

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 #2

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[General comment]

This paper describes the downscaling algorithm to generate the gridded data from the regional data calculated by the Global Change Assessment Model. After the explanation of the algorithm, methods of the downscaling evaluation and the sensitivity analysis is described, and finally, the result is evaluated.

Downscaling technique is one of a main topic of climate simulation, this paper will be helpful for understanding the concepts and ideas of this technique. Description of the downscaling algorithm and evaluation methods is so detailed and polite that readers can easily understand it.

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But the analysis results seem to be insufficient to show usefulness and advantage of this model. In addition, some more detailed descriptions and modifications seem to be required for better understanding.

[Major comments]

<The result of parameter sensitivity test>

Evaluation of parameter sensitivity summarized in Fig.5 is main topic of this paper. The result, as the author said, is dominated by mainly base year and grid resolution, and sensitivities of other parameters are relatively low. The problem is that, under the default value of base year (1800) and resolution (0.25), the result in Fig.5 can be interpreted that the reproductivity is not so good and this poor reproductivity cannot be improved by changing of any other parameters.

Therefore, I strongly recommend to recompute the parameter sensitivity under the practical base year (1900 or 1950) and resolution (0.25) setting, and redraw the Fig.5 in appropriate color scale without base_year and resolution to show the sensitivity of other parameters clearly.

The author shows only the result of crop, but it seems to be insufficient to insist that the downscaling algorithm is really useful. I think that it is necessary to show the result of other land use, at least, the forest case that strongly affects on carbon cycle.

Author mentioned about results of parameter sensitivities at P11, L19-L23, but this explanation seems to be too simple. A more detailed description is desired after the re-calculation and re-drawing.

<model description>

Model overview is described in section 2.1. But the description is totally insufficient. For example, the phrase “the terrestrial modules” (P2, L28) suddenly appears in the section title. Before this section, the author mentioned about “GCAM” and reader did not be given any information about module structure of GCAM. The phrase “Over the spin-up

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period" (P3, L13) is also the same. The readers not familiar to GCAM cannot prefigure the existence of spin-up period. For better understanding of GCAM and downscaling system, at least, the whole structure of GCAM and the computational flow should be shown in some figures.

<configuration of chapters>

Both downscaling methods and evaluation method are described in section 2. But these methods are essentially different and both are respectively important, and, despite the importance, section number indent seems to be too deep.

Therefore, I think that it is better to separate the description of the downscaling method and evaluation method and summarize the evaluation method and results into new section. Also, model overview is important and is required more detailed description as mentioned above.

As a result, it is preferable to modify the structure of chapters as follows.

before	after
1 Introduction	1 Introduction
2 .1 Overview of the terrestrial	2 Model Overview
2.2 Downscaling method	3 Downscaling algorithm
	4 Evaluation and sensitivity analysis
2.3 Downscaling evaluation and	4.1 method
3.1 Evaluation and sensitivity	4.2 results
	5 Future projections
2.4 Configuration for future projection	5.1 Objective and configuration
3.2 Future land use change scenarios	5.2 results

Authors mentioned that the objective of future projection is to illustrate the capabilities of the algorithm (P10,L18). But this reason seems to be weak. If there is a little more detailed description, there might be more convincing.

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<Introduction>

This is a model description paper, so originality is not required so strongly. But generality of the problem and solution is also important for scientific and technical progress, and should not be ignored even in a model description paper.

The author mentioned that spatial resolution is a technical challenge (P2, L11), but only from this explanation, reader cannot judge how this challenge has generality on climate science. Therefore, I ask a presentation of previous studies and an explanation of more detailed background of this study.

[Minor comments]

P2,L19: Meaning of the brackets (Kraucunas et al., 2014) is not clear.

P2,L31: Correspondence of the brackets is wrong.

P3,L13: Does " (1700-2005)" have a specific meaning? If so , description is required. If not, it is an extra information.

P3,L29: land use and land cover -> LULC

P4,L15-L19: This paragraph should be moved to "Data availability" section.

P6,L16: The code can easily be modified.... If it is so easy, why do not you do so?

P8,L2: Sect. 1.2.3.2 -> Sect. 2.2.3.2.

P24,Table 7: This table summarizes the parameters about a key topic of this paper. So, it is desirable to show all information without omission. Authors should not expect that readers are so diligent as to refer to supplementary material while reading a paper.

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