Interactive comment on "Mesozooplankton structure and functioning during the onset of the Kerguelen phytoplankton bloom during the Keops2 survey" by F. Carlotti et al.

Anonymous Referee #1
Received and published: 10 March 2015

Referee:
The paper is an interesting contribution to the knowledge of the factors controlling the development of zooplankton in an area of the Southern Ocean under the influence of the Polar Front. However, in my opinion there are technical aspects of the paper that need to be improved, and methodological questions that must be clarified.

Answers: We thank the reviewer for his/her thorough review and highly appreciate the comments and suggestions, which significantly contributed to improving the quality of the publication. Please find below a detailed response to the each of the comments

Referee:
1) The language needs to be revised and edited. This is the first requirement, as in its present form the text is quite heavy. Sentences of 7 lines (P. 2382, lines 4-10) made the text hard to be easily read. The terminology must be also revised.

Answers:
Concerning the language, we changed many sentences, reduced long sentences, check terminology, and proceed for a review by a native English speaker.

Referee:
2) The second aspect is the structure of the paper. The complex station's notation and the diverse sampling strategy (i.e., "Perpendicular transects" "semi-lagrangian, "24 h", etc.), would require to be explained and justified.

Answers:
We rewrote the paragraph "**2.1 Study site and sampling strategy"** for a better understanding of the cruise strategy. The names and terminology regarding the stations and transects are common between all papers dedicated to the KEOPS2, and we maintained them. We tried to make the presentation of the cruise simpler and clearer to the reader, guiding him in the Figure1, and quoting other key papers. The figure caption of figure 1 has been reworked with more details. Finally, we add in the result a paragraph "3**.1. Hydrology and trophic conditions**" to better explain the hydrological and trophic environmental conditions met by the sampled mesozooplankton at each stations.

Referee:
3) Aside from these general problems, the main gaps in the paper are: Some methodological aspects need to be discussed, like the problem derived from the use of 330 µm-mesh. The small zooplankton forms like small copepod species, mainly belonging to the genus Oithona (one of the most abundant genus), Microsetella and Oncaea are seriously underestimated by the mesh used, even considering the clogging of nets. To say nothing of juveniles (nauplii and copepodites).
And this will affect not only the abundance and biomass, but the isotopic signature.

Answers:
Indeed, during the cruise we used both 120 µm and 330 µm mesh size nets on the Bongo frame. The results of the 120 µm were not presented in the first version, but we added them in the present version. In many stations, the 120 µm size net was often clogged with phytoplankton cells and aggregates, and the cod-end contents could not be used for dry weight

and ZOOSCAN process. Abundances from taxonomic counting obtained with the 120 µm size net are now presented (see material and Methods explaining the dilution process). As the 120 µm size net cod-end samples were used *pro parte* for isotopes contents in the small size fractions 80-200 µm and 200-500 µm, we detail it in the m & M part.
The 330 µm size net were as well clogged, but in a lesser degree, allowing dry biomass weighing and ZOOSCAN process.

We have add the following paragraph in the part "2.2 Mesozooplankton sampling":
"Zooplankton collection was conducted at 27 stations with a double Bongo (60 cm mouth diameter) with one 330-µm mesh net and a 120-µm mesh net mounted with filtering cod ends …For each sampling station, two successive net tows at each station were done: the first net tow was taken for ZOOSCAN process, taxonomy study, and dry weight, a second net tow was taken for isotopes.
… As many of the 120 µm size net were clogged, we could not finally use it for dry weight and ZOOSCAN process. However, we used the 120 µm size net for the isotope fractions 80-200 µm and 200-500 µm.

