

## ***Interactive comment on “Southeast Pacific atmospheric composition and variability sampled along 20 S during VOCALS-REx” by G. Allen et al.***

### **Anonymous Referee #1**

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#### General Comments

This manuscript presents an important body of work that provides a substantial contribution to the catalogue of aerosol measurements. It is uniquely beneficial as a source of information on marine and offshore aerosol in the southern hemisphere, which is severely lacking. The presence of a large marine stratocumulus cloud deck in the study region means that this work has significant climate-relevance, while the multi-platform approach allows for quality control on duplicated measurements. I found the manuscript to be well-written and fairly complete, and suggest minor revisions to improve its impact and clarity. The identification of "zones" of with characteristic pollution types and levels should be emphasized more in the manuscript as that provides a useful parameterization for modelers to employ. Several general questions that came to

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mind were, "Does the variation in synoptic conditions mean that a transect along 20S is only meaningful during certain weather periods? How varied would the three "zones" be if synoptic conditions were at their extremes?" Providing some idea of the boundaries associated with the limits of the zones would make their designations even more meaningful.

### Specific Comments

1. pg 685, Ln 16: What do the authors mean by "models still simulate marine stratocumulus cloud field.. poorly"? It would help motivate the work better by explicitly stating (if known!) what the models do poorly, assuming that the current work specifically targets those specific problems. This is an important part of the contribution of the entire VOCALS study, and the authors should take the credit they deserve for moving the field forward.

2. pg 685, Ln 25: A map of AOD from the VOCALS study period is available in Fig.1 of Hawkins et al., 2010. This may prove useful as a visual aid to the authors, and they may wish to reference this figure in their description of the study region.

3. pg 691, Lns 8-10: This collection efficiency for sulfate is also in line with measurements on the RHB comparing IC and AMS, see Hawkins et al., 2010.

4. pg 692, Lns 27-28: Again, Hawkins et al., 2010 IC/AMS comparison could be referenced here. It may become important to point out that a collection efficiency of less than 1 was observed for AMS organic mass on the RHB, although the source of organics in the FT may not be the same as that in the MBL, resulting in a higher CE for FT organics.

5. pg 702, Lns 8-10: This sentence is a little confusing, since you have "more variable" contrasted with "more diverse." Do the authors mean that east of 74W the pollutant sources are local and understood, but that the quantity varies, while west of 74W there are many pollutants which are transported long range? Consider rephrasing to clarify.

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6. pg. 702, Lns 14-15: This was not entirely true from the RHB measurements of radon and PM1. Some locations were revisited at the end of November having much lower loading than one month prior. See Hawkins et al., 2010.

7. pg 702, Lns 26-29: The zones are roughly in agreement with the "sectors" presented in Hawkins et al., 2010 which are supported by shipboard measurements of radon. However, the ship did encounter air masses with varied levels of continental influence at the same location (on different dates), indicating that synoptic conditions also contribute significantly to continental influence, and not just location.

8. pg 708, Ln 8: Hawkins et al., 2010 report a stronger correlation between radon and FTIR OM than radon and AMS sulfate, and a strong gradient in OM was observed. The authors should be careful when using AMS organic measurements to keep in mind that a CE less than 1 when compared to filters.

9. pg 709, Ln 20: Although the AMS was unable to see a difference in organic functionality, FTIR measurements were able to (Hawkins et al., 2010). Marine-like organics (sugar-like) were observed at relatively higher levels in the remote ocean than near shore, where fossil fuel combustion like organics were more prevalent. Since organics were near the DL of the AMS, it may be difficult to use the spectra to interpret organic functionality. In addition, single particles collected on board the Brown identified several distinct types of marine generated OM (Hawkins et al., 2010b).

#### Technical Comments

1. pg 683, Ln 1: For consistency with the other VOCALS project papers and material, the "C" in VOCALS should be for "Cloud" instead of "Climate"

2. pg 683, Ln 2: The manuscript title has "Southeast" but the short title and references in the text have "South East." One should be selected for consistency.

3. pg 683, Ln 11: insert "concentrations" between "dioxide" and "were"

4. pg 683, Ln 13: Gradients in what? It would be more clear to say "Gradients in XX

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are observed..."

5. pg 684, Ln 21: omit "to be"

6. pg 686, Ln 16: see comment #1

7. pg 687, Ln 8: consider using "research vessel" instead of "cruise ship"

8. pg 688, Ln 4: "85 S" should be "85 W"

9. pg 688, Ln 6: I'm not sure why SW was used instead of just W, as in other uses in the manuscript. Correct if not intended.

10. pg 691, Ln 23: hyphenate C-130

11. pg 692, Ln 8: replace "0.15 mm" with micrometers, if correct.

12. pg 694, Ln 15 and 22: add reference to Hawkins et al., 2010 for RHB aerosol measurements during VOCALS, especially for the FTIR organic mass measurements.

13. pg 708, Ln 3: add reference to Hawkins et al., 2010 for RHB aerosol measurements, including detailed organic aerosol composition.

14. pg 711, Lns 18-23: run on sentence, consider splitting up.

15. pg 714, Lns 13-19: run on sentence, consider splitting up.

#### Figures/Tables

1. Table 2, add reference to Hawkins et al., 2010 for RHB measurements

2. Figure 6: In other figures, the coast is in red. In this figure, it's blue. It would be best to maintain one scheme for all figures, for clarity. Also, it's hard to tell the closed circles from closed squares. Is there another symbol that can be used?

3. Labels on many figures are very tiny.

4. Figure 9: Caption should include description of solid and dashed lines (they are in

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the text, but would be helpful here as well).

5. Figure 10: Axis labels on top panels are smaller than others.

6. Figure 11: Figure order/letter does not coincide with caption description. They look out of order.

7. Figure 13: Left and right panels are switched relative to caption.

## References

Hawkins, L. N., L. M. Russell, D. S. Covert, P. K. Quinn, and T. S. Bates (2010), Carboxylic acids, sulfates, and organosulfates in processed continental organic aerosol over the southeast Pacific Ocean during VOCALS-ÅŒREx 2008, *J. Geophys. Res.*, 115, D13201, doi:10.1029/2009JD013276.

Hawkins, L.N. and L. M. Russell, (2010b), Polysaccharides, Proteins, and Phytoplankton Fragments: Four Chemically Distinct Types of Marine Primary Organic Aerosol Classified by Single Particle Spectromicroscopy, *Advances in Meteorology*, Article ID 612132, doi:10.1155/2010/612132.

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