Geoscientific

Model Development

Discussions

[GMDD]

Interactive

comment

Interactive comment on "Downscaling land use and land cover from the Global Change Assessment Model for coupling with Earth system models" *by* Yannick Le Page et al.

Anonymous Referee #1

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[General comments] Authors present in this paper a set of algorithm to spatially down-scale global land use change dataset that is simulated by GCAM, a regional/AEZ-based integrated assessment model, into gridded formats that are more familiar with Earth system / land ecosystem modelers. The basic idea and overview of the down-scaling algorithm are firstly introduced, and then the detailed procedure in the system is explained in source-code level. They execute sensitivity tests of the downscaling system, by applying the system to a historical land use change. Demonstrations of downscaling for future LULC (land use and land cover) scenarios are also introduced, with discussions on the potential applications and limitations of their systems. The algorithm and system introduced here are clearly important, because land use change is

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[Discussion paper]

one of the key issues that make linkages between scenario making, climate projection with the Earth system models, and impact assessments by land/agricultural models. The system introduced in this paper will help to bridge the research works between them. Thanks to the authors' careful descriptions on the downscaling procedure, this paper will help to understand the creation of LULC datasets simulated by GCAM. The system is well designed for general usages of downscaling and being available for everyone. No logical fault is found in this paper, but I think there are rooms to be improved, and they are listed below. Most of them will not require so much effort to improve.

[Detailed comments] p3, L17 "energy demand (biomass crops)" Is "energy demand (bioenergy crops)" more adequate?

P4, L1 "gridded LULC data" It seems better to note that this data is observation-based, not simulated by GCAM.

Fig.2 Figure title is as same as Fig.1, and thus should be changed. Because the figure outlines all downscaling algorithms, I hope enough explanation to be put in the caption. Specifically, readers will read the manuscript more easily if you can put in the caption the linkages between technical words ("reconciliation", "transition priorities", "proximity expansion", etc) and the subsection number: e.g. "land area matching in the reconciliation process is shown in 2.2.2.1".

P5 L8 The subsection number "2.2.2.1" should be replaced by "2.2.2.2".

P5 L10 "cropland PFT" should be replaced by "cropland plant functional type (PFT)", or simply "cropland type". In my thinking, since you have already used three types of categories ("GLTs", "SLTs", and "FLTs") for land types, additional use of "PFT" will make readers confused.

Table 2 and 3: "Final land types (FLTs) for downscaling" looks better for the column title, and it will be helpful for readers if there are brief explanations in the caption on how to read this table.

P5 L29-30 In Fig.2, "transition priorities" and "spatial constraints" are shown, but "treatment order" and "intensification versus expansion ratio" likely not. It will be helpful for readers if you can put the latter two items on the figure.

P6, L7: "Intensification versus expansion ratio" looks better for the title, as you describe in p5, L31.

P6 subsection 2.2.3.4: In my view, the definition of index S ("suitability index"), which first appears in 2.2.4, should be done in this subsection, because readers cannot imagine how the KD, NA, and SW work to constrain the spatial distribution. In addition, NA and SW in eq (3) seem to have units with dimensionless: please specify them in the text.

P8, L2: "see Sect. 1.2.3.2" should be changed to "see Sect. 2.2.3.2".

Fig.3: 1) I found no loop for global grid cells. Does the loop represented by "For each land type" correspond to the loop? 2) I can find the terms "lt1" and "lt2" in the figure, but there is no explanation for them. Do they respectively represent "FLT1" and "FLT2"? 3) The figure title is ambiguous for me, and should be replaced by adequate one?

P9, L23- I'm not sure about the target dataset to which the downscaling method was applied. Did you use HYDE information that was aggregated into regional/AEZ map, and then apply the downscaling algorithm to it? Or have you used historical LULC changes simulated by GCAM? In the latter case, it might be better to refer to the existing work that created the LULC changes.

P10, L18- About initial condition for the projection: Did you use HYDE for base-year-map in 2005? Or MODIS?

P11, section 3.1 I hope to see some description on the score of the metric in the basic configuration run. Although we can see in Fig. 4 the spatial distribution of the result with the configuration, we are not sure how the basic configuration did reasonable job in the metric.

About figure: it seems slight curious for me that we cannot see any comparison of maps between "before downscaling" and "after-downscaling" throughout this paper, although downscaling is the main topic. In my simple thinking, such maps would attract attention from the readers who are not so familiar with integrated assessment models or creation of LULC scenarios, and would visualize the significance of your downscaling work. I propose the authors to put such maps in supplementary materials (or main body).

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