For preparing samples for isotope size fraction analysis, the content of the second 330 µm mesh size net cod end was firstly processed through the filtration column with the five sieves - 2000 µm, 1000, 500, 200, and 80 µm meshes - and then the filtered samples on the sieves 2000, 1000, 500 µm were collected for isotopes. For the largest size class (> 2000 µm), large organisms such as salps and euphausiids were separated in additional containers.
The filtered samples on the mesh 200 µm and 80 µm were kept on the sieves and the filtration column reinstalled for processing the 120 µm net cod-end. Aggregates were stopped by the 2000 µm, 1000 and even 500 µm sieves. Then the filtered samples on the 200 and 80 µm mesh size sieves were collected for isotopes. All samples were placed in small containers and immediately deep-frozen(-80 °C)."
We have add the following paragraph in the part "2.4 Taxonomic determination" :
"For the 120 µm mesh size net around 400 organisms were enumerated from 1 to 10 /1000 diluted samples".
Results corresponding to the taxonomic determination with the 120 µm mesh size net are presented in the Table 1 and on the figure 6, and in the paragraph 3.3 Metazooplankton community composition and distribution.

<u>In conclusion:</u>
The isotopic signatures in the small size fractions 200-500 µm do represent the community structure in these fractions. The 80-200 µm fraction is probably skewed, although the clogging in the nets probably retained organisms below 120 µm. Thus we maintain these values in the figure 9 (figure 10 in the initial manuscript), which shows the isotopic changes in the successive size fractions in our samples
The abundance and biomass from 120 µm mesh size net could not be obtained from ZOOSCAN processing. Zooplankton abundances and biomasses from 330 µm mesh size net obtained from ZOOSCAN processing certainly are underestimated for the small forms.
The comparison of taxonomic counting between 120 µm and 330 µm mesh size nets showed which small organisms are largely undersampled with the 330 µm mesh size net : adult and juvenile forms *Oithona similis*, *Oithona frigida*, *Microsetella rosea*, *Oncaea* spp., *Microcalanus pygmaeus*, larval forms of many calanoids, and appendicularians). On another side the comparison show that the 120 µm mesh size net stongly undersampled the large forms (> 1000 µm).
Concerning the estimated biomass below 500 µm, we can see that observed abundances in this fraction never result in high biomass (for instance: see the largest abundances in the

fraction below 500 µm for stations A3-2 and FL on figs 2 and 3). We believe that under-estimated abundances have a rather low impact on estimated biomasses.

Referee:
Why in Table 1 the abundance is given as an index (and in ind/m3), while in Fig. 2 is in Ind/m2? the same for biomass.

Answers:
Now table 1 has been changed giving average concentration over all stations. We maintain the information in individual / m3 which gives density values more meaningful for zooplanktonologists. In Figure 2 and 3, we want to show "stocks" over the 250 upper layers, as stocks are more meaningful for biogeochemists.
In both case we mention in the figure caption that the values refer to a sampling of a 250m water column.

Referee:
The comparison of the results obtained during the KEOPS-2 cruise with previous ones (KEOPS-1), where different counting devices were used, ought to be better discussed.

Answers:
Your question helps us to argue better about the comparison between the results obtained during the KEOPS-2 cruise with previous ones (KEOPS-1). We strongly defend this comparison.
In the text, we replaced this paragraph : "The comparison in terms of abundances could only slightly biased by the different counting devices, the Lab OPC used for the treatment of KEOPS1 samples having a lower size limit of detection (280 µm) than the ZOOSCAN used for KEOPS2 samples per (300 µm)."
By: "The use of different laboratory technologies (Lab OPC during KEOPS1 and ZOOSCAN during KEOPS2) to optically measure and size plankton organisms from net tow samples might be questionable. In their intercomparison study between LOPC and ZOOSCAN, Schultes and Lopes (2009) found a good agreement in the normalized biomass size spectra (NBSS) for particles in the size range of 500 to 1500 µm in equivalent spherical diameter (ESD). Several disparities for smaller and larger particles size range in their study were due to both in situ sampling (LOPC and net have different sampling efficiencies), in situ vs lab counting (LOPC counts any particles not only zooplankton, with potential overlapping between particles, whereas ZOOSCAN sample are delicately distributed on a scanned window), etc. Our present comparison of estimated abundances and biomasses of KEOPS1 and KEOPS2 is based on similar sampling protocols with a 330-µm mesh net on Bongo frame, and in both case a delicate laboratory protocol. The flow-through system used with the Lab-OPC for KEOPS1 samples was controlled to avoid coincidence of organisms counted by the laser (count rate at 20 particles min^{-1}; see Carlotti et al. 2008) and organisms were delicately separated on the ZOOSCAN window for the KEOPS2 samples. In both studies, a large number of individuals were counted (1000 particles per samples) to correctly count and size larger organisms. Finally, the lower and higher range of counted and measured zooplankton organisms are mainly due to the 330-µm mesh net efficiency, and the abundance and biomass results of both studies might be compared."

