**REVIEWER 1**

Review of the MS "Hydrographic CTD profiles capturing the onset of near-surface stratification in Southwest Greenland fjords during two consecutive spring 2025 field campaigns"
This MS describes field data collected in remote regions which are difficult to reach and therefore data coverage is almost non-existent and where field data are very scarce.
This alone is granting a publication of this MS in ESSD.

I have some small remarks listed below but besides them I will recommend this MS for publication after minor review addressing my remarks.

We thank the reviewer for the positive assessment of our manuscript and for recognising the value of the dataset collected in these remote and poorly sampled regions of Southwest Greenland. We also appreciate the constructive remarks, which have helped us improve the clarity and quality of the manuscript. We have addressed all comments in the revised version, as detailed below.

1. The statements below found on the first 2 pages, while being correct, looks a bit repetitive – I would suggest editing the text to address this.

L16-19: This allows users to investigate thin freshwater lenses and sharp near-surface gradients rather than systematically removing the upper few metres of the water column. The dataset therefore provides a detailed view of the onset of meltwater-driven stratification and offers the flexibility to apply alternative vertical averaging or filtering strategies depending on the objectives of future analyses.
L27-28: By preserving the upper-ocean structure during a critically undersampled season, this dataset provides a valuable resource for studies of Arctic freshwater dynamics, glacier–ocean interactions, fjord stratification, ocean model evaluation, and satellite product validation.

We thank the reviewer for this helpful comment. We agree that the statements in the final paragraphs of the Abstract were partially repetitive. We have therefore revised the text to better separate the methodological contribution, the main hydrographic findings, and the potential applications of the dataset. In particular, we removed the repeated reference to preserving the upper-ocean structure from the final paragraph and retained this information only in the paragraph describing the processing strategy.

Now the abstract reads as follows:

*Unlike many standard conductivity, temperature, and depth products, the processing strategy retains the shallowest valid observations and preserves the native vertical sampling. This enables users to examine thin freshwater lenses and sharp near-surface gradients without systematically excluding the upper few metres of the water column. It also allows alternative vertical averaging or filtering strategies to be applied according to the objectives of future analyses.*

*Thermohaline diagnostics identify four main hydrographic regimes: coastal and glacier meltwater-influenced waters, Polar Water, Winter Water, and modified Atlantic or Irminger Water. Comparison of the late-winter and early-spring campaigns documents the onset of surface restratification across Southwest Greenland fjords. The strongest freshening and shallow stratification occur in fjords directly influenced by tidewater glaciers, whereas deeper water masses remain comparatively stable over the one-month period.*

*The dataset is distributed in NetCDF-4 format compliant with Climate and Forecast Metadata Conventions version~1.8 and Attribute Convention for Data Discovery version~1.3, and is publicly available through Zenodo. The processing code is archived on GitHub and Zenodo. Together, these observations provide a valuable resource for studies of Arctic freshwater dynamics, glacier--ocean interactions, and fjord stratification, as well as for ocean model evaluation and satellite product validation.*

L72-74: A specific contribution of this dataset is the preservation of the shallowest valid measurements allowing users to examine thin meltwater lenses and sharp near-surface gradients instead of systematically removing the upper five metres, as is commonly done in standard CTD post-processing procedures.

We thank the reviewer for highlighting this sentence. We interpreted this comment as referring to some overlap with the similar statement in the Abstract. To reduce repetition, we have shortened the sentence in the Introduction while retaining the key point that valid near-surface measurements are preserved in the dataset:

