

Interactive comment on “Nitrogen leaching from natural ecosystems under global change: a modelling study” by Maarten C. Braakhekke et al.

Anonymous Referee #3

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This paper presents a modeling study on global nitrogen leaching from natural ecosystems with an ecosystem model LPJ-GUESS. Overall, the paper is well-written and the results are informative. My major concern is on the dependence of results on model representation of nitrogen and carbon cycling process and the inherent model assumptions. Please find my specific comments below.

1. Authors conclude that atmospheric N deposition is the major driver behind nitrogen leaching globally. This is not surprising as atmospheric nitrogen deposition is the dominant N input and linearly linked to soil nitrogen storage in the model. I would suggest add more details on the mathematical formulations in representing atmospheric nitrogen deposition and nitrogen mineralization in the model. Are the results sensitive to the specific formulation of atmospheric nitrogen deposition and mineralization? Discussion on the nitrogen deposition dataset should also be added.

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2. Table 1 lists the numerical experiments conducted in this study. I would suggest add some statements on the purpose of these experiment designs in the methodology section 2.3. For example, which combination of experiments is used to disentangle the effects of a specific environmental driver (e.g. N deposition)?

3. Increase in nitrogen deposition may potentially lead to increased plant carbon uptake and plant productivity, which would feedback to the nitrogen budget and affect leaching process. Is the impact of carbon–nitrogen interactions on N leaching process considered in this study? This aspect of carbon–nitrogen dynamics on N leaching process should at least be discussed. Please also add a table specifying carbon–nitrogen ratios for all natural plant types considered. It would be interesting to examine/discuss how plant growth regulate the simulated N leaching for different PFTs in the model.

4. The effects of fire and gaseous loss on N leaching is analyzed in the results section. But the descriptions on the representation of fire in the model is missing. In addition, it seems that the proposed numerical experiments in Table 1 doesn't consider fire?

5. In section 2.2.1, the CRU monthly climate is interpolated to daily values as inputs for the model. More details on this temporal disaggregation are required. Discussions are also needed as the simulated sensitivity of N leaching to precipitation may depend on the daily sequence of precipitation and intensity.

6. I would suggest clarify which specific aspect of N leaching is the focus of this study, the mean value or its temporal variation?

7. How is N status quantified?

8. In section 3.2.1, the statement “N deposition, climate and atmospheric CO₂ all increased during the 20th century” is confusing as “climate” is a broad concept.

9. I would suggest using the percentage change (%) as the unit in Figure 10

10. The name of the model used in this study can be added in the title.

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