Ocean Sci. Discuss.,
https://doi.org/10.5194/os-2018-69-RC2, 2018

Ocean Science Discussions

Interactive comment on "Parameterization of the spectral light absorption coefficient of phytoplankton in the Baltic Sea: general, monthly and two-component variants of approximation formulas" *by* Justyna Meler et al.

Anonymous Referee #2

Received and published: 31 August 2018

General comments This paper is a continuation of a series of paper by the current authors on the parameterisation of the variability in phytoplankton absorption coefficients In the Baltic Sea. The analysis is extensive and thorough and is of some value for regional ocean colour remote sensing work.

I have the following major concerns: 1) The manuscript falls short of drawing necessary conclusion from the results presented here. There is very limited discussion on natural sources of observed variability, how much of it is real and what ecosystem processes can be inferred from findings. For example: does the data suggest that

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an increased amount of photo-protective pigments influences the relationship in the summer months? And if not, why not?

2) I find myself unable to judge how much of the presented finding are actually novel and how much is a re-iteration of previous papers by the authors on the same dataset. Please clarify the progression from one paper to the next and highlight the additional value of this paper. Also justify why the results presented here were not published in previous paper.

3) The comparison of different parameterisations on this dataset does not add much value to the paper – especially if the performance is tested using the same dataset used for development.

4) The final recommendation as to which parameterization should be used (and under which conditions) is not clear. Quantify the benefit of the new parameterization and weigh it against processing time/costs.

5) Additionally, the language requires major revision (preferably from a native speaker) which should aim to shorten the article significantly and improve readability & understandability.

Specific comments

Explain the selection criteria for literature chosen for comparison. Can you use a more systematic approach to select a small (max. 5!) number of parametrisations from the hundreds available in the literature (e.g. only choose chase 2 waters or compare 2 case 1 and 2 case 2 water studies)? McKee et al. (2014), for example, did some analysis on the NOMAD data set which includes a variety of different water and geographic locations.

Revise terminology throughout article: - Use ‘case 2 waters’ rather than ‘case 2’ - Use ‘at short wavelenths/in blue spectral region’ instead of ‘short-wave part of spectrum’ - In my opinion, using ‘absorption’ rather than ‘light absorption’ is sufficient and would

improve readability

p. 4. Line 9: ‘Because of 10 weather- and sea-state-related limitations, the proportion of data collected in open water regions exceeds ca 30% only for data collected in February, March, May, September and October (see Table 1).’ – This is an example where the text can be shortened significantly: ‘The amount of data collected in open waters was limited due to adverse weather (< 30% for the majority of months).’

Methods, Table 1: Were any spectra excluded from the data – if yes, what were the selection/data quality control criteria?

p.5, paragraph 1: Justify why you did not correct for scattering offsets by forcing the spectra through zero, in red/NIR? Are you aware of the systematic errors your choice potentially introduces to the data. Lefering et al. 2016 for detailed analysis.

p. 5, l. 19: How did you assess reproducibility of samples? Did you measure any replicates at all, if yes how?

p. 5, ll.22-24: Moving averages can lead to a reduction of chl a absorption in the red. Did you observe this effect? Consider lo-ess smoothing.

p. 7, l. 11: Highlight that you calculate the RMSE/standard deviation on relative errors. I would be interested to see the range absolute errors as well.

How is the standard error factor interpreted? What is the ideal, what a reasonable value?

p.7, l.28: I understand that low measurement sensitivity can cause issues at blue/UV wavelengths. How do you explain the observed artefacts at 550 – 650 nm.

p.7, ll. 26-29: Use neutral and objective language (here and throughout document)! For example, avoid expressions like ‘undesirable artefacts’.

Overall the absorption data appears to be of low quality. I know that it’s not possible to repeat the measurements with an improved protocol but a thorough and more detailed

analysis of data quality is required. Do you have any information with regards to bleach contamination resulting in low absorption values < 440 nm?

The absorption is expected to vary several orders of magnitude across all wavelengths and samples. This is not a new result. Interesting would be what the implications for your error analysis are? Do you see larger absolute errors for low absorption or do measurement errors increase linearly with strength of absorption?

p.9, l. 14: Use neutral and objective language (here and throughout document)! Another example: 'fairly well'.

p. 11, ll. 4-5: Delete sentence, unnecessary self-citation at this point: 'We ourselves had already reported similar ranges of variability earlier (see Woźniak et al. 2011, Meler e t al. 2016b, 5 2017a and b).'

Section 3.2.1: What happens if E(lambda) > 1?

Section 3.2.1: How can the annual variability in A be explained? Can it be linked to extent of packaging effect or the amount of photo-protective vs. photosynthetic pigments?

Section 3.2.1: What can be inferred from your analysis of R2? Does is correlate with any known ecosystem dynamics? Considerably shorting the paragraph unless you justify its value.

P.12 l. 8: Do you mean '690 – 700 nm'?

Section 3.2.1: What do you derive from the observed differences in performance compared to Bricaud's parameterisation? Why do you observe less variability and what does that mean for the ecosystem?

Please explain the metric of the colour index in more detail. What the reasons for the observed flattening (drop in colour index) of the absorption spectrum? Are you expecting a certain magnitude in your colour index drop and why?

p. 18: Shorten paragraph. Only highlight key finding shown in Table and consider deleting/rephrasing the following sentences: 'We have carried out such an analysis, but we do not present its detailed results due to the fact that they are very extensive. Here we limit ourselves only to stating that the use of general or monthly parameterizations for individual months 10 has little effect on the level of statistical error according to logarithmic statistics, although it may have, as generally expected, a very significant impact on the level of systematic error.'

Section 3.2.2 The use and exchange of a_ph,cal/a_ph,m and a_ph in this section is confusing. What information can be gained from a_ph,cal/a_ph,m and how can the ratio be related to a_ph in this context?

Fig. 8 (e) & (f): Justify the use of an exponential over a linear fit.

p. 27, ll. 1-14: There is limited value in the comparison with other parameterisation using the same dataset (see comment above).

p. 27, ll. 21 – end: The conclusion of superior performance based on the standard error factor cannot be justified. 'If we take into account both systematic and statistical errors, the superiority of the new parameterizations developed specifically for Baltic Sea conditions is undisputed.' Poor scientific language!

p. 29, 32: Delete sentences: 'Practical remote sensing algorithms are a good example in this respect. Their task is often to solve complicated "reverse" problems. Starting with measurements of sea colour, such algorithms, through intermediate steps during which different inherent optical properties of seawater (including light absorption) are retrieved, should yield basic features of different seawater components in the final stage of their operation. One such feature may be the concentration of chlorophyll a, which is often treated as a practical measure of the biomass of live phytoplankton contained in water. In our opinion the parameterizations presented in this work could be used in practice for such purposes.'

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