Atmos. Chem. Phys. Discuss., 14, C6596–C6601, 2014
www.atmos-chem-phys-discuss.net/14/C6596/2014/

Atmospheric Chemistry and Physics Discussions

Interactive comment on "Seasonal characteristics of fine particulate matter (PM) based on high resolution time-of-flight aerosol mass spectrometric (HR-ToF-AMS) measurements at the HKUST Supersite in Hong Kong" *by* Y. J. Li et al.

Anonymous Referee #1

Received and published: 5 September 2014

—

General comments

The manuscript of Y. J. Li et al. presents the seasonal characteristics of fine PM in Hong Kong (chemical composition, size distribution, degrees of oxygenation, organic apportionment and air mass influences) based on high resolution time-of-flight aerosol mass spectrometer (HR-ToF-AMS) measurements, positive matrix factorization (PMF) and air mass back-trajectory analyses. The manuscript is well structured and presented in

a clear way. The methods used (PMF, back-trajectory analysis) are not innovative but are valid and well applied. The conclusions of this manuscript (e.g. the influence of air mass origins and the season studied on the relative chemical composition of NR-PM1 and the degree of oxygenation of organics at Hong Kong) are of scientific significance. I therefore recommend publishing this work in Atmospheric Chemistry and Physics after the authors respond to the following comments.

—

Specific comments

NR-PM1 levels at your HKUST suburban site (15.3 μg/m3, Fig. 2) are extremely low compared to what is reported at neighbouring sites of the Pearl River Delta (PRD) region (29.4-38.2 μg/m3 for rural and urban sites). This surprising result requires more justifications than what is mentioned in the manuscript (p. 20270 and 20277). If available, comparisons between fine PM mass determined by HR-ToF-AMS and independent analytical techniques – such as Tapered Element Oscillating Microbalance – Filter Dynamic Measurement System (TEOM-FDMS), filter measurements, etc. - should be reported and discussed in the supplementary material. In addition, HR-ToF-AMS measurements could be compared to i) Sunset ECOC Analyzer for the determination of organic matter, and ii) MARGA for the quantification of inorganic species (nitrate, sulphate, ammonium), if these independent instruments were operating at HKUST as mentioned in the following link: http://envr.ust.hk/research/research-facility/instrument.html.

The cooking OA (COA) factor identified by PMF shows surprising diurnal profiles with the presence of an evening peak but the absence of lunch peaks during all seasons (Fig. S11, S13, S15, S17). How do the authors explain the absence of lunch peaks for this factor? It is mentioned that a small canteen operates near your sampling site during evenings only (p20264, l.8). Could the COA factor be related to local emissions of this canteen? In other words, to which extent is your COA factor representative of

the Hong Kong urban area? Please comment and mention the limitations related to this COA factor in the manuscript if necessary.

p.20264, l.7: could your site be influenced by maritime transport emissions? Is there a harbour in the vicinity?

p.20266, l.15: How do the authors explain that seed=0 is the most appropriate for all months? If no local minimum is found, the chosen seed should not influence your results (in general random seeds are chosen in classical PMF analyses).

p.20267, l.8: please provide further explanations on how the output data of the WRF model were used to drive the HYSPLIT model.

p.20267, l.12: please provide more explanations on how back trajectories were clustered into groups with similar patterns.

p.20268, l.11: "NR-PM1 concentration show little seasonal variation", was it expected? Is it in agreement with previous studies? Please discuss.

p.20269, l.9: NOx could also be emitted by industrial activities. Please provide reference if NOx is emitted by traffic only in Honk Kong. It is not clear why traffic emissions would be higher in spring, please comment.

p.20269, l.26: as mentioned in the general comments, the concentration found in your study is very low compared to other studies conducted in the vicinity; please further discuss. Your explanations p.20270, l.8 and p.20277, l.15-17 are not sufficiently persuasive.

p.20271, l.21: it is not clear why primary contributions are smaller in autumn and winter. Please explain.

p.20273, l.5: please see general comment above.

p.20273, l.18: please give more information on the bootstrapping method you used (e.g. in supplementary material). Please discuss Fig. S9. Bootstrapping is usually

performed in conjunction with PMF to assess the uncertainties associated with your solution (e.g. Norris et al., 2008); such assessment is not clear from your Figure S9. What does "Profile_X_Avg" and "TSeries_X_Avg" represent here? Are they the average of your bootstrap profiles and time series, respectively? If yes, displaying medians and interquartile ranges might better represent the uncertainties associated with your results.

p.20274, l.11: it is surprising that concentrations are not lower than 14.0 μg.m-3 when air masses come from East China Sea; how do the authors explain this result (e.g. anthropogenic emissions from Taiwan or Japan?)?

