We thank Referee RC1 for his/her insightful reviews that have helped us improve the manuscript.

Short summary:

The article "Deep through-flow in the Bight Fracture Zone and its imprint in the Irminger Sea" presents the properties of the throughflow through the Bight Fracture Zone (BFZ) from ship based and Arvor float observations and focusses mainly on the property transformation of ISOW passing it. The transports and hydrographic properties of the through-flow are presented and reveal a very variable throughflow of the BFZ. Due to a small recirculation in the middle of the BFZ vertical mixing is discussed. By using two Arvor floats the influence of the through-flow on the ISOW in the Irminger Sea is attempted. The paper concludes a significant influence of the throughflow through the BFZ on the ISOW properties in the Irminger Sea.

General remarks:

I think the paper need some minor revisions as marked in the pdf and attached to this text. the experimental setup was thoroughly though through an only leaves one open question for me. The reasoning about the keyrole of the BFZ for counteracting freshening in the Irminger Sea is not supported enough by the two floats available - I think this paret should be written a little more vague or other observational data should be included in the discussion (remarks in the text). For this reason I would propose to change the name of the work to something less proposing a study of the absolute influence of the BFZ on the salinification of the ISOW signal in the Irminger Sea since from the data base presented here this is not adequately possible.

The two floats show that the salinity maximum associated with the throughflow of ISOW at BFZ is distinct from that of the CGFZ throughflow, and that the BFZ throughflow has a specific signature in the hydrography north of BFZ. Nevertheless, we agree that we cannot show from these two floats that the "*imprint*" of the BFZ through-flow can be traced over the entire Irminger Sea. So following your suggestion, we changed the title into "*Deep through-flow in the Bight Fracture Zone*".

Also, we agree that we cannot quantify to how much the salty contribution from the BFZ compensates for fresh water sources in the Irminger Sea. As such we modified the last sentence of the abstract as: "*Hence, our analysis reveals the key role of the BFZ through-flow in the salinification of the NADW in the Irminger Current*". We also modified the sentence in the result "*Hence, the northward erosion of the ISOW core reveals a compensation between cold and fresh inflow from the Irminger Sea and the saltier and warmer BFZ through-flow, which maintains a maximum in salinity for the ISOW layer at these latitudes*" into "*Hence, the limited northward erosion of the ISOW core reveals the key role of the BFZ through-flow in maintaining a maximum in salinity for the ISOW layer at these latitudes*".

Another point which is more a general point of discussion is the name of the water mass discussed - ISOW or NEADW (see remark in the text).

Formed downstream of the Iceland-Scotland-Faroe Ridge (Van Aken & De Boer, 1995; Dickson et al., 2002), the name ISOW is commonly used to define the water mass with a density higher than 27.8 kg m^{-3} and a salinity higher than 34.94 over the Iceland Basin and across the Reykjanes Ridge (Saunders, 1994; Xu et al., 2010; Zou et al., 2017; Bower and Furey, 2017).

However, we agree with Reviewer 1 and Reviewer 2 that the overflow water circulating in the Irminger Sea is a modified version of ISOW. Following Fried & DeJong (2022), we now use the name North-Atlantic Deep Water (NADW) to call the deep water circulating in the Irminger Sea.

Notes with the pdf:

page 1, L10: This is maybe a general point of discussion - whether to call the water mass ISOW or NEADW. In my understanding ISOW is really the overflow water at the ISR and FBC since it is modified almost directly when entering he Iceland basin - as you describe also in this article - hence, I always call it NEADW. The same would hold for DSOW -> but here we only know one name …
See answer on the general comment #2.

page 1, L13: allow
Done.

page 1, L18: homogenized
Done.

page 1, L19: Should be rather ISOW circulating in the Irminger Sea - or are you sure the ISOW is formed in the Irminger Sea?
The sentence was misleading. It has been modified and now reads: "*There, ISOW is mixed isopycnally with comparatively fresher NADW circulating in the Irminger Sea.*"

page 1, L20: This
The sentence has been removed for clarity.

page 1, L20: results
The sentence has been removed for clarity.

page 2, L35: reach
Done.

page 2, L36: crosses
Done.

page 2, L49: from investigating
Done.

page 2, L51: by
Done.

page 2,L 56: 2 Data and Methods -> general remark : I think it would be nice for completeness to give one sentence on the used toolboxes like TEOS-10 etc for the calculations
Additionally you state you use the methods from Petit et al. 2018 it would be nice to have one or two sentences summarizing the interpolation and treatment shortly.

