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Biogeosciences Discussions

Interactive comment on "CO_2 increases ^{14}C-primary production in an Arctic plankton community" *by* A. Engel et al.

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Point-by-point response to Anonymous Referee #2

Referee: General comments: The experiment conducted by Engel et al. studies the response of an arctic plankton community to CO2 enrichments using 9 mesocosms located in Kongsfjorden, Svalbard (i.e. an archipelago between Barents Sea and Greenland Sea). Their paper addresses relevant scientific questions about the impacts of ocean acidification on the interactions between biological and chemical processes in arctic seas. These results are important for biogeochemical models and predictions of marine ecosystems response to the climate changes. This study presents interesting data, concepts and ideas which should be published. However, the issues, the hypotheses and the conclusions of the text should be more explicit and clearly defined

so the reader could easily refer to it. The important information provided in the text should always converge to one of the conclusions. Thus, I recommend the publication of Engel et al.'s paper after major revisions.

Individual scientific questions/issues

Referee: Specific comments: First, the introduction may go from large theory to the specificity of your site. It will be easier to introduce the working hypotheses. I suggest also putting together the sections Results and Discussion. It will be easier to link up together a given result and its conclusion according to the working hypotheses. Moreover, it would be very interesting to divide this new section not by parameters (i.e. as in section 3) but by topics (i.e. as in section 4). For example, the first part of the new section 3 could also be divided in two subsections separating the dataset before and after nutrients addition.

Response: We appreciate the referee's suggestion. However, we wish to clearly separate findings and interpretations. We therefore feel that results and discussions should stay separate.

Referee: The authors must also carefully define all the parameters used, as simple as they seem, and make sure that the discussion about the methods is done in the section Material and methods. This way, the discussion will focus mainly on the results, impacts of the ocean acidification on plankton, not on the chosen methods. Some parameters discussed are not well defined in the text. The data used in the section Results are not always explained in the section Material and methods (i.e. cumulative concentrations, O2-NCP, DIC, DI13C, GCP, etc.). Some figures and authors are also not cited in an appropriate way (see section Technical corrections).

Response: We will adopt the suggestion and move the discussion of methods into the material and methods section. Abbreviations and parameters will be defined more carefully.

Referee: Finally, add a short conclusion. The abstract provides a concise and complete summary. The text should be structured in the same way. The results are sufficient in this study to support strong interpretations and conclusions.

Response: We agree with the referee 2 and with referee 1 and will add a separate conclusion paragraph.

Referee: Technical corrections 1 Introduction: Page 10287:

Line 1: Why the Arctic Ocean is predicted to be among the most affected by the increase of carbon dioxide? Could it be due to the cold water temperatures and rapid sea ice melting?

Response: The referee is right a more comprehensive reasoning for this statement will be added, including the aspects of freshening, decline in sea-ice coverage and temperature change.

Referee: Line 18: It may be obvious, but should we read: '.. the partial pressure of CO2 in the ocean (pCO2)'

Response: The suggestion will be adopted.

Referee: Page 10288: Line 4: Is energy light?

Response: 'Energy' will be replaced by 'light'

Referee: 2 Material and methods, Page 10290Line 9: Why day 10?

Response: There was a mistake. The sentence should read: Briefly, nine mesocosms were deployed close to the coast of Spitsbergen near Ny-Alesund on 28th May 2010 (day-10). All mesocosms enclosed nutrient-poor, post-bloom fjord water. The CO2 manipulation was carried out between 6th and 11th of June (day-1 to day 4) by the addition'.

Referee: Line 12: Don't need to cite the Figure 1.

Response: Reference to Fig. 1 will be omitted.

Referee: Page 10291: Line 1: This sentence includes results and not methods. Line 3: Could you be more precise on what information we should find in Schulz et al.?

Response: The following sentence will be included in the results section 3.2 Primary production of organic carbon: 'Changes in Chl a concentration (range: 1-3 μg l-1) during the study indicated the development of one smaller phytoplankton bloom before addition of nutrients to the mesocosms on day 13, as well as two bloom peaks after nutrient addition (Fig. 1). For more information on bloom development see Schulz et al. (2012).í

Referee: Page 10292: Line 9: Does d7 mean day 7?

