

Interactive comment on “Water masses and zonal current in the Western Tropical Atlantic in October 2007 and January 2008 (AMANDES project)” by A. C. Silva et al.

Anonymous Referee #1

Received and published: 31 January 2011

General impression:

The manuscript is poorly written. Potentially, some of the issues with the manuscript have to do almost as much with poor representation of the data, methodology and results as they have to do with mistakes in deriving the results.

The data can be represented in a much better way, bigger fonts would be a first step. More below.

The discussion of the currents and their connections is not very clear, has some mistakes, and the way the NBC retroreflection is described is not very accurate. The velocity figure is not done in a way to best represent the currents (at least for the diagonal

C698

transect 2).

The water mass description is even more confusing. It uses water mass terms in a different way than earlier papers, and sometimes uses the same term to lump together two clearly differ water masses. How much of this is due to the text not reflecting what the authors really want to say is not clear to me.

Section plots of theta, S and O₂ would make it easier to follow the water masses than the chosen T/S (& ...) diagrams, especially when it comes to a quick look at regional differences.

The analysis of water mass mixing ratios seems to be flawed. Also, the discussion of the results is weak.

The conclusion that the oxygen concentration in the AAIW layer went down between the two cruises has not been shown conclusively.

The overall rating in the 3 categories was not easy. If results and methods are poorly represented, then it is hard to say for sure if they are valid. However, I'm pretty confident that the described problems with the oxygen and the water mass mixing analysis justify a rating of the scientific quality as poor. Since the presentation quality is also poor the scientific significance is most likely poor or fair. This is not to say that a proper presentation of the results could potentially result in a good rating under scientific significance.

More details on these points are given below.

Abstract line 2: "a" is missing behind the "and" (the measurements are obtained by two independent systems). line 21: disconnect. I assume the AAIW is meant.

p.1955 line 3: "This system ...": the sentence describes the topography, not the "system". line 11, 12: move whereas to after "Hemisphere". line 14: The NBC/NBUC system transports more than surface water -> delete "surface". line 15: I assume "those" refers to NBC/NBUC. If so use "the latter" line 17: mix-up between "east" and "west".

C699

line 17, 18: not sure how important that statement is. If kept: change "current systems" to "currents" line 20: it is not clear what "these currents" refers to (the previous paragraph described currents that fit and currents that don't). Also, I'm not sure, but there could be a mix-up between "east" and "west". If the NEUC and EUC are meant: these two were not mentioned in the previous paragraphs (nor where the acronyms defined - the EUC is defined later), but they are at least eastward currents.

line 22: are there 2 retroreflections of the NBC? Or, is the feeding of the NBC into the EUC a retroreflection? As far as I know there is only one retroreflection that pulses and sheds the rings in the process. So, at times the retroreflection may be far enough south to feed into the EUC while at other times the NBC feeds into the EUC without the characteristic shape of a retroreflection (no sharp folding back of the current and no ring shedding).

p.1956 line 18-20: I agree with the use of NAW and SAW for the water above the thermocline (in the mixed layer). What I think is confusing is to use the same names for the water below the thermocline. The fresh, oxygen-rich water of SA origin below the thermocline must be the AAIW. Maybe, the salty, low-oxygen water of NA origin below the thermocline also has a more precise name? Stating precisely what is meant by "below the thermocline" would also help (how far below?). If the "below thermocline SAW" indeed is meant to be the AAIW, then how does it get into the "coastal system". Coastal areas usually are very shallow (<200m deep). Maybe calling it a "coastal system" is not the right term?

line 28: delete "comprised"

p.1957 lines 9-10: what's "physico-chemical exchange"? I'm not sure if the word physico exists. I assume you mean exchange of physical and chemical properties between water masses. In addition, what is meant by the exchange of physical properties? Flow characteristics? Temperature? Potential Vorticity? What is the passive margin of the Amazon River estuary?

C700

lines 22-23: what is the pumped water? Is it the ship intake? It sounds like the water from the Niskin Bottles wasn't used. Is this true? Having a salinity accuracy of 0.01 is quite poor for an SBE CTD system, but it would be expected if no recent calibrations of the sensors were done and the salinity was only checked against the water from the ship intake.

p.1958 line 8: replace "up to the subsurface (~200m depth)" with "below ~200m" if that's what you meant to say. line 10: delete ", located" line 11-12: move "in summer" to the end of the sentence line 13: 5N is not shown in the figure. line 14-15: explain the conclusion "suggesting that ...". I do not know why that should follow from the previous statement. lines 25-...: Why is the NECC so much weaker in transect 2 than in transect 1?

