Biogeosciences
Open Access
Discussions

Interactive comment on "UV effects on the primary productivity of picophytoplankton: biological weighting functions and exposure response curves of *Synechococcus*" *by* P. J. Neale et al.

Anonymous Referee #2

Received and published: 27 January 2014

The authors present the first biological weighting functions for one of the most abundant photosynthethizer on Earth: Synechococcus. They examined two strains, two temperatures, the effect of pre-illumination and had to develop a new model relating the weighted irradiance to the inhibition of photosynthesis. They are thence reporting on a large amount of work both experimental and theoretical.

General comments

I have one main comment and it pertains to the predicted profiles. Given the optical conditions the author said they used, in particular the chlorophyll concentration of 0.1 mg m-3, the productivity at depth in Figure 7 appears too high. According to Morel et

Full Screen / Esc

Printer-friendly Version

Interactive Discussion

Discussion Paper

al. (2007) equation for the euphotic zone depth, the 1% irradiance in such waters is around 90 m. It seems, therefore, unrealistic to find such high productivity at 150 m (for some of the conditions, productivity at 150 m is about 1/3 of the maximum productivity in the water column). This could originate from an incorrect assumption about the PvE model (e.g overly high PBmax at depth or overly low Es) or an overly low attenuation coefficient.

The reported Es are indeed relatively low in this study; it may be nice to compare with previous measurements on Synechoccocus. It may also be relevant to discuss how the photosynthesis models proposed are pertinent to estimating productivity at 150m. Generally due to photoacclimation PBmax and Es decrease with depth and sensitivity to inhibition increase, certainly the growth irradiance for the strains were nowhere near those found at these depths.

Specific comments

1) Methods: Could you discuss the temperature chosen for the experiments with respect to normal Synechoccocus growth conditions (distribution range). It seems to me that relatively high temperatures were selected.

2) P. 19459, lines 18-19. The graphs on Figure 3 certainly highlights an improvement with the successive models. However, as mentioned by the authors there is definitely a bias at high E*inh. Could we be seeing the "death" of the cells and only the results of a certain amount of photosynthesis at the beginning of the treatment in those cuvettes? Alternatively, would a model with a decreasing repair rate with damage past Emax be a more appropriate model? Also on this figure it seems as if the point at high E*inh has a very strong impact (higher weight perhaps?) on the fit as it is fitted better (perfectly on the latter two plots) than the ones with lower E*inh if that is the case, might it be relevant to remove that point or alter the weighting?

3) P. 19457, the authors seem to go to great length to avoid the use of PUR irradiance. I can see that their formulation is indeed a good alternative (which it appears math-

ematically equivalent). Perhaps it would be nice to spell out why this choice is made here.

4) P. 19461, line 3 and 4. It may be interesting here to guide the reader as to what this means (if anything) for previously published BWFs. Would you have a recommendation for their future use?

5) Figure 5. I think I would prefer seeing the resulting BWFs on one plot. These figures are not very enlightening to me.

6) Figure 8. Combining the two panels into one may allow for an easier comparison between the two species.

Minor comments 1) title: this study is really about Synechococcus not so much pico-phytoplankton (there are quite a few other members, including eukaryotes). Perhaps dropping picophytoplankton and replacing by Synechococcus may be a more appropriate title.

2) P. 19453, line six: Irradiance was provided by (or something along these lines)

3) P. 19456, Eq. 4, the second E*inh on the top line is too close to the parenthesis, it can be confused as a multiplication at first.

4) P. 19457 line 3: format on reference should be fixed.

5) P. 19457 line 8: Pigment absorbance: I think you mean "Irradiance weighted chloro-phyll specific absorption for the photoinhibitron". . .

6) P. 19457 line 9: Pigment absorbance: I think you mean "phytoplankton absorption coefficient". . . also add units (m-1)

7) P. 19457, line 5: I don't like the use of PFD for an irradiance (in quantum units). I think the symbol should remain some variant of E. Perhaps a superscript could details that it is in quantum units. . . but this may just be my personal preference!

8) P. 19462, line 12: Capital "B" on the superscript.

9) P. 19465, line 8. Please check spelling on both pigments.

10) P. 19465, line 8. Typo on weights.

―――――――――――――――――――

Interactive comment on Biogeosciences Discuss., 10, 19449, 2013.

Full Screen / Esc

Printer-friendly Version

Interactive Discussion

Discussion Paper