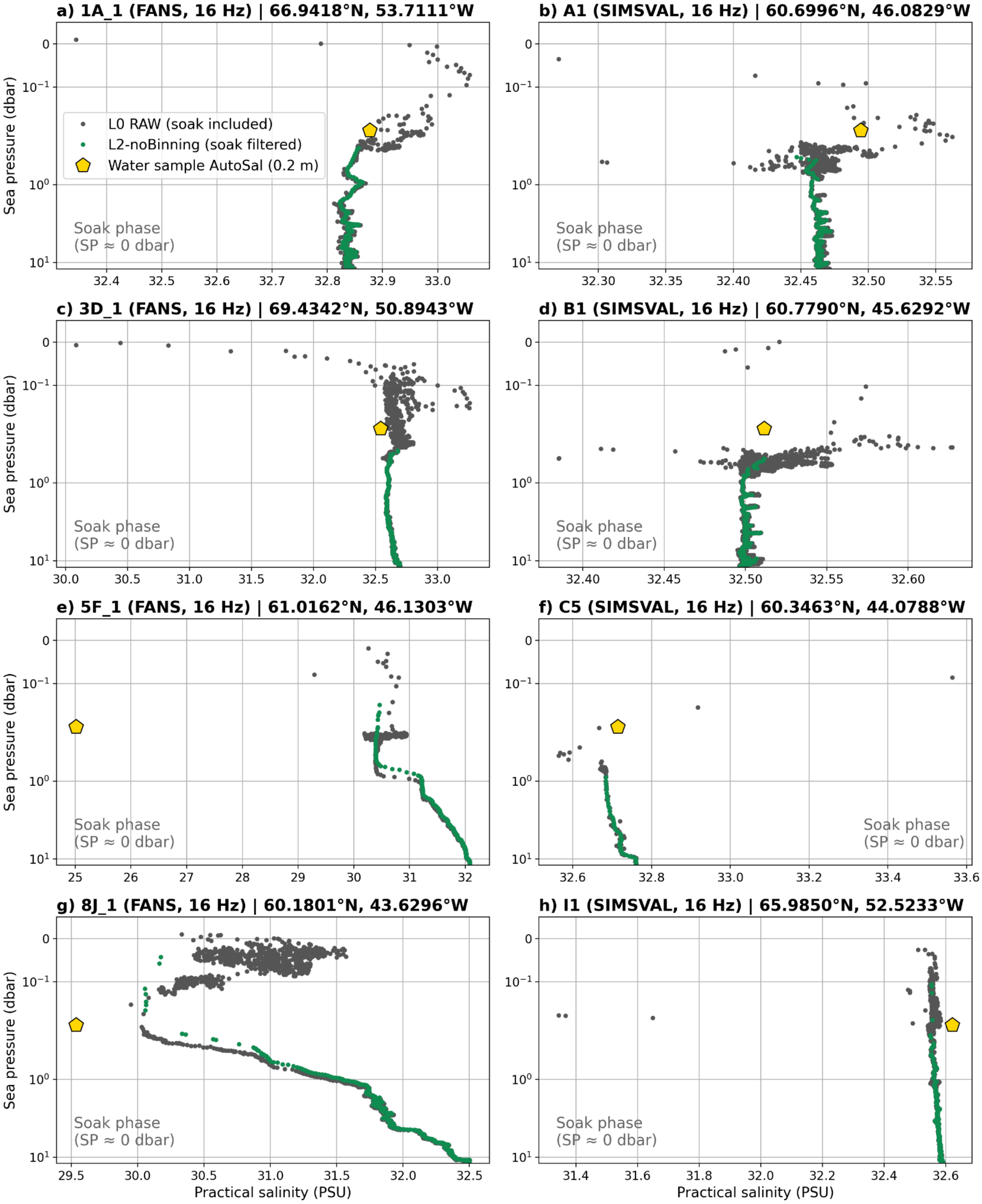
*A key feature of the dataset is the retention of valid near-surface measurements, which supports the analysis of fine-scale upper-ocean stratification.*

2. L171: add space after word ‘labelled’: The temperature channel is labelledTemperature1
Done.

3. L175-1766: I think ‘1-minute interval’ will be better than ‘1-minute resolution’.
Done.

4. Fig.3: If possible, I would suggest
a. moving this Fig right after L247,
b. increasing the font on the panels (e.g. ‘Soak phase’ legend) and a dots size.
c. I believe it will also be helpful to use non-linear (log?)-scale for the depth axis to enlarge the surface part (0-2 db)

Figure 3 has been moved to immediately follow the paragraph ending at former line 247. We have also increased the font size of the panel labels and legends, including the “Soak phase” label, and enlarged the marker size to improve readability. In addition, we have adopted a non-linear depth scale to expand the upper 0–2 dbar range and provide a clearer view of the near-surface measurements.




5. Fig. 4: To make it more conclusive and easier to compare different regions presented on this Fi9g, I would suggest:

a. Set all depth axis ranges to 0-150db for B-F areas.

b. Set salinity ranges to 32.7-33.8 for B-D areas and to 27-33 for E and D areas

c. Set T ranges to -1.5C – 2°C for all areas.

