Comment on bg-2022-56

Anonymous Referee #1

Referee comment on "Modeling nitrous oxide emissions from agricultural soil incubation experiments using CoupModel" by Jie Zhang et al., Biogeosciences Discuss., https://doi.org/10.5194/bg-2022-56-RC1, 2022

The manuscript is well written and provides an interesting review of challenges to biogeochemical modeling of N2O fluxes. It presents an incubation experiment paired with modeling to better resolve drivers of error in N2O modeling. However, the most interesting discovery from that effort, which is the contribution of biases in NO3- and NH4+ towards N2O flux biases, is touched on fairly superficially and should be delved into in much more detail. Subsequently, the paper discusses many potential drivers of model error and challenges in experimentation to better identify and address contributions to this error. However, the study conducted does not help address these shortcomings much at all. Hence, in my opinion this article is of limited value as an original research paper and is in fact a mix of limited original research and interesting review. I urge the researchers to push towards work to unravel these meaningful issues they coherently discuss here.

Other comments:

How were the parameter ranges derived? It's insufficient to just describe them as "with realistic ranges" or according to model defaults. The ranges are important to model sensitivity and calibration equifinality issues.

Too much is shown in the figure 5 subplots for interpretation. This data needs to represented in a better manner.

In table 1, why is the rRMSE so much different between the single treatment and multi treatment for NH4+?

You describe a pattern of better model fit as the simulations progress with time. This sounds like a model initialization issue. Did you make any attempts to spin-up the model?

Do you have ideas of what caused the second flux peak? Was it the residue decomposition? Something else?

Isn't seeing ranges of calibrated parameters oscilating heavily across treatments a sign that the calibration is largely fitting noise?