Interactive comment on "Mesozooplankton structure and functioning during the onset of the Kerguelen phytoplankton bloom during the Keops2 survey" by F. Carlotti et al.

Anonymous Referee #2

Received and published: 16 March 2015

Referee:
General comments:
This manuscript combines net tows, biomass estimates and stable isotope measurements to describe trophic structure and functioning of the zooplankton community near Iles de Kerguelen at the beginning of the spring bloom. It provides some useful data that provide a picture of the zooplankton community in that region, which will be helpful to future studies.

Answers: We thank the reviewer for his/her thorough review and highly appreciate the comments and suggestions, which significantly contributed to improving the quality of the publication. Please find below a detailed response to the each of the comments

Referee:
However, the manuscript is unnecessarily long and complicated and has used 3 tables and 10 figures to tell a fairly straightforward story.

Answers:
Our answers to the different referees and complementary information in the manuscript have maintained the length of the paper despite rewriting of several paragraphs to make the text easier to read.

Referee:
You have used bulk isotopic measurements to make inferences about individual taxa and this is not very convincing.

Answers:
Stable isotope analyses were made on both bulk fractions AND on separated individual taxa. The measurements on individual taxa (Table 3) were made after sorting out the different taxa from the largest size fraction (>2000 µm). Moreover, before processing the five bulk fractions for isotopic measurements, we examined them under a binocular microscope to identify the main groups composing each fraction (see manuscript in paragraph 3.3). So, our isotopic measurements were related to real taxonomic composition and not inferred. This was indicated in the Material and Method section of the submitted manuscript.

Referee:
For this manuscript to be accepted I believe it should be shortened, with major points made clearer and less speculative.

Answers: We hope that the added information and rewriting of many parts of the ms will be an acceptable answer to your comment.

Specific comments:

Referee:

1. I found the swapping between ZooSCAN results and net tows to be quite confusing. It would be helpful if you could add ZooSCAN to the figure captions, as you do in the text.

Answers:

OK we mention " ZOOSCAN" when the results came from ZOOSCAN processing. We changed the following figure captions:

Figure 2: Integrated 0–200m mesozooplankton biomass estimated from ZOOSCAN for the different stations sampled during KEOPS2 with size fractions distributions. Size fractions: <500 µm: black; 500–1000 µm: dark gray ; 1000–2000 µm: light gray; >2000 µm: white.

Figure 3: Integrated 0–200m mesozooplankton abundances counted from ZOOSCAN for the different stations sampled during KEOPS2 with size fractions distributions. Size fractions: <500 µm: black; 500–1000 µm: dark gray ; 1000–2000 µm: light gray; >2000 µm: white.

Figure 4. (a) Abundance and **(b) b**iomasses values and **(c)** ratio abundance on biomasses for the different stations visited during KEOPS2 over sampling dates.
Abundance and biomasses values from Figures 2 and 3.

Figure 5. Zooplankton biomass values against average Chl *a* in the upper 100m **(a)** and against the integrated Chl *a* in the mixed layer depth **(b)** for the different stations visited during KEOPS2. Biomasses values from Figure 2.

Figure 6. Distribution of main taxa abundances within each of the four size fractions from binocular observation. Average distributions between day and night samples at stations A3-1, A3-2, E3 and E5. For each size fraction, the color labels for the different taxa are similar.

Referee:

2. Also, while your species list in Table 1 is very helpful, it would be more useful if you showed actual abundances from your net tows.

