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Biogeosciences Discussions

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

Anonymous Referee #2

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The paper addresses an important and timely issue, i.e. the net global warming effect (GWP) of agroecosystems. The issue is well described in the Introduction, and justification is provided for the combined assessment of net fluxes of nitrous oxide, carbon dioxide, and to some extent methane. The study attempts to calculate annual GWPs for two different crop rotations at two locations using a biophysical crop model (CERES-EGC) with high temporal resolution at the plot scale. The model was tested against fluxes measured at one (CO2) or both (N2O) sites. Results from these tests reveal fairly good agreement between measurement and model output for CO2 but relatively poor agreement for N2O. The model is then used to estimate soil C sequestration over longer time periods. While the importance of the issue and the potential value of such studies are recognized, there are several important limitations of this particular study.

These are: 1.The test of the model is not done with a sufficiently developed field data base. In particular, test of CO2 fluxes was only possible for one site, and N2O flux measurements were done with manual chambers at one site with infrequent sampling, while automatic chambers were used at the second site. The agreement between measurements and model is found to be poor (page 1070, line 26), in contrast to the Conclusion on pg 1076 (line 18). This is important since at least at one site N2O is a major fraction of the total GWP and an overestimation by 130% (page 1071, line 25) may have a great effect on final outcome of the calculation 2.To estimate SOC changes based on input/output calculations over short periods of time may lead to erroneous results with respect to long-term C sequestration and generally leads to overestimates of this potential. This is exemplified by the results for the 30-yr simulations (Fig. 7) which yield quite high SOC accumulation rates especially at the Rafidin site. There should be more rigorous testing of the model with respect to soil processes involved in soil C turnover, and a critical discussion of the results obtained because the high rates of calculated SOC accumulation at the Rafidin site largely determine the outcome of the GWP difference between sites (Table 1). Clearly, to draw conclusions on soil C sequestration from a short period of measurements of the C balance is not justified. 3.The study lacks an assessment of errors. Final results are given without a measure of uncertainty. However, when systems are to evaluated for their GWP in quantitative terms, the uncertainty is of paramount importance. 4.Finally, system comparisons are often made with Life Cycle Assessment methodologies which require far less parameters than mechanistic models. I wonder if the authors could compare their results with the outcome of simple LCA calculations, for which uncertainty estimates would be much easier to derive. Overall, the present paper is a start but it seems premature to place confidence in the results.

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