

Responses to the associate editor and reviewers

Thank you for sending the revised version of your manuscript. We received the comments of two of the original reviewers. They are both satisfied with the way you have dealt with their concerns. I agree with them, and I am happy to accept your manuscript for publication. There are just a few minor points that should be addressed.

Our responses are reported below in normal font, while the editor's and reviewers' comments are in italic.

I agree with reviewer #2 that the word 'soil' should be included in the title and in the text when needed (e.g. L258, L270, L290, L331).

Thank you for the suggestion. We have incorporated the word 'soil' to clarify the location reference and added 'heterotrophic' to specify the respiration source, as soil respiration includes contributions from both microbes and plant roots. These changes help improve clarity and precision. Please see lines 258, 271, 291, and 334.

L33 '(lower moisture)'. Not clear what you mean here. Does it refer only to soils with lower moisture levels? Suggest it be omitted

We have removed it as recommended. Please see line 33.

L72 add '.' to Zhang et al. (2020)

It has been added as suggested. Please see line 71.

L96 what do you mean by 'The soil sampling depth refers to the deepest depth of a soil core, which could be used as a proxy for organic matter composition, with more microbially processed material at depth'. Unclear statement. Revise

We have clarified this sentence by revising it into "The soil sampling depth refers to the bottom of the sampled soil core and can serve as a proxy for organic matter composition, with deeper layers containing more microbially processed material". Please see lines 93-95.

L133 add '.' after (Fig. 1)

It has been added as suggested. Please see line 132.

L242-43 'FR declined with soil moisture probe depth (0-10 cm)'. What does it mean? Was the probe installed vertically and thus was recording moisture values along the 10 cm topsoil? Or did you have several probes installed horizontally to measure soil moisture along the 10 cm? It is not clear.

The soil moisture probes can be positioned at different depths. In this study, we selected datasets from the COSORE database that reported soil moisture time series at the surface layer (<10 cm). Some datasets reported surface soil moisture only at 5 cm or 10 cm. Therefore, we explored how this position depth of recorded soil moisture data affects the respiration response to rewetting, as we used the soil moisture time series to define rewetting events, and soil moisture changes can delay compared to the respiration pulse. Our results showed that FR declined with increasing depth at which the soil moisture probe was positioned, which is consistent with our expectation that using soil moisture data recorded at a deeper position to define rewetting events results in a less pronounced respiration pulse. To clarify this, we revised the sentence as "FR declined with increasing depth at which the soil moisture probe was positioned (within the 0–10 cm soil layer)". Please see line 241-242.

L261 'this disconnect'? I suggest: this difference between undisturbed soil conditions in the field and the use of homogenised soil in the laboratory...

It has been revised as suggested “This difference between undisturbed soil conditions in the field and homogenized soil in the laboratory motivated us to attempt....” Please see line 261.

L263-64 revise sentence

To keep the flow of languages, we have revised lines 264-268 as below:

“This comparison relies primarily on the qualitative shapes of the respiration responses to soil and climatic drivers rather than a direct quantitative comparison of the drivers’ effects on respiration. This approach is due to concerns that differing driver distributions (especially for temperature and soil moisture at the end of drying; Fig. 2) and varying units of respiration rate and moisture may complicate direct quantitative comparisons between laboratory and field datasets”.

L377-80 revise sentence. It's not clear – the sensor depth is not of importance. It is the readings of soil moisture values that are of interest.

We agree that sensor depth is important as it determines the soil moisture readings. Our results showed that rewetting pulses were weaker when soil moisture data were obtained from a deeper position within the surface layer. Here, we wanted to acknowledge that the influence of this position is not as significant as other drivers considered in our study. To clarify this, we have revised the relevant sentences as follows

“In addition, we expected an important role of soil moisture sensor depth on field respiration, as deep sensors report more buffered soil moisture variations than surface sensors, causing longer time lags of soil moisture changes and respiration changes—yet, we found negligible effects of sensor depth on the respiration pulses compared to the other drivers we considered”. Please see lines 381-382.

L449 (Fig. A01) delete 'that'

It has been removed as suggested. Please see line 451.

L456 (Fig. 02) substitute 'as we' with 'to that'

It has been revised as suggested. Please see line 458.