

Interactive comment on “Subglacial upwelling in winter/spring increases under-ice primary production” by Tobias Reiner Vonnahme et al.

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We want to thank the reviewer sincerely for the thorough and very helpful review. We addressed all comments as described in the attached document. We believe that the changes improved the manuscript considerably.

In cases of over-interpretations, we either rephrased the interpretation more carefully, often via adding details for clarification, or removed the statements (details in the supplement). We rewrote the sections that the reviewer considered disorganized and unclear (details in the supplement) with the most substantial changes regarding glacial processes and the chapter about subglacial upwelling and entrainment factors. We tried to clarify the relevance of on-ice processes by i) introducing the processes in more

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detail in the introduction, ii) mentioning the nutrient concentrations of the undiluted subglacial meltwater that we measured earlier in the results, and iii) giving more references to the role of nutrient enrichment under the glacier (weathering during bedrock contact, solute expulsion during freezing). However, our nutrient measurements of the undiluted meltwater still showed lower concentrations compared to the fjord bottom water. The concentrations are enriched compared to sea ice and UIW samples at NG and IE, but we consider upwelling of bottom water more important for nutrient dynamics in this area. We further clarified these findings by referring more strongly to the undiluted meltwater nutrient concentrations in the text. Please note that Svalbard studies by van der Poll (e.g. van der Poll et al., 2018) agree with our conclusion. Referee 2 suggests that shallow water depth might limit the relevance of this process. We suggest that the freshwater input occurred below the sharp halocline in 4-5m depth, explaining the nutrient differences between 15 and 1 m. Additionally this process is supported through a) the absence of any substantial external advection of inorganic nutrients (e.g through tides and wind), and b) strong salinity driven stratification preventing mixing apart from upwelling. Detailed calculations were added to the text or supplement.

We used following font colors and highlighting in the attached document: - Grey text: Reviewers' comments - Black text: Our response - green: Changes in the manuscript after RW2 - Yellow highlights: Changes in the manuscript based on RW1.

Please also note the supplement to this comment:

<https://tc.copernicus.org/preprints/tc-2020-326/tc-2020-326-AC2-supplement.pdf>

Interactive comment on The Cryosphere Discuss., <https://doi.org/10.5194/tc-2020-326>, 2020.

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