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Biogeosciences Discussions

Interactive comment on "Quantifying methane emissions from rice paddies in Northeast China by integrating remote sensing mapping with a biogeochemical model" *by* Y. Zhang et al.

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General comments

Overall this paper is clearly-written and demonstrates the use of the DNDC model in combination with satellite images to calculate CH4 fluxes from rice paddies in a high latitude region. The authors need to be a little clearer about what assumptions they used for their regional results (e.g. climate year and management practices). Some other minor points are addressed in more detail below.

Response:

The authors highly appreciate the anonymous referee for his/her time in reviewing this Discuss. paper. The authors have seriously considered and addressed his/her valuable comments by point-to-point responses in the following context. Revisions will be made in the revised manuscript.

1. Model validation tests

Table 2: this would be less confusing if each of the different treatments (C04-N60, C04-N150, C06-N150) were listed as a separate row or column.

Response:

According to the referee's comments, we will adjust the structure of Table 2 in which three treatments (C04-N60, C04-N150, C06-N150) in the validation sites will be separately listed in the revised version.

It would be good to include either the formulae or a brief description of the "goodness of fit measures" RMSE, EF and CD so that readers know something about what they measure, what values indicate a good fit, and what the differences between them are

Response:

Thanks for the advice, the authors will add the detailed depictions of three "goodness of fit measures" RMSE, EF and CD, and their implications that those values indicated. Please check the revised version of this manuscript.

Page 392, lines 5-16: these are actually results rather than methodology and should be moved to the results section

Response:

Thanks for the referee's suggestion. we have moved these sentences to the Results section in the revised manuscript.

Figure 2: What are the "P" values printed on the graphs? It seems unlikely to be the

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usual definition of p (the probability of finding such a trend in uncorrelated data). For example, Fig a2 has R2 = 0.872 and P=0.972, which doesn't make much sense

Response:

The "P" means possibility in the Paired t-test. In the validation study, the significance test of difference in between modeled and observed CH4 fluxes showed that all "P" values (0.972 for C04-N60, 0.646 for C04-N150 and 0.290 for C06-N60) of three treatments are far larger than 0.05. It means that the differences in modeled and observed values are not significant at confidence level of 95%, and further indicated the DNDC model is capable of capturing the seasonal patterns as well as the magnitudes of CH4 emissions. The explanation of "P" will be added to the revised version.

2. Regional Database

You state that "detailed management practices on rice cultivation were investigated by communicating with local agronomists and farmers". What management practices were used for the regional simulations? Table 6 quotes results for C04-N60 and C04-N150 which were the management practices used in the validation study. Were the same management practices used in the regional simulation? Were all farms considered to use the same management practices or were there regional variations?

Response:

The management practices (tillage, flooding regime, rice planting/harvesting time, etc.) used in the validation sites is very similar to the practical cultivation practiced in ambient paddy field, except for the N-fertilizer application rate. Therefore, for the regional simulation at 3 simulation scenarios (C04-N60, C04-N150 and C04-N150), we adopted same management practices used in the validation study. These complementary sentences will be added into the revised manuscript. As a matter of fact, it is impossible that same management practices were used by all farms in this study area with rice area of $\sim$1.5 million ha. It is also infeasible to investigate the practice information form

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every farm such an expansive region. Furthermore, there is small population of farmer whom owing a large amount of agro-lands in the study area where modern cultivation managements are very normally practiced. Generally speaking, unlike the South China, only single season rice were grown in the Northeast China, and the management practices are relatively identical within the study region. The indistinctive differences in rice cultivation practices make less variation in CH4 emissions from rice paddy in this study area, which has been showed in sensitivity tests of environment factors driving CH4 emissions (Fig. 3). The major objective of this study is to quantifying and mapping CH4 emissions from rice paddy at high latitude region with assumptions of identical management practices used in the study area.

3. Results

Page 396, lines 3-8: this section would be better in the Discussion

Response:

The authors appreciate the referee's comments on those sentences depicted the changing factor and trends of rice area in the study area, which will be moved to the "Discussion" section.

Page 396, lines 13-14: the results you quote here are the minimum from the C04-N60 and the maximum from the C06-N150. This is a bit strange as you are combining two simulations with different management practices and climate data. You need to state clearly what you are trying to calculate. Is it the emissions for the province for a particular year? A long term average? What assumptions are you making about management practices?

Response:

The authors highly agree with the comments of the referee, they were surly confusing expressions. The range of total emissions will be separately calculated corresponding to specific treatment (i.e. management practices assumptions and climate context) for

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each simulations in 2004 (C04-N60 and C04-N150) and in 2006 (C06-N150). This regional stimulation was made on the assumption that same management practices were used for rice cultivation in 2006. Also see the responses for "Regional Database" section. Extensively modifying will be taken in the revised "Results" section.

It would be nice to include some context for the total CH4 emissions you found. How do they compare with IPCC estimates? How do the emission rates compare with DNDC simulations in other regions?

