

## **List of changes made in revised manuscript**

1. Edits to abstract
2. Addition of basis of horizontal currents to data sets description (lines 161–163)
3. New Fig. 10
4. Revision to avoid duplicating quantities already given in Fig. 7 (lines 291–299)
5. Figure 7 caption: 'annual cycle removed' was stated in the previous version
6. Rewriting the discussion of new Fig. 10 (lines 342–374)
7. Minor edits (lines 383–384)
8. Edits (line 386)
9. Edits for clarity (lines 408–411)
10. Edits for clarity (lines 452–454)
11. Edits for clarity (lines 465–467)
12. Edits for clarity (lines 468–469)
13. Edits for clarity (lines 470–472)
14. Edits for clarity (lines 481–482)

Dear Editor:

We once again wish to express our gratitude to you for your service in refereeing our manuscript. Thank you very much for your insightful comments and suggestions. We have implemented them, as described below in blue text.

Thank-you for your response to comments and the revised manuscript. It still appears to me that the path from sub-box 15 in the NW Atlantic to sub-domain A is very tenuous. You refer in line 347 to figure C1 to motivate the NW Atlantic as an area of freshening to correlate with sub-domain A and proceed to identify sub-box 15 as having the maximal correlation. However, given the range of correlation values in Table C1, some even negative, it is not clear that this maximal correlation is really statistically significant rather than a chance extreme among the 30 values. Figure C1 also shows freshening near the coast immediately to the north of sub-domain A as more obvious input to sub-domain A. In any case, to seek an arrival path, it would seem more appropriate to look at an equivalent to figure 10a but showing the cross-correlation with sub-domain A rather than sub-box 15. That would avoid the apparent presumption about the source in the present figure 10a and would indicate how far “upstream” (from sub-domain A) the association can be taken. The present figures 10a and 10b have the difficulty of taking the path through decreasing and increasing correlation and time lag. [Another – probably more convincing – approach to the “source” question is to use an adjoint model run backwards in time; this shows the influences on properties at the time and location of interest. However, this is probably too much to expect in view of the extra “machinery” involved.]

I am sorry that this appears to be a referee (rather than editorial) comment but I am seeking to resolve the comment of referee 1 without the delay of having to find another referee. It is owing to the above that I am asking for “major” revision.

Thank you. We have now carried out the cross-correlation with subdomain A. Moreover, after further analysis and survey of the literature, we now feel that, although this cross-correlation technique can suggest the pathways by which a salinity signal propagates, it cannot ascertain the origin of the signal because of the complex nature of dispersion in the ocean. Accordingly, we have removed all references to the origin of the salinity signal that freshened subdomain A. Please see the new figure 10 and associated discussion.

Lines 4, 5 (and anywhere else). Better “rising period” → “period of rise”

Thank you. We have made the correction. Please see lines 3 and 4 in the revised manuscript.

Lines 7-8. “thermosteric expansion that counteracted halosteric expansion”. Surely one of these “expansion” (the first c.f. lines 227-229) should be “contraction”.

Thank you for the correction. We have revised the sentence. Please see lines 6–8 in the revised manuscript.

Line 8. At this stage your particular use of “multidecadal” is not known to the reader.

Thank you. We have added a definition for ‘multidecadal’ in the abstract. Please see lines 8 in the revised abstract.

Figure 4 caption refers to panel (e) (ORAS5 potential temperature) but the panel is missing.

Thank you. We have removed the reference to this figure. Please see the new caption to Fig. 4.

Line 181. “dats” → “data”. X

Thank you. We have made the correction. Please see line 181 in the revised manuscript.

Line 249. “loses” → “losses” X

Thank you. We have made the correction. Please see line 249 in the revised manuscript.

Figure 7 caption. I suggest the same methodology for “(annual cycle removed)” be added here as in the Figure 4 caption (assuming it is the same methodology).

Thank you. We already stated ‘annual cycle removed’ in this caption in the previous version.

Lines 346, 364, 365, 457-458. “decreasing trend” means the trend is getting smaller. I think you mean “negative trend” or simply “decrease”.

Thank you. We have made all the corrections. Please see the revised description of figure 10 and lines 442 in the revised manuscript.

Line 393. “there” → “their”

Thank you. We have made the correction. Please see line 382 in the revised manuscript.

Line 394. “. . to the northwest African coast.”

Thank you. We have revised this sentence.

Line 400. “. . characterizes . .”

Thank you. We have made the correction. Please see line 386 in revised manuscript.

Lines 423-426. “mean sea level is higher in subdomain B compared to subdomain A (Fig. 1[b]), and the multidecadal increase in sea level is larger in subdomain B compared to subdomain A (Table B1). There must therefore be a permanent north-south current between the two subdomains to balance the pressure gradient associated with the slope of the free ocean surface.” The logic here is not clear. B is south of A. Higher msl at B would imply surface geostrophic flow to the east and/or friction-retarded flow from south to north.

Thank you. We have revised this sentence for clarity. Please see lines 408–411 in the revised manuscript.

Lines 467-469. This sentence is unclear; what does “the same phenomena” refer to? Do you perhaps mean “. . . these phenomena varying on a multidecadal timescale.”?

Thank you. Yes, we mean that these phenomena are varying on a multidecadal timescale. We have revised this sentence for clarity.

Conclusions. I think you should emphasise that item (i) refers to 1996-2004 and item (ii) to 2010-2018, whereas item (iii) refers to the difference between the means of 1996-2004 and 2010-2018. This is to show that you answer the two objectives from the Introduction.

Thank you. We have emphasized these items in the conclusion. Please see lines 465–467, 468–469, and 470–472 in the revised manuscript.

Sincerely,  
Hamed