Biogeosciences Discuss., 9, C3470–C3473, 2012
www.biogeosciences-discuss.net/9/C3470/2012/

Biogeosciences Discussions

Interactive comment on "Modeling the seasonal cycle of the oxygen minimum zone over the continental shelf off Concepción, Chile (36.5° S)" *by* J. Charpentier et al.

Anonymous Referee #2

Received and published: 21 August 2012

General comments:

In this paper, the authors attempt to determine the contribution of different physical and biological mechanisms to the observed oxygen concentration distribution over the shelf off Chile using a 1D model. They attribute the observed changes in the distribution of oxygen concentration over the shelf to lateral exchanges with the shelf slope. I think this is clear from the observations but a model is useful to quantify the contribution of the different processes. However, I have some concerns about the model. Even though observations are used to calculate initial conditions and O2 evolution, the model fails at reproducing O2 concentrations, even near the surface (see more detailed comments

later on). Also, it is not well explained, how reducing the advection of the low oxygen water mass from the slope leads to a reduction of O2 concentration on the shelf (it should be the opposite, unless I misunderstood something). The sensitivity analysis should be better justified and the results explained in more details. Also, more care should be taken to make sure that the variable names in the text, equations, figures and tables are spelled the same way.

Detailed comments:

I agree with reviewer #1 comments about the restructuration of the paper and the need to bring forward what is new in this manuscript. I also agree with his detailed comments and will not repeat them here.

Page 7229: Lines 26-28: could you specify how these factors affect the OMZ.

Page 7231, lines 16-17: Could you specify begin and end dates of time series.

Page 7232, Line 5 and following. This sentence is not clear and I think that the description of model forcing and initial conditions should be done in the model description section. Also, it is difficult to sort out what periods are used for the different data. It should be clearly stated. T, S and O are averages of 9 years of data (over 2003-2011). Velocities are averages over 2009-2010 and the winds from 2008. Why not choose a common period to facilitate the comparison, i.e., 2009-2010 (or 2009 only)? Also, I think that wind events, and mixing events, would be important for the determination of T, S, and O profiles. Did you make simulations without a 30 days low pass (I assume 30 days since it was not mentioned)?

Page 7233, line 20, mirrors might be more appropriate than follows when talking about density and temperature.

Page 7234, line 3, I would replace Otherwise with The.

Page 7236, section 4.1: could you specify the start day of the simulation.

Page 7237, line 20: shelf instead of shell

Page 7238, equations 2 and 3. In this formulation, production is higher than consumption only at 1 m in summer. Is this realistic for this region? I find that consumption should be lower in the 0-30 m layer based on the observations in Fig. 7b (the curve lies to the left of the observed points) while production should be higher (Fig. 7a). Also, it was not mentioned when these observations were made. Could you add units to eq. 2 and 3.

Page 7239, equation 6: This formulation is the opposite of the bio 1 formulation for the surface layer (i.e. bio 1 = consumption and bio 2 = production), what is the basis for that?

Page 7239, equation 7: $\triangle z$ should not appear in this equation. Could you write O2sat the same way in the equation and in the text (see sentence above).

The four parameterizations tested should be explicitly mentioned in the text.

Section 4.2: In general, the reason for doing the different sensitivity tests should be mentioned more clearly. In particular, why test two opposite NOP in the surface layer?

Figure 7. Caption: c) should read difference between a) and b), and d) theoretical model of NOP. Could you add values on depth and NOP axis so we can compare with bio 1?

From looking at Fig. 8b (summer), it appears that exchanges with the atmosphere are too low and that mixing in the surface layer is too low as well, most likely due to low passing the wind speed. Also, from table 1, it appears that Kz is uniform over the whole water column, didn't you calculate a Kz for each layer? Also, it appears, as mentioned above that production in the surface layer should be higher that consumption (as with bio 2). Refitting you bio 1 curves should help improving your results. Also, why do the following sensitivity tests with bio 1 since bio 2 fits better (Fig. 8 d,f,h)? Fig. 8f, mixing should be increased, not reduced.

Figure 8a (winter). I find the results confusing. From figure 7 c and d, I thought that the winter NOP was negative for both bio 1 and bio 2. So the resulting curve for bio 2 should be to the left of the NOP=0 case, as for bio 1.

And finally, I do not understand how removing lateral advection and mixing leads to lower oxygen concentrations at the bottom. Your conclusion is that upwelling and advection of water from the OMZ maintain low oxygen concentrations on the shelf, so if you remove that source of low oxygen water, your concentrations should actually be higher.

Interactive comment on Biogeosciences Discuss., 9, 7227, 2012.