Biogeosciences
Discussions

Interactive comment on "Optimization of Biological Production for Indian Ocean upwelling zones: Part – I: Improving Biological Parameterization via a variable Compensation Depth" *by* Mohanan Geethalekshmi Sreeush et al.

Anonymous Referee #2

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My problems with Sreeush et al. have mostly to do with their definition of the compensation depth.

1. Line 121. I disagree with citing "Sarmiento et al. 2006." First, it should actually be "Sarmiento and Gruber. 2006" since that is the only citation for 2006. Sarmiento and Gruber is a book, with only one mention of the compensation depth; hardly justifying a citation when there are whole contributions dealing with it (e.g., Marra et al., 2014, DSR 83:45-50). Better would be Ryther, from L&O, 1956, but which in the references is listed as "2003."

2. Line 120. They use the old symbol for irradiance. Use 'E.'

3. line 124: "Suppressed"? Not suppressed, but growth will be negative, phytoplankton will decline through respiration.

4. line 125: Here is the crux of the matter. The authors continually confuse the community compensation depth with the autotrophic compensation depth. I have argued that the latter is more appropriate, since if autotrophic production is negative, the community compensation depth will be 0 m: at the ocean's surface. The compensation irradiance is not where "planktonic photosynthesis" equals respiration, it is where GROSS photosynthesis = autotrophic respiration.

It seems as if the authors want the community compensation depth (see papers by Carlos Duarte, e.g.), and that's ok. They just have to define their parameters. Najjar and Keeling (1997), based on oxygen distributions, can give only the community compensation depth.

5. line 141: work in units of quanta, not energy. I've mad the conversion and it appears that that is equivalent to 1.7 mol photons/m2/d, or about 6% of total daily surface irradiance. For a community compensation irradiance, that might be ok, but I don't agree that that is the right parameter.

A better way to get the compensation depth is to use the base of the chlorophyll-a maximum as the bottom of the euphotic zone. There is justification for this experimentally (Marra et al., 2014), and also intuitively, in that it captures all the autotrophic biomass. This of course is the autotrophic compensation depth, which I argue is better for modeling purposes than a community compensation depth.

6. line 252: Again, there is a confusion about which compensation depth the authors are referring to. My guess is that Smetacek and Passow (1990) are talking about the community compensation depth, whereas what is mentioned here is the autotrophic compensation depth.

7. line 262: Ryther (2003)??

The rest of the ms is the working out of the model results, which I can't really comment on. But the results all stem from the compensation depth. It is not clear to me whether the model currency is oxygen or carbon.

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