

# ***Interactive comment on “Satellite observations of new phytoplankton blooms in the Maud Rise Polynya, Southern Ocean” by Babula Jena and Anilkumar Narayana Pillai***

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We are thankful for your constructive comments and suggested additional analysis that helped to improve the quality of the manuscript.

Reviewer's suggestion 1: I would like to give some comments on this article which reports evidence of new phytoplankton blooms and its causative physical mechanism. Firstly, I would suggest to make modification 'unprecedented bloom' instead of new bloom'.

Authors: Yes, we do agree that 'unprecedented bloom' is appropriate than the 'new

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bloom'. We will make change as per your suggestion.

Reviewer's suggestion 2: The study demonstrates how the phytoplankton over the shallow bathymetric region of the Southern Ocean would likely respond in the future under a warming climate condition and continued melting of Antarctic sea-ice. The authors did a very good work combining variety of remote sensing satellite sensors, Bio-ARGO and reanalysis products.

Authors: Thanks for the appreciation. We have used the available dataset to report the unprecedented phytoplankton bloom. And, the study demonstrates how the recent melting of Southern Ocean sea-ice can have impact on the phytoplankton biomass over the shallow bathymetric region.

Reviewer's suggestion 3: The authors states that the occurrence of phytoplankton bloom over the shallow regions of Maud Rise seamount where the doming of isotherm/isopycnal brings deeper high nutrient water above the seamount where it may be utilised with a conducive environment of light availability. Why the salinity data is analysed in this case? I suggest the authors to look into the salinity data in the ARGO profiles because the melting of sea-ice leads to the development of shallow mixed layer. It is expected to get low salinity values with increased stability of the water column (generate the stability map). It is required to demonstrate the temperature, salinity, mixed layer profiles, and stability map from ARGO depicting extended features.

Authors: Thank you so much for your constructive suggestions that helped to improve it further. We have carried out the analysis for temperature, salinity, density, mixed layer and water column stability as per your suggestion (attached: Figure S7). We will include the results in our manuscript after the decision. ARGO float indicated mixed layer warming on the Maud Rise during spring 2016 and 2017 (Figure S7a). The upwelling of high saline and warm water into the mixed layer facilitated the sea-ice melting. The melting of sea-ice leads to the development of shallow mixed layer due to the accumulation of freshwater in the upper ocean. Therefore, we observed lower

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values of salinity in the mixed layer with increased stability of the water column (Figure S7b-c) and enhanced phytoplankton biomass.

Reviewer's suggestion 4: Otherwise, the reported event is a rare event, and likely to be occurred in the future under a warming environment. The readers will learn something new in this manuscript and has worth to report.

Authors: It's a rare event and likely to be reoccurred. We strongly agree and believe that it has worth to report.

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Interactive comment on The Cryosphere Discuss., <https://doi.org/10.5194/tc-2019-282>, 2019.

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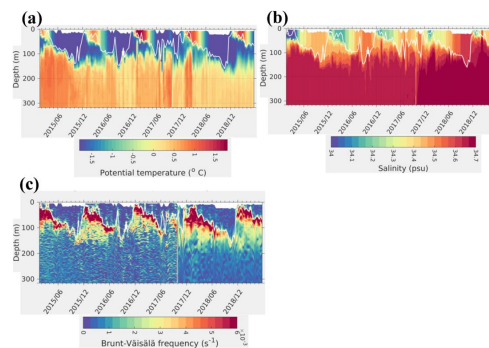


Figure S7. ARGO float (id-5904468) on the Maud Rise showing (a) potential temperature, (b) salinity, and (c) static stability of the upper ocean. White solid line in each panel shows the variability of mixed layer depth.