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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Contributions of local and regional sources to fine PM in the megacity of Paris" *by* K. Skyllakou et al.

K. Skyllakou et al.

spyros@chemeng.upatras.gr

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The paper describes a method which allows for the apportionment of PM compounds from different sources. For the current paper, the method was extended by a description of the organic aerosol based on the VBS approach. As an application, the contributions of local and regional sources to PM composition around Paris are discussed.

1. *The only part of the paper that needs significant revisions is the section where the PSAT technology is described. In particular, it is not clear, where the information about the 'apportionment of the upwind grid cell' comes from. Does PMCAMx-2008 distinguish already between the contributions from different sources, or is the transport also calculated in PSAT? And how is the information on the contributions from different*

sources passed to the system? As the cited paper by Wagstrom et al. (2008) is very vague about this (whereas the more complex OPSA method is described clearly there) the authors should add this information to their model description. Furthermore, the implementation to the VBS approach into the PSAT algorithm needs to be described in more detail, perhaps by including some equations.

We have added information about the algorithm description and the detailed description of the implementation of the VBS approach into PSAT algorithm. Briefly, the PMCAMx code has not been changed, the model, as all CTMs, does not keep track of the sources of the different pollutants that it simulates. PMCAMx just sends information after each step to PSAT about the changes in concentrations caused by the specific process in the specific cell. The initial concentration field in PMCAMx is of unknown origin so it attributed to a separate "source" the initial conditions. Its importance is reduced with time and is very small after the first days of the simulation. PSAT keeps track of the emissions by each source and this way it starts calculating the source contributions. After that this information is propagated in each step for example as material is transported from cell to cell. This is all done in PSAT just using the fluxes, from cell to cell and the reaction rates, deposition rates, etc., provided by PMCAMx. Equation (1) in the revised paper now explains mathematically how PSAT keeps track of the transported contributions of the different sources.

Additional issues:

2. *All pages: Avoid the use of 'predict', better use 'simulate' (or 'analyze' where appropriate).*

We have followed the reviewer's suggestion and have used the recommended verbs instead of "predict".

3. *Section 3.1.1: Are BVOC emissions also included for the Paris area? How does the spatial distribution of BVOC affect the results?*

The BVOC emissions are calculated by MEGAN for the entire modeling domain, including Paris, as a function of time. There are emissions inside the city (e.g., from the various parks) but of course are lower that the surrounding forested areas. The corresponding emission densities are shown in Table 1. This distribution of emissions does affect the relative contributions of the local and regional biogenic sources.

4. *Section 3.1.2: Line 7: I think it is Wagstrom and Pandis, 2011a. Besides of this: please give a definition of 'center of the plume'.*

We have corrected the typo, the appropriate reference is indeed Wagstrom and Pandis (2011a). This is the concentration weighted average center of the plume. The corresponding mathematical definition has been added to the revised manuscript (please see Equation 3 and 4).

5. *To which height do the curves in Fig. 6 refer?*

The curves of Fig. 6 refer to the ground level. This is now mentioned in the revised figure caption. The first computational cell in PMCAMx has a height of approximately 60 m so these refer to the average concentrations over these 60 m.

6. *Fig. 7: Better use a color scale that is similar to Fig. 9 in Wagstrom et al. (2008).*

Done. In the revised manuscript we have changed the color scale to be similar to Fig. 9 Wagstrom et al. (2008).

7. *Last line of section 3.2: Please give a quantitative estimate of the removal by rain.*

We have added the amounts of rainfall during the two periods in the revised paper.

8. *What is the impact of the annual course of the emissions?*

The seasonal change in emissions does contribute to the differences in relative source contributions shown in Figure 9. These changes are summarized in Table 1. A brief discussion of their importance has been added.

9. *Page 25781: Please explain HOA.*

We have added the definition of HOA at this point.

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