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Interactive comment on "ORCHILEAK: A new model branch to simulate carbon transfers along the terrestrial-aquatic continuum of the Amazon basin" *by* Ronny Lauerwald et al.

Anonymous Referee #2

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Overall the authors present compelling work to address a major deficiency in earth system models. The authors demonstrate successful simulation of CO2 and DOC lateral transport and CO2 evasion in the Amazon using ORCHILEAK. Previously, no ESM models existed that simulate the lateral transport of CO2 and DOC from surface water sources. The ORCHILEAK enables scientists to attribute DOC and evasion sources. Additionally, the model has the ability to quantify the CO2 evation in relation to terrestrial net primary production. The authors partition these processes into flooded and non-flooded lands with regard to soil carbon and DOC throughfall and subsequent lateral transport and evasion. Below I provide general and specific comments for the authors to consider to improve the current form of the manuscript.

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The authors clearly describe the work that was instrumental to their contribution, and present sufficient references to support their model advancement. The authors provide a succinct abstract summarizing the modeling advancement, results, and potential future application. The authors explicitly show where code area available to replicate this project and provide this in the supplement with good instructions. Including a table of all forcing and evaluation datasets and sources would aid efforts of anyone attempting to build upon the authors work. The equations and formulae are correctly defined, but providing all the equations within the appendix hinders the reader's ability to distinguish which equations are novel to the manuscript. The manuscript would benefit by including a table describing each variable in the appendix, not in a different file in the supplement, or by including the equations in line throughout the document with variable description.

1. The general methods are clearly outlined, however ambiguity exists in the temporal resolution of the model implementation. Specifically, many temporal resolutions are mentioned: i.e. 6 min, 30 min, and daily. Clarification on how these different components of the model interact would enhance clarity. Adding a flow chart or including this within Figure 3 would add clarity.

2. There is limited discussion on calibration. After reading the manuscript, the majority of the parameters seem to be taken from the literature. Please describe the calibration process referenced in Sections 2 and 3.

3. The authors mention this briefly on page 37 L16-21 and on 38 L2-4 how the lack of representation of POC transport might shift in stream DOC and CO2 production downstream. Please expand upon how the lack of representation impacts the current model evaluation including the impact on aggregate downstream DOC, POC, and CO2 evasion. How would this impact the evaluation results presented in Figure 12 and 13? Does this mean the current form of the the model over/under-compensates for the lack of mobile POC? Which parameters would be impacted?

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4. Figure 14 displays the performance of modeled DOC concentration relative to observations. Removing the data from Rio Negro from this plot reveals that the model only produces ranges of DOC from 3-5 mg C/L while observations are double that range [1-7 mg C/L]. How do you reconcile the low variability of the model relative to the observations? This seems in contrast to the results of the simulation data presented in Table 4.

5. The authors note how CO2 evasion is comparable to data from Richey et al., 2002, but also disclose that the inundated fraction is greatly underestimated for the central Amazon. The central Amazon shows that the model has the highest evasion rates there [Fig. 15]. The concluding remarks on Page 35, Lines 10-17 should explicitly address how the match in CO2 evasion and mismatch in inundation are related. Specifically, how does the underestimation of inundated extent impact the assertion that 51% of CO2 evasion is attributed to the floodplain?

Specific comments: Figure 3 caption refers to Table 1, I believe the authors intend to reference Table S1.

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