

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

Anonymous Referee #3

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The article presents a unique dataset on dissolved oxygen measurements in light and dark in-situ incubations, which potentially can be used to calculate net community productivity, respiration and photosynthesis rates. Because such data and observations are generally lacking, I consider the study as having relatively high novelty and usefulness. Article is well written and presents the importance, methods, results and their interpretation in a sufficient manner.

I would suggest changing a title. In my opinion ‘marine productivity’ should be exchanged with e.g. “marine microbial respiration”, as the second term more clearly indicates what is actually provided and was directly measured contrary to ‘productiv-

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ity', which can only be indirectly retrieved from oxygen measurements and which in practice was not observed at all.

Abstract: I think the main finding “rate of photosynthesis – if it was occurring – must have been much smaller than that of respiration” should be mentioned in the Abstract.

Introduction: generally, it is well written, informative and well explaining the importance of the study. I think it could also refer to the work by Assmy et al. 2017 (Scientific Reports): Leads in Arctic pack ice enable early phytoplankton blooms below snow-covered sea ice.

Please provide a reference to the statement “While estimates of marine net primary productivity (NPP) based on satellite retrievals of chlorophyll a have shown a link between reductions in sea ice cover and increases in NPP across much of the Arctic during 1998-2009”

Dataset : it is stated that up to 10 samples per experiment were analysed. Also in Pangea it is written that datasheet should contain 167 data points, however the database I had an access contain only 13 records, which I assume are already the means of the particular measurements. However, as the errors of the means are substantial, I do think it would be great to have a possibility to work on all the data (measurements).

If the effect of the glacier was taken into consideration in the sampling design, ideally if data could be supplemented by e.g. turbidity levels. The same applies to providing the data that were measured for sure (temperature, ice thickness).

Methods: field measurements and sample handling is described with great detail and accuracy.

Results: I cannot find those results : “Throughout the study period, the sea water temperature and salinity varied between -1.5 and -1.7o C, and between 32.6 and 32.8 psu, respectively (Fig. 2a).”, neither at the Figure nor in the dataset.

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Why there is no 'rate of change' on Fig. 2c & 2d for the 21.02.2013 in the Fjord Edge station ?

According to the results description, which is as follows: "ΔDO calculated for the light and for the dark bottles is interpreted as GPP. None were found to be significantly different from zero (Fig. 2d)" there was no production occurring ! That's why I proposed to change the title.

How is the result described in the Abstract "Averaged over the full study period, dark incubations showed statistically significant decreases in DO of -0.36 ± 0.24 (near shore) and -0.09 ± 0.07 gO₂ m⁻³ d⁻¹ (fjord centre), which are 2-20 times greater than rates previously reported under sea ice in the Arctic" obtained? What kind of calculation stays behind ? Is that a difference between first and last sampling ?

Conclusions: I am afraid some data interpretations may be too far reaching and cannot be supported by the dataset provided: e.g.,

"at Lillefjord, then it is likely that ice algal photosynthesis commenced earlier than photosynthesis in the underlying water column" "in this study, the difference is most likely attributable to net production by sea ice algae (which would increase DO in the ambient sea water), contrasting with net respiration in the underlying water 270 (which would decrease the DO in the closed incubations). This suggests an earlier onset of photosynthesis at the underside of the sea ice than in the underlying water."

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