Comment on gmd-2021-23

Anonymous Referee #1

Referee comment on "Integrating Agricultural Practices into the TRIPLEX-GHG Model v2.0 for Simulating Global Cropland Nitrous Oxide Emissions: Model Development and Evaluation with Site-level Observations" by Hanxiong Song et al., Geosci. Model Dev. Discuss., https://doi.org/10.5194/gmd-2021-23-RC1, 2021

Song et al. developed a new version of the process-based TRIPLEX-GHG model to estimate N_2O emissions from croplands by coupling major agricultural activities. The authors state that they found that the coefficient of the NO_3^- consumption rate for denitrification was the most sensitive parameter based on their sensitive analysis result. I commend the authors for their effort to improve global N_2O emissions from croplands as it is essential but I have some major issues with the paper that I believe need to be addressed before it can be published.

First, the authors simulate daily N_2O emissions and compare them to observational data. However, most of the measurements are often taken once a day, neglecting variations within a day, and so they are not representative for daily emission estimates. I am unsure how the authors have quantified daily estimates from existing literature. Also, there are different flux calculation schemes and for example, Venterea et al. (2020) illustrate a gold standard approach for calculating N_2O flux. I wonder how many of the studies cited follow this approach and how these uncertainties in the observational data are taken into account.

Second, the authors write down equations in the paper without explaining the units and some of the assumptions are not well explained. For example, the authors state that COE_{NO3} was set to 4.0 according to the model test (L. 160) but it is unclear what kind of test was conducted.

Third, the authors state that the NO_3^- consumption rate for denitrification was the most sensitive parameter based on their sensitive analysis result but it is also written that the authors selected the coefficient of the NO_3^- consumption rate (COE_{dNO3}) as the fitting parameter to simplify the parameter fitting processes (L. 301). It is unclear to me how this variable was selected as the fitting parameter and if it can really be considered as sensitivity analysis if all the other parameters were simply set to the original constant

value.

I find that there is a value to the paper but without the above issues being addressed, it is hard for me to recommend publication in GMD. I think more explanation of the sensitivity analysis itself is also essential.

Minor comments:

- 90 validate modeled the results --> validate the modeled results
- 314 I don't quite understand what the two D values are referring to (D = 0.65, D = 0.56)
- 485 pluses --> pulses
- 485 to captured --> to be captured