Interactive comment on "Export fluxes in a naturally fertilized area of the Southern Ocean, the Kerguelen Plateau: ecological vectors of carbon and biogenic silica to depth (Part 2)" by Rembauville et al.

Response to the reviewer #1.

We thank the anonymous reviewer #1 for the careful reading of our manuscript and the many constructive comments that helped improving the manuscript. All the modifications appear on the new version of the paper attached as a supplement to this answer.
R2-Cx: Reviewer's comment, **R2-Rx**: authors response.

General comments

R1-C1. *The MS by Rembauville and colleagues report quantitative biogeochemical and biological (diatoms and faecal pellets) data gained with a shallow sediment trap deployed during one year in a naturally fertilized area of the Southern Ocean, the Kerguelen Plateau. Comparison of sed trap data with measurements in the mixed layer suggest a strong flux attenuation between 200 and 300 m. Resting spores of Chaetoceros Hyalochaete and Thalassiosira antarctica appear to be responsible for about 60% of the annual POC export at 300 m. The authors suggest that diatom resting spores might be key vectors of POC export in many other oceanographic settings in the world oceans. The seasonal succession of diatom taxa groups seems to be linked to the stoichiometry of the registered particle fluxes. The seasonal progression of faecal pellet types suggests a transition from small copepods in spring, euphausiids and large copepods in summer and salps in autumn and winter. The manuscript by Rembauville is an important contribution to our understanding of the marine biological carbon pump and provides new insights to the understanding of present-day seasonal dynamics of diatom populations in naturally fertilized marine systems. In spite of the need for clarification, the MS deserves to be published in Biogeoscienes. Below I list several suggestions, which I hope will contribute to clarify some issues and help the authors to improve their MS.*
R1-R1. We thank the reviewers for their keen interest in our manuscript. Below we address the specific comments and questions;

R1-C2. *Along the text the authors often refer to cups instead of months, it would be more useful for the reader to know the months or seasons instead of the cup numbers.*
R1-R2. The months were added in the updated version of the manuscript.

1. Introduction

R1-C3. *Is there a particular reason why the authors present the fluxes in mol m^{-2}? Many sediment trap studies in the Southern Ocean (e.g. Honjo et al. 2000; Fischer et al., 2002; Trull et al. 2000) show the data in g or mg. I would suggest to at least include the data in these other units in Table 1 to facilitate comparisons with previous studies.*
R1-R3. We choose to present the fluxes in mole because an important component of our manuscript addresses BSi:POC and POC:PON molar ratios. Other publications discussing the stoichiometry of the fluxes use moles (e.g. Trull et al., 2001; Pilskaln et al., 2004). The

companion paper (Rembauville et al., 2014) which focuses more specifically on POC fluxes compares the data with other studies.

R1-C4. *" Highest diatom fluxes (> 109 cellsm−2 d−1) are observed in the Seasonal Ice Zone (SIZ) near Prydz Bay and Adélie Land and are dominated by Fragilariopsis kerguelensis and small species of Fragilariopsis curta and Fragilariopsis cylindrus (Suzuki et al., 2001; Pilskaln et al., 2004)." Are these values annual averages or the highest values registered by the traps? Please clarify.*
R1-R4. These fluxes are the highest diatom fluxes registered by the traps and this has been clarified in the manuscript.
MS change: "Highest diatom fluxes registered by sediment trap (> 10^9 cellsm^{-2} d^{-1}) were observed…"

R1-C5. *Instead of "and small species of Fragilariopsis curta and Fragilariopsis cylindrus" it would be better to say: "and smaller Fragilariopsis species such as Fragilariopsis curta and Fragilariopsis cylindrus".*
R1-R5. Change made.

R1-C6. *"These high fluxes occur in spring and are associated with the melting of sea ice." These studies reported maximum fluxes during summer not spring.*
R1-R6. We have corrected this error and have changed "spring" to "summer".
MS change: "These high fluxes occurred in summer and were associated with the melting of sea ice".

R1-C7.*"These high fluxes occur in spring and are associated with the melting of sea ice. Changes in light availability and melt water input appear to establish favorable conditions for the production and export of phytoplankton cells (Romero and Armand, 2010). In the Permanently Open Ocean Zone 5 (POOZ), diatom fluxes are two orders of magnitude lower _ 107 cell m^{-2} d^{-1} (Abelmann and Gersonde, 1991; Salter et al., 2012; Grigorov et al., 2014) and typically represented by F. kerguelensis and Thalassionema nitzschioides, except in the naturally fertilized waters downstream of the Crozet Plateau where resting spores of Eucampia antarctica var. antarctica dominate the diatom export assemblage (Salter et al., 2012)." Same comment as above. Are the diatom valve fluxes provided here annual averages or highest values recorded? Please clarify.*
R1-R7. These fluxes are highest diatom fluxes registered by the traps.
MS change: "In the Permanently Open Ocean Zone (POOZ), the maximum diatom fluxes recorded were two orders of magnitude lower…"

2. Material and methods

R1-C8. *The depth of the water column should be mentioned in this section. Sediment traps deployed at shallow depths are subject to several hydrodynamic biases. Despite the fact that the efficiency of this sed trap is assessed in the companion paper a general statement about the efficiency of the trap should be given here as well. The companion manuscript (Rembauville et al. 2014) has already been accepted or just submitted? It probably would be better to cite it as (Rembauville et al., this issue). Please check with the journal guidelines and correct if necessary.*
R1-R8. We added the water depth and a sentence about the trapping efficiency. The

companion paper has been submitted for the KEOPS2 special issue and is also in discussion on Biogeosciences Discussion.
MS change: "Comparison with thorium-based estimates of carbon export suggests a trapping efficiency of 15-30 % relative to the proxy, although strong particle flux attenuation between 200 m and the trap depth (289 m) might also contribute to the low fluxes. We therefore interpret our results to accurately reflect the relationships between the biological and geochemical signals of the material caught by the sediment trap, which we acknowledge does not necessarily represent the entire particle export at 289 m."

2.2. Chemical measurements

R1-C9. *POC and PON data have already been presented in the companion paper and therefore shouldn' t be presented as part of the results of this manuscript. The abstract should also be corrected accordingly.*
R1-R9. We deleted the first paragraph of section 2.2 and added one sentence. We deleted the first sentence of the abstract to specify that this study focuses on the biological components of the fluxes.
MS change: "POC and PON analyses are described in the companion paper (Rembauville et al., 2014)."

2.3. Diatom identification, fluxes and biomass

R1-C10. *"...thereby facilitating the observation of diatom frustules..." The word "frustules" should be replaced by "valves".*
R1-R10. Change made.

R1-C11. How many diatoms per sample were counted? 300? 400? Why was this number chosen?
R1-R11. One half to one quarter of the counting chamber was observed, depending on the diatom abundance. This proportion is taken into account in Eq. 1. Total diatoms counted was always more than 400 specimens, with exception to the winter cup #12 where diatom abundance was very low (total diatoms counted = 55).
MS change: "The total number of diatoms counted was >400 in all the cups except in the winter cup #12 where the diatom abundance was low (<100 diatoms counted)."

