

Interactive comment on “The quasi-equilibrium framework re-visited: analyzing long-term CO₂ enrichment responses in plant-soil models” by Mingkai Jiang et al.

Anonymous Referee #1

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Overall, this paper is excellent. It usefully adds to the body of experimental results based on the use of quasi-equilibrium models and further develops our understanding of the importance of key processes and assumptions.

Having said that, I was very happy with reading the paper up to page 19, line 5. Introduction and the associated discussion of past research was excellent, detailed and informative and structured to derived useful information and leading to new questions.

The description of the model was also clear and gave all the relevant model components. It was maybe a little long (34 equations), and there a danger that key model steps might have be swamped within a sea of less important ones. There might be a

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point in moving some of the model detail to Supplemental Information, and only presenting the key steps in the main text.

However, the remainder of the paper was not well presented. Page 19, line 6 should have started a ‘Results Section’ where the various figure and tables could have been presented and discussed in some detail. As it is, all the key findings were dumped here within half a page. I do not regard this as satisfactory.

Each figure shows important information that is not immediately obvious. It needs careful text that explains to the reader what we can learn from each figure. A general ‘data dump’ with virtually no explanation is never a good way to proceed, but totally unacceptable in this case, as the essence of the modelling is not immediately obvious, but the reader needs to be led through the various figures to extract the key insights gained from each.

Some of that detail is then given in the Discussion, like page 21, line 5 onwards, but only very briefly. That reference is too brief on its own and would have needed a proper description in a results section that could then be referred to. So, the Discussion might be OK if it had an appropriate Results section. But without a Results section, the reference to the various figures is still too brief to be readily and fully understood by the reader.

So, all in all, I would regard the paper as not acceptable in its current form, but that is entirely due to the lacking Results Section and insufficient description of the modeled findings. If that can be added, and the Discussion section then be modified to appropriately refer to text in the Results Section, the paper should be able to make a really strong contribution to the literature.

Minor comments: Page 3, line 7: The authors introduce the abbreviations QE for ‘quasi-equilibrium’. That is unnecessary in my view and just obscures the subsequent text. ‘Quasi-equilibrium’ is short enough and can continue to be used throughout the paper. No need to confuse the reader by an unnecessary abbreviation.

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Page 7, line 7: When the authors mention 'concentration-carbon' feedback, I assume they mean 'CO₂-carbon' feedback. It would be better if that could be spelled out more explicitly as 'CO₂-carbon' or something else that would leave the reader in doubt as to what concentration is referred to.

Page 7, line 22: Here, it states that in assumption 3, N uptake is modeled as a saturating function of root biomass. This makes it sound as though there were no upper limit to N uptake other than that imposed by root biomass. However, the detailed model description states that N uptake is also dependent on mineralized N, which seems like a sensible assumption. Just make sure that in the initial description of this assumption, it is also made clear that mineralized N is a co-limiting factor. Currently, that is not included and gives a misleading impression of the model assumption.

Nothing to add to the Model Description. The text after that needs some bigger overhaul as mentioned above, and I have refrained from referring to specific details as they will hopefully be changed in a bigger re-write.

Interactive comment on Geosci. Model Dev. Discuss., <https://doi.org/10.5194/gmd-2018-291>, 2018.