Response to referees

essd-2026-691: A Comprehensive Global Ocean Radiocarbon Dataset (1700–2024) for Climate Applications

We thank both referees for their careful and constructive reviews. Each referee comment is quoted below in grey italics, followed by our response and the changes we made in the manuscript. Line numbers in the headings refer to the discussion preprint. Line numbers under *Changes in manuscript* refer to the revised manuscript.

Referee 1: Dr. Patrick Rafter (RC1 and RC2)

We thank Dr. Patrick Rafter for his positive and constructive review. We are glad the dataset is already in use, and we would be glad to include his unpublished and recently published datasets in a later release. We will contact him directly about this.

1.1 Submission of new data

> *"... another thing my compilation studies failed to acknowledge is the future submission of data to the compilation. [...] If the text could explicitly state that new datasets are welcome—plus directions on submission—I think that might be useful."*

Response: We agree. The invitation at the end of the preprint conclusions was too vague. Version 1.2026 stays as reviewed. New data will go into later versions, and the manuscript now explains how to submit them.

Changes in manuscript: We added a paragraph at the end of Sect. 2.5.2 (Versioning and updates; L241–250). New seawater DIC and biogenic carbonate Δ^{14}C can be sent to `ocean-delta14c@googlegroups.com` or submitted as an issue at `https://github.com/nmamnun/ocean-delta14c-dataset/issues`. Each measurement should include location, depth, date or age, Δ^{14}C and its uncertainty, δ^{13}C where reported, a laboratory sample code, and a reference or DOI. Carbonate records should also give the archive type, taxon, and dating method. Unpublished data will be included only after the owners agree to release them under CC BY 4.0. Contributed data will go through the same quality control and into a later Zenodo version, with contributors credited, and the LiPDverse compilations will be updated to match. The conclusions now point to this section (L499–500), and so does the Code and data availability section (L478).

1.2 Line 3: "harmonized"

> *"... I would use this novel and useful description, although with a very brief (perhaps parenthetical) explanation of exactly what is meant."*

Response: We agree. We removed the word from the abstract and defined it once in the introduction. No offsets or calibration adjustments were applied to the reported Δ^{14}C values.

Changes in manuscript: The abstract now says "comprehensive" (L3). In the introduction (L56–59), "harmonized" is defined as a common reporting notation (fractionation-corrected Δ^{14}C, following Stuiver and Polach, 1977), units, column structure, metadata fields, and synthesis quality flag (`DELC14QC`). The same sentence states that no offsets or calibration adjustments were applied.

1.3 Line 15: "is planned" (LiPD)

> *"'Is planned'. [...] I find it is non-standard for manuscripts to 'plan' to submit datasets. [...] I would either not mention LiPD or I would push this through in LiPD."*

Response: We agree, and Referee 2 raised the same point. The LiPD files were completed during revision and are now available on LiPDverse (see our reply to Referee 2, comment 2.2).

Changes in manuscript: The abstract no longer says a LiPD release is planned. It now states that the same measurements are available in LiPD format on LiPDverse (L14–15). The Zenodo deposit remains the CSV files.

1.4 Line 313: LiPD/LiPDverse discussion and timing

> *"A lot of discussion of LiPD and the LiPDverse. I'm confused because the text seems to suggest (?) that the data will be released in the LiPD framework... before / after acceptance in ESSD?"*

Response: The LiPD files are available now, before acceptance.

Changes in manuscript: See our reply to Referee 2, comment 2.2.

1.5 Line 345: crossover analysis

> *"I especially like this entire 'crossover analysis' discussion. Very thoughtful."*

Response: Thank you. We kept the discussion.

Changes in manuscript: We added a short explanation of why North Atlantic and Southern Ocean pairs are excluded from the baseline (L181–186 and L358–364). See our reply to Referee 2, comment 2.11.

1.6 Section 4.2: examples

> *"...I think this section does a good job of using some of them as examples. [...] I think it is unnecessary for this particular journal."*

Response: Thank you. We kept the section.

Changes in manuscript: The only change there is the Figure 6 symbols. See our reply to Referee 2, comment 2.12.

Referee 2: Dr. Siv K. Lauvset (RC3)

We thank Dr. Siv Lauvset for her careful and helpful review and her recommendation of minor revisions. We gladly accept the offer to promote the dataset through `www.glodap.info` and will contact the GLODAP team once the paper is published.

2.1 General: semicolons

> *"The manuscript is remarkably well-written (though in my mind with far too many semicolons)..."*

Response: Thank you. We split several semicolon sentences in the running text. Semicolons that separate items in tables, field lists, and citations were kept.

Changes in manuscript: Semicolons were replaced with full stops in the quality-control and crossover text (L158, L161–162, L177, L184, and L191). The semicolon in the Arctic sentence was also removed (see comment 2.13).