R1-R12. *With the magnification used in this study (especially with x200) it can be quite hard to differentiate an empty complete frustule (i.e. two valves together) from a single valve. This can be particularly difficult for some species such as those of the genus Pseudo-nitzschia or small Fragilariopsis species. Were the authors able to make such a difference? And if so, most of the empty frustules were found as separate valves or forming a complete frustule?*
R1-R12. Samples were preserved with formalin, a preservative that fixes cells membranes. We clearly identified the majority of diatoms as complete frustules. The term 'empty cells' describes whole intact empty and recognizable frustules. We did not consider the broken frustules in our study or the very rare single valves.
MS change: "All whole intact and recognizable frustules were enumerated. Full and empty cells were counted separately, following suggestions in Assmy et al. (2013)."

R1-R13. *Please provide the raw frustule and cell counts as supplementary material. Are all the species identified in this study described in Hasle and Syversten (1997)? Authorships for all the species should be provided in Table 4 or in a separate appendix.*

R1-C13. We provide the raw frustule and cell counts as supplementary material (see the tables at the end of this answer). We added the authorship for all the diatom species in Table 4 and 5.
MS change: "Diatoms species were identified following the recommendations of Hasle and Syvertsen (1997). All whole intact and recognizable frustules were enumerated. Full and empty cells were counted separately, following suggestions in Assmy et al. (2013)"

R1-C14. *This is an interesting observation and something worth looking further into. However the authors should be cautious when referring to the "micropaleontological technique" as different authors use different versions of this technique. For example, after the acid cleaning treatment some researchers centrifuge the samples several times to wash and buffer them to a neutral pH. In contrast, other authors wait 24 h between washings allowing the diatom to settle without the use of the centrifuge. The use of the centrifuge could also be a responsible, at least partially, for the fragmentation of weakly silicified diatoms. Something similar occurs with the acid treatment, various concentrations, temperatures, and times of treatment are used in the literature and thus results may vary between authors*
R1-R14. We acknowledge the differences in the various steps of the classic micropaleontological approach. We compared our counting technique with the "micropaleontological technique" as used in Rigual-Hernández et al. (2015), which includes centrifugation and rinsing steps to buffer samples to neutral pH. We have clarified this in the manuscript. We are preparing a separate publication to compare the results from different counting techniques and will discuss the important variations highlighted by the reviewer.
MS change: " We directly compared the micropaleontological (as used in Rigual-Hernández et al. (2015)) and biological counting techniques in our sediment trap samples and noted the loss of several species (*Chaetoceros decipiens, Chaetoceros dichaeta, Corethron pennatum Corethron inerme, Guinardia cylindrus* and *Rhizosolenia chunii)* under the micropaleontological technique. We attribute this to the aggressive chemical oxidation techniques used to "clean" the samples as well as the centrifugation steps which may also selectively destroy or dissolve certain frustules"

R1-C15. *"Biomass calculations for both Chaetoceros Hayalochaete resting spores..." Why did the authors decide to estimate the biomass of Chaetoceros RS and Thalassiosira antarctica? At the beginning of this paragraph the authors should briefly explain why these particular species were chosen. Perhaps it would be preferable to start the paragraph with the last sentence.*
R1-R15. We modified this paragraph, beginning with the last sentence as suggested by the reviewer. We decided to estimate the biomass of *Chaetoceros Hyalochaete* resting spore and *Thalassiosira antarctica* resting spores because they largely dominated the numerical diatom export fluxes and therefore an appropriate estimation of their frustules volume was critical in providing an appropriate quantification of their contribution to carbon fluxes. We added a sentence to support this choice. Moreover, we generalized Equations 2 and 3 into one Equation 3 representative of the approach taken for all diatoms.
MS change. "Diatoms species that contributed to more than 1 % of total full cell flux were converted to carbon flux. For *E. antarctica* var. *antarctica*, *Fragilariopsis kerguelensis*, *Fragilariopsis separanda/rhombica*, *Pseudo-nitzschia* spp. and *Thalassionema nitzschioides* spp., we used published cell-specific carbon content (CellC, pgC $cell^{-1}$) for diatoms communities of the Kerguelen Plateau from Cornet-Barthaux et al. (2007). As *Chaetoceros Hyalochaete* resting spores (CRS) and *Thalassiosira antarctica* resting spores (TRS) largely dominated (>80%) the full diatom fluxes, an appropriate estimation of their carbon content

based on the specific sizes observed in our dataset was required for a good estimation of their contribution to carbon fluxes. Biomass calculations for both CRS and TRS …"
"Full diatom fluxes were converted to carbon fluxes as follows:

$$C\ flux_{(x)} = \frac{Flux_{(x)} \times Cell_{C(x)}}{M_{12_C} \times 10^9} \qquad (3)$$

where $C\ flux_{(x)}$ is the carbon flux carried by each diatom species x (mmol C m^{-2} d^{-1}), $Flux_{(x)}$ is the full cell numerical flux of species x (cell m^{-2} d^{-1}), $Cell_{C(x)}$ is the carbon content of species x (pgC $cell^{-1}$) and M_{12C} is the molecular weight of ^{12}C (12 g mol^{-1}) and 10^9 is a conversion factor from pmol to mmol."

2.5. Statistical analyses

R1-C16.*"Chi2 distance is very sensitive to rare events. Consequently, only full- and empty-cells fluxes > 10% of the total mean flux of all sample cups were retained in the correspondence analysis." Do the authors mean that only the species representing more than 10% of the annual assemblage were used in the statistical analysis? Please clarify. A list with the annual relative contribution of each species should be provided in Table 4 or in a separate figure or table.*
R1-R16. Only the diatoms species with an annual mean flux higher than 10% of mean annually integrated flux of all the species were kept for the analysis. We have now clarified this point in the manuscript.
MS change: "Chi^2 distance is very sensitive to rare events. Consequently, only species with an annual mean flux higher than 10% of the mean annually integrated flux of all the species were retained in the correspondence analysis. This selection was performed separately on full and empty cell fluxes."

R1-C17. *A list with the annual relative contribution of each species should be provided in Table 4 or in a separate figure or table.*
R1-R17. Table 4 was split into two tables (Tables 4 and 5) containing respectively the full and empty diatom cell fluxes. We added a last column containing the contribution (%) of diatom species/taxa group to the annual export.

3. Results

3.1. Chemical composition of the settling material

R1-R18. *Satellite chlorophyll-a estimates belong to material and methods not to this section. POC fluxes have already been presented in the companion paper and therefore shouldn0 t be presented in the results section of this paper. This should also be clarified in the abstract, as it written now it seems that these results belong to this paper.*
R1-R18. We deleted the description of the POC fluxes in the results and the abstract but they are briefly discussed in the discussion section with a reference to the "Part 1".

