

## ***Interactive comment on “Microbial processes in the weathering crust aquifer of a temperate glacier” by Brent C. Christner et al.***

### **Anonymous Referee #1**

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There is an increasingly amount of literature showing that microbial presence (particularly pigmented algae) on the surface of the ice can promote positive feedbacks between melting and microbial activity. There is also plenty of information on microbial processes in cryoconite holes. However, the microbial structure within the weathering crust aquifer (WCA) of glaciers has only been conceptually explored, and the reality is that there are hardly any data looking at microbial processes on glacial surfaces at an appropriate scale to improve our understanding of these processes in the WCA. I think that this paper goes a long way to explore microbial processes at the WCA, and it is completely appropriate for a journal like “Cryosphere”. I really enjoyed reading it. The combined modelling, geochemical and microbial measurements makes the paper particularly attractive and informative.

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My main suggestion for improvement is related to the presentation of the sampling procedure in the boreholes, which I think is a crucial part of the study. I am sure most readers would like to have a better visualisation of how samples were obtained by having some photos and/or a schematic figure (either in the main paper or as supplementary information). I have no doubt that the study has captured well the weathering crust microbial processes. The data of microbial composition provides some solid evidence of a different community in the WCA compared to the surface community, and some more information in the methods would help to make this point clear.

Minor suggestions: Page 4, line 16 – Please specify how the boreholes were monitored. I think this will also help to clarify the first paragraph of the results section.

Page 8, line 18 – please specify the volume of the serum vials.

Last paragraph of page 17 – Maybe it is worthy to mention/reinforce the fact that the sample used for those incubations has a relatively high proportion of Cyanobacteria/plastids. Nevertheless, the cell number increase during the oxygen consumption experiment indicates a strong bottle effect during the incubations. It would be good if this can be further discussed in line with the calculations in the first paragraph of page 18.

The literature on microbial processes at the very ice surface provides quite often evidence for organic carbon accumulation, which in turn results in the darkening of the ice. Is it possible for the authors to make inferences (based on the incubation experiments and microbial community composition of the WCA) whether the WCA microbial processes could have a role on surface activity (e.g., via recycling of nutrients that become available to surface organisms as the ice ablates exposing WCA communities at the surface)?

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