

Biogeosciences Discuss., referee comment RC1
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Comment on bg-2022-106

Anonymous Referee #1

Referee comment on "Winter season Southern Ocean distributions of climate-relevant trace gases" by Li Zhou et al., Biogeosciences Discuss.,
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The investigations about the climate-relevant trace gases, such as DMS and isoprene, during the winter season of the Southern Ocean are still insufficient. Current knowledge about the distributions and sea-to-air fluxes of DMS and isoprene during the winter season of the Southern Ocean is also limited. In the modelling studies, the concentrations and fluxes of trace gases in the winter season of the Southern Ocean were usually considered to be very low. However, it is difficult to achieve field observation data to support this conclusion. The manuscript entitled "Winter season Southern Ocean distributions of climate-relevant trace gases" mainly introduced the dimethyl sulfide (DMS and related sulfur compounds) and isoprene surface water data obtained from the Atlantic sector of the Southern Ocean during the winter season (August 2019). The distributions and fluxes of trace gases during the winter season of the Southern Ocean were analyzed. Undoubtedly, the findings in this manuscript provided valuable information for the modelling studies and improved our understanding of trace gases in the polar regions. Thus, I believe that this manuscript is worth being published in the Journal of Biogeoscience after a minor revision. My comments and suggestions are attached as follows.

Minor comments:

- On page 2, line 65, '400-600 Tg C yr⁻¹; (Arneeth et al...', Delete, '('.
- On page 2, line 66, 'plays an important role in the chemistry there...', it is recommended to revise 'there' to 'locally'.
- On page 3, line 71, it is recommended to delete 'subsequently'.
- On page 5, for Figure 1(right), the cruise track is not clear. Please revise it.

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