

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 M. Rembauville et al.

Anonymous Referee #3

Received and published: 3 February 2015

General Comments

This paper combines chemical analysis of flux coupled to a species based approach to identifying the main phytoplankton agents of flux. This is an important and commendable approach and one that is essential if our mechanistic understanding of the workings of the marine biological carbon pump are to be improved. As such this approach is also a prerequisite to marine carbon cycle model parameterisation. The distinction between full and empty diatom cells is also especially relevant in addressing the issues of potential coupling and decoupling of the carbon and silica cycle, and

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the reconstruction of a seasonal flux succession of species related to Si/C is especially innovative and impressive. There is also a useful appraisal of the relative importance of the different types of faecal pellets for POC flux. The paper is, on the whole, well written and should be published with minor to moderate revisions.

However, the paper is linked to a “Part 1” (also a Discussion paper in this issue of Biogeosciences) which documents the biogeochemical fluxes but also makes the case for strong flux attenuation. This case is not well made and the “part 1” will require substantial revision if it is to be reconsidered. Consequently the present paper should be made to stand alone on its own merits and some revision in references to the “Part 1” and some “decoupling” will be required.

Specific Comments

P 17093 The Section “As reported in the companion paper ...” in lines 2 – 12. This needs re-written since the case for flux attenuation in the “part 1” companion paper is not well made (see reviews of Part 1).

Section 2 (introduction to Materials and Methods) and 2.1 (Sediment trap sample processing) may need expanded to stand more on their own, pending the fate of “part 1”.

At the beginning of the discussion section (p17109 lines 7-8) the authors state: “Although there was generally a strong attenuation of flux between the base of the winter mixed layer (WML) and 300 m on the Kerguelen Plateau (Rembeauville et al., 2014)...”. As stated above, the case for strong flux attenuation is not well made so that this statement should be withdrawn from the present manuscript.

In the discussion, the section listing studies that have documented the importance of Chaetoceros resting spores for flux (p 17110 lines 3-22) may be misleading since important specifics are missed out and in fact many of these occurrences are coastal. For example, the study of Kato et al. (2003) is referred to in the text as being of the “East

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China Sea” – but is in fact on “Omura Bay”. Similarly, Treppke et al (1996) referred to as “Eastern Equatorial Atlantic” ascribe the presence of Chaetoceros resting spores to lateral advection from the coastal upwelling cell. The discussion would be improved if it clarified which of these studies documented truly oceanic or “deep sea” occurrences as opposed to coastal or shelf-related. This is an important distinction since there appear to be three situations where resting spores are important for flux: 1) the well-known coastal/ shelf occurrences generally associated with upwelling or spring bloom; 2) the near-ocean island occurrences (e.g. Crozet & this study) and 3) the genuinely oceanic occurrences – of which the North Atlantic example documented by Rynearson et al (2013) may be the only documented occurrence. The manuscript would be improved by a more thorough treatment of this point.

Technical corrections

In the representation of the fluxes in the figures, the diatom and biogeochemical fluxes are represented by month whereas the faecal pellet fluxes are represented by cup number. It would help if the latter also included months so that more ready comparisons could be made.

Abstract: line 9 – should be “cells”; and “of the biological pump”;

p 17091 line 3 “mode” waters not “modal”;

p 17091 line 20 “micronutrient” not “micronutrients”

p 17101 line 10 replace “comprised in” with “within”

p 17103 line 15 “The flux of . . .” delete flux

p 17109 line 23 “the remaining of the.” needs re-written

p 17111 lines 14-15 should be “life cycles” also delete “the” in line 15.

p 17113 line 22 should be “dynamics”

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p 17115 lines 8 – 12: this sentence needs a rewrite

p 17119 line 18 – spore not “sport”

p17124 line 12 “Quguiner” spelling

Interactive comment on Biogeosciences Discuss., 11, 17089, 2014.

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