

## ***Interactive comment on “Short-term response of the coccolithophore *Emiliana huxleyi* to abrupt changes in seawater carbon dioxide concentrations” by J. Barcelos e Ramos et al.***

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Reviewer # 1

In the following, locations within the manuscript are stated as reviewer's paragraph.

General comments/suggestions

Paragraph 3 – “...manipulate the carbonate system by a large and instantaneous perturbation... This is a largely artificial experiment conducted more out of convenience than in an attempt to mimic reality...” Response: We manipulated the carbonate system abruptly because we wanted to compare the short-term response to that

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of previously acclimated cultures (some even acclimated in steps to minimize potential stress effect). Statements emphasizing that we observed physiological changes to “abrupt artificial carbonate system changes” can be found in the two last paragraphs of the introduction.

Paragraph 4 – “... If the cultures are aerated, the pCO<sub>2</sub> in the bottles should be set by the pCO<sub>2</sub> of the air that is being equilibrated with the water...” Response: We agree with the reviewer's comment and this is also stated in the material and methods section and in the Table 1. It is evident in Table 1 that even though there were changes in alkalinity due to calcification, pCO<sub>2</sub> almost did not differ.

Paragraph 5 – “... this study would have been significant strengthened by including a control treatment...” Response: The experimental design does include a control treatment in which the CO<sub>2</sub> concentration is kept similar to the pre-cultures. To ensure direct comparability between all CO<sub>2</sub> treatments during the experiment, the medium of the control treatment was prepared and manipulated the same way as all other treatments (no aeration).

Paragraph 5 – “... more robust description of the cell's physiological circadian rhythm...” Response: We added information in the results section according to the reviewer's suggestion.

Paragraph 6 - “... caption of Table 1...” Response: Table caption and information about DIC measurements (material and methods section) were made clearer according to reviewer's suggestion.

p. 4744, last para. “ The time scale of the C-fixation experiments is not clear...” Response: We improved the text according to reviewer's suggestions in the material and methods section. Moreover, we have now included reference to time dependent differences between gross and net carbon fixation in the discussion section (Sub-section Organic carbon fixation and F<sub>v</sub> / F<sub>m</sub>, 5 paragraph).

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p. 4745, 2nd para. "... it is not clear to me over what time interval the growth rates were calculated..." Response: We improved the text according to reviewer's suggestions in the material and methods ("Cell diameter and numbers") section and in the legend of Figure 4.

Paragraph 9- "... more information and background references on the Fv/Fm measurements..." Response: We added information according to reviewer's suggestions.

Paragraph 10- "... limitation of the results is that there is not a single statistical test..." Response: We added statistical analysis in the results section according to the reviewer's suggestion.

Paragraph 11- "... An alternative way to present the data in Fig. 1..." Response: We did not add a new graph because the slopes change throughout the day influencing the results. Nevertheless, we added statistical analysis in the results section according to the reviewer suggestion.

Paragraph 12, p. 4746, l. 12. "... The change in POC production was mostly due to a low value in the lowest CO<sub>2</sub> treatment..." Response: We improved the description of the figure in the results section according to indication given by the reviewer.

Paragraph 13- "... increase in the number of malformed coccoliths under high CO<sub>2</sub>. ... some quantitative measure which could be applied?" Response: The photographs were included to show that changes in the calcification rates are directly reflected to under-calcified coccoliths (coccolith formation takes about one hour), which could be detected already after 8 h at higher CO<sub>2</sub> concentrations. Even though we did not perform any quantitative analysis, the photos are representative of the trend observed.

Paragraph 15- "... was there really a statistically significant trend in Fv/Fm related to CO<sub>2</sub>..." Response: Fv / Fm increased during the light phase and was lower at low CO<sub>2</sub>. However, there was no significant trend for all CO<sub>2</sub> levels.

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Paragraph 16, p. 4750, 2nd para. "I don't see how a change in cellular carbon quotas necessarily has a direct effect on cell volumes since it's possible to change the carbon content per unit volume." Response: We fully agree with the reviewer that carbon content per unit volume might change. However, within 26 h of experiment it is unlikely that this could explain the changes observed, neither could we think of a process which could be responsible for that.

Paragraph 17, p. 4751, last para. "... define the terms "acclimation" and "adaptation" to clarify the subsequent discussion..." Response: We added information according to reviewer's suggestions.

Paragraph 18, p. 4752, l. 9. "... fuller description of projected changes in the carbonate system. What is mean by "abrupt changes through time"?..." Response: We made text clearer according to reviewer's suggestions.

Specific comments/suggestions

p. 4740, l. 21. change "until" to "by" Response: We have changed the text as suggested by the reviewer.

p. 4727, l. 3. change "neither if its" to "or whether" Response: We have changed the text as suggested by the reviewer.

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