

Reviewer 1

We sincerely thank the reviewer for the detailed and thoughtful evaluation of our manuscript. We appreciate the positive assessment of the dataset quality.

Comment: As we known salinity measurements are usually affected by conductivity cell thermal inertia due to the lag between temperature and conductivity measurements, so it is of importance to conduct thermal lag correction for each profile. However, I cannot see any descriptions throughout the context.

Response: Temperature–conductivity lag (thermal-lag) effects were handled during the standard instrument preprocessing prior to salinity computation. In addition, the final product is pressure-binned (1 dbar) and median-filtered, which strongly reduces any residual fine-scale imprint; thus, these effects do not influence the basin- and mesoscale analyses for which the dataset is intended.

Comment: The manuscript notes a sharp decline in sampling post-2020. While this is acknowledged, the authors should explicitly discuss how this discontinuity may impact specific analyses. For example, does the reduced sampling limit decadal trend analyses? Are there any supplemental observations, for example Argo or other observational data from WOD?

Response: We agree that the reduction in cruise frequency after 2020 introduces a temporal inhomogeneity in the dataset. To clarify this, we have added a paragraph in the manuscript discussing the implications of the post-2020 sampling gap and the recommended scope of analyses.

Comment: Line 284: Figure 7 shows below 50 dbar salinity exhibits a much more variability than the upper 50 dbar. This phenomenon is worth interpretation here.

Response: We have added a brief explanation of this mechanism in the manuscript.

Comment: Lines 230-231: A threshold of density inversion should be clarified here, e.g. 0.03 kg/m^3 is employed by QC of Argo TS profile.

Response: We have clarified the density inversion criterion. A strictly monotonic stability condition was used, when any density decrease with depth ($\Delta\rho < 0 \text{ kg m}^{-3}$) was treated as static instability and flagged. This conservative threshold ensures physical consistency of hydrographic profiles.

Because the Baltic Sea water column is strongly stratified below the halocline, true density inversions are rare and typically confined to very small vertical scales associated with microstructure processes. Our criterion therefore removes only a small fraction of data and primarily targets acquisition artefacts rather than physically meaningful overturns. Moreover, the dataset is intended for basin- and mesoscale hydrographic analyses, for which preserving static stability is more important than resolving fine-scale turbulence features.

Comment: Lines 314-316: In fact the Arkona Basin also shows the highest salinities and strong halocline from 30 dbar to the bottom. The authors shouldn't neglect this.

Response: We agree that the Arkona Basin can exhibit some of the highest salinities in the section during inflow events and may display a pronounced halocline extending from ~30 dbar to the bottom. We have clarified this point in the manuscript.

Comment: Line 329: From Figure 10, the deep-layer signals in the Arkona Basin are stronger than in the Bornholm Basin and Slupsk Furrow. Can the authors interpret this?

Response: We have added a clarification in the manuscript to explain this along-basin evolution of inflow signatures.

Comment: Table 2: the unit of conductivity should be unified as S/m or mS/cm.

Response: Tab 2 Corrected

We remain grateful for the reviewer's suggestions; they were instrumental in refining the manuscript's narrative and precision.

Reviewer 2

We sincerely thank the reviewer for the detailed and thoughtful evaluation of our manuscript. We appreciate the positive assessment of the dataset quality.

I understand the reviewer's main concern that some hydrographic features are described only briefly and that the scientific potential of the dataset is not fully exploited in terms of physical interpretation. However, we would like to clarify that this manuscript is submitted as a **data paper**, whose primary aim is to document the dataset, its acquisition strategy, instrumentation, quality-control procedures, and data structure, rather than to provide a comprehensive scientific analysis of the observed processes.

Nevertheless, following the reviewer's suggestions, we have expanded several sections to provide clearer links between the observations and the underlying physical processes, while maintaining the data-focused nature of the manuscript.

Below, we address all specific comments in detail.

1. Introduction

Comment: The term "unique" is not sufficiently justified.

Response: We agree that the term "*unique*" may appear overly strong without detailed justification. The region indeed has characteristics of basin-wide relevance, as it represents the principal pathway of North Sea inflow waters toward the central Baltic, strongly influencing stratification, deep-water renewal, and ecosystem conditions. It also hosts key hydrographic

features such as the Bornholm Basin and Stupsk Furrow, which play a central role in large-scale circulation and biogeochemical dynamics.

However, we recognize that a full discussion of these broader regional aspects would extend beyond the scope of a data paper. To maintain focus on the dataset description, we have therefore replaced the term “*unique*” with a more neutral formulation referring to the long-term, consistently repeated observational section.

Comment: Previous measurements in the region not sufficiently discussed.

Response: We have expanded the introduction to better place the dataset in the context of historical observations in the region, while clarifying that the IOPAN section represents a rare multi-decadal, repeat transect.

Comment: Influence of Danish Straits and circulation not well explained.

Response: We added text explaining the controlling role of the Danish Straits and the eastward propagation of saline inflows, which govern stratification, deep-water renewal, and interannual variability.

2. Study area and campaign design

Comment: Transect completion unclear.

Response: We clarified in study area and campaign design

Comment: ... , providing a rough estimate (e.g. in percentage) of the completed transects and sections..

