Biogeosciences Discussions, 2, S117–S123, 2005
www.biogeosciences.net/bgd/2/S117/
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.

H. Pathak et al.

Received and published: 1 April 2005

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

Anonymous Referee #2 Overall comments: This paper deals with calibrating the DNDC model to estimate GHG emissions from rice fields in India, and upscaling the model estimates. It is an interesting paper that warrants publication, however, there are quite a few minor corrections that could be made to improve the paper. The number of significant figures seems unreasonable in most instances. A more detailed section on the evaluation of the model is warranted (section 3.1). Additionally, an estimate of the uncertainties in the GHG estimates would be very interesting. Some discussion of uncertainty was brought up in the introduction, and a presentation of some of these calculations would be appropriate.

Full Screen / Esc

Print Version

Interactive Discussion

Discussion Paper

Response: The number of significant figures has been made consistent through out the text. The evaluation section (section 3.1) has been elaborated. The uncertainties in the GHG estimates have been discussed in the revised manuscript.

Specific Comments: Page 82: Line 7: "Adequately capture" doesn't inform the reader well of what the specific problem is. Only after reading further do I assume it means that DNDC was overestimating the CH_4 fluxes since it was not leaking out DOC and substrates with the excess water.

Response: The sentence has been reworded as "Originally the CH_4 fluxes simulated by the model were higher than the measured fluxes in some rice paddies in India (Pathak et al., 2003)."

Page 85: Section 3.1 - Evaluation of the model Table 1 shows very good agreement between Observed and Simulated results. Were different datasets used to calibrate, and test the model? It would be interesting to see how the timing of simulated and observed emissions compare. It has been our experience that DNDC does well at estimating the annual emissions but can sometimes lag in the timing of specific events with respect to N_2O emissions. The inclusion of a such figure would be very interesting. Additionally, I would put more importance on a figure detailing simulated emissions vs measured emissions than Figure 2 and 3, which only show simulated results.

Response: Different datasets were used for calibration and testing the model. However, similar to the experiences of the reviewer, the timing of fluxes did not match well but the model very well predicted the annual emissions. Comparison of daily simulated and measured fluxes has been illustrated in the revised manuscript. In the present study our goal was to upscale the emissions of methane and nitrous oxide to regional level with much broader variations in soil, climate and management on annual basis. As the specific timings of the fluxes are dependent upon daily events of weather and management, they are highly variable over a region. Therefore, good prediction of annual emission will serve the purpose to a large extent. However, work is in progress to fine tune the model to improve the prediction of the daily flux events. These points have been discussed in the revised manuscript.

Page 87: The initial peak in N2O emissions at the beginning of the year has no corresponding peak at the end of the year (Figure 3). Is this initial peak a one-time emission event, or is it an annual emission event? N2O emissions (Figure 3) between JD 150 and 200 are very sporadic. If these fields are continuously flooded, it is unclear how rainfall and flooding events (Line 6) could have influenced this to produce sporadic emissions. A more detailed section on simulated N2O emissions is merited.

Response: This initial peak is one-time emission event. The sporadic emissions were the result of fertilizer (urea) applications. The sentence has been corrected as "Subsequent peaks corresponded to fertilizer application events, which supplied substrate (NH4+) for nitrification and NO3 for subsequent denitrification in aerobic microsites." Simulated N2O emissions have been discussed in detail in the revised manuscript.

Technical Corrections: Page 78: Line 1-2: the first sentence in the abstract could be dropped.

Response: OK

Line 17: Not clear by what is meant by "GHG related issues"

Response: "GHG related issues" meant emission of GHG from soil as well as the influences of agronomic management, soil and climatic parameters on the emissions. However, the sentence has been modified as "The study suggested that the model can be applied for estimating the GHG emissions and the influences of agronomic management, soil and climatic parameters on the GHG emissions from rice fields in India."

Page 79: Line 3: (rewording suggestion): are the key greenhouse gases (GHG) that contribute towards global warming at 60, 15 and 5% respectively.

Response: OK

BGD

2, S117–S123, 2005

Line 6: should use a more recent reference

Response: OK

Line 8: GHG emission from soils

Response: OK

Page 80: Line 2: (rewording suggestion) model but did not simulate N2O or CO2 emissions.

Response: OK

Line 3: (rewording suggestion) Other models however do simulate the entire set of greenhouse gases, DayCent (Parton et al., 2001), DNDC (Li, 2000)

Response: OK

Line 5: the models have not been frequently used for tropical regions.

Response: OK

Page 81: Line 12: the parameterization

Response: OK

Line 14: and variations in climate and soil properties.

Response: OK

Page 82: Line 5: improved the model's ability to predict rice crop yields in India.

Response: OK

Line 18: The experiments were conducted at the

Response: OK

Page 83: Line 13: Model sensitivity was evaluated for changes in the application rates

BGD

2, S117–S123, 2005

Interactive Comment

of N fertilizer and irrigation on rice yields and GHG emissions using the baseline

Response: OK

Page 84: Line 9: It was decided that since much of the statistical data was district based that districts should be chosen as the basic geographic unit of the database to maintain

Response: OK

Line 18: rainfed lowland rice systems simulations were done

Response: OK

Page 85: Line 13: 3.2 Sensitivity analysis - Section header might be able to be shortened to just Sensitivity analysis . Table 2 lists the sensitivity analysis as including manure applications but it is currently not included in the section header.

Response: OK

Line 15: Different application rates of N fertilizer significantly

Response: OK

Line 17: Emissions of CO2 (sentence needs to be reworded as it is currently awkward to read)

Response: The sentence has been reworded.

Page 86: Line 20: Should quantify the emissions. Smaller than other countries does not inform the reader very well.

Response: The methane emission values have been inserted.

Line 21: 4.2 M ha (Check decimal places and be consistent)

Response: OK

Page 87: Line 4: 112.3 g ha-1 d-1 (not day)

Response: OK

Line 15: The majority of soils in India are alkaline in pH (pH$>$7.5) while soils in

Response: OK

Line 26: In the case of upland rice

Response: OK

Page 88: Section header should be changed from Emission of GHG. Scaling up GHG emissions?

Response: OK

Line 5: 42.25 Mha

Response: OK

Line 8: fields was reduced to Response: OK

Line 9: The intermittent flooding approach

Response: OK

Line 24-25: 106 kg CH4-C (check decimals - 2 decimal)

Response: OK

Page 89: Line 13: the major impacts of water management and various N fertilizer rates on rice crop

Response: OK

Line 17: N2O emission was determined. The tradeoffs that exist between CH4, CO2, and N2O mitigation measures demonstrated the challenge of mitigating GHG emissions when focusing on the biogeochemical cycles in terrestrial ecosystems

BGD

2, S117–S123, 2005

Interactive Comment

Response: OK

Line 21: use “should” rather than “would”

Response: OK

Table 2: Should center column headers and numbers

Response: OK

Table 4: Minimum and Maximum values for N_2O emissions are reversed.

Response: Scenarios for minimum emission correspond to the minimum values of SOC, pH and bulk density and maximum value of clay content of soil while scenarios for maximum emission correspond to the maximum value of SOC, pH and bulk density and minimum value of clay content of soil. Thus, minimum and maximum values for N_2O emissions are related to these scenarios as explained in the footnote of the Table.

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