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Ocean Science Discussions

Interactive comment on "Transport of AABW through the Kane Gap, tropical NE Atlantic" *by* E. G. Morozov et al.

Anonymous Referee #1

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The authors have gathered an interesting data set on the temperature and flow of the bottom water of Antarctic origin at the Kane Gap, a deep passage that connects the Gambia Abyssal Plain and the Sierra Leone Basin at the bottom water level. This data set deserves to be published however in my opinion a major revision is needed before the manuscript can be considered ready for publication in Ocean Science.

My main criticism is that the authors focus on the analysis of one current meter record and ignore the analysis of the repeat hydrography and current meters at shallower levels that would provide complementary information on the variability of the cross-channel structure and on the vertical structure of the flow. This additional analysis is mandatory for a better understanding of the representativeness of the punctual current meter measurements discussed in the manuscript (see also detailed comments).

In general the manuscript is lacking adequate reference to literature especially in the introduction where the main papers on AABW circulation in the Atlantic should be mentioned (see also detailed comments).

Detailed comments

P541: The bottom temperature at the entrance of the Chain Fracture Zone should be updated according to Mercier and Morin (1997, their table 1) who reported a bottom temperature of 0.682°C at the entrance of the Chain Fracture Zone, a value very similar to the bottom temperature found at the entrance of the Romanche Fracture Zone (0.674°C) and quite different from the 1.33°C inferred from Mantyla and Reid (1983) and quoted here.

P541: An AABW transport of 0.4 Sv through the Vema Fracture Zone is in the lower bound of published estimates. This should be reported. For instance Fischer et al. (1996) measured a transport of 1.8 to 2 Sv below 2°C, McCartney et al. (1991) reported a transport of 1.3-3.0 Sv and Rhein et al. (1998) measured 1.1 Sv.

P541: Most studies on AABW transport in the eastern North Atlantic haven chosen to define AABW as potential temperature less than 2°C. It would be better to systematically give the transport estimates for this temperature limit as well as for potential temperature less than 1.9°C. (eg in a table summarizing all transports values).

P541, last paragraph: This is an oversimplified view of the AABW dynamics. The fact that the colder temperature observed at Kane Gap is 1.85°C does not necessarily mean that AABW with potential temperature less than 1.85°C away from the Kane gap does not flow through the Gap. It could also be that it warms up while flowing.

P542: Some explanation about the choice of the mooring deployment location is needed. Why on the western side of the Kane Gap (and not in the middle or on the right side)?

P542, the dataset is made of 5 CTD/LADCP sections. Only one CTD/LADCP is shown

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while it would be quite relevant to the present study to discuss how the cross-channel structure of the flow varies from one survey to the other. This would help interpreting the present results that are based on one punctual current meter record only. The mooring was equipped with three current meters, but only one time series is displayed and discussed. The vertical structure of the deep flow is not addressed. How does it vary with time?

P542: I suggest a stand-alone section for the technical presentation of the data set and not to mix it with the scientific discussion of the data set.

P543, l28. The bottom potential temperature value of 1.8°C should be indicated in Figure 2.

P544, l1-3: This assertion should be documented by a study of the evolution of the vertical temperature profile along the bottom water path. Also, it seems from Figure 2 that the bottom potential temperature in the Gambia Abyssal Plain is very close to the one observed at the Kane Gap, which is in contradiction with your statement.

P544, l5-9. Since the LADCP section is not shown in Morozov et al. (2010d), it should be presented in this paper.

P544, l9-11. The coldest bottom water is also found at the western side of the Kane gap in Figure 4. Again it is necessary to show all the CTD and LADCP sections such that the reader can makes its own opinion on the cross-channel variability of the flow. The statement on the role of the Ekman frictional boundary layer should be substantiated by (at least) adequate reference to literature.

P544, l11-19: please show the data!

P545, l1: Thierry et al. (Ocean Dynamics, 2006) have shown that the seasonal signal which is observed in the Romanche Fracture Zone was caused by the vertical propagation of equatorial Rossby waves generated at the eastern boundary. This signal is thus likely to be confined to the equatorial band.

P545: The vertical structure of the flow should be discussed based on the three current meter records obtained in 2010-11.

P545, l6: Was this transport computed using the three current meter records?

P545, l22: Bottom potential temperature does not reach 1.92°C in Figure 5.

P545, l19-20: This statement is true only for waters in the vicinity of the Kane Gap.

P546,l4: This transport variability of +/-0.3 Sv should be presented before. The conclusion is not the place where presenting a new number (especially without any explanation on how it was obtained).

P545,l7-8: This statement was not proven (and I believe it is false).

Figure 2: The oval is too thin on the plot and I can hardly distinguish it from the background.

Figure 5: Indicate that those are daily values.

Figure 6: Add confidence intervals. It might be interesting to average the highest frequency to reduce the noise.

Some relevant references

Fischer, J., Rhein, M., Schott, F., Stramma, L., 1996: Deep water masses and transports in the Vema Fracture Zone, DSR I, 43, 7, 1067-1074 Hall, M. M., M. McCartney, and J. A. Whitehead, 1997: Antarctic Bottom Water flux in the equatorial western Atlantic. J. Phys. Oceanogr., 27, 1903–1927.

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McCartney, MS, Bennett, SL, Woodgatejones, ME, 1991: Eastward flow through the mid-atlantic ridge at 11°N and its influence on the abyss of the eastern basin. J. Phys. Oceanogr., 21, 1089-1121.

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Mercier, H., and P. Morin, 1997: Hydrography of the Romanche and Chain Fracture Zones. J. Geophys. Res., 102, C5, 10373-10389.

Rhein, M., L. Stramma, G. Krahmann, 1998: The spreading of antarctic bottom water in the tropical Atlantic, Deep Sea Res. I, 45, 507-527.

Thierry, V., H. Mercier, A. M. Treguier, 2006: Direct observations of annual and semi-annual fluctuations in the deep central equatorial Atlantic Ocean. Ocean Dynamics, DOI: 10.1007/s10236-005-0045-y.

Interactive comment on Ocean Sci. Discuss., 10, 539, 2013.