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Biogeosciences Discussions

Interactive comment on "The sensitivity of microbial processes in Icelandic soils to increasing temperatures" *by* R. Guicharnaud et al.

Anonymous Referee #2

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This paper describes the short term effect of temperature on microbial processes in Icelandic agricultural soils. It is generally well written and presented. In addition to a nice confirmation of previous studies which indicate microbial activity at sub-zero temperatures in high latitude soils, the critical observation of this paper is that despite stable microbial biomass across all temperatures, lower DOC concentrations and highest soil respiration was observed at higher temperature (10oC) while low temperatures (-10oC) give highest measured DOC concentrations and lower respiration. The authors go on to conclude that the main factor controlling soil respiration at −100C was the concentration of dissolved organic carbon. I was a little confused by this statement since correlation is not causality. Some discussion of the literature which speculates on a switch to DOC based microbial activity during cold spells has been used to support this statement but surely the main factor which controls respiration at -10oC is this

low temperature itself and the decrease in soil degradative processes/microbial activity. I agree that the DOC pool looks to be highest at -10 but is this again likely to be down to lower microbial activity (caused by temperature) simply not consuming what is present whether it be easily degradable or recalcitrant. Admittedly DOC remains the likely available carbon pool to drive CO2 production in the unfrozen films of water and in this sense it is important.

The authors discuss the limitations of the short time frame of their experiments and concede that these results may have little bearing on longer term CO2 fluxes and yet they state in the abstract that their results are of importance to understanding global carbon dynamics. I think in its very widest sense this is true from a perspective of understanding short term dynamics of these systems, however, the key question must be what components (and dimensions) of the degradable organic carbon pool is driving respiration at the higher temperatures in their experiments and, therefore, how long might the enhanced CO2 continue for. The authors also discuss this subject but I think on balance the results are of considerable interest without the need to make the global dynamics statement.

One general concern with the study is the descriptions of the sampling regimen and specifically how replicate sub-samples for doing the different process analysis were prepared. In the methods description no mention of sub-sampling from the incubations is made and we only find out that replicates have been taken and analysed when you see the error bars on the figures. I presume these error bars relate to separate random samples taken from the bulk incubations.

In a wider sense what is the justification of the bulking of eight cores to produce presumably a single composite soil for each temperature (not explicitly stated). Would it not have been better to keep individual soil cores separate for incubation and as such was this a logistical decision. In addition, was the sub-sampling scale sufficiently large and the mixing at a sufficiently fine scale to evenly encompass components of all eight soil cores.

Abstract: change significance to significant

675 line 16: insert community after the word microbial The figure 3 legend is not very helpful. What data is linked to which axis. Presumably the scatter of dots are for the right hand axis but it would be helpful to include an indication of this. The shading in these dots is rather difficult to discern could more contrast be made using open and closed symbols The figure 8 legend mentions ammonia but this is not correct for figure 8. I think this is the legend for figure 9. For figure 9. the fractions of labile carbon have no errors. Presumably the fraction of each pool was calculated as a mean values across all samples. What is the error of these calculations?

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