

Interactive comment on “Calibration and analysis of the uncertainty in downscaling global land use and land cover projections from GCAM” by Min Chen et al.

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This study developed a method to calibrate key parameters in Demeter, a community spatial downscaling model, by using a long-term global satellite-based land cover dataset. The sensitivities of the key parameters and propagation of the uncertainties in the projection were also evaluated. The parameterization in the Demeter is important for a better performance of downscaling land use and land cover data from projection at the regional level. I'd recommend accepting this paper upon some minor revisions.

- We thank the reviewer's positive comments on the importance of this paper. Below we respond the reviewer's specific comments point-by-point.

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1. The section of introduction needs to be improved. The first paragraph discussed multiple topics such as background and motivations. They can be separated as individual paragraphs for readers' understanding. The challenges can also be briefly discussed in the introduction.

- We have separated the second paragraph in the original manuscript into two paragraphs. In the first paragraph of the revised "introduction" section, we introduced the critical role of LULCC in the Earth system science research, followed by the statement of motivation of studying spatial downscaling of LULCC by the integrated Human-Earth system models such as GCAM. In the third paragraph, we added sentences for introducing other spatial disaggregation models as suggested by RC2, and briefly discussed the challenges of determining Demeter parameters. See Line 55-77.

2. Although the Demeter has been published, an overview illustration of this model will be very helpful for readers to understand the work in this paper without reading the Demeter paper.

- We added a figure to provide an overview of Demeter's key processes. Please see Figure S1 in the supplementary materials.

3. As this paper focused on the calibration of parameters, these parameters are important and deserve some explanations. For example, it is not clear what is selection threshold.

- We added further clarifications to the parameters and associated variables. Please see Line 105-106 and Line 115-116.

4. I read the paper in pdf. I found the symbols in the equations do not show up. They are "sum"?

- We have made modifications to the equations to make sure they show up correctly.

5. Figure 7 can be improved regarding readability. For example, some boundaries of AEZ can be removed?

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- We improved the quality of Figure 7 and the related Figure S2-S6 in the supplementary file by reducing the visibility of the AEZ boundaries.

6. Figure 8 can be improved. - We have improved the quality of Figure 8 and made modifications with the results of using “top 10%” parameters as suggested by reviewer 2.

7. Figure 8: I expected the uncertainty will increase monotonously. But for some land cover types, it even decreases after the middle of the century. Any explanations?

- We thank the reviewer identify this problem. We found a mistake in preparing Figure 8. All the uncertainties increase monotonously after the correction.

8. This study is an important contribution to the development of the community spatial downscaling model, Demeter. It is still worth to discuss the limitations and future directions. For example, a set of global parameters were used in the Demeter. Further efforts should be made for the regional level and even AEZ level parameterization, especially with the capability of parallelized computing. The second effort should be made in the future work is the improvement of urban land use. Currently, the performance of urban land use is not good as other land cover types. It could be due to the limited consideration of complex urbanization process as well as the input historical urban data. More spatially and temporally consistent urban extent data can be explored (references: A global map of urban extent from nightlights; A global record of annual urban dynamics (1992–2013) from nighttime lights) in the future research. With some minor revisions, I would like to see this paper published.

- We thank the reviewer’s valuable suggestions. We have inserted a paragraph of discussion on the limitations of current version of Demeter and its parameterization, and pointed out future study directions such as regional/AEZ-level parameterization and improving urban parameterization with satellite-derived urban records. Please see Lines 383-401.

Please also note the supplement to this comment:

<https://www.geosci-model-dev-discuss.net/gmd-2018-248/gmd-2018-248-AC1-supplement.zip>

Interactive comment on Geosci. Model Dev. Discuss., <https://doi.org/10.5194/gmd-2018-248>, 2019.

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