

Interactive comment on “Composition and sources of particulate matter in an industrialised Alpine valley” by N. Perron et al.

Anonymous Referee #3

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General comments:

The manuscript presents analysis of speciated PM₁₀ and PM₁ data measured during a three-week study in a Swiss valley. The work focuses on one week of the three-week study, contrasting three working days with one Sunday during this week. The work provides an interesting source apportionment study for this valley; however, the statistical sample is too small to support the weekday/Sunday conclusions. In fact, the work notes that the one Sunday is atypical of the sampled Sundays for PM₁. Some important details for the work are found only in figure captions or in the supplemental information and should be included in the main. Some other details are omitted, and better explanation of these points would strengthen the paper significantly. Some of the remarks made in this review repeat the concerns expressed by other reviewers to

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emphasize their importance. I recommend that the paper be reconsidered after major revisions to address the points raised in the review.

Main comments:

1) Working days vs. Sunday. The working days for the PM₁₀ samples and PM₁ data are not the same. It appears that the PM₁ measurements are complete only for Monday, Tuesday, and Friday. Why are the PM₁₀ data from different days than the PM₁ data? A stronger comparison could be made between the two sizes if the same days were chosen. The authors do discuss results for “the Sunday” throughout the paper, but that only one Sunday is used for the comparison to working days should be more clearly emphasized in the abstract. The selected Sunday is noted as a special case for the PM₁ data (pg. 9406, line 20); it may be helpful to note this in the captions of Figs. 8 and 9.

2) Some important details are only in figure captions or in the supplemental information (SI). The description the PM₁₀ source apportionment shown in Fig. 6 is found only in the caption for that figure; it would be helpful if this description was instead moved to the main text, since the PM₁₀ source apportionment is only mentioned but not described on pg. 9405, line 16. At the author’s option, this figure could be moved up to be Fig. 4 and serve as an overview for Sect. 4.1.2–4.1.4, and then the source apportionment method for each species could be included briefly in the existing sections. The description of the PM₁ factor analysis using the Multilinear Engine (ME2) is insufficient. ME2 can be used to solve any number of models, not only the one used in this analysis. The text in the SI should, at a minimum, state that the model being solved is a constrained bilinear model; it would be better if this line was included in the main text.

3) Presentation of the FA-AMS results should be enhanced. Important details of the factorization results are completely absent from the paper. Each factor in the model used has both a mass spectrum and a time series; it is inappropriate to separate them

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and only show the results of one. The bilinear factorization performed in ME2 in this work constrains the mass spectrum of the HOA factor, so it is important to show the resultant mass spectrum for this factor in comparison to the literature spectrum. In Lanz et al. (2008), most of the discussion of the choice of solution focuses on the mass spectra, comparing the factor mass spectra to reference spectra. As the present work is one of very few papers reporting results with this factorization method, it is very important that a more complete picture be presented. Figures similar to Lanz et al. (2008) Figs. 2 and 3 would enhance the paper significantly. Furthermore, the choice of the $a=0.4$ solution is not strongly supported with the information provided here, since the correlations between the factor time series and ancillary data do not change substantially between the solutions listed in Table S2. Yet, something must have changed to favor this solution. The inclusion of more supporting material in the SI would be extremely helpful to the reader.

4) There is a significant unaccounted mass fraction in PM10 (labeled "rest" in Fig. 3) for working days but not for Sunday. The reasons given in the text (pg. 9403, lines 8-13) should not have a day-of-week dependence. The OM/OC ratio used in this work is larger than that in the studies cited, and so this work would be expected have smaller unassigned mass fractions than the studies cited.

5) Is the increase in secondary inorganics in PM10 on the Sunday significant? Is it typical of other days? How does it compare to the secondary inorganics in PM1 on the same day?

Minor comments:

1) In general, more comparisons between PM10 and PM1 species would be interesting (as was shown in Fig. 11c for chloride and mentioned for ammonium on pg. 9406, lines 4-8). Comparisons of BC and the apportioned OC and EC would be of interest.

2) Some discussion of the uncertainties of the results of the PM1 factor analysis should be included; this could be done with the solutions already obtained, perhaps even for

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$a=0.2$ to $a=0.6$.

3) Pg. 9396, line 18: is the analysis of these additional filters discussed?

4) Pg. 9403, lines 19-21: The text notes that that the source estimates suggest that the meteorological impact during Week 1 was negligible, but it appears that there is sufficient measured meteorological data (pg. 9397, lines 10-11) to better support this statement.

5) Pg. 9407, line 29: The high correlation between the traffic and woodburning source categories identified from FA-AMS and aethalometer methods should be highlighted in the abstract and conclusions.

6) Pg. 9406, line 18: The text here states that total anion concentrations are shown in Fig. 11; however the units in the figure are $\mu\text{eq m}^{-3}$.

7) How is the unassigned PM10 mass (the "rest" show in Fig. 3) reflected in Fig. 6 for working days? From the caption, it does not appear to be included in "Others". There is a typo in the text in the caption of Fig. 6, last sentence: change "others than" to "other than".

8) In Fig. 9, it is hard to see the very light grey HOA.

Interactive comment on Atmos. Chem. Phys. Discuss., 10, 9391, 2010.

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