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Interactive comment on “Regional differences in modelled net production and shallow remineralization in the North Atlantic subtropical Gyre” by B. Fernández-Castro et al.

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General comments

This paper estimates biogeochemical rates of net photosynthesis and respiration at two subtropical North Atlantic time series locations using a mass balance approach applied to climatological annual cycles of dissolved oxygen, dissolved inorganic carbon, and nitrate. It builds on a similar approach applied to one of the sites in an earlier study (Ono et al. 2001). The authors make useful improvements by including a variable (in time) vertical diffusivity, more robust error estimates, and, most importantly, extension to another a second location that has an intriguing difference in export production. The

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paper is well done and I recommend publication.

Specific comments

I do take issue with the following claims made in the abstract:

“Lateral advection, which was more significant at ESTOC, was responsible for the differences in estimated oxygen remineralization rates between both stations. Due to the relevance of the horizontal transport at ESTOC, we cannot assert that the differences in shallow remineralization rates computed for both stations can explain the observed discrepancies in the flux of sinking organic matter.”

It does not make sense to me that lateral advection is responsible for remineralization, even “estimated remineralization.” The only way this would be true is if organic matter was advected into the region; however, there is no evidence for this. What is really puzzling is that there is a difference in remineralization estimated from oxygen vs. DIC and nitrate. That difference needs to be discussed more in the paper. Along the same lines, I don’t think the authors can state (Page 12500, Lines 9-10) that their results are consistent with enhanced respiration until they can reconcile the inconsistent differences between oxygen and the other two tracers (DIC and nitrate).

Technical comments

Page 12479, Line 24: replace “in” with “on”

Page 12481, Lines 3-5: please give the depths of the traps, which are key for understanding at what depths remineralization difference may help to account for particle flux differences.

Page 12482, Line 19: replace “seasonal” with “mean annual”

Page 12483, Line 15: remove “Maxima”

Page 12484, Line 21: replace “extend” with “extent”

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Page 12484, Line 25: remove “to”

Page 12485, Equation 2: You should state that K is assumed to be constant with depth but variable in time. I would even take K out of the derivative to make this clearer.

Page 12491, Line 5: replace “consistently” with “consistent”

Page 12492, Line 28: replace “with” with “to”

Page 12493, Line 18: replace “for a season scale” with something like “for the depths (mixed layer base to 110 m) and time period (April-December) we considered”

Last sentence of paper: “At the light of this . . .” does not translate well

Tables 1 and 2 are not needed because almost everything in them is in Figures 8 and 9, which are better ways to present the budget. Having said that, the small font size and some of the box shading makes these two figures very difficult to read, so they need to be made more legible.

Figure 6 has a typo. The title of the second panel in the top row should say “O₂” not “DIC”

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