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Biogeosciences Discussions

Interactive comment on "Use and uncertainty evaluation of a process-based model for assessing the methane budgets of global terrestrial ecosystems" *by* A. Ito and M. Inatomi

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Dear reviewers and editor:

We appreciate your helpful comments on our manuscript submitted to Biogeosciences. The previous manuscript was revised on the basis of open discussion including comments from the reviewers. Major points of this revision are as follows: (1) A number of recent publications were included on the basis of the comment from reviewer-#2: Riley et al. (2010, Biogeosci.), Wania et al. (2010, Geosci. Model Dev.), Ringeval et al. (2010, GBC), Petrescu et al. (2010, GBC), Neef et al. (2010, GBC), Bloom et al. (2010, New Phytol.), Martinson et al. (2010, Nat. Geosci.), Kai et al. (2011, Nature),

Patra et al. (2011, Atm. Chem Phys.), Dlugokencky et al. (2011, Phil. Trans. Roy. Soc.), Bastviken et al. (2011, Science), Spahni et al. (2011, Biogeosci.), Hodson et al. (2011, GRL), and Lassey et al. (2011, Tellus). Thus, we tried to catch up with the latest achievements in the research field. (2) We re-considered the number of combinations of the estimated specific CH4 fluxes from 576 to 786 by adding one more paddy filed emission value estimated by the Cao's scheme. As a result, total terrestrial budget and figures of frequency distribution (Figure 3) were revised. (3) We added discussion on the uncertainty estimated by the model on the basis of the comments from reviewer-#2. In general, we agree that the opinion that the present analysis underestimated the true range of estimation uncertainty. Therefore, we explicitly stated this point as a limitation of this study, and suggested that further analyses including parameter uncertainty are required.

For each of the general and specific comments, we reply as shown by the following. We hope this revision is satisfactory for acceptance.

Reviewer #1 Comment: This manuscript represents a very useful study of evaluating different existing schemes and parameterizations to estimate different components of the global methane budget along with their uncertainties. The schemes considered by this study are the major schemes that have appeared in the modeling literature in the last 15 years, and it is very helpful to see them compared. In general, the manuscript is well organized and well written. However, there are some awkward phrasings that need revision (see my comments below). Also, there are a few things that need clarification (see my comments below). Reply: Thank you for your encouraging comments. We surely revised "awkward phrasings" pointed out by your specific comments (below).

Specific Comments Comment: (1) Page 7035, sentence from line 14 – 16. Awkward wording. Perhaps revise to: "Also, aerobic emissions of CH4 from plants (Keppler et al., 2006) is arguably an influence source of CH4."

Reply: Modified as suggested.

Comment: (2) Page 7035, line 24: Change “premature” to “immature”.

Reply: Revised as suggested.

Comment: (3) Page 7036, line 12: Change “simulates” to “simulate”. Reply: Revised as suggested.

Comment: (4) Page 7037, lines 1-2: Change “difference” to “different”. Reply: Revised as suggested.

Comment: (5) Page 7037, end of sentence at beginning of line 10: Should this sentence end “industrial) emissions.”? Note that some people would consider “livestock” emissions to be anthropogenic.

Reply: We added “emissions” after “(urban and industrial)”.

Comment: (6) Page 7038, line 6: Change “coupling with climate model” to “coupling with a climate model”.

Reply: Revised as suggested.

Comment: (7) Page 7045, sentence on lines 14 and 15: I’m not sure what you mean by “are among the largest in the terrestrial biosphere”. Largest of what? Largest “source” of emissions. At 15 – 27 Tg C per year in your estimates, it is about 3-7% of total emissions including anthropogenic sources. Maybe just say that it is a “non-trivial source”.

Reply: We revised this part as “a non-trivial source from the terrestrial biosphere”.

Comment: (8) Page 7047, line 17: I don’t understand where “576 different combinations” comes from. I came up with 512 different combinations.

Reply: In this revision, we got 768 different combinations: 3 wetland sources $\times$ 4 paddy field sources $\times$ 2 fire sources $\times$ 2 plant sources $\times$ 2 livestock sources $\times$ 2 termite sources $\times$ 4 upland soil sinks (see Table 1).

Comment: (9) Page 7048, line 3: Change “We estimated the global terrestrial CH4 budget” to “We estimated components of the global terrestrial CH4 budget”.

Reply: Revised as suggested.

Comment: (10) Page 7048, line 4: Change “summarized” to “summarizes”.

Reply: Revised as suggested.

Comment: (11) Table 1 legend: Change to “Comparison of components of the global CH4 budget for terrestrial ecosystems (Tg CH4 yr-1) between the different simulations in this study and estimates from previous studies.” Also, I was confused by Potter et al. scheme for wetland sources in Table 1, but I see that the other review has noted that absence of reference to the Cao et al. scheme.