Answers:

We changed the presentation of the table, presenting the actual average abundances (ind/m3) rather than our index of abundance. We maintained the term "rare" when a taxon was found in low densities in a few sampling stations. In the same table, we put the average abundances obtained in the 120 µm mesh size net.

Referee:

3. Your use of T and IS groups is unnecessarily complicated. If sorting your stations into T-groups to match the previous work is important then why mention the IS groups?

Answers:

The mention of IS groups is now suppressed in the sections 'Data analysis', 'Results' and 'Discussion'. We kept only the groups of stations (T-groups) individualised by Trull et al (2015) based on the chemometric characteristics of phytoplankton.

Referee:

4. Also, in Figure 10 there is no reason to link the scatter points with lines.

Answers:

This way of presentation in figure 10 (now figure 9 in the revised manuscript) follows the one used by Trull et al. (2015) in BG for the isotopic signatures of Keops2 phytoplankton fractions. We decided to use the same figuration for zooplankton stable isotope values for an easier comparison of the two data sets.

Referee:

5. Your net size was 330 um, so it is not appropriate to put too much emphasis on the data represented by the 80-200 and 200-500 um size classes. Even suggesting that these smaller fractions are isotopically different to the larger fractions is pushing the interpretation of your data as you can't be certain that the smaller size fractions are representative of all the particles that were available in the water column.

Answers:

Indeed, during the cruise we used both 120 µm and 330 µm mesh size nets on the Bongo frame. The 120 µm size net were often clogged with phytoplankton cells and aggregates, and the cod-end contents could not be used for dry weight and ZOOSCAN process. The 330 µm size net were as well clogged, but in a lesser degree, allowing dry biomass weighing and ZOOSCAN process.

In the first version of the manuscript, abundances from taxonomic counting obtained with the 120 µm size net were not presented. We know present the taxonomic results, as the 120 µm size net cod-end contents cod-end were used *pro parte* for isotopes content in the small size fractions 80-200 µm and 200-500 µm.

We have add the following paragraph in the part "2.2 Mesozooplankton sampling"

"Zooplankton collection was conducted at 27 stations with a double Bongo (60 cm mouth diameter) with one 330-µm mesh net and a 120-µm mesh net mounted with filtering cod ends …For each sampling station, two successive net tows at each station were done: the first net tow was taken for ZOOSCAN process, taxonomy study, and dry weight, a second net tow was taken for isotopes.

… As many of the 120 µm size net were clogged, we could not finally use it for dry weight and ZOOSCAN process. However, we used the 120 µm size net for the isotope fractions 80-200 µm and 200-500 µm.

For preparing samples for isotope size fraction analysis, the content of the second 330 µm mesh size net cod end was firstly processed through the filtration column with the five sieves - 2000 µm, 1000, 500, 200, and 80 µm meshes - and then the filtered samples on the sieves 2000, 1000, 500 µm were collected for isotopes. For the largest size class (> 2000 µm), large organisms such as salps and euphausiids were separated in additional containers.

The filtered samples on the mesh 200 µm and 80 µm were kept on the sieves and the filtration column reinstalled for processing the 120 µm net cod-end. Aggregates were stopped by the 2000 µm, 1000 and even 500 µm sieves. Then the filtered samples on the 200 and 80 µm mesh size sieves were collected for isotopes. All samples were placed in small containers and immediately deep-frozen(-80 °C)."

We have add the following paragraph in the part "2.4 Taxonomic determination" :

"For the 120 µm mesh size net around 400 organisms were enumerated from 1 to 10 /1000 diluted samples".

Results corresponding to the taxonomic determination with the 120 µm mesh size net are presented in the Table 1 and on the figure 6, and in the paragraph 3.3 Metazooplankton community composition and distribution.