Figure 2: it says eastward velocities are shown. I assume that means zonal velocities are shown. It would be more informative if the velocity in the direction of maximum flow were shown. Doing this would truly capture the strength of the currents along the shelf break.

p.1959 lines 3-7: On the one hand: if you do not want to show the sections of 1/2008 and do not want to discuss them in any form here, then I suggest to delete the whole paragraph and leave it to the future paper. On the other hand: what surprises me is that the water masses for the 1/2008 cruise are discussed in the next section. So why skip the velocities? line 11-15, Fig.3: A section plot of the salinity would more readily show the influx of the Amazon water. The paragraph mentions rain fall. Is there evidence in the data of rainfall events? Isn't the SMW the Subtropical Underwater (STUW, eg Snowden & Molinari, 2003)? Since it is not at the surface, why should it be part of the TSW? Below you identify it as coming from the south. line 18: How can the ACW be between the thermocline and an isopycnal? I can't read the numbers in the figures (too small fonts throughout), but the thermocline includes the isopycnal mentioned (what helped was the 450m mentioned in the text). Even if that is not the case: the thermocline extends over a couple of hundred meters, so it is very imprecise

C701

to use it as a watermass boundary. In fact: Central Water is the "thermocline water". So please check the use of thermocline throughout to make sure that similar problems do not exist elsewhere. lines 24-25: as stated in line 20 the ACW has a linear T-S relationship (as found in the thermocline), so how can the NACW have a high salinity above and below the thermocline?

I gave up on the water masses of the "surface layer", because the inconsistencies continue. Maybe it is just that the text does not reflect what the authors want to say?

p.1961 change austral ocean to southern ocean. AAIW discussion: I do not see a need to call it "AAIW - Guyane". The AAIW subsection for the January cruise seems odd, since it basically consists of only one sentence. Skip it. Oxygen depletion is no surprise. Why not discuss it right here?

p.1962-1963: It is quite obvious that AAIW will lose oxygen due to biological activity as well as mixing on its way away from the source region. What's not very well explained is why a comparison of AOU in the study area and AOU at the same latitude from the WOCE atlas supports this. After all, all AAIW at any latitude and longitude away from the source region will have experienced both effects. Especially, the paragraph lines 16-24 on p. 1963 needs rewriting.

p.1963: The text mentions figure 8. This figure does not exist.

p.1964: what values were used in the equations for the "source AAIW"? Those on p. 1963? The calculation of the mixing ratios is poorly described, and leaves me with the suspicion that the way they were calculated is wrong. One main concern is, that the mixing does not take place on the spot, but along the way of each water parcel basically all the time. Therefore, a local solution of the set of equations is not very meaningful. Basically, the equations would need to be solved for three source water masses (i.e. not using local water mass properties). The difficulty is to know what to use as a source water masses. Another problem is: Considering that there is quite a large range of values observed for each parameter and water mass during each

C702

cruise, and that the profiles during the 2 cruises were not taken at the same locations (according to figure 1), it seems likely to me that the difference has more to do with the method rather than with a real change of the mix of water masses. Aside from that the reader can not know what exactly was done to get the results because the table shows only one set of numbers for each water mass (and the line with the unexplained "water mass mixture"), so it is unknown (to the reader) which values are different between the cruises and by how much they changed.

To summarize: I do not agree with the way the calculation was done and represented, and I do not agree with the conclusion that the differences of the contributions by the three water masses between 10/2007 and 1/2008 are due to seasonality and it's impact down to the AAIW depth. Generally, seasonal/temporal differences in water mass composition are likely to occur near the source region and get "diluted" the farther away a water mass is from its source region. This is not to say that a reader can not be convinced that the variability has to do with seasonal differences, but it has to be shown very clearly that the observed differences can not be caused by anything else.

Figure 6: which stations are these AOU-T diagrams for.

Interactive comment on Ocean Sci. Discuss., 7, 1953, 2010.

C703