

## Reviewer 1:

We thank Reviewer 1 for the time they spent reading and commenting on the manuscript. Your contribution has been noted in the acknowledgement section:

“We thank the two anonymous reviewers and the editor Agnieszka Beszczynska-Möller for their comments, which greatly improved this manuscript.”

In the abstract, you just mention "deep ocean", specify that you talk about 2500m, XXm above the bottom, and at sill depth between the 2 basins, also L301. It would be useful to sharpen exactly what you mean by “deep ocean” in this context and which layers (above and below) you do not consider in your analysis. It is fine that you don’t consider them, but it would be good not to pretend that you cover the whole ocean below the mixed layer. e.g. Langehaug&Falck, unlike you, consider “intermediate and deep waters”.

We thank the reviewer for pointing this out. We have now rephrased L3 in the abstract, as well as L301 in the conclusions to be more precise and better reflect that we looked at changes close to the sill depth of Fram Strait.

L16 all these references deal with the Greenland Sea which often is considered Nordic Seas rather than Arctic Ocean. At least clarify what your definition of Arctic Ocean is then.

We have now defined the Arctic Ocean, as the Nordic Seas and the central Arctic Ocean. This is also consistent with the definition by the International Hydrographic Office.

L72 The north-south extent of the Fram Strait box is actually quite a bit larger than around the sill across the strait. Maybe comment on the meridional extent of the sill separating the basins.

We thank the reviewer for their comment. After L72 we have now added: “For the definition of Fram Strait, we chose a larger meridional extent compared to the sill. We did this as we expect that the mixed waters from Fram Strait are not just limited to the sill but might be seen north and south of the strait.”

L76 to the exact choice of

Done.

L82 typo: -0.7 --> -0.8degC

Changed

L91 moorings F10...

Done.

L107 conductivity which translates to XX for salinity

We assume you mean L104 and have added “which translates to  $0.003 \text{ g kg}^{-1}$  for Absolute Salinity.”

Tab 1 4.03degE -- 4.333degE. I don't think the range of the location in the zonal direction was that large. The mooring was always close to 4.33degE = 4deg20minE

Almost all deployments were deployed close to 4.33 °E, however the 2013-14 deployment was deployed at 4.03 °E. We have made no changes to the text.

L117 Are those in the bottom boundary layer? By comparison to the treatment of the temperature/salinity data, the info on velocity data is comparably brief. Do the links to data sets that you give for temperature/salinity also contain the velocity data?

Yes, the current meters were deployed at the same depth as the MicroCATs, and the datafiles we link also contain the velocity records. We have now clarified that in the text.

Fig 2 what is the -1degC 35.05 excursion of GSDW in 2000?

Might note that (deep!) Argo is only 6 profiles in GSDW in one year, thus it does not really contribute to your conclusions.

You could show the locations of the profiles in Fig. 1 as dots in the basins.

We thank the reviewer for pointing this interesting feature out. We are not sure of underlying dynamics; however, it appears that the freshening observed in the early 2000's is related to a freshwater anomaly further up in the water column (Fig. R1-1 of this document) and a deepening of the isopycnals. This deepening of isopycnals is clearly visible in Fig. 5 of Brakstad et al., 2019 (<https://doi.org/10.1175/JPO-D-17-0273.1>). We have now added a sentence at L175: “although in 2003-2005 we observe a strong freshening, likely caused by deepening of fresher intermediate waters”.

Indeed, we only have 6 profiles from Deep Argo, however they extend our hydrographic profile time series until 2023 in the Greenland Sea and therefore provide the most recent data we use in this study. We have nonetheless added a sentence at L66: “Although we note that since Deep Argo floats were only recently deployed in the Greenland Sea, we were only able to acquire 6 profiles.”

We have now added the locations of the profiles as dots in Fig. 1a.

