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Atmospheric Measurement Techniques Discussions

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Interactive Comment

Interactive comment on "Optical properties of different aerosol types: seven years of combined Raman- elastic backscatter lidar measurements in Thessaloniki, Greece" *by* E. Giannakaki et al.

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Particular comments: In lines 21-29 of page 3031 the authors described the ranges of uncertainties of their retrievals. In view of the figures presented it seems that the mentioned uncertainties of Klett method do not include the effects associated to the choice of the lidar ratio. This point must be clarified. Considering the errors in lidar algorithms, what we mention in the text is not the actual error in the estimation of the backscatter coefficient with Klett method but the deviation of our estimates from the solution in the frame of the intercomparison exercises that took place within the EARLINET (see cited papers). Following the reviewer's suggestion, the following information has been added: "Typical statistical errors due to the signals detection are below 10% in the PBL for backscatter and extinction coefficients at 355 nm. In the free troposphere, typical backscatter coefficient errors at 355 nm are below 30% for values higher than 0.25 Mm-1sr-1. For extinction coefficient at 355 nm, errors are below 30% in the free troposphere for values higher than about 8 Mm-1. For backscatter coefficient at 532 nm additional uncertainties are being introduced by the fact that an unknown lidar ratio has to be assumed. Both the system and algorithms used have been quality assured within the EARLINET"

Page 3034, line 22, substitute "that" for "those". The word "that" has been replaced by the word "those"

The authors analyzed the data base using different criteria for the cases classification. In a first step they present a section on mean aerosol properties, section 3.1. The results presented in this section are relevant. The lidar ratios obtained by Raman retrieval are in the range encountered by other authors. Nevertheless, the Ångström coefficient derived from backscatter coefficient reaches rather large values (up to 3.4) that seem unphysical. Are these large values representatives of a large number of cases? It would be worthy that the authors revise these cases. Ångström exponent is being calculated from backscatter profiles of 355 and 532 nm. Backscatter coefficient at 355nm is being calculated by the Raman method and thus, any overlap effect cancels out. However backscatter coefficient at 532nm is being calculated by Klett method. In this way backscatter at 532 is affected by the unknown estimation of lidar ratio. Moreover backscatter profile at 532nm is not corrected for overlap effect. As a result, the regions of incomplete overlap are affected by the underestimated backscatter profile at 532 nm, which is the reason for high (unphysical) Ångström exponents. Following reviewer's suggestion, we have revised the cases with large Ångström exponents, by (1) excluding the cases where overlap seemed to affect the measurement in heights above 1.5 km and (2) change the initial selection of lidar ratio. The revised results are now presented in the new version of our paper.

In section 3.2 the values of optical depth are expressed with an excessive number of significant figures considering the associated standard deviations. (e.g. 0.83+-0.29 must read 0.8+-0.3,: : :) Now the optical depth is expressed with one significant figure.

In section 3.3 the authors discuss about the vertical profiles for each of the aerosol types considered. Interesting results concerning the vertical distribution of the aerosol optical properties are presented in this section. Nevertheless, the authors must clarify the criteria employed to determine the separation between the Boundary Layer and the Free Troposphere. In our study AOD has been calculated by integrating the aerosol extinction profile derived with the Raman lidar at 355nm, assuming that the lowest extinction value is representative down to the surface. This is reasonable assumption and it is a common approach in lidar studies (e.g. Amiridis et al., 2005). To estimate the contribution of light extinction by free tropospheric particles to the total tropospheric optical depth, we calculate AOD in the layer above 1.5 km and we consider this value as the optical depth of free troposphere. In principle for this purpose one has to determine the Planetary Boundary Layer height. However, the typical aerosol layering at Thessaloniki does not allow reliable detection of the PBL (=as the first significant negative gradient in the range corrected lidar signal). The frequent existence of sea breeze circulation, as well as the presence of Saharan dust at low altitudes (even below 2km) due to relatively short transport path (Papayannis et al.,2001; Kalabokas et al.,2002) does not allow the accurate determination of PBL height. To overcome the difficulties of the PBL estimation over Thessaloniki and the relative uncertainties that these calculations may have introduced, we followed the approach of integrating our profiles above and below the fixed value of 1.5 km to estimate the free tropospheric contribution. This approach is based on the fact that for the altitude of 1.5km, the mean backscatter coefficient for the total record of our measurements is maximized over Thessaloniki (Matthias et al., 2004, Amiridis et al., 2005).

Figure 2 requires larger and clearer symbols. We have now used thick lines.

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Table 1 requires revision of the number of significant figures used. One significant figure was used in the mean values of aerosol optical depth in table 1.

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