

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.

Anonymous Referee #2

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General Comments: The paper presented a thorough investigation of the sensitivity of a global land cover / land use downscaling model (Demeter) to its six model parameters. The work provides essential foundation for making better use of Demeter, and is worth publishing. From a user's point of view, I would appreciate the following suggested modifications made, which collectively ask the authors to further interpret their experiment results and form actionable suggestions for Demeter applications.

Specific Comments: 1. The authors argued “equifinality” is present with multi-parameter models like Demeter, and presented the optimal setting and top 5% performance setting. It would be useful to see the top few (say, 5-10) “equifinality” parameter

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settings. 2. The manuscript showed attempts to make suggestions for general users of Demeter, but they need to be more specific and explicit to be useful. For example, the ideal weight for soil nutrient is 0 (figure 2), meaning the model is better off without considering this input variable. Then, the implication for Demeter users is that, users don't need to worry if they don't have good input for this variable, and should focus on getting better quality input for variables that the model is more sensitive to. 3. Regional applications of Demeter: The authors stated that different regions differ from the global "average" situation in their own ways, and regional applications of Demeter require "careful" tuning, but provided no further suggestions. Although this paper focuses on a global application of Demeter and global applications are different from regional ones, the authors have learned much about the model's sensitivity, and are better positioned than any user out there to infer what are good starting points (e.g. a range of values to try first, proper sizes of increments when changing values of specific variables) when parameterizing Demeter for regional uses. This doesn't need to be long, but given the authors' knowledge about the topic, even some speculations would be helpful, but they need to be actionable. 4. Global applications: The authors presented the optimal set of parameters for global applications, then made some vague suggestions for (global) modeling tuning. Since the authors' experiment is global, it seems the optimal parameters have been identified for global applications. In what cases would global tuning be needed? And what are good starting points for such tuning? 5. Demeter's residuals show very strong spatial patterns / biases (figure 7). Some explanations about why it occurred and how it may be moderated (if possible) would be useful.

Technical Corrections: 1. The authors mentioned how Demeter compare to other spatial downscaling models, but it came up in the method section. It would be nice to see that in introduction. 2. Many equations are not displayed properly in my copy of the manuscript. Equation (5) especially is not readable at all. 3. Table 1 showing land cover conversion priorities must label whether rows/cols are origin/destination land cover types, because the conversion priorities are not symmetric. 4. Ln 152: "Y is the model outputs (i.e., E)" and the following equation $E(Y|X)$ are confusing. Usually,

$E(Y)$ denotes the statistical expectation of Y .

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

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