

Interactive comment on “Contribution of recent plant photosynthates of *Eriophorum vaginatum* and *Scheuchzeria palustris* to methanogenesis and CH₄ transport at a boreal mire: a ¹⁴C pulse-labeling study” by M. Dorodnikov et al.

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General comments:

We acknowledge the valuable comments of the Reviewer and have to admit that some methodological details were not clear and needed some more explanation. We changed all points mentioned by the Reviewer as outlined below and hope that we addressed them adequately.

Specific comments:

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1. Both the CH₄ and CO₂ fluxes were measured by transparent chamber. Therefore, do not use for the CO₂ flux the term “respiration” as has been done e.g. on page 4373/line23. The measurement method shows NEE, i.e. sum of photosynthesis and respiration.

* We completely agree with the Reviewer and corrected the terms from “respiration” to “NEE” for CO₂ data here and throughout the text.

2. A potential reason for the carbon loss not detected is the release of methane in bubbling. The incubation temperature of the mesocosms was 22/27 °C, i.e. higher than the highest in peat during summer (some 14 °C in the uppermost peat). High temperature likely enhanced bubble formation in the experiments. It could well be that the measuring system did not cover the irregular bubble release events (on average 20 % of the incorporated label was not recovered). The relative low amount of added ¹⁴C found in emitted methane could be a result of the missed methane released in bubbles. A second point would be that the photosynthesis (transparent chambers) caused re-assimilation of released ¹⁴CO₂ which decreased the recovery?

* We appreciate the Reviewer for such an important comment. Indeed, the CH₄ ebullition process is an essentially valuable CH₄ transport mechanism from belowground to the atmosphere (Glaser et al. 2004; Lai 2009) and we may assume this process to happen under the conditions of the experiment. As it was noticed in the paper (L 22-24, page 4376) the experimental set-up did not allow us to do continuous measurements of labeled ¹⁴CO₂ and ¹⁴CH₄ fluxes from studied mesocosms and we could have had losses of ¹⁴C through the process of CH₄ ebullition between measurements. However, during measurements of gas fluxes we did not observe a noticeable ebullition event (neither by naked eye, nor by GC measurements) in any of mesocosms. Still, we acknowledge the possibility of the ¹⁴C losses through bubbling in the text (L 24-26, page 4376, improved version). Regarding the re-assimilation of released ¹⁴CO₂, this apparently took place, and during flux measurements we might not detect this activity. However, since the ¹⁴C assimilated again, it incorporated into plant biomass

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(aboveground, or transferred belowground to roots) and was measured at the end of the experiment in plant compartments directly.

3. For the CO₂ fluxes following aspects should be considered and discussed. The isolated mesocosms showed only the carbon balance of the above-ground vegetation whereas the control mesocosms included also CO₂ released from the soil (root respiration, heterotrophic respiration). Therefore, if we assume similar photosynthesis in the controls and isolated mesocosms, the isolated mesocosms should show generally lower CO₂ uptake or lower CO₂ net release. There is some evidence on that when looking the data shown in the Figures.

* We agree with the Reviewer that isolated mesocosms having similar photosynthesis as in the not isolated mesocosms showed generally lower CO₂ net release, because the contribution of root and heterotrophic respiration was excluded by the isolation. Fig. 2 A, B shows that the net CO₂ flux was lower in isolated vs. not isolated treatment on average of 18 days of measurements, especially for *Scheuzeria* from hollows. In turn, emission of labeled CO₂ (Fig. 3 A, B) clearly demonstrated that the initial flush of ¹⁴C was to large extent plant-derived (in not isolated treatment: root respiration, in isolated: transpiration, convective or diffusive flux through aerenchyma) and comparable by the activity. However, after 3-4 days ¹⁴C in CO₂ was substantially higher in not isolated vs. isolated treatment due to increasing contribution of heterotrophic (soil-derived) decomposition of recent plant-derived deposits. These interesting aspects were now explicitly included into the text of the paper (pages 4371, 4372, improved version).

4. Was the light intensity of 800 μ mol m⁻² s⁻¹ used also in the gas flux measurements not only in maintaining the mesocosms (see the previous comment on the CO₂ uptake/release in the various mesocosms during the measurements).

* The light intensity of 800 μ mol m⁻² s⁻¹ was used for maintenance and during gas flux measurements without changes (a 14 h photoperiod) and equally for all mesocosms and treatments (L 19-20, page 4366).

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References

Glaser PH, Chanton JP, Morin P, Rosenberry DO, Siegel DI, Ruud O, Chasar LI, Reeve AS (2004) Surface deformations as indicators of deep ebullition fluxes in a large northern peatland. *Global Biogeochem Cycles* 18:GB1003

Lai, D. Y. F. 2009. Methane dynamics in northern peatlands: A review. *Pedosphere*. 19(4): 409–421.

Please also note the supplement to this comment:

<http://www.biogeosciences-discuss.net/8/C1567/2011/bgd-8-C1567-2011-supplement.pdf>

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