

Interactive comment on “Implementing the Nitrogen cycle into the dynamic global vegetation, hydrology and crop growth model LPJmL (version 5)” by Werner von Bloh et al.

Anonymous Referee #2

Received and published: 13 January 2018

General comments:

This study presents the development of a C-N coupled DGVM by incorporating Nitrogen cycle into a carbon-only version of LPJmL. DGVMs with representation of coupled C-N cycles could help better understand the terrestrial greenhouse gas fluxes (e.g., future carbon sink capacity). The authors then evaluate model performance of the global carbon and nitrogen pools/fluxes against literature values. A specific effort was made on evaluating the performance of simulating crop productivity. The model development is clearly described, while the model evaluation part needs some more efforts on the organization, clarification, and deeper investigation of results.

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Specific comments:

1. The results part before section 4.1 presents the comparison between outputs from global simulations with various model versions and setups with some interesting findings. However, the section is hard to follow without clear organization of the results, and some interesting findings and important characteristics are presented without proper investigations/explanations. I would suggest authors to make it a sub-section with clearer titles/points indicating the major content of each paragraph. A little deeper investigations or more detailed explanations on the differences between versions/setups would be preferable. In addition, model versions/setups should always be presented along with results (sometimes, it is missing).

2. Section 4.1.1 and 4.1.2 present the comparison of N and C pools/fluxes at both site-level and globally against literature values. Besides comparing values, some more explanations/discussions in the differences/discrepancies could be helpful for readers to understand the model performance.

3. The authors present the improvement in simulating crop productivity by model developed in this study very briefly in Section 4.1.3, while it was shown as major results consisting almost half of the Abstract, which might make readers think the evaluation is only done for crop productivity. Even it is the major part of evaluation, I actually did not get the 'improvements' that authors claimed from the text. Though model results and its comparison with data were shown in Fig. 10 and lots of SI Figures, readers can only get little information on the model performance and the improvement due to implementation of N cycle (at least for me). With comparison on many sites, no statistically synthesis of the performance (no numbers), and no further investigations on 'how and why' were shown in the text. It is necessary/critical to show quantitatively how the improvement can be supported by the results. It is not the job of readers to check every figure, compare the lines, and draw the conclusion. In addition, there is no line for LPJmL3.5 in SI Fig. S5-S20, how the 'improvements' can be seen?

4. The authors tried to discuss the improvements and limitations of this study in 'Discussion and conclusions' section. But it is lack of clear structure. A synthesis of limitation might be helpful (e.g., listing limitations points by points at first).

Minor comments (there might be some duplicate points as some listed above):

P18L1-3: Need to indicate the results come from which version/setup. The means of red/yellow lines were opposite in the text and the figure. Fig. 4: It is necessary to show LPJmL35-PNV too. All lines in the figures of this manuscript should be drawn with thicker lines. P18L14: It seems not 'quite stable' and not 'slightly increase' in Fig. 5. And how the factor of 2 be derived? P18L22: Please give model setup. P20L9-10: What ratio? It is not clear. It would be necessary to explain why the ratios above 1 can occur. P21L9-13: I don't understand these 3 sentences. What's the meaning? Figure 9: Please indicate the data sources for the observed values. P23L5: It is necessary to show in SI figures the LPJmL3.5 output for a real comparison. P23L9: Please indicate what is 'satisfying', is there any indicators to draw this conclusion? P24L5: Please indicate where the climate conditions are not the only yield limiting factors. Sect. 4.1.3: Please indicate how well the model performance. We can get nothing solid from the text.

Interactive comment on Geosci. Model Dev. Discuss., <https://doi.org/10.5194/gmd-2017-228>, 2017.

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