

## ***Interactive comment on “GLODAPv2.2020 – the second update of GLODAPv2” by Are Olsen et al.***

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### **### Short summary**

The authors present an update of the GLODAPv2.2019 data product, by adding new data from 106 cruises. Before addition, observations of 12 core variables have undergone a primary (f flag) and secondary (qc flag) quality control. The secondary quality control is based on the comparison of new data with those contained within GLODAPv2.2019. Adjustments were - if necessary - applied to the new data, in order to correct for biases between measurements from different cruises, but preserve temporal trends in the variables. The merged data product includes observations from 946 cruises and extends until 2019.

### **### General comments**

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The overall quality of this data product and its description in the companion manuscript appear very high. I have no general comments which would require a revision of fundamental aspects of the data set as a whole. The updated product GLODAPv2.2020 is an invaluable contribution for the scientific community and an essential prerequisite to reach the stated goal of documenting “the state and the evolving changes in physical and chemical ocean properties, e.g., the inventory of the excess CO<sub>2</sub> in the ocean”. This review is written from the perspective of a new user of the product.

### ### Specific comments

Following specific issues were identified and might (if taken into account) require a revision of some aspects of the data product:

-I.412: “Neutral density was calculated using Sérazin (2011).” It should be noted that the reference given here refers to a master thesis and that the proposed polynomial approximation of neutral density in this thesis has not undergone peer review. Furthermore, polynomials were fitted to a preliminary neutral density data set with known issues (pers. comm. P. Barker and G. Sérazin). To take those limitations into account, the computed density variable gamma could either be revised, removed or labelled as preliminary in the main text.

-It might be helpful for some users if the f flag value would distinguish between interpolated and calculated values.

-I.190: It is stated that “not all offsets larger than the initial minimum limits have been adjusted for. . . . Conversely, in some cases where data and offsets were very precise and the cruise had been conducted in a region where variability is expected to be small, adjustments lower than the minimum limits were applied.” I was wondering whether at all an initial minimum adjustment limit needs to be defined and what the added value of this definition is. Would it be possible to define an offset-to-precision ratio that could rigorously be applied to all decisions?

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-I.249: An adjustment of  $-3 \mu\text{mol kg}^{-1}$  was applied, although an offset of  $3.68 \pm 0.83 \mu\text{mol kg}^{-1}$  was found. Is this difference intentional? What is the general rule on how the adjustment values are set?

### ### Technical corrections

Following comments address the presentation of the data product, and cover also aspects that are not purely technically:

-The presentation of the flagging scheme could be improved, aiming at clarity from a user perspective. Taking table 2 as an example, it confused me that labels 0-9 are presented, whereas the data product only uses f flag values 0, 2, and 9. Readers currently need to refer to footnotes in column “Merged product files” to find out that WOCE flags 6 and 7 were set to 2, whereas 3, 4, 5, and 8 were set to 9. Furthermore, the term “Not used” might add to the confusion, as it can easily be misinterpreted as “observations were not used” rather than the intended “the flag value was not used”. Starting table 2 with the first column indicating f flag values that are actually used in the data product would greatly improve clarity and avoid potential misinterpretation of the flagging scheme. Likewise, in table 5 rownames (first column) are not intuitive. I was wondering what -888 does stand for. Does this label occur in the data set? Finally, several important information about flags are given in section 3.3.2 (Merging), but might be better placed in 3.1 (Data assembly and primary quality control) and 3.2 (Secondary quality control).

-I.45: The entire data product contains “measurements from more than 1.2 million water samples”. However, this number decreases significantly when the number of available core variables is considered. As an example, I found in the merged master file <0.5 million dissolved inorganic carbon (tco2) observations and <10.000 observations with all core variables being available (in both cases ignoring f and qc flags). To this end, readers might benefit from a more detailed description of the data set. Giving expected row numbers for a few exemplary combinations of subsetting conditions would be valuable

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for users to check if they handle the data set correctly.

-I.51: Adjustments are applied in a way that takes “into account any known or likely time trends or variations in the variables evaluated”. However, I could not figure out in which way an unwanted bias correction is avoided, in particular with respect to variables for which a temporal change is expected, such as dissolved inorganic carbon (tco2). Maybe this was covered in previous versions of this living document, but I would find it useful and appropriate if this information could be included.

-Some qualitative statements could be replaced by more quantitative and exact descriptions. Examples include:

\*I. 226: “In areas where a strong trend in salinity was present”: What exactly is a strong gradient?

\*I. 259: “A few new cruises had no or very few valid crossovers with GLODAPv2 data” What means very few here?

\*I. 268: “exact selection determined based on the statistical robustness of the fit, as evaluated using the coefficient of determination ( $r^2$ ) and root mean square error (RMSE)” How exactly were  $r^2$  and RMSE evaluated jointly? Was one given preference under certain conditions?

-I.173: It is stated that “Missing numbers are indicated by -999, with trailing zeros to comply with the number format for the variable in question”, but in the file “GLODAPv2.2020\_Merged\_Master\_File.csv” all NAs seem to be coded as “-9999”. Description and data product should be checked for coherence.

-I.197: Crossover comparisons, multi-linear regressions (MLRs), comparison of deep-water averages and predictions made with CANYON-B and CONTENT are introduced and were used to identify offsets. Information about which method was finally used to judge and if necessary adjust individual cruises seems to be missing.

-I.510: Definition of boundaries for Arctic, Atlantic, Pacific, and Indian ocean (or a

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reference to the applied basin mask) is missing. Ideally, basin boundaries could also be displayed in Fig. 9.

-1.519 This links seems not to work: [https://www.ncei.noaa.gov/products/ocean-carbon-data-system/oceans/GLODAPv2\\_2020/](https://www.ncei.noaa.gov/products/ocean-carbon-data-system/oceans/GLODAPv2_2020/)

L.536-545: Some information on data coverage appears for the first time in the summary but might deserve a dedicated chapter.

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