

## ***Interactive comment on “Regional differences in organic composition of submicron and single particles during INTEX-B 2006” by D. A. Day et al.***

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### **Reply to comments of Referee #1**

We thank the referee for his/her constructive suggestions for improving the paper before publication. In the following text, the reviewer comments are in italics followed by our response.

### **General comments**

*This paper describes regional differences in organic composition of submicron and single particles during INTEX-B 2006. The authors have described in details the sampling locations, sampling methodology, analytical techniques and QA/QC procedures.*

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*The work will be helpful in adding information to the existing knowledge base regarding sources and processes responsible for OM in different regions of USA. Therefore, this paper should be considered for publication after some revisions and addressing the comments described below. However, the authors have not tried to find any variation of the sources due to seasonal difference of wind pattern/directions (if any). Please add a paragraph elaborating this possibility. We address the referee's concern regarding seasonal difference of wind pattern/directions below in response to a specific comment.*

### **Specific comments**

1. *Abstract Line 21: “losses of organic aerosol” - Provide reference for this. This is not discussed anywhere in the text.*

We have removed “losses” of organic aerosol from the abstract since it is not discussed in the text.

2. *Introduction line 30-31 (page 6660): “Northeastern pacific free troposphere” - Is this “Pacific” air mass as mentioned in abstract; “Western North American free troposphere” - Is the “Continental” air mass as mentioned in abstract?*

Yes, that is the case. For consistency, we have rephrased this sentence which now reads: “regions, namely the Pacific free troposphere, the continental free troposphere, the Seattle metropolitan region, and the California Central Valley.”

3. *Experimental Methods (page 6660): Is there any effects of season? Please provide a paragraph on it.*

The reported measurements were taken during a 4-week period in the spring. Therefore, we would not expect seasonal trends over the course of the experiment. Trans-Pacific transport from Asia to North America has been shown to peak during

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springtime and was a major consideration for conducting these flights during the spring ((Singh et al., 2009) and references therein - referenced in introduction). While we believe the seasonal trends cited in other works also affect the organic aerosol, the lack of comparable data during other seasons prevents us from commenting on this question.

4. *Experimental Methods line 15 (page 6660): "Fights" should be "flights".*

This has been corrected in the revised manuscript.

5. *Experimental Methods line 16 (page 6660): Please provide another figure on flight tracks and not a "link"*

We have added grey lines to Figure 1 in the revised manuscript indicating tracks for entire flights.

6. *Flight tracks from above link - Flight numbers on this link and on Figure 2 don't match*

Yes, the link was incorrect and is now omitted.

7. *Experimental Methods line 3 (page 6661): "typically these "short". . .of a level flight leg - Please clarify and language is not clear*

This sentence now reads: "Typically these "short" (20-40 min) samples were collected for the duration of a level flight leg."

8. *Experimental Methods line 6 (page 6662): "We estimate that they could have accounted. . .10% of OM - Any supporting reference?"*

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We have added text for clarification which now reads: "Based on detection limits (Russell, 2003; Russell et al., 2009), we estimate that amine functional groups could have accounted for at most 10% of OM."

9. *Experimental Methods line 10 (page 6662): "Several samples were NOT excluded. . . > 2 detection limit criteria - Please clarify, sentence not making much sense".*

The text now reads: "Several samples were included in this analysis for which alkane or alcohol groups had signal-to-noise ratios between 1 and 2; as a consequence, estimated uncertainties for these samples exceed 50%."

10. *Experimental Methods line 5 (page 6663): "Approximately half of the filters. . .by the presence of detectable organics" - Please clarify as sentence not making much sense.*

The text now reads: "Approximately half (47) of the filters were analyzed by XRF."

11. *Experimental Methods line 7 (page 6663): "Of these samples, 40. . .above the detection limit" - What is the conclusion from the sentence.*

We state these values to indicate to the reader the number of samples for which we have a large range of different elements at detectable concentrations.

12. *Experimental Methods line 25 (page 6664): "Seattle included most of flight 3" - Does the flight number matters unless you provide a list of flights, their order in air masses etc?*

We have added dates following each flight number in parenthesis in the revised manuscript to make this notation more accessible to readers.

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13. *Experimental Methods line 2 (page 6664): "Similarly, we included. . .during the Seattle flight" - What is the logic behind this part?*

We have clarified this distinction by rephrasing two sentences in this section which now read:

"Seattle" included most of flight 3 (4/24/2006), conducted largely in the Seattle region (at 700-3800 m) above the planetary boundary layer (600m)."

"Similarly, we include an additional sample collected in the Seattle region at 1600 m on a different flight (flight 10), but exclude a sample collected at 5000 m and 180 km south of Seattle during the "Seattle flight".

14. *Results line 10 (page 6666) - "Upper and lower bounds. . ." - In section 3.1 mention the upper and lower bounds. . .*

This should reference Sect 2.2 and has been corrected.

