**Atmospheric
Chemistry
and Physics
Discussions**

Interactive comment on "Characterization and source apportionment of submicron aerosol with aerosol mass spectrometer during the PRIDE-PRD 2006 campaign" *by* R. Xiao et al.

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Received and published: 8 February 2011

This paper presents interesting results from a very unique and valuable data set. At least one additional paper by these authors has been published presenting other aspects of the data. Overall, it was a pleasure to read and very informative, however, I have two major questions that are somewhat related.

1) It is noted that compared to SV-OOA, LV-OOA is more oxygenated and more aged and that SV-OOA evolves to LV-OOA. What is the evidence in this data that LV-OOA is more regional in nature? It apparently is more water-soluble, consistent with being more oxygenated and thus has a clear diurnal peak during daytime, but how does that

make it regional? Is this conclusion based solely on the correlation to sulfate? As a background site in which local events have been removed from the data set, what does regional mean? It is not clear to me what regional means in the context of this study.

Along this line, some clarification is needed regarding the aging of the aerosol (Page 1904 and 1905, eg 1904 line 23 - 24). Are the authors suggesting that SV-OOA evolves with minimal mass increase into LV-OOA? This is my impression. It is not clear that the data shows that. For example, why does LV-OOA peak during the day? If no mass of SOA is being formed during this time, then one would conclude that changes in the concentration of LV-OOA are just due to changes in air mass age (ie, just recording the passage of different aged air masses). Why not make a plot similar to Miyazaki et al., JGR 2009 Fig 9, that shows changes in SV- and LV-OOA with photochemical age, his could be very insightful and it seem much of the analysis (eg, data segregation) has been done.

2) It was not clear how these results fit in with the early publication by the same authors (Miyazaki et al., JGR 2009). Ie, how does LV- and SV-OOA relate to HULIS? This is an interesting aspect of the data set and more analysis or discussion should be added, if possible (no one else has this kind of data!). The issue relates to hydrophilic WSOC (WSOC-hpi) and hydrophobic WSOC (WSOC-hpo) versus SV-OOA and LV-OOA. Here is what I found puzzling about the results presented.

Based on the correlation analysis near the end of the paper, it appears that the authors believe LV-OOA is mostly related to WSOC-hpi since the r2 is 0.71. There is a low correlation between SV-OOA and WSOC-hpo, so it is not clear what SV-OOA is associated with. (Maybe SV-OOA is associated with both and so combined with the observation that only 65% is water-soluble, the r2 is low for both SV-OOA to WSOC-hpi and SV-OOA to WSOC-hpo). It would be nice to know what the correlation was between WSOC-hpo and LV-OOA. (Note, it would be most informative to include WSOC-hpi and WSOC-hpo in the regression Table 3). The authors also argue that LV-OOA is more aged as it has a spectra similar that of fulvic acid. This seems contradictory since

one may expect fulvic acid (or HULIS) to be correlated with WSOC-hpo since the solid phase resin (XAD-8 or DAX-8) used to isolate fulvic acid is the same used to quantify WSOC-hpo (see Miyazaki et al., JGR 2009). Maybe the difference is that fulvic acid is isolated from natural surface water.

Without knowing all the correlations between, LV-OOA, SV-OOA, WSOC-hpi, and WSOC-hpo, it is hard to come to a conclusion, but I suggest the authors make an attempt. One guess is that it may be that each of LV-OOA and SV-OOA have components of both WSOC-hpi and WSOC-hpo, that would be interesting.

It would be very interesting if the authors could explore the possible roles of cloud chemistry versus clear air. Interesting data is shown that sulfate and the OOA is bimodal suggesting these two formation routes were occuring. Can this be expanded? For example can the size distributions of SV-OOA and LV-OOA be determined in any way? Can any tracer be used for droplet and condensation modes and then correlations between SV-OOA, LV-OOA, WSOC-hpi, and WSOC-hpo explored? Maybe this could be done by looking at the air mass origins, comparing LV-OOA/OOA and SV-OOA/OOA for southeast-south air masses versus southwest and north (the former are biomodal, the latter are not). I raise this issue since there is some speculation that LV-OOA is more likely cloud processed.

Specific Questions.

Abstract pg 1893 line 4, change summer reason to summer season.

Page 1896, lines 20 to 22. If you are going to refer to other data collected during this study, but not discussed in this paper, can references to publications be provided?

Pg 1897 line 9, Not sure what is meant by an inlet T of 40C. Is this heated sample line external to the AMS? Apparently this was done to dry the particles. What about loss of semi volatile species (eg nitrate SV-OOA)?

Pg 1899, lines 15 and so on throughout the paper. Be careful, comparisons are being

made to what was measured by an AMS, not necessarily the same thing as the total submicron aerosol mass.

Eq 1, (lognormal distribution) is missing a square bracket at the end.

In Fig 4 and text, these units are commonly written as micro equivalence per m3.

Pg 1900 and 1901: I suggest referring to this as apparent acidity, you are not measuring H+, or pH, but only roughly estimating acidity indirectly assuming the only missing component from the ion balance is H+.

Pg 1901, line 7 and Fig 5, is local time and Beijing time the same?

Page 1902 and 1903 discussion of Fig 8. I understand the how SOA (eg, m/z 44) can be in the smaller and larger modes of fig 8, but POA (m/z 57) also has a significant fraction in the larger mode (eg, 0.08/(0.08+0.14)=36%). How is that explained?

Page 1905 line 17, if LV-OOA is regional why does it have a clear diurnal profile with maximum during the day, in stark contrast to SV-OOA? I would interpret this that LV-OOA is more closely linked to photochemistry compared to SV-OOA, which may be more closely linked to primary emissions. This is consistent with SV-OOA being roughly 40% non-water soluble species.

Page 1906, line 9, how was the number 1.1 = POC/EC determined?

Page 1906, line 23. Can you give an example of oxygenated primary species (biomass burning?).

Page 1907 lines 22-23, change was very trace to was at trace levels throughout the study period.

Page 1908 line 19 to 20, I would put brackets around LV-OOA and SV-OOA (it looks like subtraction) in the WSOC fit equation.

Page 1909 line 1: Is it true (ie has it actually been measured by AMS or other MS

approach) that WSOC-hpi is more oxygenated (eg, higher O/C) than WSOC-hpo?

Why in Fig 10 is LV-OOA + SV-OOA plotted with the sum of sulfate and nitrate? Wouldn't it be better to plot just OOA, I assume that LV-OOA and SV-OOA must be fairly close to OOA.

Fig 13, This figure could be made more informative by also showing the subdivision of OOA into SV- and LV-OOA.

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