Ocean Science
Discussions

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Interactive comment on "Volume transport and mixing of the Faroe Bank Channel overflow from one year of moored measurements" *by J. E. Ullgren et al.*

Anonymous Referee #1

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GENERAL COMMENTS

Ullgren et al present moored measurements of the Faroe Bank Channel overflow from the exit of the channel and on the slope from May 2012 to June 2013. Overall the authors have done an outstanding job in collecting and anlayzing this dataset. The long-term measurements of the dense plume allow detailed description of volume transport and turbulent mixing during the initial exit and descent from the channel onto the slope. It is found that, despite strong turbulent mixing changing the properties of the flow drastically, the volume transport does not increase significantly along the path of the overflow analyzed here. My few major comments and questions mainly concentrate on the heat budget analysis that needs a little more work and description. I suggest

publication in Ocean Science after minor revision.

SPECIFIC COMMENTS

2316-18: "mean diffusivities" - probably "time mean vertical diffusivities"?

2316-22ff: If you want to describe the whole GSR overflow you also need to mention the IFR and WTR overflows.

2317-1: Maybe more precise to say "the thermohaline composition of North Atlantic Deep Water"

2317-22: "similar results" - please specify results

2317-23: It would be helpful to mention instruments and averaging time span for the Hansen and Osterhus volume transport.

2319-5f: Continued moored measurements in the FBC since 95! This is one of the few global long term moored time series of (part) of the deep MOC, so I wouldn't say most of the work on the FBC has been based on hydrographic sections.

2323-22: Do uncertainties become too large when going beyond January 17 with less instruments? My earlier understanding was that some ADCPs stopped sampling after about 3 months, so this statement doesn't make sense.

2323-24: How do you calculate the standard deviation of daily values?

2325-5: Any idea what could cause a seasonal cycle in core plume temperatures? Hansen & Osterhus (2007) show a seasonal cycle in temperature with a minimum in July/August.

2325-14: How do you know about semidiurnal variability in volume transport if daily averages were calculated? Why not calculate hourly transport and show the tidal peaks in the spectra?

2325-15: What is the difference between plume transport and total transport?

2325-9: Either swap Figs. 7 and 8 or mention Fig. 7 already when talking about volume transports in Section 4. I'd prefer the latter.

2328-18ff: The heat budget section needs a little more scrutiny. For the heat budget to work you need to assume steady state, this needs to be discussed. I do not understand the averaging process, what do you mean by "daily averaged data in 30 day windows to sufficiently average over the 3-5 day mesoscale variability"? Equations 1-4 need to express that quantities are averaged. Shouldn't the horizontal eddy temperature fluxes enter equations 3 and 4? What are the errors on volume transports Q3 and Q6 through upper isotherms?

2329-10: The equation relating turbulent vertical heat flux is defined locally, not in an area-averaged sense as implied here. The quantity you get from the heat budget, averaged over the volume/area defined by the mooring arrays, is the heat flux. Calculating an average vertical diffusivity can be misleading as K and dT/dz may not be independent from each other.

2329-26: I am not convinced yet that the Ekman transport can be neglected in the heat budget. The plume has lateral temperature gradients as you move from the edge to the center, i.e. the zero degree core of the plume doesn't cover its whole width. Also, at Section S there is no zero degree water left. You mention transverse circulation later in the discussion (2332-23), could this not be at play here?

2330-7: K is usually termed vertical diffusivity, not eddy diffusivity.

2333-1: What could be the important implications?

2333-18: Again, K should be vertical diffusivity.

2334-7: Great to see that horizontal eddy fluxes are consistent with baroclinic instabilities generating the eddies!

2335-12: Repeating the heat budget results here seems a little out of place where one expects a more general closing statement.

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2336-4: Table A2 does not list the percentage of data discarded.

2336-10: Does it make a difference if you calculate volume transport from hourly observations of T and v and then low pass-filter? Why do you reduce your resolution in time?

2337-1: Would it make a difference if all velocities were included?

Figure 1: Labels on the depth contours would be helpful. Also, colorbar should be labeled here and elsewhere.

Figure 4: Different colormaps for time-mean and standard deviation would make this figure much easier to interpret. Again, colorbars should have labels.

TECHNICAL CORRECTIONS

2316-5 arrays were deployed - use past here and elsewhere if applicable

2319-22: at section C, at section S

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