

Interactive comment on “Effects of CO₂ on particle size distribution and phytoplankton abundance during a mesocosm bloom experiment (PeECE II)” by A. Engel et al.

Anonymous Referee #1

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The authors investigate the effects of CO₂ concentrations on the size spectrum and community composition of phytoplankton in mesocosm incubations conducted at three CO₂ concentrations: high, medium and low concentrations, corresponding respectively to natural conditions in the distant past, present and projected future. They present clear observations of significant changes in the size spectrum and community composition as a function of CO₂ concentration and discuss theoretical arguments that can explain at least some of these differences. This paper addresses an important and timely topic, and I rate the overall quality of this work as good to very good. However, there are a few items that should be clarified, which I will address as Specific Comments below, and several Technical (typographical) errors, which I list last as Technical

Comments.

Specific Comments:

p. 4112 (bottom) 8211; p. 4113 (top): I find it an overstatement that the average phytoplankton composition during the post-bloom phase of the future and present CO₂ treatments converged to that observed for the past treatment during the bloom phase. One might say that the former approached the latter, but convergence seems too strong a statement. The distributions are different (comparing the two right-most bars of the bottom panel of Fig. 6 to the left-most bar of the middle panel of the same figure). The differences appear greatest for *Emiliania* and *Micromonas*.

p. 4115, section 4.2, lines 20-23 Is it not also true, however, that diatoms exhibit a much wider range of C:N (and C:nutrients) than (most?) other phytoplankton? This to me suggests that while they are good at concentrating carbon and taking up CO₂, they may not be so good at regulating their carbon uptake. At least, they do not seem to mind large variations in carbon content.

p. 4119. lines 4-19. Did the smaller cells in the past treatment really not constitute a greater fraction of the PON (N biomass) than in the other treatments? If this is true, I suggest explicitly stating this, and clarifying (proportion relative to what? Volume or abundance?) by adding to the end of the sentence (lines 9-10), to read: "Then, however the smaller cells in the past CO₂ treatment should have contributed to PON in a higher proportion than larger cells (on a volume basis), which they did not." If C:N ratio increases with size, why do the smaller cells NOT contribute relatively more to the PON? Overall, this paragraph needs to be more focused, perhaps by adding a closing sentence to sum it up and make a point.

Technical Comments:

p. 4106, line 5, presumably should read "phosphate and silicate". line 8, and "...the carboys were brought..." p.4112, line 29, should be "...no significant differences in terms

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of...between the CO2 treatments..." p. 4113. lines 5-6: should be something like "...particle- and cell-size distribution..." (Or did the authors intend some other meaning? The use of respective here did not have a clear meaning to me.) p. 4114, lines 21-22: Should this not read, "...a general increase in cell size with increasing CO2..." p. 4118. line 12 should read "...the very low size range..." lines 14-19: This sentence should be re-written for clarity. I suggest something like: "Only at particle sizes < 4 mm could the higher abundance of particles in the past CO2 treatment compensate partially for the slower supply rates per cell."

Lines 21-22: "indicate that the total supply rate of CO2 to cells was slowest in the past treatment, despite the..., whereas the present day and future CO2 treatments..." p. 4119, line 24: should state "CO2-dependent sink for carbon." p. 4120, line 5: should state "...in ways that..."

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