Dear Editor,

Thank you for your helpful comments. Below are our responses. The original comments are in black, and our responses are in blue. The changes made in the manuscript are also marked in blue.

We look forward to hearing back from you.

Best regards,
Shuang-Ye Wu

Comments to the Author:
This revised manuscript is much clearer and the revisions have addressed many of the reviewer comments. After reading the paper I do think there are some additional issues that remain to be addressed, listed below. The most substantive comment is the last one, concerning separation of the observation of weak association of icebergs with NPP from hypotheses about functional relationships.

1) On page 6, lines 10-15, the F test for linear trend in iceberg changes is mentioned. Although the F test is fairly standard a reference here would be helpful.
The following reference is added:
Lomax, Richard G. (2007). Statistical Concepts: A Second Course. p. 10. ISBN 0-8058-5850-4.

2) In the tables, where means are presented, and p values given, a measure of uncertainty in the means (for example 95% confidence interval) should also be given - really, for all reported statistics in this paper the confidence interval should be given. Where p values are given the test these are relevant to should be mentioned in the figure caption as well.
Standard errors are calculated for the mean values and added to the tables and in the paper to indicate the uncertainty. Statistical tests are added as notes for all p-values reported in the tables.

3) On page 6, lines 29-31, NPP differences between cells with and without icebergs are discussed for seasonal data. Although there are differences they are very small, are these really important?
Seasonal NPP differences between cells with and without icebergs are discussed on page 7, lines 25-31. Although the differences are small, they have seasonal variations. The differences are usually larger in the productive months (October – March), averaging 7-10%, reaching 15-20% in some months in some zones. We believe that this difference is not insignificant, and the seasonal and zonal variation are important patterns. Therefore, we decided to keep the original discussion.

4) Page 10, lines 20-26. This section starts by saying that the general enhancement of NPP near icebergs is consistent but then says that the small iceberg effect in the CSZ is not significant. These seem contradictory statements to me. The large iceberg effect in the PFZ also seems to be ignored in this section, and then the section ends by saying the data may be too coarse. So, I am the first sentence of this section seems at odds with its remainder - and my suggestion is to reword the first part unless you really feel you can demonstrate a consistent enhancement.

We reworded the first sentence as follows:
"Enhanced levels of NPP are often found with both small and large icebergs, although their zonal response is different."

5) Page 10, lines 28-32. Significance is repeated several times here, this could be reworded.
These lines has been reworded as follows:
"Over the period of 1992-2014, the amount of small icebergs has a rather notable increasing trend (Figure 7). Annual iceberg volume increases at 2.6% per year, and iceberg frequency increases at 4.7% per year. Both trends are statistically significant (Table 5). Iceberg amount increases the most for the period 1992-2004, and decrease slightly since then. In particular, there seems to be a period of rapid increase in the first half of the 2000s. Large iceberg frequency, measured as the mean annual number of grids occupied by large icebergs, follows a similar increasing trend (Figure 8) at 7.09% per year (Table 6)."

6) Page 11, line 5, type "ad"
"ad" is changed to "and".

7) Page 11, line 11-12. This sentence seems to be saying that because icebergs did not change much then it is not surprising that NPP did not change? But the alternative hypothesis is that icebergs don't matter to NPP, or that other things were affecting NPP, given that the relationships presented elsewhere in the paper are not that strong. I think this could be reworded, perhaps to say that if icebergs are important to NPP then it is not surprising that a trend in NPP was not found.
This has been reworded as suggested:
"If icebergs play an important role in enhancing the SO NPP, it is probably not surprising to see the lack of any observable trend in the total NPP of the SO for the data period of 2002-2014 (Figure 9), given the slight negative to no trends in iceberg presence for the same time period."

8) Page 12, line 26-29. It is first stated that in general grids with more icebergs have high NPP but then an exception (the CSZ) is noted. "In general" implies to me a consistent pattern, rather than one with clear exceptions, so I suggest rewording.
The sentence has been reworded:
"We found that in many places grids with iceberg presence have higher NPP than those without icebergs."

9) In the conclusions section I am concerned about concluding there is a functional relationship between icebergs and NPP based on the correlations in the data. Reviewers also brought this up. For example, the statements that "Therefore, icebergs, large and small, have an observable positive impact on ocean NPP at the SO scale" and that that icebergs might provide a negative feedback to warming imply that the data presented here prove there is a functional relationship, but as I understand what they show is there is a statistical association, mostly fairly weak. Readers who do not look carefully at the data in the paper may draw the wrong conclusion from these statements so I suggest some revision is needed to carefully separate the observations from hypotheses about what they mean. There are similar statements in other places in the manuscript.

In the revised manuscript, we reworded our conclusion to tone down any suggestion of "functional relationship" between icebergs and NPP. For example, in many places, we replaced the word "impact" with "association". The revised conclusion is as follows:

"This study aims to examine whether icebergs have a significant impact on the ocean NPP at the scale of the SO. Through using remote sensing data, we examine the impacts of both small and large icebergs on the ocean NPP. We divided the SO into four ecological zones based on their different nutrient source and profile. For small icebergs, we compared NPP for grids with and without iceberg presence within each zone. We found that in many places grids with iceberg presence have higher NPP than those without icebergs. However, the impact is not uniform. In the CSZ where high level of iron is supplied through glacial meltwater and sediment input from the continent and continental shelf and phytoplankton growth is largely limited by macronutrients, the presence of icebergs does not seem to have any impact on the ocean NPP. On the other hand, Iceberg presence is associated with significantly higher NPP values in the HNLC regions. The NPP of grids with icebergs is 21% higher than those without in the SIZ, and 16% higher in the POOZ. Direct correlation between iceberg frequency and NPP is weak although statistically significant. Strongest correlation is found at the SIZ, which contains over 70% of the icebergs by volume. For large icebergs, we examine the average NPP of iceberg occupied grid cells, immediately adjacent cells, and nearby cells that are further away. We found that NPP of iceberg cells and adjacent cells is on average 10% higher than NPP of nearby cells. The positive impact of large icebergs is stronger in high latitude zones of the CSZ and the SIZ, where most of them occur. Therefore, icebergs, large and small, have an observable positive association with ocean NPP at the SO scale. For the entire period of the iceberg data, 1992-2014, both large and small icebergs have shown significant increasing trends. The increase is most rapid during the first half of 2000s, and levels off since then. For small icebergs, the increasing trend is most notable for the Pacific and Indian sections of the SO, whereas the Atlantic section of the SO shows no statistically significant trend. This could be related to the greater mass loss of the West Antarctica Ice Shelf, and the relative stability of the East Antarctica Ice Shelf under present climate change. The sectional trends are different for large icebergs, which increase significantly for the S. Atlantic and S. Indian sections, but remain relatively unchanged in the S. Pacific section of the SO. The very low frequency of icebergs in the S. Pacific section of the SO makes it harder to detect any trend. However, the exact mechanism that accounts for the difference in sectional trends between small and large icebergs remains unclear. As the climate continues to warm, the Antarctic Ice Sheet is expected to experience increased mass loss as a whole, which could lead to more icebergs in the region. Based on the positive association between icebergs and NPP shown in this study, this could result in higher level of NPP in the SO as a whole, providing a possible negative feedback for global warming."