Responses to reviewers' comments on manuscript bgd-379 ("Technical Note: A mobile sea-going mesocosm system – new opportunities for ocean change research") by Riebesell et al.

We thank the reviewers for their very constructive comments. We agree that the focus of this manuscript needs to be on the engineering and handling of the mesocosms. As described below, we will accommodate the reviewers' suggestions by providing additional information on relevant aspects of mesocosm hardware and performance and changing the Results and Discussion sections accordingly.

Below please find our point-by-point responses to the referees' comments.

Reply to comments by reviewer #2:

First of all and most importantly, this manuscript lies between science and engineering. The science part is minimal and, in my idea, should not even be included in this manuscript, the important list of papers submitted to the special issue should be sufficient no? This implies significantly modifying the results section and removing the section 4.1 of the discussion. Instead of this, after reading the material and methods, I was waiting for some results and some answers for: 1) were the starting conditions (right after the closing of the bags), in terms of nutrients, organic matter, phytoplankton, zooplankton etc. . . identical between the 9 mesocosms?, 2) were the CO2 conditions close to the targeted values, would it be possible to see the evolutions over the 4 days during which you injected saturated CO2 water in the 7 mesocosms?, 3) the same for nutrient additions, 4) what is finally necessary to clean the walls? What was the importance of the biofilms as compared to "water-column" chlorophyll, POC etc.., 5) sampling: any problems of contamination? If so, you have to report it, if not you should also report it. How did you clean the integrated samplers actually?

This is a very good point. In the revised manuscript we will add information on

- starting conditions in the nine mesocosms and the surrounding water right after closing the mesocosms with data on salinity, pH, O_2, HPLC pigments, phytoplankton cell numbers, bacterial and viral abundances
- pCO_2 levels right after CO_2 manipulation in comparison to target values
- nutrient concentrations before and after nutrient addition in comparison to target values
- estimates of biomass on the mesocosm walls in comparison to suspended biomass at the end of the experiment and measures to prevent wall growth
- possible contaminations through sampling

We agree that the first paragraph of section 4.1 of the discussion is superfluous and will be deleted as suggested. The following two paragraphs deal with the study location. As the manuscript combines the description of a new experimental facility and its application in the field, we believe that a short discussion about the study location is appropriate.

- Second, the authors should first present their protocol for the Svalbard experiment, second report on the results and highlights the problems, and 3) expose the subsequent improvements as operated during the following experiments as well as, potentially, insisting on the, if any, unresolved issues. This whole sequence should be much clearer in this manuscript, and is totally mixed in the present version of the manuscript.

Restructuring the manuscript as suggested by the reviewer initially seemed like a good idea. After some attempts to reorganize the text accordingly we decided to keep the structure as is. The reason is that modifications to the mesocosm hardware and handling implemented after

the Svalbard study are limited to two aspects: (1) replacement of the bottom plates by a flange-connected sediment trap (sections 2.4 and 2.6), and (2) weekly cleaning of the mesocosm walls in follow-up studies instead of a single cleaning at the end of the experiment in the 2010 campaign (section 2.8). We believe that these two aspects do not really justify separating the improvements from the rest of the mesocosm description. Keeping these aspects in the related sections may in fact make it easier for the reader to understand the reasoning for the implemented changes.

- It is a pity that the techniques used to measure the mesocosm volumes and those used to estimate gas exchange not included in the present manuscript. I do believe one single "technical" paper would have been much better.

We agree with the reviewer that it will be useful for the reader to learn more about the approaches for volume determination and gas exchange estimation described by Czerny et al. (a and b) in this manuscript. However, incorporating those two manuscripts into this one in full length would make this paper rather unbalanced. On the other hand, incorporating a condensed version of those two rather technical manuscripts may compromise their usefulness for those readers who would like to apply those approaches. As none of the reviewers of the other two manuscripts suggested combining of manuscripts, they presumably felt that each of them has sufficient substance to be considered as stand-alone paper. We therefore suggest adding further information on volume determination and gas exchange estimates in this paper, but still keep the other two manuscript as stand-alone manuscripts with the detailed technical information they now contain.

- Maps in Figs. 8 and 9 are not necessary. Instead I would present a scheme of the moorings and of the free-floating mesocosms and perhaps a picture.

As this is the introductory paper to the Svalbard 2010 mesocosm campaign, we believe that a map indicating the location of the study site and the positioning of the mesocosm moorings in Kongsfjorden is needed. Hence we would prefer to hold on to Fig. 9. For geographical orientation it may also be helpful for the reader to view the study site in an areal map. If the editor advises to take out Fig. 8, we would of course follow the advice. As suggested by the referee we will add a graph showing the design of the mooring array. We would prefer not to add a graph of the free-floating mesocosm array as the corresponding campaign off Hawai'i was only a test run and the set-up used there will be modified greatly when applied in a full-scale experiment in free-floating mode.

