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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Are EARLINET and AERONET climatologies consistent? The case of Thessaloniki, Greece" *by* Nikolaos Siomos et al.

Anonymous Referee #2

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In this study the authors present results from the climatological behavior of the aerosol optical properties over Thessaloniki during the years 2003-2017. Two independent datasets, representing two individual networks, the EARLINET and the AERONET, were applied to investigate the consistency and the statistical significance between both networks using geometrical and optical properties of aerosols. The analysis show a decreasing on AOD at 355 nm trends of -21.0% and -16.6% per decade for the EARLINET and the AERONET, respectively. Also, results show the dominance of dust and biomass burning on the free troposphere during summer. Different from other studies that considered only short time periods such as four or six years, and only one single kind of instruments (Lidar Raman), this study presented very important results of climatological studies of 14 years using two well establish networks. Overall,

the manuscript is well well-organized and clearly presented. I'd like to suggest the acceptance of this manuscript after some revisions.

Section 2.1 The Lidar setup – page 3 – lines 16 to 19.

The authors use the Lidar data set between 2003 to 2017 and states, "since a long timeseries of data was necessary, only the extinction 355nm and the backscatter 355nm and 532nm products were included in the analysis. The dataset included in this study covers the period 2003-2017 in order to be chronologically consistent with the sunphotometer dataset."

The Lidar dataset used is from 2003 to 2017. It is well known that EARLINET has a weel stablish standard pattern of quality assurance tests such as dark current, bin-shift, zero bin, trigger delay corrections, Telecover tests, Rayleigh fit, etc. Since when these tests are applied to Thessaloniki EARLINET station? Since 2003? What is the influence of these tests on the results of your comparisons? What type of errors or uncertainties the lack of these tests for the early dataset can take into account?

Section 2.2 The sunphotometer - page 3 – lines 25 to 26

"The level 1.5 aerosol optical depth values (AOD) at 440nm and the angstrom exponent 440-670 during the period 2003-2017 were used in this study. The AOD at 440nm is preferred for the comparison with the lidar UV products in order to take advantage of the longer time series since the 340nm and 380nm channels were added in 2005."

Why not to use Level 2.0 data? What would be the differences on the trend results using the level 2.0 since it is quality assured; the final post-deployment calibration values are applied to the data set, and the aerosol optical depth data are inspected for possible cloud contaminated outliers.

For AERONET level 1.5 data, when Angstrom parameter computed using all available channels between 440 and 870 nm is greater than -0.1 the point is considered cloud and pointing error free. Is the Level 1.5 AERONET data used for this study filtered

using this assumption?

Section 2.2 The sunphotometer - page 3 – lines 26 to 28

“The AOD at 440nm is preferred for the comparison with the lidar UV products in order to take advantage of the longer time series since the 340nm and 380nm channels were added in 2005.”

You add 2 year more on your climatology (2003 and 2004, since the 340nm and 380nm channels were added in 2005). How is the difference in your result considering these 2 years more?

Subsection 4.2.1 - Aerosol Optical Depth – page 9 – 20 to 23

“The AOD cycle in the PBL and in the FT is presented in figure 3b. The contribution from the free troposphere seems to be comparable and even higher than the PBL contribution during April and the summer months. This is probably attributed to transported biomass burning aerosol during summer and spring in the FT (see section 4.2.2.4) The other months, especially March, exhibit a lower FT contribution.”

It is possible to obtain some result or correlation of the biomass burning aerosol transported on the free troposphere using only AERONET AOD values? Or considering the annual cycle of the monthly mean columnar products of AOD at 355nm in the whole column presented on figure 3 (a), is possible that AERONET is missing any aerosol layer on the free troposphere? How could it affect the results of the decreasing trends?

Subsection 4.2.2 Integrated Backscatter – page 9 – lines 25 to 27

“Another columnar optical product, the integrated backscatter (INTB) at 355nm and at 532nm, is presented in figure 3c and 3d. The AERONET equivalent is calculated by dividing the AOD at 355nm and at 532nm with a constant lidar ratio of 50 sr and it is also included in the figures.”

What kind of error uncertainties and/or bias the authors could expect using the fixed

Lidar ratio of 50 sr to calculate in INTB for the AERONET data? Since the the lidar ratio at 355 nm ranging from 45 to 70 sr according to statement on lines 2 and 3 of page 10, why not to use a mean fixed lidar ratio of 57 or 58 sr to calculate the AERONET integrated backscatter?

One thing that is not clear on the manuscript is the consideration about the column AOD comparison between AERONET data, that performs measurements during daytime, and the AOD from Raman Lidar measured during the nighttime. What kind of correction or assumption the authors take into account for these cases?

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