

Interactive comment on “Controls of terrestrial ecosystem nitrogen loss on simulated productivity responses to elevated CO₂” by Johannes Meyerholt and Sönke Zaehle

Anonymous Referee #3

Received and published: 16 July 2018

Overall, I really like the paper and I think it is worthwhile to publish. The paper highlights the different N loss routines in DVMs, and how this affects model performance in both N loss and C gain. Especially the experimental setup of running the model makes it useful and applicable for others. Also, the paper is well written and has good graphics.

However, I have some questions about the paper. First, while the N loss differences of the experiments are well explained and show with nice graphics, the C accumulation is more difficult to understand. Especially in the global simulation, the three different routines show quite different N accumulation (fig 5), while the C accumulation seems to be insensitive to the N accumulation. This is the same when the C:N ratio is constant

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rather than flexible. The authors state that 'the exact mechanisms are difficult to discern', but that leaves me puzzled.. Did the authors look into more differences besides the C:N ratio's? How does this result link to the earlier 'experiments' in the paper? Where is most of the N that is accumulated stored and how does this relate to the C accumulation?

I have a few more questions and comments which I will go through one by one:

P1, line 37: the authors refer to figure 1, but this is confusing in this part of the paper. P4-5 & figure 1: the N loss formulations are well explained in words, but figure 1 is difficult to read on its own. Also, would it be possible to add N uptake somewhere in the methods? Since later in the paper we look at both N loss and C gain, it would be good to know the general N update scheme of O-CN, and how the Nloss routine of NL3 is altering the overall Nuptake routine in that formulation?

P4, line 17: is leaching of NH_4^+ equal to leaching of NO_3^- ?

P6, line 27: just to be sure, in the global model run you use fertilizer application, but no N-deposition? What is the rationale?

P8, paragraph 3.1.3: This paragraph could use more explanation. Especially figure 2j is still unclear to me, as an example: why, with eCO_2 , is the leaching loss so much reduced? Is this because N uptake is mainly inorganic N and will happen before leaching? Why is the gaseous loss in NL2 so much reduced?

P10. Line 13: relative to 1850 values (285 ppm)?

P10, line 34: The 1 sentence for figure 4g is quite limited. Could this be extended? It is relative to control CO_2 N loss? And how does it stand for N limitation?

Interactive comment on Biogeosciences Discuss., <https://doi.org/10.5194/bg-2018-232>, 2018.

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