Very very minor issues:

- please always mention the pH scale (pHT etc..)

Will be done as suggested

- was it necessary to bubble for so long (24h), my understanding is that CO2 has a very high solubility in seawater, equilibration and therefore saturation should be done in few minutes no?

A few minutes of bubbling are definitely not sufficient to reach CO_2 saturation. While aerating for 24 hours may be somewhat longer than needed, this ensures that the CO2 level is close to saturation. Please note that complete is not achieved even after 24 hours of vigorous bubbling.

Reply to comments by reviewer #2:

I agree with Reviewer #1 that this MS would be more focused and would be of much greater value if it conveyed more info on the technical side by revising the result and discussion to concentrate only on the technical development and performance of the mesocosms.

Results and Discussion will be revised to focus more on the technical development and performance of the mesocosms. See response to the corresponding comment of reviewer #1.

I were also going to suggest that the technical calculation of volume only referred to in this MS, rather should be fully described here, so that a reader that looks for the technical descriptions, find them all in this MS.

See response to the corresponding comment of reviewer #1.

Another general comment is that to my knowledge this project was also substantially supported by a collaboration with the EU project MESOAQUA (see: http://mesoaqua.eu/kiel_kosmos and http://mesoaqua.eu/kbml). If so this should be clearly stated in the Abstract (page 12986, lines 24-25), Acknowledgments (page 13003, lines 6-14), as well as in all pertaining manuscripts and elsewhere.

I am grateful to the reviewer for noticing this omission. Reference to MESOAQUA support will be added to the acknowledgements.

Specific comments:

Page 12988, Lines 5-6: states that a unique advantage of mesocosms are that they can investigate community dynamics of two or more trophic levels. . . Don't the authors mean "three or more", or "more than two"? Many laboratory studies incorporate two trophic levels (or even three occasionally) in plankton at least from virus to mesozoo- plankton levels.

Will be changed as suggested.

Similarly I suggest for point 2: ". . .perform mass balance calculations." To add ". . .in complex systems". Since many less complex lab systems offer this possibility. I think the unique possibility with mesocosms is the to work with (natural) complex systems.

Will be changed as suggested.

Page 12990, line 10: How transparent was the plastic for different light? UVA,B,C. . . PAR? Percent transparency? Please specify.

Some relevant information will be added in the revised version. Unfortunately we do not have precise information on UV transparency of the PVC hoods. Based on information available in the internet, PVC is reported to have an extremely low transparency for UVB and UVC and low to moderate transparency for UVA. Because most of the light enters the mesocosms through the walls rather than the hoods, the light transparency of the TPU foil used for the flexible bags mostly determines the light climate inside the mesocosms.

We have measured the transparency of the TPU foil for thicknesses of 0.5 and 1 mm and compared it to the transparency of a thin glass sheet (see graph below). This information will be added in the revised manuscript.

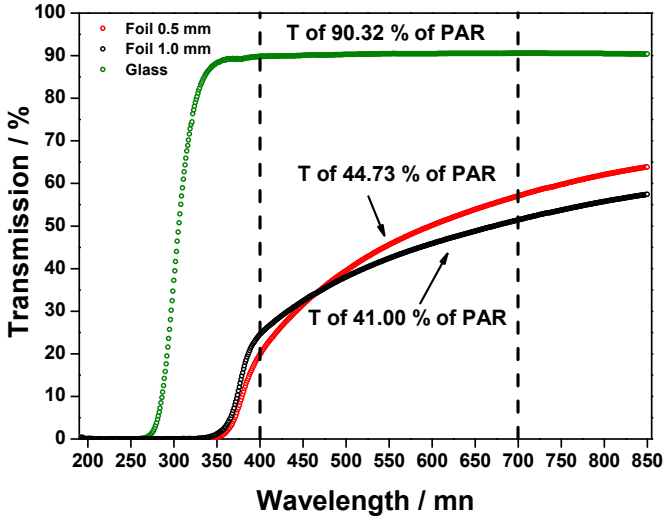

Fig. 1: Transparency of TPU foil of 0.5 (red line) and 1 mm thickness (black line) as a function wavelength. For comparison the transparency of a 1 mm glass sheet was measured (green line).

Page 12991, lines 14-17, and section 2.8 "cleaning of the mesocosm wall", and Page 13002, lines 19-21: How do you differ material and aggregates potentially produced from cleaning the walls (i.e. artificial "benthic" growth) from actual material produced and sedimented out of the water column? Please describe or reformulate accordingly.

Material released from the walls during cleaning was determined based on measurements of suspended matter right before and after cleaning. Increased suspended matter concentration after the cleaning was interpreted as originating from wall fouling. Estimates of wall growth are presented in Czerny et al. (this issue). Section 2.8 will be modified to better explain this.