

Interactive comment on “Three-year ground based measurements of Aerosol Optical Depth over the Eastern Mediterranean: the urban environment of Athens” by E. Gerasopoulos et al.

Anonymous Referee #1

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General comments: A large body of measurements performed previously in Greece, Turkey, Egypt, and aboard aircrafts have demonstrated that the aerosol atmospheric content in the Mediterranean eastern basin is generally particularly high. However, most of these past measurements were of too short durations to allow derivation of the aerosol variability in the area. This is particularly true for the northern part of the basin and the aim of the authors of the present work is to fill this gap. More precisely, they want to: 1) assess the variability of both the aerosol load and characteristics over the city of Athens (Greece), and 2) apportion this variability to a variety of sources either local or external to the city. For this, they analyze three years (2006-2008) of ground-based AOD measurements performed with a 5wavelength-Multi-Filter Rotating

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Shadowband Radiometer in the urban environment of the city. The amount of data available to the authors is sufficient to reach their goal and the scientific approach and methods applied to analyze the dataset are sound. The results they obtain are very interesting in the sense that they give a clearer picture of both the variability and origin of the aerosol loading in Athens and probably also to some degree in the broader context of the Mediterranean eastern basin.

More specific questions or comments:

P. 28276, lines 13 and 14: High aerosol columnar contents are not always linked to elevated surface levels of particulate matter. Numerous studies (including over Greece) have shown that aerosols (such as mineral dust but not only) can be transported in elevated layers.

P. 28278, line 23: Please correct the Beer-Lambert-Bouguer law

P. 28279, line 26: How is the contribution of the Rayleigh scattering calculated before being subtracted from the AOD?

P. 28281, lines 19 to 24: The authors mention that the AOD spikes are generally associated with low values of the Angström exponent. This is relatively difficult to see on Fig.1. I suggest adding a plot of the Angström exponent against the AOD, which would immediately show that at least a significant fraction of the large AODs are due to coarse aerosols (probably mineral dust) (see El-Metwally et al., JGR, 2008, and references therein).

P. 28282, line 7: I agree that the ‘spring mode’ is most certainly due to the advection of mineral dust from the Sahara. Regarding the summer mode, it might be due in part to advection of polluted airmasses from the north but could not local photochemistry also play a role in its building up?

P. 28283, line 20 and following: the authors explain the increase of the AOD during the day by a combination of aerosol source/processes whose activity follows a diurnal

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cycle and by meteorological factors -especially in spring and summer when prevailing winds blow from the west towards the experimental site all day long and not just after approximately 9AM like in autumn or winter. What could explain that the afternoon peak of the AOT cycle is much more pronounced in autumn than in the other seasons? Is this just result of the fact that the 'mornings' are relatively clean and that in comparison the afternoon deviation of the AOT from the average situation seems larger?

P. 28284, line 15: What is the numerical criterion used for separating "short" from 'long' trajectories in the various classes?

Fig.5: On the maps, there seems to be significant overlapping of the arrows labeled C corresponding to clusters 1a and 2. Is there really a difference between the two? Same question for arrows A from classes 1a and 3. Couldn't the total number of clusters be further reduced?

P.28288, line 10: Some of the "stagnant" trajectories" visible on figure 5 seem to have travelled over the Sahara. In this case, it cannot be excluded that the relatively low value of the Angström exponent (1.2) could be due to the presence of mineral dust and not just to marine aerosols.

P.28289: Similar comparisons of the MODIS and AERONET AOTs for the different seasons have already been made for the city of Cairo (El-metwally et al., Atmospheric Research 97, 14–25, 2010). These authors also found that 1) MODIS generally tends to overestimate the sunphotometer reference optical depths, 2) the best agreement between MODIS and AERONET is obtained in winter when the aerosol load is dominated by local pollution sources, and 3) an overestimation of approximately 30% is observed when aerosol sources external to the city (Saharan dust or biomass burning aerosols from the Nile delta) are active. I suggest mentioning this earlier work with whom your results perfectly agree because it could only strengthen your own conclusions.

P.28290, line 20: The authors claim that a negative value of the difference of angstrom's exponents calculated over the 440/675 and 675/870nm ranges is indicative of the

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dominance of coarse dust particles. Isn't this contradictory with the fact that a significant number of negative values of this difference correspond to cases for which the Angström exponent is larger than 1.5, and even 2? At such large values of the Angström exponent a submicron mode must clearly be dominating the aerosol properties.

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