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Biogeosciences Discussions

Interactive comment on "Carbon budget of tropical forests in Southeast Asia and the effects of deforestation: an approach using a process-based model and field measurements" *by* M. Adachi et al.

Anonymous Referee #2

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The simulation results may be valuable information for those, who examine the impact of land-use changes particularly in Malaysia, where forests have rapidly changed into oil palm plantations since 1990's. The reviewer, however, thinks that the interpretation is still inadequate throughout, and that they should understand the impact of both input data and the procedures of calculation on model output thoroughly. Then their comments will be more appropriate in Results and Discussion. Also, please explain the model outline with a new figure and show the design of numerical simulations accurately in Materials and Methods. Therefore, the manuscript needs much-revise.

Detailed comments: P3054, L26, A clear-cut in 2001 and replanting in 2002: The simulated carbon stock and flux don't seem to include the processes in Fig. 4. But the comments are not found.

P 3055, L21-23: Although it explains how to decide the initial conditions of C stock, I think it is not sufficient. I want to know whether the balance of C input and output in an ecosystem at each site is almost maintained under the initial conditions and climate conditions. Figures 3a and 3b shows the C stocks are gradually increasing. This indicates that C input remains beyond C output instead of mature forests. The readers may feel that the initial conditions were decided so that the simulated results can agree with observations (Table 4).

P3055, L24&25: The authors stated the ecosystem structure of the C stock is four sectors (i.e., tall canopy, understory plants, dead biomass and mineral) in the model. But simulated results in Figures 3 and 4 show the different sectors (i.e., aboveground biomass, belowground biomass, tree biomass under the canopy, etc.). The relationships among these sectors should be described in the methods before Results. Also, the authors should explain the model overview and the sectors of C stock, showing a figure of the model concept.

P3056, L14, "production of woody and root debris": This should be "residual (or leaving) woody and root debris"?

P3056, L19-23: I could not understand the sentence, "40% and 27% of total biomass C . . . within the 1st and 10th year, respectively", when I first read it. After I read McGuire et al. (2001), I understood it. Please describe it clearly and concretely as McGuire et al. (2001), with showing the above-mentioned figure. Also, these values of 33 40, and 27 % don't seem from McGuire et al. (2001) but originally from Houghton et al. (1983).

P3057, L4-7: Are they, in "they are harvested from 10 yr of age", leaves or/and fruits? A reference on this management of oil palm plantations should be needed. Or is it assumption in the model? Please explain it clearly.

BGD

8, C1397–C1401, 2011

Interactive Comment

P3057, L11-13: The authors changed the parameters from evergreen forest into oil palm plantation after clear-cut. It is clearly stated in P3063, L16&17 in Discussion, but it should be already stated here. I wonder why the ratios of both sand and clay contents change after a clear-cut or planting oil palm. If any, please make comments about the changes.

P3057, L26&27: Here, reanalysis data in precipitation and temperature in reanalysis are shown in Fig. 2. There are different from the annual precipitation and temperature by site-observations shown in Site description. In particular, the annual values of precipitation are much larger than site observations. The authors should point out the differences here. They have to consider the impact of these input data on model output in Discussion.

P3058, L19&20: Simulated seasonal change in RF seemed to depend on the input data of soil temperature rather than precipitation in DEF, as the timing of peak (around April) is similar to that of air temperature (Fig. 1a). Please check this point and the procedure in model.

P3058, L20, "Fig. 3c,f": It is "Figs. 3c - f"?

P3059, L4&5: I wonder why the authors can state it. The comment seems not suitable in Results. Here, they should interpret the simulated results in Fig. 4 etc. in detail and objectively.

P3059, L5-7: The topic on the model sensitivity is abrupt. The design of numerical experiments should be described in Materials and Methods.

P3059, L9&10: The key factor is the amount of residual debris rather than the proportion of residual stem debris in the model, since the decomposition rate of the debris after a clear-cut is same instead of leaves, stem and root debris (see P3056, 24&25).

P3059, L27, "lower": It is "higher"?

P3060, L1, Fig.4: The design of the numerical simulation should be described in Mate-

BGD

8, C1397–C1401, 2011

rials and Methods. This numerical simulation doesn't consider the process of a clear-cut in 2001 and planting in 2002.

P3060, L9, Fig.5a: Fig. 5a shows both simulated and observed soil respiration (SR) in the oil palm plantation in 2000 - 2004. Does the simulated SR consider a clear-cut in 2001 and planting seedlings in 2002? But the authors don't state this point clearly. The measured RS following the clear-cut was the lowest, and I feel the clear-cut reflected RS.

P3060, L16&17: I feel that this attributes to the difference in saturated volumetric water content among measurement points (i.e., soil-sample points and soil-water-content measurement points). For soil properties are not vertically and horizontally homogeneous, even although the distance is very near. Rather I am concerned about the larger seasonal changes in simulated RE soil water content in 2003 – 2005. The input data of precipitation may have larger seasonal changes than that of precipitation by site observations, as Fig. 1b. Please check it.

P3060, L19 – 21, (a): I think the GPP simulated with VISIT don't capture the seasonal changes by Tera, in particular in 2004 - 2005. The reason is needed in Discussion.

P3060, L19 – 21, (b): The largest difference of RF-GPP between Aqua and Tera seems probably due to the short distance between OPP and RF, although the reason is stated in Discussion.

P3060, L19 – 21, (c): Simulated GPP in OPP shown in Fig. 6 appears to consider the processes of a clear-cut in 2001 and planting oil palm trees in 2002. Please describe it clearly in Materials and Methods.

P3061, L5: Please add "(Table 4)" after "Southeast Asia".

P3061, L6 – 16: The precipitation and temperature data (maybe, solar radiation) is different between reanalysis and site-observation as I mentioned. The modeled results may be close to observed ones (Table 4), because the difference might influence model

BGD

8, C1397–C1401, 2011

output.

P3062, L10: “Litter” ?

P3062, L12-14: The sentence is not consistent to that in P3058, L19&20.

P3062, L25-28: I wonder how the value of maximum photosynthesis rate of oil palm is decided in Table 1. It needs a reference. This agreement of above ground biomass (Table 4) between model simulation and observation is maybe due to the parameter tuning, I think. Dufrene and Saugier (1993) reported that the value was 20 micro-mol /m2/sec, which is higher than that in the model (Table 1). Dufrene and Saugier (1993) also stated that the photosynthesis reduced with frond age in the Abstract. (Because I have to purchase the paper to read the all content, I read Abstract only.) They might state that the reduction was not significant in the result/ discussion as the authors stated. Also please check it.

P3063, L19 & 20: Please show the carbon loss per area and the area of deforestation used to estimate the value of 1.47MtC. The calculation should need the processes of both the clear-cut in 2001 and planting seedlings in 2002 although it is not stated clearly. Therefore, the authors can fill up the values at all “nd” in OPP site in Table 4. The values will be variable information.

P3071, Table 3: I wonder how the both maximum and minimum air temperatures and cloud cover are used in the model. Does the cloud cover influence downward long wave radiation, and both direct and indirect downward shortwave radiations? The both maximum and minimum air temperatures influence physiological condition?

P3076, Fig. 3: Please the difference among different colored areas in Fig. 3a and b as captions in Fig.4.

Interactive comment on Biogeosciences Discuss., 8, 3051, 2011.