

Interactive comment on “Sources and processes that control the submicron organic aerosol in an urban Mediterranean environment (Athens) using high temporal resolution chemical composition measurements” by Iasonas Stavroulas et al.

Anonymous Referee #1

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The manuscript of Stavroulas et al., presents and analyzes the organic aerosol sources over Athens (Greece) using long term observations (1 year) and 2 intensive campaigns measurements. The source analysis is based on the Aerosol Chemical Speciation Monitor (ACSM). The findings are very important for the region of Athens but also crucial for the atmospheric science community as they found that during the winter a significant fraction of the secondary organic aerosol is clearly connected to the biomass burning organic aerosol. The paper is very well written and organized. I definitely recommend publishing of this paper, after some minor changes:

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(1) The introduction contains information about Athens topography and biomass burning aerosol (BBOA). However, since in the paper are discussed additional sources found (e.g., LV-OOA, SV-OOA, HOA and COA) I suggest adding a paragraph giving some information about these sources and provide previous measurements for Athens. For example Kostenidou et al., 2015 have measured the OA sources for Athens suburban area during an intensive summer (2012) campaign using HR-AMS data.

(2) Page 3, line 62: please add Florou et al. 2017 after Kalogridis et al. 2017 reference.

(3) I suggest replacing the sentence: “Respective measurements using high resolution techniques are scarce and limited in time (Florou et al., 2017)” with: “Florou et al., 2017 have measured the chemical composition and the OA sources during a wintertime intensive campaign in the center of Athens using an HR-AMS and however their data are limited in time.”

(4) Page 4, line 119: Please provide the RIENH4 and RIESO4 with the corresponding standard deviations.

(5) Page 6, line 162: the right parenthesis should not be in bold form.

(6) Page 9, line 261: please add domestic or residential before heating.

(7) Pages 12-14, lines 353-425 (warm period section): It would be interesting to compare the HOA, COA, SV-OOA and LV-OOA mass spectra of the warm period in terms of angle theta with the corresponding spectra of Kostenidou et al. (2015) that they found for a suburban area of Athens during summer.

(8) Pages 14-15 lines 426-459 (cold period section): It would be nice to also compare the BBOA, HOA, COA and LV-OOA mass spectra from the winter period with the BBOA, HOA, COA and OOA mass spectra of Florou et al. 2017 that they measured during the winter at the same site. Florou et al. (2017) found two BBOA factors during the winter for a study in Patras (Greece); one of them (BBOA-II) was less oxygenated and its origin was not fully explained i.e., it could be due to the different types of fuel or

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combustion or due to different degree of BBOA aging. What is the angle theta between the SV-OOA mass spectrum of this study (that is linked to aged BBOA) and the BBOA-II of Florou et al. (2017)?

(9) Page 17, line 496: there is a “t” alone in that sentence which it should be deleted.

(10) For the winter case you show in Table 2 that the BBOA mass fraction is around 8-10%. How about the absolute mass concentration? Did you see any correlations with temperature?

(11) I believe that a comparison with summer sulfate measurements from previous years should be made. It could be a paragraph before the conclusion part. How did the PM1 sulfate mass concentration and mass fraction change over the years? You could use the data of Kostenidou et al. (2015), for Athens during the summer and Bougiatioti et al., (2014) and Hildebrandt et al., (2010), which are for summer but for the Finokalia station (different location) given the fact that the sulfate concentration is similar in many locations above Greece during the summer (Tsiflikiotou, Master thesis). Using this trend, could you make any implications? For example how did the economical crisis in affect the air quality (less industry that produces SO₂, which is converted to particulate sulfate)?

(12) Figure 5. Please improve the resolution of this figure. Top graph: The left y axis should say “mass concentration ($\mu\text{g m}^{-3}$)” once. The right y axis should also say “mass concentration ($\mu\text{g m}^{-3}$)” once and for each sub-axis just indicate the name of the species without $\mu\text{g m}^{-3}$. Bottom graphs: again “mass concentration ($\mu\text{g m}^{-3}$)” or “% mass concentration and for each sub-axis just indicate the name of the species without $\mu\text{g m}^{-3}$ or Contrib.(%). Please take care the numbers on the y axis, some fall on other and it is difficult to be read. Avoid gaps.

(13) Figure 6. The same as for Figure 5.

(14) Figure 8. You should consider using a lighter green for the LV-OOA in order to be

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more distinguishable from the SV-OOA. May be use another color for the map behind (light blue)?

References:

Bougiatioti, A., Stavroulas, I., Kostenidou, E., Zarrmpas, P., Theodosi, C., Kouvarakis, G., Canonaco, F., Prévôt, A. S. H., Nenes, A., Pandis, S. N., and Mihalopoulos, N.: Processing of biomass-burning aerosol in the eastern Mediterranean during summertime, *Atmos. Chem. Phys.*, 14, 4793-4807, 2014.

Florou, K., Papanastasiou, D. K., Pikridas, M., Kaltsonoudis, C., Louvaris, E., Gkatzelis, G. I., Patoulas, D., Mihalopoulos, N., and Pandis, S. N.: The contribution of wood burning and other pollution sources to wintertime organic aerosol levels in two Greek cities, *Atmos. Chem. Phys.*, 17, 3145-3163, doi: 10.5194/acp-17-3145-2017, 2017.

Hildebrandt, L., Engelhart, G. J., Mohr, C., Kostenidou, E., Lanz, V. A., Bougiatioti, A., DeCarlo, P. F., Prévôt, A. S. H., Baltensperger, U., Mihalopoulos, N., Donahue, N. M., and Pandis, S. N.: Aged organic aerosol in the Eastern Mediterranean: the Finokalia Aerosol Measurement Experiment – 2008, *Atmos. Chem. Phys.*, 10, 4167–4186, 2010.

Kostenidou, E., Florou, K., Kaltsonoudis, C., Tsiflikiotou, M., Vratolis, S., Eleftheriadis, K., and Pandis, S. N.: Sources and chemical characterization of organic aerosol during the summer in the eastern Mediterranean, *Atmos. Chem. Phys.*, 15, 11355-11371, doi:10.5194/acp-15-11355-2015, 2015.

Tsiflikiotou, M. Spatial distribution of summertime particulate matter and its composition in Greece (Master thesis) <http://nemertes.lis.upatras.gr/jspui/bitstream/10889/8345/1/MS%20Thesis%20M.Tsiflikiotou>.

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