

Geosci. Model Dev. Discuss., referee comment RC2  
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## **Comment on gmd-2021-260**

Anonymous Referee #2

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Referee comment on "Modeling symbiotic biological nitrogen fixation in grain legumes globally with LPJ-GUESS (v4.0, r10285)" by Jianyong Ma et al., Geosci. Model Dev. Discuss., <https://doi.org/10.5194/gmd-2021-260-RC2>, 2021

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Ma et al. describe a new parameterisation for two types of nitrogen fixing crops in tropical and temperate regions for the widely used LPJ-Guess model. They clearly explain and document the added mathematical formulation and parameters, provide a succinct evaluation of the model using suitable data and also provide a global evaluation of the consequences of the model implementation in terms of simulated nitrogen fixation and yields.

Overall this is a well written paper, which only requires minor adjustments. The model description is sufficient to understand what has been done and tested, but I want to highlight that the manuscript falls short of making the code accessible to the public. The code availability statement says that the code would be made available for review, but I have not been provided with such a link.

Minor comments:

A few model choices have been made that deviate from previous approaches (e.g. how N fix responds to growth stages, that the cap of NPP investment to N fix is, why is oxygen required for N fixation, which is a process happening in anoxic environments, and why is oxygen availability ignored in the water limitation function). It would be helpful for readers and fellow model developers to better understand the motivation of these choices. In each case, probably one - two sentence explaining the choice would be sufficient.

A somewhat more comprehensive explanation on the calculation of planting dates would be appreciated.

The method description is not explicit about the source of N fertiliser used. This information should be added to Section 2.4. It is specifically important to clarify how the authors have dealt with the N fertiliser information that is related to cropland N fixation, which is included as a factor in many estimates of N fertiliser application.

Figure 4: Please be specific, which regression data belongs to which simulation set.

Figure 6: does panel e not suggest that there's something wrong in the time dependence of N fixation?

Figure 9: Please attempt to arrange the panels more logically (e.g. placement of China and Canada?).

Figure 10: Here it is important to understand what the underlying N fertilisation data source was, and to which extent this contributes to finding?