

Review of 'Ocean color algorithm for the retrieval of the particle size distribution and carbon-based phytoplankton size classes using a two-component coated-spheres backscattering model'.

Reviewer: Emmanuel Boss, UMaine

This paper report on the design of a new model to invert remote-sensing inversion to size. Result suggest it is not ready to be implemented in its current form.

The paper is well written. It is of significant interest. It does represents a very significant effort.

However, my biggest fear is, as happened with the previous versions of this model, that it will be implemented by modelers of ocean BGC to make predictions on ecosystems, export etc' while not propagating the large biases observed in the validation of this paper. I do realize it is not my job to protect the community from poor use of biased models.

For it to be more useful it needs, in my mind, additional work.

1. There is significantly more data for validation than suggested here. For example, there is LISST data from NAAMES and EXPORTS from my group on Seabass as well as direct observations of phytoplankton PSDs (reported in Haentjens et al., 2022).
2. As Organelli et al., 2018 have shown, the same parameters retrieved here could be used to predict the beam attenuation measured by, for example, the LISST, C-star and AC-S instruments. We have many more data of all those from the whole ocean (e.g. Tara datasets on SeaBASS). Why not use them as part of your validation? It could help you to better constrain model parameters (particularly associated with NAP).
3. Chlorophyll itself is a predictor of PFT, PCT and PSD. I would like to see, as I discussed with the lead author in the past, proof that the prediction of this model are significantly different than relationship with Chlorophyll itself or other current product from Rrs (e.g. bbp). Why go for a complicated model if a simple one is just as good (or just as bad, depending on your point of view)? I would love to see property-property plots involving C_phyto/POC, Chl, No and χ_{si} . In short, does the inclusion of all the model parameters into a novel model able to teach us about the ocean in ways [chl] does not (all the global maps presented seem highly correlated with [chl] and/or bbp distribution in the upper ocean)?
4. It is obvious that No and χ_{si} are correlated. Why not show their relationship? Is it consistent with in-situ data?
5. The use of the same satellite matchup for multiple validation seems not acceptable to me as it is not an independent evaluation. You could/should average the in-situ data prior to matching up.

Minor comments.

1. Figures numbers are not consistent with order of their citation.
2. Line 1445: remove 'using'.

Using the rubric of EGU:
Scientific significance -3

Scientific quality -3

Presentation quality – 2

1. Does the paper address relevant scientific questions within the scope of OS?

yes

2. Does the paper present novel concepts, ideas, tools, or data?

Yes.

3. Are substantial conclusions reached?

Not really, in my mind, beyond those of model evaluation.

4. Are the scientific methods and assumptions valid and clearly outlined?

Clearly outlined, but validity needs further work.

5. Are the results sufficient to support the interpretations and conclusions?

No.

6. Is the description of experiments and calculations sufficiently complete and precise to allow their reproduction by fellow scientists (traceability of results)?

Yes.

7. Do the authors give proper credit to related work and clearly indicate their own new/original contribution?

Yes.

8. Does the title clearly reflect the contents of the paper?

Yes.

9. Does the abstract provide a concise and complete summary?

Yes.

10. Is the overall presentation well structured and clear?

Yes.

11. Is the language fluent and precise?

Yes.

12. Are mathematical formulae, symbols, abbreviations, and units correctly defined and used?

Yes.

13. Should any parts of the paper (text, formulae, figures, tables) be clarified, reduced, combined, or eliminated?

See above comments.

14. Are the number and quality of references appropriate?

Yes.

15. Is the amount and quality of supplementary material appropriate?

Yes.