Response to the reviewers

Manuscript: The consistent in-situ global gridded temperature and salinity dataset, CORA OA 1960–2024 **MS No.:** essd-2026-376 **Authors:** Tanguy Szekely, Jean-Renaud Miadana

We thank both reviewers for their careful reading of the manuscript and for their constructive comments, which helped us improve the paper. Below, reviewer comments are reported as **RC** and our answers as **AC**. In the revised manuscript, all modifications made in response to the reviewers are highlighted.

Comments that are not listed individually below (typographical and wording corrections, figure and table formatting, terminology harmonisation, equation ordering, removal of duplicated text, etc.) have been taken into account directly in the revised manuscript and are highlighted there.

Main comment of Reviewer 1

AC: To quantify the comparison between CORA OA and the other products, we have added new tables reporting the RMS differences between products and the detrended variability of the SST, SSS and global ocean heat content time series (basin-averaged, for each sub-period), together with the corresponding descriptions and discussion in the Results sections (see highlighted text). We chose to base the comparison on basin-averaged quantities, which address the core of the request; spatial maps of the differences are left for future work.

Reviewer 1

RC: Bottom of page 3: it would be interesting to know to which extent the data set is MEOP-based, thus qualified/adjusted, and to which extent it is not the case...

AC: We have clarified in Sect. 2.1 that the MYNRT in-situ dataset underlying CORA combines MEOP-adjusted profiles with profiles from other sources (NRT versions, independent programs, etc.). All profiles, regardless of origin, go through the same delayed-mode validation procedure (Szekely et al., 2019; Gourrion et al., 2020;

Szekely et al., 2024), although we note that the prevalence of residual errors is markedly lower among MEOP profiles than among other near-real-time profiles.

RC: Line 106: a bit strange. Should it be instead of Tclim, Sclim, Tstd and Sstd. (otherwise what are Tstd and Sstd?). As there is a combination of two terms, not obvious to the reader what is the proportion of the data that is filtered out in this step. I believe that it should be reported somewhere (maybe a percentage as a function of the depth?)

AC: Tstd and Sstd are standard deviations taken from interpolated fields, and are distinct from Tclim and Sclim. We have added a citation to the manuscript where these fields are described, and clarified the notation in the text (see highlighted text).

RC: Figure 4: there is a change of data density increasing just after 2000m before the early 1990s (also near 800m). Is it linked to the change of grid spacing with depth and the criterium on maximum vertical data spacing...

AC: We agree that this feature is linked to the vertical interpolation criterion described in Eq. (vertical-interpolation criterion), which depends on the grid spacing with depth. As noted by the reviewer, this choice is somewhat arbitrary, and we have added a sentence acknowledging this limitation. The criterion will be revised in future versions of the dataset to reduce this artefact.

RC: Ln 179: "SSS product described in Sammartino et al (2022)". [...] Why not use the product of N. Kolodziejczyk L4 product [...] or the CCI V4.4 S product [...]

AC: We thank the reviewer for this suggestion. We have added a clarification in Sect. 2.4 explaining our choice. The Sammartino et al. (2022) SSS L4 product was preferred over purely satellite-based salinity products (e.g., the L4 product of Kolodziejczyk et al., or CCI SSS v4.4) because its combined in-situ/satellite and SST/SSS approach extends its temporal coverage back to 1993, whereas products based solely on satellite-measured SSS are limited to the 2010–2025 period, constrained by the operational lifetime of L-band radiometry missions (SMOS, Aquarius, SMAP). Given that CORA OA spans 1960–2024, we prioritised a longer common comparison period over using a purely salinity-based reference product.

RC: Ln 210: the comment puzzled me. Which data version of the sea mammal data is used. What are the temperature (and pressure) validation steps (if it is MEOP, or if

not). There might also be issues of non-randomness of sampling by the sea mammals at time, thus potential biases. [...]

AC: We have clarified in Sect. 3.1 that, regardless of their origin (MEOP or otherwise), animal-mounted CTD profiles go through the same CORA delayed-mode validation process, which efficiently detects and flags failed or drifting instruments (Szekely et al., 2019; Szekely et al., 2024). We note, however, that we do not have visibility into the specific quality-control procedures applied to animal-mounted profiles by the other products used for comparison. We therefore cannot rule out that part of the spread observed among products in the Southern Ocean stems from differences in data validation rather than from data availability or first-guess fields alone. We now state this limitation explicitly in the text.

RC: Ln 237: I don't see from Table 3 a larger spread in the first period than in the last one (when spatially averaged!). The average trend is less in first period, but the spread is comparable (at least averaged over 20 years). What is really clear is the very small interannual variability of CORA product when basin-averaged.