2.2 Major issue: LiPD version that does not yet exist

> *"The authors repeatedly mention and describe a version of the data (in LiPD-format) that does not yet exist. [. . .] I recommend that the authors complete this version of the data and make it available during revision of this manuscript. [. . .] If the authors are unable to complete the LiPD-version during revision then the text describing this version needs to be removed from the manuscript. The authors can instead add a brief 'future work/plans' section. . . "*

Response: We agree. The LiPD files were completed during revision and are on LiPDverse as two compilations: GlobalOceanDelta14C for biogenic carbonate (`https://lipdverse.org/GlobalOceanDelta14C/`) and GlobalOceanDelta14C-Seawater for ship-based DIC (`https://lipdverse.org/GlobalOceanDelta14C-Seawater/`). They carry the same Δ^{14}C values, uncertainties, and `DELC14QC` flags as the Zenodo CSV files. The LiPD files do not have a separate DOI, so users should cite this paper. Because the data now exist, we described them in the manuscript and did not add a Future plans section.

Changes in manuscript:

- Abstract: the LiPD sentence now says the measurements are available on LiPDverse (L14–15).
- Sect. 2.5.1 (File organization): we shortened the LiPD description, removed the planned-release and primary-format wording, and named the two compilations with their links (L215–222).
- Sect. 2.5.2 (Versioning and updates): only the Zenodo files are described as having a persistent DOI. The LiPDverse compilations are described as versioned, with future approved updates released as new versions (L232–234).
- Sect. 3 (Dataset overview): "a single hierarchical LiPD product is planned" was replaced with the names of the two compilations (L254–255).
- Table 2: the caption no longer says "planned". The single planned LiPD row was replaced with one row for each compilation, and the table note says the compilations are on LiPDverse and not in the Zenodo bundle.
- Code and data availability: the planned LiPD paragraph was removed and replaced with the two links and a note that the LiPD files have no separate DOI (L473–475).

2.3 L14–15

> *"Either publish the LiPD-version or remove this information"*

Response: The LiPD version is now available (comment 2.2).

Changes in manuscript: The abstract states that the measurements are available on LiPDverse and no longer describes a planned release (L14–15).

2.4 L46: GLODAP citations

> *"... it is more appropriate to cite Key et al. (2004), Olsen et al. (2016) and Lange et al. (2026) for GLODAP versions 1, 2, and 3 respectively. Lauvset et al. (2024) is cited when GLODAPv2.2023 is mentioned."*

Response: We agree and updated the citations as suggested.

Changes in manuscript: The first GLODAP citation is now Key et al. (2004), Olsen et al. (2016), and Lange et al. (2026a) for the GLODAPv3 description (`https://doi.org/10.5194/essd-2026-496`) (L46). Where the methods name GLODAPv3 (Sect. 2.2, L72–73), we also cite the GLODAPv3 data product (Lange et al., 2026b; `https://doi.org/10.25921/m6tp-mj50`). Lauvset et al. (2024) is cited only where GLODAPv2.2023 is named. Both Lange et al. (2026) works were added to the reference list.

2.5 L137: WOCE exchange format reference

> *"I believe Swift and Diggs (2008) is a better reference to use for the WOCE exchange format."*

Response: We agree, and thank you for the reference.

Changes in manuscript: The WOCE Exchange format is now cited as Swift and Diggs (2008) (L138). Key et al. (2004) remains the citation for GLODAP version 1. We added the reference:

Swift, J. H. and Diggs, S. C.: Description of WHP exchange format for CTD/Hydrographic data, CLIVAR and Carbon Hydrographic Data Office, UCSD Scripps Institution of Oceanography, San Diego, CA, USA, `https://cchdo.github.io/hdo-assets/documentation/WHP_Exchange_Description.pdf` (last access: 1 October 2026), 2008.

2.6 L191: section name

> *"The section referred to in parenthesis is called 'Data and Code Availability'. Please correct."*

Response: Thank you. The ESSD template heading is "Code and data availability".

Changes in manuscript: The cross-reference now reads "(Code and data availability, Sect. 5)" (L192–193).

2.7 L213–223

> *"Please update to describe an existing and available version of the data, or remove."*

Response: The paragraph now describes the existing LiPDverse compilations (comment 2.2).

Changes in manuscript: See comment 2.2. The revised paragraph is at L215–222.

2.8 L233

> *"Remove mention of LiPD unless the available data product is updated."*

Response: The LiPD product now exists (comment 2.2). We kept the persistent-DOI statement for the Zenodo files only.

Changes in manuscript: "All files distributed through Zenodo and LiPD" was changed to "All files distributed through Zenodo". A separate sentence states that the LiPDverse compilations are also versioned (L232–234).

2.9 L239–240: living data process

> *"As a matter of curiosity: are the authors planning a living data process in ESSD for this data product and future versions?"*

Response: No. Version 1.2026 stays fixed. Later measurements will be released as new Zenodo versions with new DOIs. If a later update is large enough to justify a living-data paper or a short follow-up, we will describe it when that update exists.

Changes in manuscript: None. The versioning text (L231–240) already describes this and does not mention a living-data process.

2.10 Table 2

> *"An ESSD paper should describe [data] that exist and are available to the reader. This table also presents planned versions which I find inappropriate."*

Response: We agree. Table 2 now lists only deliverables that exist.