Response:

The simulated regional average was 381 to 387 kg CH4-C/ha/year in 2004 and 416 kg CH4-C/ha/year in 2006, which was far higher than that (114–138 kg C/ha/year) observed in the Southeast China such as Taihu Lake region. And also, it was almost double the default emission factors suggested by the IPCC guidelines (200 kg CH4/ha/season). However, our simulated results were lower than that estimated emissions in Central Plain of Thailand (450 kg C/ha/year). In this simulation study, high CH4 emission rates was mainly attributed the high SOC content in rice soils (averagely 0.31 kg C/kg soil) in combination with the assumption of continuous flooding in the study area.

Figure 5: there is no legend explaining the colour codes used for each county in Figures 5(a)-(c); Page 397, line 18: "Statistic results", should be "Results"; Page 397, line 19: Figure 5(d) is not labelled.

Response:

Sorry for our ignorance, the authors edited some original fault: modifying the subtitle "Results", adding the legends for the case of C06-N150 (other case maps were deleted) in Fig. 5 of the original manuscript. Otherwise, we added a label for the original Fig. 5(d) (should be Fig. 5(b) in the revised manuscript).

It could also be interesting to look at counties on an emissions/ha basis as well as just

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the total emissions.

Response:

Thanks for the referee's comments. what the authors understand is an average emission in each county is required to estimate (i.e. total emissions is divided by the total rice area of one county). Note that the average emission is very different from the emission rates at county scale which has been extensively used in past studies for CH4 estimation at regional or country scale. Owing to the lack of high-resolution inputs needed by model, researchers have to utilize the average of climate, soil properties and management practices information in the county to estimate its average or total emission (one inputs for one county), without taking account of the emission variations within one county dimension. In our study, we improved the spatial resolution of CH4 emissions to 10 km*10 km grid. And then, the total county emission calculated by the grid emission. Thus the estimation should be more accurate than that in previous studies. We may add the average emission map for each county in the revised manuscript though it makes no much sense.

4. Discussions

Page 398, lines 13-14: the range of results obtained were not simply due to variation in the MSF (Most Sensitive Factor) soil properties. There were also differences in the climate and management practices assumed in the different simulations.

Response:

The authors agree with the referee the factors driving emissions are complicated. For each specific simulation among C04-N60, C04-N150 and C06-N150, we assumed the general (or average) management practices were identical cover the entire study area. The differences in total CH4 emission of 2004 and 2006 (or named temporal variation) mainly are attributed to the climate context and management practices, while the spatial variations in emissions for a specific treatment were primarily due to the Most

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Sensitive Factor (MSF) soil properties (i.e., soil texture and SOC content). The climate condition are not homogeneous cover the entire study area but very similar so that its effect on CH4 emission rate is negligible. We will add the analysis and explicit explanation on the range of emissions to the revised manuscript.

5. Minor edits

Page 386, line 4 use “climate” rather than “weather”; Page 387, line 9 change “In the perspective” to “From the perspective”; Page 387, line 12 delete “evidently”; Page 387, lines 16-17, place commas after “rice cropland” and “(Frolking et al. 2002)”; Page 389, line 17 “upscaling” misspelt; Page 390, line 18: change “dominatingly” to “predominantly”; Page 395, line 16: change “grad” to “grid”.

Response:

Thanks for the referee’s corrections in rhetoric and word-building, we have seriously checked in the original manuscript and corrected the misuse and misspell of some words in the revised version. Otherwise, the word “upscaling” is right, it’s widely used in scientific literature.

Interactive comment on Biogeosciences Discuss., 8, 385, 2011.

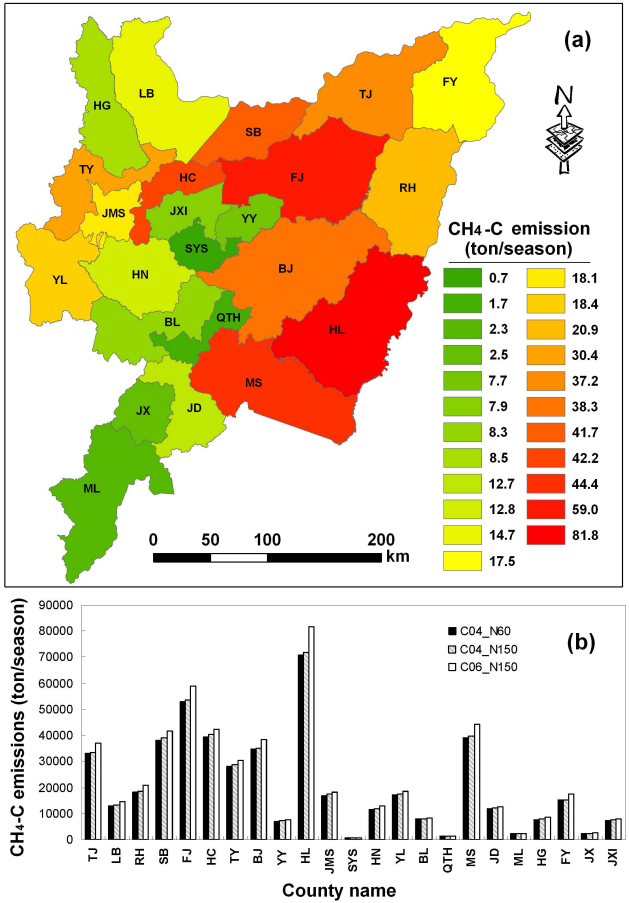

Fig. 1. Fig.5_revised

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