In conclusion:
The isotopic signatures in the small size fractions 200-500 µm do represent the community structure in these fractions. The 80-200 µm fraction is probably skewed, although the clogging in the nets probably retained organisms below 120 µm. Thus we maintain these values in the figure 9 (figure 10 in the initial manuscript), which shows the isotopic changes in the successive size fractions in our samples
The abundance and biomasse from 120 µm mesh size net could not be obtained from ZOOSCAN processing. Zooplankton abundances and biomasses from 330 µm mesh size net obtained from ZOOSCAN processing certainly are underestimated for the small forms.
The comparison of taxonomic counting between 120 µm and 330 µm mesh size nets showed which small organisms are largely undersampled with the 330 µm mesh size net : adult and juvenile forms *Oithona similis*, *Oithona frigida*, *Microsetella rosea*, *Oncaea* spp., *Microcalanus pygmaeus*, larval forms of many calanoids, and appendicularians). On another side the comparison show that the 120 µm mesh size net stongly undersampled the large forms (> 1000 µm).
Concerning the estimated biomass below 500 µm, we can see that observed abundances in this fraction never result in high biomass (for instance: see the largest abundances in the fraction below 500 µm for stations A3-2 and FL on figs 2 and 3). We believe that under-estimated abundances have a rather low impact on estimated biomasses.

Referee:
4. For Figure 6 the pies charts are hard to read at that size. Also your caption stating that 'color labels for the different taxa are similar' is unclear. What do you mean?
Answer:
We increase the size of the police on the pie charts. The figure caption of the figure 6 has been more detailed:
"Figure 6. Distributions of main taxa abundances at stations A3-1, A3-2, E3 and E5 from binocular observation. Distributions are presented for four size fractions (small, medium, large, and very large) for the organisms observed in the 330 µm mesh size net samples (four upper bands on the figure), and distributions are presented for the two lower size fractions (small and medium) for the 120 µm mesh size net samples (two lower bands on the figure). Distributions are average values between day and night samples. For each size fraction (the four pie charts on the same horizontal band), the color labels for the different taxa are similar."

Referee:
5. Your description of the 8 long term stations is very hard to understand (P2386; L9-15).
Answer:
The paragraph "2.1 Study site and sampling strategy" and the description of the 8 long term stations has been rewritten

Referee: 6.Figure 4c does not seem to be mentioned in the text.
Answer: This figure 4C is used for the discussion, and is mentioned in the paragraph "4.1 Zooplankton development during the early spring bloom in 2011 and comparison with other seasons".

Referee: 7. The details of the map in Figure 1 are hard to see.

Answer: We completed the information of station names on the figure and increased the size of text. The figure caption was rewritten.

Referee and answers:
Technical corrections:
1. P2383; L7: add ‘the’ before Antarctic Circumpolar Current; **Answer:** OK
2. P2384; L4: remove ‘in contrast’; **Answer:** OK
3. P2384; L9: remove ‘as well’; **Answer:** OK
4. P2384; L16: did not describe; **Answer:** OK
5. P2384; L27: Antarctic; **Answer:** OK
6. P2384; L28: remove ‘a’; **Answer:** OK
7. P2385; L1: relatively, change ‘of’ to ‘in’; **Answer:** OK
8. P2385; L21 change ‘in’ to ‘of’; **Answer:** OK
9. P2385; L23: change ‘aim’ to ‘chosen’; **Answer:** The sentence has been removed

Referee: There are many instances of small changes that need to be made to the text, so it would be useful to have a native English speaker proof-read the MS before resubmission.
Answer: The final MS was proof-read by a native English speaker before resubmission

Interactive comment on "Mesozooplankton structure and functioning during the onset of the Kerguelen phytoplankton bloom during the Keops2 survey" by F. Carlotti et al.

Anonymous Referee #3
Received and published: 17 March 2015

Journal: BG

Title: Mesozooplankton structure and functioning during the onset of the Kerguelen Bloom during Keops2 survey

Author(s): F. Carlotti et al. MS No.: bg-2014- 598

Referee:
General Comments Carlotti et al. present and extensive and intensive overview of the zooplankton abundance, biomass, taxonomic composition, and stable isotope composition observed around the Kerguelen Island survey during the spring of 2011. They particularly investigate an undulation of the Polar Front east of the region, and the effect of time over their 6 week survey (a positive effect with time approaching early summer), the effect of day-night (little effect), and the influence of HNLC waters and Fe enrichment over the plateau. The zooplankton is sampled with a bongo net and 333 um mesh; it is significant that all the samples are analysed with Zooscan which is an achievement in itself.
In some ways this paper is actually 2 papers in one.
The separation and identification of specific taxa for stable isotope analysis is impressive; Figures 5, 7 and 8 are very revealing.

