

Interactive comment on “LPJmL4 – a dynamic global vegetation model with managed land: Part I – Model description” by Sibyll Schaphoff et al.

Anonymous Referee #1

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Dear authors

The manuscript "LPJmL4 - a dynamic global vegetation model with managed land: Part I – Model description" is suitable for Geoscientific Model Development. This model could contribute the broader science including earth system modeling, climate science, atmospheric chemistry and so on. Authors tried to make new version of LPJmL model for global carbon, water, and energy cycling. I agree this model is quite important tool to assess the anthropogenic activities in global C cycling. The manuscript is well written and model is enough described even in the current version. I appreciate all efforts to describe such big model. Honestly speaking, I'm sorry that I cannot follow all of the topics and processes implemented in this model. So, perhaps, I overlooked fatal errors

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in mathematical formulations in this text.

From the view to description paper in GMD, I can almost recommend acceptance for the publication. However, some points are needed to improve in the model description before the publication .

Major comments

I don't have any strong objection for this data processing and the products. Another concerns are as follow;

Summary table Please add tables for the inputs (and outputs) variables of LPJmL4.

Mathematical expression If possible, in equations, please use italic font for the parameters and roman font for inputs and predictive variables. Generally, in this manuscript, the mathematical expression is according to this rule. But, some parameters and variables are not (e.g., T_{soil} should be replaced as T_{soil} . H should be replaced as H . t_{fire} should be t_{fire} . Equations for crop model are not entirely followed this rule.).

Parameter and input variables In some parameters and variable, there are no units in the text and SI table (e.g., Γ^* , $[O_2]$, V_m , Michaelis-Menten constants, LA , , SA , H , D , $mort_{heat}$, $n_{h,ig}$, TW_{PFT} , phu , hi_{opt}), even though the author showed some of them in SI table. But, for the readability, I recommend to specify these units in all parameters also in the text, as much as you can.

Figures The letters in the figure are too small to read. Please enlarge all letters in Fig.1–5.

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Individual comments

Introduction A short descriptions of LPJmL (i.e., history of LPJmL model) is needed in this section, even though the detail information in 2nd section and discussion.

L24–26 Could you clarify and add the reference for this sentence? Le Quéré et al. (2015) have just described carbon budget.

L31 SDGs is more appropriate.

L34 No citation in the reference list.

L47 Could you clarify "improve the DGVMs' skills" in the text?

L153 "Celsius degrees" -> "°C"

L152–154 Please add the definition of " n_i (the proportion of bright sky)" among L152–154. To me, " n_i " is confusing with "NI (Nesterov index)".

L152–198 "1 and 1 m depth" -> "1 and 2 m depth"?

L233 Are there any reference for sublimation rate of snow.

L360–361 Are there any reference for the growth respiration parameter r_{gr} .

L448–449 Please add the equation for new sapling rates, here.

L445–449; Establishment I can't understand the rate of establishment. Is this "per month (day)" or "per year"? If "per year", which seasons are new saplings introduced in each grid cell.

L454–460; Background mortality Same as above. Which timings are plants died in the model? Is this uniform rate during a year?

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L466–469 Are there any reference for the heat damage function?

L679; Eq 82 Why lai_{inc} don't have time step subscription t ?

L713–716 Are there any reference for the fast and slow fraction of the residue?

L731; Eq 93 I guess that a significant figure in coefficients of Eq. 93 is too much.

L786–790 Please clarify the units in parameters.

Eq. 117 and 119 There is no definition of W_{fc} in the text. Perhaps, just after the "field capacity" in L919 is appropriate insert place for W_{fc} .

L975 "changes in soil water and soil carbon are computed separately". How to deal spin-up period among different stands (especially between crops and natural vegetations).

L1010 I cannot understand the meaning of "In order to simulate a reasonable global distribution of temperate and tropical regions". For??

L1014; SI-Fig. 3 Please clarify the climate data used for making this map (CRU TS?)?

L1013–1019 Is this definition appropriate also in the projection period?

L1207–1214; Fig 5 These results and figures are not very impressive and not informative to see model performance. At least, it is needed to focus the topic (e.g., just see fire dynamics).

L1216–1223 Very interesting information. Could you add citation for some of representative papers in each studies deal ?

Fig 1 Could you highlight major update processes of LPJmL 4 in this figure?

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