

Comment on bg-2022-90

Anonymous Referee #1

Referee comment on "Temperature sensitivity of dark CO₂ fixation in temperate forest soils" by Rachael Akinyede et al., Biogeosciences Discuss.,
<https://doi.org/10.5194/bg-2022-90-RC1>, 2022

This study explores the temperature sensitivity of microbial non-phototrophic CO₂ fixation in temperate forest soils. The manuscript is interesting but some aspects are not clear and require improvement. Particularly, the authors should explain why the temperature sensitivity of CO₂ fixation differs depending on whether it is reported per soil mass or per microbial biomass C (see below).

Main comments

Figure 2 Why does Q₁₀ for CO₂ fixation differ between the rates per MBC and soil? I assume this is due to differences in the MBC in the two soil subsamples that have been exposed to different temperatures. It is rather surprising that the MBC concentrations differ so strongly, and it would be good to see the values (in a table).

Section 3.3 The rationale behind the quantification of the "C allocation" is not clear. Given that the incubation lasted only a few days, it is unrealistic that a lot of the microbial biomass C already turned into microbial necromass during the incubation. Thus, what the authors report here is probably rather the result of differences in the efficiency of the chloroform fumigation.

Lines 459-461 I agree with this sentence. In addition, the authors should also mention that changes in primary production and root exudation might completely change the response of the studied processes to changes in soil temperature, which adds further to the uncertainty to the predictions. Given these uncertainties, I strongly recommend to remove Fig. 7 from the manuscript.

Section 2.4 For how long were the soils exposed to the ¹³CO₂?

Further comments

L. 25-27 Based on the determined parameters (respiration and CO₂ fixation) no conclusion about microbial biomass turnover can be drawn

L. 42 Remove "which also affects CO₂ emissions from other soils"

L. 52 Do you mean SOC concentration or quality?

L. 71 replace second "by" by "until"

L. 77-80 This statement cannot be drawn from the cited studies since they measured both processes at only one temperature

L. 83 are there other forest types in the temperate zone besides coniferous and deciduous forests?

Table 1 Please indicate the depths of the soil horizons

L. 441/442 Remove "derived"

L. 462-464 These two sentences are not clear, at all.

L. 492-494 There seems to be some confusion here, and the process of microbial biomass turnover and microbial necromass turnover get mixed up. I think what the authors actually refer to is the rate at what C turns over in the living soil microbial biomass. It would be good to separate these two process more cautiously in the text.