Atmos. Chem. Phys. Discuss.,
https://doi.org/10.5194/acp-2019-133-RC1, 2019

Atmospheric Chemistry and Physics Discussions

Interactive comment on "Characteristics of biogenically-derived aerosols over the Amundsen Sea, Antarctica" *by* Jinyoung Jung et al.

Anonymous Referee #4

Received and published: 22 March 2019

Aerosol and seawater samples were collected and analyzed during a cruise over the Southern Ocean and Amundsen Sea polynyas in this article. Aerosol compositions, specifically MSA, nss-sulfate, WSOC, WIOC and sea salt (represented by Na+), are reported and their spatial and temporal behaviors are investigated with environmental factors influencing their distributions. WSOC was also analyzed by fluorescence excitation-emission matrices to elucidate its sources.

This work presents a unique data set of atmospheric and seawater measurement in west Antarctica region and shows some interesting results, such as the domination of biogenically-derived nss-sulfate in the Amundsen Sea, strong correlations between OC enrichment on sea salt particles and DOC concentration in the Amundsen Sea, and different biological processes that could account for WSOC and WIOC formation.

I will support the publication of this manuscript if the authors can properly address the following comments.

Major Comments:

In section 3.6, the authors attributed the negative correlation of the wind speed and WSOC/Na+ and WIOC/Na+ to sea surface micro-layer coverage, suggesting that lower wind speed led to higher sea surface micro-layer coverage and higher OC enrichment on sea salt particles. I am not sure if this is clearly supported by the measurements. In order to come to this conclusion, WSOC and WIOC could only be exclusively ocean-generated and internally mixed with sea salt particles. This is not directly supported by the measurements since the particle mixing state was not presented in this study. The correlation of DOC concentration in sea surface micro-layer to wind speed (Figure 7e and Figure 7f) is too weak to account for the strong negative correlation of the wind speed and WSOC/Na+ and WIOC/Na+ (Figure 7c and Figure 7d). The most intuitive reason of this wind dependence of OC to sea salt ratio is that wind speed is higher in the Southern Ocean and thus more sea salt particles were emitted from the ocean whereas OC is not as strongly affected by wind as sea salt. According to section 3.7, WSOC and WIOC are from secondary and primary sources, respectively, yet their ratio to sodium showed a somewhat similar trend against wind speed in Figure 7c and Figure 7d. This probably means that sodium, instead of OC, was more sensitive to wind speed changes.

Minor Comments:

1. P2 Line 11- P3 Line 5: These two paragraphs are about marine and biological CCN. Not sure such a detailed introduction is needed since CCN is mentioned in only section 1 and not discussed in later sections.

2. P9 Line10-16: Since there are only 14 samples (or in this case 9 samples), removal of outliers needs better discussion. Please specify how "the highest mean wind speed" affects DMS flux and possibly provide either reference or calculation.

3. P9 Line 28: "the variation trend of " Can the authors provide correlation coefficient?

4. P11 Line 12: "somewhat overestimated... showing negative values" Can the authors discuss possiblities causing this overestimation?

5. P11 Line 14: "variation trend" Again consider show correlation coefficient.

6. P 17 Line 7: "negatively correlated with the relative biomass of P. antarctica ($r = 0.79$, $p < 0.05$)" Should be "-0.79" if using the Pearson correlation coefficient. Otherwise, the authors should specify the sign. This also applies to some other place where r is less than 0 including some of the figures.

7. P18 Line 18: Consider citing this article (Bromwich et al., 2013).

Editorial Comments:

1. P4 Line 20: "Procedural blanks (n = 4)..." Change to "Four procedural blanks..."

2. P13 Line 15:" reflecting that Na+ was formed from bubble by local wind speed. " Delete "speed".

3. P16 Line 15-16:" our results strongly suggested that the submicron WSOC observed in the Amundsen Sea might be formed..." Remove "might"

4. Figure 8c: Check unit

References

Bromwich, D. H., Nicolas, J. P., Monaghan, A. J., Lazzara, M. A., Keller, L. M., Weidner, G. A., and Wilson, A. B.: Central West Antarctica among the most rapidly warming regions on Earth, Nature Geoscience, 6, 139-145, 10.1038/ngeo1671, 2013.

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