

## ***Interactive comment on “Observations of late-winter marine productivity in an ice-covered fjord, West Greenland” by David Chandler and Shona Mackie***

### **Anonymous Referee #1**

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The manuscript deals with a set of controlled incubation experiments that aim at investigating the microbial metabolism in an ice-covered oceanic environment. The authors clearly highlight the need for respective field observations as e.g. satellite data are not suitable for providing information on microbial metabolism magnitudes in fjord regions or for under-ice conditions. Very few field observations exist so far, which vary concerning methodology and sampling strategy. The authors add to this database by providing insight from a western Greenland fjord system, the Lillefjord, and clearly lay out their sampling strategies and methodological approaches. For this purpose the authors carried out 13 incubation experiments at two sites of the Lillefjord (fjord edge and center) during late winter 2013. The experiments consisted of obtaining and analyzing

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the content of dissolved oxygen (DO) into two kinds of bottles kept under the ice in the surface layer of the fjord for 1-4 days. While one kind of bottles was opaque to ambient light which was achieved through foil wrapping, thereby mimicking dark conditions, the other kind of samples was exposed to ambient light representing light conditions. Changes in the DO concentration over the incubation period were used as proxies for the net community production (light samples), community respiration (dark samples) and gross primary production (difference between light and dark samples regarding DO change).

The authors carefully describe their experimental setup with all its advantages and limitations. They state what methods they used to treat their samples and protect them from e.g. freezing or any contamination. The manuscript continues by explaining the statistical methods the authors used to obtain uncertainty ranges. The paper provides two tables and two figures. Table 1 summarizes existing measurements and results regarding microbial metabolism in the Arctic realm. The authors use this for comparison with their own results. Table 2 is the actual database of the authors and is identical to the corresponding data set archived at PANGAEA. Table 2 and the PANGAEA file provide further details on the incubation experiments at the two sampling sites as well as mean values and uncertainties of the various DO measurements of the 13 incubation experiments with each experiment consisting of 2-5 individual samples. Figure 1 shows two maps, a larger map focusing on the western Arctic and highlighting the sampling sites of the present study as well as of previous studies, and a smaller map showing details on the two sampling sites in the Lillefjord system.

The paper is well written and understandable even for non-experts regarding microbial metabolism. The authors clearly describe what they have done, what they have found out and to what degree the results are comparable to other studies. As the authors have measured temperature and salinity for each of the experiments (if not samples), I wonder, why this data (though not being crucial) is not included in the data set. I also wondered, why the data file archived at PANGAEA did not include the full data set,

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i.e., DO results for each of the individual samples. Instead, it only included the results listed in Table 2 of the manuscript, i.e. mean values and uncertainties/ranges for the different experiments carried out in the fjord center and at its edge. I would like to ask the authors to comment on this. A few minor changes I would like to see made before accepting the manuscript for publication are the following:

page 5, second paragraph: Could you please add an explanation why there aren't any "dark" samples for February 22? Furthermore, what was the reason for changing the incubation time (1 vs 2 vs 4 days), and was there any notable effect ?

page 5, line 183: Figure 2a presents "ambient DO", not temperature and salinity as mentioned in the text. It would be useful to have this data included in the data file as well as in Figure 2.

page 6, line 191: please, add a reference to Figure 2c at the end of the sentence.

page 6, line 204: This should be Figure 2c ("dark"), not 2b, which shows results for the light incubations

page 7, line 261: please, add some references at the end of the sentence "... in the Arctic."

Table 1: Please, add the incubation time (or a respective range) for the results originating from the present study. They are provided for the other studies listed in the table.

Figure 1: The figure would clearly benefit from having some map coordinates. I can only guess that the black circle shown in Fig. 1a indicates the polar circle. What topography data set is used ?

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