Changes in manuscript: See comment 2.2. Table 2 has one row for each LiPDverse compilation, and the caption no longer refers to planned products.

2.11 L348–350: exclusion of North Atlantic and Southern Ocean pairs

> *"Please add a few words to elaborate on why the North Atlantic and Southern Ocean pairs are excluded."*

Response: We agree. North Atlantic pairs are excluded from the baseline because bomb ^{14}C is still entering North Atlantic Deep Water below 1500 m, so their offsets mix real change with measurement differences (Lester et al., 2024). Southern Ocean pairs south of 40°S are excluded because $\Delta^{14}C$ below 1500 m cannot be assumed stationary between occupations where deep water is formed and exported. The low, nearly uniform Southern Ocean values are not proof that nothing has changed. Both sets remain in the archived crossover table.

Changes in manuscript: We added this explanation in Sect. 4.1 (L358–364), with a shorter version in Sect. 2.4.3 (L181–186). The text also states that the remaining 178 station pairs (3131 depth levels, 56 cruise combinations) are in the Pacific and the subtropical and tropical Indian Ocean (L363–364).

2.12 Figure 6 caption: crimson vs purple stars

> *"It is difficult to see the difference between the crimson and purple stars [. . .]. Please change to colors with more contrast, or use different markers."*

Response: We agree. Purple is already used for Guilderson and Schrag (1998) in panel a, so we changed the markers in panel b instead.

Changes in manuscript: In Figure 6b, values flagged by visual inspection (`DELC14QC` = 10) are now filled black stars, and values flagged by inter-profile regional comparison are open black diamonds. The caption was updated to match.

2.13 L436–438: incomplete clause, Druffel et al. (2017)

> *"The sentence after the semicolon is incomplete [. . .] it is not obvious how Druffel et al (2017) relates to the Arctic data. Please revise for clarity."*

Response: We agree. Of the 115 shallow 2010s Arctic bottles (depth ≤ 50 m, north of 66.5°N, `DELC14QC` = 2), only four are from Druffel et al. (2017). Those four, however, are the ends of the range: about -35 ‰ in the Chukchi/Beaufort sector (USCGC Healy, 2012, 21 m) and about 50 ‰ in the Eurasian Arctic (R/V Oden, 2012, 20 m). Both are dissolved inorganic carbon measurements.

Changes in manuscript: The incomplete clause was rewritten as separate sentences in Sect. 4.3 (L450–453). They state the Arctic range, say that the end-members are DIC measurements from Druffel et al. (2017), and relate the range to regional ventilation contrasts. The semicolon was removed.

2.14 L458–462: Code and data availability

> *"The Code and Data Availability section should only present data that are actually available. The LiPD-version is not."*

Response: The LiPD version is now available (comment 2.2).

Changes in manuscript: The planned-LiPD paragraph was removed. The section now gives the two LiPDverse links and states that the LiPD files have no separate DOI (L473–475).

2.15 L465–466: future plans

> *"I recommend the authors add a brief 'future plans' section for information such as this."*

Response: The sentence at L465–466 described a future software deposit. That deposit already exists, so the sentence is no longer needed. We did not add a Future plans section: new data are described in Sect. 2.5.2, and the LiPD compilations are described where they are available (comment 2.2).

Changes in manuscript: The future-software sentence was removed. The Code and data availability section now cites the code deposit (Mamnun, 2026; `https://doi.org/10.5281/zenodo.22100626`) and points to Sect. 2.5.2 for new submissions (L476–478).

Additional changes

3.1 Editorial request: supplement table numbering

> *"Please number the supplement material according to the guidelines [. . .], i.e., tables must be numbered as 'Table S1', 'Table S2', 'Table S3', etc."*

Response: We renumbered the supplementary tables.

Changes in manuscript: The supplementary tables are now numbered Table S1–S6 in the supplement. All references in the main text were updated to match, for example "Supplementary Table 1" was changed to "Table S1" (L91, L92, L98, L105, L140, L145–146, and in the acknowledgements, L512 and L514).

3.2 Correction of the dataset DOI

The Code and data availability section of the preprint cited `https://doi.org/10.5281/zenodo.18674659` for the dataset. That was a mistake (not most updated version). The correct DOI for version 1.2026 of the dataset is `https://doi.org/10.5281/zenodo.22100029`, which is the DOI already given in the reference list (Mamnun et al., 2026).

Changes in manuscript: The dataset DOI in the Code and data availability section was corrected to `https://doi.org/10.5281/zenodo.22100029` (L467).

3.3 Acknowledgements

Changes in manuscript: The acknowledgements now thank Dr. Deborah Khider and Dr. Nick McKay for their support in making the data available on LiPDverse (L517).

3.4 Author affiliation

Changes in manuscript: The affiliation of Rolf Sonnerup was updated from the Joint Institute for the Study of the Atmosphere and Ocean to the Cooperative Institute for Climate, Ocean and Ecosystem Studies, University of Washington, Seattle, WA, USA (affiliation 4).