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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.

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Dear Dr. J. Leifeld.

We would like to sincerely thank you for showing our research paper interest and value greatly your input, especially in turns of your knowledge and experience in this research topic.

Concerning comments made on the possibility of depletion of substrates at the end of incubation we feel that this might not be of relevance, as it is rightfully pointed out, that solely 0.1 % of the soil SOC was released as CO2. In your paper (Leifeld and Fuhrer, 2005) it was stated that when only 5.7 % of the SOM had been mineralized that corresponding to the active SOM. Moreover, Conant et al. (2008) state that the

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first 1% respired C arises from decomposition of similar quality OM across different temperatures. We therefore feel that we can be confident that we have been measuring only the readily available C pool. However the authors agree that such a link is missing and will be added to the discussion of the research paper.

We tested, as suggested by the referee, to double check for any significant correlations between biomass C and CO2 production and did not find such a relationship neither when all soil types where tested together or when soil types where tested individually. Perhaps this might be related to high variability in CO2 production between replicates or most likely due to the fact that our study was a short term one not allowing for measurable changes in soil microbial biomass C.

We tested for correlations between the CO2 flux and Q10 at lower temperatures for all the sites. Respiration at -10°C and -2°C did not correlate with Q10 for the temperature interval -10 to -2°C (r 0.89 P 0.85 and r 0.92 P 0.16 respectively). The same was observed when respiration at +2 and +10°C where correlated against Q10 obtained from the +2 to +10°C temperature interval (r 0.91 P 0.57 and r 0.95 P 0.06 respectively). The only correlation found was between respiration at -2°C and Q10 for the -2 and +2°C temperature interval (r 0.84, P 0.03) which generally displayed highest Q10 values (mean Q10 of 4, Table 2). The correlation found between respiration at -2°C and Q10 -2 to +2°C was the same relationship as reported by Leifeld and Fuhrer (2005). This could be an indication of a relationship with the quality of SOM as suggested by Leifeld and that at this temperature interval SOM might be less available to soil microorganisms. We feel that it is though difficult to make such assumption as our study did not investigate either long term changes in SOM or the different fractions of SOM within soils making it difficult to draw any definite conclusions on the decomposability of OM in this study. However such a study would be a valuable input in understanding the carbon dynamics of Icelandic soils and the authors fully intent to conduct such a study.

We are very thankful for the referee to point Conant et al (2008) paper and hence

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calculated Q10-q values as suggested to overcome the possibly higher CO2 efflux at the end of incubations at e.g. lower temperatures. We calculated the Q10-q for the initial 100μg of C from each soil type. The very small amount was chosen to incorporate all soil values. As the referee pointed out this would perhaps be of limited value since the total sum of carbon respired from the soils was so small. In table 1 Q10-q values for each soil can be viewed. We feel that these results are not significant (and hence will not be included in the manuscript) as they only include values from a 2 week incubation not allowing for 1% of SOM to be respired like is done in Conant et al., (2008). Conant et al. (2008) calculated the Q10-q values from the initial 1% of C respired which was supposed to represent the more labile portion of soil C. Our incubation time did not allow for this. Conant et al (2008) likewise allowed for 8 % of the initial C to be respired to represent the more resistant portion of soil C, again our incubation did not allow for this. But by just looking at the mean of Q10-q values and not taking into account how much of the initial C has been respired from the soil, highest Q10-q values are obtained from -10 to -2°C temperature interval (mean Q10-q values 8.14) and from the -2 to +2°C (mean Q10-q values 14.62) temperature interval and lowest from the +2 to +10°C temperature interval (mean Q10-q values 2.06). According to Conant et al. (2008) this would indicate that SOM was more resistant at those temperatures (below zero). We however feel that in this case (due to the short time period studied) that this solely represent limited amount of microbial activity at lower temperatures when the majority of soil organisms is in an inactive state due to little access of water when soils are frozen. Above freezing point (temperature interval of +2 to +10°C) the mean Q10-q values are 2.06, which in our view represent more activity due to warmer temperatures of the soil.

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Site	Q_{10-q}		
	-10 to -2	-2 to +2	+2 to +10
Glb	19.6	1.59	1.73
Glg	17.2	1.02	0.90
Hvb	0.18	15.4	2.03
Hvg	11.10	6.99	0.91
Korb	4.30	12.8	0.27
Korg	10.7	0.65	0.77
Mob	1.09	2.32	8.32
Mog	0.95	75.3	1.55

Fig. 1. Table 1. Q10-q values from all soils

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