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Interactive comment on “Aerosol composition, oxidative properties, and sources in Beijing: results from the 2014 Asia-Pacific Economic Cooperation Summit study” by W. Q. Xu et al.

Anonymous Referee #2

Received and published: 31 October 2015

The manuscript reports detailed chemical characterization of PM₁, mostly NR-PM₁ during an important event (APEC) in Beijing. Strict atmospheric legislation emissions were imposed during APEC, which gave the authors the opportunity to investigate aerosol properties and sources before and during APEC, including severe haze episodes. The authors demonstrate experience on the techniques and provided very detailed information. Although not many new insights are presented, it seems to me that the results have implications on atmospheric chemistry and for this reason I recommend it to be accepted for publication in this journal after the considerations below are taken into account.

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General comments:

Language was often poorly written, I recommend careful text revision, especially with the use of 'plural' form.

In the introduction the authors claim that 'understanding of size distributions and elemental compositions of OA in Beijing remains poor'. Nowhere in this planet there have been so many studies with HR-AMS including HR-PMF, size distributions and elemental composition of OA till the present moment (I counted 8 studies!). No doubt that they were all important. However, I do not believe such sentences can be used as motivation statements.

The authors say that emissions control during the Olympic Games 2008 were implemented to a lesser degree. Please provide more detail on that.

Limits of detection for the HR-AMS were estimated and presented, however, it surprises me that some compounds presented much lower values than the ones presented by DeCarlo et al. (2006), especially ammonium. Do the authors have an explanation for that?

I suggest the authors include the input organics matrix dimensions, so the readers will know the number of variables and samples used in the PMF analysis. Also, explain if PMF was run for all the period (before APEC, during APEC) together or separately.

In section 3.1 the authors say that nitrate contribution was larger than in previous studies. Is that an indication that legislation imposed during APEC was more effective for this compound? Why?

Concerning the acidity, do the authors have additional information concerning cations, such as K^+ , Na^+ , Rb^+ ? For example, Takegawa et al. (2009) measured those ions with tan AMS in Beijing. In an environment where mass loadings are so elevated, one could expect them to be relevant for the neutralization.

Diurnal cycles of SIA components were very similar, increase in the afternoon. To me

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that suggests mixing layer development. Regional pollutants stay imprisoned above the mixing layer during the night and during the day when the mixing layer evolves they are released down to the surface level.

Concerning the COAs factors, the authors associate COA2 to charbroiling because that was the banned cooking technique during APEC. Could the authors provide further evidence of charbroiling cooking factor? For example, this factor presented CHN⁺ and CHNO⁺ fragments, especially for larger m/zs (>m/z80). Any insights on what could those fragments represent? How could they be related to charbroiling and not to typical cooking?

It surprises me that all POA factors (but COA1) contain significant fractions of m/zs 60 and 73. Did the authors try ME2 to better separate the factors? They look rather mixed.

Why was the terminology SV-OOA and LV-OOA utilized instead of OOAI and OOAI (Huang et al., 2010)? Both OOAs are very oxidized (m/z 44>43) and both present similar agreement with nitrate and/or SIA. It is not clear to me that the factor labeled as SV-OOA is more volatile. Concerning diurnal cycle of SV-OOA, how can the mountain-valley breeze influence only this factor and not the others? Please explain.

SIA and OOA showed similar large accumulation modes peaking at 650nm. Usually, the lens transmission efficiency drops abruptly at Dva>600 nm. Please explain how could that be? Was the transmission efficiency measured for this instrument?

In the Krevelen diagram, slopes before and during APEC are very similar (-0.52 and -0.58) to infer that different aging processes took place.

Minor Comments

P23414, L13: Write W-mode.

P23416, L17: NO_x or NO_y? In section 2.1.1 NO_y was mentioned. Please choose one.

P23416, L19-22: Sentences need clarification. Were the two SV-OOAs combined?

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Please, write clarify.

P23417, L11: 3rd, not '3'.

P23417, L18: Write 'composed of' down.

P23417, L20: Did you mean organic mass fraction?

P23417, L27: Please report the NO₃/SO₄ value for Zhang, et al. (2014), so the reader can compare it.

P23419, L7: Spell out BA and DA.

P23419, L23: Please cite few chloride combustion sources.

P23421, L4: The authors probably meant 'increase', not 'decrease'. Please correct.

P23421, L17-18: Already described in section 2.1.1, no need to mention it again here.

P23421, L21: The word correlates is not appropriate, replace it by 'in agreement'.

P23427, L-14-15: This sentence is not clear.

P23432, L26: Please include the meteorological effects after emission control.

Fig. 5(f) right panel, there's a typo, 'SNA'.

Fig. 4 was cited after Fig 5 in the manuscript.

References DeCarlo, P. F., Kimmel, J. R., Trimborn, A., Northway, M. J., Jayne, J. T., Aiken, A. C., Gonin, M., Fuhrer, K., Horvath, T., Docherty, K. S., Worsnop, D. R., and Jimenez, J. L.: Field-deployable, high-resolution, time-of-flight aerosol mass spectrometer, *Anal. Chem.*, 78, 8281–8289, 2006.

Huang, X.-F., He, L.-Y., Hu, M., Canagaratna, M. R., Sun, Y., Zhang, Q., Zhu, T., Xue, L., Zeng, L.-W., Liu, X.-G., Zhang, Y.-H., Jayne, J. T., Ng, N. L., and Worsnop, D. R.: Highly timeresolved chemical characterization of atmospheric submicron particles during 2008 Beijing Olympic Games using an Aerodyne High-Resolution Aerosol Mass

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15, C8724–C8728, 2015

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