15. *Results line 9 (page 6667) - "Figure 4 shows that. . . 1000 m" - There is a error on this figure, either it is a color mismatch problem or the statement is wrong. Pacific showed maximum range of O/C ratios and continental the least.*

We believe this statement and figure are both correct. We do not discuss the Pacific samples in this statement (and they are omitted from that panel in Fig. 4). In this statement, we compare the large vertical range of the Continental (red) samples (1800-6000m) to the small vertical range of the Central Valley (green) samples (<600m). The O/C values in this statement: (0.4-0.6) and (0.2-0.4), are averages of the upper/lower bounds presented in a form that is consistent with the rest of the text.

16. *Results line 7 (page 6668) - Pacific air mass samples favored - Change to "fall"*

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The text now reads: "Three out of five of the Pacific air mass samples fall in this category. These three samples also showed the highest OM of the Pacific air mass category."

17. *Results line 4 (Page 6669) - Why is pollution generated in Asia not affecting Central Valley?*

We do not suggest that the Central Valley may not be influenced by Asian transport to some extent, but we expect that local sources from the population centers and agricultural activities within the valley will dominate particle sources. Sampling of a concentrated Asian pollution layer would seem much more likely in the free troposphere than within the continental boundary layer.

18. *Results line 27 (Page 6669) - Space missing between "that MCKendry"*

Corrected.

19. *Results line 9 (Page 6670) - MBL - What does it mean?*

It is now written out in full in the revised manuscript (marine boundary layer).

20. *Results line 4 (page 6671)- Why no particles from Central valley?*

No samples were analyzed from the Central Valley since the focus of the study was on Asian transport. We have added a sentence to the revised manuscript noting this.

21. *Results line 25 (page6672) - High frequency - Clarify "high frequency" - Is it absorbance or occurrence?*

We have clarified this statement in the revised manuscript which now reads: "We ob-

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served these groups to be among the most common particles types during ACE-Asia (except for "d"), showing similarities."

22. *Discussion line 8 (page 6673) - There are no published. . .Northeast . . .air masses: Is it northeast or northwest?*

Northeast is correct. We state the lack of measurements in the Northeast Pacific where INTEX-B occurred, then continue with a description of existing measurements in the North Pacific (i.e. the northwestern Pacific during Ace Asia).

23. *Discussion line 4 (page 6675) - Noy - Is it total reactive nitrogen?*

Yes. It is now written out as "total reactive nitrogen" in the revised manuscript.

24. *Discussion line 4 (page 6675) - It should be mentioned in the experimental methods if there is simultaneous gaseous sampling.*

We have added the following text to the revised manuscript (end of Sect. 1): "The C130 payload included a large suite of aerosol, gas, and radiation instrumentation which is summarized in Singh et al. (2009)."

25. *Conclusions Acknowledgements part (page 6677) - "In addition we bn are grateful. . ." - Delete bn*

Corrected.

26. *Figure 3 (Caption last line) - Explain more about upper and lower bound in the text of the journal*

We estimated lower bounds for functional group concentrations as the concentrations  
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measurements that were sometimes below the detection limit (DL; S/N=2). Upper bounds were estimated by assigning below detection limit (BDL; S/N<2) functional groups to the detection limit concentrations. We discuss these bounds in Sect 2.2 of the manuscript; however we have added text describing the bounds to the caption of the figure for easier access to the reader.

27. *Figure 4 (Caption) - Mention "K" type panel*

In Fig. 4, "K" represents the element potassium.

28. *Figure 4 - Particle diameter missing for panel (e)*

We have added particle diameters below panels (e) and (k) in Figure 5 in the revised manuscript (now Fig. 2).

29. *Figure 6 - How about a plot like these for every air mass? In other words, 4 different plots based on air masses.*

We considered such a plot, but due to the limited number of particles we did not feel it was useful or added any new discussion not already presented with Fig. 5.

## References

Dunlea, E. J., DeCarlo, P. F., Aiken, A. C., Kimmel, J. R., Peltier, R. E., Weber, R. J., Tomlison, J., Collins, D. R., Shinozuka, Y., McNaughton, C. S., Howell, S. G., Clarke, A. D., Emmons, L. K., Apel, E. C., Pfister, G. G., van Donkelaar, A., Martin, R. V., Millet, D. B., Heald, C. L., and Jimenez, J. L.: Evolution of Asian aerosols during transpacific transport in INTEX-B, *Atmos. Chem. Phys. Discuss.*, 8, 15375-15461, 2008.

Peltier, R. E., Hecobian, A. H., Weber, R. J., Stohl, A., Atlas, E. L., Riemer, D. D., Blake, D. R., Apel, E., Campos, T., and Karl, T.: Investigating the sources and atmospheric processing of fine particles from Asia and the Northwestern United States measured during INTEX B, *Atmos. Chem. Phys.*, 8, 1835-1853, 2008.