Reply: Revised as suggested. The latter error was pointed out by V. Arora in the open discussion (Biogeosciences Discuss., 8, C2157–C2158). We replaced “Potter et al.” by “Cao et al.”.

Comment: (12) Page 7048, sentence from lines 22-25: You shouldn’t call the 350 and 30 Tg CH4 per year, the “estimated global CH4 budget”. Also, these numbers don’t really appear in Table 1, so Table 1 is not appropriate to cite here. Or add some lines to Table 1 so that the 350 and 30 Tg CH4 can be compared.

Reply: We removed the citation of Table 1 here.

Comment: (13) Sentence spanning pages 7048 – 7049: Change to “A key uncertainty found in this study is associated with the available wetland and inundation maps, in which estimates were different by more than 20 Tg CH4 yr-1 (Table 1).”

Reply: Revised as suggested.

Comment: (14) Page 7049, sentence spanning lines 4 and 5: Suggest that you change this sentence to “This difference suggests that it is important to accurately delineate the location of wetlands to more accurately estimate their contribution to global CH4

emissions".

Reply: Revised as suggested.

Comment: (15) Do Figures 7 and 8 cited on page 7050 depict the baseline simulation? If so, please indicate in the table legend.

Reply: In the legend of Figures 7 and 8, we mentioned that they show results of the baseline simulation.

Comment: (16) Page 7050, line 24: I think that "buffalo" is plural, and that "buffaloes" is incorrect. Also, I'm assuming that this refers to water buffalo. If so, it would be good to be explicit so as to not confuse with North American buffalo (i.e., bison).

Reply: We replaced "buffaloes" by "(water) buffalo".

Comment: (17) Page 7051, end of line 10: Change "increases" to "increased".

Reply: Revised as suggested.

Comment: (18) Page 7051, second half of sentence spanning lines 18 – 21: The meaning of "further studies at both biogeochemical and socio-economical dimensions" is unclear. I think you could end the sentence after the citation to "(Archer et al., 2009)" and that would be fine.

Reply: Revised as suggested: "The feedback would be accelerated by additional emissions from permafrost melting and methane hydrates (Archer et al., 2009; O'Connor et al., 2010)."

Comment: (20) Page 7051, line 24: Change "in the estimation schemed used and the input data" to "among the different estimation and parameter schemes".

Reply: Revised as suggested.

Comment: (21) Page 7051, line 25: Delete "Fortunately,".

Reply: Revised as suggested.

Comment: (22) Page 7052, sentence spanning lines 6 – 8: Change beginning of sentence to "However, it should be noted that several sources were not accounted for in this study, namely emissions from mining, landfills, wild ruminants, : : :".

Reply: Revised as suggested

Comment: (23) Page 7053, sentence spanning lines 3 and 4: Change to "It is difficult to constrain and validate large-scale models because observation-based estimates of CH4 emissions at these scales is very uncertain."

Reply: We revised concluding sentences by including suggestion from reviewer-#1.

Interactive comment on Biogeosciences Discuss., 8, 7033, 2011.

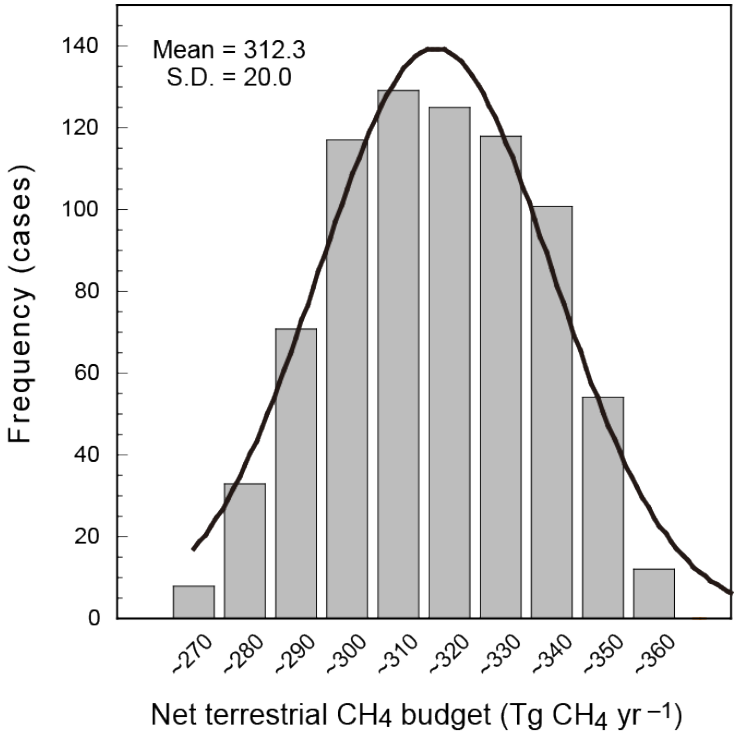

Fig. 1. Revised Figure 3