

Interactive comment on “Temperature sensitivity of soil respiration is dependent on readily decomposable C substrate concentration” by A. A. Larionova et al.

A. A. Larionova et al.

Received and published: 18 September 2007

Interactive comment on "Temperature sensitivity of soil respiration is dependent on readily decomposable substrate concentration" by A. A. Larionova et al. Reply to anonymous Referee #4

1.I have read this manuscript with great interest, but it was extremely difficult to follow, mainly because of the very poor language. If the authors would be invited to submit a revised version, it is absolutely crucial that the manuscript is corrected by a native English speaker, because this level is not acceptable. -The revised version has been corrected by a native speaker.

2.Unfortunately, this study was not well-designed to study temperature responses.

What the authors should have done is expose the samples to short-term changes in temperature. In this case, the immediate physiological respiratory response could have been detected. - Although our work is lacking studying short-term effects, the extent at which these effects are important or even detectable is still disputable. The matter is that the results obtained by other authors in the experiments with pure microbial cultures clearly demonstrate that improved affinity (K_s decrease) takes place only by long-term cultivation in substrate limited conditions (Senn et al, 1994) while short-term temperature changes do not affect K_s (Button, 1987). This was the main reason why we have chosen the long-term rather than short-term incubation for studying canceling effect.

3.The comparison of the two temperature regimes is interesting, and perhaps more relevant than the short-term temperature response in itself, but it cannot be used as an estimate of the Q_{10} . By incubating soil samples at two different temperatures for two months, one cannot distinguish the temperature sensitivity of soil respiration from other responses. Microbes could have adapted their physiology (acclimation), microbial community shifts might have occurred, S_n could have differed, and so on. - Respiration involves many biochemical reactions and processes and we can estimate only apparent Q_{10} for both short-term or long-term respiratory responses. The reason is that the real Q_{10} coefficient as such has been proposed by Vant Hoff for describing single chemical reaction. Therefore apparent Q_{10} s can also be calculated from our long-term data, and these coefficients are very useful if one compares all integrated temperature responses across soils and ecosystems at the same time scale.

4.Also acclimation cannot be proven by the mere fact that a certain parameter was less than twice as high in the 12 degree treatment than in the 22 degree treatment. - As for Q_{10} s, we imply apparent effect. Many biochemical reactions and transport mechanisms integrated into respiration process show cumulative (increased sensitivity) and counteracting or canceling effects (apparent acclimation). At the same time, low temperature response does not exclude real adaptation of organism, but we can not prove

real microbial acclimation based only on the data on growth and substrate utilization parameters.

5. What also intrigued me is the statement of the authors that at substrate concentrations lower than K_m , k_m becomes insignificant again and thus the temperature sensitivity increases. This is mathematically incorrect, and further trivial, because as the substrate concentration becomes that small, the reaction rate also becomes so small that the temperature sensitivity hardly plays a role. -In the new version of the ms we have reformulated this statement (see p. 9). When the substrate concentration was small, i.e. no exogenous substrate was added to high and low temperature treatments, soil respiration depended on the amount of endogenous substrate (S_n) which was twice as high at 22 as at 12°C. Under these conditions, V_{max} and K_s cancelled each other but this mechanism was not the main factor controlling soil respiration. We agree that at very small respiration rate temperature changes have no effect, but there is not the case in our experiments. Threshold concentration below which glucose and other carbohydrates are not utilized and temperature plays no role is of nanomolar level, while S_n in our incubations amounted to micrograms per gram of soil, i.e. 3 order higher than threshold concentration.

6. I was also unsure about the sample size. In the text it is stated that there were 3-4 replicates, but in the graphs $n=5$? -The number of replicates has been mentioned separately for each of the experiments, p.6. 3-4 replicates were used in long-term incubation for k_1 and k_2 estimates, while V_{max} , maximal specific growth rate, K_s were determined in 5 replicates.

7. The authors compare a forest soil with an arable soil, and attribute the observed differences to the difference in the amount of (depletion of SOM, p. 2014). These soils differ in many more aspects than just the organic matter content, so I would not assume that differences in their responses to the addition are related to the different C content. - Practically all differences in physical, chemical and microbiological characteristics between forest and arable soils are directly or indirectly associated with

[Full Screen / Esc](#)[Printer-friendly Version](#)[Interactive Discussion](#)[Discussion Paper](#)

the difference in SOM content and quality.

8. In conclusion, I believe the authors should completely revise their manuscript, not focus on the temperature sensitivity, or acclimation, but on the responses to the glucose additions, and this under two temperature regimes, which then reflect an integration of all aspects of temperature responses: the physiological temperature sensitivity, acclimation, adaptation, etc. -Revised manuscript has been focused on temperature response of soil respiration to glucose addition in accordance with the Reviewer's comment.

Interactive comment on Biogeosciences Discuss., 4, 2007, 2007.

BGD

4, S1401–S1404, 2007

Interactive
Comment

Full Screen / Esc

Printer-friendly Version

Interactive Discussion

Discussion Paper