We thank Reviewer #1 for his in-depth analysis and detailed comments on our work, allowing us to revise and improve the manuscript. All critical points raised have been considered and addressed/discussed as detailed in this document (blue). Every indication of lines and/or pages refer to the originally uploaded manuscript.

1. On page 2, line 65, ‘400-600 Tg C yr-1; (Arneth et al…’, Delete, ‘(’.

   Done.

2. On page 2, line 66, ‘plays an important role in the chemistry there…’, it is recommended to revise 'there' to ‘locally’.

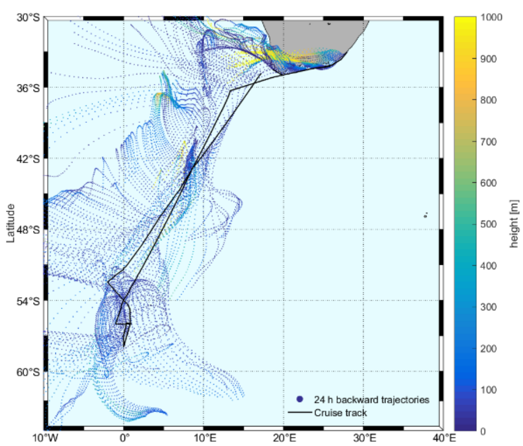
   Thanks for pointing that out. Changed to “locally”.

3. On page 3, line 71, it is recommended to delete ‘subsequently’.

   Deleted.

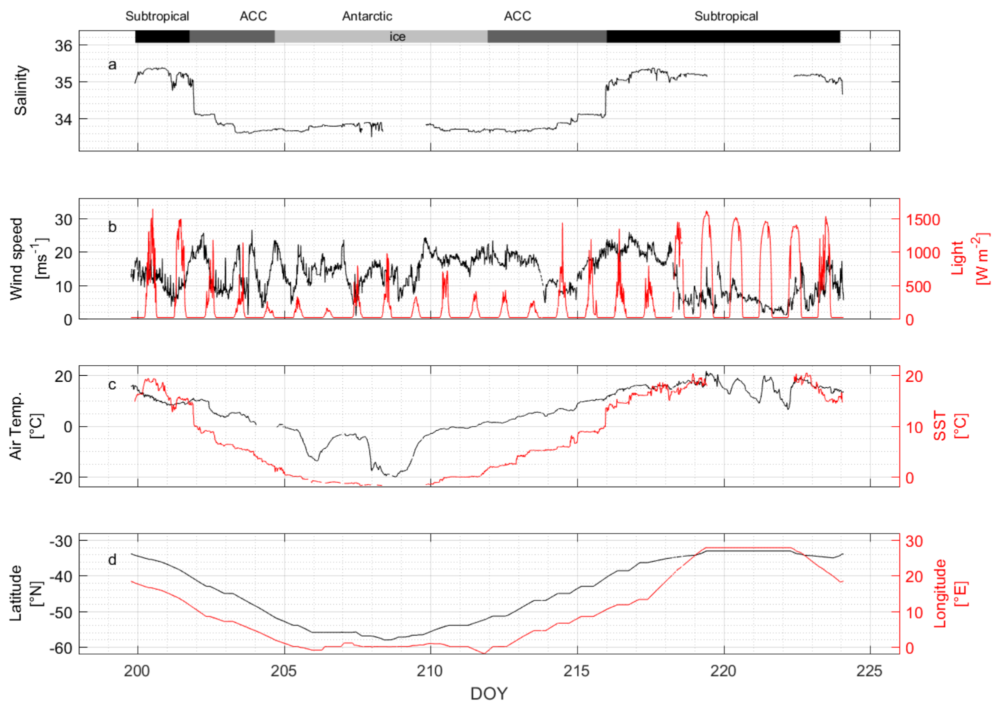
4. On page 5, for Figure 1(right), the cruise track is not clear. Please revise it.

   We revised Figure 1 by using a bold line for the cruise track.



