Supplement. Answer to reviewer #2

R2-Cx : Referee comment, **R2-Rx:** authors response.

R2-C1: *This is an important contribution that takes a species-based approach to the attribution of carbon flux and potential CO2 draw down. Sediment traps that tap export from the surface layer in key locations in the Pacific sector of the Southern Ocean offer an important insight into the operation of the biological carbon pump. The paper is, on the whole, well written, with just a few lapses in phrasing (see detailed comments below).*
While the role of key species and species groups is generally well considered, there are some potentially miss-leading and contradictory over-generalisations regarding some taxa, notably Thalassiothrix – see detailed comments below.

R2-R1: We appreciated the constructive criticism of reviewer #2 and have carefully considered all their comments, addressing each of their concerns as outlined below. Overall, in the new version of the manuscript the issues addressed by reviewer #2 in regard to the formation the Subsurface Chlorophyll Maximum in the PFZ have been clarified. Moreover, a new paragraph dedicated to the role in the carbon export to the ocean interior of *Thalassiothrix antarctica* and other shade flora species at the 54°S site has been included in section "5.4. Ecological flux vectors in the PFZ" (lines 854-867, manuscript with tracked changes). Finally, *Thalassiothrix antarctica* has been deleted from the list of diatoms that preferentially sink silicon versus carbon mentioned in section "5.5 Relative importance of the SAZ and PFZ to carbon export" in order to avoid over-generalizations.

***R2-C2*: Specific comments:**
Last sentence of abstract is muddled – needs rephrased to e.g. "F. kerguelensis plays a major role in the decoupling: : :.".

R2-R2: Corrected according to reviewer #2´s suggestion. The sentence "... *F. kerguelensis* is a major aspect of the decoupling of the carbon and silicon cycles in the high-nutrient low-chlorophyll waters of the Southern Ocean" has been replaced by "... *F. kerguelensis* plays a major role in the decoupling of the carbon and silicon cycles in the high-nutrient low-chlorophyll waters of the Southern Ocean" (lines 44-46, manuscript with tracked changes).

R2-C3: P 8619 – line 7 replace "to determine" with "the determination of".

R2-R3: Corrected according to reviewer #2´s suggestion (line 109, manuscript with tracked changes).

R2-C3: P 8621 – line 12 "biological distributions" - meaning uncertain – do you mean "biological characteristics"?

R2-R3: Corrected according to reviewer #2's suggestion. "biological distributions" has been replaced by "biological characteristics" (line 178, manuscript with tracked changes).

R2-C4:P. 8622 lines 23-27. It is not clear how a subsurface chlorophyll maximum (SCM) can be formed as a response to iron and silicate colimitation. Surely the SCM is formed either by settling of cells to depth or by growth at depth – this needs clarification.

R2-R4: Corrected according to reviewer #2's suggestion. The explanation of the possible causes of the formation of the SCM in the PFZ south of Tasmania has been extended and clarified in the new version of the manuscript. Now it reads as: "Finally, it is worthy to note a feature present in the PFZ but not in the SAZ: a subsurface chlorophyll maximum (SCM) dominated by large diatom species (Kopczynska et al., 2001) has been consistently reported during summer in the PFZ within or beneath the seasonal pycnocline. The formation and maintenance of this SCM is most likely due to the settling of phytoplankton cells as a response to iron and silicate colimitation in the mixed layer during summer (Popp et al., 1999; Parslow et al., 2001)." (lines 215-221, manuscript with tracked changes)

R2-C5: P. 8626 line 19 – replace "at" with "to".

R2-R5: Corrected according to reviewer #2's suggestion (line 332, manuscript with tracked changes).

R2-C6: P. 8633 – line 17 – insert "the" before "relative".

R2-R6: Corrected according to reviewer #2's suggestion (line 531, manuscript with tracked changes).

R2-C7: P. 8633 – line 25 replace "distributions" with "characteristics".

R2-R7: Corrected according to reviewer #2's suggestion. The word "distributions" has been replaced by "characteristics" (line 541, manuscript with tracked changes).

R2-C8:**Discussion:**
p. 8636 – line 5; the authors state that Chaetoceros resting spores are indicators of coastal environments. – Yes – but not exclusively – see for example the recent account of massive flux of Chaetoceros resting spores in the oceanic North Atlantic (Rynearson, T.A. 2013 "Major contribution of diatom resting spores to vertical flux in the sub-polar North Atlantic" Deep-Sea Research I, 82, 60-71). This study should be referred to here, and the possibility of oceanic resting spore formation acknowledged.

R2-R8: In order to fulfil reviewer #1's recommendations (see **R1-R17**), section "5.2. Latitudinal diatom species distribution" has been reduced to the ecologically most significant species. The paragraph dedicated to the possible origin of *Chaetoceros* resting spores was quite long and not essential in the discussion. Therefore, this part of the discussion has been deleted in the new version of the manuscript. Nonetheless, we acknowledge reviewer #2's comment on the possible origin of *Chaetoceros* resting spores and the reference of Rynearson et al. (2013) will be cited in a future paper that will compare the diatom assemblages captured by the sediment traps (shallow and deep traps) and the ones registered in the surface sediments.

R2-C9:P. 8641 – line 11: replace "any" with "one".

R2-R9: Corrected according to reviewer #2' suggestion (line 697, manuscript with tracked changes).

R2-C10: P. 8646 - lines 13-17 – here the authors lump a number of species together including Thalassiothrix antarctica with Fragilariopsis kerguelensis – following the quoted Assmy et al (2013) study. But, in fact, both the present discussion paper and the Assmy study are selective here. Both studies make the ecological association of T. antarctica with other subsurface chlorophyll maximum taxa such as the relatively more lightly silicified Proboscia – then both papers place T. antarctica together with F. kerguelensis. The main difference here is that T. antarctica with its fall dump sedimentation (along with Proboscia) is probably much more critical as a carbon sinker than F. kerguelensis. The manuscript would benefit from a fuller discussion of these issues.

R2-R10: Corrected according to reviewer #2's suggestion. *Thalassiothrix antarctica* has been deleted from the list of diatoms that preferentially sequester silicon relative to carbon in the last section of the discussion (line 924, manuscript with tracked changes). Moreover, a paragraph dedicated to the subsurface chlorophyll maximum taxa (i.e. *Thalassiothrix* and *Proboscia*) and their role driving carbon export at the 54°S site has been included in the new version of the manuscript (lines 853-866, manuscript with tracked changes).