Response to Anonymous Referee #1

This work coupled the nitrogen model DayCent-SOM with the land surface model SSiB5/TRIFFID to study the N limitation on GPP,NPP and LAI. It is interesting to implement the carbon-nitrogen study, which can be useful to earth system models or climate system models and it might improve the land-air interaction. The simulation with nitrogen shows the general better performance compared to that without N processes of SSiB4. But in some regions, such as Amazon and eastern China, the incorporation of N limitation leads to larger underestimation of carbon fluxes, which is needed to more discussion the mechanism in science.

Response:

Thank you for your constructive comments and suggestions, which help to improve the quality of our manuscript.

As you said, this paper mainly focuses on implementing the plant N processes, which are fundamental to plant physiology in the natural world but are not included in SSiB4, into the model SSiB5. After introducing N processes through our C-N framework, in general, SSiB5 has a lower bias for GPP than that of the baseline version of SSiB4. At the same time, the improvements are not homogeneous over all regions. We admit that the GPP simulation (underestimation) of SSiB5 in Amazon even gets a little bit worse. In SSiB4's simulation, there are some regions with lower GPP than observations. Therefore, the imposed N-limitation in SSiB5 would further increase the bias in the regions where the N-limitation is not dominant. In fact, when a new parameterization was introduced, it may not homogeneously improve the simulation everywhere because other deficient in the model. This mismatch is a common issue reported by a number of papers (Anav et al., 2013; Liu et al., 2019; Piao et al., 2013). Some studies (Gallup et al., 2021; Yan et al., 2017) speculated that the DGVMs poorly reproduce eddy covariance estimates, which affects Amazon rainforest gross primary productivity. In the revised manuscript, we have also added discussion in line 545-548 to address the shortcoming in Amazon and eastern China, and indicate this issue for the future

investigation and made some suggestions based on current research.

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