REVIEWERS COMMENTS

The calcification of coccolithophores in the high latitude regions is a growing concern as it will have large influence on ocean biogeochemistry and thus climate. The data provides new information on coccolithophore response to varying environmental conditions at Antarctic Zone using sediment traps samples. However, the information provided here can be expressed in a much better way. Sediment trap data from Southern Ocean is difficult to obtain and is therefore a welcome addition to knowledge and needs to be published. Here are some major and minor comments which need to be incorporated in the manuscript.

Major comments/changes needed to be done:

1. Authors documented only abundance of coccoliths of E. huxleyi B/C morphotypes in the traps. It is also mentioned that occurrence of other coccolithophores were also documented. Though other coccoliths are in low abundance, it represents changes in the upper oceanic conditions. It is also important to plot a graph of other coccolithophores and discuss what their assemblage indicates.

2. The overcalcification of E. huxleyi is documented by few researchers in past few years. But not many papers are published on this. Authors have documented overcalcification on coccoliths retrieved from sediment traps. I assume intact coccospheres are also documented in the both the sediment traps. In this case, whether authors documented overcalcification on coccospheres of E. huxleyi? If any information is available on living coccolithophores in this region, it should be included. It is important to document the overcalcification on E. huxleyi is a natural process and not a part of secondary calcification. So, if extant coccolithophores data is available at/around study site then it should be presented.

3. Authors often compared diatom assemblage with coccoliths. Plotting a graph of total diatom assemblage vs coccoliths abundance will be useful for understanding changes in the AZ region.

4. A recent study indicates polysaccharides are also responsible for overcalcification of coccolithophres. Authors need to discuss outcomes in more detail and should be cited with recent references.

5. Authors should be consistent in framing sentences. Some sentences are too large, some are too small. Be consistent in using AZ vs AZ-S, Fe vs. iron, E. huxleyi, vs Emiliania huxleyi etc.

6. Since, both sediment traps are located in the 61degS and there is no comparison done with other sediment traps showed in the Fig. 1, it is not necessary to mention “at 61S sediment trap everywhere”

7. Authors should crosscheck references very carefully. Many references listed in the text are not reflected in the reference list. Similarly, many references listed in the Reference list are not

mentioned in the text. Genus and species name should appear properly and in italics. For ex. Line 860- emiliania huxleyi.

Hagino et al. 2011 reference- written in caps

Minor comments:

Line 14-30: The information provided in the abstract can be shifted to the introduction. The abstract should start from Line 31.

Line 32: In the deep ocean >>> at the Antarctic Zone

Line 33: ~2000>>> 2000

Line 33: and 3700>>> and 3700 respectively

Line 37: Emiliania huxleyi morphotype B/C>>>> E. huxleyi morphotype B/C

Line 38: coccolith assemblage experienced weight and length reduction>>> coccoliths experienced weight and length reduction

Line 39: during the summer months>>> during summer months (December-March?)

Line 40: at both sediment trap depths>>> at both sediment traps

Line 41: in other southern ocean settings>>>> which settings?

Line 43-46: Apart from first record, significant outcomes of the study needs to be highlighted here.

Line 71-75: May not required in the introduction

Line 76: Coccolithophores also has the potential >>>> coccolithophores has potential

Line 89: 25% of ocean area is not small.

Line 107: Trull et al., 2017 is not mentioned in reference list

Line 109: Cubilos et al. 2008 or 2007? Cubilos et al. 2008 is not mentioned in the reference list

Line 111: Freeman and Lovenduski (2015) not mentioned in the reference list

Line 116-122 and elsewhere in the introduction: very large sentence. Authors should be consistent in framing sentences. Such long sentences to be avoided in the introduction

Line 123: Trull et al., 2017 missing in the reference list

Line 138: inferred from one-year record>>>> inferred from 10 month record

Line 139: SOIREE……. Elaborate when using short forms for the first time

Line 147: Regional setting and oceanography; and water carbonate chemistry, should be shifted in the introduction under a different sub-heading.

Line 151… SAACF>>>SACCF

Line151: (SAACF)>>>(SACCF) Fig.1

Line 155: upper water column with nutrients (add reference). Similarly for sentences between lines 155-160 (add references)

Line 155: Chlorophyll-a, vs/ Line 484 chl-a>>> use one style of writing

Line 160: ….. in algal biomass occurs within the mixed layer (add reference)

Line 164: Trull et al. 2001>>>> Trull et al. 2001a or Trull et al. 2001b or 2001c??

Line 169: Large calanoid copepodites.>>> Copepods and copepodites are different. Copepodites are immature form of copepods. What authors are trying to say? “large Calanoid copepods” or “mainly Calanoid copepodites”??

Fig. 1. Since author has mentioned that sediment trap location was away from sea ice activity, authors should draw seasonal sea ice zone or winter sea ice limit for the year 2001-2002 in Fig. 1

Line 180: SACCF- Southern ACC Front>>>> SACCF- Southern Antarctic Circumpolar Current Front

Line 193: calcite saturation horizon (CSH)>>>> Calcite Saturation Horizon (CSH)

Line 194: CaCO3 compensation depth (CCD)>>>> CaCO3 Compensation Depth (CCD)

Fig. 2. Similar to Fig. 1 and Fig. 3, Fig. 2 should be plotted in the Ocean data view and figures should be readable. What does the dotted line indicate in Fig. 2b?

Fig 2 a. legend should contain surface macronutrient concentrations?

Line 200: (Fig. 3)>>> (Fig.3a) or (Fig. 3b)

Fig. 3. Mark Fig. 3a and Fig 3b; Mark frontal locations, put units for color scale bar, x axis etc. Also, include sampling dots if possible. Mark 1000m sediment trap in fig 3 in different color., as it is mentioned in line 226.

