Atmos. Chem. Phys. Discuss., 11, C5870–C5878, 2011
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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Source apportionment of size and time resolved trace elements and organic aerosols from an urban courtyard site in Switzerland" *by* A. Richard et al.

A. Richard et al.

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Dear reviewer,

We thank you for providing helpful comments to our manuscript and our replies are listed below.

On the same line of reviewer 1:

1. The replacement of RDI values is highly questionable.

This issue was also raised by Reviewer 1. You find our detailed answer to this point in our response to her/his review.

2. Some comments should be made about the new evidence (London, Manchester, New York, Beijing) of a cooking aerosol factor reported by the AMS community and a better explanation of what is beyond the 3 factor AMS-PMF solution should be made.

This issue was also raised by Reviewer 1. You find our detailed answer to this point in our response to her/his review.

3. Peaks of HOA on 10th December should be filtered out.

This issue was also raised by Reviewer 1. You find our detailed answer to this point in our response to her/his review.

Following additional comments:

Pg 3740 line 10: there is a great amount of confusion in the paper, and the reader has to jump between figures in the article and figures in the supporting information (SI). Looking at figure 2 and figure S4 for example and getting to understand which fine and coarse fraction is and why some of the figures are in the article and some in the SI. Put a label (PMx) on each figure. Moreover, why is not the K in the fine fraction associated with a biomass type diurnal trend?

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We have merged Figure 2 and S4 and changed the layout and the labeling to make it easier to read. Generally we have decided to put only the most significant figures into the manuscript, whereas other figures that are also interesting for the reader but less important are placed in the SI in order to avoid having too many figures in the manuscript.
As discussed in Section 3.2.3, the biomass combustion identified with the RDI originates to a large extent from regional sources and therefore no clear diurnal variation is visible as would be expected for anthropogenic heating in the morning and evening. In contrast, Figure 13 shows the existing diurnal cycle of the AMS-BBOA factor which is caused by the more local emissions of the organics that contain less potassium. This could be the case for very inefficient burning from nearby fireplaces.

Pg 3744. On the traffic source, why is PM coarse and PM fine traffic PMF source so decoupled?

There is a difference of the traffic sources in the coarse and fine mode in terms of contributions of S, K, Si and Ca, which are higher for the coarse fraction. This can be explained by coarse mineral dust particles which are resuspended by vehicles and therefore appear with a similar time series as metallic traffic elements. Furthermore, it can be hypothesized that trains from the nearby main station also play a role in the fine mode since it is dominated by iron. Correlations of the three traffic factors identified for the three size ranges are shown in Figure 1.

Pg 3746: section 3.2.3 is the most important part of the paper and yet the most confusing and superficial part. It needs a much in-depth analysis.

We re-arranged the paragraphs to avoid any confusion in the order of the text and

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added some new sentences to explain things better, see revised manuscript.

Figures:

Figure 1: ok, good

Figure 2: Very confusing, why fine and coarse mode put together (with no labels) and different from figure s2? Very confusing

We decided to merge Figure 2 and Figure S4 and separated the new Figure 2 in three parts, so that it is more clear, which elements are shown in which size fraction. We wanted to show the elements in the size range where they are most typical, so traffic and mineral dust/crustal elements in the coarse size fraction and secondary sulfate and wood burning elements in the fine mode.

Figure 3: Any comment on what is the 25% unexplained (after detailed organic and inorganic characterization?)

Due to the gravimetric measurements of PM_{10}, we assume that a large fraction of unexplained mass can be attributed to water (Hueglin et al, 2005). Furthermore we decided to change the figure, because so far, sulfate was excluded also for $PM_{10-2.5}$ and $PM_{2.5-1}$, but it actually only should be excluded for $PM_{1-0.1}$ to avoid double counting with AMS PM1 sulfate. With this, the unexplained fraction decreased somewhat. The "zoom" on the right side now refers to trace elements in all three size ranges plus AMS PM1 sulfate. In addition, uncertainties of the measurements may explain a considerable fraction of the differences that is folded into the unexplained

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fraction.

Figure 4-6: Diurnal trends of the different factors are not presented, and would be interesting to see them. At the same time, lots of interpretation is missing. Why secondary sulphate for fine and coarse are temporally so different? Again why de-icing and industrial are again so different? Surely some of these classes do not present much difference in the size distribution between fine and coarse. Perhaps a correlation plot or an interpretation of the temporal profile of Figure 4-6 would be good.

Diurnal trends of the different factors are presented in Figure 12, which is now modified and includes more information. Secondary sulfate in the intermediate size range is most probably including contributions from the wood burning factor, which was not separated even for higher factorial solutions. This is why the time series of the two secondary sulfate factors differ, since the intermediate size range contains also contributions from (regional) wood burning. This can be better seen from Figure 2, where we excluded the last days of the measurement period, where large concentrations in the secondary sulfate are seen for the intermediate size range and with the new axes the similarity of the time series is more obvious.

