

Supplement. Answer to reviewer #1

We thank anonymous referee #1 for the interest he showed in our manuscript and detailed comments that have helped to improve the original version of the manuscript. We have considered all his/her comments and addressed each of his/her concerns below.

R1-Cx : Referee comment, R1-Rx: authors response.

R1-C1: *The manuscript documents an annual record of coccolithophore production and coccolith weights/lengths at a Southern Ocean site. The topic is worthy of publication in biogeosciences, and the results will be of potential interest to the wider scientific community.*

In general, the manuscript is well written and illustrated, and does not contain any major flaws. However, see below for minor points.

Scientific points Line 38: “ : : : coccolith assemblages experienced weight and length reduction ..” !? It is not the assemblages that have reduced weight and length, it is the coccoliths

R1-R1: Corrected according to reviewer 1' suggestion. Now it reads: “coccoliths captured by the traps experienced weight and length...”

R1-C2: *Line 89: the Southern Ocean is a small area ? – 25% of the global area looks quite significant to me*

R1-R2: The sentence referred by reviewer #1 has been rephrased in order to avoid subjective descriptions of the size of the Southern Ocean. Now it reads: “Despite the fact that the Southern Ocean accounts for about 25% of the global ocean, it contains ~40% of the global ocean inventory of anthropogenic CO₂”

R1-C3: *Line 148: why is this section in the methods ? move regional setting and oceanography to the introduction*

R1-R3: Corrected according to reviewer 1' suggestion. In the new version of the manuscript, section “Regional setting and oceanography“ has been moved to the introduction (subsection 1.2). Section 1.1. has been titled “1.1. Background and objectives”. Subsections of Material and Methods section have been renumbered accordingly.

R1-C4: *Line 235: why unfiltered ? I am not a specialist on sediment traps but it seems odd to use unfiltered seawater. Is there not a risk of contamination ?*

R1-R4: The water used to fill the sediment trap cups was unfiltered deep seawater from > 1000m, where the particle abundance is so low that filtering is unnecessary and hard to do without adding more particles than you remove. Moreover, it is important to highlight that the risk of contamination is negligible since the particle levels in sea water are of the order of micrograms per litre while concentration in the trap cups after recovery are of the order of milligrams per litre. This point has been clarified in the new version of the manuscript. The following text has been added in lines 446-449 of the new version of the manuscript with tracked changes:

“Risk of sample contamination by the unfiltered seawater is considered negligible due to the fact that the deep water exhibits low particle abundance and also because particle concentration in sea water is of the order of $\mu\text{g/L}$ while concentration in the trap cups after recovery was of the order of mg/L .”

R1-C5: *Lines 357 and 345: “coccolith particle bloom” – since coccoliths are inanimate (just pieces of calcium carbonate) I think the word ‘bloom’ is inappropriate here – use ‘The summer coccolith flux exhibited : : :’*

R1-R5: Corrected according to reviewer 1's suggestion.

R1-C6: Line 548: you mention two factors that possibly explain the changes in calcification. Calcification (i.e. overgrowth) tends to increase with depth in the photic zone, at least in some areas of the world. So in winter it may be that the coccolithophores are sitting deeper and therefore have more calcified coccoliths than in the summer when they are closer to the surface and therefore with lightly calcified coccoliths. Of course this difference in surface vs deeper photic could be related to various parameters (light, nutrients, temperature). Do you have data/images of coccoliths from different photic depths ? In Plate 1 you show lightly and heavily calcified coccoliths from the traps – but how do they relate to the surface oceans ?

R1-R6: We appreciate reviewer 1's comment. Unfortunately, there is no data available of coccolith weight from different photic depths. Only samples collected by two sediment traps (that were deployed far below the photic zone) and satellite data are available for the study site. Therefore, our current data set precludes the assessment of the relationship between coccolith weight and the depths were the coccolithophore populations developed. In regard to seasonality, no relationship between the overgrowths and a particular period of the annual cycle was observed. This is now clarified in a sentence that has been included in the new version of the manuscript with tracked changes ("lines 674-675").

Minor points for correction/consideration

R1-C7: Title and elsewhere: Just a query. Is the use of Australian Sector OK ? Naming the sectors after the oceans, like the Atlantic Sector, Pacific Sector and Indian Ocean Sector is fine, but I wonder whether using country names (for sectors and territories) is considered to be geopolitical.

R1-R7:

We acknowledge the point highlighted by reviewer 1. Indian sector could also be an appropriate term for referring to the study region of this research. Nonetheless, we decided to use the term "Australian sector of the Southern Ocean" in order to be consistent with the terminology of previous work along the 140°E parallel such as Findlay and Giraudeau (2000), Quéguiner (2001), Trull et al. (2001), Sedwick et al. (2008), de Salas et al. (2011), Lannuzel et al. (2011) and many others. Please find the references of the publications mentioned in the previous sentence listed below:

de Salas, M. F., Eriksen, R., Davidson, A. T., and Wright, S. W.: Protistan communities in the **Australian sector** of the Sub-Antarctic Zone during SAZ-Sense, Deep Sea Research Part II: Topical Studies in Oceanography, 58, 2135-2149, <http://dx.doi.org/10.1016/j.dsr2.2011.05.032>, 2011.

