

## **Response to reviewer's comments**

**I appreciate the constructive comments from the reviewer to improve the manuscript. Below, I respond to each comment with the original comments copied in black font and my responses in blue.**

The paper by Du al. compares eight gridded dissolved oxygen products to assess global dissolved oxygen climatology, annual cycle and oxygen minimum zone (OMZ) representation. This is timely and useful contribution for the oxygen community. A multi-product comparison of this kind is much needed and valuable.

The focus on both climatology and annual cycle is worthwhile, and the effort to define common comparison metrics through GODIP-DO is a strong point. In my view, the manuscript is strongest as a descriptive intercomparison. It is less convincing when it moves toward explaining why products differ, or when it comes close to treating product spread as formal uncertainty estimate.

The main findings are clear: the global mean vertical oxygen structure is broadly similar across products, while local upper-ocean differences can be much larger.

My main concern is that the manuscript sometimes over-interprets what this study design can support. The products differ in their source observations, quality check, bias correction, mapping approaches, resolution, mask and climatological periods. The study is therefore well suited to attributing those differences to a specific cause.

The manuscript acknowledges this point, but not consistently enough throughout.

Thank you for the constructive comments. Yes, this study aims to comprehensively assess the differences among eight O<sub>2</sub> climatological data products within the framework of GODIP-DO. We can only provide some potential reasons for the differences, with the specific reasons requiring further study, as in Ito et al. 2025, where a common input experiment is conducted. The “uncertainty” can not be derived from this study because it is poorly defined by the ensemble spread of either product. According to this suggestion, we have refined the manuscript carefully and clarified which conclusions are directly supported by this study and which need further investigation.

## Main issues

- The abstract states that the intercomparison “allows assessing the robustness of uncertainties through the spread of products”, and in the conclusion presents the results as a starting point for resolving the uncertainty budget. That is reasonable at a broad level, but the wording needs to be more careful. What the paper really quantifies is inter-products spread or product disagreement, not total uncertainty in a formal sense.

Thank you for this comment. We have modified the last sentence of the abstract as ‘ Our results help to depict and understand the spread among the available O<sub>2</sub> gridded datasets’ and also refined the wording in the conclusion section accordingly.

## Some comments

- The annual cycle section seems weaker than the climatology section, and could be discussed more in the text.

Thank you for the comment. More discussions of the annual cycle, based on the zonal mean distribution of Apparent Oxygen Utilization (AOU), and a new figure for the four monthly climatological data products have been added to the manuscript following Fig. 9 (zonal mean annual cycles of O<sub>2</sub> anomaly).

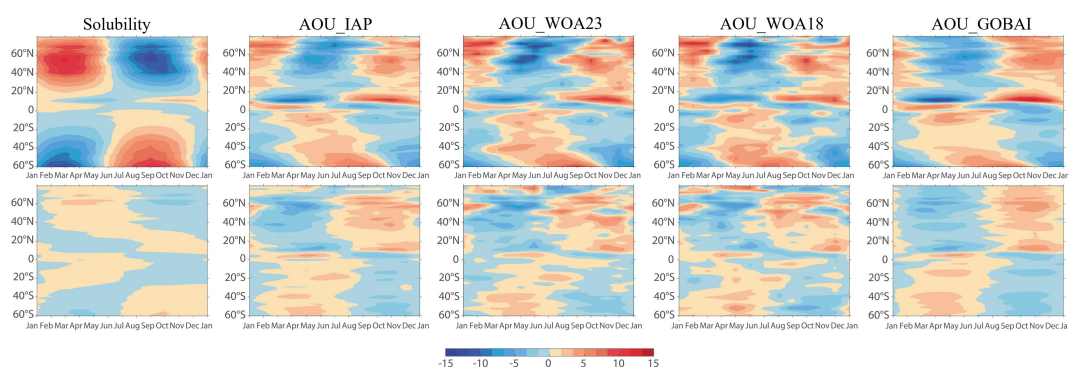


Figure 10 Zonal mean annual cycles of the solubility and AOU anomaly of different data products for 0-100 m (upper) and 100-600 m (lower) (unit:  $\mu\text{mol kg}^{-1}$ ).