Answers: We thank the reviewer for his/her thorough review and highly appreciate the comments and suggestions, which significantly contributed to improving the quality of the publication. Please find below a detailed response to the each of the comments.

My concerns are:

Referee:
1) It is a rich data set and the conclusions mostly sound, but from an external perspective of this paper for a special Keops issue it seems rather colloquial. I realise the readership will be from the Keops2 group, but to others it may seem rich with jargon on the station names and "T-groups" and it is hard to glean the major findings. At some points the paper seems like a technical report.

Answers:
We agree about the heaviness of the names of stations and group of stations.
We rewrote the paragraph describing the cruise strategy and the different stations. The names and terminology are common between all papers dedicated to the KEOPS2, and we maintain them. We tried to make it simpler and clearer to the reader, guiding him in the Figure1, and quoting other key papers. The figure caption of figure 1 has been reworked with more details.

Concerning the results about isotopic ratios, the mention of IS groups is now suppressed in the sections 'Data analysis', 'Results' and 'Discussion'. We kept only the groups of stations (T-groups) individualised by Trull et al (2015) based on the chemometric characteristics of phytoplankton.

Referee:

2) Could the analyses be made more general rather than cruise specific, by relating the conditions of zooplankton to water mass and bathymetry rather than latitude, longitude and voyage track?

Answers:

We rewrote the introduction to better specified the scientific objectives and explain the sampling strategy in relation with these objectives. The paragraph 2.1 Study site and sampling strategy has been rewritten to better link the different group of stations and hydrodynamical features. Other papers of the KEOPS2 special issue have been quoted in a way to better guide the reader for complementary information.

Moreover, we add in the result a paragraph "3.1. Hydrology and trophic conditions" to better explain the hydrological and trophic environmental conditions met by the sampled mesozooplankton at each stations.

Referee:

3) More importantly there is no discrete question on why this survey was done. The main objective is to compare the zooplankton with Keops1 (which was not explicitly possible with OPC vs. zooscan?) and "its responses to primary production" – presumably to Chl-a biomass (as primary production was not measured).

Answers:

When rewriting the introduction, webetter specified the scientific objectives both of the whole KEOPS 2 cruise and the specific objectives of the present paper.

At the end of the introduction, the last paragraph sum up these objectives

"The main objective of the KEOPS2 study was to investigate the early phase (October–November 2011) of the seasonal marine productivity in this Kerguelen region in order to gain new insights on the biogeochemistry and ecosystem response to iron fertilization. The study was conducted in contrasted environments differently impacted by iron availability, i.e. on the plateau waters, in areas common with KEOPS1, and in productive oceanic deep waters with strong mesoscale activity to the east of the Kerguelen Islands. The focus of the present paper is to document the responses of zooplankton in terms of species diversity, density and biomass in the mosaic of blooms observed during the survey, and to characterize the trophic pathways from primary production to large mesozooplanktonic organisms.

Referee:

3) The stable isotope analysis lacks an ecosystem analysis, to compare composition of phytoplankton (?) (the source) with the other members of the zooplankton community. There are many elegant methods (some Bayesian) in the public domain to quantitatively compare the predator-prey relationships. Most copepods are omnivorous, and the degree herbivory reflects the availability of alternative prey.

Answers:

Stable isotope values of zooplankton were compared to those of phytoplankton recorded by Trull et al. (2015) in the same stations. This information was synthesized in the new figure 10 and added in the Discussion section. We discussed the link between phyto- and zooplankton in the different groups of stations and calculated the mean trophic fractionation between these two broad trophic levels.

