Review on “Deep through-flow in the Bight Fracture Zone and its imprint in the Irminger Sea” by Petit et al.

Summary

Using deep Argo-float and hydrographic data, Petit et al. have investigated the transport and property evolution of the Iceland-Scotland Overflow Water (ISOW) when it flows through the Bight Fracture Zone (BFZ). Possible attributions of the evolution, including isopycnal and vertical mixing in the fracture zone, as well as the property imprint in the Irminger Sea were discussed. Overall, I found the paper well-written and the focus on ISOW branch through the BFZ, which was less studied before, is of interest to the oceanographic community. Observation-based descriptions on transport and property structures were quite thorough. However, their temporal and spatial variabilities observed by the data need better explanations.

Major comments

[1]. It is still unclear of what determines the transport/property difference between years at the BFZ. In 2015, the ISOW at east section is saltier, denser and the transport core is located at the center of the section. In 2017, on the other hand, the ISOW at east section is fresher, lighter and the maximum transport is attached to the northern bathymetry. Is this temporal difference attributable to a different source in the East Reykjanes Ridge Current (e.g. either from west of 30W or between 29-30W)? Or is the interannual variability of the ERRC itself responsible for this downstream difference?

[2]. A related question is whether the difference of cyclonic pathway at the middle section is related to the different transport structure at the east section between 2015 and 2018.

Minor comments

[1]. Line 19 & 234: I think “ISOW” may not be the appropriate name for the deep water in the Irminger Sea because mixing has eroded much of the ISOW characteristics (e.g. high salinity). I would suggest calling it Northeast Atlantic Deep Water.

[2]. Figure 1: The blue dots are indistinguishable from the background color.

[3]. Table 3: The ratio of ISOW transport to top-to-bottom transport seems to be quite steady over years. This implies a barotropic transport variability through the BFZ. What might be responsible for this barotropic variability? This is related to my major comment.

[4]. Line 182: I think you are referring to Figure 1d (instead of Figure 1c). Also, the trajectories in Figure 1d, especially the blue ones, are not easy to track. Please enlarge the trajectories for better illustration.

[5]. Lines 200-205: It is interesting to see a homogenization of the ISOW in terms of temperature within the BFZ. By looking at Figure 4a, there is an increase of bottom depth from east section (station 99) to the middle section (station 104). Could this topographic change result in vertical mixing observed here?

[6]. Lines 239-241: Where are you referring to as “Eastern and Western sills”?

[7]. Line 260: This sentence may need to be re-written. Previous studies have shown a discontinuity of the boundary current from the CGFZ northward based on hydrographic sections (Stramma, 2004) and floats (Zou et al., 2020).

References

Stramma, L. et al. Deep water changes at the western boundary of the subpolar North Atlantic during 1996 to 2001. Deep Sea Res. Part I: Oceanographic Res. Pap. 51, 1033–1056 (2004).

Zou, S., Bower, A., Furey, H., Susan Lozier, M. and Xu, X., 2020. Redrawing the Iceland–Scotland Overflow Water pathways in the North Atlantic. Nature communications, 11(1), pp.1-8.