

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.

Anonymous Referee #1

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General comments:

In this manuscript, the authors described aerosol optical and physical properties retrieved from a 6 wavelength Raman lidar system, as well as rough chemical composition estimation based on a thermodynamic model (ISORROPIA-II) at an urban site of Athens, Greece. A few of in situ aircraft measurements are also used in the comparison. The Raman lidar measurements including extinction coefficient, backscatter

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coefficient, lidar ratio and Angstrom exponent are first used to derive aerosol effective radius, complex refractive indices and single scattering albedo following Muller et al. (1999, 2001), and then the complex refractive indices are used to constrain ISORROPIA-II as well as temperature, relative humidity profiles obtained by radiosonde and water vapor profiles obtained by Raman lidar. The topic is of interest to AMT readers, but some main technical issues are not presented clearly and proved to be valuable robustly in its current format.

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, 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.

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.

Minor comments: 1. Table 1, I am strange for such kind of big different on refractive index results ($1.56+0.051i$ vs. $1.31+0.011i$) at 2.8km 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

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both measurements (in situ and lidar retrievals).

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.

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).

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.

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