

## ***Interactive comment on “A spatial investigation of the environmental controls over cryoconite aggregation on Longyearbreen glacier, Svalbard” by H. J. Langford et al.***

**Anonymous Referee #2**

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### General comments

The manuscript entitled “A spatial investigation of the environmental controls over cryoconite aggregation on Longyearbreen glacier, Svalbard” by the authors H. J. Langford et al. is focused in to explain the influence of some biogeochemical parameters on the size and stability of cryoconite holes. The manuscript shows valuable results of concentration of organic matter, carbohydrates and pigments as well as rates of productivity and respiration and abundance of phototrophic microorganisms in cryoconite environments. These results represent an important contribution to increase the knowledge of these extreme environments. However, I consider the authors need to reorganize their results and rewrite part of the discussion in order to support their conclusions.

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### Specific comments

1) Introduction I considered the paragraph discussing about the phycobiliprotein measurements is too extensive and not need in this section. Introduction needs to focus in the main objectives of the study.

2) Results:

â€” In figure 2, chlorophyll a pattern (increase down-glacier) is not as evident as the authors claim. Take care with the over interpretation of results. The same for phycobiliproteins. Indicate GT and SL in the figures. â€” I consider that CCR is just another way to show carbohydrate distribution and not provides additional information â€” For easy comparison and interpretation, to include all correlations in the table â€” Move paragraph in page 3436, line 20 to discussion â€” Move paragraph in page 3437, line 25 to methods

3) Discussion â€” As authors indicate, contrary to previous works, they were focused in to explain how some biochemical processes could control some physical characteristics of the cryoconites holes. However, in the first part of the discussion (pages 3438-3442) they clearly exposed how their results indicate that biological parameters respond to stability and size of cryoconites. Considering the characteristics of the ice matrix and the ablation in glacier surfaces, I consider that this explanation is the most plausible. In spite of this, I agree with the idea that the evolution of microbial community can impact cryoconite stability and at the same time to conduct to a more mature community (e.g. high-size filamentous microorganisms). In contrast, I can't figure out how community evolution can influence the size of the aggregates. I am more agree with a model where feedbacks between some physical and biological parameters can explain the evolution of the cryoconite aggregations. â€” It would be interesting to include measurements of total carbohydrate to support statement in page 3443 (line 25) about the increase of bound carbohydrates down-glacier. â€” Is there a significant correlation between carbohydrate concentration and community respiration?

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In summary, I consider the authors need to reorganize the results and rewrite part of the discussion in order to show a compressive analysis of how physico-biological interaction determine the evolution of cryoconites

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Interactive comment on Biogeosciences Discuss., 11, 3423, 2014.

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