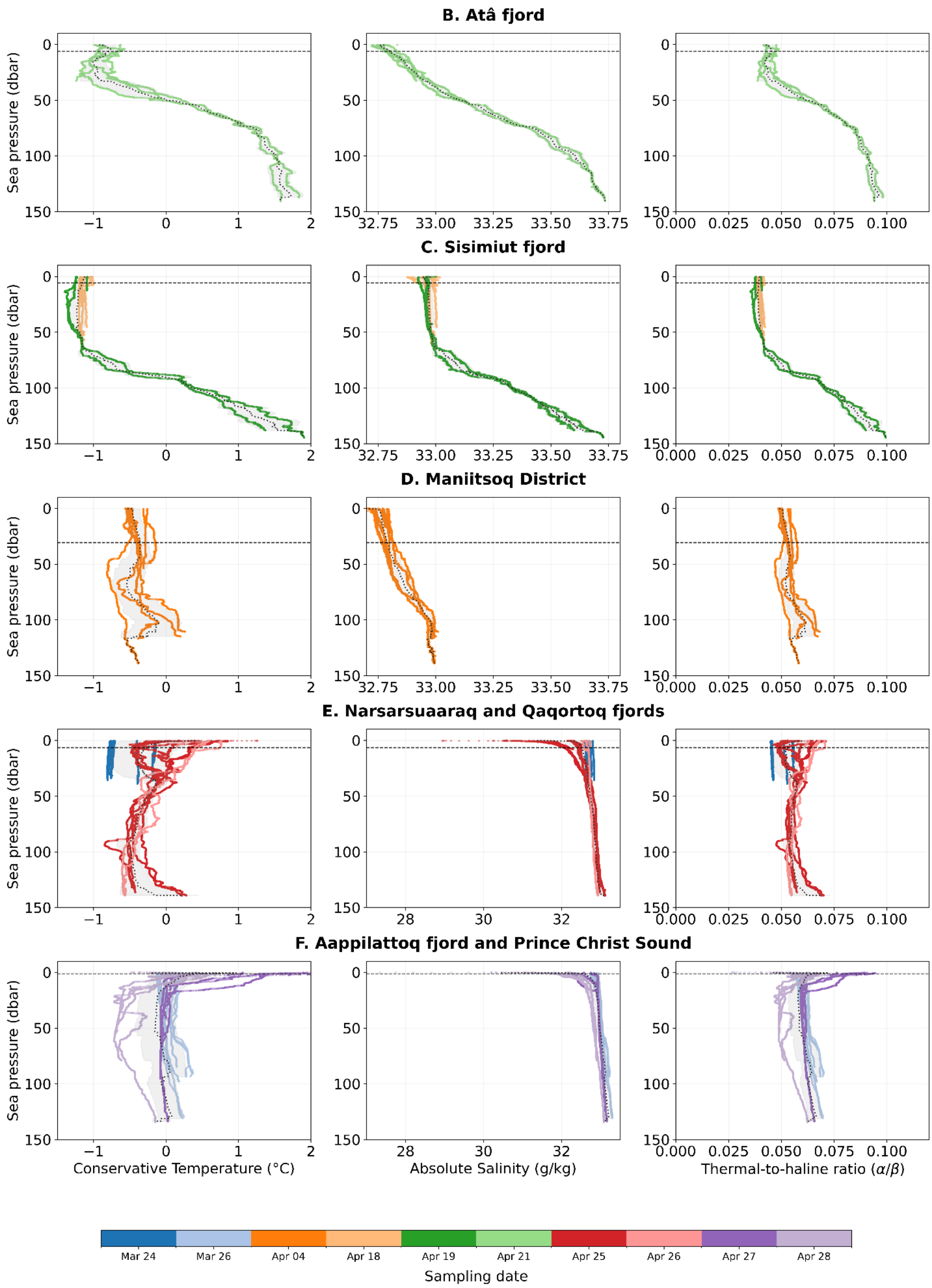



Figure 4 has been revised to facilitate comparison among the different regions. The depth range has been set to 0–150 dbar for panels B–F, and a common temperature range of −1.5 to 2 °C has been applied to all panels. The salinity range has been set to 32.7–33.8 for panels B–D and to 27–33 for panels E–F, interpreting the reviewer's second reference to panel D as referring to panel F.

6. L297: What is the 'sea pressure' listed under 'Coordinates' section? Is it a pressure at the sea level? Or pressure along the profile? In Table 6 it is listed as 'sea_water_pressure' Please add this description to L297 as well to avoid confusion.