—

Technical corrections

p.20263, l.1: please remove "the some".

p.20263, l.3: "the organic fractions in PM are higher especially in autumn and winter, although high PM episodes do not occur frequently"; please provide references justifying it.

p.20265, l.10: Middlebrook et al. (2012) do not explicitly mention the influence of biomass burning aerosols on collection efficiencies. They report the influences of (1) high nitrate content, (2) high relative humidity, and (3) high acidity. Please modify accordingly (also discussion l.12-14).

p.20266, l.2: please replace "equals to" by "can be approximated by".

p.20266, l.11: please put "weak" in inverted commas.

p.20266, l.14-15: please define "exploration mode" and "seed value" or provide references.

p.20269, l.15: please also mention studies reporting an overview of the chemical composition of PM in Asia (e.g. Yang et al., 2011; Zhang et al., 2012). Please mention

what is the added value of your study compared to the aforementioned ones (NR-PM1 determined with AMS measurements, OA apportioned in POA and OOA for most sites).

p.20270, l.1: “non-urban sites have much higher fractions of OOA than POA”. Please mention that this is in agreement with what is reported worldwide (Zhang et al., 2011).

p.20271, l.8: please provide references describing the Van Krevelen diagram.

p.20272, l.18: please refer the reader to Table S3.

p.20274, l.26: please rephrase “was strongly affected by traffic-related emissions” since one would expect higher PM concentrations and HOA contributions with such statement.

p.20279, l.24: please modify the website link which is not correct.

p.20285: Table 2, please add a row below Org reporting NR-PM1 total mass Supplementary Material.

p.4, l. 3: please replace “201105” by spring.

p.12: please detail the legend of the figure S9, explaining what “Profile_X_Avg” and “TSeries_X_Avg” represent.

p.13: please provide more detailed information in the legend, as you did for Fig. 1 by explaining what x-c and x-d ($1 \leq x \leq 7$) graph represent.

p.21, Table S3: please define in the legend the acronyms that are used in this table i.e. “Summary of correlation coefficients of time series (TS) with external data and mass spectra (MS) with (. . .)”. Please report what are the three ions used as tracers for COA in the legend too.

p.23, l. 11: please rephrase point (3): do you mean that anthropogenic transported species should be associated with long trajectories from the continent? As it is stated it seems that marine transported species should also be associated with continental air

masses, which is not correct.

—

References

Norris, G., Vedantham, R., Wade, K., Brown, S., Prouty, J. and Foley, C.: EPA Positive Matrix Factorization (PMF) 3.0: fundamentals & user guide, US Environ. Prot. Agency, 2008.

Yang, F., Tan, J., Zhao, Q., Du, Z., He, K., Ma, Y., Duan, F., Chen, G. and Zhao, Q.: Characteristics of PM2.5 speciation in representative megacities and across China, Atmospheric Chem. Phys., 11(11), 5207–5219, doi:10.5194/acp-11-5207-2011, 2011.

Zhang, Q., Jimenez, J. L., Canagaratna, M. R., Ulbrich, I. M., Ng, N. L., Worsnop, D. R. and Sun, Y.: Understanding atmospheric organic aerosols via factor analysis of aerosol mass spectrometry: a review, Anal. Bioanal. Chem., 401(10), 3045–3067, doi:10.1007/s00216-011-5355-y, 2011.

Zhang, X. Y., Wang, Y. Q., Niu, T., Zhang, X. C., Gong, S. L., Zhang, Y. M. and Sun, J. Y.: Atmospheric aerosol compositions in China: spatial/temporal variability, chemical signature, regional haze distribution and comparisons with global aerosols, Atmospheric Chem. Phys., 12(2), 779–799, doi:10.5194/acp-12-779-2012, 2012.

Interactive comment on Atmos. Chem. Phys. Discuss., 14, 20259, 2014.