Last changes by Hans : 16 February 2015

<u>Overall reactions that need NO response</u>

Rev. 1.

 I feel that many of the original shortcomings pointed out by the reviewers largely remain in this version. The authors should return to those reviews and in particular review carefully past literature and the important questions in the field to make better light of their results; they have a nice experimental set-up and some interesting results I feel they simply are not presented and discussed within the context of current and past scientific advancements and key questions

Rev 2.

This study utilizes controlled batch-culture mesocosms to examine the performance of optical proxies for {\it Phaeocystis} biomass, physiology, and growth rates. Because the transition from exponential to N-limited stationary growth leads to non-linear relationships between the C:Chl ratio, Chl-specific absorption, and Chl fluorescence yield, the authors conclude that optical proxies may not provide useful estimates of production and growth rate for this species under such environmental conditions

I commend the authors for the extensive revisions in response to comments received on the original manuscript, which in my opinion have led to a significant improvement in the paper. The study's aim and description of the methodology is much clearer, and I believe the results provide some worthwhile observations to the literature on relationships between growth and the remotely-sensed chlorophyll-a fluorescence signal.

Suggestions minor improvements rev. 2

We like to thank reviewer # 2 once more for the critical review of our text and suggestions to improve the readability of this manuscript. Again, this reviewer is completely right that the use of symbols for fluorescence line height (units sr^{-1}), fluorescence emission (μmol photons m^{-2} s^{-1}) , phytoplankton absorption (m^{-1}), absorbed energy in the mesocosm (μmol photons m^{-2} s^{-1}) and quantum efficiency (emitted photons/absorbed photons, dimensionless or just %) is too sloppy at a number of lines in the text and in the Table 1. We checked again the content and the figures: these remain correct.

The following changes have been made:

Page 8, L10. Added info on mesocosm 2.

"and slightly higher for mesocosm 2 (151 μmol photons m^{-2} s^{-1})."

Page 8, L10. Changed

Symbol in equation (1a) changed to "FLH "

Page 8. Description of the F values.

This section was slightly rewritten to describe the steps in the conversion from FLH to F.

Page 13, L23. Was changed to:

"By measuring the in situ fluorescence (F) increase due to nitrogen limitation, and the increase in photons absorbed by phytoplankton (PFR), an optical estimate of the quantum efficiency of fluorescence φ_{ph} (= F/PFR) could be made."

Table 1

F is defined as the Fluorescence emission with units (μmol photons m^{-2} s^{-1})

PFR is defined as the Potential Fluorescence radiation as the photon available to the phytoplankton for excitation of the PSII system. (μmol photons m^{-2} s^{-1})

φ_{ph} is the quantum efficiency of fluorescence using phytoplankton absorption and is the ratio of F/PFR

Figure 6 and Figure 7c

On the vertical axis, the symbol for quantum efficiency was changed from φ to $\varphi_{ph,}$ consistent with the use in the text.

Fig. 5 – Suggestion

Q. Because the incident light intensities are slightly different between the two mesocosms, I think it would be better to show fluorescence normalized to incident irradiance as the dependent variable in these plots. This would eliminate the confounding effect of different excitation intensities between the two experimental systems; for example, in Fig. 5B is the increased fluorescence from mesocosm 2 simply a result of higher excitation intensity?

A. Indeed , a correction for the instantaneous irradiance difference between mesocosm 1 and 2 (138 and 151 μmol photons m^{-2} s^{-1} respectively) would imply a small correction of 0.914 that would bring the results of mesocosm 2 a bit closer to mesocosm 1. We have tested this suggestion and found a marginal difference compared to the original Fig 5 (see below). The reason is that mesocosm 2 has experienced a higher illumination and the growth of algae has progressed further compared to mesocosm 1.