R1-C19. *Was the total mass flux estimated? What was the relative contribution of the biogenic silica fraction to the total mass flux? Did the authors estimate the contribution of the carbonate fraction? I would like to see the annual relative contribution of each bulk compound in Table 1 or in a new table or figure.*

R1-R19. We added the total mass flux and the biogenic silicon contribution to mass flux to Table 1. The carbonate fraction was also measured and results will be published in a dedicated study focused on the fluxes of calcifying organisms.
MS change section 3.1: "Similarly, the opal contribution to total mass flux was highest in spring (70.8 % in cup #2, November 2011) and lowest in autumn (21.5 % in cup #11, February to May 2012)."

R1-C20. *In order to facilitate comparisons with other sites, fluxes of all the bulk compounds should be also provided in mg m-2 d-1 and annual estimates in g m-2 yr-1 in Table 1.*
R1-R20. Some of the regional sediment trap publications we compare with also use mole instead of grams (eg Trull et al., 2001; Pilskaln et al., 2004; Salter et al., 2012). Moreover, the use of POC:PON and BSi:POC molar ratios is central in our study and this is why we choose to present fluxes in mol.

3.2. Diatom fluxes

R1-C21. *In order to compare the results with data from the sedimentary record, it would be useful that the authors present the annual relative contribution of each diatom species as I already suggested previously. In this section, the authors describe the changes in the relative contribution of the different diatom taxa but this information is not shown in the graphs or in the tables. This information should be included in Figure 2 or in a separate figure.*
R1-R21. We added the annual contribution to total cell flux in Tables 4 (full cells) and 5 (empty cells). We included the references to these tables in the text.

R1-C22. *The authors should explain in more detail how the annually integrated empty:full ratio presented in Figure 4 was estimated. Did the authors take into consideration the flux of each species in each cup for this calculation or was it just an average of the empty:full ratio of each species of all the cups?*
R1-R22. The definition of the annually integrated diatom flux was added in section 2.3.
MS change section 2.2. "The annually integrated full and empty diatom flux for each species was calculated as follows:

$$Annual\ flux_{(x)} = \sum_{i=1}^{12}\left(Flux_{(x)i} \times days_i\right) \qquad (2)$$

Where $Annual\ flux_{(x)}$ is the annually integrated flux of a full or empty diatom species x (cell $m^{-2}\ y^{-1}$), $Flux_{(x)i}$ is the full or empty flux of this species in the cup number i (cell $m^{-2}\ d^{-1}$) and $days_i$ is the collecting time for the cup number i (d). The calculations assume negligible export occurred during the month of September which was not sampled by the sediment trap. We consider this assumption reasonable based on the preceding flux profile and low concentration of satellite-derived chlorophyll (Rembauville et al. 2014)."

4. Discussion

4.1. The significance of diatom resting spores for POC flux

R1-C23. *Please briefly resume in a sentence or two why the authors know that there was a strong attenuation of flux between the WML and 300 m. The reader should be able to*

understand the paper without reading the companion manuscript. Also, please provide the depth of the WML.

R1-R23. We added a sentence to support the idea of a strong POC flux attenuation between the WML and 300 m.

MS change section 4.1.: "In a companion paper we present multiple lines of evidence that converge on a scenario of strong flux attenuation between the base of the winter mixed layer (WML at ~220 m) and 300 m on the Kerguelen Plateau. Most notably large attenuation coefficients (3.3 – 4) were calculated from independent measurements in spring and summer.(Ebersbach and Trull, 2008; Jouandet et al., 2014; Rembauville et al., 2014)."

R1-C24*"We did not observe any full cells of the vegetative stage of Chaetoceros Hyalochaete, a feature possibly related to its high susceptibility to grazing pressure in the mixed layer (Smetacek et al., 2004; Quéguiner, 2013; Assmy et al., 2013)". Silica dissolution in the upper water column should also be considered as an important factor determining the absence of full vegetative cells in the sediment trap. Weakly silicified diatoms such as Chaetoceros may lose one of their valves or the girdle band more easily than more heavily silicified and compact diatoms, which would facilitate the remineralization of its cellular content.*

R1-R24. We added a sentence to discuss this point.

MS change section 4.1.: "These empty frustules may be the remnants of vegetative stages following spore formation. Alternatively dissolution of the lightly silicified valves or girdle bands of the vegetative cell could result in the rapid consumption of the cellular organic material in the upper water column and this may also explain the absence of full vegetative cells in the sediment trap record."

R1-C25. *"Numerous sediment trap studies have reported a strong contribution, if not dominance, of CRS to diatom fluxes at depth in various oceanographic regions (e.g. Antarctic Peninsula (Leventer, 1991), Bransfield Strait (Abelmann and Gersonde, 1991), Gulf of California (Sancetta, 1995; Lange, 1997), Eastern Equatorial Atlantic (Treppke et al., 1996), East China Sea (Kato et al., 2003), coastal North Pacific Ocean (Chang et al., 2013) and the subarctic Atlantic (Rynearson et al., 2013)). CRS are also found to be dominant in surface sediments in the coastal northeastern Pacific (Grimm et al., 1996), the North Atlantic (Bao et al., 2000), the northeast Pacific (Lopes et al., 2006), the North Scotia Sea (Allen et al., 2005), Antarctic sea ice and coastal regions (Crosta et al., 1997; Zielinski and Gersonde, 1997; Armand et al., 2005), and east of Kerguelen Island (Armand et al., 2008b). Moreover, the annual POC export from the A3 station sediment trap at 289m (98.2±4.4 mmolm^{-2} yr^{-1}) falls near annual estimates from deep sediment traps (> 2000 m) located in the naturally fertilized area downstream of the Crozet Islands (37–60 and 40–42 mmolm^{-2} yr^{-1}, Salter et al., 2012) where fluxes were considered as mainly driven by resting spores of Eucampia antarctica var. antarctica. The frequent occurrence and widespread distribution of diatoms resting spores suggest their pivotal role in the efficient transfer of carbon to depth. Although they are frequently observed in blooms heavily influenced by the proximity of the coast, large scale advection might explain that their impact on carbon export is not restricted to neritic areas." Most of the sites mentioned in the list are coastal regions where Chaetoceros RS are quite abundant, however, in open ocean regions of the SO Chaetoceros RS show very low numbers or are absent (e.g. Fischer et al. 2002, Grigorov et al. 2014, RigualHernández et al. 2015) and therefore they don't play an important role in the carbon transfer at these sites. Authors should be more cautious in the last two sentences of the paragraph as resting spores are not an important vector of carbon export in all marine systems.*

