Biogeosciences Discuss., 11, C4234–C4236, 2014
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Biogeosciences Discussions
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Interactive comment on "Biogeochemical implications of comparative growth rates of *Emiliania huxleyi* and *Coccolithus* species" *by* C. J. Daniels et al.

Anonymous Referee #3

Received and published: 8 August 2014

This manuscript deals with a comparison of exponential growth rates of coccolithophore cultures to test the assumption that under identical culture condition E. huxleyi grows significantly faster than either of two Coccolithus species. Next the authors present a model using these growth and calcite production rates in combination with abundance data of Emiliania/Coccolithus species from field samples from the North Atlantic to examine biogeochemical consequence of such species specific growth/calcite production rates and to nominate the most important calcite producing coccolithophore species.

This work is an interesting combination of culture experiments, field observations and modeling, that can contribution to a better understanding of the role of coccolithophores

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Interactive Discussion
Discussion Paper

in the oceanic carbon cycle. However, I have some concerns mainly regarding the interpretation of the culture experiments and the relevance of these results for predictions on calcite production in natural coccolithophore communities.

The authors performed culture experiments to challenge the assumption that under identical culture conditions Emiliania grows “significantly“ faster than either of two Coccolithus species. Though I agree that such a direct comparison under identical culture conditions is a useful approach, I cannot follow the conclusion derived from the results. The authors confirm that under various identical culture conditions Emiliania has indeed higher growth rates than C. pelagicus/ braarudii. To me this confirms the assumption they set out to challenge. The authors claim that these differences are small and not significant. Please clarify for what reason. The term "significant" is obviously not used in a statistical context. Instead the authors define 2 times higher to be significant (p.10516, lines 15-18). This approach is difficult to understand and needs to be clarified. I suggest including statistics on your results and in addition evaluating the differences in growth rate in a biological context. As growth rate is an exponential measure, the biological significance of even small differences may be underestimated. For instance, translating 12 and 28% higher exponential growth rate (p.10519, lines 8-9) into abundance in a natural phytoplankton community will result in huge differences after only a few rounds of cell division. However, further following the discussion I have the impression that growth rates from culture experiments are not necessarily informative when determining the relative abundance/contribution to calcite production of the respective species in natural phytoplankton communities and wonder if such a model as used in this study should actually be based on growth rate data from culture experiments.

p. 10514, lines 5-7: I suggest to clarify what you consider to be a fast/slow growing coccolithophore species as this may confuse the readers.

p. 10519, lines 21-23: The light intensities used in this study do not appear to be a reasonable explanation for the lower growth rates compared to many other studies on

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Emiliania cultures that report growth rates >1 at similar temperature/light levels.

p. 10521, lines 20-25: I am not familiar with this method. However, I wonder if there is any inter-calibration of different methods available that you could refer to?

p. 10522, lines 17-20: This is not a “population” but a “community” as you refer to an assemblage of different species.

p. 10523, lines 2-3: Please clarify what you mean by “The relative abundance of E. huxleyi to C. pelagicus was generally low (0.7–85) . . .”

p. 10525/10526: I suggest to include a brief discussion on the relative importance of the studied coccolithophore species for calcite production/the oceanic carbon cycle in areas where Coccolithus species are of high abundance vs. a global scale.

Interactive comment on Biogeosciences Discuss., 11, 10513, 2014.