

Interactive comment on “Environmental drivers of coccolithophore abundance and calcification across Drake Passage (Southern Ocean)” by Anastasia Charalampopoulou et al.

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Response to review by M. Saavedra-Pellitero (Referee) msaavedr@uni-bremen.de

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The present study by Charalampopoulou et al. addresses the composition and structure of coccolithophore communities and calcite production across Drake Passage (Southern Ocean), regarding also primary production, chlorophyll-a, nutrient concentration, temperature, salinity, irradiance and carbonate chemistry parameters. The manuscript is well written and adds an interesting contribution to the ecology of coccolithophores at high latitudes in a marked environmental N-S gradient. I consider that

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this manuscript is novel and addresses compelling scientific questions within the scope of Biogeosciences.

Response: We thank the reviewer for their positive comments.

Specific comments: L. 44: What about morphotype C described in Young et al. (2003)?

Response: Indeed there are other *E. huxleyi* morphotypes (C, O, T) described in the literature, however this statement refers to the main ones which have recognisable differences in calcite content and quantifiable differences (e.g., differences in distal shield length or element thickness or central area characteristics). Morphotype C appears to be a small version of the B/C coccolith and as the size description in Young et al. (2003) does not clearly differentiate B/C and C we have chosen not to mention it in this case (i.e. how would a study quantifiably and statistically differentiate a mixed population of B/C and C morphotypes?).

L. 97: Would it be possible to add other references here on top of Winter et al. (2014)?

Response: We have now cited Malinverno et al. (2015) here and elsewhere in the discussion to emphasise that not all studies agree with the conclusions of Winter et al. (2014).

L. 123: Section 2.2 Study area should go before section 2.1 Sampling.

Response: We have now swapped these two sections as suggested by the reviewer.

L. 117. Is it possible to know at which depths (0-100m) the samples were retrieved?

Response: We apologise for not making this clearer in the previous draft to either reviewer. Water samples were collected from 5 m, 10 m, 50 m, 75 m and 100 m (not added to Ln 145). Both Figure 4 and 5 include surface water (5 m) abundance and calcification rate data: hence there is no difference between surface species distribution and rate data. We have now altered the Figure legend for Fig. 4 to reflect the sampling depth.

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In L. 139 you wrote “up to 5 CTD depths over the upper 100m”, but that is the only information provided.

Response: See previous response.

L. 135-138. Not very clear, be more specific.

Response: We have now been more specific about the Orsi et al. (1995) criteria to differentiate the different fronts/water masses across the Antarctic Circumpolar Current (ACC). This is now clarified in the text: “. . .as well as the hydrographic criteria of Orsi et al. (1995). . .”.

L. 153: I think that the cocospheres and coccoliths were identified not only to species level, since morphotypes were also separated.

Response: We have corrected this statement to reflect that *E. huxleyi* was also differentiated into morphotypes based on the criteria of Young et al. (2003) and Poulton et al. (2011).

L. 166: >99%, on average?

Response: Detached coccoliths were predominantly from *E. huxleyi* in terms of total numbers. We have clarified this in the revised paper.

L. 170. Delete “and Poulton et al. (2011)” since they followed Young et al (2003) in their paper.

Response: We have now deleted Poulton et al. (2011) from this section.

L. 171. “. . .and central area open or with a thin plate”. Based on the morphological study of culture strains by SEM, Hagino et al. (2011) suggested to separate coccoliths with an open central area as Type O from existing morphotypes B, B/ C, and C, characterized by coccoliths with a solid plate in the central area. I wonder why the authors did not separate morphotype O from B/C considering that Type O is extensively distributed in the Southern Ocean (e.g., Hagino et al., 2011; Malinverno et al., 2015).

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Response: We are aware of the study by Hagino et al. (2011) however made no attempt to differentiate types B/C and O in the present study. This stems from two reasons: (1) we have never been able to resolve the question of whether preservation of the central plate in B/C coccoliths depends on sample processing or degree of calcification; and (2) our focus in this study was coccolith calcite content, where differences between type A and B/C are likely to be significant, whereas differences between type B/C and O are likely to be minimal. We have now changed the wording in this section of the paper to recognise the possible differentiation of B/C and O coccoliths.

L. 322: If you mention *Pappomonas* spp. (L. 324) and *Papposphaera* spp. (L. 325) you should use “coccolithophore taxa” instead of “coccolithophore species”.

Response: We have now corrected this.

L. 322: were identified as coccospheres? or as detached coccoliths? Specify.

Response: We now specify as coccospheres.

L. 326: (Charalampopoulou, 2011). I do not think you need to cite it when she is the first author of this manuscript.

Response: We have removed this reference to the PhD thesis by the lead author in this instance, but retain it elsewhere as a primary reference to results which are not presented in the manuscript but are contained in the thesis (which is available online).

L. 326: “all the way across Drake Passage” might be misleading when looking at Fig. 4.

Response: Indeed this is slightly misleading and we have removed the ‘all the way’ from this sentence.

L. 384-385: Since the section 3.4 refers to morphometric measurements performed on *Emiliana huxleyi* specimens (see L. 165, section 2.4), you should specify that there, in section 3.4 (e. g. using “*Emiliana huxleyi* placolith size” instead of just “coccolith

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size”).

Response: We have now retitled this section and added *E. huxleyi* several times to emphasise that this refers to *E. huxleyi* only. However, please note that >99% of the coccoliths detected were from *E. huxleyi* (see Ln 180).

L. 400: I could not find Fig. 7!

Response: We apologise to the reviewer, this should have read Fig. 6A and 6B (Fig. 7 was included in a previous draft).

L. 410 and L. 422: You did not talk about diversity before. I would suggest adding something about diversity in section 3.2.

Response: We have now added species richness data to Figure 5 to highlight the latitudinal trends and show the raw data before the statistical analysis. We have also added the line “Diversity (species richness) generally declined with latitude (Fig. 5b), with the lowest number of species (1-2) present in the Antarctic and Continental Zones of both transects” to the relevant results section in the revised manuscript (Lns 361-363).

L. 430: It would be worthwhile to consider Malinverno et al. (2015) and Saavedra-Pellitero et al. (2014) here and/or in L. 55-57.

Response: We thank the reviewer for pointing out these two key recent publications which we have now added to our references and cited in both the introduction and discussion.

L. 619: Make clear that this refers to coccolithophore communities in the Iceland Basin/North Hemisphere.

Response: We have now been more specific with this line as suggested by the reviewer.

L. 970, 980, 985 and 990: I suggest plotting both transects N-S in Figures 2, 4, 5 and 6

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instead of N-S-N. In that way it will be easier for the reader to compare Transect 1 and 2.

Response: We thank the reviewer for the suggestion but believe that the figures and axis are clearly labelled to allow comparison N-S-N. We also hope that this emphasises the decrease in all coccolithophore measurements south of the SB (i.e. mid-plot).

Technical corrections:

L. 342: (0.5-1.8 cells mL⁻¹) Response: Corrected.

L. 347: (<0.01 _ 103 coccoliths-1 mL⁻¹) Response: Corrected.

L. 374: (0.4 cells mL⁻¹) Response: Corrected.

L. 497: Winter et al. Response: Corrected.

L 708: Baumann, K.-H. Response: Corrected.

L. 762: 257 pp. Response: Corrected.

L. 791: 401 pp. Response: Corrected.

L 830: Whitworth III, T. Response: Corrected.

L 870: Baumann, K.-H. Response: Corrected.

L. 880: 327 pp. Response: Corrected.

L 887: pp. 75-97 Response: Corrected.

L 896: Whitworth III, T. Response: Corrected.

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