R1-R25. We took into account this remark and changed the end of this paragraph. We acknowledge that a single observation of resting spores driving carbon fluxes into the open ocean is not enough to generalize their impact in the open ocean. We reformulate this paragraph to present references sorted into three different processes as suggested by the reviewer (coastal influence, upwelling influence, advection to the open ocean).
MS change section 4.1.: "Numerous sediment trap studies have reported a strong contribution, if not dominance, of CRS to diatom fluxes at depth in various oceanographic regions: firstly, in coastal influenced regions (e.g. Antarctic Peninsula (Leventer, 1991), Bransfield Strait (Abelmann and Gersonde, 1991), Gulf of California (Sancetta, 1995), the Omura Bay (Kato et al., 2003), North Pacific Ocean (Chang et al., 2013) and the Artic (Onodera et al., 2014)), secondly in upwelling-influenced regions (e.g. Santa Barbara basin (Lange, 1997), Eastern Equatorial Atlantic (Treppke et al., 1996)) and finally in the open ocean in the subarctic Atlantic (Rynearson et al., 2013). Similarly to sediment trap observations, CRS are reported as dominant in surface sediments of coastal regions (peri-Antarctic shelf and Antarctic sea ice (Crosta et al., 1997; Zielinski and Gersonde, 1997; Armand et al., 2005), the North Scotia Sea (Allen et al., 2005) and east of Kerguelen Island (Armand et al., 2008b)), but also in upwelling-influenced regions (the northeastern Pacific (Grimm et al., 1996), the northeast Pacific (Lopes et al., 2006)) and finally in the open ocean (the North Atlantic, Bao et al., 2000). Moreover, the annual POC export from the A3 station sediment trap at 289 m (98.2±4.4 mmol m^{-2} y^{-1}) falls near annual estimates from deep sediment traps (>2000 m) located in the naturally fertilized area downstream of the Crozet Islands (37-60 and 40-42 mmol m^{-2} y^{-1}, Salter et al., 2012) where fluxes were considered as mainly driven by resting spores of *Eucampia antarctica* var. *antarctica*. Diatom resting spores are frequently observed in blooms heavily influenced by the proximity of the coast. Major resting spores contribution to carbon fluxes was observed in one study in the open North Atlantic Ocean (Rynearson et al., 2013), but they are generally absent or very rare in open ocean sediment trap studies (Fischer et al., 2002; Grigorov et al., 2014; Rigual-Hernández et al., 2015). The frequent occurrence and widespread distribution of diatoms resting spores in the neritic or coastal-influenced ocean suggest their pivotal role in the efficient transfer of carbon to depth in these areas."

4.2 Contribution of faecal pellets to POC flux.

R1-C26. *Carlotti et al. 2014 appears in the references as in preparation. Has this paper already been published or submitted? Please check and correct if necessary.*
R1-R26. The manuscript from Carlotti et al. (2015) is now available online on Biogeosciences Discussion. We updated the reference in the manuscript accordingly.

4.3. Diatom fluxes
R1-C27. *"This value falls between the POOZ (~10^7 cells m^{-2} d^{-1}, Abelmann and Gersonde, 1991; Salter et al., 2012; Grigorov et al., 2014) and the SIZ (> 10^9 cells m^{-2} d^{-1}, Suzuki et al., 2001; Pilskaln et al., 2004). What do these values represent? maximum fluxes or annual average values?*
R1-R27. These values are maximum values reported in the references. We added this precision.
MS change section 4.3.: "This value falls between the highest values observed in POOZ…"

R1-C28. *Most of these studies present the diatom fluxes in valves m-2 d-1and some do not provide annual estimates. When the authors estimated the values presented in the text from*

these publications, did they divided the results of these authors by two (i.e. two valves = one cell)? Please check and correct if necessary.

R1-R28. The reviewer is correct, previous studies always reported diatom fluxes in valves m^{-2} d^{-1}. We have corrected this estimate by multiplying our highest flux of 1.2×10^8 cells m^{-2} d^{-1} by two to obtain 2.4×10^8 valves m^{-2} d^{-1}, this allows the direct comparison with previous studies. Nonetheless our conclusions remain valid because the differences in maximum fluxes between the POOZ and the SIZ still represent two orders of magnitude.

MS change section 4.3.: "The diatom fluxes (sum of empty and full cells) observed at the central Kerguelen Plateau reached their maximum value of 1.2×10^8 cells m^{-2} d^{-1} during the two short export events, which is equivalent to 2.4×10^8 valves m^{-2} d^{-1}. This latter value falls between the maximum values observed in POOZ (~10^7 valves m^{-2} d^{-1} Abelmann and Gersonde, 1991; Salter et al., 2012; Grigorov et al., 2014) and the SIZ (>10^9 valves m^{-2} d^{-1}, Suzuki et al., 2001; Pilskaln et al., 2004). The values are similar to the $2.5\text{-}3.5 \times 10^8$ valves m^{-2} d^{-1} measured at 200 m depth in a coastal station of the Antarctic Peninsula …"

R1-C29. *"Although the resting spore formation strategy is typically associated with 5 neritic areas (Smetacek, 1985; Crosta et al., 1997; Salter et al., 2012), their very high export and transfer efficiency together with advection can explain their contribution to deep open ocean fluxes (e.g. Rynearson et al., 2013)." "can explain their contribution to deep open ocean fluxes"? This sentence is not clear, please clarify.*

R1-R29. Following the previous reviewer comment on the contribution of resting spores to open ocean area, we reformulated this sentence and deleted the advection hypothesis.

MS change section 4.3.: "Previous studies report the presence of a resting spore formation strategy in diatom species as typically associated with neritic areas (Smetacek, 1985; Crosta et al., 1997; Salter et al., 2012). During the first multidisciplinary process study of the Kerguelen Plateau (KEOPS1, 2005), a shift in plankton community composition…"

R1-C30. *"Highest Pseudo-nitzschia spp. full cell fluxes were observed in summer, concomitantly with the second export event (cup #9). Pseudo-nitzschia species are rarely found in deep sediment trap studies and are absent from the sediment diatom assemblages due to their susceptibility to dissolution (Grigorov et al., 2014; Rigual-Hernandez et al., 2014). The genera have been reported to accumulate in summer in deep chlorophyll maximum, benefiting from nutrient diffusion through the pycnocline (Parslow et al., 2001). This ecological characteristic, together with the shallow sediment trap depth (289 m) may explain our observations of peaks in Pseudo-nitzschia spp. fluxes during summer."*
"Genera" should be replaced by "genus".

R1-R30. Change made

R1-C31. *Only some species of this genus have been found in association to a DCM, and therefore it is incorrect to state that all the species of this genus have similar ecological affinities. Parslow et al. do not report this taxon, it was Kopczynska et al. (2001) who reported the species composition of the DCM. In regard to the last sentence, why does the shallow depth of the trap*

R1-R31. We corrected the reference error and included the *Pseudo-nitzschia* species that was observed by (Kopczynska et al., 2001). We inititally suggested that the shallow trap depth was important for the collection of Pseudo-nitzschia species is they dissolve in the upper mesopelagic. However, since we cannot confirm if the absence of *Pseudo-nitzschia* from other sediment trap studies comes from their dissolution in the upper mesopelagic or from the micropaleontological technique itself (as discussed in R1-R14), we deleted the sentence concerning the shallow trap depth.