Findlay, C. S., and Giraudeau, J.: Extant calcareous nannoplankton in the **Australian Sector** of the Southern Ocean (austral summers 1994 and 1995), Marine Micropaleontology, 40, 417-439, [http://dx.doi.org/10.1016/S0377-8398\(00\)00046-3](http://dx.doi.org/10.1016/S0377-8398(00)00046-3), 2000.

Lannuzel, D., Bowie, A. R., Remenyi, T., Lam, P., Townsend, A., Ibsanmi, E., Butler, E., Wagener, T., and Schoemann, V.: Distributions of dissolved and particulate iron in the sub-Antarctic and Polar Frontal Southern Ocean (**Australian sector**), Deep Sea Research Part II: Topical Studies in Oceanography, 58, 2094-2112, <http://dx.doi.org/10.1016/j.dsr2.2011.05.027>, 2011.

Quéguiner, B.: Biogenic silica production in the **Australian sector** of the Subantarctic Zone of the Southern Ocean in late summer 1998, Journal of Geophysical Research: Oceans, 106, 31627-31636, [10.1029/2000JC000249](https://doi.org/10.1029/2000JC000249), 2001.

Sedwick, P. N., Bowie, A. R., and Trull, T. W.: Dissolved iron in the **Australian sector** of the Southern Ocean (CLIVAR SR3 section): Meridional and seasonal trends, Deep Sea Research Part I: Oceanographic Research Papers, 55, 911-925, <http://dx.doi.org/10.1016/j.dsr.2008.03.011>, 2008.

Trull, T. W., Bray, S. G., Manganini, S. J., Honjo, S., and François, R.: Moored sediment trap measurements of carbon export in the Subantarctic and **Polar Frontal zones of the Southern Ocean, south of Australia**, Journal of Geophysical Research: Oceans, 106, 31489-31509, 10.1029/2000JC000308, 2001.

R1-C8: *Line 30: Don't mix z and s verbs. For example, here you use 'characterized' and on line 151 'summarized', but on line 35 you use 'analysed' and on line 135 'fertilisation'. Furthermore, on line 236 you use 'programmed' and on line 349 'grey'. You need to be consistent, and choose between British English and US English. It looks like you are favouring the former.*

R1-R8: Corrected according to reviewer 1's suggestion. The whole manuscript has been revised and corrected in order to be consistent with the use of British English (i.e. verbs "z" has been replaced by "s" when needed".

R1-C9: *Line 45: coccolithophorid vs coccolithophore. Be consistent, and choose one.*

R1-R9: Corrected according to reviewer 1's suggestion. In order to be consistent the word coccolithophorid has been replaced by coccolithophore in the new version of the manuscript.

R1-C10: *Line 62: "...some species (but not all) of coccolithophore .." – please change to 'some species of (but not all) coccolithophores ..'*

R1-R10: Corrected according to reviewer 1's suggestion.

R1-C11: *Lines 71-75: needs to be rewritten, as it doesn't make sense*

R1-R11: The sentence highlighted by reviewer 1 have been deleted following the suggestion of reviewer 2 (See **R2-C21**).

R1-C12: *Line 79: one bracket is missing*

R1-R12: Corrected according to reviewer 1's suggestion.

R1-C13: *Line 102: dominantly present -> dominate*

R1-R13: Coccolithophores are abundant in the subantarctic waters of the Southern Ocean, but this does not mean that they dominate the phytoplankton communities in terms of numbers or biomass. In order to be more precise, the sentence highlighted by reviewer 1 has been rewritten: "coccolithophores exhibit high concentrations in the Subantarctic Southern Ocean"

R1-C14: *Line 115: spares -> sparse*

R1-R14: Corrected according to reviewer 1's suggestion.

R1-C15: *Line 149: ".at the north : : : at the south .." -> '..in the north : : : in the south ..'*

R1-R15: Corrected according to reviewer 1's suggestion.

R1-C16: *Line 203: CO2 rich -> CO2-rich*

R1-R16: Corrected according to reviewer 1's suggestion.

R1-C17: *Line 253: "After settling 12 hours .." -> 'After settling for 12 hours ..'*

R1-R17: Corrected according to reviewer 1's suggestion.

R1-C18: *Line 271: by using-> using*

R1-R18: Corrected according to reviewer 1's suggestion.

R1-C19: *Line 273: "...to the winter .." -> '..to winter ..'*

R1-R19: Corrected according to reviewer 1's suggestion.

R1-C20: *Line 285: Scanning Electron Microscopy -> scanning electron microscope (SEM)*

R1-R20: Since this point has been also mentioned by reviewer 2 (See **R2-C55**), the text has been modified trying to satisfy both reviewers suggestions. The text now reads: “a Scanning Electron Microscope (SEM)”.

