

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 #2

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Charria et al. discuss the correlation of chlorophyll anomalies with Rossby-wave sea-level anomalies, observed and modelled, focusing on 1998. They go on to look at associated changes in modelled primary production and the terms in constituent equations contributing thereto. The main conclusion is represented by figure 10 showing the relative contributions to chlorophyll anomalies: of horizontal advection, vertical transport of DIN and vertical transport of phytoplankton. In most cases, vertical transport of phytoplankton is found to be a minor contribution, but the vertical transport of DIN is emphasised.

The changes in primary production (relative to no chlorophyll anomaly) are of order

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20%, positive and negative and nearly balancing out as shown here. However, there is no "control run" without Rossby waves, and the waves propagate; hence there is no guarantee that the primary production with no chlorophyll anomaly here is the same as in the absence of Rossby waves. As the authors conclude, there is a need to investigate what happens when the Rossby wave effect is removed.

The work is logically presented, and in most places fairly clear (some exceptions in detailed comments below).

Detailed comments.

Page 936 line 21 and Page 942 line 7. There might be some initial comment about whether $1/3^\circ$ is suitable spatial resolution. If the Rossby wavelengths are 400 km or more, this is more than 10 grid points per wavelength, OK I would think. Are the "lower amplitudes in the simulations" really "due to the model spatial resolution"?

Page 938. There is a problem with the notation for time. In (8) there is integration over $t = \text{time of day}$ to produce J (overbar) which is still a function of time (of year?). This definitely needs a different variable from the one integrated over. Presumably time in (6) is the same as on the left side of (8). In (10), beta needs to be defined and also tau: "the time at noon" is not a helpful definition.

Pages 945-948. I found this quite hard to follow, and I am not convinced by the use of percentages. If the CA0 value of a term is small, then a big percentage change may not represent much effect in the P equation. If absolute values (not percentages) were used, then the some of the terms (the "phy" terms?) should add to equate to the rate of primary production; their anomalies would add to the change in rate of primary production. I think this could be shown diagrammatically better than the present figures 7 to 9.

I think the advection and vertical diffusion of DIN are different; they do not contribute in the same way to the phytoplankton equation (advective-diffusive plus SMS). In (2)

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DIN only appears through J; there is no advection or diffusion of N here. So how do advection and vertical diffusion of DIN have equal status with advection and vertical diffusion of chlorophyll/phytoplankton in figures 7 to 10? I think clarification is needed.

"Typos" and use of English.

Page 935 lines 11-12. Better ".. assumptions were made (for example .. ratio). We .."

Page 936 line 2. Better ".. processes such as induction in .."

Page 939, line 7. Strictly the "G(P) slope" for small P is $2pP$, not p .

Page 942 lines 4, 5. In the figure it looks as though the wave height from crest to trough ($\sim 2 \times$ wave amplitude) reaches 5 cm (simulated), 7-10 cm (observed).

Page 942 line 19. Better ".. slightly longer north of this .."

Page 944 line and figure 4. Should the units be " $\text{cm log}_{10}(\text{mgChl m}^{-3})$ "? The Rossby wave amplitudes are only a few cm; I assume the chlorophyll concentration is of order 10 mgChl m^{-3} , not $10^{**}100 \text{ mgChl m}^{-3}$.

Page 945 footnote 2. Better to write this as a formula, $100[(CA+) - CA0]/|CA0|$?

Page 957, Table 2 title line 3. ".. North- .."

Page 958 Figure 1. The caption should explain that the numbers relate to the text in section 2 before equations (1) to (5).

Page 964 Figure 7. The caption in lines 3-4 should explain the abbreviated notation for location of the sections, as in section 6 of the text.

Page 967 Figure 10. Caption line 8, omit "respectively". Can there be consistency please, either always "chlorophyll" or always "phytoplankton" (as in figures 7-9)?

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