We thank the reviewer for pointing out this ambiguity. The RBR CTD sensor physically measures absolute pressure (including atmospheric load, ~10 dbar at the surface); this raw variable is available in the companion L0 RAW product. Sea pressure is a derived quantity obtained by subtracting the ship's atmospheric pressure — recorded by two independent FerryBox sensors — from the raw instrument pressure, yielding ~0 dbar at the sea surface and increasing downward along the profile. Its CF standard name is `sea_water_pressure`, as already indicated in Table 6 (column "Standard name (CF)", note "atm. removed").
In the submitted manuscript, `sea_pressure` was incorrectly listed under "Coordinates" at L297, while Table 6 already correctly categorised it as a measured/derived variable. We have corrected this inconsistency by (1) removing `sea_pressure` from the "Coordinates" bullet, (2) moving it to the "Derived" bullet with its CF standard name and a brief definition (sensor pressure minus atmospheric pressure), consistent with Table 6.

7. L329: Was it considered to perform inter-sensor comparison in the lab environment before field work? Or in parallel in the field? That would eliminate 'sampling slightly different water parcels near the surface, where salinity and temperature gradients are steepest' as mentioned in L348-349.

We thank the reviewer for this suggestion. A dedicated inter-sensor comparison under controlled laboratory conditions was not performed before the field campaigns because the PONANT instrument (RBR Concerto - 2Hz, S/N 237329) belongs to *Le Commandant Charcot* and was not available for pre-cruise laboratory testing. Likewise, simultaneous side-by-side deployments was not carried out during the campaigns. We agree that either approach would have enabled a cleaner separation of instrumental offsets from environmental variability.

The original statement at L348–349 — noting that the residual scatter is partly attributable to the instruments sampling slightly different water parcels near the surface, where salinity and temperature gradients are steepest — has been retained in the revised manuscript, as we agree with the reviewer that it accurately captures this inherent limitation of a field-based comparison. We have also taken the opportunity to add an explicit clarification that no laboratory or simultaneous side-by-side comparison was performed, so that readers can contextualise the results accordingly.

Now, the text reads as follows after "*... at the same location (distance <0.01 km)*" (L332) :

*The results presented here should therefore be interpreted as a field-based of inter-sensor consistency rather than a formal evaluation of sensor accuracy. No pre-cruise laboratory intercomparison was possible because the PONANT instrument was not available before the campaigns, and no simultaneous side-by-side deployment was conducted.*

*L335:* The paragraph beginning with *“The comparison was conducted … the processing chain.”* remains unchanged. However, the following two paragraphs have been revised and now read as follows:

*After applying the full post-processing pipeline (pressure correction, hold-event removal, CT-lag alignment, despiking, smoothing, and soak- and loop-phase removal), comparison of the processed profiles (N = 31 QC-good points between 2 and 10 dbar) yielded ΔT = +0.0028 °C (STD = 0.0014 °C), ΔC = −0.0107 mS cm$^{-1}$ (STD = 0.0021 mS cm$^{-1}$), and ΔS = −0.017 PSU (STD = 0.0029 PSU).*

*The slightly larger bias and scatter in the processed comparison most likely reflect differences in processing and sampling conditions rather than intrinsic disagreement between the sensors. First, the CT-lag correction, applied only to the 16 Hz ICM sensor, shifts the conductivity channel by approximately one scan (~0.06 s), potentially introducing a small offset when conductivity measurements from the two instruments are compared at identical pressure levels. Second, the 1.4 min delay between the casts means that the instruments sampled slightly different water parcels, particularly within the near-surface layer where temperature and salinity gradients are strongest. Over this time interval, tidal oscillations and internal waves may have displaced the pycnocline by several decimetres, producing apparent inter-sensor differences that reflect genuine oceanographic variability rather than sensor bias. Consequently, a substantial fraction of the residual scatter (STD ≈ 0.003–0.018 across variables) is likely attributable to short-term environmental variability rather than instrumental differences.*

*Although ΔC and ΔS slightly exceed the nominal single-instrument precision of the RBR Concerto (±0.003 PSU), the observed discrepancies remain well within the recommended field-comparison thresholds (±0.05 °C and ±0.05 PSU). Moreover, they are more than an order of magnitude smaller than the hydrographic variability observed across the Greenland fjords (ΔT ~3 °C and ΔS ~3 PSU over 0–150 dbar). Overall, the agreement between the two instruments is considered fully adequate for the objectives of this dataset.*

8. Fig.5: In caption, please replace Concerto with Concerto3 for the blue line legend to be consistent with the notation in L332.
Done

9. Fig.6: What is the point of plotting down to 20db if no comparable data exists deeper than ~7db? Consider cutting the empty space.
Done

10. L421-425: L2 and L0 files listed under same names. On Zenodo they listed under correct names though (e.g., *_RAW.nc and *_PROC.nc). Please correct the text.
Thank you, the correction has been applied.

