

General comments

This manuscript is overall of good quality. It aims at understanding the drivers of the interannual variability of salinity in the Barents Sea and its impacts on the dense water formation in that region. To do so, it relies on satellite, in-situ and reanalysis data.

This manuscript is interesting, of good scientific quality, well structured, and overall well-written making it easy to follow the stream of thoughts, and addresses successfully the scientific question.

We thank the reviewer for the positive and constructive comments. We sincerely value the reviewer's time and effort in providing feedback, and we are confident that the comments, corrections and suggestions provided by the reviewer will greatly contribute to enhancing the quality of our manuscript.

Specific comments

Introduction:

Line 29-31: The sentence is correct, but I suggest rephrasing it, as it can be misinterpreted when read quickly. 'Buoyancy fluxes' is a general expression and is usually used to refer to surface buoyancy fluxes. Yet the Atlantic water densification is dominated by surface buoyancy fluxes but subsurface mixing contributes as well.

We agree

Method section: When using acronyms for the first time, please write in full the meaning of the acronym (for example the meaning of ICES).

Thanks for pointing it out. Yes, we will correct it.

Result section:

I recommend introducing subsections to better guide the reader and increase readability (maybe by subdomains (SBS, NBS), impact on the outflow of dense water).

Yes, we agree. We will introduce subsections as suggested by the reviewer.

Line 117: 'upstream north Atlantic' this expression is hard to understand. Please replace it with a more meaningful one. Does the author mean 'in the northward circulation'?

We agree. We realize the phrase “upstream” is creating the confusion. It will be removed.

Line 121: please add a justification of the definition of the Barents sea subdomains. Please also add a justification of the decision to analyse the two subdomains separately in the first place (this could be included in the introduction as there is already mention of some difference between the two subdomains). It seems that the latitudes of the northern and southern subdomains have been swapped in this sentence. It would also help the reader to highlight the subdomains using boxes on figure 1.

We agree. We will add justification, correct the typo as well as add subdomains in figure 1.

Line 129: Mention of Svinoy but the reader does not know where it is located. The caption of figure 2 says it is indicated in figure 1 but I can't find it there (it is actually outside the scope of the map of figure 1). Please add its location in figure 1, if not possible please give a sense of where it is with a description (Feroe Islands).

Thanks for pointing this out. Yes we will show the location in figure 1

Figure 2: The y axis of the panels indicates 'salinity anomaly' (please add unit on panel a for consistency) but the caption only says 'salinity'. Please indicate how the salinity anomalies were computed. Please add after 'in situ observations' "(ICES data)".

Yes, we agree. We will add the details.

Line 165: Please add a reference to support the travel time from the SBS to the NBS.

Yes, we will add the reference.

Line 174-175: This result is very light. It is not really adding much as this figure is from the same dataset used for figure 2 so it is trivial that it shows the same positive trend as the data used is the same (one showing an average, the other the vertical dimension). I recommend removing it or to add a value to it, e.g. by giving information added by the depth layers (e.g. which layers are responsible for most of the positive trend?). In addition, the positive trend is not so evident for me for the ESA CCI SSS data (black curve) as the time period is very short and present strong inter annual variability.

Yes, we agree. We will remove it.

Figure 5: I don't understand the caption "between the time periods (2016-2024) and (1993-2015)" and therefore the whole figure. What is represented? Is it the difference between the two periods? Please clarify.

Yes, this is the difference between the two time-periods. The sentence will be rephrased for clarity.

Lines 197-199: I disagree with that statement. On figure 6b (SAT), the salinity of the dense water seems to vary fairly little in comparison to temperature which seems to drive the density change as well. However, I agree that in the most recent years (e.g. 2023) the salinity is very low. I recommend rewriting this sentence to be more nuanced (not to say that the pattern is similar, the variability of the density of dense waters crossing SAT is dominated by temperature but that in recent years salinity contributed to form record low density).

We agree with the suggestion of the reviewer. We will correct the sentence.

Section 4

Line 217 and following: I recommend rephrasing and breaking the sentence into several sentences. It is relatively hard to read.

We agree, the sentence will be rephrased.

Lines 228-230: I don't understand this sentence. I don't understand "upstream subpolar gyre", "northward in the Norwegian Sea", please rephrase.

We agree, the sentence will be rephrased.

Lines 252-255: I don't understand this sentence. Which lag are we talking about? During which period? How does it change in time?

A lag correlation analysis will be done to clarify it.

Line 266: Please remind at the end of the sentence the figure supporting this conclusion (I think it is figure 6).

We agree, the sentence will be rephrased.

Lines 269-271: "offset the reduction in density": I think the author wants to say 'increase' in density. Indeed, a temperature decrease (cooling) leads to denser waters. The beginning of this paragraph (lines 266-271) took me a long time to

understand because of the way it is written and because the changes in temperature, salinity, and density in time are not readily visible from the TS diagrams. I suggest rephrasing these sentences to increase clarity and to add a third panel on figure 6 showing the temperature, salinity, and density time series of the data represented in panels a, and b. This should make it more straightforward to see the changes in time.

We agree. We will rephrase the sentences as the reviewer suggested also show the temp, salinity and density time series.

Figure 7: The figure 7 should be referred to at least once in the main text. I recommend modifying it: it should show two contrasting states: the mechanisms prior to the recent freshening versus the freshening. It should also emphasize the different mechanisms between the SBS and NBS. It should also show the limits of your SBS and NBS. The text on the figure should make it clear what has changed between the 'normal state' and the 'freshened' state with comparatives like 'lighter dense water outflow', 'fresher AW inflow', 'reduced vertical mixing'...

Yes we will correct it accordingly

Technical corrections

Line 123 and 125, 129, 130, 173, 175, 183, 242 : replace 'increasing' by 'positive' (x5). Replace 'decreasing' by 'negative' (x3). Although grammatically correct, 'increasing trend' is misleading as I don't think that the authors are interested in the change of magnitude of the trend but rather on the sign of the trend.

Agree. We will correct it

Figure 2: the y-axis has negative values on both sides of the zero value. Please correct.

Many thanks for pointing this out. Yes we will correct it.

Line 162-163: this result corresponds to figure 2a not 2b.

Many thanks for pointing this out. Yes we will correct it.

Line 168: the sentence is weirdly arranged. It seems that the propositions have been swapped. Please correct: "Lind et al (2018) attributed the increased salinity in the NBS during the same period to the reduced sea ice import from the central Arctic".

Many thanks for pointing this out. Yes we will correct it.

Line 177: modify 'showed' to present tense.

We agree.

217: Please correct the grammar 'during when'.

We agree