

Interactive comment on “Zooplankton faecal pellet transfer through the meso- and bathypelagic layers in the Southern Ocean in spring” by Anna Belcher et al.

Anonymous Referee #1

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“Zooplankton fecal pellet transfer through the meso- and bathypelagic layers in the Southern Ocean in spring“ by Belcher, A., Manno, C., Ward, P., Henson, S., Sanders, R., Tarling, G.

Belcher et al. estimated in their manuscript the fecal pellet (FP) production of copepods in the epipelagic layer and measured then the FP size, shape and number of FP in the meso- and bathypelagic to investigate the FP transfer to these depth layers. They found that smaller, cylindrical and elliptical shaped FP dominated in the upper mesopelagic in the Marine Snow Catcher, while larger, ovoid shaped FP prevailed in the sediment traps in the bathypelagic. The authors claim that the larger, ovoid shaped FP are an important vehicle for the POC transport to depths and that they are either a result of

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repackaging of surface produced FP in the upper mesoplagic or in situ produced FP in the lower meso- and bathypelagic, augmented by vertically migrating zooplankton.

General comments: The manuscript presents an interesting approach of field data, measured data (sinking velocity) and estimation of data, which were not assessed during the cruise. The arguments presented are to a large extent well thought through and the manuscript is well written. In my opinion, the work absolutely deserves publication after some minor revisions.

The authors claim in the title that they investigate the zooplankton fecal pellet transfer, but apart from Fig. 2 and L116-118 the focus is on copepod (fecal pellets) only. I therefore ask the authors to revise their manuscript, because the title and abstract right now imply a study of the whole zooplankton community (also e.g. krill), but this is not the case.

Further, the authors argue (amongst others in the abstract L19) that vertical migration of zooplankton augmented the in situ production of FP in the lower mesopelagic and bathypelagic layer. However, the manuscript does not contain any data on vertical migration (VM), and despite it is likely that VM is an important factor, I ask the authors to revise their manuscript and be more cautious in the conclusions (as nicely done in 356-358) – or presenting additional data on VM.

Similarly, I think that the schematic illustration (Fig.7) draws too sharp conclusions. In my opinion, the data presented do not provide evidence that only VM caused the change in FP size and shape at P3, while only repackaging caused it at P2. Also, the conclusion at the end of the discussion implies that there several repackaging steps may have occurred, but this is not included in Fig. 7. I generally like conceptual figures a lot, but they need to be concise, because they otherwise give easily a wrong impression. Therefore, I ask the authors to revise the conclusion and the schematic illustration to make sure that it matches the data presented. Adding depth terms, that are used in the manuscript (meso-/bathypelagic) as well as the MSC and ST depth deployment may

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further help to give a good schematic picture of the situation experienced.

Specific comments:

Title: See general comment

Introduction: 25-28: The authors claim that 10% of primary production sink out and that <10 % reach the deep ocean. That's fine for me, but I have problem understanding then the following sentence "close to 10% of surface primary production is stored in the interior." To my knowledge benthic processes may also use some of the primary production and I am a bit confused by the many "10%". Please revise the language to make it easier understandable.

30-32: Similar to the example above, also this sentence contains lots of numbers, which confuse me somewhat (btw. what is an increase in depth? 24 m deeper?). Consider revising the sentence in a way, which makes it easier to understand, but keep it, because it leads the reader nicely to the reason of the present study.

74-77: Move further up in this paragraph? E.g. L69?

Methods: 82: I would recommend including few short sentences about the study site to introduce it to your reader. Which currents do you find? Do resident deep zooplankton populations drift with it? Potentially drifting patterns could also help to explain the stronger attenuation at P2?

83ff: I struggled a bit with the different locations abbreviations (D1/ D2/ P2/ P3) and would suggest sticking to one label (e.g. P2/ P3 as also marked in the map).

85-89: Consider moving this information to the paragraph "sediment trap deployment". I think this would be a more natural place to have it

93ff: Where have the nets been taken?

111: literature values – did you have similar zooplankton species as in Stamieszkin et al (2015) that you can assume that the estimated made are meaningful?

144: How did you do the classification of the FP? I totally understand that you get a feeling for it, but was it more a subjectively choice (eye-balling) or did you e.g. take pictures and use roundness/ ratio of the minor/major axis? This is more a question out of curiosity, but I think that some standards should be established to make FP classification as objective as possible.

Results: 251-253: This sentence confuses me... Please revise the language.

Discussion: 255: mainly copepod? See general comments

277-282: Good and important point!

362-365: Please revise language to make easier understandable

379: “the increased abundance of small copepods at P2”: I am unsure what you mean by the term “increased abundance” (increased compared to what?) and Fig. 2 shows that there were more small copepods at P3 compared to P2. Thus, I do not understand the argument made in line 379-380.

383-387: Do you have any data that you have a larger deep ZP community at P3 than at P2? Otherwise the argumentation is a bit thin.

387-392: Can you please make your arguments a bit clearer? I have problems understanding what you mean here.

392: Consider replacing the sentence by something like: “Most likely a combination of both mechanisms takes place.”

396ff: Please be a bit more cautions in your conclusions as you were previously in the discussion (line 351).

398-412: Please revise to make it easier for your reader to follow (e.g. 400: deep ocean – what do you mean by that; 402: depth of migration – how deep it that?) and also revise your Fig. 7 to interlink text and figure better).

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Figures and Tables: Figure 1: You do not mention the different fronts in the text. Is there any reason to include them here? In my opinion, depth lines could be more interesting – perhaps that could also help to explain the stronger attenuation of FP at P2?

Figure 7: See general comment

Technical corrections: 205: change to “<2 mm” to be consistent (no space after the <)

205: change “is similar” to “was similar”

192: past tense? Change to “we took into account”?

Figure 2: Other zooplankton (see text for full information. . .) – I could not find that information

Figure 3/ 5 / 6: Unsure about the labelling of the x-axis. Why do you have the step from 0.005 to 0.008?

Table 2: Minor aspect, but is there a reason, why you put P2 on the right side of the table and P3 on the left side? Intuitively, I would do expect it the other way round (as in Fig. 2)

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