R1-C21: *Line 298: “..using a with a Nikon ..” -> ‘: : :using a Nikon ..’*

R1-R21: Corrected according to reviewer 1’s suggestion.

R1-C22: *Line 346: “..should be looked with caution ..” -> ‘should be viewed with caution’*

R1-R22: Corrected according to reviewer 1’s suggestion.

R1-C23: *Line 358 (and elsewhere) : you need to insert x (times) between the number and the power. For example, 2.2 10 -> 2.2. x 10*

R1-R23: Corrected according to reviewer 1’s suggestion. The manuscript has been revised and “x” has been included between the number and the power when absent.

R1-C24: *Line 365: Biogenic -> biogenic*

R1-R24: Corrected according to reviewer 1’s suggestion.

R1-C25: *Line 370: of the species *Calcidiscus* -> of *Calcidiscus**

R1-R25: Corrected according to reviewer 1’s suggestion.

R1-C26: *Figure 5 (and elsewhere): I realise that ‘liths’ is in common use in presentations, but it is not an official term. Better to use cocoliths.*

R1-R26: Corrected according to reviewer 1’s suggestion. The word “liths” has been replaced by cocoliths in the Y-axis of Figure 5. The text has been revised although no inconsistencies were found.

R1-C27: *Line 382: tiles? I think you mean ‘elements’*

R1-R27: PREGUNTAR A Lluïsa Cross The text has been corrected following reviewer 1’s recommendation. The term tiles has been replaced by “tile-like elements”.

R1-C28: *Line 384: “Distal shield measures ranged between 2 and 4,35 ..” -> ‘Distal shield ranges from 2.0-4.35 ..’ [use decimal point not comma]*

R1-R28: Corrected according to reviewer 1’s suggestion.

R1-C29: *Line 424: here you use station 62 S, and before 62 S site – perhaps be consistent in usage*

R1-R29: The words site and station are used as synonyms in the text and are used alternatively in order to avoid repetition. Therefore, no changes in the usage of these words have been incorporated in the text.

R1-C30: *Line 463: genetical -> genetic*

R1-R30: Corrected according to reviewer 1’s suggestion.

R1-C31: *Line 550: degrees of calcification -> degree of calcification*

R1-R31: Corrected according to reviewer 1’s suggestion.

R1-C32: *Line 555: B/C south 50_S -> B/C south of 50_S*

R1-R32: Corrected according to reviewer 1’s suggestion.

R1-C33: *Line 576: light-dependant -> light-dependent*

R1-R33: Corrected according to reviewer 1’s suggestion.

R1-C34: *Line 617: absence accompanying in situ -> absence of in situ*

R1-R34: Corrected according to reviewer 1’s suggestion.

R1-C35: Line 643: *That supported* -> *That is supported*

R1-R35: Corrected according to reviewer 1's suggestion.

R1-C36: Lines 741-759: *delete, as the same as later references*

R1-R36: Corrected according to reviewer 1's suggestion.

R1-C37: Lines 773 and 816 (and elsewhere): *Deep Sea* -> *Deep-Sea*

R1-R37: Although we agree with reviewer 1 that the title of the journal is “Deep-Sea Research” all the references downloaded from their official website display the title of their own journal like “Deep Sea Research”. Therefore, in order to be consistent with the references of the journal we have kept the title in all references without the “-“.

R1-C38: Line 860: *emiliania huxleyi*

(haptophyta) Å'z, *Journal of phycology*, -> *Emiliania huxleyi* 860 *(haptophyta)* Å'z,

Journal of Phycology, [why is there a superscript 1 at the end of the title ?

R1-R38: Corrected according to reviewer 1's suggestion. The superscript 1 has been deleted from the title.

R1-C39: Lines 864, 867 and 884 (and elsewhere): *italicize the species name*

R1-R39: Corrected according to reviewer 1's suggestion. The references have been revised and species names have italicized.

Additional changes

- Section 3.3, line 674, of the “new version of the manuscript with tracked changes”, the sentence “annual amplitude of the coccolith weight was approximately” has been replaced by “annual amplitude of the **mean** coccolith weight was approximately” in order to be clearer.
- The correlation between Biogenic silica and coccolith fluxes at 2000 m showed in line XX of the first version of the manuscript was the correlation coefficient ($r = 0.86$), not the coefficient of determination ($R^2 = 0.74$). In the new version of the manuscript the coefficient of determination is shown.
- The coccolith length values presented the results listed in section 3.3 of the first version of the manuscript (lines 405-409) corresponded to an earlier version of the data set.. The correct values have been included in the new version of the paper. Please note that the seasonal trend remains identical (only there was a slight variation of the absolute values). Please also note that the calculations made in the discussion regarding the relationship between size and weight in the first paragraph of Section 4.3 are correct. The coccolith length data at 3700 plotted in figure 6 also corresponded to the older version of the dataset. This has been corrected in the new version of the manuscript. Please note that the seasonal trend remains identical.
- Plate I: In the first version of the manuscript we skipped the letter “d” listing the photos of Plate I. In the new version of the manuscript, this typo has been fixed.