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Ocean Science Discussions

Interactive comment on "Arctic Mediterranean Exchanges: A consistent volume budget and trends in transports from two decades of observations" *by* Svein Østerhus et al.

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The manuscript is the conclusion of a multi-year effort to bring together information from the exchanges between the Arctic Mediterranean and the rest of the world's oceans. This is an important update of work that was started within the framework of the Arctic-Subarctic-Ocean-Fluxes and maintained since. The implications of these exchanges for the regional and global oceanography are clear and important. The manuscript is written in a straightforward way, of good presentation quality, and therefore easily readable. As such I can recommend publication of this manuscript in Ocean Science after a minor revision.

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Major comments:

One thing that is probably an explicit choice, but does not always work, is that the authors do not consider any information provided about these exchanges by models. I have remarked in the minor comments below where at least a few sentences could be added.

I was a bit surprised that this recent paper which also brings together observational information from most of the same gateways discussed was not mentioned: Bringedahl JClim doi:10.1175/JCLI-D-17-0889.1 At least a reference to it and how those seasonal cycles and long-term time series agree and/or differ seems warranted.

There are many places in the manuscript (e.g. p1l31, p4l3, p16l15/23/29/30) where subscripts and superscripts were not converted correctly into the typeset version.

Minor comments line by line:

p1l31 9.1+-0.7Sv What does the "+-" refer to? Is it the standard deviation? Of what? Please specify.

p1l38 "At the 95% confidence level"

p2l29 and p9l30 "en route" instead of "on route"

p3l5 Somehow the grouping should be different. CAA should be separate from the combined outflow route of FS/DS.

p4l7 "without yielding any information"

p5l13 Many months have 31 days whereas February has 28 days in most years. Has this difference been taken into account? Or in order to arrive at an annual value, did you simply take the sum of (January average + February average + March average + . . .) divided by 12?

p5l17 "but is deeper" Should it not rather be "shallower" or do you need a different

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conjunction than “but”?

p7l1 “it seems clear” Why does it seem clear? To me it is not clear at this point.

p10l10 Are those 0.2Sv accounted for in the surface outflows?

p11l9 Is “Canadian Arctic Archipelago” not a more common term than “Canadian Archipelago”?

p11l18 “mooring array north of the sill”

p14l22 “serial correlation” It is not clear exactly what is meant by that term. Please elaborate in 1-2 sentences.

p14l24 Consider “The exchanges between the AM and the Atlantic are therefore characterized by stability rather than change—at least over the observed period.”

p16 While it is in principal mathematically correct to define tauH and tauQ and relate them to each other (equation 9), in my point of view, this is needlessly confusing. The more straightforward way would be to substitute cos by sin in equation 2 and to have the same phase tauQ there.

p1730-32 What is “wanted” and “unwanted” water? Is not all of the water passing the sections water that passes the sections and therefore to be considered? Maybe I’m just confused by the terminology.

p18l5-7 Are you referring to non-linear effects of correlations between transport and water mass variability on higher frequencies than monthly (e.g. “eddy correlations”)? If so, it is not clear to me why this should be random and small. Rather this could introduce a systematic (rather than random) bias whose magnitude is not clear a priori.

p19l20 This would be a good place to spend at least 1-3 sentences on what models have to say about this point. While your paper is observationally in its focus, you can at least refer to model results for hypotheses/speculation.

p19l34 “in Fram Strait in some years”

p21l6-7 “cannot have been caused” Also in light of your later sentence (p21l12-13) I think this statement is too strong. Given that changes in overflow properties (density in particular) can non-linearly lead to changes in the AMOC even for a constant overflow volume, you could point out that the overflow volume has not changed while you are not focussing on the other properties.

p22l29 “. . . simultaneously. However, even . . .”

p23l2/3 Could you provide more complete links (not just the main website domain) or even more appropriately DOIs?

p30l20 “trends that are significant”

p33l7 “Grey areas . . .” On the shelf this makes for a humorous statement. I presume that was intended. . .

Fig8/Fig10 Both of these figures do not need a panel (a) and panel (b) which then have different spacings on the y-axis. Rather you could have a single panel with the y-axis ranging from -3.5Sv to 4.5Sv. This would make a visual comparison a lot less difficult.

Fig8 In this way, visually January and December are represented as half months while the other 10 months take up more space per month. This again makes a visual assessment of what is happening more difficult than necessary. Put another way, the line connecting December to January is missing while it is present (and occupying the visuals) for the other months.

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