De-icing salt in the largest and the intermediate size fraction might have different time series due to different residence times in the atmosphere of larger and intermediate sized particles. Mixing of factors can occur for de-icing salt and mineral dust in the largest size fraction and mixing of de-icing salt and traffic metals can occur in the intermediate size fraction.

Figure 7 ok

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Figure 8: perhaps merge with figure 13 and call it 8c giving they are the same data

We decided not to merge the figures (although the data are the same and we agree that it belongs together) because of better readability, figures would appear too small, when merged. In addition, we wanted to have the diurnal cycles in Figures 12 and 13 close to each other.

Figure 9: why not putting the inorganic species too so it can be compared with other figures?

Figure 9 shows the result of PMF factors explaining the organic fraction of AMS data. The inorganics would be added without having any relevance for the PMF results, that's why we decided to exclude them. In this part of the manuscript we wanted to describe first the PMF results obtained with RDI and AMS data separately, whereas Fig. 3 is showing "the big picture" of all measured compounds. Inorganic species are finally included in Fig. 14.

Figure 10-11. Whilst this is an excellent figure coupling numbers and charts, it is really superficial. Why only some data are presented here and not all? Surely an important one would be BBOA AMS and biomass PMF and many others for example.

The reason why not all correlations are shown is that it would be completely unreadable, or it would be distributed to 5 figures, which again would not enable correlation of

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everything with everything. That's the reason why we decided to show only the most relevant and correlated ones. The ones not shown do not have significant correlation. The correlations of BBOA AMS and biomass PMF are shown in Fig. S10.

Figure 12. Again confusion on what is fine, what is coarse.

We agree and changed the layout of the figure and also included more information of diurnal variations.

Interactive comment on Atmos. Chem. Phys. Discuss., 11, 3727, 2011.

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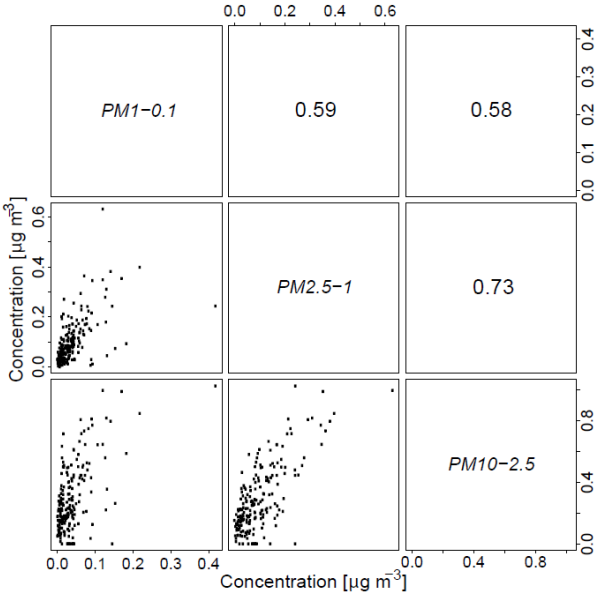

Figure 1: Correlations of the traffic factor in the three size ranges.

Fig. 1.

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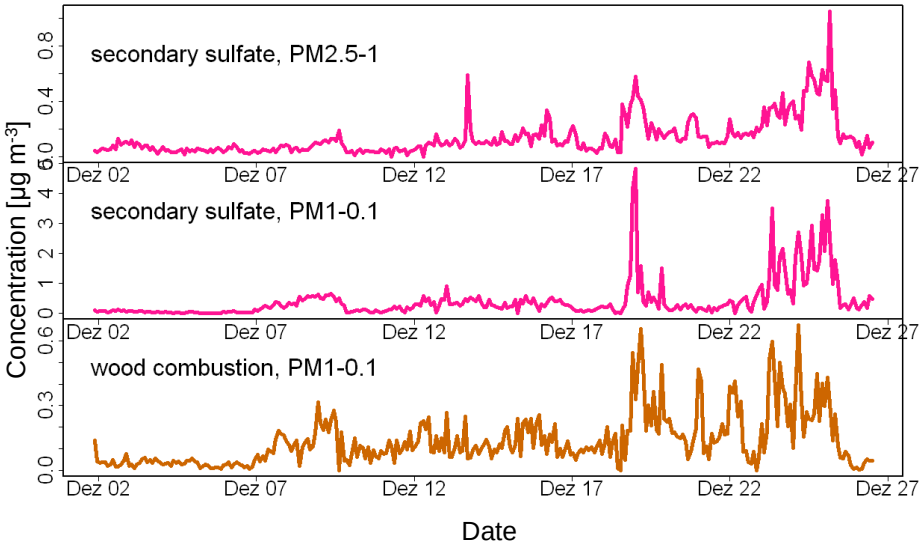

Figure 2: Comparison of time series of secondary sulfate in the smallest and intermediate size range as well as wood burning in the smallest size range.

Fig. 2.

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