Response: We have added a brief summary of spatial coverage in Section 2 (Study area and campaign design).

Comment: Figure 1 should include bathymetry and sills.

Response: Bathymetric and key features are now added.

3. Instruments and measurement modes

Comment: Rationale for 5 nm spacing unclear.

Response: We added that this spacing balances mesoscale resolution with ship-time constraints, ensuring consistent basin-scale coverage.

Comment: Were discrete salinity samples collected?

Response: We clarified that discrete bottle samples were not routinely collected for all cruises; sensor accuracy was ensured through regular manufacturer calibration and inter-comparison.

4. Dataset and methods

Comment: Clarify “four transects annually”.

Response: We clarified that in section 4.

Comment: Figure 3 would benefit from the inclusion of an additional line below month 12 summarizing the total number of campaigns, which would help the reader better interpret the temporal coverage of the dataset.

Response: We agree that the total number of campaigns is important; however, we prefer not to add a dedicated “Total” row to Figure 3 to avoid visual clutter. Since the monthly values are small (typically ≤ 5), readers can readily infer totals from the matrix, while the total number of campaigns ($n = 96$) is stated explicitly in the manuscript.

Comment: If significant currents affected station positioning, this should be explicitly mentioned and discussed

Response: We have mentioned current effect.

Comment: Positional uncertainty and NMEA explanation unclear.

Response: We clarified that in section 4

Comment: Replace “deliberately” regarding winch operation.

Response: We replaced the “deliberately”

Comment: Reduced sampling frequency and impact on statistics not discussed.

Response: We have clarified the implications of reduced sampling frequency for statistical representativeness and trend analyses in Section 4.

Comment: Conductivity units inconsistency.

Response: Units in Table 2 have been unified to $S\ m^{-1}$.

5. Quality control

Comment: Salinity range origin unclear.

Response: We have clarified the adopted salinity ranges.

Comment: Comparison with Argo suggested.

Response: Ship-based CTD measurements represent reference-quality hydrographic observations and were therefore not calibrated against Argo data. Argo floats are autonomous platforms with different sampling characteristics and are typically evaluated against ship-based CTD measurements rather than the other way around. The purpose of this data paper is to document the dataset, processing, and quality-control procedures rather than to perform inter-system intercomparisons. Quality assurance relied on manufacturer calibrations, internal hydrographic consistency. For this reason, a formal comparison with Argo profiles is outside the scope of the present manuscript.

A dedicated validation exercise based on spatio-temporal matchups between the IOPAN CTD casts and Argo float profiles (bias/dispersion statistics and uncertainty characterization) is planned as future work.

6. Data structure and export

Comment: Data availability through EU infrastructures.

Response: The dataset is publicly available through an open-access repository with DOI, ensuring long-term preservation and FAIR compliance. At present, the dataset is not yet integrated into European marine data infrastructures. The dataset format, metadata structure, and CF-compliant NetCDF export make it technically suitable for future integration into European infrastructures, and such integration may be considered in the future. However, the primary objective of this data paper is to document and make the dataset openly available in a standardized and citable form.

7. Basin-scale structure and variability

Comment: Link observations to physical processes.

Response: The present manuscript is a data paper focused on documenting the dataset and its characteristics; detailed process oriented analysis is beyond its scope and is addressed in dedicated scientific studies using these data.

Comment: Arkona Basin halocline and salinity underrepresented.

Response: The role of the Arkona Basin is now explicitly described in Section 7

Comment: Deep-layer signals in Arkona stronger than elsewhere.

Response: We have now clarified in Section 7 (Figure 10 discussion). As this is a data paper, we intentionally limit the discussion to this hydrographic context.

Comment: Figure 8 lacks salinity discussion.

Response: We have slightly clarified the lack of seasonal cycle of salinity.

Comment: Figure 9 mean salinity purpose unclear.

Response: With the previous answer to comment about seasonal cycle we have clarified the purpose of Figure 9.

Comment: Intermediate layer in Fig. 10 not shown.

Response: We focused Figure 10 on the surface and bottom layers as they represent the two primary hydrographic regimes: the seasonally forced upper layer and the deep layer affected by renewal and stagnation processes. The intermediate layer reflects transitional conditions between these regimes and does not provide an independent signal; including it would increase figure complexity without adding distinct information within the scope of a data descriptor. More detailed process-oriented analyses of vertical layer interactions, including the intermediate layer, are being addressed in complementary scientific studies based on this dataset.

Comment : Figure 7 – I suggest using the same scale for all the graphs (i.e., also for the Arkona Basin).

Response: Thank you for this suggestion. We initially used a common axis range across all panels; however, the primary purpose of Figure 7 in this ESSD data descriptor is not to inter-

compare basins quantitatively (as in a process-oriented scientific analysis), but to provide a clear, basin-by-basin overview of the typical hydrographic structure and its variability. Using identical scales across panels compresses the signal in some basins and substantially reduces readability. Therefore, to maximize interpretability and to highlight the characteristic variability within each basin, we kept basin-specific axis ranges.

Once again, we sincerely thank the reviewer for these constructive comments; they helped us improve the clarity and focus of the manuscript.