MS change section 4.3.: "Highest *Pseudo-nitzschia* spp. full cell fluxes were observed in summer, concomitantly with the second export event (cup #9). *Pseudo-nitzschia* species are rarely found in deep sediment trap studies and are absent from the sediment diatom assemblages due to their susceptibility to dissolution (Grigorov et al., 2014; Rigual-Hernández et al., 2015). The species *Pseudo-nitzschia hemii* has been reported to accumulate in summer in deep chlorophyll maximum in the Polar Frontal Zone (Kopczynska et al., 2001). Such deep biomass accumulation is hypothesized to benefit from nutrient diffusion through the pycnocline (Parslow et al., 2001). These observations are consistent with the peaks in *Pseudo-nitzschia* spp. fluxes we report in summer."

R1-C32. *"Although their fluxes were very low, species of the Rhizosolenia and Proboscia genus were mostly exported as empty cells at the end of summer and during autumn (cups #8 to #11), occurring in parallel with the full cell fluxes of the giant diatom Thalassiothrix antarctica (Table 4). It has been suggested that these species belong to a group of "deep shade flora" that accumulate at the subsurface chlorophyll maxima in summer with their highly silicified, large frustules protecting them from grazing pressure (Kemp and Villareal, 2013)." Many species of the genus Rhizosolenia exhibit weakly silicified frustules.*
R1-R32. We deleted the term "highly silicified"
MS change section 4.3.: "It has been suggested that these species belong to a group of "deep shade flora" that accumulate at the subsurface chlorophyll maxima in summer with their large frustules protecting them from grazing pressure in stratified waters (Kemp and Villareal, 2013)."

R1-C33. *Kemp et al. (2000) DSRII, should be mentioned here.*
R1-R33. We have changed the reference to the "fall dump hypothesis" for Kemp et al., (2000).

R1-C34. *In the first line replace genus by genera*
R1-R34. Change made.

R1-C35. *Replace "as the fall dump suggests" by "as the fall dump hypothesis suggests"*
R1-R35. Change made

4.4 Preferential carbon and silica sinkers

R1-C36. *"The annual BSi :POC ratio of the exported material (1.16) is much higher than the usual ratio proposed for marine diatoms of 0.13 (Brzezinski, 1985). Moreover, the BSi :POC ratio of the exported material in spring (2.1 to 3.4, cups #1 to #3) is significantly higher than the BSi :POC ratio of 0.32±0.06 in the mixed layer of the same station during spring (Lasbleiz et al., 2014). Numerous chemical, physical, biological and ecological factors can impact BSi :POC ratios of marine diatoms (e.g. Ragueneau et al., 2006). However, the ten-fold differences in BSi :POC ratios of exported particles between spring and summer is unlikely to result simply from physiological constraints set during diatoms growth (Hutchins and Bruland, 1998; Takeda, 1998)." Authors should explain the meaning of differences between the BSi:POC ratio in the mixed layer and in the trap during spring.*
R1-R36. One sentence was added at the end of the paragraph.
MS change section 4.4. "Differences in BSi:POC ratios between the mixed layer suspended particle stock and particles exported out the mixed layer may be explained by the dominant sedimentation of empty diatom frustules that results from the grazing pressure by the

zooplankton community and the intense carbon utilization by heterotrophic microbial communities (Christaki et al., 2014)"

R1-C37. *"These observations are consistent with previous studies of natural (Salter et al., 2012) and artificial (Assmy et al., 2013) iron fertilization that identified C. pennatum, D. antarcticus and F. kerguelensis as major silica sinkers and C. Hyalochaete vegetative cells, CRS and E. antarctica var. antarctica resting spores as major carbon sinkers. "Notably, resting spore formation was not observed in the artificial experiment and carbon export was attributed to mass mortality and aggregation of algal cells (Assmy et al., 2013)." Of all the species listed in this paragraph only F. kerguelensis is classified as a silica sinker by Assmy et al. 2013. Moreover, Assmy and colleagues do not report RS in their study (as mentioned here), so it is incorrect to use this reference to support the findings of the authors, (at least as it is written now). This statement should be rewritten.*

R1-R37. The section was reformulated for clarity.

MS change section 4.4.: "These observations are consistent with a previous study of natural iron fertilization that identified *C. pennatum, D. antarcticus* and *F. kerguelensis* as major silica sinkers and CRS and *E. antarctica* var. *antarctica* resting spores as major carbon sinkers downstream Crozet islands (Salter et al., 2012). During the EIFEX artificial fertilization experiment *C. Hyalochaete* vegetative stages were identified as major carbon sinker whereas *F. kerguelensis* was considered as strong silica sinker (Assmy et al., 2013). Notably, resting spore formation was not observed in the artificial experiment performed in the open ocean remote from coastal influence, and carbon export was attributed to mass mortality and aggregation of algal cells (Assmy et al., 2013). Nevertheless, a more detailed analysis of species-specific carbon and silica content in the exported material is necessary to fully validate their respective role on carbon and silica export."

4.5 Seasonal succession of ecological flux vectors over the Kerguelen Plateau

R1-C39. *"The species succession directly observed in our sediment trap samples differs somewhat to the conceptual model of ecological succession in naturally iron fertilized areas proposed by Quéguiner (2013), although the general patterns are similar. The first diatoms exported in spring are indeed small species of F. kerguelensis, T. nitzschioides spp., and small centric species (< 20 µm)." F. kerguelensis and T. nitzschioides are generally considered as relatively large diatoms. Do the authors mean that the size of the specimens of these species found in spring were smaller than the ones found later in the year?*

R1-R39. We had defined *F. kerguelensis* and *T. nitzschioides* as small species when compared to the very large and elongated species (>200 µm) represented by *Proboscia* sp., *Rhizosolenia* sp. and *Thalassiothrix antarctica*. We changed the sentence to make this differentiation clearer.

MS change section 4.5.: "The diatom species exported in spring were *F. kerguelensis*, *T. nitzschioides* spp., and small centric species (<20 µm), whilst in summer the comparatively very large (>200 µm) species of *Proboscia* sp., *Rhizosolenia* sp. *and Thalassiothrix antarctica* were observed."

R1-C40. *"However we observe that these species are exported almost exclusively as empty cells." Why however? The authors should succinctly describe conceptual scheme proposed by Quéguiner (2013) or at least provide some insights of this scheme in order to compare their results with it.*

R1-R40. We added a succinct description of the Quéguiner 2013 scheme at the beginning of the paragraph.

MS change section 4.5.: "A scheme of phytoplankton and zooplankton communities succession in naturally fertilized areas of the Southern Ocean was proposed by Quéguiner (2013). Spring phytoplankton communities are characterized by small, lightly silicified, fast growing diatoms associated with small microphagous copepods. In summer, the phytoplankton community progressively switches toward large, highly silicified, slow growing diatoms resistant to the grazing by large copepods. In this scheme carbon export occurs mostly at the end of summer through the fall dump scenario."

