

Interactive comment on “Interactive effects of vertical mixing, nutrients and ultraviolet radiation: in situ photosynthetic responses of phytoplankton from high mountain lakes of Southern Europe” by E. W. Helbling et al.

E. Boss (Referee)

emmanuel.boss@maine.edu

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This paper presents the result of an experiment carried in three lakes where the effects of changing mixing regime, spectral light and nutrients on phytoplankton productivity and exudation were conducted. The lakes and their flora are different in both their properties as well as the response to the manipulation experiments.

The topic is of interest to BGC readers and within its scope. I have several major comments on the paper that I feel, if addressed, could significantly improve it:

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1. The link to climate is weak at best. The duration of the experiments was short and represents a very specific state in the evolution of the lake through the growth season. Phytoplankton populations continuously adapt to changing conditions from passing storms to longer term changes in nutrient availability, predators etc'. Assuming we could draw conclusions on changes that are likely to occur due seems a stretch to me. I would not be surprised if two weeks earlier or later from the occurrence of the experiments described here the phytoplankton species composition were different.

2. I am not at all surprised to see that phytoplankton in the lake with the most UV attenuation be the one that are the most stressed when exposed to a larger UV dose than that which they are used to. Phytoplankton, for example, produce MAAs as sun screen to UVR when needed. Imagine taking an Alaskan inuit (or me from Maine) to the equator in the middle of the winter. He will feel a shock too and stress out. However, if the cells and ecosystem could have time to acclimate to new conditions (from individual cells producing MAAs to another phytoplankton species dominating by being better adapted), the ecosystem response may be very different from a short-term un-natural perturbation as performed in the experiments presented here.

3. Some phytoplankton swim and hence have the potential avoid stressors such as UVR (when not incubated) and access nutrients even under increased stratification.

4. In many shallow marine environments benthic production can dominate that of the water column (E.g. works by Nelson and others by Gattuso). Do you know whether this is important in the shallow lakes investigated here? I am mentioning it as you specifically avoided deep lakes with DCMs.

5. K_d PAR is not constant even in a layer of constant optical properties (e.g. Morel, 1988, JGR) due to the rapid change in light spectra as well as changes of direction and degree of 'diffusion' of surface light by absorption (which tends to focus it) and scattering (which tends to diffuse it). You measure K_d so can directly integrate it w/o the need to make this assumption (e.g. in Equ. 1).

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6. The fluctuation of light near the surface is consistent with waves (e.g. Zaneveld et al., 2001, Applied optics) than with clouds passage (which can produce negative K_d). In addition the differences in surface illumination for the days of the experiments seem very similar, such that clouds are not likely to have played a major role.

7. It is not clear how the measurement of Carbon with a CHN analyzer provided you with phytoplankton carbon (in the ocean most of POC is not phytoplankton, e.g. works by Durand and Olson). Can you please elaborate?

Dear authors: I am not a limnologist (though I worked in lakes) and have limited knowledge of your field. If you feel my comments are wrong feel free to contact me directly and I will be happy to change my comments.

Please also note the supplement to this comment:

<http://www.biogeosciences-discuss.net/9/C4690/2012/bgd-9-C4690-2012-supplement.pdf>

Interactive comment on Biogeosciences Discuss., 9, 9791, 2012.