Review of Optical community index to assess spatial patchiness during the 2008 North Atlantic Bloom.

The author propose (and use on Glider collected data) a new optical index of phytoplankton community structure. The index appears robust at the time of year and study area that they have examined allowing them to study the spatial variability in diatom-dominated communities vs other communities in their study region.

Main comments

While the study is interesting I am a bit uneasy when the authors attempt to interpret the index. In this aspect, I think the authors could go a little further with all the data available to them. The authors suggest that it is the higher chlorophyll to carbon ratio of diatoms that leads to variability in this index. This assumes that b_{bp} is a good estimator of phytoplankton carbon across communities. Theory suggests that it isn't (see Stramski et al. 2004 cited in the text) and that c_p is a better estimator of phytoplankton carbon (this is why it has been used multiple time to estimate phytoplankton growth rates). If their hypothesis was true we would expect a CHL F/c_p ratio to be even better. They did not present this data to support their analysis.
The author rejects physiology (fluorescence non-photochemical quenching and nutrient limitation, apart from Si) as a potential source of variability in the data but suggest the higher concentration of Chl per volume in larger cells would be responsible for variability in the index. This part (last paragraph of p. 12849) is very confusing to me, as the authors appear to make several leaps that are not easy to follow. The following sentence is particularly ambiguous I find: *Chl per cell volume scales inversely with cell size… resulting in higher Chl-to-carbon ratios for larger cells.* The changes seem to go the opposite way to me (i.e. lower Chl/C ratio in larger cells). Their strongest support for that argument originates from Fig. 5c where the ratio of Chl to autotrophic carbon is higher in communities with higher diatoms. However, it is not clear on this figure where the "Chl" comes from (fluorescence or HPL). On panel A they refer to HPLC specifically, but not on panel C which suggest that it chlorophyll from fluorescence (as in Fig 3A or 2B?). It seems to me that the authors should look at the ratio of Chl F/Chl_{HPLC} as a function of their % datoms index to examine if is varies with their index. Also, authors do not discuss the lower fluorescence efficiency expected from larger cells due to pigment packaging (both for absorption and reemission).

One aspect that I found quite exciting with this paper is that it presents an in situ study showing a clear optical community index (at least for that region and time of year). This, however, brought a particularly puzzling aspect: the index varies exactly in the opposite to the way the phytoplankton functional group algorithm developed by Alvain et al. (2006). For example Brown et al.(2008) (see also [oddly] similar study by Alvain et al, 2012) showed that the Alvain et al. algorithm identifies regions with high backscattering (to chlorophyll) as composed of diatoms. I think this is worth mentioning in the paper.

Minor points.
p. 12838 line 18, change "volts" to "voltage"
Throughout - change Michaelis-Menton to Michaelis-Menten. Also check for consistency of hyphenation.

Figure 2, panel C - There appears to be photochemical quenching (PQ) of fluorescence below ~70 umol m-2 s-1). (i.e. a decrease in fluorescence at as light decreases). The red points (high community index), however, do not seem to be affected by this quenching. Suggesting less response to PQ in these points (i.e. physiological aspect to the index?).

Figure3, caption - In panel C I think you should change ”line solid line” for “solid line” and “Heavy solid line” for “dashed red line”.

Figure 6 - I think the reader needs a bit more help interpreting this figure (this reader does anyway). I am particularly confused with what seems like to different series of points in panel A (a similar thing happens in panel B). With high community index points following the glider data and low community index points not following the glider data but taken on the same day. Were they taken in different areas? If so perhaps a different symbol would be appropriate?

Conclusion - Although that point is alluded to, I think it should be highlighted more strongly that this index has only been validated for a very limited set of conditions. It should certainly not be used blindly elsewhere. Furthermore, the absolute values of this index are only relevant for the fluorometers used on that cruise and in the way they were intercalibrated; relationships between voltages and phytoplankton absorption will vary widely between fluorometers.

References

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