- There is also a coverage mismatch across products. Some extend only to 2000 m, while others reach deeper; some provide annual climatology only, whereas others

include monthly fields. The authors do point this out, but the implications for comparability should be discussed more explicitly, especially for the OMZ analysis.

Thanks for the comment. The monthly/annual climatologies for different data products are introduced in Lines 135-137. And only the four monthly climatologies (IAP, WOA18, WOA23, GOBAI) are included in the annual cycle intercomparison (Lines 326-327). For the OMZ analysis, we calculated the total volume of OMZ60 and OMZ90 globally and for each basin using the climatologies with depths of 5500/6000m, excluding GOBAI and SJTU because their maximum depth only reaches about 2000 m below the ocean surface, as explained in Lines 440-442. In the analysis section of OMZ areas versus depth levels, the following discussion is added as suggested to explicitly point out the depth coverage difference across products: ‘So that all the climatologies, including GOBAI and SJTU with the maximum depth of 2000 m could be involved in the analysis of OMZ areas at depth levels.’.

- The handling uncertainty remains descriptive. I would encourage the authors to be more precise in how they frame product disagreement. As noted above, the paper measures inter-products spread, not uncertainty in a formal sense.

Thanks for the comment. We have removed or modified most of the descriptions about ‘uncertainty’ because we agree that inter-product spread is not a good quantification of the uncertainty.

- At times, especially in the conclusion, the manuscript moves too quickly from descriptive comparison to causal explanation. For example, the statement that discrepancies “...could give an insight into regions where the accuracy of gridded data reconstruction is relatively more sensitive to the mapping method and observation data distribution...” is stronger than the analysis allows. This comparison does not isolate the effect of mapping method or observation data distribution, since products differs in several ways at once. I would suggest softening this kind of language. More generally, the final paragraph is trying to look ahead, but it becomes somewhat generic. I think the paper would end more strongly by saying that it establishes a baseline descriptive benchmark, while

controlled intercomparisons are still needed to partition the causes of spread, especially in regions with strong gradients and sparse observations.

Thanks for the comment. The statement of causal explanation in the conclusion part has been softened as suggested: ‘Substantial local differences (25  $\mu\text{mol kg}^{-1}$  for the upper 1000 m climatological mean) can be seen, which could influence the baseline from which anomalies and trends are calculated and could give an insight into regions that are relatively more sensitive in the process of gridded data reconstruction’.

And the last paragraph in the conclusion section has been modified as suggested: ‘The overall spread across products results from all uncertainty sources (e.g., measurement errors, mapping errors, different time periods, etc.). Controlled intercomparisons that isolate each error source are needed in the future to understand the contribution of a single factor, especially in regions showing a large spread. It will eventually help the community to improve the methodologies and reduce the spread in the future. Another caveat is that only a limited number of products are included in this inter-comparison. We hope to maintain and extend this activity in the future and serve as a regular intercomparison exercise to provide critical information to the data users.’ Overall, the main revision need is not the dataset comparison itself, which is useful, but a tighter framing of what the study can and cannot infer.

We have carefully revised the expressions in this study to focus on establishing a description of inter-product differences, and we also expect a careful investigation of error sources in the future through controlled intercomparison experiments.

Some wording comments:

- Line 509:” by its depth-mean spatial distribution” is awkward and should be rephrased.

Thanks for the comment. It has been rephrased as ‘Substantial local differences (25  $\mu\text{mol kg}^{-1}$  for the upper 1000 m climatological mean) could be observed between data products.’.

- Lines 527-528: “serve as a regular practice” would read better as “serve as a regular intercomparison exercise”.

Thanks for the suggestion. The content here has been modified as suggested.