

This manuscript examines an approach to modeling the heterogeneous effect of rhizosphere oxygen input from plants on heterotrophic respiration, as current models only use a single mean O₂ value. This paper draws attention to the importance of radial oxygen loss on belowground respiration which is an increasingly important topic across ecosystem types. While I see the novelty and timeliness of this paper, I believe some of the language could be changed to better engage a wider audience. Particularly in the abstract, it is difficult to understand the main takeaways from this paper without reading the entire manuscript. It should be made very clear what the reader will learn about after finishing the abstract. I would suggest major revisions regarding terminology and using plain language when possible so that the main findings can be better communicated to a wider audience.

Abstract

It is unclear if you are referring to plant respiration, soil respiration, or both. Please clarify in the abstract. Is it necessary to bring up specific terminology like “Dual Arrhenius Michaelis-Menten” in the abstract, without some readers likely not being able to understand what that means until reading the entirety of the manuscript. My main critique for the abstract would be to rewrite it so that a broad audience can understand the main findings, without having to read the entire manuscript to understand the abstract, since the abstract should be easily accessible. I would suggest also writing a plain language abstract/ summary if possible.

Intro

Line 30: Plant roots also respire (autotrophic), was this taken into consideration/ discussion at all? If its relevant to the approach, I would recommend including discussion about autotrophic respiration, particularly root respiration, since often times this makes up a larger portion of total respiration than heterotrophic.

Line 31: ROL is usually referred to as radial oxygen loss, not root oxygen loss. Please correct throughout or justify this terminology.

Line 30: Are you referring to tidal marshes here? If so, there are many factors that influence porewater oxygen concentrations, namely tidal inundation dynamics and platform elevation. While the focus of this paper is ROL, you should consider describing these other very important mechanisms in controlling belowground oxygen concentrations in marsh systems. Does ROL really matter in the grand scheme of things when you factor in tidal inundation, either flood tides bringing in dissolved oxygen/ limiting diffusion into soil versus ebb tide of allowing diffusion into soil?

Methods

I am missing where the incubation methods were described. This seems important as the incubation values feed into the model variables. I would like to see a better description of how the incubation was done, what tools were used to gather data etc.

Results

Fig 1. I am a bit confused, as the abstract stated the incubations were run at the same temperature and soil C concentration, but the Y axis indicates variability in C concentration. Also several points are outside the confidence interval. Is there any discussion to be had about this considering this is the fit used in the model?

Lines 269: 1/10 of what? This also doesn't seem like a huge difference between models. Is this significant? Is this not really that different? Please elaborate?

Discussion

This organization of the discussion is a bit strange. Instead of having a single discussion section, can you break it up into the main findings, so the readers have a better understanding of what they're supposed to take away from this paper? In its current form, a single discussion section makes it seem like another results section. How does this fit into the overarching literature? How does this compare to previous work? I think the discussion needs a bit of work to simplify and organize the main findings of the paper, without rehashing the results again. There is no broad discussion on how the main findings will impact of the field of Earth System Modeling, Biogeochemical Modeling etc.

Conclusion: It seems strange to not have a conclusion section.