Zooplankton size fractions were composed of organisms with different feeding regimes (herbivores, omnivores and carnivores in varying proportions, as indicated in the discussion). Thus, it would be incorrect to use mixing models (Bayesian SIAR for example) for inferring

predator-prey relationships between zooplanktonic fractions. However, we calculated the mean trophic fractionation between phytoplankton and zooplankton as a whole. The low fractionation values observed (+ 0.40 ‰ for $\delta^{13}C$ and + 2.69 ‰ for $\delta^{15}N$) indicated a dominance of herbivory in zooplankton, and confirmed the conclusions based on zooplankton composition.
The Discussion section on stable isotope results was rewritten and this information added to the text (p 21-22).

Referee:
In summary, the Introduction needs to better justify why this study was made, and where the knowledge gaps are that need to be filled.
Answers:
Introduction has been rewritten consequently.

Referee:
In the Methods section (p. 2386) are many papers of 2014 about the fate of phytoplankton, but not much about how this paper fits in. These papers should be cited more in the Introduction.
Answers:
In the paragraph "3.1. Hydrology and trophic conditions", we better explain the hydrological and trophic environmental conditions met by the sampled mesozooplankton at each stations, and we quote a restricted number of relevant papers of KEOPS 2 needed to discuss our results. In the discussion part, we gave more explanations about the linkages between our results and those of KEOPS2 companion papers dedicated to the fate of phytoplankton.

Specific Comments

Referee:
The mesh size does affect the size data from sieves, so that the smaller sizes (as they acknowledge) are not quantitatively sampled, but merely indicative because of occasional, sporadic clogging. The species composition is useful for long-term ocean observing, but it does not contribute to their specific questions (how does the biodiversity compare with Keops1?).
Answers:
Indeed, during the cruise we used both 120 µm and 330 µm mesh size nets on the Bongo frame. The results of the 120 µm were not presented in the first version, but we added them in the present version. In many stations, the 120 µm size net was often clogged with phytoplankton cells and aggregates, and the cod-end contents could not be used for dry weight and ZOOSCAN process. Abundances from taxonomic counting obtained with the 120 µm size net are now presented

Results corresponding to the taxonomic determination with the 120 µm mesh size net are presented in the Table 1 and on the figure 6, and in the paragraph 3.3 Metazooplankton community composition and distribution.
Another paper is in preparation to discuss in more detail about biodiversity patterns during the KEOPS2 cruise (from bacteria to mesozooplankton) and in the present paper, we only mention in paragraph 4.2: "The taxonomic composition did not show major differences between shelf and oceanic waters, except that the contribution of copepods to the whole mesozooplankton was higher in oceanic waters than on the shelf, and these taxonomic patterns were quite similar between the KEOPS 1 (see Fig. 7 in Carlotti et al. 2008) and KEOPS2 survey (Fig. 6)."

Referee:
They could take their ECD data, or sieve data, and compare it with the Keops1 OPCdata series by amalgamating size classes.

Answers:
We were not quite sure about the comment understanding. Indeed, we defined the same size fractions for the abundance and biomass results of KEOPS1 and KEOPS2 from the ESD data. In the part "**4.2 Comparison with previous results",** we explain why the results are comparable even using different laboratory technologies (Lab OPC during KEOPS1 and ZOOSCAN during KEOPS2) and we give more details about the comparison of results.
A new table 4 synthesizes the data of abundance and biommas size fractions:
"Table 4: Seasonal variations of zooplankton abundance and biomass from KEOPS2 (15 October – 20 November 2011) and KEOPS1 (January 19- February 13, 2005) surveys with contribution of different size fractions (<500 µm, 500-1000 µm; 1000-2000 µm; > 2000 µm). The reference stations were A3 (shelf waters) and C11 (oceanic waters) for KEOPS1 (see Carlotti et al., 2008, their Figs. 3 and 5) , and A3 (shelf waters) and TNS6-TNS5 and E4E-E5 (oceanic waters) for KEOPS2."

Referee:
Can Tables 1 and 2 be put into an appendix or supplementary information (it is very useful data) but can they be graphed in some way?

