

This paper is a valuable contribution to knowledge of the phenomenology of the eastern tropical North Atlantic, especially as it relates to the supply of oxygen to the oxygen minimum zone. The authors gather an impressive collection of data from satellite altimetry, ADCP/hydrography sections, float trajectories and a tracer release. The paper describes the circulation as revealed by these methods over the past decade or so. A very significant result of the work is the report on the long term decline of oxygen in the oxygen minimum zone over the past several decades. This trend seems to be well documented.

The paper is mostly descriptive of the circulation as revealed by the methods mentioned above. This circulation, including transport by mesoscale eddies, is no doubt a dominant player in resupply of oxygen to the oxygen minimum zone (OMZ), the other potential player being diapycnal mixing. A disappointing aspect of the whole paper in its present form, however, is that it does not address the authors' estimates or even speculations about how oxygen is fed into the OMZ. Was this answered by earlier papers by the same research group? If so the results could be summarized here. If not, what work is in process to address this important question?

Some more minor or detailed comments are as follows, in the order in which material appears in the manuscript.

For the abstract:

Mixing the discussion of the surface flow with the flow at the level of the OMZ is awkward and distracting from the OMZ flow, the way it is presented. I would leave out mention of the surface flow in the abstract.

What is meant by "northward shift" in the abstract?

What is meant by "expands into the OMZ layer" in the abstract?

The phrase "the OMZs" seems like it should be "the OMZ" or just "OMZs" in the abstract. Another distracting and awkward facet of the paper is the inclusion, with little context, of the Pacific OMZ, or of OMZs in general.

The abstract would read more smoothly if the sentence bringing up the performance of the oxygen sensor came before the sentence starting with "Mesoscale eddies ..."

The presentation of the tracer data together with the ADCP data in the figures is novel and economical. However, interpreting them together is naïve, since the ADCP surveys give a snapshot influenced by eddies and internal waves, while the distribution of the tracer is the result of the advection field over the previous many months. This fact is acknowledged only in the discussion section; it should be acknowledged when it first comes up. Comparison of the tracer distribution with the float trajectories, or the float displacements at parking depth, with the surface displacement removed, seems a bit more relevant. Most relevant is the comparison of the apparent tracer movement with the mean of many ADCP sections. So I recommend reversing the order, and the emphasis of the comparisons of current measurements and the distribution of the tracer.

I'm not sure what is meant by the sentence:

"Our three floats may underestimate the mean eastward spreading of the tracer during periods of westward recirculation"

Do you mean that the floats were biased because of the time they were deployed?

Again, it does not seem justified to use ADCP snapshots to give the general circulation, as in the following sentence. Indeed the impression I get from the ADCP velocity maps is mainly one of a field of eddies that may be transitory.

“To the south of the deployment location large tracer signals are found at about 6_N
25 where the ADCP velocities are directed westward and indicate recirculation of the lower part of the NECC or the nNECC to the west”

Here is another example of assigning too much permanence to the ADCP data. The tracer may have been moving westward at the moment of the ADCP profile, but the main point should be that the tracer has moved west over many months from the release location:

“At 6 to 7_5N the floats have a westward drift and the tracer signal in December 2009 is large and directed westward”

In the sentence containing the following, I would say “appeared to be” rather than “was”. The tracer may have moved equatorward and been swept out of the region of the survey.

“the tracer signal is almost zero, hence there was no exchange between
25 the NECC and the equatorial region”

The following sentence starts with the tracer signal and ends with the float. Was “tracer” meant where it says “float” near the end:

“The tracer signal between the Cape Verde Island and Africa along 15_N is near zero except for a weak signal at 21 to 22_W, indicating a weak northward flow component which might have shifted the float to the north of the Cape Verde Islands.”

It seems that the section on the tracer should have started with the following paragraph and figure, rather than ending with it, since it is the start of the tracer story. Also, the floats are hard to find in the figure (I can find two of them with a lot of searching):

15 In November/December 2008, just seven months after the deployment the tracer was located closer to the deployment region and the ship survey was carried out in a smaller region near the deployment site (Fig. S5). The maximum tracer concentration seven months after the deployment in November 2008 are up to 230 fmkg \square 1, much larger than the maximum tracer values of 6.5 fmkg \square 1 in November/December 2009 or 3.9 fmkg \square 1
20 in October/November 2010. The strongest tracer values were observed northeast of the deployment site with the highest values at about 9_N, 20_W and the float f350 shifted also to this region. The two other floats shifted toward the southeast and in this region a westward recirculation with enhanced tracer values is present. Some of the tracer shifted around the Guinea Dome and spread westward at 11_N.

A note on English usage: The phrase “up to” or the word “through” would be better than “until” in sentences like the following.

The shipboard oxygen observations in 2008, 2009 and 2010 augmented by 4 other oxygen cruise measurements are used to determine the deoxygenation trend near the Guinea Dome in the upper OMZ until the year 2014

“Until” carries a strong implication that something different happened afterwards. “up to” might also, but it is a weaker implication. “through” has very little of such an implication.

Again, regarding eddies as they are mentioned in the discussion, eddies do seem to affect the ADCP patterns shown, as I already mentioned, - the circulation argued for seems blurred by eddies. The Guinea Dome anticyclone is not always clear. "Recirculations" seem to be invoked for westward flow where eastward is expected, but maybe cases of unexpected westward flow are merely due to transient eddies.

The following sentence needs to be reworked, though I think I understand it and agree with it. The word "variability" is used 4 times! Plus mesoscale variability should be acknowledged much earlier, as I have already suggested, when comparing ADCP, float and tracer measurements.

“In snapshots of the horizontal distribution of current vectors combined with oxygen
25 and tracer measurements (Figs. 6 and 11) the mean large-scale circulation signal is obscured by meridional variability in the flow components as observed in the ship surveys and in the SODA velocity field and is overlain by circulation variability caused by climate related variability such as the AMM and mesoscale variability”

The paper ends with the following rather weak statement about the circulation. Is the reader supposed to infer the relevance to supply of oxygen to the OMZ? Again, the paper should address this issue to the extent possible, since it seems to be the main issue motivating the research.

“Nevertheless, the different measurements used and combined here demonstrate that the circulation of the upper OMZ widely mirrors the near-surface circulation (Fig. 12) except for the weak 200 to 400m flow below the NECC and an enhanced westward excursion of the 200 to 400m flow north of the Guinea Dome at about 12° N.”