We clarified the processing of the measurements, which now reads: "*The calibrations and processing of these measurements were identical for all four cruises. As described by Petit et al. (2018), the OS150 datasets were used to correct the calibration of the second S-ADCP, and the velocity profiles were averaged over 2-km segments along the sections.*"

And: "*The geostrophic velocities were estimated from the $CTDO_2$ measurements using the seawater toolbox, and were referenced by velocity measurements from the OS38 and OS75 (Petit et al., 2018).*"

page 3, L 67: Regarding the km scale here I would not call them basins - rather - channels ?
Done.

page 3, L69: 200-m isobaths spacing from white at the surface to dark blue at greater depths; * erase, page 3: The deepest bathymetries are represented with darkest blue
Done.

page 3, L80 : at,
Done.

page 4, L82 : basins -> deep channels
Done.

page 4, L102 : 0.002 psu ? Or g/kg salinity units
As we use the Practical Salinity for a better comparison with previous OVIDE papers, there is no unit (as indicated in TEOS10). We clarified the sentence, which reads: "*The accuracies of the temperature, practical salinity, pressure and dissolved oxygen concentration are better than 0.002°C, 0.002, 1 dbar and 1.5 µmol kg^{-1} for the four cruises, except for the dissolved oxygen concentration for which the accuracy was estimated at 2 µmol kg^{-1} for OVIDE18.*"

page 6, L135 : 0.004 psu ?
See answer above, the sentence now reads: "*Temperature, practical salinity and pressure were measured using a Seabird SBE41CP CTD sensor with a target accuracy of 0.002 °C, 0.004 and 7 dbar, respectively.*"

page 6, L139 : salinity
Done.

page 6, L148 : areas
Done.

page 6, L148 : East Reykjanes Ridge section

We clarified the text by indicating: "*along the OVIDE section*".

page 7, L152 : eastern entrance

Done.

page 7, L156 : East section (upper panels)

Done.

page 7, L156: Middle section (lower panels)

Done.

page 8, L164 : the

Done.

page 8, L165 : the

Done.

page 8, L166-168: Did you check the SPG index -> maybe it also related to different states of the SPG

This is an interesting idea, but with the limited temporal resolution of our data set any correlation with an SPG index would be speculation. We prefer to comment the close ratio of barotropic/ISOW transports for these two years, as suggested by Reviewer 2: "*The similar ratio of ISOW/top-to-bottom transports between 2015 and 2017 suggests that the BFZ through-flow is influenced by local barotropic circulation, as observed at the CGFZ (Bower & Furey, 2017; Bower & von Appen, 2008; Racapé et al., 2019).*"

page 9, L189 : 0.005 psu

As now indicated in section 2.2 and 2.3, the salinity has no unit because we are using Practical Salinity.

page 9, L190: shows

Done.

page 9, L196: which

Done.

page 11, L 222 : channels

Done.

page 11, L 230 : channels

Done.

page 11, L 232 : channels

Done.

page 11, L 234 : from the Irminger Sea.
I am not sure about the exact origin - It might be the ISOW that passes CGFZ, mixes etc and is then transported along the western flank of RR ? ISOW from the Irminger Sea sounds like it is formed here.

As previously, the sentence was misleading and has been modified into: "*This suggests that ISOW exiting the BFZ along the northern walls of the channels is isopycnally mixed with colder and fresher NADW circulating in the Irminger Sea.*"

page 11, L236-237: must originate from the Irminger Sea -> see comment above
The sentence now reads: "*The lower part of the layer (σ_0 > 27.855 kg m^{-3}) is fresher along the northern walls than in the upper part. This lower part of the layer cannot be renewed by BFZ through-flow, whose density is lower than 27.855 kg m^{-3}, and must be mainly fed by denser NADW.*"

page 12, L238 : channels
The sentence has been changed, see answer below.

page 12, L239: See comment above
The sentence now reads: "*The ISOW layer at the exit of the BFZ is thus a superposition of dense waters of different origins: the upper part results from the mixing of BFZ through-flow with fresher and colder NADW, while the lower part is mainly composed of dense NADW flowing in the Irminger Sea.*"

page 12, L243: at a few week interval -> in an interval of several weeks
Done.

page 12, L250: channels
Done.

page 12, 256: from the Irminger Sea
The sentence has changed and now reads: "*Hence, the limited northward erosion of the ISOW core reveals the key role of the BFZ through-flow in maintaining a maximum in salinity for the ISOW layer at these latitudes*."