R1-C41. *"The main difference in our observations and the conceptual scheme of Quéguiner (2013) is the dominance of Chaetoceros Hyalochaete resting spores to diatom export assemblages and their contribution to carbon fluxes out of the mixed layer in summer, 10 probably triggered by Si(OH)4 limitation. Resting spores appear to efficiently bypass the "carbon trap" represented by grazers and might also physically entrain small faecal pellets in their downward flux. " It is generally accepted that zooplankton activity diminishes with depth toward the lower mesopelagic zone (1.5 km). Therefore, it is possible that RS are grazed or affected by other processes after 300 m. This should be also addressed in the discussion.*

R1-R42. Our results are only relevant for the Kerguelen Plateau (500 m depth) and we cannot therefore extend our observations to the deep-ocean. It is also worth noting that CRS contribute significantly to the sedimentary diatom assemblages at 500 m at the same site (Armand et al., 2008). We anticipate that the contribution of resting spores to carbon flux is at least maintained as a function of depth, and may even increase as other C-flux components more susceptible to remineralisation are attenuated. Salter et al. (2012) show the larger *Eucampia antarctica* var. *antarctica* resting spores reached 2-3km depth in the water column to dominate the flux. In addition we are currently analyzing data from a similar site which shows the dominance of CRS to POC flux at 2km. This information and discussion however forms the basis of a separate submission. Finally, diatom resting spore abundances in multiple deep sedimentary records (see references in section 4.1.) also support their efficient transfer through the mesopelagic ocean.

Conclusions

R1-C43. *Despite iron availability,. . ." The authors should provide values and references of the iron concentration in the surface layer during the experiment (if available). This information should also be mentioned in the discussion.*

R1-R43. We added a sentence to discuss iron availability in spring and summer in section 4.1 (factors likely to trigger resting spore formation).

MS change section 4.1.: "Notably, dissolved iron concentration in the mixed layer rapidly decreases to 0.1~0.2 nmol L^{-1} after the beginning of the spring bloom at A3, but the vertical entrainment is much weaker in summer compared to spring (Bowie et al., 2014)."

Figures and Tables

R1-C44. *Table 1. A column with the number of days that each cup was open should be included.*

R1-R44. Change made

R1-C45. *The units of the column LSi seems to be erroneous. Please revise all the units on the table and text. Table 2 , 3 and 5.*

R1-R45. Corrected

R1-C46. *The word bold shouldn' t be in bold in the caption figures. Table 4. The heading of the first column "Species-taxa group/Cup number" is confusing, please correct.*
R1-R46. Change made (see Tables 4 and 5).

R1-C47. *Figure 1. It is not clear what the two curves plotted in figure 1a represent. Please clarify in the figure caption*
R1-R47. We added a description of the two time series in the figure caption.
MS change figure caption 1: "The black line represents the climatology calculated for the period 1997/2013, whilst the green line corresponds to the sediment trap deployment period (2011/2012)."

R1-C48. *Figure 7 is not mentioned in the text.*
R1-R48. This error was corrected. Figure 7 is now mentioned in sections 3.4 and 4.7.

Technical corrections

R1-C49. *In the penultimate paragraph of the discussion (line 18) change "sport" by "spore".*
R1-R49. Change made

R1-C50. *In Table 1 please correct the name of these species: Rhizosolenia antennata/styliformis (two "n") (i) Thalassiosira antarctica (two "s")*
R1-R50. Change made.

References

Abelmann, A., Gersonde, R., 1991. Biosiliceous particle flux in the Southern Ocean. Mar. Chem., Biochemistry and circulation of water masses in the Southern Ocean International Symposium 35, 503–536. doi:10.1016/S0304-4203(09)90040-8

Armand, L.K., Crosta, X., Quéguiner, B., Mosseri, J., Garcia, N., 2008. Diatoms preserved in surface sediments of the northeastern Kerguelen Plateau. Deep Sea Res. Part II Top. Stud. Oceanogr. 55, 677–692. doi:10.1016/j.dsr2.2007.12.032

Assmy, P., Smetacek, V., Montresor, M., Klaas, C., Henjes, J., Strass, V.H., Arrieta, J.M., Bathmann, U., Berg, G.M., Breitbarth, E., Cisewski, B., Friedrichs, L., Fuchs, N., Herndl, G.J., Jansen, S., Krägefsky, S., Latasa, M., Peeken, I., Röttgers, R., Scharek, R., Schüller, S.E., Steigenberger, S., Webb, A., Wolf-Gladrow, D., 2013. Thick-shelled, grazer-protected diatoms decouple ocean carbon and silicon cycles in the iron-limited Antarctic Circumpolar Current. Proc. Natl. Acad. Sci. 110, 20633–20638. doi:10.1073/pnas.1309345110

Blain, S., Sarthou, G., Laan, P., 2008. Distribution of dissolved iron during the natural iron-fertilization experiment KEOPS (Kerguelen Plateau, Southern Ocean). Deep Sea Res. Part II Top. Stud. Oceanogr., KEOPS: Kerguelen Ocean and Plateau compared Study 55, 594–605. doi:10.1016/j.dsr2.2007.12.028

Carlotti, F., Jouandet, M.-P., Nowaczyk, A., Harmelin-Vivien, M., Lefèvre, D., Guillou, G., Zhu, Y., Zhou, M., 2015. Mesozooplankton structure and functioning during the onset of the Kerguelen phytoplankton bloom during the Keops2 survey. Biogeosciences Discuss 12, 2381–2427. doi:10.5194/bgd-12-2381-2015

Christaki, U., Lefèvre, D., Georges, C., Colombet, J., Catala, P., Courties, C., Sime-Ngando, T., Blain, S., Obernosterer, I., 2014. Microbial food web dynamics during spring phytoplankton blooms in the naturally iron-fertilized Kerguelen area (Southern Ocean). Biogeosciences 11, 6739–6753. doi:10.5194/bg-11-6739-2014

Cornet-Barthaux, V., Armand, L., Quguiner, B., 2007. Biovolume and biomass estimates of key diatoms in the Southern Ocean. Aquat. Microb. Ecol. 48, 295–308. doi:10.3354/ame048295

Crosta, X., Pichon, J.-J., Labracherie, M., 1997. Distribution of Chaetoceros resting spores in modern peri-Antarctic sediments. Mar. Micropaleontol. 29, 283–299. doi:10.1016/S0377-8398(96)00033-3

Ebersbach, F., Trull, T.W., 2008. Sinking particle properties from polyacrylamide gels during the KErguelen Ocean and Plateau compared Study (KEOPS): Zooplankton control of carbon export in an area of persistent natural iron inputs in the Southern Ocean. Limnol. Oceanogr. 53, 212–224. doi:10.4319/lo.2008.53.1.0212

Fischer, G., Gersonde, R., Wefer, G., 2002. Organic carbon, biogenic silica and diatom fluxes in the marginal winter sea-ice zone and in the Polar Front Region: interannual variations and differences in composition. Deep Sea Res. Part II Top. Stud. Oceanogr. 49, 1721–1745. doi:10.1016/S0967-0645(02)00009-7

