

## ***Interactive comment on “Megacity emission plume characteristics in summer and winter investigated by mobile aerosol and trace gas measurements: the Paris metropolitan area” by S.-L. von der Weiden-Reinmüller et al.***

### **Anonymous Referee #1**

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In their manuscript, von der Weiden-Reinmüller et al. compare mobile and stationary aerosol and gas-phase measurements of background air and the emission plume of the European megacity Paris. In particular, they use the mobile laboratory MoLa to measure the submicron aerosol chemical composition, aerosol number concentrations and size distributions, and atmospheric trace gases at various fixed stations, to measure cross sections of the emission plume, and to carry out quasi-Lagrangian experiments following the emission plume from the Paris center to the surroundings. The authors use fresh pollution markers such as black carbon and hydrocarbon-like organic

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aerosol (HOA) to identify and characterize the emission plume, then compare pollutant concentrations in the emission plume and background air, study the spatial distribution of pollutants in the emission plume, and finally investigate aging of the organic aerosol in the emission plume.

The manuscript is well structured and clearly written. The presented results are an important contribution to the MEGAPOLI project, and will help designing future field experiments investigating urban emission plumes and their interpretation. The authors show that the mobile laboratory MoLa is a valuable tool in studying urban emission plumes and their impact on air quality in surrounding areas. The supplementary material nicely complements the manuscript. I recommend publication of this manuscript in ACP after taking into account the following comments:

- a) In section 2.2, please add some more information about the instrumentation, e.g. a table with the types of instruments used in this study.
- b) p. 11259, l. 9/10: Please give an estimate or quantify the mass fraction typically contributed by  $m/z > 100$ .
- c) p. 11261: How would PMF results change if local pollution events were removed from the data before positive matrix factorization as compared to removing data when OC mass concentrations are larger than  $50 \mu\text{g m}^{-3}$ . Also, please discuss the uncertainties of the changes in the composition of the organic aerosol (p. 11272) taking into account a 30 % uncertainty in ambient AMS data for absolute mass concentrations of individual factors derived by PMF. How will this affect the significance of the plume contribution estimates shown in Fig. 3, the changes in the average organic mass spectra presented in Fig. S4 (supplementary material), and the correlation coefficients shown in Tab. 2?
- d) p. 11273: The mode in the aerosol number size distributions at a diameter of 10 nm (Fig. 4) may be an artifact as stated e.g. by Freutel et al. (2013; Atmos. Chem. Phys., 13, 933–959): »>The comparison shows a mode in the number distribution measured

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by the FMPS around 10 to 15 nm which is likely an artefact due to the inversion algorithm used for this instrument (A. Wiedensohler, personal communication, 2012).«< Please include this information and briefly discuss it.

e) p. 11275/76: I was distracted by the CO<sub>2</sub> data in Fig. 5 (especially in Fig. 5b) when the discussion in the text focused primarily on the comparison of measured and modeled HOA concentrations. Therefore, I suggest removing the CO<sub>2</sub> example from Fig. 5. You may add an additional figure showing the good agreement between the plume shape and spatial extent of other measured fresh pollution markers.

Technical comments:

p. 11251, l. 17: Please clarify what "the second process" refers to.

p. 11267, l. 10: Change "average O/C ratios are shown" to "average O/C ratios in organic aerosol are shown".

p. 11281, l.17: Replace "regression coefficient" by "correlation coefficient".

p. 11283, l.14: Change "secondary pollutants as particulate sulfate" to "secondary pollutants such as particulate sulfate".

Fig. 1: In the figure caption, replace "squares" by "diamonds".

Tab. 1: The columns showing the plume contributions in summer and winter are hard to read. Please split these two columns into four columns, showing the absolute concentrations and the relative contributions in separate columns, respectively.

Tab. 2: Replace "regression coefficient" by "correlation coefficient" in the caption of Tab. 2.

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Interactive comment on Atmos. Chem. Phys. Discuss., 14, 11249, 2014.