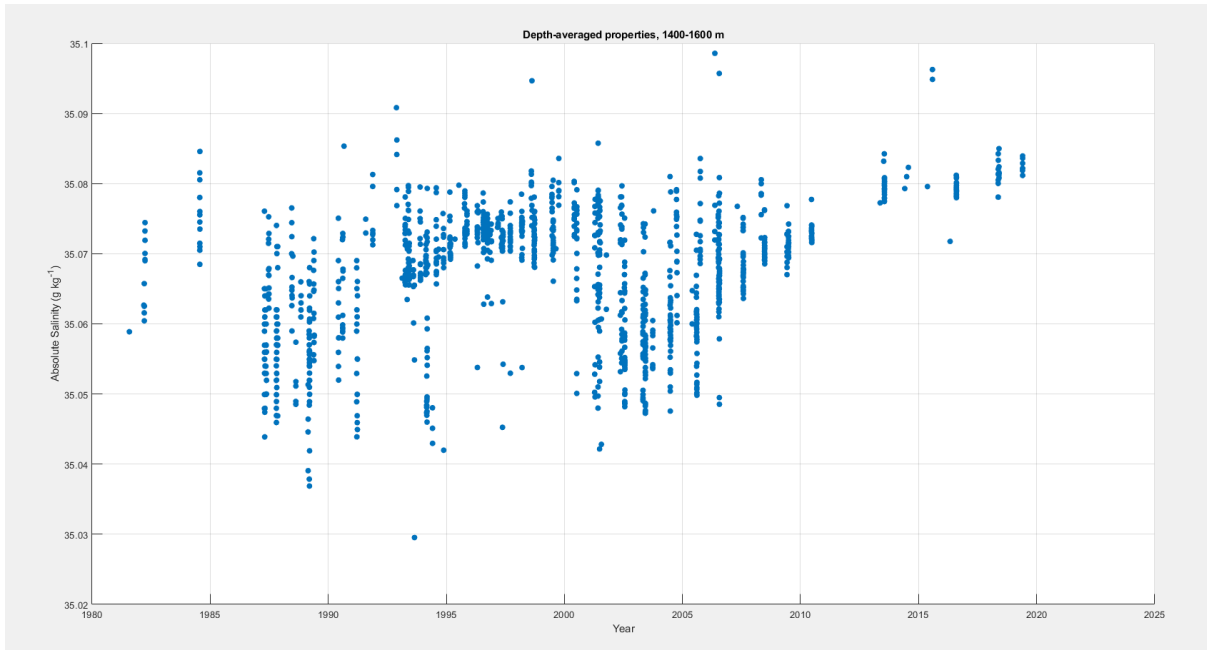


Fig. R1-1. Depth-averaged salinity (1400-1600 m) in the Greenland Sea.

L204 Fig 5b

Fixed

Fig 6 caption Clarify whether the direction of the velocity impacts whether it is +1 or -1. This might be especially useful when in Fig 7 caption you just state that it is the same.

We have now added a sentence in the figure caption stating: "Note that the sign of the velocity itself is near-constant throughout the time series".

Eqn 2: EKE is 1/2 times what you show in eqn 2. This is correct in Fig 8 caption, though it is not clear why you need the info in the figure caption and the main text.

We thank the reviewer for pointing this out. We have corrected the error in eq. 2 and removed the equation from the caption in Fig. 8. We would like to point out that the error in eq. 2 was only in the text and has not impacted the results.

L248 associated with

Fixed

L256 "thus likely plays" maybe replace by "may play". The causal relationship why one should be more important in the net than the other is not clear to me.

Done.

L260 However... grammar!

We agree that the sentence was poorly written at best. We have now replaced it with “However, the hydrographic profile data shows that GSDW is still fresher than EBDW”.

L269 increase

Fixed

L284 What about vertical mixing unrelated to convection?

While there is some vertical mixing unrelated to convection, especially close to boundaries where tide-topographic interactions can occur, this is likely rather small. As explained in Somavilla, 2019 (<https://doi.org/10.1029/2018JC014249>), high rates of vertical mixing would lead to a homogenisation of the water column, which is not observed in observations (Fig. 9 in Somavilla (2019)). Instead, a continuous decrease in temperature is observed rather than a bottom mixed layer. It therefore seems more likely that the deep waters of the Greenland Sea are being upwelled out of Greenland Sea and being replaced by e.g. EBDW and GSAIW.

We have now added in the text at L289: “Previously, high rates of vertical mixing have been reported in the deep Greenland Sea, which would quickly homogenise any gradients in the deep ocean (Budeus and Ronski, 2009). However, this is not observed in recent observations (Somavilla, 2019).”

L311 "tragically" not sure that is the best word. Maybe tone down a bit.

Replaced with “still”

L312 understanding the

Changed

L464 data set from 2010 contains data until 2015?

Yes, the DOI was created in 2010, but the dataset was updated until 2015.