Biogeosciences Discuss.,
https://doi.org/10.5194/bg-2017-341-RC1, 2017
© Author(s) 2017. This work is distributed under
the Creative Commons Attribution 4.0 License.

Biogeosciences Discussions
Open Access
EGU

Interactive comment on "Modelling Ocean Colour Derived Chlorophyll-a" *by* Stephanie Dutkiewicz et al.

Anonymous Referee #1

Received and published: 28 September 2017

This manuscript provides an overview on the how a coupled biogeochemical-ecosystem-optical model can be used to explore ocean colour algorithms, with a focus on Chlorophyll-a. The authors effectively show the kind of interrogation studies that can be done with this type of "virtual laboratory". They clearly demonstrate how the ocean colour community can explore the bias and uncertainties of algorithms and their products, by investigating the effect of (1) other optically significant materials on derived Chlorophyll-a, and (2) different sized and regionally focused training datasets on robustness of an algorithm. I think this manuscript paves the ground for more detailed studies on the use of a radiative transfer component in a biogeochemical-ecosystem model to investigate ocean colour algorithms. The manuscript is well-written and logically presented, but there are a couple of points where I think a bit more clarity would

Printer-friendly version

Discussion paper

CC BY

improve the presentation of the methods & results (see comments).

Specific comments:

P2 L20-21: the band-ratio definitely used to be the most commonly used Chl-a algorithm for NASA, but they switched their “default” Chl-a to a merged approach of Hu et al. (2012) and the OCx type algorithms in Reprocessing 2014.0. I am not suggesting you redo your analysis using the band-difference algorithm (because as I understand it, the point in the paper is more to show the kind of analysis you can do with this type of “virtual laboratory”, and dealing with multiple Chl-a algorithms might confuse matters - that being said, it would be an interesting task), but I think it might be worth acknowledging that the OCx algorithms are not the most common for NASA anymore.

Hu et al. (2012), J Geophys. Res., 117(C1). doi: 10.1029/2011jc007395

P4 L29-30: While this appears to be true for the January images, it seems to me that the July OC-CCI image (1d) has higher values in the northern high latitudes (around Greenland, Bering Sea, around Scandinavia) than actual July image (1e).

P5 L15-27: It is a bit unclear to me which results we are comparing at different points in this paragraph e.g. are the “observations” (L19) the OC-CCI observations? What is the “real world actual Chl-a” (L24)? L19-20: Are you saying the model blue Rrs is too high in the equatorial regions compared to the OC-CCI, coincident with where the model “actual” Chl-a is too low compared to the OC-CCI? Are you meaning OC-CCI is the “real ocean”? Maybe this sentence could be reworded to clarify this.

P7 L4: I think this sentence could be more clearly explained. I think I understand the point you are making: that because the model derived Chl-a compares better with the OC-CCI Chl-a than the model actual Chl-a does, then some of the difference between OC-CCI and model actual Chl-a can be attributed to problems with the band-ratio algorithm (i.e. “product bias”)? Is this what you mean by “product bias” - that there is an intrinsic problem with the band ratio formulation? I think the use of term “model” at the

CC BY

end of this sentence is particularly confusing: often in the ocean colour community, the term “model” is used in terms of a bio-optical proxy/relationship e.g. Chl-a is modelled using the band-ratio. Perhaps use “ecosystem model” (or something similar), to make this distinction clear.

P10 L2-5 (& Appendix B): The exact method is a bit unclear to me here. Did you: take the results of the full run (i.e. those shown in Fig 5a), then take the monthly mean of Rrs output and Chl-a input and derive the 4th order polynomial coefficients on those monthly means? Then, for each of the 3 experiments, did you: do a full run with daily values, take the monthly mean of the model output Rrs and input Chl-a, and use the monthly band-ratio relationship with the monthly Rrs for input? Or did you set up the model with monthly means for the input? Perhaps this could be clarified in the text.

Fig 11: If I am understanding correctly, Fig 11a is the same as Fig 5a, but 11a uses the monthly coefficients i.e. the black line in Fig 4, whereas 5a uses the light blue line. I think it would be useful to point this out explicitly.

P12 L20-21 & L33-P13 L1: I’m not so sure it is quite as simple as this. I agree that the other optically significant materials are contributing to false Chl-a signals: there is a shoulder in all the derived Chl-a time series (Fig 8a), that aligns perfectly with the peak in CDOM and detritus (Fig 8b). But you can see the pattern of the actual Chl-a signal in the derived values, with peaks aligning on around days 60 and 75 - the magnitude of these derived values are just less than the actual values, but I’d say these are the “true peaks” of the spring bloom. After approximately day 75, there is the interference from CDOM and detritus, hence when calculating the initiation of the spring bloom (as described in the appendix), this large “false peak/shoulder” increases the median Chl-a and skews the determined initiation date. So I think what your data could be showing is (1) the Chl-a products do capture the peak of the spring bloom, but the magnitude of that peak is too small, and (2) the CDOM and detritus contribute to a false Chl-a signal, which makes it appear as if the bloom lasts longer and (depending on how you define bloom initiation) makes the initiation date appear to lag compared to the model actual.

CC BY

It might be useful to have a table presenting the numerical results (e.g. log/linear RMSE, absolute % bias, etc.) for each approach in Section 3 and 5, to make it easier to compare the different results.

Fig 4 and Fig 8: Legends would make these plots easier to read.

Fig 5 and Fig 11: it would be useful to have a title or text on each graph to show which subplot is which e.g. “(a) GS”

Fig 8: The thick black line on top of the other time series signals masks some of the detail of the derived Chl-a products, particularly after the first 3 months - could this be represented in a different way? Also, check the axis labels, I think Fig 8b is showing days, not months.

Technical Corrections:

P1 L15-16: missing the word “to” i.e. sentence should read “...derived Chl-a to the actual...“

P1 L25: should be either “These results indicate” or “This result indicates”

P9 L29: Should this sentence not end with a question mark? i.e. “. . .community structure)?”

P11 L23: remove the second “like”

P12 L24: build should be built

Interactive comment on Biogeosciences Discuss., https://doi.org/10.5194/bg-2017-341, 2017.

CC BY