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Interactive comment on "Simulating the effect of tillage practices with the global ecosystem model LPJmL (version 5.0-tillage)" *by* Femke Lutz et al.

Anonymous Referee #2

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General comments: The work presented in this paper putting forward a 'tillage' module for LPJmL model version 5.0 is the perfect fit for GMD as a journal enabling outreach to a wider community of ecosystem, earth system and atmospheric modelers. It is definitely a crucial addition in the suit of tools that enable evaluation of soil N and C dynamics resulting in CO2 and N2O emissions and how they are impacted by agricultural management practices like, tillage in conjunction with other practices like use of residue cover. However, after going through the GMD Discussions draft submitted, it seems to require some major revisions in terms to addressing the scientific assumptions to modeling approach used in this proposed module, before it can go ahead for final publication. Some overarching comments are highlighted as follows:

1) There are some structural discrepancies in how some processes that are not ac-

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tually modeled as listed in Fig 1 are still listed in the text as explanation for model performance. Authors need to address those discrepancies.

2) More discussion on soil Nitrogen pools and their dynamics with different management strategies along with soil Carbon pools is needed both in terms of explaining the N2O emissions better, as well as adding differentiation between C and N parts of SOM in equations by incorporating C:N ratios.

3) It would be helpful to list in a tabular form or in form of figures, as to how the proposed tillage module improves upon the already available modeling approaches for effects of Tillage on SOM dynamics, soil properties, crop yield, CO2 and N2O emissions.

4) Effects of tillage on Bulk density is adapted from APEX v0806 model (http://epicapex.tamu.edu/files/2014/10/APEX0806-theoretical-documentation.pdf), however it seems it has been assumed that Bulk density after tillage = Bulk density after soil completely settles, which is not necessarily accurate all the time after Tillage. Moreover, this assumption is really not highlighted in the text.

5) There can be huge uncertainty in terms of how CO2 and N2O emissions are effected by additional management practices adopted with Tillage or No tillage, under short or long term analysis for different crops and climate with varied soil properties. This needs to be explained more as to how such kind of uncertain behavior can be explained by proposed LPJmL-Tillage version 5.0 currently and what aspects need more work in the future.

"Specific comments" addressing the scientific issues including but not limited to the above general overarching comments with the modeling approach and analysis to be addressed, are all listed in detail in the attached Supplement (gmd-2018-255_RC2.pdf).

Please also note the supplement to this comment:
https://www.geosci-model-dev-discuss.net/gmd-2018-255/gmd-2018-255-RC2-

supplement.pdf

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