

## ***Interactive comment on “Uncovering biological soil crusts: Carbon content and structure of intact Arctic, Antarctic and alpine biological soil crusts” by Patrick Jung et al.***

**Anonymous Referee #2**

Received and published: 10 November 2017

The present manuscript has the value of providing information regarding biological soil crust communities from poor studied locations. At the same time, the manuscript introduces new methodologies that can be used to further understand biocrust structure and organization. Although I like the approach the authors used, I believe that a further effort in identifying cyanobacterial and microalgae species from the studied samples (by light microscopy or molecular survey) would have provided more insights and would have been helpful in supporting some of the points the authors make in the discussion and conclusion.

Overall, there is a need to improve redaction, grammar and the flow of the manuscript

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(mostly in the discussion). This can be achieved by removing no relevant information (discussion), splitting and shortening sentences, and using connectors and punctuation (overall).

**Abstract:**

Line 12: main primary producers instead of main producers

**Introduction:**

Page1 Line 2: Change by cyanobacteria, bacteria, microalgae.

Page 2 Line 3: missing a connector between (BCS), dominate these ecosystems.

Page 2 Line 13: I do not think that Johansen 1993 is the most relevant/precise reference for the two previous sentences, mostly when referring to hot and cold deserts worldwide. It should include other citations as well.

Page 2 Lines 15-19 Citations are missing.

**Methods:**

Page 3 Line 27 Can you clarify, within the given T/ frost and ice days, when biological activity is expected/have been predicted? Can you provide for all locations an approximation of current expected biological activity?

Page 4 Lines 19-15 Please provide number of samples collected/analyzed per location. Were samples collected randomly or within a given transect?

Page 5 Line 2 What type of Chlorophyll was targeted?

Page 5 Line 5-6 You are saying that chlorophyll a from green algae was excited using a 555nm beam and that chlorophyll a from cyanobacteria was excited by using a 639nm beam. It is not clear to me, how an excitation at 55nm will have no effect on chlorophyll a from cyanobacteria and vice versa.

Page 5 Line 18 Explain what do you mean by cyanobacteria and green algae were

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isolated. Also, from which solution?

Page 5 Lines 24-25 Sentence difficult to follow

Page 5 Line 25-28 Does it mean that cyanobacteria associated to lichens were also neglected? How did you discriminate chlorophyll a fluorescence from mosses?

Page 6 Line 2 move meaning for the abbreviation for voxels from line 6 to line 2

Page 6 Line 11 Use past tense

Page 6 Line 11-13 Sentence difficult to follow/understand

Page 6 Line 23 Normally distributed data.

Results

Page 6 Lines 27-30 Define a tense (past or present). Recurrent change in tense in the manuscript.

Page 7 Lines 18-21 Improve sentences flow.

Page 7 Line 22 How did you measure bryophytes contribution to apC and npC. Can you please explain how this differentiation was made? I also do not see them (bryophytes) marked in any of your biomaps, neither in figure 6. Being this the case, please use arrows to show them in your biomaps.

Page 7 Line 24 Please clarify what you mean by cyanobacteria occupy between 7 and 23 %. Is there any difference among locations?

Discussion:

Page 7 Line 28 -30 Revise sentences. Either add punctuation/connectors or split into more sentences. Revise this throughout the manuscript.

Page 8 Line 8 named instead of called

Page 8 Line 9-10 I do not understand this sentence/what you are aiming to communicate

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cate

Page 8 Line 18 "hard to detect" by what means? Please explain

Page 8 Line 19-20 What and how is supported by Budel et al., 2014 and Peer et al., 2013?

Page 8 Lines 22-24 Which technique was used in Budel et al., 2014, was it the same time of the year? These sentences need a better flow to communicate better the point the authors are trying to make. A take home message from this finding is missing.

Page 8 Line 28 Which literature? Add references and some comparisons

Page 8 Lines 28-30. These sentences are hard to follow, please re-write. How different in thickness were your biocrusts at the studied locations? Do your results agree with your light regime explanation?

Page 8 Line 34 Page 9 Line 4 I do not see the point of adding the dark and light crust classification.

Page 8 Line 34 Page 9 Line 16 Therefore is missing the last e

Page 9 Lines 20-41 Please provide references

Page 10 Line 5 demonstrated instead of could demonstrate

Figures:

Figures 1 Add used wavelength for each channel. Add arrows to show fluorescence from EPS. Include either here or as a supplementary a similar panel showing a filamentous cyanobacteria.

Figure 2 Add used wavelength for each channel. I am not sure you need to show figures 2 a and c.

Figure 3 Add arrows to indicate filamentous and single coccoidal organisms. Also show differentiation between cyanobacteria and green algae. Indicate profile depth for each

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panel. Indicate biocrust position in the profile. In the results, you mentioned that Nostoc is on top as well as within the biocrust (Page 7 Line 3). I only see what you identified as Nostoc within but not on top of the biocrust. Clarifying the biocrust position in the profile may help with this. I also do not clearly understand how you concluded that what white triangles are showing is Nostoc. Maybe a zoom in will help. Also, Nostoc from figure 3b looks different from Nostoc in figure 3a, especially color wise. Add PAL, PIL layers to figure 3 and provide measurements (profile depth)

Figure 4. Provide layers measurements (profile depth). Optional since already asked in figure 3. Although I acknowledge the effort and recognized its beauty, I do not see the need to include Figure 4 in the main text. It could be supplementary. I leave it to the authors to decide.

Figure 6. I do not see bryophytes represented in the figure, however, their contribution to the apC and npC was mentioned in the results.

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