Answers:
Information of Table 1 is used in Figure 6, and Table 2 data are graphed in Figures 9 and 10.

Referee:
Line 5, p. 238, 330 micron (not mm)

Answers: OK, we changed it

Referee:
Line 6 – how did the bongo nets to 250 m depth compare with the thermocline depth?

Answers:
As written before, we add in the result a paragraph "3.1. Hydrology and trophic conditions" to better explain the hydrological and trophic environmental conditions met by the sampled mesozooplankton at each stations. Particularly we add more information about the MLD and quote papers which have deeper description about the vertical physical structure of the water column at the different stations (Trulls et al, their table 4a, Jouandet et al., 2014). Our bongo nets to 250 m depth always included the mixed layer.

Referee:
Line 21, p 2390. You may have compared 13C to VPDB and 15N to atmospheric N, but there is the internal laboratory (working) standard of acetanilide. This is not a simple comparison. How was this compared; did the working standard overlap the observed values for zooplankton? A two point calibration is needed, see Paul D, Skrzypek G, Forizs I (2007) Normalization of Measured Stable Isotopic Compositions to Isotope Reference Scales - a Review. Rapid Communications in Mass Spectrometry 21:3006-3014); and Coplen TB, Brand WA, Gehre M, Groning M, Meijer HAJ, Toman B, Verkouteren RM (2006). New guidelines for delta c-13 measurements. Analytical Chemistry 78:2439-2441.

Answers:
Stable isotope values were properly corrected following routine standard procedures in the laboratory where the analyses were done (UMR LIENSs, University of La Rochelle). Calibrations to VPDB and N2 are performed regularly using certified reference materials

(USGS-24, IAEA-CH6, -600 for carbon; IAEA-N2, -NO-3, -600 for nitrogen), as well as intercalibration between several facilities. The replicated measurement of internal standards each 10 analyses are used to determine the accuracy of the values and to detect any analytical drift. Acetanilide is used as internal standard. It has values in the range of the analyzed samples: -27.0 ‰ for $\delta^{13}C$, +1 ‰ for $\delta^{15}N$. These precisions were added to the § 2.6 on stable isotope analyses in the Materials and methods section.

As detailed before, we do make calibrations regularly but we do not realize two point calibrations while running each batch of samples. This procedure is carried out regularly but it appears that it does not give a better precision.

Referee:
Line 20, p. 2392. The ANOVA tables would be useful, at least as supplementary information.
Answers:
The tables are presented below

ANOVA tables for linear regression of abundances versus time

Source	SS	DF	MS	F
Treatments	25909,18	1	25909,18	24,62164
Error	36830,26	35	1052,29	
Total (corrected)	62739,44	36		

ANOVA table for linear regression of biomasses versus time

Source	SS	DF	MS	F
Treatments	10,01	1	10,01	6,491218
Error	53,96	35	1,54179	
Total (corrected)	63,97	36		

Referee:
Fig. 6. Pie charts are very hard to quantitatively compare – can these be presented as bar graphs?
Answers:
We maintained the pie charts which allow to present the distributions for several stations in a synthetic way. Moreover we had pie charts for two size class from the 120 *m mesh size net. To help the reader, we increased the size of the police on the pie charts, and the figure caption of the figure 6 has been more detailed:
"Figure 6. Distributions of main taxa abundances at stations A3-1, A3-2, E3 and E5 from binocular observation. Distributions are presented for four size fractions (small, medium, large, and very large) for the organisms observed in the 330 µm mesh size net samples (four upper bands on the figure), and distributions are presented for the two lower size fractions (small and medium) for the 120 µm mesh size net samples (two lower bands on the figure). Distributions are average values between day and night samples. For each size fraction (the

four pie charts on the same horizontal band), the color labels for the different taxa are similar.”

Referee:

Fig. 7. The 80% similarity for grouping your samples is arbitrary, and the discrimination of groups is tenuous considering that there are branching just above and below 80%.

What was the stress statistic for the associate MDS plot?

Answers:

The value stress statistic for the associate MDS plot is 0,12. We added the associated MDS plot in the figure 7