AC: We thank the reviewer for pointing this out and agree that our original wording was misleading. Table 3 does not show a larger spread among products in 1960–1984 than in 2005–2024 (1.1 vs. 0.9 ZJ yr^{-1}); it mainly reflects a lower trend value for CORA specifically in the early period relative to the other three products. We have revised the text to remove this inaccurate characterisation and to highlight instead what the table actually illustrates: the comparatively small interannual variability of the basin-averaged CORA time series. This feature is now further quantified in the new tables on the detrended standard deviation of the GOHC and on the RMS differences between products, added in response to the main comment.

RC: On Fig. 6, IAP presents a strange large negative peak in SSS in 2001, not seen in all the other products, coming from Pacific and Indian Ocean north of 35°S. Any reason? This suggests some bug (TAO or Rama uncorrected and biased mooring data, perhaps?). Also, in caption, add that deep ocean is areas with bottom depth > 1500 m.

AC: We thank the reviewer for pointing out this feature. Following the reviewer's suggestion, we investigated its origin by examining monthly surface salinity anomaly fields (e.g., January 2001 and January 2003 relative to the January mean of 2004–2010). This analysis shows that the negative peak is driven by a large-scale, spatially coherent negative anomaly (exceeding −1 PSU) located in the eastern Indian Ocean and the western Pacific Ocean. This anomaly pattern and amplitude appear to be unique to the IAPv4 product during that period, and are absent from the

other SSS products considered in this study. We therefore interpret this feature as a product-specific artefact in IAPv4 rather than a real oceanographic signal, and we have added a note to this effect in the revised manuscript (see highlighted text). We have also specified in the caption that the deep ocean corresponds to areas with a bottom depth greater than 1500 m.

Reviewer 2

RC: Ln 8, "The time series spans from 1960 to December of the previous year." Mentioning the previous year relative to 2026 implies 2025, contradicting the 1960–2024 interval indicated in your title. Revising this phrase for consistency would prevent potential reader confusion.

AC: We thank the reviewer for pointing out this ambiguity. The sentence described the general rule for the CORA time series (each release extends to December of the year preceding its publication), whereas the present paper describes a specific version covering 1960–2024. As "previous year" was ambiguous for a reader in 2026, we have reworded the sentence to state explicitly that the version described here covers 1960–2024 (see highlighted text).

RC: More details should be provided regarding the quality control criteria and processing procedures. Additionally, further elaboration is needed on the bias corrections applied to the dataset. This information is vital for readers to fully evaluate the data utilized in the objective analysis.

AC: The quality control criteria, processing procedures and bias corrections applied to the CORA dataset are described in detail in Szekely et al. (2019) and Szekely et al. (2024), as well as in the CORA product documentation, and we preferred not to duplicate this material in the present paper, which focuses on the objective analysis. To make this information easier to find, we have added a paragraph in the Data section recalling the main steps and explicitly referring the reader to these documents for the complete description (see highlighted text).

RC: Vertical interpolation relies on a linear scheme, which could prove problematic across specific regions and depth levels, particularly when dealing with low-resolution profiles. Significant uncertainties may stem from this approach. I suggest comparing this technique against interpolation schemes employed by comparable datasets to better highlight its limitations and associated errors.

Addressing this aspect is vital for clarifying some discrepancies observed between CORA and alternative products.

AC: We thank the reviewer for this relevant remark. We agree that the linear vertical interpolation may be a source of significant uncertainty in some regions and depth ranges, especially for low-resolution profiles. However, since each of the products considered here relies on a different approach to vertical interpolation (which in practice amounts to using different vertical correlation lengths), a thorough comparison of these schemes and a quantification of their impact on the differences between CORA and the other products would require substantial dedicated developments. We consider this a topic of high scientific interest, but one that goes beyond the scope of the present paper. To acknowledge this limitation, we have added a statement in the revised manuscript (see highlighted text) and indicated that this aspect will be addressed in future versions of the dataset.

RC: Figure 5, Are the mean SST from different products used the same baseline and comparable? If different baselines are used, please explain the differences are induced by different baselines or convert the data to the same baseline to make them comparable.

AC: In the previous version, each product was expressed as an anomaly relative to its own mean over its own period, which is not a common baseline when products have different temporal coverage. In the revised manuscript, all products are now expressed as anomalies relative to their mean over the period common to all of them (2002–2020), and this is stated in the text and in the figure caption (see highlighted text). We also clarified that trends are computed over the available period of each product, which is now indicated in the figure legend.

We thank the reviewers again for their time and valuable suggestions.

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