Biogeosciences Discussions, 2, S1–S3, 2005
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European Geosciences Union

Biogeosciences
Discussions

Interactive comment on "Greenhouse gas emissions from Indian rice fields: calibration and upscaling using the DNDC model" *by* H. Pathak et al.

Anonymous Referee #1

Received and published: 25 January 2005

This paper deals with greenhouse gas emissions from Indian rice fields. The authors modified the widely used DNDC-model and calibrated it with data from irrigated rice fields near New Delhi. The model was linked to a GIS and used to calculate the annual methane emission from all major rice ecologies of the Indian subcontinent.

The model: (i) As I understand from the ms, the model treats nitrification as an aerobic process that stops once a soil is becoming anoxic after flooding. This is not entirely true: nitrification can occur in the rhizosphere where oxygen is leaking from the roots into the soil. This nitrification is tightly coupled to denitrification in the surrounding anoxic bulk soil and may be a potential source for N2O. (ii) The model does not include methane oxidation. Methane oxidation is subject to other controls than methane production and may display different seasonal patterns in different rice ecologies. (iii) The

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most severe deficit is the lack of an iron-reduction routine. The amount of iron may differ largely between different soils, and evidence is increasing that reducible iron is the major control of methanogenesis e.g. after an intermittent drainage.

Calibration and validation: Maybe I missed it, but the modified DNDC model seems not to be validated. As a minimum requirement, the model should been validated against data from other irrigated rice fields that have not been used for calibration. However, it would be much better to use data from the other major rice ecologies as well.

Other models: A comparison to process-oriented models like that by Walter (Walter and Heimann, 2000; Bogner et al. 2000) or van Bodegom (van Bodegom et al. 2000; van Bodegom et al. 2001) would help to understand better the specific power as well as the limitations of the modified DNDC model. Similarly, the regional estimates in other major rice growing areas should be mentioned. Bachelet and Neue and Matthews et al. have made important contributions, but they are definitively not the only authors calculating regional estimates (p. 4).

Various: On p12, the authors attribute the relatively low methane emissions from Indian rice fields to the high percolation rate in sandy loam soils that allows to leach dissolved organic carbon (DOC) to deeper soil profiles. Is this process really neutral with respect to GWP? Or is this DOC mineralized in the aquifer and emitted later to the atmosphere? If true, it would be a spatial separation between primary production in the rice field and the resulting GHG emission, but the overall balance might become more similar to other rice ecologies.

Reference List

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Interactive comment on Biogeosciences Discussions, 2, 77, 2005.