were observed.

In the new version of the manuscript some corrections and clarifications were made concerning the airborne data and uncertainties are now discussed. The comparison between the two measurements has been revised.

2. P595, line 5-15. Authors used lidar ratio from nighttime dust measurements to deal with backscatter coefficients obtained in day time (before sunset time). This treatment can be not thought as a reasonable assumption considering aerosol property varies a lot with time. The rationality of this kind of treatment are expected to be discussed in detail.

Reply: According to the reviewer's comment, this point is now further discussed and clearly presented in the revised version of the manuscript. A new figure (Fig. 7) has been added.

3. Page 604, line 26-27, “: : for each of three selected days (18, 20, and 21 July) using EOLE Raman lidar data, we followed the same methodology as described for the case of 21 July 2009, : : ” and Fig. 7. The same questions with question 2, i.e. authors are expected to provide more explanation on comparing results obtained from daytime (sunphotometer) and nighttime (lidar).

Reply: According to the reviewer's comment, a new paragraph has been added in the revised version of the manuscript. More explanations are now given concerning the

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direct comparison between sun photometer and lidar data in section 5.

4. Part 6, the second paragraph. Authors give a detailed description on previous study results. This might be moved to introduction part instead of conclusion part.

Reply: According to the reviewer's comment, the detailed description on previous studies is now removed from the conclusions and was added in the introduction in the revised version of the manuscript.

Please also note the supplement to this comment:

<http://www.atmos-meas-tech-discuss.net/5/C1360/2012/amtd-5-C1360-2012-supplement.pdf>

Interactive comment on Atmos. Meas. Tech. Discuss., 5, 589, 2012.

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