

% Response to Reviewer 1

Mi minor revisions are:

The results are better argued and presented than in the previous version. The writing could be still improved by writing more clearly and concisely.

We sincerely appreciate the reviewer's effort in providing detailed feedback. We have included all suggestions and corrections pointed out by the reviewer. The abstract and introduction have been redrafted for improved clarity, coherence, and alignment with the study's objectives. The entire manuscript has been carefully reviewed for language clarity and consistency. Revised text in the main text is highlighted in blue. A point-to-point response to the reviewer comments are given below (in blue).

We appreciate the new lagged correlation analysis provided. It is mentioned in the text that the significance of the correlation has been tested but with no mention of the method used to test it. Could you add this please?

Thank you. Yes this information is added. Line 115-118.

Figure 4: this figure is not well used in the text. Why show the vertical distribution of salinity if not to use it? As it is now, the figure is not useful (only the ESA CCI SSS is used in the text).

We agree. The figure is removed. The text is rephrased. Line 191-198.

Technical corrections:

Abstract:

Line 25: "model data record": perhaps 'model and data' ?

Agree. We have redrafted the abstract.

Section 3.1:

Line 140: 'at a lag' : this is weirdly said, and I am not sure what the authors mean. Maybe the authors mean " with a lag of xx years between the two regions."

The phrase is removed. Line 136.

Line 144: 'green' to change to 'black'.

Corrected, Thank you for pointing out the mistake. Line: 140.

Line 158: 'than the its core speed': missing word in the sentence?

Corrected. Removed 'the'. Line 158

Line 168: ‘ in comparison to the one during’.
Sentence rephrased. Line 168

Line 194: ‘for a longer period’: I recommend mentioning the period using dates for precision.

As also response to the comment on Figure 4, this section is revised. Line 191-198.
Dates are added (Line 195).

Line 204: replace ‘through’ by ‘into the NBS’.

Corrected. Line 204.

Section 4:
Line 259: ‘as well as the as the’ to correct
Corrected. Line 254.

Figure 6: panels c-d: need to say how is computed the normalisation.

Added to the text. We have used z-score normalisation. Line 231.

Table 2 is not referenced in the main text.

Table 2 is referenced now. Line 91.

Line 286-287: correct to ‘ this has not always been the case’.

Corrected. Line 279

Line 301: replace ‘effects’ to ‘impacts’, remove ‘the’ in front of ‘dampens’
Corrected. Line 295.

% Response to Reviewer 2

General Comment

The revision gives the impression of having been prepared somewhat quickly. The change-tracked text suggests that several newly added phrases would benefit from further language polishing. In addition, the Introduction could more clearly articulate the motivation for the study and the specific research question being addressed. I would strongly recommend professional proofreading by a native speaker or careful language polishing (e.g., with the assistance of an LLM).

We sincerely appreciate the reviewer's thorough and constructive feedback. All suggested revisions and corrections have been incorporated. The abstract and introduction have been redrafted for improved clarity, coherence, and alignment with the study's objectives. The entire manuscript has been carefully reviewed for language clarity and consistency. Revised text in the main text is highlighted in blue. A point-to-point response to the reviewer comments are given below (in blue).

Line-by-line comments

Abstract

lines 17–19: I would suggest rephrasing for clarity and readability:

Due to an influx of anomalously low salinity water from the North Atlantic, whole Barents Sea salinity declined during the period from 2016 to 2022. Also, is this a result demonstrated in the paper? Can it be stated that the salinity decline was caused by North Atlantic inflow based on the presented data analysis?

Abstract have been redrafted for improved clarity, coherence, and alignment with the study's objectives. In doing so all concerns raised above by the reviewer are addressed.

line 19: I suggest using “decrease” instead of “reduction”.

Corrected. Line 20.

lines 21–24: This point could benefit from clarification. Earlier it is stated that the whole Barents Sea freshened due to North Atlantic inflow, whereas here the Northern Barents Sea is described as being additionally influenced by an Arctic signal. It would be helpful to briefly indicate in the abstract which methods allow distinguishing between these influences.

Abstract, have been redrafted for improved clarity, coherence, and alignment with the study's objectives. In doing so all concerns raised above by the reviewer are addressed.

Introduction

line 33: It should be “influence” rather than “influencing”:

“can weaken... and ...influence” for correct parallel structure.

The sentence rephrased. Line 62-64.

lines 40–42: It is not entirely clear what the propagation speeds refer to (e.g., AW advection velocity?). A clearer connection between the clauses would improve readability, for example: “..., which correspond to a 2–3 year lag ...” or “..., resulting in a 2–3 year lag ...”. Please consider rephrasing.

The entire introduction is redrafted. The sentence mentioned above is removed to preserve continuity of sentences. Please note that a similar sentence is already there in the Results Section. Line: 155-160.

lines 43–45: It is difficult to follow what happens to Arctic-origin water. Is the Labrador Current shifting poleward or moving off the continental shelf? The second part of the sentence would benefit from clarification. Also, the second mention of the Holliday paper at the end is redundant.

We agree with the reviewer that the long text was confusing. The text has been redrafted.

The text is rephrased

“While, Holliday et al. (2020) attributed this freshening to anomalous winter wind patterns rerouting Arctic-origin water in the Labrador Current into the northern North Atlantic, Kenigson and Timmermans (2021) linked it to the wind-driven displacements of the Subpolar Front.”
Line 75-78.

line 48: The phrasing is somewhat unclear. “These events” appear to refer to the 2012–2016 period, yet the sentence mentions both strong and weak gyre circulation during 2005–2016 and 1993–2005. It would be helpful to clarify what is meant here.

