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Discussions

# *Interactive comment on* "Biological soil crusts on initial soils: organic carbon dynamics and chemistry under temperate climatic conditions" *by* A. Dümig et al.

**A. Dümig et al.**

duemig@wzw.tum.de

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Unfortunately, the experimental setup for these studies comprises a major deficit. Samples were taken of 5 different successional stages of crusts on each of the two dunes. Three replicate samples of each crust type were taken within 1 m2 each, meaning that these samples clearly originate from the same patch of crust, implicating that they are definitely NOT independent from one another and thus are obvious pseudoreplicates. Consequently, there is only one value per crust type forbidding all statistical analyses. Within their study, the authors found no evidence for soil properties affecting the BSC distribution. They observed that the mean 14C residence time of soil organic car-



bon decreased with increasing BSC development, being a potentially interesting result, which should be verified in a statistically correct research approach. The differences in carbohydrates should also be verified in a statistically sound experimental approach. Due to major deficits in the methodological approach I strongly suggest to reject the manuscript in its present stage. The experiments on the 14C residence time and the carbohydrate composition could be repeated in a statistically sound experimental setup with a sufficient number of replicates and a profound statistical analysis in order to get robust and statistically significant results.

Answer: The sampling design was adjusted to the specific patterns of these crusts which developed on both sand dunes and our concept of analyses: (1) the sand dunes were small (please see Figure 1)and the BSC occurred only on small patches (BSCs were not continuous and not wide spread), which did not allow the establishment of three independent transects. (2) sampling of large amounts of BSC and substrate materials (due to the low organic carbon content) for the fractionation (has not been done before)and analyses (e.g. carbohydrates, 13C NMR, 14C).The analyses are rather elaborate and cost-intensive (e.g. one 14C measurement costs 500 EUR, and a 13C NMR spectrum is also around 500 EUR) which restricts the number of possible analyses.

Therefore, it was not possible to find a sufficient (and independent) number of BSC spots for each BSC type with respect to the performance of profound statistical analysis. Following these constraints, we sampled BSC (three replicates of each crust type) from spatially independent patches within 1-2 m2. This allowed us to assess the small-scale variability of BSC properties. We can clarify this in the revised manuscript as follows: "BSCs and substrates at all spots were sampled from three spatially separated patches with BSC in a total area of about 1-2 m2". In addition, we will describe in more detail the concept of our sampling as described above in the material and method section.

Although we were not able to analyze our data using multivariate statistic, we evalu-

ated the development of soil crusts by correlating organic carbon contents (as a proxy of crust formation) against other parameters (carbohydrate, radiocarbon age, OC in soil fractions). This approach clearly revealed an innovative data set and gave new insights into the chemical composition of different BSC types, the potential of BSCs to accelerate soil formation and the organic carbon dynamics in BSCs and the underlying substrates in combination with the chronology of BSC establishment and development.

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