

Interactive comment on “Carbon export and sequestration in the southern Benguela upwelling system: lower and upper estimates” by H. N. Waldron et al.

Anonymous Referee #1

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In this paper three different estimates of carbon export from the southern Benguela upwelling system are contrasted. All of the estimates had been reported previously, so the paper doesn't add much if any in terms of new results. The paper is not particularly well written and would greatly benefit from a thorough revision. I can't recommend publication in the present form.

Furthermore, I have major concerns about the concept underlying the Waldron estimate on page 1177: The equation on line 5 ($C=A+B$) says that New Production (C) is equal to upwelled nitrate (A) plus recycled nitrate (B). In my opinion this is wrong. By definition New Production does not use recycled nutrients. The equation on line 6

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($C=D+E$) says that New Production is the sum of the fraction of New Production that is advected offshore and sinks below the permanent thermocline (D) and the fraction that sinks on the shelf (E). There will also be a significant fraction that is advected offshore but doesn't sink below the thermocline. Why is this not accounted for?

Specific comments not in order of importance:

Lines 18-19: The open ocean is not always nutrient limited (e.g. Southern Ocean or North Atlantic in winter) and doesn't always have low primary productivity and biomass (e.g. spring blooms in temperate latitudes, open ocean upwelling regions).

P. 1174, Line 21-22: What do "the former" and "the latter" refer to?

P. 1174, Line 24: Toggweiler is misspelled (no double l)

P. 1174, Line 25: When inferring carbon export the concept of "new production" doesn't work well for coastal systems (see, e.g., Falkowski et al. 1983, Journal of Plankton Research 5(4):515-537).

P. 1175, Line 2-3: "Previous studies have upheld the view that the modest areal extent of the ocean margins account for a disproportionately large fraction of total ocean productivity ..." What does this sentence mean? Are the authors trying to say that despite their relatively limited areal extent the margins account for a large fraction of total productivity?

P. 1175, Line 7: "In respect of the NE USA, ..." is awkward.

P. 1175, Line 15: This was stated by who?

P. 1175, Line 20: "... meridional contrasts in ocean-atmosphere CO₂ fluxes" What are these contrasts specifically?

P. 1175, Line 26-27: A hypothesis contrasting the southern and northern Benguela system is formulated. Why is this hypothesis posed when only the southern part is considered in this manuscript?

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P. 1176, Line 18: Should read “upwelling source water nitrate”?

P. 1176, Line 20: As stated already above, the concept of new production is problematic for shallow systems. What does “potential new production” represent?

P. 1177, Line 10: If this is supposed to be a heading it should be numbered and formatted as such. Same for Line 21, same page, and Line 5, next page.

P. 1177, Lines 15-19: This part of the methodology is rather opaque and should be described better.

P. 1177, Line 20: What do the three different numbers represent? For which years were they derived?

P. 1177, Line 23: “SACW” should be spelled out here.

P. 1177, Line 24: What process/mechanism underlies the “nitrate enhancement”?

P. 1178, Line 3: It is not clear at all how the conclusion that 30% of C is local New Production was reached.

P. 1179: What exactly does the “gate hypothesis” state?

P. 1179, Line 2: What does this study refer to? Presumably not the present study, but an older study by Monteiro? Should be clarified.

P. 1179, Lines 6-7: Noun missing in “event-scale resolving hourly wind-stress”?

P. 1179, Lines 26-28: Is the model a numerical model? If so, what are its underlying assumptions, inputs, forcings and outputs?

P. 1180, Line 8: It is not clear at all how the authors arrived at these fluxes.

P. 1180, Line 12-14: “The fluxes calculated from measurements and an Ekman model ...” How were these calculated?

P. 1180, Line 23: This item seems out of place in the list. Was this supposed to be the

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section heading for the next section?

P. 1180, Line 24: What does “this study” refer to?

P. 1181, Line 11-12: What is the skill of these relationships? For example, the R-squared could be given.

P. 1181, Line 19: The “decay rate” of what?

P. 1181, Line 24: Again, what does “this study” refer to?

P. 1183, Line 11: What is the difference between “potential new production” and “new production per se”?

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