Response to Gerbrand Koren

We would like to thank Gerbrand for taking the time to read and helpfully comment on this manuscript. We have responded to their comments (reproduced in blue) below.

1) I have read your work with great interest. The exchange of oxygen isotopes between CO_2 and soil water is an important process for $\delta^{18}O$, and this work contributes to a better understanding of that exchange. However, this exchange is also of great importance for the budget of $\Delta^{17}O$ in CO_2, a different tracer for GPP. $\Delta^{17}O$ in CO_2 was first proposed as a tracer of GPP by Hoag et al. (2005). More recently, laboratory studies confirmed the effect of photosynthesis on $\Delta^{17}O$ in CO_2 (Adnew et al., 2020), and we simulated large-scale variations of $\Delta^{17}O$ in atmospheric CO_2 (Koren et al., 2019). We struggled with representing the soil exchange in that model, and for follow-up studies we can possibly improve our representation of soil exchange using Eq. 6 from your manuscript. I think you can reach a greater audience if you also explicitly address the $\Delta^{17}O$ community in your work.

Thank you very much for your positive comment. We appreciate your interest in our work and agree with you that our work could also interest groups like yours working on the $\Delta^{17}O$ in CO_2. We have now added a couple of sentences in the introduction to clarify this point.

2) In the first line and last line of the abstract I would replace "$\delta^{18}O$" with "$\delta^{18}O$ and $\Delta^{17}O$".

We have rephrased the first and last line of the abstract to remove the emphasis on only $\delta^{18}O$ and replaced this with a more general reference to the oxygen isotope composition of atmospheric CO_2. In addition we have referenced explicitly in the introduction text the importance of k_{iso} for understanding the $\delta^{17}O$ composition of CO_2 and the $\Delta^{17}O$ of CO_2.

3) Sec 2. Are you sure that the sampling and transporting of soil samples does not affect the CA or microbes in the sample?

We do indeed expect there to be a disturbance effect on the microbial community when transporting soils and sieving them, thus it is important to be mindful of this when comparing results from soils measured under field conditions and those measured in laboratory experiments as well as extrapolating results from mesocosms to the large scale. This study however was designed to characterize a set of homogenized climate-controlled soils to make a link between the measured CA activity, the mesocosm soil characteristics and their response to changes in inorganic N concentrations. However the quantitative influence of transport and sieving on carbonic anhydrase activity is so far not well understood but is discussed. Please see L360 - L380 in the Discussion.

4) There are two sections with number 2.1.

Thanks. We have corrected section ‘2.1 Gas exchange measurements’ to be ‘2.2 Gas exchange measurements’.

5) L139: "Tillburg". This should be the lovely city "Tilburg".

Thanks. We have corrected this.

6) L147: Why did you choose to report on the VPDBg scale, instead of e.g. VSMOW?

We preferentially report our CO_2 in air measurements on the VPDBg scale (also known as VPDB-CO_2 scale) reflecting the fact that values assigned to our working standards are ultimately tied to the acid digestion of RM NBS-19 calcite. Please see:

Werner, R. A., Rothe, M. and Brand, W. A.: Extraction of CO_2 from air samples for isotopic analysis and limits to ultra high precision $\delta^{18}O$ determination in CO_2 gas, Rapid Communications in Mass Spectrometry, 15(22), 2152–2167, doi:https://doi.org/10.1002/rcm.487, 2001.

Werner, R. A. and Brand, W. A.: Referencing strategies and techniques in stable isotope ratio analysis, Rapid Communications in Mass Spectrometry, 15(7), 501–519, doi:https://doi.org/10.1002/rcm.258, 2001.

7) L210: The units provided in the text do not agree with Eq. 1.

Thanks! We have removed the erroneous “m^{-3}” from “where u is the flow rate (mol s^{-1}) through the chamber line”.

8) L423: I would briefly mention Δ17O here.

Please see our response to comment 2) above.

9) Caption Fig. 1: The authors mention twice: "dissolved organic carbon (DIC)". Should this be DIC or DOC?

Thanks, this should indeed be dissolved inorganic carbon! We have altered the caption accordingly.