

Interactive comment on “Volume and temperature transports through the main Arctic Gateways: A comparative study between an ocean reanalysis and mooring-derived data” by Marianne Pietschnig et al.

Anonymous Referee #2

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Estimates of a year-long (September 2005 to August 2006) transports through the four main Arctic Gateways from the Centro Euro-Mediterraneo sui Cambiamenti Climatici (CMCC) Global Ocean Reanalysis C-GLORS version 7 (C-GLORSv7) are evaluated in comparison with observational transport estimates based on moored data. The main stated objective of this paper is to better understand and quantify relative contribution of oceanic heat transport to Arctic warming. However, and as pointed in comments by other reviewers, estimates of heat transport at individual gates are not useful due to the problem with the choice of reference temperature; while the Arctic ocean heat

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divergence is only briefly discussed in this manuscript. At the same time, there is a lot of information presented but without specified purpose, with insufficient details and discussion. In the end, it's not clear what the overall 'new' knowledge about the Arctic climate warming this paper contributes.

My suggestion, for a possible major revision, is to focus the results, comparison and discussion on volume transports, as uncertainty in estimates of those fluxes will affect estimates of Arctic ocean heat divergence. In the discussion, I'd encourage more focus on possible causes of discrepancies between different estimates and on quantifying uncertainties in those estimates at each gate, including in relation to other published estimates and/or for other time periods.

The following are specific comments and suggestions to help with such a major revision, should the editor recommend it.

1. Focus on volume transport analysis:

a. Qualify what new knowledge this manuscript contributes to the topic in addition to Tsubouchi et al. (2017a,b), given the 'mixed' skill of C-GLORSv7 and relatively large differences in estimated net fluxes;

b. Quantify uncertainty of flux estimates based on each source / method, not just as standard deviations within each time series but also due to the extrapolation / interpolation methods, use of hydrography to calculate geostrophic currents or use of other model results to fill in gaps and / or missing data;

c. provide more information about the NEMO model and quality of its output at the four gates where OBS were supplemented, including the upper water column and shelves;

d. include volume flux estimates based on all the grid points from C-GLORSv7 for each section and e. discuss those in comparison to the subsampled estimates and those based on OBS;

f. clarify if C-GLORSv7 are subsampled both in the horizontal and vertical to the obser-

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vational 'transport points' or just in the horizontal direction. In the former case clarify further what horizontal length and vertical thickness each transport point represents (i.e. what kriging method was used). In the latter case please justify why subsampling was only used in the horizontal and not in the vertical direction for comparison with OBS;

g. explain reasons for non-zero net integrated volume flux for the four Arctic gateways, including possible contributions from gaps between separate 'lines' evident especially at BSO;

h. expand the discussion of relative eddy contribution to total flux estimates based on C-GLORSv7, which is not eddy resolving for those high-latitude and shallow straits;

i. discuss 'good/bad' agreement in comparison with observational flux estimates for different years than 2005-2006 as well as interannual variability of reported fluxes at different gates;

j. explain how it is possible to increase volume flux by 0.6Sv between northern Baffin Bay and Davis Strait, when the combined Arctic-wide P-E+R+sea ice transport is $\sim 0.2\text{Sv}$;

k. address the discrepancy of the net volume flux estimate for Davis Strait between C-GLORSv7 / OBS and those from Curry et al. (2014) at 1.7Sv for 2005-2006;

l. discuss the importance of mesoscale eddies, common in Fram Strait but 'missing' in C-GLORSv7, as well as the location of section in Fram Strait on estimates of northward/southward/net volume fluxes across this gate; also, as a follow-up to comment 2a above;

m. address the contribution of the Norwegian Coastal Current (Skagseth et al. 2011) to the volume flux estimates at BSO, likely missing in both C-GLORSv7 and OBS, again as a follow-up to comment 2a above;

n. address comment 2a in case of Bering Strait;

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o. compare volume flux estimates presented here against other published modeling results, including: Ilicak et al. (2016), Jahn et al. (2012); Kinney et al. (2014) and address comment 2a again.

2. Remove details and discussion of temperature transports / fluxes for individual gates, leave the Arctic heat divergence for the net zero volume flux and expend discussion of those estimates and associated uncertainties.

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