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Biogeosciences Discussions

Interactive comment on "Sub meso scale phytoplankton distribution in the north east Atlantic surface waters determined with an automated flow cytometer" *by* M. Thyssen et al.

M. Thyssen et al.

Received and published: 27 September 2008

Anonymous Referee #2

Received and published: 17 July 2008

The authors frequently examined phytoplankton distributions in surface waters in the NE Atlantic using a Cytosub flow cytometer. As a result, they found that the phytoplankton distributions could be affected by their cellular cycles. The data obtained in this study are novel, and the paper is mostly well written. However, I found a few ambiguous points on their data interpretations:

1) It is well known that cellular chlorophyll fluorescence (i.e. FLR) can be changed with

light intensity. Such light acclimation (non-photochemical quenching) for phytoplankton photosynthesis has shorter time-scale than their cell cycles. However, the authors did not show irradiance data or discuss on the effect of light intensity on the tempo-spatial variations of FLR and FLR/FWS ratios during the cruise. If light intensity is not a major controlling factor for the meso-scale variability in FLR, please indicate the reason(s). Perhaps the ability of light acclimation differs among each cluster (C1-C6).

Reply: As fare as I know, the flow Cytometry lasers saturate the PS II, avoiding the turnover rate of the electron transport. All the energy is released as fluorescence and heat, and does not allow the observation of quenching. Only a destructive quenching of the pigments (photo bleaching) may be visible on the flow cytometer FLR signatures, this is as well a process that happens at time scales of the hour and should be illustrated as a decrease of FLR. The FLR variations that would not be linked to cellular cycle may be observed if the surface waters were not involved in advections at the sub meso scale, since cells in deep waters do not have the same amount of pigments than surface cells, and as suggested, the clusters may not have the same ability of light acclimation. I would say that our observations are not suitable to address photosynthetic processes that are highly complicated and this is why I decided not to refer to them.

2) In Table 3 and Fig. 8, the r1 and r2 values seems to be generally low, but the authors did not show any significance levels on the statistics. Please indicate them in Table 3.

Reply: As asked from the reviewer 1, the r1 and r2 values were given with their standard error estimation after bootstrapping of the respective loess. The significant levels of the autocorrelation values given in Table 3 are represented.

My minor comments are described below.

P. 2474, lines 16-17: "which would have been critical to interpret otherwise" is not clear for me.

Reply: The sentence means that at a larger scale of observation, the interpretation of

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the distribution of the phytoplankton assemblages is nearly impossible. The sentence was modified as follow: "The access to the sub meso scale variability offers a high definition of information on the phytoplankton distribution, giving rise to the interpretations of its distribution."

27: " FlowcontTM" should be changed to "Flow-CountTM".

Reply: The modification was done.

2476, line 7: Insert "and" between "length" and "apparent size".

Reply: The modification was done.

2477, 2: PO3-4" and "Si(OH)4". 12: "between the 14 April and the 25 April" should be changed to "between 14-25 April".

Reply: The modification was done.

line 25: low mixed layer depth" should be changed to "shallow mixed layer depth".

Reply: The modification was done.

2478, 10: " μm" should be changed to " M". The highest concentrations" should changed to "The higher concentrations".

Reply: The modification was done.

12: 16: lines 5-6. How did you estimate MLD in M0 without in situ temperature and salinity data? Are the estimates of the MERCATOR model applicable to this study with high precision? At least, please verify the outputs from the model with in situ data between M1 and M4.

Reply: The data obtained from the MERCATOR model are independent from our data. The use of the outputs of the model is highly suggestive and is used to help in the interpretation of the physical surrounding of the observed phytoplankton. The collected data were sent to the MERCATOR group for their own use.

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P. 2478, line 16: "μm" should be changed to "μM".

Reply: The modification was done.

P. 2478, line 18: Remove "salinity" from the sentence, because no diel oscillation in salinity was observed (P. 2477, line 22).

Reply: The modification was done.

P. 2478, line 19: "Sl(OH)4" should be changed to "Si(OH)4".

Reply: The modification was done.

P. 2479, lines 13-14. I cannot follow the statement "FWS and FLR of C2 cells exhibited a decrease through M0", because increases in these parameters for C2 were obvious.

Reply: The sentence was modified in order to be more explicit: "The amplitude of the decrease of FLR and of FWS of C2 in M0 was important, compared to the rest of the transect."

P. 2479, lines 14-15: The sentence "FLR kept decreasing between M1 and the end of the transect (near 5°W)" is also incomprehensible, because FLR for C2 was highly variable between M1 and M3, and the decrease trend the authors pointed out seemed to be statistically insignificant.

Reply: The figures were interchanged accidently. Figure 6 being FWS and figure 7 FLR. So that the decrease on the corrected Figure 6B is obvious.

P. 2480, lines 2-3. Why didn't you show the statistical analyses of C2, C4, C5 and C6 in Fig. 8?

Reply: Because it would take too much place, since it would mean drawing 9 panels per cluster (abundances, FWS and FLR). This figure is only to illustrate the process. The Figure 8 was modified in order to illustrate the values for C1 abundances, FWS and FLR, instead of the abundances of C1 and C3.

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P. 2480, line 6: "illustrate" should be changed to "illustrates".

Reply: When talking of "panels 8c", it corresponds to both panels presented. Now their will be 3 panels. In order to facilitate the understanding, a letter was given to each panel.

P. 2482, lines 21-22: The average cell size in the observed clusters ranged from less than $<$1 μm up to 50 μm. The "less than" or "$<$" should be removed. This sentence seems to contradict the description "The Cytosub was designed to analyse large phytoplanktonic cells (P. 2475, line 4)". Can the Cytosub measure tiny algal cells ($<$ 1 μm) such as Prochlorococcus with high accuracy?

Reply: Our instrument has a limit of detection at 1 μm with some variability and is not able to detect cells like Prochlorococcus. The sentence was modified and a "~" was added instead of a "$<$". The constructor has developed an additional optical module specific for picoplankton analysis but our instrument is not yet equipped with this additional attachment that would insure observation of small cells like Prochlorococcus.

P. 2487, line 29-P. 2488, line 2: Why do you think that C6 could be coccolithophores?

Do you have any support data on its identification? If not, you should delete the sentence.

Reply: No support on its identification was available. The sentence was deleted.

Figs. 1, 2, 3, 5, 6, and 7: The unit of x-axis should be changed from "E" to "W", as is the text.

Reply: The modification was done.

Figs. 2, 3, 4, 5, 6, 7, and 8: The A, B, C, D, E, and F should be changed to (a), (b), (c), (d), (e) and (F), respectively.

Reply: Such a typology is not asked by the BGD manuscript preparation. But the annotations were homogenised with the text.

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Figs. 8(a) and 8(b): The unit of x-axis should be changed from date to longitude (W), as is the other figures.

Reply: In this figure, the notion of time is of importance. But since it was asked by an other reviewer too, the asked modification was done.

Interactive comment on Biogeosciences Discuss., 5, 2471, 2008.