

# ***Interactive comment on* “Soil profile connectivity can impact microbial substrate use, affecting how soil CO<sub>2</sub> effluxes are controlled by temperature” by Frances A. Podrebarac et al.**

## **Anonymous Referee #1**

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General comments The authors describe two soil incubation experiments, (1) of individual sub-horizons of boreal forest organic layers and (2) of entire organic layer profiles with their natural sequence from less to more degraded organic matter. Based on a comparison of these two treatments in two forest sites of different climate and at two incubation temperatures, the authors draw conclusions on the impact of exchange processes between shallower and deeper parts of the organic layer on carbon and nitrogen cycling, in particular soil respiration. I find the study interesting and relevant and I agree with the authors that soil connectivity might have a strong (and understudied) effect on biogeochemical processes especially in the deeper soil. However, I have to admit that I cannot follow the argument in the discussion; this includes both difficulties

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understanding the meaning of the partly convoluted text and relating the interpretation to measured parameters. I recommend to carefully revise the discussion, refer to figures and tables throughout and consider an overview figure or scheme.

Specific comments Figures 3, 4, 5: The Q10 values seem oddly similar in the three figures and I can't align them with the temperature comparisons. Is it possible that you forgot to change this part of the figure moving from one to the other? Also, what do you mean with "cumulative respiration" in the legends of these figures (that are not about respiration)? Sub-chapter 4.1: I have difficulties following this central argument. If you are referring to actual respiration data – are they shown anywhere in the manuscript or are they described in a previous publication? If they are in previous publications, would it be possible to show these data here (citing the original publications)? Or do you mean the mass loss data? Is the change in carbohydrates shown in Figure S4; and if Fig. S4 is central to the interpretation, why is it not in the main manuscript? It seems to me that you are describing an increase in both labile and complex substrate degradation by soil connectivity – but are they not measured relative to each other? I understand that the dataset has a complex structure so I tried several times, but I still do not understand this argument. I would also appreciate if you could refer to Figures and Tables in the Discussion to make it easier to follow. Line 558: Soil R? Line 587: What do you mean with "a climate relevant range of availabilities"?

Technical corrections Line 162: "Provide" instead of "provides". Figure 2: The two types of blue squares are difficult to distinguish.

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