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Interactive comment on "High temperature decreases the PIC / POC ratio and increases phosphorus requirements in *Coccolithus pelagicus* (Haptophyta)" *by* A. C. Gerecht et al.

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We would like to thank J.-P. Gattuso for taking the time to comment on the present manuscript and would like to address the points he has raised.

1) It is not the PIC/POC ratio that is determining the impact of biology on air-sea CO2 fluxes, it is the ratio of PIC production to POC production.

We agree. The abstract (and relevant parts in the text) have been changed to read "the ratio of PIC to POC production determines whether coccolithophores act as a source or a sink of atmospheric CO2".

2) Ψ (mol CO2 released per mol CaCO3 precipitated) is not considered when calculating CO2 production by net calcification.

The threshold of PIC/POC=1, for determining release or uptake of CO2 by the system, has been removed from the text. We have calculated the relevant Ψ values (Lavigne & Gattuso, 2013) from measured pH and TA (see supplement to this comment, Table S1) to determine the thresholds for release/uptake of CO2 for the initial experimental conditions as well as the end conditions (at the time of sampling). These end conditions represent the most "extreme" conditions, in regard to carbonate chemistry that the cultures (albeit briefly) were exposed to.

Initial experimental conditions had an average Ψ-value of 0.72 but rose in all treatments towards the end of the experiment, mainly due to the decrease in culture pH. Accordingly, threshold ratios of ΔPIC/ΔPOC were lower at the time of sampling than at the onset of the batch experiments (Table S1). At the time of sampling, the calculated threshold of ΔPIC/ΔPOC was between 1.20-1.32 (in the experiments with available algal cell PIC/POC ratios; see Gerecht, Biogeosciences Discuss., 11, C60–C63, 2014). In three cases, algal PIC/POC ratios were 6-14% higher than these threshold values, so that the carbonate chemistry of the cultures could have promoted release of CO2. However, the 32-56% lower PIC/POC ratios in ssp. pelagicus at elevated temperature (15°C) would have favoured CO2 uptake.

In any case, independently of the threshold of ΔPIC/ΔPOC, increased net PIC production over net POC production will reduce CO2 uptake by the ocean (Rost & Riebesell, 2004). Conversely, reduced PIC over POC production (low PIC/POC ratios) as measured in this study for ssp. pelagicus grown at elevated temperature (15°C) will favour CO2 uptake by the system.

The relevant parts of the text will be modified accordingly.

3) I would also suggest to indicate which "omega" is listed in Table 1. "omega" has been changed to read "Ωc" in Table R1.

References:

Gerecht, A., et al.: Biogeosciences Discuss., 11, C60–C63, 2014.

Lavigne, H. and Gattuso, J.-P.: seacarb: seawater carbonate chemistry with R. R package version 2.4.10. http://CRAN.R-project.org/package=seacarb, 2013.

Rost, B. and Riebesell, U.: Coccolithophores and the biological pump: responses to environmental changes, in: Coccolithophores – from molecular processes to global impact, edited by: Thierstein, H. R. and Young, J. R., Springer, Heidelberg, Germany, 99–126. 2004.

Please also note the supplement to this comment:
http://www.biogeosciences-discuss.net/11/C117/2014/bgd-11-C117-2014-supplement.pdf

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Interactive comment on Biogeosciences Discuss., 11, 1021, 2014.