

OS-2022-18: Author responses to Referees

Referee's comments are in plain text, authors' comments in response are in bold.

Anonymous Referee #1:

We thank Referee #1 for their comments, our responses to the technical corrections requested are detailed below.

The authors have done a thorough job at revising the manuscript. Overall readability is improved, and it is now much more clear how the results align/contrast themselves to previous work. I also appreciate the clarifications regarding e.g. particle sampling errors and the Labrador Current components. I would be happy to see the manuscript accepted (I only have a few very minor comments):

1) l. 78: 'while not excluding the southward upper ocean flow east of Greenland.' Phrasing not entirely accurate considering the East Greenland Current is not a part of the release section?

Agreed. This should have been 'while excluding', we have removed the 'not'.

2) l.130: 'variously calculated'?

Changed to 'calculated both as.... and by....' as there are just two distinct methods used to calculate these averages.

3) l.228: 26 Sv not 26 m.

Corrected.

4) l.572: check citation parenthesis.

Corrected.

5) L.574: 'a positive anomaly in the net surface heat flux into the Labrador Sea (i.e. reduced heat flux out of the Labrador Sea)'. Unclear if you don't define the direction of positive/negative heat flux. Perhaps just formulate as 'reduced surface heat loss' (which is used in the following section anyways).

We think the positive direction was defined as 'into' the Labrador Sea, however we have adopted the suggested simplification.

6) This might be slightly beyond the scope, but in identifying reduced surface heat loss between 2000 and 2013 as the 'trigger' for the cooling/freshening in the following years, a natural question is what caused the reduced heat loss. If you look at the accumulated NAO index (over the 10 years prior) you will see a peak of positive NAO values around 2000 and a peak of negative NAO values

around 2011-12 – meaning that for the years in-between there has been a tendency for more negative NAO states (typically accompanied by reduced heat loss over the SPNA). Perhaps you have some reflections on this (NAO, heat loss etc.) for the conclusions.

Lines 632+. We have added a couple of sentences in the Conclusions about the source of this reduced heat loss and the possible relationship between the cumulative atmospheric forcing, ocean heat content, isopycnal depths and SPNA freshening. We refer readers to the (already referenced) work of Yashayaev and Loder (2017) where these ideas are discussed in more detail.

Anonymous Referee #1:

The authors have addressed all my concerns. I appreciate the authors' efforts on the modifications, especially for the comparison of isopycnal depth between the model and observation. I recommend to accept the manuscript as it is.

We thank Referee #3 for their comments. The requested revision of the comparison of isopycnal depth between the model and observation allowed us to examine this in more detail we feel resulted in significant improvements and increased confidence in the presented results.