**Atmospheric
Chemistry
and Physics
Discussions**

Interactive comment on "Wintertime aerosol chemical composition and source apportionment of the organic fraction in the metropolitan area of Paris" *by* M. Crippa et al.

Anonymous Referee #1

Received and published: 29 October 2012

This manuscript reports the source apportionment results from three aerosol mass spectrometers and two black carbon analyzers deployed at three stationary sites in the Paris metropolitan area during winter 2010. It presents a thorough analysis of the chemical characteristics and the sources of aerosol particles in the Paris region during winter season. The subsequent discussions on the effect of Paris on local and regional air quality are very interesting. The overall quality of this work is good and the manuscript is well-written. I thus recommend its publication after the authors respond to a few comments.

I'd like to suggest that the authors are more specific about the spatial contexts of the

regional and local sources. For example, what region (spatial coverage) does "local" correspond to? Does it refer to the city center and nearby vicinity only or to the broad metropolitan area? Speaking of Paris emissions, it seems that the latter is more relevant. According to Wikipedia: "A metropolitan area is a region consisting of a densely populated urban core and its less-populated surrounding territories, sharing industry, infrastructure, and housing." (http://en.wikipedia.org/wiki/Metropolitan_area). So, what if all three sites are located within the Paris metropolitan area and neither GOLF nor LHVP is a background site strictly speaking? The similarities in the time series of primary aerosol species (HOA, COA, BBOA, and BC) seem to suggest so. Their diurnal patterns correlate very well with human activities (e.g., rush hour, meal times, and wood burning for heating) and there are no time shifts in the temporal variation profiles among the three sites. If urban emissions are the main sources of primary aerosols in Paris, the fact that they together constitute a significant fraction ($\sim$ 30% or more according to reading Fig. 12) of the aerosol loading indicates emissions from Paris is a significant contributor to aerosol pollution in its metropolitan region. It was mentioned on page 22562 that aethalometer measurements at a remote rural site located 58 km east/northeast from the center of Paris show no significant differences from the BC levels detected at GOLF and LHVP. I agree with the authors that this could be interpreted as an evidence for the regional influences on Paris aerosol. However, another interpretation is also possible – Paris emissions control BC loading in the region. These points need to be clarified.

The OOA2-BBOA factor is ambiguous and related discussions vague. Was PMF performed on the high-resolution mass spectra? The aerosol loading was high during this study, so the high resolution spectra should have good signal-to-noise ratios. Analyzing the high resolution spectra will likely give less ambiguous PMF solutions and better separated factors.

Page 22539, line 23, a comprehensive review of factor analysis approaches of aerosol mass spectrometry of ambient aerosol was published [Zhang et al., 2011]. It seems an

appropriate reference to cite for this sentence.

Page 22558, 2nd paragraph, for COA in Beijing, Sun et al. [2010] and Huang et al. [2010] should be cited since they actually reported the observations of cooking aerosols based on analyzing ambient AMS measurement data while He et al. [2010] primarily discuss the spectral profiles of various cooking OA. In addition, significant quantities of COA were also determined in New York City [Sun et al., 2011] and Fresno [Ge et al., 2012]. Fig. 1, it would be helpful to show the comparisons of the average loadings of total PM1 among three sites too.

Fig. 2 and 8, the medians are used for making the diurnal profiles at here. Often times, the means are also shown. It will be interesting to know how the diurnal patterns differ if the mean values are plotted. The difference between the median and the mean is usually larger for a set of data that is more deviated from normal distribution. Primary species are more influenced by spikes, thus might show bigger differences between the mean and the median.

References: Ge, X., A. Setyan, Y. Sun, and Q. Zhang (2012), Primary and secondary organic aerosols in Fresno, California during wintertime: Results from high resolution aerosol mass spectrometry, Journal of Geophysical Research-Atmospheres, 117(D19301), 15p, 10.1029/2012JD018026

He, L. Y., Y. Lin, X. F. Huang, S. Guo, L. Xue, Q. Su, M. Hu, S. J. Luan, and Y. H. Zhang (2010), Characterization of high-resolution aerosol mass spectra of primary organic aerosol emissions from Chinese cooking and biomass burning, Atmospheric Chemistry and Physics, 10(23), 11535-11543, 10.5194/acp-10-11535-2010

Huang, X.-F., L.-Y. He, M. Hu, M. R. Canagaratna, Y. Sun, Q. Zhang, T. Zhu, L. Xue, L.-W. Zeng, X.-G. Liu, Y.-H. Zhang, J. T. Jayne, N. L. Ng, and D. R. Worsnop (2010), Highly time-resolved chemical characterization of atmospheric submicron particles during 2008 Beijing Olympic Games using an Aerodyne High Resolution Aerosol Mass Spectrometer, Atmos. Chem. Phys., 10, 8933-8945, 10.5194/acp-10-8933-2010

C8712

Sun, J., Q. Zhang, M. Canagaratna, Y. M. Zhang, N. L. Ng, Y. L. Sun, J. Jayne, X. C. Zhang, X. Y. Zhang, and D. Worsnop (2010), Highly Time- and Size-Resolved Characterization of Submicron Aerosol Particles in Beijing Using an Aerodyne Aerosol Mass Spectrometer, Atmospheric Environment, 44(1), 131-140, 10.1016/j.atmosenv.2009.03.20

Sun, Y., Q. Zhang, J. J. Schwab, K. L. Demerjian, W.-N. Chen, M.-S. Bae, H.-M. Hung, O. Hogrefe, B. Frank, O. V. Rattigan, and Y.-C. Lin (2011), Characterization of the Sources and Processes of Organic and Inorganic Aerosols in New York City with a High-Resolution Time-of-Flight Aerosol Mass Spectrometer, Atmospheric Chemistry and Physics, 11, 1581-1602, 10.5194/acp-11-1581-2011

Zhang, Q., J. L. Jimenez, M. Canagaratna, N. L. Ng, I. Ulbrich, D. Worsnop, and Y. L. Sun (2011), Understanding Organic Aerosols via Factor Analysis of Aerosol Mass Spectrometry: a Review, Analytical and Bioanalytical Chemistry, 401, 3045-3067, 10.1007/s00216-011-5355-y

Interactive comment on Atmos. Chem. Phys. Discuss., 12, 22535, 2012.