11. L454: The statement that: ‘The dataset fills a critical observational gap in Arctic coastal hydrography’ it too ambitious on my opinion. While it provides important view on the local processes in some limited and hard to reach areas during spring season, it is not filling

‘critical observation gap’ per se by any means and cannot be extrapolated or applied to ‘Arctic coastal hydrography’. Please adjust the wording.

We thank the reviewer for this comment. We agree that the original wording was too broad and could suggest that the dataset addresses Arctic coastal hydrography as a whole. We have therefore revised the statement to restrict its scope to the remote and sparsely sampled fjords of Southwest Greenland covered by the two campaigns. We have also replaced “fills a critical observational gap” with more cautious wording and limited the scientific implications to local fjord processes and seasonal hydrographic evolution.

Now the text reads as:

*The dataset provides new observations of hydrographic conditions in several remote and sparsely sampled fjords of Southwest Greenland during the late-winter to early-spring period, when in situ measurements are limited and access can be restricted by sea ice and harsh weather conditions. By resolving and preserving the upper few metres of the water column, the dataset documents shallow meltwater signals and near-surface stratification processes relevant to local fjord freshwater dynamics, glacier–ocean interactions, and seasonal hydrographic evolution.*

I must underscore that it would be great to see this data in the World Ocean Database – it will add about 10% to the data in WOD for Mar-May (769 profiles presently), expanding coverage to the coastal area (see plot below)

We thank the reviewer for highlighting the potential value of including these observations in the World Ocean Database. We agree that the dataset would make a meaningful contribution to the limited March–May coverage in this region, particularly by extending the available observations into coastal fjord environments. We have therefore added submission of the dataset to the World Ocean Database as a planned dissemination step and will initiate the submission process following publication.

**REVIEWER 2**

Reviewer2: Hydrographic CTD profiles capturing the onset of near-surface stratification in Southwest Greenland fjords during two consecutive spring 2025 field campaigns

By Marta Umbert et al.

General comment

The dataset presented by the authors is certainly interesting, particularly for a region that has been sampled very little. The main strengths of the paper lie in the methodology used for the monitoring, although some issues need to be clarified.

The data are high resolution, allowing the identification of vertical stratification. The measurements were carried out from a Zodiac boat using a manual winch. The CTD may therefore have been subject to small but significant vertical movements that could affect the purpose of the measurements. The authors should clarify whether and how corrections were applied to account for these movements, particularly with regard to the calculation of salinity.

In the quality control procedure, the authors use gross range checks and fine range checks that appear to be based on methodologies developed for areas different from those examined here. A region-specific adaptation would have been desirable.

We thank the reviewer for the positive evaluation of the dataset and for highlighting the value of the high-resolution observations collected in a region and season that remain poorly sampled. We also appreciate the reviewer's constructive comments regarding the potential influence of Zodiac motion and manual winch operation on the CTD profiles, as well as the need to clarify the regional applicability of the quality-control thresholds. We have revised the manuscript to explain these aspects more explicitly.

Specific comments

Para. 4.3: Could the movements of the small boat, and therefore the vertical movements of the CTD (up and down), introduce spurious data?

Regarding the possible effect of vertical movements of the Zodiac and the manually operated winch, we agree that short pauses or small reversals in the CTD trajectory may occur during zodiac-based deployments. During acquisition, a weight was attached below the CTD to promote a stable vertical descent, the downcast was conducted at a controlled speed not exceeding 0.5 m $s^{-1}$, and only downcast data were retained for processing. Potential disturbances were subsequently addressed at two stages of the processing chain. First, the despiking step (Sect. 4.3, RSKdespike, 4σ threshold in a 15-point moving window) flags individual anomalous values caused by abrupt sensor motion. Second, using RSKremoveloops, all segments where vertical velocity fell below 0.10 m $s^{-1}$ were removed, thereby excluding winch pauses, minor profile reversals, and short-term vertical motions potentially induced by movement of the Zodiac. Therefore, no separate correction based on the motion of the boat was applied; instead, the portions of the profiles potentially affected by

