



EGUsphere, referee comment RC2  
<https://doi.org/10.5194/egusphere-2022-472-RC2>, 2022  
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## **Comment on egusphere-2022-472**

Anonymous Referee #2

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Referee comment on "Observation-based estimates of volume, heat, and freshwater exchanges between the subpolar North Atlantic interior, its boundary currents, and the atmosphere" by Sam C. Jones et al., EGU sphere,  
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Review of Jones et al., "Observation-based estimates of volume, heat and freshwater exchanges between the subpolar North Atlantic interior, its boundary currents and the atmosphere".

This paper creates a novel climatology of the subpolar North Atlantic around the 1000 m isobath and across 47N and discusses properties and fluxes across and with this region. The techniques used are interesting and the climatology looks great. I have reservations about the use of EN4 at 47 N that I think could be investigated further. I think the discussion and observations are good and interesting.

My major comment on the paper is that it could be much more focused. The introduction covers much more material than the results address. The question that the climatology and calculations are addressing could be framed much more succinctly. Likewise in the discussion and conclusions, there needs to be a closing of the loop back. E.g. the discussion around Fig. 12 was very interesting but I wasn't sure what question this was addressing.

I have a long list but these are minor comments, the only major comment is a tightening up of the framing of the results.

Minor comments:

Why were Argo velocities not used? The dataset seems dominated by Argo Fig 2b

I think the abstract is too long and could be shortened to 2 paragraphs. Too much intro material in paragraph 3 of the abstract especially.

L32. This definition of the AMOC is not correct: the AMOC (uniquely) transports heat across the tropics from the South Atlantic

L53, no need to complicate with the drifter results

L58, canonical -> generally accepted

L64, to the mean what? This line throws the paragraph out. If you're considering processes north of GSR, then your first sentence should consider these also i.e. GSR overflows + entrainment in addition to Lab Sea processes are fundamental to AMOC functioning.

L67, 'they' is ambiguous here. I presume you mean Lab Sea density anomalies?

L70, don't see why you're bringing in subpolar mode water

L78, add 'in the eastern basin'

The introduction is very general. It should be more focused to frame this study rather than a general subpolar gyre introduction.

Fig. 2. Radon transform for analysis of propagation speeds in Fig. 2. Not much data prior to 2008. Higher propagation speeds upstream of FSC. Propagation speeds are only relevant for the Argo data, not the CTD data (unless you're telling us about the speed of the ship). Can ship CTD data be removed from Fig. 2b.

L144. What is the justification for using a much longer search radius in the along bathymetry direction than cross bathymetry, limited to 75 km?

L160. It's not so surprising that EN4 and Argo agree closely as the Argo profiles are in EN4. Did you compare with a ship hydrographic section? Are the (complex) fronts and current meanders across this section captured in EN4?

L174. A sensible constraint. What was the reference velocity and how much transport does it amount to in total? Please state in the paper.

L178. The ADT requires an estimate of the geoid, which can be uncertain in the open ocean. How much do your results depend on the mean dynamic topography?

L190, could I suggest using  $l$  or  $s$  instead of  $x$  for your along contour co-ordinate.  $x$  is very frequently used to mean zonal direction.

L195, define  $Q$ ,  $v$  in equation. Suggest using  $Qv$  to match later equations.

L230, did the volume conservation constraint applied in the observations work in the Viking model?

L282, I don't find the overbar helpful notation

L295, counter-clockwise -> cyclonic

Fig4: fabulous figure. Please add colorbars.

L297. I think 'negative' deserves more explanation: it means going to a higher density in a cyclonic direction?

Fig 5a. I'm not sure about arrows here. The arrows don't point in the direction of the current. They're constrained to be perpendicular to your section.

L346. Do you mean Goban Spur or the Porcupine Bank? It looks bigger than GS to me.

L357. I'm struggling with export and a negative number in one line. 'Export of 12 Sv' or 'transport of -12Sv'?

Fig. 6a is hard to read the arrows.

Really interesting breakdown of Ekman component. Why not the same colours for the geostrophic? Fig 5a?

Fig. 7. I like this a lot. Very convincing.

Section 3.4. I need more context here. This overturning is different from say the OSNAP estimate as it's overturning around a closed contour around the subpolar gyre. Could you add the OSNAP mean to Fig. 9 for context? The overturning in this calculation occurs at a lighter density seems to be the key difference (OSNAP 27.5-27.7, here 27.3). As this is a very OSNAP inspired paper—could you break the streamfunctions into an analogue of OSNAP east and OSNAP west?

Similarly, I would suggest adding OSNAP estimates of heat + fw flux to Fig. 10. You get half the heat flux and  $\frac{1}{4}$  of the fw flux of OSNAP.

L585. I don't agree that's what you're doing! Specifically you've calculate the flux across the 1000m isobath + 47 N. I think you need to say that you've built in a definition of interior and exterior at least.

For the discussion, a visual summary would be very useful. It's hard to keep all the numbers in mind.

I like Fig. 12 and the discussion that goes with it.