

## Author response to Reviewer #3 comments:

Reviewer comments are in black, and our responses are in red.

# Review for "Linking northeastern North Pacific oxygen changes to upstream surface outcrop variations"

## Overall

The authors focused on investigating the temporal variability of subsurface DO at the center of the eastern subarctic gyre (OSP), and the linkages to the surface density variabilities in the western subarctic gyres.

The OSP has been maintained for the longest periods in the global ocean, the partially updated description was variable.

The mechanisms of the DO changes shown in this work seemed to be raised in the previous studies, but the relationships between outcrop areas and subsurface DO changes were shown clearer in this study. In addition, the authors seemed to intend to describe carefully with comparison with previous studies and the other observations.

So I believe this work helps many researchers to understand variabilities in the northern North Pacific deeply, thus it's worth publishing after minor changes.

Thank you for the thoughtful comments. Below we provide responses to the two points raised and how we would address them when revising the manuscript (if invited to do so).

Specific points.

1. The outcrop areas in the western subarctic gyre were broads especially around the periods of maxima. So all the points of the areas did not directly contribute to the DO variability. And it took some years to transfer the anomalies formed by the outcrop area changes even in the western subarctic gyres (e.g., Sasano et al., pointed out).

This may cause the transit time differences based on geostrophic currents and the lags outcrop areas and OSP DO changes.

I think this is worth to add discussions.

Thank you. We will add references to Sasano et al. (2015, 2018) to the discussion of transit times, highlighting their findings that more than one process is affecting the O<sub>2</sub> cycles in the northwestern as well as northeastern North Pacific.

2. In the previous study (Kouketsu et al.; <https://agupubs.onlinelibrary.wiley.com/doi/full/10.1029/2019JC015916>), the figure similar to Figure A3b was shown. And they analyze transfer the salinity anomalies from west to east, and showed the relationships nitrate changes. They discuss the changes transferring western subarctic gyres may transferring east of OSP, which seemed to be related to discrepancy between GO-SHIP and OSP changes pointed out in this study.

So I think it's worth citing in this study.

Thank you for the comment. We apologize for not including a reference to Kouketsu et al. (2020) who also show the 2014–2007 difference of O<sub>2</sub> along the P1 section among other properties (their Figure 4b). We will add a citation to that paper and include discussion of their analysis when addressing differences between GO-SHIP sections and OSP.

**Citation:** <https://doi.org/10.5194/bg-2023-132-RC3>