Review GMD-2020-436

Dear authors

The topics in the manuscript "CM2Mc-LPJmL v1.0: Biophysical coupling of a process-based dynamic vegetation model with managed land to a general circulation model" could be interesting for the readers in GMD and a central topic in this special issue "The Lund-Potsdam-Jena managed Land (LPJmL) dynamic global vegetation, hydrology and crop model - developments, evaluations and documentation". Authors tried to describe a new earth system model based on climate model CM2Mc coupled with LPJmL. The simulation outputs by the CM2Mc-LPJmL seemed to nicely agree with the previous simulation results in both historical and future period. The current draft is readable. However, I feel that it is not sufficient in describing the model. Therefore, I did not make an acceptance decision in the current draft of the version.

General comments

The major comments are as follows;

1. I understand that creating a new ESM is challenging, but I did not understand what was new about this new ESM compared to the existing ESM. For example, it describes forest fire and permafrost schemes, but it is not clear whether these are new to the existing ESM. At least, there are no results showing any changes due to the introduction of these schemes into the simulation. The significance of new coupling DGVM with an atmospheric circulation model rather than extending the existing "ESM" is also unclear. It would be nice to have more explanation on this point.

2. Honestly, I don't know how much description is appropriate in describing such a huge model. Therefore, this is just a hunch, but I felt that the description of each elemental model was still too small. For example, as a person who deals purely with GCMs, is the description of biogeochemical models sufficient? At least, I can hardly imagine the contents of AM2 model and MOM5 models.

Individual comments

L89–94 It seemed that the limited variables are interconnected

L89–94 I'm not familiar with ESMs. So, for me, it is hard to imagine how a coupler work between models. How do you reconcile the conservation of energy and mass as variables are exchanged between models with different resolutions?

2.1.2 & 2.1.3 Please don't use abbreviations in the section title. Like 2.1.1 or more insightful title is better.

2.2 Same above.

L105 What are the input variables for this component. Please specify them as in L118.

L110 dynamic core of ?

L111 Sorry, what is a C and D grid. Perhaps, it is a very common term in the climate model study field.

L112 What do the tracers mean? What do the dynamics suggests?

L121 LPJmL5 -> LPJmL ver. 5? Please add the citation for this version.

L126 Please summarize all plant functional types in the manuscript or the supplemental material. Although the simulation results are presented in Fig 8, the readers can only reach the abbreviation about PFT.

L131 Which dataset was used for the prescribed land-use input?

2.3.2 Section 2.3.2 should be incorporated into Section 2.2 (LPJmL part).

L174–179 It is better to describe this sentence in the introduction.

L321 Please add the citation for the "historic land-use data from 1700".

L354 Please provide here which variables y_i are evaluated by this metric.

L367: 3.1.1 How about the stability in other variables in other model components such as PFT distribution, C stock in terrestrial and Ocean ecosystems?

L410 Are there any improvement in the CM2Mc-LPJmL output that should be mentioned, compared to CM2Mc-LaD?

L414 & Figure 6 I don't know the manner of climate science, but why do you compare annual precipitation in mm/day instead of mm/year? It is hard to intuitively understand the size of the bias.

L450– There are no information about PFTs in detail. I can see only abbreviation in the legend of Figure 8. So, please add this information in material and method or in appropriate place.

L485 If the results of the comparison with CMIP5 are important, it would be better to include them as a figure in the draft instead of sending them to the supplement.

L587–590 Some of this text could be taken to the intro and explained as to why we are creating a new ESM using the coupler.

Figure 1 Figure 1 is not referred in the text. Are there any exchange between MOM and LPJmL? How about atmospheric pressure between AM2 and LPJmL.