

Interactive comment on “Carbon cycling and phytoplankton responses within highly-replicated shipboard carbonate chemistry manipulation experiments conducted around Northwest European Shelf Seas” by S. Richier et al.

Anonymous Referee #1

Received and published: 19 March 2014

The manuscript describes the general set-up, experimental design and phytoplankton community's dynamic. The manuscript is well written however some parts of the results section are confusing. The general discussion and conclusion are globally coherent, well justified and brought to the reader even if some considerations are (I think) missing.

General comments and suggestions:

1. You really managed to emphasize the fact that the major interest was on replicate number and not time and the discussion point about this is convincing. The preferred short time experiment versus wide geographic area has been a nice risk and it was

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challenging to choose this approach. It is unfortunate that at one location you could not (for technical reason obviously) extend the experiment period of few days. This might be a point on the discussion, of what could have been done to add justification on the short-term effect. It remain exceptional to have so good replicates on the biology, which is a major results and strength of your study.

2. Your justification of small cell size being more sensitive to H^+ is based only on one publication (Flynn et al 2012). As doing experiments it would be interesting to compare with previous experiments performed in situ in similar conditions as yours. For example, you do not cite Yoshimura et al. 2013, in which the different response to pCO_2 of two locations (Fe limited) was attributed to different community composition. For them large cells dominated the community that respond to pCO_2 while the location with small cell size did not show pCO_2 effect. The experimental conditions and method to increase CT wasn't the same as your but this could have been a point of the discussion to compare with contradictory results obtained from in situ experiments.

3. Looking in the literature and the increasing number of publications the last years at community level, it seems that biological answer will depend on the region. You had a large geographical distribution showing some differences. The nutrient status and generalities about in situ conditions could have been interesting to be discussed also to place in the local environmental context before generalise to all oceanic provinces.

Specifics comments:

1. The title suggest for that we'll have information on the whole carbon cycle (including DOC production, grazing, particles sinking, ...) which isn't the target of the manuscript. I would rather suggest to use "carbon net production and phytoplankton responses ..." or something restricting the "carbon cycle" term.

2. For the introduction there might have too many publication cited for one concept, it might be interesting to reconsider some cited papers.

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3. P.3495, L20: the total depth of the water column is not shown; it is disturbing especially for the E3 location. I made the assumption to read the manuscript assuming that the depth was much important at that site than the others, as stratification is deeper.
4. For the light, it might be interesting (in the idea to repeat and compare experiments), to know which percentage of the surface irradiance the $100 \mu\text{mol photons m}^{-2} \text{ s}^{-1}$ represents for each locations (in Table 2?). P 3501, L10: For coherence with the first part of the sentence, I would prefer to read, \hat{A} with E2 being the exception ($20 \% < 10 \mu\text{m Chl a}$).
5. For results section, paragraphs 3.2 and 3.3 nothing is mentioned about the additional locations. Do we have to assume they behave the same as the main locations in term of carbonate chemistry and reproducibility?
6. P 3502 paragraph 3.4 I would suggest to reorganise this part, as there is some repetition. L16 should be later in the paragraph.
7. Table 2: the depth column is the sampling depth? Why some of them have < 10 or < 20 ?
8. Figure 4 b); do you take into account the E1 location for this? In the text it is written “highly reproducible” (P3502 L7) but on the figure the area in the middle of the graph is spreading. Is that E1 effect?
9. Figure 6: I suggest decreasing the symbols’ size to make them clearer and coherent with other figures (such as Fig 4 or 3).
10. Figures 7: for the significant difference indicated by “**”, does it mean “at least one treatment was statistically different”, as it is for figure 8? You have decided to not have any paragraph about statistics in the manuscripts, so it should be very precisely specified in the legend what “**” mean. If the other manuscripts of the special issue use the same statistical tests it might be interesting to mentioned in which the statistics are explained.

11. References: change “Klause” to “Krause”

Yoshimura, T., Suzuki, K., Kiyosawa, H., Ono, T., Hattori, H., Kuma, K., & Nishioka, J. (2013). Impacts of elevated CO₂ on particulate and dissolved organic matter production: microcosm experiments using iron-deficient plankton communities in open subarctic waters. *Journal of Oceanography*, 69, 601–618. doi:10.1007/s10872-013-0196-2

Interactive comment on Biogeosciences Discuss., 11, 3489, 2014.

BGD

11, C446–C449, 2014

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