

Interactive comment on “Influence of Rossby waves on primary production from a coupled physical-biogeochemical model in the North Atlantic Ocean” by G. Charria et al.

Anonymous Referee #1

Received and published: 15 April 2008

This manuscript reports on how the Rossby waves in a numerical model of the North Atlantic are correlated with phytoplankton and nutrient flux terms in an associated biological model. The results, which are compared qualitatively with the expectations from a simple advective model, highlight (or at least indicate) the complexity of the interactions and the weaknesses of the simpler model. Unfortunately the presentation is not clear and many of the results or conclusions are not properly justified. The results merit publication but before that happens the paper needs serious revision.

Detailed points.

Abstract: This reads as though part of it has been lifted from a proposal. It starts with

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a question and then says 'we aim to investigate ... '. Then if an abstract wants to tell me that vertical and horizontal processes are involved, I could wonder whether there is really anything new in the paper.

Page 935, line 25: This section confuses the long baroclinic Rossby waves discussed later with the meso-scale eddies discussed by Oschlies et al.

P 936, Section 2: The detailed equations for the biological model add very little to the paper and could either be left out, as has been done with the physical model, or placed in an Appendix.

P 936, Section 2: The results of the paper are only of interest if we have some confidence in the underlying physical and biological models. At present the only real justification is the newsletter article of Charria et al (2006b).

Either some good references to refereed papers should be added or the paper should include examples of the fields, showing both spatial and temporal behaviour, which can be compared to observations and other models.

P 939, L 18. What is the scale length of the exponent?

P 939, L 19. I am surprised that the Rossby wave and other transients had all died out by the end of year two. The statement could do with more justification.

P 942, L 3. This section implies that model also has other (eastward propagating?) waves present. Is this so?

This raises a more important point. The paper seems to assume everywhere that the features being observed are long Rossby waves orientated predominantly north-south. The paper provides no evidence of this.

If they are long Rossby waves with a predominantly north-south orientation, then one would expect the same Rossby waves would show up on the neighbouring lines of figure 5 and have very similar effects on the biology. However the discussion (for

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example of the two northern lines) implies (because different times had to be used) that the Rossby wave regime is very different on neighbouring lines.

P 943, L 7. The model grid size here (~40 km) is an order of magnitude less than the wavelengths being studied (>400 km). For most ocean models, numerical errors are proportions to the square of this ratio. Thus unless the present model has some other serious problem, grid size effects are unlikely to produce an error in SSH of more than a few percent (say <4%). The grid size certainly could not explain the factor of two seen in figure 2. Thus the differences are more likely to be due to errors in the forcing or in some other aspect of the model physics.

P 942, L 19: How can the surface chlorophyll and SSH fields be related if their wavelengths differ? It would be helpful to add a model chlorophyll plot to figure 2 and to give examples from more than one latitude.

P 944, L 11. Although the study of extreme cases with a good chlorophyll signal is a useful start, you also need to explain why the neighbouring regions did not have such a good signal.

P 944, L 15. Region CA0 is defined as "the lack of chlorophyll anomaly", but given that the wave crest and wave trough have been defined, a description in terms of the wave properties may be better. Later CAO is described as the "background condition" but given that conditions during wave growth and decay are different is it a mistake to average over both?

P 943, L 20. "The value for the lack of chlorophyll" A better descriptive phrase is needed. In calculating the values of fluxes during the CAO period I am not clear why the "western boundary of the trough" is not the same as "the eastern boundary of the crest" or the the bit presumably "between the crest and the trough".

It may be helpful to show some examples of the waves and the regions chosen for analysis.

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Figures 6 to 9. It would be better to plot absolute values of the fluxes (per cubic m of the surface layer). The values currently plotted do not show which changes are most important. As a result much of the discussion in the rest of the paper could be in error. One of the relative fluxes may have increased significantly, but its absolute effect may have been negligible.

Section 6. The section needs to be reworked with more information on the vertical profiles and horizontal gradients of chlorophyll and nutrients, and the vertical and horizontal volume transports. This would help the reader understand better the differences between the different sections - i.e. are the differences in the vertical flux of chlorophyll due to different vertical volume fluxes or to differences in the vertical gradient of chlorophyll?

Other points:

Introduction, p 935. This is still proposing to carry out an investigation. This is because 'the influence of Rossby waves has to be investigated'.

P 941, L 13 and 18. Use 'calculated' not 'estimated'. For readers who do not know the model it may be worth saying that the physical model does not have a free surface so the effective sea surface has to be calculated from the pressure field.

P 944, L 16: 'detailed'. Should this be 'calculated'? Really the whole manuscript needs some good copy editing to ensure that the text is always clear and that all words have their normal meaning.

p945, Section 6. The scheme used to describe the different sections needs to be improved. Just try reading "38.9 N-42 W/37.1 N-32.7 W/34.7 N-37 W/34.7 N-40 W/32.2 N-31.3 W/31.9 N-41.7 W/29.9 N-32.7 W/29.6 N-47.3 W".

Strictly speaking this is also a list of points not lines. As a result on page 946, line 27 the reader cannot be sure which is the most easternmost 'area' (sic) without first identifying the lines on figure 5, as some are longer than others.

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Figure 1. The different boxes need to be defined.

Figure 2. The same colour bar scale should be used for each figure.

Figure 3. Why is the projection so distorted?

Figure 6. It would be helpful to use the same shorthand CA+, CA- and CA0 as in the text.

Figures 7 to 9. Why not use the same scale in each of the figures?

Interactive comment on Ocean Sci. Discuss., 4, 933, 2007.

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