

Interactive comment on “A global compilation of coccolithophore calcification rates” by Chris J. Daniels et al.

Anonymous Referee #2

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Reviewer 2 comments on Daniels et al. “A global compilation of coccolithophore calcification rates”

General comments:

Daniel et al. have created a global dataset of field calcification rates by coccolithophores. This dataset will be extremely useful to the scientific community and should be published. The manuscript is well written and the figures are clear and describe the dataset well. I have a few comments and suggestions below, but overall the manuscript is in great shape and I recommend publication after minor revisions.

Specific comments:

Line 38: excessive “the” before “coccolithophores”

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Line 63: Biocalcification is also poorly constrained due to data limitations (e.g., satellite-derived PIC only sees the surface and is tuned to capture E. hux and not other species)

Line 84-86: Might want to also mention that the E hux morphotype B/C, which dominates the Southern Ocean (Charalampopoulou et al. 2016), is particularly lightly calcified and the PIC algorithm overestimates PIC in the Southern Ocean due to the unique reflectance properties of E hux B/C (see Holligan et al., 2010)

Line 97: Unclear who “their” is referring to. Either delete it or replace it with “coccolithophore”, if you are just referring to coccolithophore calcification.

Line 105: Perhaps add to this citation list: two recent reviews by Balch (Annual Review in Marine Science) and Krumhardt et al. (Progress in Oceanography) – see ref list at the end of this document for complete citation.

Line 238: There is a left open parenthesis in this sentence and it's a bit confusing. I suggest a rewrite: “From these profiles, depth-integrated values were calculated to represent euphotic zone integrated CP in which the euphotic zone is taken as either 1% (e.g. Poulton et al., 2006) or 0.1% (e.g. Balch et al., 2011) of incident irradiance in the different studies.” Line 252: Is there an extra “of” after “surface”?

Line 358: I'm confused about this range of global CP estimates. It is indeed highly uncertain but 8 Gt C yr⁻¹ seems way too high. I'm not seeing this value in the references that are cited. Another more recent reference that would be an upper end of the range would be Smith and Mackenzie, 2016 (2.1 Gt C yr⁻¹)

Figure 5 (and maybe elsewhere): Since coccolithophores are well known to be quite seasonal, perhaps point out that the points on the maps are not separated by season but are all measurements are included on these maps regardless of the time of year the CP measurement was taken. Due to the seasonal bias in the dataset we could almost see this as a “growing season snapshot” (?)

Line 375: Is cell-CP really a measure of calcification per unit biomass? Cell size and or-

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ganic carbon content in coccolithophores can vary between species and under changing environmental conditions (see POC-normalized growth rates in Krumhardt et al., 2016 and volume normalization in Muller et al., 2017)

Line 394: Southern Ocean E hux morphotype B/C approaches this low cell-CP (Figure 1i in Muller et al., 2015, converting from pgC cell⁻¹ d⁻¹ to pmol cell⁻¹ d⁻¹)

References: Balch, William M. "The Ecology, Biogeochemistry, and Optical Properties of Coccolithophores." *Annual review of marine science* 10, no. 1 (2018).

Holligan, P. M., A. Charalampopoulou, and R. Hutson. "Seasonal distributions of the coccolithophore, *Emiliana huxleyi*, and of particulate inorganic carbon in surface waters of the Scotia Sea." *Journal of Marine Systems* 82, no. 4 (2010): 195-205.

Krumhardt, Kristen M., Nicole S. Lovenduski, M. Debora Iglesias-Rodriguez, and Joan A. Kleypas. "Coccolithophore growth and calcification in a changing ocean." *Progress in Oceanography* (2017).

Müller, Marius N., Thomas W. Trull, and Gustaaf M. Hallegraeff. "Independence of nutrient limitation and carbon dioxide impacts on the Southern Ocean coccolithophore *Emiliana huxleyi*." *The ISME journal* 11, no. 8 (2017): 1777.

Müller, Marius N., Thomas W. Trull, and Gustaaf M. Hallegraeff. "Differing responses of three Southern Ocean *Emiliana huxleyi* ecotypes to changing seawater carbonate chemistry." *Marine Ecology Progress Series* 531 (2015): 81-90.

Smith, Stephen V., and Fred T. Mackenzie. "The role of CaCO₃ reactions in the contemporary oceanic CO₂ cycle." *Aquatic geochemistry* 22, no. 2 (2016): 153-175.

Interactive comment on Earth Syst. Sci. Data Discuss., <https://doi.org/10.5194/essd-2018-52>, 2018.