Biogeosciences

Discussions

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Interactive comment on "**A mechanistic model of an upper bound on oceanic carbon export as a function of mixed layer depth and temperature**" *by* **Zuchuan Li and Nicolas Cassar**

Anonymous Referee #2

Received and published: 12 July 2017

This is a nice, clearly written paper, based on an interesting idea and executed well.

The paper could be improved by clarifying the significance of the study somewhat. It may be very difficult ever to test or 'validate' this model properly. Yet, it is conceptually useful in some ways, e.g. the discussion about f_pt and nutrient limitation. The authors might want to discuss further, or clarify the existing discussion of, what the reader is supposed to have learned about the ocean.

There are several circumstances where the manuscript could be connected better to the literature. For instance, in line 30, there should be at least one reference for this sentence (good references should be easy to find from the reference list in Boyd, 2015)

- same for the next sentence. Dunne et al (2005) and Cael and Follows (2016) develop mechanistic models to which this paper is very directly related, yet these models are mentioned only in passing. It is worth mentioning that not everyone loves the Sverdrup model (Behrenfeld, 2010), though using it in this context is a nice idea. Some readers might also take issue with the sentence starting on line 31 - it's better to say 'export production is frequently assumed to be a function of' (e.g. Estapa et al, 2015), though the rest of the paragraph deals with this nicely.

It seems a bit ironic to compare this model, which is mechanistic, quite sophisticated, and carefully developed, with export data extrapolated using the Martin curve (an empirical parameterization) with a constant b-value. Granted, the model must be validated in some way, but the 'comparison to observations' subsection of the paper definitely appears to be its weak point.

Figures 3+4 are somewhat difficult to see/understand. The maps could be larger, and the axis limits could be chosen in a way to present the information more clearly.

Eq. 21 may be missing a normalizing constant - a proportionality (Eq. 20) is not the same as an equals sign. The values of Pt and Bt both merit a bit more discussion - both numbers have some associated uncertainty, do they not?

Interactive comment on Biogeosciences Discuss., https://doi.org/10.5194/bg-2017-259, 2017.