page 12, L263: channels
Done.

page 13, L273: additional deep inflows -> could diapycnal mixing play a role here? Since you have a steep flanks in the middle part and a recirculation cell diapycnal mixing could be an additional possible source. - how about the import of LSW and SPMW into the section - does it change between im- and export in the BFZ?
Inflows of ISOW through deep valleys localized immediately north of the entrance sill (<0.5 Sv) show similar properties to those of ISOW at the eastern and middle sections. Due to the small evolution of the ISOW properties in the rift valley, mixing does not play a significant role there (Figure 4b).

page 13, L 278: isopycnal mixing -> diapycnl mixing? See my comment above
See answer above.

page 14, L 279: left hand side - > southern side?
Sorry for the confusion. We moved "(*i.e. southern wall*)" immediately after "*left hand side*".

* Highlight, page 14: basins
Done.

* Highlight, page 14: isopycnal mixing
See answer above.

* Highlight, page 14: isopycnal mixing
See answer above.

page 14, L301-302: See Holliday 2018 -> 1 Sv of the flow exiting the IC in the lNADW class is added to the uNADW class at OSNAP -> is 1 Sv really playing a key role when thinking about a through flow of unsteady ~1 Sv through the BFZ? Id rather say that the BFZ is supplying salt to the Irminger Sea but if this really plays a significant role compared to the saline inflow of water in the upper AMOC component in the Irminger current and the slight freshening of ISOW in the Irminger Sea through mixing with LSW is an open question to me. As the salinification of ISOW happens just south of the ISR (Devana 2021) and the ISOW has this very saline signature at the EGC at OSNAP EAST and at OSNAP WEST. I am wondering about the relative importance here.

We agree that ISOW has a very saline signatures at OSNAP East and OSNAP West, both sites being downstream of the BFZ. Here, we simply argue that the BFZ contributes to this very saline signature as evidence by the analysis of the float measurements. This role is further confirmed by the amplitude of ~1 Sv of the ISOW transport through the BFZ. It is of similar magnitude as the exchanges of deep water reported in other main fracture zones of the North and Equatorial Atlantic, including the Romanche Fracture Zone (Mercier et al., 1994), Vema Fracture Zone (Mercier & Morin, 1997) or the Charlie-Gibbs Fracture Zone with 1.1 Sv of ISOW (Petit et al., 2018), with significant impact of the deep water mass properties in the downstream basin. This is now clarified in the discussion:

"*The inflow of NADW from the interior of the Irminger Sea has been estimated to 1.4 Sv by Petit et al. (2019). It is of similar magnitude as the BFZ through-flow estimated in this study (~1 Sv). Hence, our analysis highlights the key role of the BFZ through-flow in the salinification of the NADW as it flows northward along the Reykjanes Ridge and provide benchmarks for the validation of ocean models at high resolution.*"

page 14 L303-307: I would include the OSNAP observations here - the southward current band is not stable and possibly part of a recirculation cell within the Irminger Sea. Additionally concluding from one float I rather arbitrary.
We simplified the discussion of the float trajectories as we agree that we cannot conclude on pathways shown by 2 floats. The first sentence of the paragraph now reads:

"*Although more Deep-Arvor floats would be required to analyze the imprint of the BFZ through-flow on the evolution of NADW properties over the entire Irminger Sea, the pathways of the 2 Deep-Arvor floats can provide insights about the deep circulation in the Irminger Sea.*"

page 14, L306: a local
The sentence has been simplified:

"*The southward propagation of a Deep-Arvor float along the western flank of the Reykjanes Ridge is consistent with the southward currents observed west of the Irminger Current at OVIDE latitudes (de Jong et al., 2020; Lherminier et al., 2007; Sarafanov et al., 2012; Våge et al., 2011) and at 56.4°N along the Reykjanes Ridge (Petit et al., 2019).*"

page 14, L310 : get
Changed into "*got*"

page 15,L 314 : floats
Done.

page 15, L 315-317: I would include the mean circulation argument from eg. Fischer et al 2018 here - the central Irminger Sea is occupied by 2 large recirculation cells rather close to the Greenland shelf break.
The reference has been added.

page 15, L321 – 324 : Maybe add Fox et al 2022
The reference has been added.

References

Berx, B., & Payne, M. R. (2017). The Sub-Polar Gyre Index - A community data set for application in fisheries and environment research. *Earth System Science Data*, *9*(1), 259–266. https://doi.org/10.5194/essd-9-259-2017

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