

Interactive comment on “Current state and future scenarios of the global agricultural nitrogen cycle” by B. L. Bodirsky et al.

B. L. Bodirsky et al.

bodirsky@pik-potsdam.de

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Dear Reviewers,

thank you for your valuable comments. They were of great help to improve both the model and the paper.

The major model improvements done for this revision include:

- A Monte Carlo Analysis to estimate the uncertainty range of agricultural N₂O emissions stemming from the uncertainty of IPCC emission parameters
- An endogenous implementation of soil organic matter loss, depending on the cropland conversion estimated by MAgPIE.
- The substitution of an exogenous scenario for atmospheric deposition by endogenous regional growth paths of agricultural volatilisation losses.
- A

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bugfix of the emission calculations in the livestock sector.

- A better implementation of biological Nr fixation, taking into account regional differences in crop management.
- An improved interface between MAgPIE and LPJml, allowing us to use the most recent LPJml data.
- An improved technical structure of the model, allowing us to make calculations with higher intra-regional resolution (500 cluster cells).

Furthermore, we deliver now a much larger set of output data which allows other researchers to better understand our model and eventually use our data for ongoing research. This table shall be included into the supplementary material of the article.

As it was the wish of both reviewers that our scenario assumptions should be made more clear and discussed in detail, we want to include a new section into the discussion "4.2. Critical assessment of scenario assumptions".

Finally, we compare our estimates for inorganic fertilizer consumption and N₂O emissions additionally to several other estimates.

In the following, we will answer each of your comments explicitly. According to the review process, a revised manuscript shall only be submitted after the Final Author comments. However, we answered where possible already with concrete suggestions how to change the manuscript.

Certain changes to the manuscript, like the adjustment of table 2, figure 2 or the result section to the results of the new model runs will be provided with the upload of the revised manuscript.

We will refer in the following to the page numbers and lines of the unrevised Discussion Paper.

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