



Interactive comment on “A simple parameterization of nitrogen limitation on primary productivity for global vegetation models” by G. Krinner et al.

Anonymous Referee #1

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This paper presents a simple parameterization to represent progressive nitrogen limitation/availability for global ecosystem models. The authors do a good job of describing how difficult it is to simulate the nitrogen cycle and its control over productivity. The authors also test the parameterization in a series of pertinent cases, including CO₂ fertilization and soil warming scenarios. Overall, I found the paper well written and easy to understand. However, there is an issue that needs to be further addressed or discussed.

The parameterization uses the ratio of heterotrophic respiration (R_h) and net primary production (NPP), on two different timescales (3 and 7 years, respectively), to down-regulate potential photosynthetic capacity. The logic behind this approach is that the R_h/NPP is a proxy for nitrogen limitation when the ratio is low (heterotrophs not supply-

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ing N to match NPP). As the ratio approaches 1, nitrogen supply is matching demand, and thus the system is not N-limited.

At a basic level, this parameterization makes sense. However, this approach seems somewhat decoupled from the important role that allocation plays in buffering or alleviating N-limitation. In a high CO₂ environment, progressive N limitation might lead to increased root allocation to increase N supply to plants. At the global scale, the time difference in the 3 and 7 year response times of Rh and NPP indirectly accommodates this variation in allocation responses, if and only if Rh is well estimated. Is it? Rh is exceedingly difficult to assess. It would thus be helpful for the authors to directly address the allocation issue, if not quantitatively, then in an extended discussion, just after the parameterization logic on page 1249.

Another issue: In the humid tropics where I work, we recognize that N limitation is often weak and highly variability, whereas P and Ca limitation is often pronounced. Does the Rh/NPP parameterization work for rock-derived nutrients like P and Ca? It probably does so at about the same level of validity as for nitrogen in temperate systems. So, in the least, the authors should consider their effort with respect to "nutrient" limitation, not just nitrogen limitation.

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