Ocean Sci. Discuss.,
doi:10.5194/os-2016-76-RC1, 2016

Ocean Science Discussions

Interactive comment on "Characteristics and causes of Deep Western Boundary Current transport variability at 34.5° S during 2009–2014" *by* Christopher S. Meinen et al.

Anonymous Referee #1

Received and published: 16 November 2016

This paper presents the second set of observations from the 34S array in the Atlantic, measuring the strength of the deep western boundary current. The observations have now been extended to >5 years.

The main new findings that I gleaned from this paper are perhaps unsurprising (given recent developments in monitoring circulation in the North and South Atlantic by this set of authors and others): 1. The strength of the DWBC is highly variable (with a total range of 140 Sv) compared to the mean (expected to be around 15 Sv, but subject to the choice of reference level - see point 3). 2. Variability is particularly strong on sub annual timescales (here in the 90-150 day band, and also the 20-50 day band), and likely associated with eddies or Rossby waves, and 3. It can be complicated to

measure mean transport strength using geostrophic methods. In this case, the authors use the velocities at 1500 dbar from a numerical model (OFES) and reference their geostrophic velocities to this depth level.

The paper represents a valuable contribution, particularly given the importance of the South Atlantic transports to ideas of the stability of the MOC (not mentioned in the paper).

I have a couple questions on the methods:

- How sensitive is the mean or transport variability to the choice of reference velocities from OFES? Why did you choose 1500 dbar (L194) if the level of no motion is closer to 800 dbar (L412)?

- Can you give an indication of how low frequency fluctuations (not measured by PIES) might manifest? Fig 6 shows that the relative velocity contributes less than the absolute velocity to the transport estimates âĂŤ what portion of the velocity comes from the 1500 m reference vs pressure from the pies? For someone who might like to further interpret the time series of the strength of the DWBC, over what frequency bands is the variability "trustworthy"?

- The discussion of the pathways of the DWBC seems valuable âĂŤ that 20% of the DWBC volume transport is taking another pathway, but perhaps is mostly a reference to previous work by Garzoli et al. (2015) and van Sebille et al. (2012). Can the variability of this percentage be deduced from this dataset (or from a dataset that is fully transbasin)? Is the result that the AABW flow is northward subject to any of the reference level or other choices? This also seems like one of the more startling results if you are now identifying that the northward AABW is not in this region.

Comment - I find the composite analysis only marginally enlightening. Given the later results on the importance of westward propagating features it is possible that another method of identifying the characteristic patterns of variability would be more suited to

this phenomenon. This may be beyond the scope of the present study, as the model results and previous studies in the North Atlantic do support the conclusions of the influence of westward propagating signals on DWBC measurements.

Comment - of the proposed improvements (L685/686), I don't know whether better resolving the westward propagating signals is worthwhile. Investing additional observations on full transbasin measurements would allow a better estimate of the time mean transport, which seems like a worthwhile endeavor. I suppose one reason the higher resolution in the wset could help is if a shorter distance between observations means that eddies are better resolved and so not aliased by the array (L530)?

On the figures, I would recommend not using the jet colormap anywhere. In your velocity figures, it can make it hard to visually distinguish between weak northward and weak southward flow, and artificially highlights the "yellow" color which is a mid-range value and otherwise unremarkable. (Fig 2, 5, 9, 11, 14)

Minor points:

L24, midpoints BETWEEN three of the existing?

L46, SOCIETALLY?

L402, Is there a sensible way to choose the offshore limit (rather than a fixed 200 km)?

L557-558, Anticorrelated seems expected since both have site B as a boundary. Lack of anticorrelation would be if the transport variability were dominated by variability at sites A and C.

L567, "more complex and nuanced" - can you be more specific?

L607-608, I don't see eastward propagation. I see faster westward propagation in the east, and slower westward propagation in the west

L641-642, Do these features have a surface expression, as in SSH? Could use SSH to identify the features observed by the PIES (probably beyond the scope of the present

study)

Interactive comment on Ocean Sci. Discuss., doi:10.5194/os-2016-76, 2016.