

Dear Editor,

Please find attached the revised version of our manuscript entitled “Electrical conductivity measurements as proxies for diffusion-limited microbial activity in soils under controlled laboratory conditions,” submitted for consideration in *SOIL*.

We would like to thank you and the reviewers for the thoughtful and constructive feedback provided during the review process. Following the discussion, we have revised the manuscript to clarify several aspects of the study and to strengthen the interpretation of the results.

In the revised version, we further develop the conceptual framework that links soil respiration to diffusion-limited microbial activity across varying soil moisture conditions. In response to the reviewers’ suggestions, we expanded the discussion of the mechanisms connecting electrical conductivity measurements to microbial processes and incorporated additional pedophysical analysis to illustrate how changes in water-phase connectivity and tortuosity accompany variations in respiration across matric potentials. These additions help clarify the added value of electrical conductivity measurements beyond simple changes in soil moisture.

We also revised several sections of the manuscript to improve clarity and consistency, updated references supporting the diffusion-limited framework, and refined figures and captions to better reflect the results and their interpretation. In particular, the conceptual model presented in Figure 4 was clarified to distinguish more explicitly between elements directly supported by our experimental observations and broader conceptual interpretations grounded in previous literature.

Because numerous edits were made during the revision process, the tracked-changes version of the manuscript may appear somewhat dense. We apologize for this and have therefore also included a clean version of the manuscript for ease of reading.

Thank you for your time and consideration.

Best regards,
Orsolya Fülöp
on behalf of all authors