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Discussions

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Interactive comment on "Vertical and horizontal variability of PM$_{10}$ source contributions in Barcelona during SAPUSS" *by* M. Brines et al.

Anonymous Referee #1

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General comments

The manuscript presents interesting results on the spatial distribution of PM10 chemical species and sources in Barcelona. Although many studies have been carried out in this area, these data are useful for improving the understanding on PM vertical and horizontal variability. In general, the work has been carried out correctly and well presented, results are sound and data interpretation is reasonable. Some criticisms may be however identified, as described in the following.

Specific comments

In the calculation of the mineral matter mass (pag. 33339) Si and Al contributions are included using their main oxide form (Al3O3 and SiO2) and Ca as Ca carbonate:

why the contribution of the other crustal elements (Na, Mg, K and Fe) is calculated just summing up their concentrations, without any correction for uncounted Oxygen or carbonate mass?

Some more information on the robustness of PMF results should be provided: in source profiles, is the sum of the contributions of the chemical species (sum of fjk) minor of 1, and also close to 1 (as most of the aerosol species have been measured)? is the PM10 mass well reconstructed by the model? which are the chemical species included in the PMF? I imagine they are those reported in Figure 4, but I do not understand "SiO2CO3"

The discussion on the spatial distribution of the mineral component is a bit confusing: at the beginning it is shown that calculated mineral matter and crustal tracers (Ti, Rb, Li, which also characterize the mineral PMF factor) are higher in the RS and UB sites with respect to the tower sites, then a very homogenous contribution of the mineral factor is found. I understand that the calculated mineral matter also includes contributions of road dust, but I think this point needs some more explanations especially for what concerns the specific mineral tracers. May the contributions of SO4, OC and EC in the profile of the mineral factor have been overestimated by PMF (thus overestimating also the homogeneity of the spatial distribution)?

As the sampling at the ground level are not in the same place of those on the towers, some caution should be played in the attribution of observed effects to the altitude, as they could be simply due to the different (horizontal) location. For example, it is commented that the impact of the industrial factor is higher at the ground level: is not the position of the UB (closer to the industrial area) more relevant than the altitude? Moreover, the distribution of nitrates is in my opinion more correctly described when discussing the concentrations in the 4 sites (pag. 33348, lines 7-10), highlighting that nitrate decrease with the distance to traffic sources, than when summarizing that their contribution is slightly higher at the ground (pag. 33348, lines 27-29).

The sentence "this statistical tool is usually unable to differentiate between natural and

anthropogenic sources contributing to the same factor" seams a bit tautological (if they are within the same factor they are not separated by definition). It would be better to say that PMF may not be able to separate similar sources and, due to chemical reactions, apparently "natural" PMF factors like mineral and sea salt may also include anthropogenic contributions. To this regard, did the authors try to increase the number of factors? What happens with 9 factors? Also, how robust is the presence of sulfate in the mineral and sea factors? Did the authors try to pull down this contribution? To evaluate the aging of the sea salt source it would be important to say which is the Na/Cl ratio in the profile of this source.

The description of the method used to calculate the fresh marine and the anthropogenic marine sulfate contribution (pag. 33354, lines 19-22) is not very clear.

Technical corrections

- Although reported in other SAPUSS papers, a map of sampling sites would be useful - Graphs in Figures 3 and 4 are too small. - pag 33343 line 22: check parenthesis position. - pag 33344 last two lines: the verb is missing, and it is not clear to which profile this constrain was applied (mineral?) - pag 33348, line 4: "evidencing that THESE sources" instead of "ITS sources"

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