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Biogeosciences Discussions

Interactive comment on "Predicting the global warming potential of agro-ecosystems" *by* S. Lehuger et al.

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Assessing direct and indirect greenhouse gas emissions from agroecosystems and their mitigation potential is of great importance. This paper contrasts two different sites with similar rotation with a model study using the CERES-EGS model. Counter intuitively the two sites show a large discrepancy in the total greenhouse gas budget with one site showing a high sequestration rate of 750 kg C ha-1yr-1. The main reason for this difference seems to be the left over of residuals on the field. Crop rotations non including legumes or grass clover mixtures are not known to sequester at such high rates. Consequently a solid argumentation is needed and the performance of the model should be convincingly shown. The paper fails in respect to both requirements. The validation of the model with data is insufficient. N2O shows major discrepancies.

With the given information it cannot be decided whether the measurements, the model or both are responsible. I would prefer to use default IPCC emission factors for the N2O emissions to assess the greenhouse gas budget. They might not be adequate for the specific site, but they at least reflect a common sense. For the C-budget a good correspondence of NEP between model and measurements does not necessarily mean that the model predicts the sequestration rate right. The sequestration rate mainly emerges from the difference of two large numbers, the sum of NEE and the yield. At least an uncertainty analysis would be needed to get a feeling whether a sequestration rate $<$ 1000 kg C ha-1yr-1 is within the uncertainty range.

The runs over 10 crop cycles show in the average a large discrepancy of the sequestration rate. The Rafidin site shows an almost constant high sequestration rate over the 30 years that amount to a net increase of 21 tons C per hectare, roughly a 50% increase of the organic C content in the top soil at that site. What was before this period? Did the model started from an equilibrium state and how was this found? What was changed in the management, that such an increase in the soil C results? Are there any field evidences from this region that such an increase happens in reality?

The paper reports a specific application of a model that seems rather far off the reality and seems not be suited to describe what the title announces.

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