5. On page 10, I suggest combining Figure 3(d) and (e).

   We combined figure 3 (d) and (e). It will look as follows in the manuscript:



6. The descriptions of isoprene are much shorter than those related to DMS in the manuscript. However, the data of surface water isoprene during the winter season of the Southern Ocean was possibly reported for the first time. It looks like the isoprene is not important.

   Isoprene is not unimportant, but earlier studies determined that seawater isoprene concentrations were low and did not further study the compound. Subsequent studies have shown that marine isoprene may have an impact on climate (e.g. Shaw et al., 2010, Bonsang et al., 1992), which has led to renewed interest in marine isoprene. Our first observations of isoprene in the winter are very important for characterizing the seasonal cycle of isoprene emissions based on observations. Our discussion of isoprene is less than that of DMS, because we did not measure isoprene precursors and related substances. We made the following changes to the manuscript in order to highlight the importance of isoprene surface measurements:

   Page 21, line 493: "The results of measurements in the surface ocean during the stormy and mostly dark winter season in the Southern Ocean will be valuable for future atmospheric aerosol chemistry model studies, as they will not need to rely any longer on pure assumptions."

   We think the importance of isoprene is highlighted in the conclusions already. Nonetheless, we started a new paragraph in line 547 to address isoprene only and separating it from DMS, in order to emphasize the importance of isoprene.

7. I am curious about the amount of trace gas emission during the winter season of the Southern Ocean. Is it possible to estimate it. And how?

Yes, it can be estimated by multiplying the calculated trace gas fluxes in the manuscript by the number of days in winter and the sea ice-free area of the Southern Ocean, assuming a uniform set of concentrations and wind speeds. These assumptions are of course not true, so the scaled-up estimate of winter season emissions is uncertain and should be used with caution. Nonetheless, we can get an idea of the scale. The scaled-up amount of DMS and isoprene emitted during winter in the Southern Ocean are calculated to be 0.013 Tg S and $0.39*10^{-3}$ Tg C, respectively. Compared with the annual mean emissions south of 60°S of 1 Tg S (Lana et al., 2011), winter emissions account for about 1.3% of the annual DMS flux in the Southern Ocean. As these were the first winter time measurements of isoprene in the Southern Ocean there is no published value directly to compare to. In comparison to global annual emissions of 0.21 Tg C, calculated by Booge et al (2016), winter time isoprene emissions account for ~0.2% of global annual emissions.

8. During the winter season of the Southern Ocean, the oxidation of trace gases is known to be slow under the dark and cold atmosphere. It means that the particle formation from the trace gases is not that easy. Could the authors comment on the role of trace gases in influencing the climate during the winter season of the Southern Ocean?

   The reviewer is correct that radical concentrations such as OH, NO_3, BrO may not be significant in the dark and cold winter due to weak solar radiation in the Southern Ocean. The oxidation of trace gases is slower than in warm conditions with sufficient light. However, even if suppressed, trace gas emissions from the Southern Ocean during winter time could potentially affect the climate. Because DMS and isoprene are readily emitted into the atmosphere, they may accumulate in the winter troposphere due to a longer lifetime. The existence of this build up and its potential effect through transport and when the sunlight turns on in spring is unknown. The relationship between oxidation products (e.g., aerosols and clouds) in all seasons must be established if we want to fully understand the natural atmospheric background. Therefore, despite low reactivity, observations of all components of the air-sea system are needed in the winter as well as the summer season.

References

Bonsang, B., Polle, C., and Lambert, G.: Evidence for marine production of isoprene, Geophysical Research Letters, 19, 1129-1132, https://doi.org/10.1029/92gl00083, 1992.

Booge, D., Marandino, C. A., Schlundt, C., Palmer, P. I., Schlundt, M., Atlas, E. L., Bracher, A., Saltzman, E. S., and Wallace, D. W. R.: Can simple models predict large-scale surface ocean isoprene concentrations?, Atmospheric Chemistry and Physics, 16, 15, https://doi.org/10.5194/acp-16-11807-2016, 2016.

Shaw, S. L., Gantt, B., & Meskhidze, N.: Production and emissions of marine isoprene and monoterpenes: a review. Advances in Meteorology, 408696, https://doi.org/10.1155/2010/408696, 2010.