Grigorov, I., Rigual-Hernandez, A.S., Honjo, S., Kemp, A.E.S., Armand, L.K., 2014a. Settling fluxes of diatoms to the interior of the Antarctic circumpolar current along 170 °W. Deep Sea Res. Part Oceanogr. Res. Pap. 93, 1–13. doi:10.1016/j.dsr.2014.07.008

Grigorov, I., Rigual-Hernandez, A.S., Honjo, S., Kemp, A.E.S., Armand, L.K., 2014b. Settling fluxes of diatoms to the interior of the Antarctic circumpolar current along 170 °W. Deep Sea Res. Part Oceanogr. Res. Pap. 93, 1–13. doi:10.1016/j.dsr.2014.07.008

Hasle, G.R., Syvertsen, E.E., 1997. Chapter 2 - Marine Diatoms, in: Tomas, C.R. (Ed.), Identifying Marine Phytoplankton. Academic Press, San Diego, pp. 5–385.

Jouandet, M.-P., Jackson, G.A., Carlotti, F., Picheral, M., Stemmann, L., Blain, S., 2014. Rapid formation of large aggregates during the spring bloom of Kerguelen Island: observations and model comparisons. Biogeosciences 11, 4393–4406. doi:10.5194/bg-11-4393-2014

Kemp, A.E.., Pike, J., Pearce, R.B., Lange, C.B., 2000. The "Fall dump" — a new perspective on the role of a "shade flora" in the annual cycle of diatom production and export flux. Deep Sea Res. Part II Top. Stud. Oceanogr. 47, 2129–2154. doi:10.1016/S0967-0645(00)00019-9

Kemp, A.E.S., Villareal, T.A., 2013. High diatom production and export in stratified waters – A potential negative feedback to global warming. Prog. Oceanogr. 119, 4–23. doi:10.1016/j.pocean.2013.06.004

Kopczynska, E.E., Dehairs, F., Elskens, M., Wright, S., 2001. Phytoplankton and microzooplankton variability between the Subtropical and Polar Fronts south of Australia: Thriving under regenerative and new production in late summer. J. Geophys. Res. Oceans 106, 31597–31609. doi:10.1029/2000JC000278

Parslow, J.S., Boyd, P.W., Rintoul, S.R., Griffiths, F.B., 2001. A persistent subsurface chlorophyll maximum in the Interpolar Frontal Zone south of Australia: Seasonal progression and implications for phytoplankton-light-nutrient interactions. J. Geophys. Res. Oceans 106, 31543–31557. doi:10.1029/2000JC000322

Pilskaln, C.H., Manganini, S.J., Trull, T.W., Armand, L., Howard, W., Asper, V.L., Massom, R., 2004a. Geochemical particle fluxes in the Southern Indian Ocean seasonal ice zone: Prydz Bay region, East Antarctica. Deep Sea Res. Part Oceanogr. Res. Pap. 51, 307–332. doi:10.1016/j.dsr.2003.10.010

Pilskaln, C.H., Manganini, S.J., Trull, T.W., Armand, L., Howard, W., Asper, V.L., Massom, R., 2004b. Geochemical particle fluxes in the Southern Indian Ocean seasonal ice zone: Prydz Bay region, East Antarctica. Deep Sea Res. Part Oceanogr. Res. Pap. 51, 307–332. doi:10.1016/j.dsr.2003.10.010

Quéguiner, B., 2013. Iron fertilization and the structure of planktonic communities in high nutrient regions of the Southern Ocean. Deep Sea Res. Part II Top. Stud. Oceanogr. 90, 43–54. doi:10.1016/j.dsr2.2012.07.024

Quéroué, F., Sarthou, G., Planquette, H.F., Bucciarelli, E., Chever, F., van der Merwe, P., Lannuzel, D., Townsend, A.T., Cheize, M., Blain, S., d' Ovidio, F., Bowie, A.R., 2015. High variability of dissolved iron concentrations in the vicinity of Kerguelen Island (Southern Ocean). Biogeosciences Discuss 12, 231–270. doi:10.5194/bgd-12-231-2015

Rembauville, M., Salter, I., Leblond, N., Gueneugues, A., Blain, S., 2014. Export fluxes in a naturally fertilized area of the Southern Ocean, the Kerguelen Plateau: seasonal dynamic reveals long lags and strong attenuation of particulate organic carbon flux (Part 1). Biogeosciences Discuss 11, 17043–17087. doi:10.5194/bgd-11-17043-2014

Rigual-Hernández, A.S., Trull, T.W., Bray, S.G., Closset, I., Armand, L.K., 2015. Seasonal dynamics in diatom and particulate export fluxes to the deep sea in the Australian sector of the southern Antarctic Zone. J. Mar. Syst. 142, 62–74. doi:10.1016/j.jmarsys.2014.10.002

Rynearson, T.A., Richardson, K., Lampitt, R.S., Sieracki, M.E., Poulton, A.J., Lyngsgaard, M.M., Perry, M.J., 2013. Major contribution of diatom resting spores to vertical flux in the sub-polar North Atlantic. Deep Sea Res. Part Oceanogr. Res. Pap. 82, 60–71. doi:10.1016/j.dsr.2013.07.013

Salter, I., Kemp, A.E.S., Moore, C.M., Lampitt, R.S., Wolff, G.A., Holtvoeth, J., 2012a. Diatom resting spore ecology drives enhanced carbon export from a naturally iron-fertilized bloom in the Southern Ocean. Glob. Biogeochem. Cycles 26, GB1014. doi:10.1029/2010GB003977

Salter, I., Kemp, A.E.S., Moore, C.M., Lampitt, R.S., Wolff, G.A., Holtvoeth, J., 2012b. Diatom resting spore ecology drives enhanced carbon export from a naturally iron-fertilized bloom in the Southern Ocean: EUCAMPIA DRIVEN CARBON FLUXES. Glob. Biogeochem. Cycles 26. doi:10.1029/2010GB003977

Smetacek, V.S., 1985. Role of sinking in diatom life-history cycles: ecological, evolutionary and geological significance. Mar. Biol. 84, 239–251. doi:10.1007/BF00392493

Suzuki, H., Sasaki, H., Fukuchi, M., 2001. Short-term variability in the flux of rapidly sinking particles in the Antarctic marginal ice zone. Polar Biol. 24, 697–705. doi:10.1007/s003000100271

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

Supplementary table 1: Raw counts of full diatoms cells from the 12 sediment trap cups.

