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Biogeosciences Discussions

Interactive comment on "Short-term fate of phytodetritus across the Arabian Sea Oxygen Minimum Zone" *by* J. H. Andersson et al.

J. H. Andersson et al.

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Referee #1 acknowledges the importance of maintaining oxygen levels during incubations close to those present in the Arabian Sea Oxygen Minimum Zone. We agree that this is not a trivial task, which is why the description of the functioning of this system was left out of the paper, as the description merits a paper in its own. Nevertheless to inform the reader, we will add the following information about the oxystat functioning in the method section of the updated version of the paper.

For the purpose of incubation experiments, cores were fitted with core top seals, and all air bubbles were excluded. The undersides of the seals featured magnetic stir bars, ports for oxygen and temperature microsensors, and a further five ports; one for slurry introduction, two to allow water sampling, and two for the 'oxystat' system. The 'oxystat' system was designed to maintain core-top oxygen levels at seafloor conditions despite

sediment oxygen consumption. On each core the two oxystat ports were connected to each other via an 8m length of gas-permeable tubing (the oxystat gill), submerged in a reservoir of filtered seawater (the oxystat reservoir). This reservoir was sparged with an air and nitrogen mix tuned to maintain oxygen levels slightly above those at the seafloor. A peristaltic pump circulated core top water out of each core barrel, through its dedicated oxystat gill, and back. Diffusion across the tubing in the reservoir replenished core top water with dissolved oxygen which had been consumed. Sub-aerial parts of the oxystat system were made of gas impermeable tubing.

In addition, we will add to the results section *The oxystat system maintained oxygen concentrations within 10% of in-situ values*

Based on our introduction referee # 1 has the impression that a comparison between shipboard and in situ incubations was a major goal of our study. This was an unfortunate interpretation as we never had the intention to do so (the dataset is too small for that). The wording in the revised manuscript will be changed to avoid such misinterpretation. Lander experiments will not be mentioned in the abstract or the introduction.

As a consequence of this misunderstanding, referee # 1 also wishes to see more use of the available in situ data and not only used alone as in Figure 3. We would like to point to Figure 8 and Table 2, where the percentage of total label respired is also shown, both from shipboard and lander experiments. Moreover, as mentioned above our introduction will be revised to guide the reader towards biogeochemical relevance at the expense of in situ-shipboard comparison. Referee # 1 also points out a lack of in situ incorporation data, which we do not understand fully as these data were presented in Table 2, but they were not discussed in the context of in situ-shipboard comparison.

Referee # 1 believes that the paper remains rather descriptive and not enough quantitative. We only partly agree with this statement. Indeed, we did not include a quantitative, dynamic model as we have applied in some of our previous studies (Van Oevelen et al., 2006a,b,c). However, in contrast to many previous studies of phytodetritus processing

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where results were given only as specific uptake ($\Delta\delta^{13}$C), we have provided quantitative measures (in terms of mmol ^{13}C m^{-2}) of respiration and incorporation in three major components of the benthic foodweb (bacteria, foraminifera and macrofauna) as well as POC. In fact this is the first deliberate tracer study resolving dissolved organics as well. To facilitate future quantitative comparisons across systems, we will also publish all relevant data on PANGAEA - Publishing Network for Geoscientific Environmental Data (http://www.pangaea.de).

Referee # 1 pointed out that "ex situ results were 3-5 times higher" and that the difference is more pronounced at the shallower of the two stations, make decompression an unlikely candidate for the discrepancy. We maintain that the discrepancy is primarily a technical artefact due to patchy delivery of the phytodetritus as was outlined in the sentences below from page 2503.

However, the distribution of added phytodetritus in the in situ incubation the chamber was very patchy, as highlighted by large differences in excess 13C-POC and bacterial uptake between subcores (Table 2). This heterogeneity introduces large uncertainty when data from subcores are extrapolated to the entire chamber area.

We will clarify this further by changing this text to:

However, the distribution of added phytodetritus in the in situ incubation chamber was very patchy, as highlighted by large differences in excess 13C-POC and bacterial uptake between subcores at the 140m site (Table 2). As a consequence of patchy availability of phytodetritus, a large fraction of bacteria residing at the sediment surface was unable to participate in the processing of this material. Upscaling measurement made on small subcores, such as excess 13-POC and bacterial uptake rates, introduces large uncertainty in total chamber estimates.

Finally, referee # 1 suggested including the time-series from Figure 4 in Figure 3 for an easier comparison. They are presented separately because different amount of algae have been added per m^2, making a comparison of absolute values confusing.

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The relative comparison between respiration in shipboard and in-situ experiments are however found in Figure 8.

References cited:

van Oevelen, D, , Middelburg JJ, Soetaert K, Moodley, LM (2006a) The fate of bacterial carbon in an intertidal sediment: Modeling an in situ isotope tracer experiment. Limnol. Oceanogr. 51(3) 1302-1314

van Oevelen, D, Moodley, LM, Soetaert K, Middelburg JJ (2006b) The trophic significance of bacterial carbon in marine sediments: an in situ stable isotope labeling study. Limnol. Oceanogr. 51(5) 2349-2359.

Van Oevelen D., Soetaert, K., Middelburg, JJ., Herman PMJ., Moodley, L., Hamels, I., Moens T., Heip CHR (2006c) Intertidal food web features revealed by assimilating biomass, isotope and trace data. J. Mar. Res. 64(3) 453-482

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