The sentence is rephrased.

“This event also coincided with the decadal variability in the subpolar gyre circulation, which has strengthened since the mid-2000s (Chafik et al., 2019) and exerts a strong influence on the properties of AW entering the Nordic Seas (Hátún et al., 2005).”
Line 78-80.

line 53: “into the downstream” is not ideal phrasing; a clearer alternative would be: “...propagation of the negative salinity anomaly downstream in the Nordic Seas ...”

The sentence is rephrased. Line 81-82.

Figure 1 caption: For the Svinøy and BSO sections, it would be helpful to include more information in the text about the origin of the Svinøy section data.

Thank you. We understand why the reviewer had suggested this point. Kindly note that in the revised version of the manuscript, we have included a comparison of TOPAZ4b reanalysis and ICES observations at Svinøy and BSO. Line: 152-153. Since we now use both datasets, we are not specifying the source in the Fig Caption.

line 70: “lower salinity Arctic water” could be expressed more clearly as “less saline Arctic water” or “fresher Arctic water”.

Corrected. Line 41.

line 89: Consider removing “outflow” and keeping:
“The dense waters exiting the BS...”

Agree. Removed. Line 70.

line 92: “associated with freshwater and sea ice import”.

Sentence rephrased. Line 70-73

line 93: “in this paper” instead of “in here”.
Changed. Line 83.

General comment on Introduction:

The Introduction provides a useful overview of existing studies, but the specific research question or knowledge gap addressed by this work is not yet clearly articulated. It currently reads more as a general overview of processes influencing the Barents Sea. It would strengthen the manuscript to more explicitly identify what remains unresolved in the literature and how this study addresses that gap. Additionally, it would be helpful to briefly motivate the chosen methods and explain why they are suitable for addressing the stated research question. This context is currently absent in both the Introduction and the Methods section.

We thank the reviewer for the constructive comment. In the revised version we have revised the Introduction as suggested. Additionally, in the methods section, we have mentioned the statistical methods used, particularly to show the propagation of salinity anomalies from the upstream sections to the Barents Sea.

Data and methods

line 107: sea surface temperatures, sea ice concentrations

Corrected. Line 99.

line 119: It would be helpful to mention the ERA-5 spatial resolution.

Added. Line 111.

lines 121–122: Suggested phrasing:
“ICES data: The temperature, salinity, and density data at BSO and Svinøy sections are obtained from the ICES database”.

Corrected. Line 113.

Results

line 127: Was a weighted vertical mean used? If not, this may affect the representation and

could be briefly discussed.

Thank you. We have corrected it. The overall results remain the same, only minor changes in values.

lines 131–134:

“The salinity minimum aligns...., provided an advection” – the tense usage is inconsistent; please revise for consistency.

Rephrased. Line 127-130.

lines 137–140: The phrase “at a lag” is unclear. Please specify what the lag refers to (e.g., between SBS and NBS, or relative to upstream forcing).

The phrase “at a lag” is removed. Line 136.

line 154: The lagged correlation analysis.

Corrected. Line 153

lines 168–170: The sentence would benefit from rephrasing for clarity.

Rephrased. Line 168-170.

line 196: A positive trend is not clearly visible in Fig. 4; please clarify. lines 197–198: being referred to.

“similar trend during the time-period due to a decrease...” – please specify which period is

As suggested by Reviewer 1, figure 4 is removed . The text is rephrased. Line 191-198.

Figure 5 caption:

“TOPAZ4b reanalysis derived winter mean (NDJFM) sea ice drift velocity (cm/s) difference during the two time periods (2016–2024) and (1993–2015).”

This describes a difference between two periods, but it is not immediately clear what is subtracted from what. Additionally, panel 5a is quite small and difficult to interpret. It may be helpful to include separate maps for each period mean to improve readability.

Figure Caption is redrafted: “Figure 4. a. Difference in winter-mean (NDJFM) sea-ice drift velocity (cm/s) from TOPAZ4b, defined as the mean over 2016–2024 minus the mean over 1993–2015. b. Same as (a) but for MSLP difference from ERA-5.”

Kindly note that separate maps are not used here, since it is much easier to see the changes between the two time-periods when using the difference map, instead using separate maps.

line 217: “respectively” is used twice; consider removing the first instance. SAT has already been defined earlier.

Thank you. Corrected. Line 217.

lines 219–220: The period 1993–2024 includes the last ten years; this should be clarified.

Clarified. Line: 220.

line 224: The Methods section does not mention the use of any authors’ models; it appears that reanalysis data is used. Please clarify.

Thank you. Corrected. Line 224.

line 275: Please clarify what is meant by “our model results”.

Corrected. Line 270.

lines 282–285: This sentence is difficult to follow and would benefit from rephrasing: “Our results indicate...., to a large degree reflect...”

We agree. Shortened the sentence. Line 276-278

lines 295–296: The density of the bottom water, which is used to support this conclusion, could be shown in the paper but is currently not included.

The temporal evolution of the density of the 5% of the water masses at BSO and SAT is shown in Figure 5c,d. We also checked the density of bottom waters of the Barents Sea (Figure shown below) which also show a similar pattern. Kindly note that we have not added the new fig below in the manuscript since it conveys similar message.