	Sediment trap cup number											
Species	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
Asteromphalus spp.	0	1	0	2	0	0	0	0	5	0	0	0
Chaetoceros atlanticus Cleve	0	0	0	0	0	0	0	0	3	0	0	0
Chaetoceros atlanticus f. *bulbosus* Ehrenberg	0	0	0	0	0	0	0	0	0	0	0	0
Chaetoceros decipiens Cleve	0	0	2	0	0	0	0	0	3	0	0	0
Chaetoceros dichaeta Ehrenberg	0	0	0	4	0	0	0	0	11	0	0	0
Chaetoceros Hyalochaete spp.	59	0	245	2354	477	1276	669	926	3350	1120	241	0
Corethron inerme Karsten	0	0	0	0	0	0	0	0	10	0	0	0
Corethron pennatum Grunow	0	0	0	0	0	0	0	0	0	0	0	0
Dactyliosolen antarcticus Castracane	0	0	0	3	0	0	0	0	1	0	0	0
Eucampia antarctica var. *antarctica* (Castracane) Mangin	7	3	8	11	5	20	9	38	44	25	29	4
Fragilariopsis kerguelensis (O'Meara) Hustedt	75	94	0	114	26	7	10	7	60	0	0	0
Fragilariopsis separanda/rhombica group	2	14	0	40	3	11	6	4	63	0	0	0
Guinardia cylindrus (Cleve) Hasle	0	0	0	0	0	0	0	0	3	0	0	0
Leptocylindrus sp.	0	0	0	2	0	0	0	0	0	0	0	0
Membraneis spp.	3	1	0	11	0	0	1	1	1	0	0	0
Navicula spp.	0	0	5	38	0	0	0	17	25	0	0	0
Odontella weissflogii (Grunow) Grunow	0	0	0	5	0	0	0	0	2	0	0	0
Pleurosigma spp.	1	0	0	13	1	1	0	2	41	2	0	0
Proboscia alata (Brightwell) Sundröm	0	0	0	0	0	0	0	0	4	0	0	0
Proboscia inermis (Castracane) Jordan & Ligowski	0	0	0	2	0	0	0	0	14	0	0	0
Proboscia truncata (Karsten) Nöthig & Logowski	0	0	0	0	0	0	0	0	0	0	0	0
Pseudo-nitzschia spp.	22	2	27	107	5	25	86	91	303	20	7	0
Rhizosolenia antennata/styliformis group	0	0	0	0	0	0	0	0	2	0	0	0
Rhizosolenia chunii Karsten	0	0	0	0	3	0	0	2	3	0	0	0
Rhizosolenia crassa Schimper in Karsten	0	0	0	0	0	0	0	0	0	0	0	0
Rhizosolenia simplex Karsten	0	0	0	0	0	0	0	0	3	0	0	0
Thalassionema nitzschioides spp. Pergallo & Pergallo	123	131	25	274	18	8	16	42	38	8	17	8
Thalassiosira lentiginosa (Janisch) Fryxell	1	0	0	0	0	0	0	0	0	0	0	0
Thalassiosira spp.	0	4	0	3	0	0	0	0	5	3	0	0
Thalassiosira antarctica resting spore (TRS) Comber	3	0	275	156	11	8	6	8	5	0	5	0
Thalassiothrix antarctica Schimper ex Karsten	0	0	0	1	3	2	16	8	30	0	0	0
Small centrics (<20 µm)	4	0	0	24	0	0	0	0	8	10	0	0
Large centrics (>20 µm)	0	0	6	5	0	0	0	0	2	0	0	0
Total	300	250	593	3169	552	1358	819	1146	4039	1188	299	12

Supplementary table 2: Raw counts of empty diatoms cells from the 12 sediment trap cups.

	Sediment trap cup number											
Species	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
Asteromphalus spp.	2	2	11	5	0	3	0	2	2	0	0	0
Chaetoceros atlanticus Cleve	0	0	0	0	0	0	0	0	0	0	0	0
Chaetoceros atlanticus f. *bulbosus* Ehrenberg	1	0	0	0	0	0	0	1	0	1	0	0
Chaetoceros decipiens Cleve	0	0	2	14	0	0	0	0	0	0	1	0
Chaetoceros dichaeta Ehrenberg	0	0	8	4	0	0	0	0	2	0	2	0
Chaetoceros Hyalochaete spp.	0	0	56	2252	0	0	0	35	780	10	0	0
Corethron inerme Karsten	1	1	5	0	0	1	0	0	10	17	22	0
Corethron pennatum Grunow	0	0	2	0	0	0	0	1	0	0	2	1
Dactyliosolen antarcticus Castracane	0	0	0	3	0	0	0	4	1	3	0	0
Eucampia antarctica var. *antarctica* (Castracane) Mangin	0	0	5	15	4	3	3	5	12	6	15	0
Fragilariopsis kerguelensis (O'Meara) Hustedt	191	41	105	60	17	35	41	68	50	80	55	18
Fragilariopsis separanda/rhombica group	16	15	22	31	9	29	15	51	35	68	54	2
Guinardia cylindrus (Cleve) Hasle	0	0	0	0	0	0	0	0	0	0	0	0
Leptocylindrus sp.	0	0	0	0	0	0	0	0	0	0	0	0
Membraneis spp.	0	0	2	3	1	2	1	4	6	4	2	0
Navicula spp.	0	0	16	21	0	0	0	7	5	0	0	0
Odontella weissflogii (Grunow) Grunow	0	0	2	6	0	0	0	1	0	1	1	0
Pleurosigma spp.	15	5	10	24	5	0	4	7	40	21	9	0
Proboscia alata (Brightwell) Sundröm	0	0	0	0	0	0	0	2	2	19	5	0
Proboscia inermis (Castracane) Jordan & Ligowski	0	0	1	5	0	0	0	2	2	7	2	0
Proboscia truncata (Karsten) Nöthig & Logowski	0	0	2	0	0	0	0	0	0	1	0	0
Pseudo-nitzschia spp.	50	0	15	35	6	2	46	44	225	19	6	0
Rhizosolenia antennata/styliformis group	0	0	0	0	0	0	0	1	1	7	1	0
Rhizosolenia chunii Karsten	0	0	0	2	0	0	0	1	1	11	8	0
Rhizosolenia crassa Schimper in Karsten	0	0	0	0	0	0	0	0	0	2	0	0
Rhizosolenia simplex Karsten	0	0	0	0	0	0	0	1	0	0	0	0
Thalassionema nitzschioides spp. Pergallo & Pergallo	367	175	678	122	12	5	22	7	31	10	11	5
Thalassiosira lentiginosa (Janisch) Fryxell	21	5	12	0	0	0	0	0	0	0	0	0
Thalassiosira spp.	2	5	1	0	0	0	0	0	0	0	1	0
Thalassiosira antarctica resting spore (TRS) Comber	0	0	0	0	0	0	0	0	0	0	0	0
Thalassiothrix antarctica Schimper ex Karsten	0	0	0	0	0	1	0	0	0	2	0	0
Small centrics (<20 µm)	41	39	372	995	18	7	8	14	28	11	10	10
Large centrics (>20 µm)	0	3	1	12	0	0	0	0	7	2	0	0
Total	707	291	1328	3609	72	88	140	258	1240	302	207	36