Line 210: Elaborate when appear for the first time

Line 211: Tanhua et al. 2008 is missing in the reference list

Line 122: Draw seasonal sea ice zone in Fig. 1

Line 225: for approximately one year>>>> for ten months

Line 227: highlight Fig. 3a and 3b

Line 231: be consistent in using depths. Either use “~2000” or “2000”,,,, “3800 or 3700

Line 283: Emiliania huxleyi>>>> E. huxleyi

Line 235: why unfiltered seawater used? Won’t it contaminate samples?

Line 285: Scanning Electron Microscopy>>>> Scanning Electron Microscope (SEM)

Line 286: decantation method outlined by>>>> method outlined by

Line 287: coated in Gold>>> coated with/using Gold

Line 288: please mentioned magnification range (for example 2000-7000x) used during analysis.

Line 288: Emiliania huxleyi>>>>E. huxleyi

Line 291: Emiliania huxleyi>>>>E. huxleyi

Line 293: Emiliania huxleyi>>>>E. huxleyi

293-294: Emiliania huxleyi coccoliths into morphotypes>>> Emiliania huxleyi into different morphotypes

Line 298: using a with a Nikon>>>> using a Nikon

Line 319: sea surface temperature (SST) already elaborated in line 153

Line 320: Sea Surface Temperature Analysis>>>> SST Analysis

Line 323: SST variations>>>> Sea Surface variations

Line 326: Photosynthetically active radiation (PAR)>>>> Photosynthetically Active Radiation (PAR)

Line 327: particulate inorganic carbon (PIC)>>>> Particulate Inorganic Carbon (PIC)

Fig. 4. Authors have mentioned March as a late summer months in the line 158. In this case, the shaded area should also include March

Line 341: particulate inorganic carbon (PIC)>>>> PIC

Line 342-346- It is important…….. Trull et al., 2017)>>> already mentioned before

Line 347: particulate organic carbon (POC)>>>> POC; Calcium Carbonate (CaCO3)>>>> CaCO3

Fig. 5. Please check scale bars. $2x10^9$ appeared twice on left side.; in the first figure only 10^9 appeared. Is it $1x10^9$?. Put same scale in both figures. Mark Figure 5a and 5b.

Fig. 5. What is the reason diatom valve flux remained almost constant at 2000 and 3700 but there is an increase in diatom flux during February and March. Please explain.

Line 370-372: which Calcidiscus leptoporus species? Small or intermediate? Which time of sampling month these species are documented?

Line 383: distal shields partially missing, may be due to >>>> distal shield partially missing, due to

Line 384: 2 to 4,35>>>> 2 to 4.35

Line 394: (2.3 and 2.1 pg/coccolith)>>>> (2.3 ±…. and 2.1±…. pg/coccolith)

Lien 396: (down to 1.6 and 1.9 pg at 2000 and 3700m, respectively)>>>> (down to 1.6±…. and 1.9±…. pg/coccolith at 2000 and 3700m)

Line 399: Average annual coccolith weight at the 61S traps>>>>it is already mentioned that both traps are located at AZ-S, at 61S. just mentioned depths. Similarly at Line 433, at the 61S site>> study site. Similarly correct changes at line 446 and elsewhere

Line 405-406: what makes E. huxleyi coccolith change their lengths in early spring to summer discuss under discussion. Please refer Bollmann et al paper.

Line 410-412: If possible, plot graphs of correlation

Line 422: South of the Polar Front>>>> South of the PF

Line 422: include recent studies carried out in the Southern Ocean such as, Patil et al., 2017, Saavedra Pellitero et al, Malinverno et al.,

Line 426: Buesseler et al., 2007 reference is not in the reference list

Line 435: What author mean by “coccolith particle bloom”?

Line 450: use either AZ or AZ-S

Line 463: general variability they found between>>>> general variability found between

Line 463: please differentiate morphological differences between Morphotypes A, B/C, var. huxleyi and var. aurorae. E. hxuelyi morphotype C is usually less calcified morphotype of E. huxleyi usually found in the AZ. What are the probable reasons for absence of morphotype C in sediment trap samples?

Plate 1: I don't agree with all six images belonging to morphotype B/C. Plate 1b, e, looks like morphotype C. Plate 1. g is unrecognizable due to overcalcification. Authors can follow Young et al., 2003 atlas for differentiating E. huxleyi morphotypes.

Line 508: Silicate and/or Fe>>>> Silicate and/or iron

Line 522, line 535: Tagliabue et al., 2014. Year of publication missing in the reference list

Line 533: the part of the Emiliania huxleyi>>>> the part of the E. huxleyi

Line 598: Trull et al., 2001>>>>> Trull et al., 2001a or 2001b or 2001c?

Line 623: both traps (2.5 pg at 2000m to 2.6 pg at 3700)>>>>> both traps (2.5±…. pg at 2000m to 2.6±…. at 3700m)

Line 634: (Turner, 2002: Turner, 2015)>>>> (Turner, 2002; 2015)

Line 655: E. huxleyi morphotype B/C is more weakly calcified than other morphotypes>>>> I am not convinced with this. E. hulxleyi morphotype C is more weakly calcified than B/C. It can be written as >> E. huxleyi morhotype B/C is weakly calcified than A> if authors want to tell extent of calcification.

Line 676, 682: Salter et al. (2014) missing in the reference list

Line 679, 683: Rembauville et al. missing in the reference list

Line 698: Analysis of the sediment trap materials>>> analysis of two sediment trap material