Geosci. Model Dev. Discuss.,
https://doi.org/10.5194/gmd-2018-71-RC2, 2018

Geoscientific Model Development Discussions
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EGU

Interactive comment on "The Multi-Assumption Architecture and Testbed (MAAT v1.0): Code for ensembles with dynamic model structure including a unified model of leaf-scale C3 photosynthesis" *by* Anthony P. Walker et al.

Anonymous Referee #2

Received and published: 10 May 2018

The manuscripts presents MAAT, an R-based interface to assess epistemic uncertainty and its sources within and between models. The tool is validated using a simple groundwater model and an application of MAAT is presented using different process representations for the C3 pathway of photosynthesis and stomatal conductance, key components in all land surface schemes for ecosystem and climate models. A modelling tool that serves as a testbed for such an uncertainty analysis is definitely useful. However I have a few comments and criticisms for the present manuscript:

- As far as I understand, MAAT needs all modelling components to be written or

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wrapped in R functions (Please correct if I am wrong and clarify in the manuscript). I am a bit worried that this will need substantial recoding, especially for models written in different languages (e.g. compiled code from C, FORTRAN can be called through R, but what about interpreter languages such as e.g. Matlab). This kind of recoding might be unfeasible if someone needs to perform uncertainty analysis for a specific component of a large model (e.g. land surface model [e.g. CLM], dynamic vegetation models [e.g. ORCHIDEE, LPJ, ED etc.]) that involves several thousand lines of code. Can the authors give more detail on the applicability of their tool? I might be wrong, but it is worth clarifying the limits of applicability of MAAT.

-The scope of the manuscript is to present MAAT. However much more detail is given on the description of the application (C3 photosynthesis, stomatal conductance models). I would expect more detail on the algorithms of MAAT. Details of the models of photosynthesis and stomatal conductance can be presented in a supplementary since anyhow have been presented elsewhere.

-Linking to my previous comment, lines 3-20 in page 10 that describe the key algorithms in MAAT need to be presented more rigorously. A better explanation of the matrices A, B and AB(i) is also needed.

-Since MAAT is a testbed for uncertainty analysis, I would expect a number of uncertainty/sensitivity metrics, similar to the ones presented in Table 2, also for the detailed photosynthesis application. In the present manuscript the authors state that “the purpose of the simulations is to verify the photosynthesis code”, but since this is an application of MAAT it is worth actually presenting the uncertainty/sensitivity results that MAAT can produce. Validation of the photosynthesis functions could be moved to a supplementary file, since I believe this is not the focus of the paper. The authors might want to consider restructuring their results accordingly.

-In several points throughout the manuscript the authors claim that epistemic uncertainty linked to process representation between models has not been treated formally

in the past. There is a big exception in that in climate science related to climate models (see some references), where the literature is vast, especially when it comes to multi-model ensembles. I believe this is worth a discussion point.

References:

Knutti, R., & Sedláček, J. (2013). Robustness and uncertainties in the new CMIP5 climate model projections. Nature Climate Change, 3(4), 369.

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