Singh, H. B., Brune, B. H., Crawford, J. H., Flocke, F., and Jacob, D. J.: Chemistry and transport of pollution over the Gulf of Mexico and the Pacific: Spring 2006 INTEX-B Campaign overview and first results, *Atmos. Chem. Phys. Discuss.*, 9, 363-409, 2009.

### Captions for Revised Figures

Fig. 1. Map showing the locations of all the reported (constant altitude) samples with the analytical method indicated (red=XRF, blue=FTIR, green=STXM). Overlapping tracks are slightly offset to show all tracks. Solid light grey lines show all flight tracks. Dashed dark grey lines encompass the four air mass regions.

Fig. 2. (Fig 5 in original manuscript) Summary of particles analyzed by STXM-NEXAFS. Panels represent previously established categories (Takahama et al., 2007); average spectrum of each particle type is used for classification into these groups. Shaded panels indicate meta-classes: Combustion (grey), Ultisol (light red), Secondary (light yellow), and Biomass (light green). (x) indicates irregular particle and (o) indicates spherical particle. Symbol colors indicate air mass categories: Continental (red), Pacific (blue), and Seattle (black).

Interactive comment on *Atmos. Chem. Phys. Discuss.*, 9, 6657, 2009.

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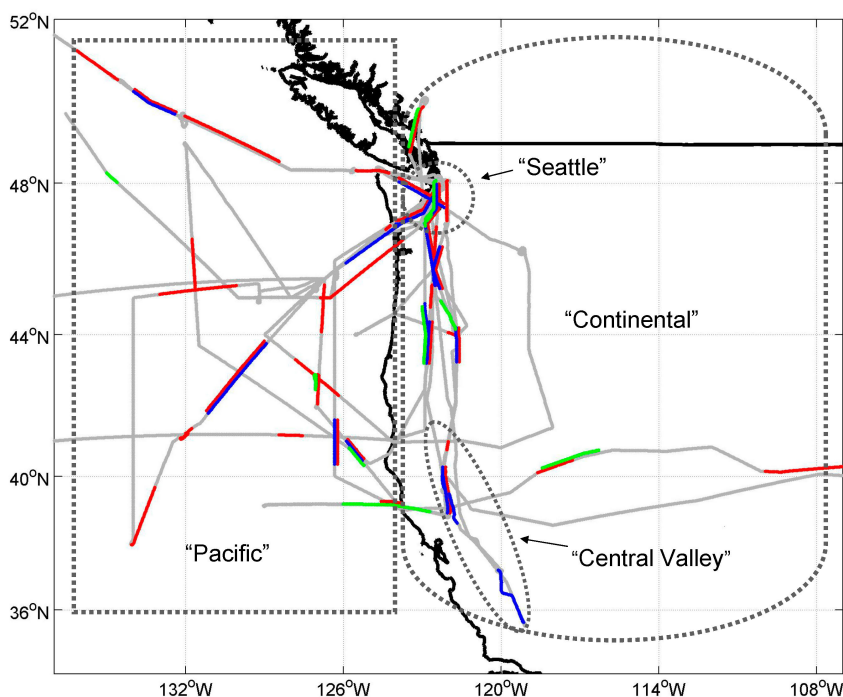


Fig. 1.

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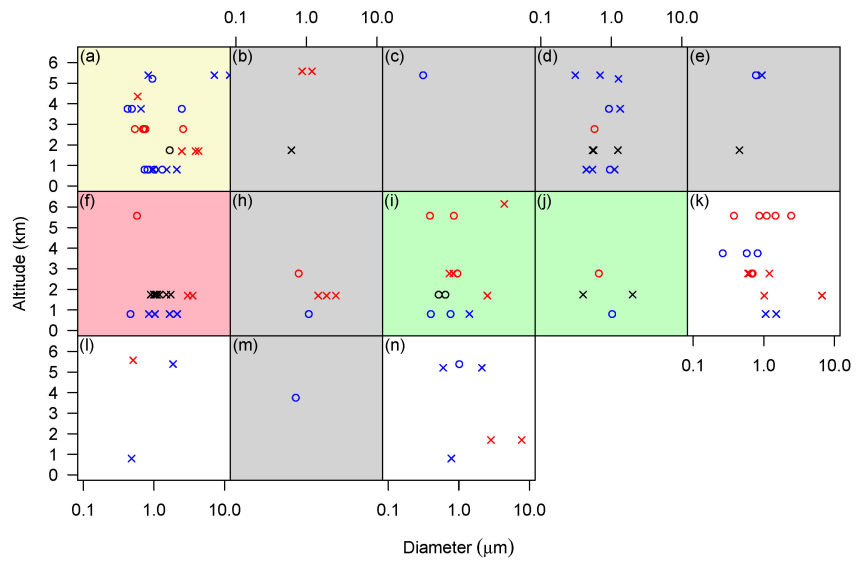


Fig. 2.

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