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Interactive comment on "Six-year source apportionment of submicron organic aerosols from near-continuous measurements at SIRTA (Paris area, France)" *by* Yunjiang Zhang et al.

Anonymous Referee #2

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The study represents a multi-year source apportionment of submicron organic aerosol in a regional background site of the Paris metropolital area. 6-year high temporal resolution data from a quadrupole Aerosol Chemical Speciation Monitor (Q-ACSM) are used along with aethalometer data in order to distinguish between different sources contributing to OA loadings during the different seasons. Overall, two primary and two secodnary factors are selected to be representative for the whole measurement period. Primary factors comprise mainly hydrocarbonl-like OA (HOA) and biomass burning OA (BBOA) with both factors exhibiting clear sasonal variability with maxima during winter-fall and minima during summer-spring. Two oxygenated OA factors are also derived, one more- and one less-oxidized (MO-OOA and LO-OOA, respectively). The

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MO-OOA also exhibits higher concentrations during wintertime, suggesting common sources from combustion sources and also possible transportation from northeastern Europe, while LO-OOA exhibits higher concentrations and contributions to total OA during summertime, associated with secondary OA formation processes involving biogenic precursors. Finally, multi-annual trend analyses showed a decreasing trend solely for MO-OOA during these 6 years, while very limited or insignificant decreasing trend for the primary OA is observed.

The paper is well written and easy to follow, though there are some issues and more thorough discussion should be made in specific sections. Other than that the paper can be recommended for publication after addressing the issues listed below.

Specific comments:

1) More information about the ACSM measurements and data analysis should be provided: - L145-148: Was there a collection efficiency correction applied?? Was a constant CE used or a chemical composition dependent one e.g. Middlebrook et al. (2012)?

- L184-185: How do the ACSM data compare to the filter measurements? E.g. sulfate, nitrate and ammonium, since they are used further on in the study.

2) PMF analysis: Most of the details in section 3.1 can be omitted, at least the basic principles. On the other hand, more information should be provided for the selection of the specific solutions. E.g. L223-224 what are the final a-values used to constrain POA? In Fig. 1 a=0.21 and a=0.22 for HOA and BBOA are shown, respectively, why are the specific values selected?

3) A more thorough discussion should be made concerning the existence or not of COA. The provided spectra are clearly very different, as obviously the constrained approach is used. When performing a non-constrained run, is there a distinguishable COA factor obtained? Or is it mixed with the BBOA? Furthermore, as COA is con-

sidered to be part of BBOA in this study (if I am not mistaken), and since BBOA concentrations seem really low during summer (Fig. 5), can it be that this BBOA during summer, is indeed the "product" of the source apportionment technique but representing actually COA? Because which primary BB sources can contribute to the site during summertime?

4) More attention should be given to the hypotheses of the origin of the different factors, e.g. L 390-395 HOA considered as a mixture of traffic and biomass burning. Could it be that instead of BB, HOA could be considered as more of a mixture between traffic and combustion from central heating units?

Technical corrections:

L394-395 Rephrase

L488-489 More recent studies also report part of the low-volatility (more oxidized) OOA originating from primary combustion sources (e.g. Stavroulas et al., 2019).

References

1) Middlebrook, A. M., Bahreini, R., Jimenez, J. L., and Canagaratna, M. R.: Evaluation of Composition-Dependent Collection Efficiencies for the Aerodyne Aerosol Mass Spectrometer using Field Data, Aerosol Sci. Technol., 46, 258–271, https://doi.org/10.1080/02786826.2011.620041, 2012.

2) Stavroulas, I., Bougiatioti, A., Grivas, G., Paraskevopoulou, D., Tsagkaraki, M., Zarmpas, P., Liakakou, E., Gerasopoulos, E., and Mihalopoulos, N.: Sources and processes that control the submicron organic aerosol composition in an urban Mediterranean environment (Athens): a high temporal-resolution chemical composition measurement study, Atmos. Chem. Phys., 19, 901–919, https://doi.org/10.5194/acp-19-901-2019, 2019.

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