non-continuous descent were identified from the CTD pressure record and excluded before calculation of the final hydrographic variables. The per-sample descent velocity is also distributed as the variable profile_velocity in the NetCDF file, enabling users to apply stricter velocity filtering if required.
Regarding salinity, practical salinity was calculated only after the signal-conditioning and loop-removal steps. For the 16 Hz instrument, the conductivity and temperature channels were aligned using the estimated thermal response lag of approximately 0.06 s (i.e. ~1 scan at 16 Hz, capped at ±2 scans — corrected from the submitted value of 0.3 s, which corresponded to ~5 scans and did not reflect the lag actually computed by RSKcalculateCTlag for this instrument). This correction was applied specifically to reduce salinity spiking caused by the different response times of the conductivity and temperature sensors. Temperature and conductivity were also despiked and smoothed before practical salinity was derived.

We have introduced the following changes in the manuscript to clarify these procedures.
In Sect. 2.4, after the description of the deployment method, we added:

*"Potential short-term vertical motions associated with Zodiac movement or manual winch operation were subsequently identified from the CTD pressure-derived vertical velocity and handled during the signal conditioning (Sect. 4.3) and the loop-removal step described in Sect. 4.4."*

In Sect. 4.4, we revised the description of the loop-removal procedure as follows:

*"Data segments where vertical velocity fell below 0.10 m s⁻¹ were removed using RSKremoveloops to eliminate artefacts associated with winch pauses, minor profile reversals, or short-term vertical motions of the CTD potentially induced by Zodiac movement. This procedure ensures that only continuously descending portions of the downcast are retained for the calculation of the final hydrographic variables."*

In Sect. 4.3, we corrected the CT-lag value from "Δt ≈ 0.3 s" to "Δt ≈ 0.06 s (~1 scan at 16 Hz)", reflecting the lag actually estimated by RSKcalculateCTlag for this instrument (S/N 237957), capped at ±2 scans (~0.13 s) to guard against spurious cross-correlation peaks in weakly stratified profiles.

Para. 4.6: The gross range check is certainly appropriate for "oceanic" values, but the threshold values are excessive for this area.
Para. 4.6: The regional range check should be complemented by a different check for each fjord, in order to take into account their different characteristics.

Concerning the quality-control range checks, we agree that regional hydrographic conditions should be considered when defining appropriate thresholds. The processing workflow already combines broad global gross-range limits with narrower Arctic-specific regional limits. The gross range test (T: −5 to 50°C, SP: 0 to 45 PSU, p: 0 to 12,000 dbar) is designed exclusively as a first-pass sanity check for physically impossible values indicative of sensor malfunction or data corruption — not as an oceanographic filter. No observation in this dataset approaches these limits. The operationally relevant filtering is performed by the regional range test, which is selected to encompass the expected hydrographic variability of

Arctic and sub-Arctic waters sampled in this study, including the particularly fresh near-surface conditions found in glacier-influenced fjords. We deliberately did not define separate thresholds for each fjord or hydrographic sector because the dataset spans strongly contrasting environments, from very fresh glacier-influenced surface waters to relatively warm and saline Atlantic-origin waters. More restrictive local thresholds could therefore incorrectly classify physically plausible observations as erroneous. Furthermore, the density inversion test (test 6) and the pressure monotonicity check (test 7) provide complementary quality checks that are sensitive to local oceanographic anomalies without requiring predefined regional limits.

We also emphasize that the automated quality-control flags were not used to remove observations. All original values, including those classified as Suspect, remain in the distributed dataset together with their associated flags. This conservative approach is particularly important in the upper few metres, where genuine freshwater lenses, sharp salinity gradients, and small density inversions may otherwise be rejected by automated tests.

To clarify this rationale, we added the following text to Sect. 4.6:

"*The gross range test serves as a first-pass check for physically impossible values indicative of sensor malfunction; all observations in this dataset fall well within these limits. The regional limits were selected to encompass the broad range of hydrographic conditions expected across Arctic and sub-Arctic fjord environments, including highly fresh glacier-influenced surface waters and saline Atlantic-origin waters. Separate thresholds were not defined for individual fjords because the sampled regions exhibit strongly contrasting hydrographic regimes, and more restrictive local limits could incorrectly flag physically plausible observations. Automated QC flags were therefore used as indicators rather than exclusion criteria, and all original values were retained in the dataset.*"