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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Aerosol particle measurements at three stationary sites in the megacity of Paris during summer 2009: meteorology and air mass origin dominate aerosol particle composition and size distribution" *by* F. Freutel et al.

Anonymous Referee #1

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The paper by Freutel et al., titled Aerosol particle measurements at three stationary sites in the megacity of Paris during summer 2009: meteorology and air mass origin dominate aerosol particle composition and size distribution" is a well-written manuscript summarizing summertime observations of aerosol size and composition measurements in Paris and two suburban areas as well as from a mobile lab. Aerosol data interpretation was complemented by FLEXPART back trajectory analysis as well as measurements of O3 and NOx. Furthermore, PMF analysis has been performed

on the AMS organic spectra. Although no significant new science regarding aerosol formation and evolution is presented in the paper, the results of the study are valuable for understanding summertime trends and characteristics of aerosols in Paris and the surrounding regions. Therefore, I recommend publishing the manuscript after the authors address the following comments:

1. Section 3.1: how do the O/C ratios of the OOA factors compare with other SV-OOA and LV-OOA factors? I think it would be helpful to include a discussion based on the degree of aerosol oxidation level at the different sites (and a comparison to previous PMF factors) to gain more insight into OA evolution upon transport. It seems the distance between the suburban sites and downtown site is ~20 km. Assuming surface winds of say 1 m/s, it will take airmasses to travel this distance in ~5-6 hr, which is long enough for some local SOA formation from the primary emissions.

2. Section 3.1: It appears that the PMF analysis has been performed on the unit mass resolution Org spectra. Have you tried looking at the high resolution spectra to see what the contribution of oxygenated species to fragments commonly assigned to HOA (like 41, 55, 57, etc) are since recent lab and ambient measurements do report on 'intermediately oxidized' species with an HOA backbone (Kroll et al., Nature Chem, 2011 and Bahreini et al., EST, 2012)? If you see a significant contribution, have you tried running PMF on the HR spectra? Different degrees of oxygenation in HOA could be a reason of worse correlation between the 'split' HOA factor in this study and the reference HOA.

3. Pages 22227-22228 (and in the summary): as written, it appears that the authors claim that organics were responsible for aerosol nucleation events. However, the measurements discussed here don't really include composition of the nucleation particles. Therefore, I suggest rewriting these sections to avoid drawing such conclusions.

4. Page 22228 (and summary section): Decrease in OOA in the early mornings can also be due to an increase in the BL height. Therefore, I suggest normalizing the OOA

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mass with a non-reactive tracer (e.g., BC) to account for dilution differences before concluding if OOA is evaporating.

5. Figure 6: is there a reason for not showing 'central Europe' diurnal profiles?

6. Section 3.5: In my opinion this section is the most interesting contribution of the paper. However, I think comparing absolute concentrations is not useful because of the dilution that's imposed on the air masses as they travel from downtown to SW or NE. Similar to #4 above, I suggest considering enhancement ratios of these species against a non-reactive species (e.g., CO or BC). Also, how much NOx would react away through the transport from downtown? Would it be possible to estimate and add the amount of NOx that is reacted away back in?

Interactive comment on Atmos. Chem. Phys. Discuss., 12, 22199, 2012.