Waite et al Biogeosciences Discuss., 10, 1–26, 2013

In many regions, and for a number of reasons, low oxygen/high nutrient layers form in oceans. Because these waters are isolated from the atmosphere (thus low oxygen), they are bound to become more acidic as nutrients accumulate and oxygen is consumed. This paper identifies one such water mass off the northwest coast of Australia, suggesting much of the nitrate (and therefore the oxygen loss) in it arises from nitrogen fixation.

General comments

I cannot see that particles trapped in density layers are a cause of low oxygen waters below (abstract and discussion). Particle rich layers look more like they were recently transported from the ocean surface to depth (as you discuss in section 4.2). Most models of particle remineralization suggest an exponential decline with depth, although some work is suggesting zooplankton play a significant role in transport and turnover (e.g. Steinberg et al., 2008 Limnol. Oceanogr, 53(4), 2008, 1327-1338). It is unusual to see particles sink and concentrate on a density surface.

This does not affect the main tenet of your work, that nitrate in the low oxygen layers arises from fixed N. It just suggests the process is not local (not arising from particles sinking to depth along the Australian coast. Imasoto et al 2000 (J. Oceanogr 56) provide estimates of oxygen consumption rates in the Indian Ocean which may help establish the age of the LDOHN waters, although I don't think such a discussion would assist your paper.

Specific/technical comments

Indicate which data have been used in all figures (missing in Fig 2, 6, 7)

In methods, supply dates of survey cruises. I gather circulation is strongly seasonal in this area, so we need to know when sampling was carried out.

Various currents could be identified in Fig. 1. I concur with reviewer 1 that the map size could be increased, also the domain may have to increase slightly to help identify currents.

Note the frequent use of LODHN (all figures) but the water mass is defined as Low Dissolved Oxygen, High Nitrate (LDOHN) in the introduction and discussion. Maybe LOw Dissolved oxygen High Nitrate is the easy way out.

Fig. 1. Units needed for most parameters. Show current directions on the map which may require expanding its domain (S and C trajectories if possible). Please confirm transmission is a voltage. Units look like % light transmission over the optical path length (e.g. %/25 cm or %/m). I don't see SB shown on the map. Also what is the colour shading, perhaps temperature? You could use satellite chlorophyll (monthly averaged from NASA's Giovanni site for example, see below) if this helps identify particle sources.

Fig. 2. use S for salinity to shorten. Note spelling error of salinity, line 11 of caption. Fig 1 shows high particle concentrations only in surface waters. Are the particle rich layers associated with LC and EGC?

What is missing is a plot of oxygen vs light transmission which would show whether particles are associated with LDOHN layers.

Fig. 7. add to caption GROUP 3 where appropriate. (B) Remove space in "based". Axis labels (B and C) and panel identification (A, B, C) should be enlarged. I am squinting to read them at 150% enlargement.

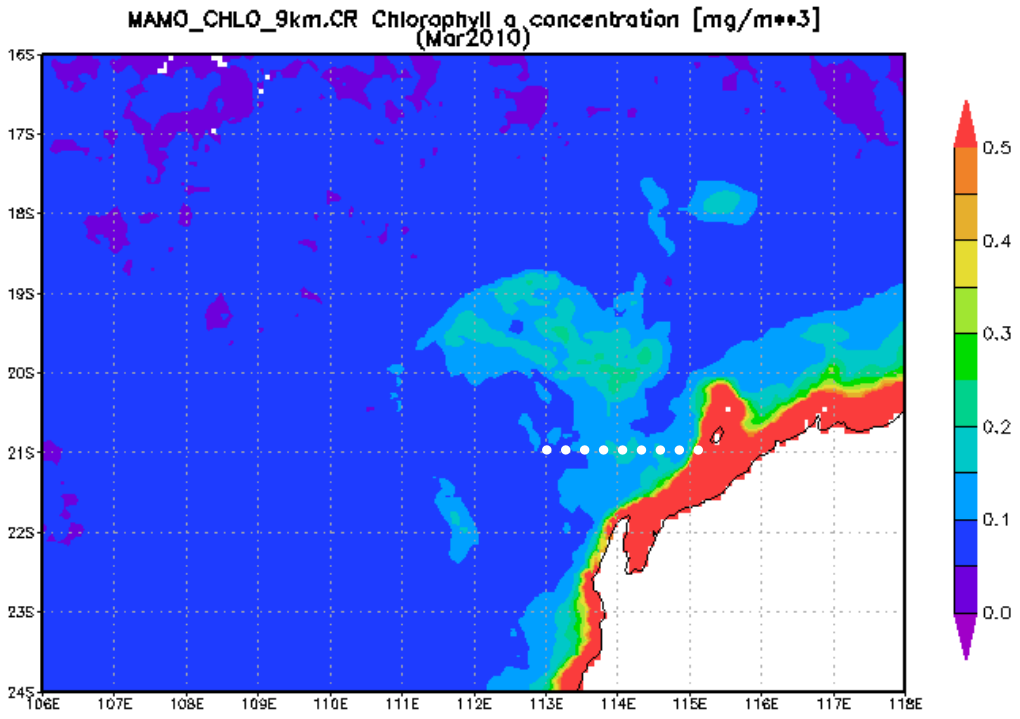
I'd also love to see these groups of data plotted on e.g. Fig. 4 or some graph which helps show exactly where the groups are found within the water column.

Fig. 8. correct spelling of periodically. Define current directions for both symbols (x and dot). Some of this information would be helpful in Fig 1 to inform the reader earlier about current directions. Reword the last sentence - as it stands it reads that nitrate is remineralized.

I am more familiar with density quoted as sigma-t or sigma-theta. Make it clear in methods you are using *in situ* density.

p 9, l 19-20 - remove one "nominal" from sentence

I plotted March 2010 (and April, not shown) chlorophyll in your study region to help understand where particles may come from. In both months, increased chl was observed over a broad shoal, upstream of your study site.



Giovanni plots (http://gdata1.sci.gsfc.nasa.gov/daac-bin/G3/gui.cgi?instance_id=ocean_month) of MODIS chlorophyll, averaged for March 2010. Surface chlorophyll is generally low, although the survey line at 21 S does show levels >0.1 mg m^{-3}. The area of elevated chlorophyll is evident also in the April average. White dotted line represents the 21 S survey line.