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Biogeosciences Discussions

Interactive comment on "Soil warming in a cool-temperate mixed forest with peat soil enhanced heterotrophic and basal respiration rates but $\vec{Q}_{10}$ remained unchanged" *by* M. Aguilos et al.

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Aguilos et al. present results from a two and a half years soil warming study in a forest grown on former peatland in northern Japan. The topic is in the focus of Biogeosciences and is of high relevance in climate change research. The presented paper in Biogiosciences Discussion however, to my feeling, does not meet the high standards of the journal. The main outcome of the study, that the former peat soil likely loses high quantities of C under warmer conditions, is of relevance and should be published. However, the speculation about Q10 and heterotrophic basal respiration could be re-

duced to a minimum. I am sorry for being so critical. The reasons, you find below in the comments.

Major comments:

In the study soil was trenched to 30 cm depth. It however seems that the former peatland soil is much deeper than 30 cm (as the organic layer is already reported to be 40 cm thick; P6420). What if there were roots below 30 cm? - What is likely, considered that the trees on site were 40 years old. Unless authors dont give a reasonable explanation why they did not trench down to the bedrock (or groundwater table), this will be seen as a major weakness of the study.

The discussion on how warming affected Q10 and heterotrophic basal respiration, which comprises a major part of the paper, is highly speculative and not supported by any statistics. Also the concept how Q10 and basal respiration were calculated might be overthought.

General comments:

As recommended by Reviewer 1, the paper should be edited by a native speaker.

Authors gathered CO2 data in very high temporal resolution. They could try to find out if the warming effect was equal over time or changed throughout the observation period, seasons, day-night, periods with high or low soil moisture/temperature, during or after litter-fall and so forth. This would be very interesting.

The calculation of Q10 from seasonal soil respiration data is problematic (see comments of Reviewer 1, which I completely agree with). Beside the suggestions of Reviewer 1, I also suggest to compare only Q10 values and basal respiration which were calculated over the same temperature range. Soil temperatures at warmed plots showed a broader spectrum (0-24°C (Fig 6)) as control plots (0-20°C). Hence, it is difficult to conclude if basal respiration and Q10 were influenced by warming treatment, or if the differences in Q10 and basal respiration resulted from theoretically lower tem-

perature sensitivity at the end of the temperature spectrum which, however, was only evident at the warmed plots (20-24°C).

Missing statistics regarding comparison of Q10 and basal respiration from different treatments could be solved by calculating Q10 and basal respiration for each chamber and then calculating and comparing the treatment means, instead of comparing single Q10 numbers calculated out of mean CO2 fluxes and temperatures. Generally, I am not sure if two and a half years of warming is enough to draw conclusions about variations in Q10 and basal respiration – especially, as pre-warming CO2 measurements seem to lack. - And considering all the problems regarding calculating Q10 out of seasonal CO2 data as mentioned by Reviewer 1.

It seems that there were no pre-treatment CO2 measurements. This is a problem as authors found higher (20-40%) basal respiration on warmed-trenched plots as on control-trenched plots. If there were no pre-warming CO2 measurements, to my understanding, it is not clear how to distinguish if the higher basal respiration resulted from soil warming (as concluded by authors) or if the warmed-trenched plots already showed higher basal respiration before the warming treatment. If pre-warming basal respiration was really higher at the later warmed chambers, than the estimate of 74% increase in soil respiration due to warming would be overestimated.

Authors used infrared heaters to warm the soil. I suggest giving more information on how that worked out. So far only soil temperatures at 5cm soil depth are provided. Where temperature differences at the soil surface similar, or much higher? Also a picture or conceptional drawing of a warmed chamber would be helpful.

To give a more accurate estimate of the contribution of autotrophic and heterotrophic soil respiration, CO2 efflux from decomposing trenched roots should be accounted for.

Specific comments:

Abstract:

L1: We conducted a soil warming experiment in a forested peatland in northern Japan, during the snow-free seasons 2007-2009. (snow-free instead of snowless throughout the whole paper)

L3: ... respiration rate and its temperature sensitivity...

L8: ..was carried out....and autotrophic respiration. (delete: from the total soil respiration)

L11: ... contributed 71 % to total ....

L13-14 and the whole manuscript and figures: mean 3.52 +- 1.74 μ mol m-2 s-1 of what ? CO2, C? For example: 3.52 +- 1.74 μ mol C m-2 s-1

L20: ... in the temperature sensitivity of heterotropic soil respiration (Q10 of 2.79 and 2.74 determined....

Last sentence: I do not understand that.

Introduction:

P6417: L5: actually it is the second largest flux in the terrestrial C cycle (not global)

L15: ...the decomposer community..

L17: Hence, the feedback strength may not be as large as the prediction obtained by assuming constant temperature sensitivity of soil organic matter decomposition (Friedling...

L28: ...with high carbon stock...

P6418: L1: We conducted a soil warming experiment in a cool-temperate mixed forest on peat soil. For precise....

L7-L15: This part should be completely rewritten. Please define your hypotheses here. We hypothesized that..... because.....

Materials and methods:

Authors always refer to “chambers” and not plots, which makes the whole section difficult to read and understand (at least for me). It might help if you once state, that you have placed an automatic chamber on 5 trenched plots, 5 trenched-warmed plots, and 5 control plots, and then refer to trenched plots, trenched-warmed plots, and control plots in the further text.

P6419: L15 onwards: it would be important to determine C and N contents and stocks of the whole soil profile and not only for the first 5cm soil depth.

P6423: L3: This quality checking successfully removed bad quality data (Fig. 1). -> This sentence actually belongs to the results already.

Generally, it seems that data processing was done very thoroughly – which is very much to appreciate.

Results:

In accordance with Reviewer 1 + statistics for Q10 and basal respiration are missing.

Discussion:

See general comments and comments from Reviewer 1.

Table1: Statistical significance?

Fig 1: The figure could be skipped as the data processing is nicely explained in the methods.

Fig 2 and Fig 3 could be merged and soil moisture data could be added

Fig 3: is much too small – these are the main results and they should be presented more prominently

Fig 4 and Fig 5 (and Fig 6) show the same – don’t they?

Figure 8 could be deleted. It is mentioned in the text, that there was no relationship between soil moisture and CO2 efflux.

Interactive comment on Biogeosciences Discuss., 8, 6415, 2011.