

Interactive comment on “Effect of enhanced $p\text{CO}_2$ levels on the production of DOC and TEP in short-term bioassay experiments” by G. A. MacGilchrist et al.

Anonymous Referee #3

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General comments

The present work is a novel contribution to the knowledge of the effects of acidification on the carbon cycle through the study of DOC and TEP dynamics. TEP may represent an important intermediary carbon pool in the ocean and accurate information on their dynamics is therefore important in predicting future climate change. Although it has been proposed that increasing levels of $p\text{CO}_2$ may result in enhanced TEP production, is still in debate if that generates positive or negative feedback on atmospheric $p\text{CO}_2$. Results presented here are short-term shipboard experiments from a range of locations characterized by different environmental settings. While authors did not observe significant effect of $p\text{CO}_2$ on DOC production, they found significant but highly

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variable effect of pCO₂ on the production of TEP. This finding “in experiments with natural ecosystems at a community level”, is consistent with the view that the variable effect of pCO₂ on TEP is not simple and straightforward, but it’s complex as it’s in the mesocosmes manipulated by nutrients or in batch culture experiments.

Specific comments

The introduction section are well structured and provides the relevant literature on the subject while the results section are very hard to read and some paragraphs need to be improved. The set experiments using triplicate provides the possibility of good replication that lacks sometimes in the other experiments. References are well cited

The main issues are that variable effect of pCO₂ on the production of TEP is rather indirect and due to a combination of several environmental factors varying differently according to studied locations (nutrient availability, phytoplankton community structure and growth conditions), is missing here a discussion on how different hydrological context (well-mixed /stratified water) may affect these relationship.

-in some experiments the accumulation or degradation of TEP is mainly impacted by the effect of pCO₂ on phytoplankton growth and was dependent on species composition. While some results are given on small-celled phytoplankton, I suggest, if available to include data and on large- phytoplankton species that contributed to net growth in the higher pCO₂ treatments.

- in experiment E2 it was suggested that TEP production is a function of the initial availability of nutrients and could be treatment dependent. The environmental condition of this location corresponds to the post- blooms and the occurrence of carbon overconsumption (already described as a mechanism increasing TEP pool in oceans). So the hypothesis of a treatment-dependent increase in TEP needs to be accompanied by the given calculations specifying in what treatment (1000 μ atm) significant result was observed.

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- Page 3716 Line 15 -30 (and Figure 5) The few presented data do not allow for a conclusion on a future scenario of TEP production through grow as they do show how TEP production would change at different growth rates, growth could no be calculated here. Authors should compare TEP data with primary production available for the same experiment

-Fig. 5 shows that relationship between TEP production and chlorophyll are not treatment dependent and not always positive, it is already suggested by many authors (included in the MS). In the ocean, cell growth rate is highly variable due to nutrient, light, temperature changes.... Moreover I'm not sure about the significant correlation between TEP and Chl a in experiment E1 and E2. In the methodological settings, "measurements are taken at the start and after 48 and 96 h. You have only 2 time steps; the time 48-96h is a subtraction of the amount of TEP obtained from 0-96 to 0-48h. In this case it cannot be considered in the regression. This figure could be removed as not related to the main question

-Initial and final pCO₂ of experiments are not given. This information is crucial to see the range of pCO₂ experienced in different locations.

Specific comments:

-Page 3713 line 10 is better to use "the rate of TEP increase/decrease per day -The term lower pCO₂ for the 550 μ at could bring to confusion is better is use 550 μ atm -Instead of "TEP destruction" is better to say " TEP losses or TEP decrease (bacterial degradation can be an important pathway of TEP loss, Passow 2002).

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