

The paper by Manousakas et al. uses aerosol composition data obtained online at high-time resolution with an ACSM, AE33, and Xact to determine sources of aerosols in Athens during a month-long study. The source apportionment (SA) approach is carried out with SoFi offline and in real-time to demonstrate performance of the real-time (RT) SoFi software when combining data from these 3 instruments. Based on the statement in the abstract, this is the first study investigating combination of all these data in SoFi RT. I think the results and approach are interesting and show promise for using SoFi RT with data from ACSM and Xact. I have some concerns and would like the authors to clarify a few details before accepting the paper.

#### Major comments:

1. Although from the abstract I got the impression that SA was applied on all the data together, it seems given the different levels of uncertainties and variable magnitude of species concentrations from each measurement, the data are actually treated separately, by running two independent PMFs in one ME-2 experiment. So is that really combining data to do source apportionment? I understand that because of the reasons explained in the paper, it may not make sense to include secondary aerosol species in the PMF run of primary metal components, but then I think the language in the abstract/body of the paper/conclusion needs to be changed. I think the paper also needs to better explain what is the advantage of running both PMFs in one ME-2 run rather than separately (other than more manual work at the end to combine the results if ran separately).
2. This is a more philosophical comment, but I'd like to hear the authors' thoughts on this. As shown in Fig. 5, secondary OA, sulfate, primary HOA, BC, BBOA are a large fraction of PM<sub>1</sub>. Of course this is a picture for Athens only, but I think in most other urban areas this is still the case. If I understood the conclusions correctly, gaining a valid representation of factors that can have variable profiles depending on time of year or location by RT SoFi requires some knowledge about their actual profile before running RT SoFi. So what is the advantage of RT SoFi if one needs to also run SoFi offline to gain that initial knowledge and how often should the offline SoFi be done if we think profiles of some factors change with time (say changes in fleet, fuels, etc)?

#### Technical comments:

1. Sampling section: Although this is an analytical method paper, types of inlets used with each instrument should be included (PM<sub>1</sub> cyclone, etc).
2. What was the time resolution of AE33? Also, are the data from AE33 (BC<sub>lf</sub>, BC<sub>sf</sub>) just used in the last step when combining concentrations of different PM factors/species? L149 indicates PMF was used on AE33 but I don't see eBC showing up in any of the Xact or ACSM profiles.
3. Why wasn't Ba used as one of the main Xact species? Ba is a good marker for brake wear.
4. L194: what threshold for S/N of elements was considered?
5. L228: typically more information from PMF results are included in SA papers to justify the choice of specific solutions. Can the authors add for example Q/Q<sub>exp</sub> plots as a function of factor number?
6. L236: can you please explain why a higher 'a-value' would affect the results for ACSM but not Xact?
7. L252: although it's mentioned later in the paragraph that the reference study was for a year-long, I think that information needs to be mentioned in the beginning of this sentence.

8. L330-331: what other model parameters are needed to be defined?
9. L406- starting in this paragraph is where the zero/non-zero approach for constraining the profiles is discussed. It's unclear still to me what basis is used to use the 'random values'. Why are the values for the same element for the same factor not the same in the base run and RT run? I'm still very confused how this approach sets the relative concentrations but not the relative composition.
10. What interpreting the Regional sources, I think a better use of WD and location of sources can be helpful. Can a map and wind roses be drawn. Is there a specific direction that has the heavy oil/industrial sources vs. port emissions?
11. L526: during the Greek Festival, COA, HOA and BBOA all increased. Does it mean that HOA is also not separated well from BBOA/COA?
12. Fig 4: what is the traffic factor? Is the Brake Wear? If so, rename it for clarity
13. Fig. 5: I find this pie chart a bit confusing/misleading. NO<sub>3</sub>- and SOA and maybe even NH<sub>4</sub><sup>+</sup> all likely have contributions from traffic-related emissions (NO<sub>x</sub>, VOC, and NH<sub>3</sub> emissions). Perhaps a better categorization would be "primary traffic" instead of "traffic". Biomass should be "Biomass burning".  
These clarifications still don't fix the issue of mixing sources with composition. I think the best is to not mix these two concepts and actually have individual pie segments for each composition category (i.e., a segment for HOA, brake wear, etc.).
14. Fig 5: I'm curious if there was any mass closure effort comparing the total mass predicted using the approach of Fig. 5 with the OPC measurements? What's the basis of the statement in L640? It's better to be quantitative in L640 instead of most include a percentage.
15. L568: does it no make sense to remove the festival period in the PMF to see how different results will be without the influence of such an event?
16. L595: can you please elaborate about what common tracers of regional and traffic factors are with HOA? Or perhaps you mean with other factors?
17. L:600-601: Instead of "practically identical" please include a quantitative measure of the similarity
18. Figure S8: what is the Industrial factor in these plots? And what two slopes are referred to in the text?
19. L641: traffic emissions are the dominant source of PM (dominant primary seems to be repetitive and confusing)

Minor edits:

1. L299: typo: change to Xact
2. L337-338: type of biomass burned and regional variation in vegetation are relaying the same information so one can be deleted
3. L471: road salting?
4. L515: add a reference
5. Fig S5: I don't recommend autoscaling all the vertical axes. It's best to show the extremes separately and zoom in so actual features are shown well.
6. Fig 5 caption and L565: Brake wear
7. L575: change "transportation" to "transport"

8. L598-599: the sentence doesn't read correctly and needs to be rephrased