Response: d7 will be replaced by day7; day will be used throughout the text.

Referee: Page 10293: Line 14: The mathematical formula (1) and (2) may be too obvious to be numbered in the text. There are others more important formula in my opinion (i.e. PP and PER (%)) that could be numbered in section 2.7.

Response: We agree and will only briefly describe equations 1 and 2 in the text. We will add equations for PP, PPPOC, PPDOC and PER.

Referee: 3 Results, Page 10294: Line 5: Could 'No temperature ...the fjord. At the site deployment.... be in the sections Material and methods? Temperature variations could be indicated for the period before and after the nutrients addition (same thing for PAR data).

Response: Temperature and light conditions at the incubation site will be described in the material and methods section. Temperature and light variations will be included.

Referee: Line 15: Sometimes it is written 'day' or 'd'. It should be more homogenous.

Response: 'day' will be used throughout the text.

Referee: Line 17: Could it be better to use the pCO2 level in Table 1? At least, enumerate the mesocosms as the Table 1 would be classified in order of pCO2 levels.

Response: Average pCO2 levels will be included in Table 1 (see comment referee 1)

Referee: Page 10295: Line 4: Insert at the end of the sentence: (data not shown)

Response: 'data not shown' will be inserted.

Referee: Line 20: Could you change the numbers attributed to the mesocosms as we could read: high pCO2 (M7, M8, M9), by 48% in the medium (M4, M5, M6) and (M1, M2, M3). If it was well defined in the Materials and methods, you could just say high, medium and low pCO2 levels.

Response: We will better define assignments of mesocosms to low, medium and high pCO2 levels in the material and methods and omit mesocosm numbers in brackets.

Referee: Lines 22-24: These sentences should be in the section Material and methods.

Response: Manuscript will be modified accordingly.

Referee: Page 10297: Line 12: Replace 'We do not known' by 'We did not know'... It is rare to use the pronoun 'we'.

Line 15: This sentence should be in the section Material and methods.

Line 18: This sentence should be in the section Material and methods.

Page 10298: Line 6-11: These sentences should be in the section Material and methods (sections 2.7).

Page 10299:

Lines 3-8: These sentences should be in the section Material and methods (sections 2.7).

Response: Manuscript will be modified according to referees suggestions raised

above.

Referee: Line 12: Did you mean: (Fig. 7b)?

Response: We actually meant 8b; will be changed accordingly.

Referee: Page 10300:, Lines 1-22: These sentences should be in the section Material and methods (sections 2.7).

Response: Manuscript will be modified accordingly.

Referee: Lines 23-27: These sentences should be in the section Introduction.

Page 10301:

Lines 1-5: These sentences should be in the section Introduction.

Lines 6-14: These sentences should be in the section Material and methods.

Line 16: Repetition: this sentence is also in section Results, page 10297 at line 5.

Page 10302:

Lines 1-7: These sentences could be directly associated with the related results of

section 3.

Response: Manuscript will be modified according to referees suggestions raised above.

Referee: Line 13: Why the authors are cited?

Referee: Line 17: How did you measure the nutrient concentrations during the experiment? Shouldn't it be in the section Material and methods?

Response: We will briefly explain in the M&M section how nutrients were determined and will refer to Schulz et al. 2012 for more information.

Referee: Page 10303: Line 3-7: These sentences could be in the section Introduc-

tion. If all the concepts are predetermined, you just refer to it as part of your working hypotheses. I think it is a mistake to always introduce new parameters and concepts throughout your paper.

Response: Here, we feel that these sentences better fit in the discussion section.

Referee: Line 27: The interrogative form may be not appropriated here.

Response: We will delete the sentence line 27.

Referee: Page 10303: Line 23: Is it the first time you use the terms DIP and DIN? Page 10304: Line 3: Is it the first time you use the term PON?

Response: Abbreviations will be defined.

Interactive comment on Biogeosciences Discuss., 9, 10285, 2012.