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Interactive comment on “Seaglider observations of variability in daytime fluorescence quenching of chlorophyll-a in Northeastern Pacific coastal waters” by B. S. Sackmann et al.

Anonymous Referee #1

Received and published: 31 July 2008

The paper examines chlorophyll fluorescence and backscattering data collected from a glider and complement their dataset with remotely sensed variables (incident irradiance and chlorophyll). Their study focuses mostly on the depression of fluorescence observed during the day and caused by non-photochemical quenching. For their work, the authors have developed new metrics to quantify the depression.

The paper is scientifically sound and well written. It is a perfect illustration of what many people using AUV are faced with: an enormous amount of data with limited means to interpret them. Unfortunately, I feel that at present this limits the scientific interest of the paper. Indeed, after reading the paper, we are left with one main scientific result:

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the depression of fluorescence is similar to what was found previously by other author. So while the approaches used are interesting, the end result lacks much significance. Therefore, as it is presently written the paper appears is very methodological; it seems a matter of editorial choice whether or not this paper fits within the scope of Biogeosciences.

In my opinion, there are ways to improve the utilization of the dataset to have a more significant scientific content. This analysis should focus on the enormous amount of data to extract statistically significant signals and by relying more heavily on the remote sensing data.

For example questions that could be addressed are:

1) Are there any differences between seasons of the fluorescence depression at a given irradiance. If differences are found, this could lead into an explanation using an analysis of the mean irradiance within the mixed layer (using for example remotely sensed attenuation coefficient, the mixed layer measured with the glider along with the satellite PAR).

2) You have not exploited the backscattering measurements by themselves. There seems to be a lot that could be done with them. Perhaps this is waiting for another paper. Still, given the limited number of new results presented in the present manuscript it could be a nice addition in particular if it can be discussed along with fluorescence. For example, were diel changes observed in bbp were bbp higher at the end of the day than early in the day as is commonly observed for scattering?

A central aspect of the paper is the normalization of fluorescence to backscattering. The authors do not make a very good case of why this needs be done. They should support their argument with convincing figures.

Minor comments

-p2844 line 9. The sentence starting with " For this dataset...". It does not seem to

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make sense that different sensors are not calibrated to make them comparable. Part of what a calibration does is to give them a common scale to all sensors. I think the author must mean something different from what is written.

-p. 2844, line 12. typo!

-p.2844, lines 13 to 20. Please explain what this estimates includes? In particular does it include clouds?

-p 2844, line 27. "recorded" should be replaced by "estimated" or "modeled"

-section 2.4. It would be helpful if you showed an idealized diagram of your different cases when the method can and cannot be applied. Similarly a diagram of DFQ on an idealized fluorescence trend would be nice.

-section 3.1. The author seem to be justifying the use of backscattering coefficient to normalize the fluorescence in this section. But they are not exactly clear on why they are telling us all this. If you are trying to show that backscattering is a good proxy for phytoplankton biomass in you waters, say so.

-p.2847, line 22. You assumption that bubbles would be restricted to only the surface may not be true for very small bubbles that have been proposed to contribute to the backscattering. You should check the literature and cite appropriately.

-p. 2847, line 20. Paper by Huot et al. on backscattering in biogeosciences is certainly relevant here.

-p.2848, line 7. I am not sure that your description of the backscattering is correct. I see significant backscattering up to near the mixed layer depth on Figure 2 c, with no significant increase towards the bottom.

-p. 2849. last paragraph. The basic assumption that is not clearly layed out here is that the ratio of bbp over phytoplankton biomass is constant.

-p. 2851, last paragraph. Since non-photochemical quenching do no affect fluo-

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cence the same way when reaction centers are open and closed. The DFQ, will depend on the fluorometers used (i.e. whether it is measuring something closer to Fo or to FM in active fluorometry). It may be good to say something along these lines.

-p. 2852, line 18. Explanation of nutrient stress is on very shaky grounds. I would definitely be very cautious about this explanation. If you decide to keep it you will need to detail your thoughts. If you cite the work of Kolber and Falkowski papers, you must also cite the work of Parkhill et al. : Parkhill, J.-P., Maillet, G., & Cullen, J.J. (2001). Fluorescence-based maximal quantum yield for PSII as a diagnostic of nutrient stress. Journal of Phycology, 37, 517-529. There are also some papers from the Beardall group that are relevant to this discussion.

-p. 2853, line 4 to 12. A subsurface chlorophyll maximum is also a near ubiquitous feature in the ocean when measured using extracted pigments. I think your paragraph is within the context of autonomous measurements, because on sea going mission it is very easy to measure the pigments. If it is so, say it explicitly. If not explain more clearly why you are telling us this.

-p. 2853, lines 13 to 20. There is significant work on mixing, photoadaptation and fluorescence in the literature that is not cited in this paragraph. See for example works by Dusenberry, Cullen, Oliver.

-p. 2854, line 22. Funny to send papers to anonymous reviewers before submission... unless :-)

-Figure 2. It may be nice to show a section of density to give some physical context. Also, it seems to me that the size of the figure could be changed to increase the horizontal to vertical length ratio.

-Figure 6. Perhaps it would be nicer on this figure to show only the maximal DFQ measured each day?

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