

Geosci. Model Dev. Discuss., author comment AC2
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Reply on RC2

Robert Schwappe et al.

Author comment on "MPR 1.0: a stand-alone multiscale parameter regionalization tool for improved parameter estimation of land surface models" by Robert Schwappe et al., Geosci. Model Dev. Discuss., <https://doi.org/10.5194/gmd-2021-103-AC2>, 2021

We would like to thank the reviewer for her/his time and effort in revising our manuscript and the provided comments. We address her/his comments below. Reviewer comments are *italic*.

General comment

This paper addresses a key topic for earth system modelling related to the physical parametrization and the associated uncertainties. For land surface models the representation of soil water transfer relies on transfer functions which relate soil texture properties (that can be accessed from soil map at global and regional scale) to the soil hydraulic parameters. As largely documented by previous studies, these transfer functions are important sources of uncertainties which can be related to their calibration and/or their application at coarse grid resolution. This paper presents a new configuration of the Multiscale Parameter Regionalization framework used for soil water parametrization in land surface model and shows its ability and flexibility to generate continental-scale soil hydraulic parameters at distinct scales. The tool is evaluated for the simulation of evapotranspiration flux using two land surface models largely used by the land surface community.

My main concern for this paper, is that most of the content is dedicated to the development of the tool which include a large part of technical and programming components. While this information is of importance for the user community, the scientific part of the paper dedicated to the evaluation of the tool is quite limited. I wonder whether this imbalance between the technical development and the actual scientific outcomes can be a problem for publication in GMD. My main recommendation is major revision to emphasize the scientific value-added of the presented parametrization tool. For this reason, I provide very light feedbacks because I think that the content needs to be modified before doing any additional review.

We use hydrologic models and earth system models to improve our understanding about the earth system. Within our research, MPR is a tool that we want to expand to other models and make available to other scientists. To do so, we need a stand-alone version of MPR in which we can easily change the TFs and upscaling operators. We describe this newly developed stand-alone version in this model description paper. This is the reason why there is a comprehensive technical description in this manuscript. Additionally, we demonstrate how MPR can be applied and that the application of MPR leads to substantial

changes in flux estimates. This is the content of Section 4. In this Section, we show that the new MPR implementation gives the same results as the previous one for the mesoscale Hydrologic Model (mHM). We apply MPR to reproduce soil hydraulic parameters and show that MPR allows to easily obtain results at different configurations. Finally, we apply MPR to calculate parameters for two state-of-the-art LSMs and quantify the impact on long-term fluxes. In summary, this highlights the relevance of MPR. The scientific requirement for MPR has also been exhaustively discussed before with great detail in Samaniego et al. (2017). While interesting scientific questions arise from the presented material, like how to choose TFs for a given parameter and objective, what is the impact of predictor variables on obtained model parameters etc., it has to be clear that there are no scientific questions within this manuscript. MPR, however, allows to ask and answer scientific questions in a rigorous, reproducible way which is the scientific value-added of the presented MPR software. In line with comments from reviewer 1, we will add advantages of MPR in Section 2.3 that should further highlight the scientific value-added.

Specific comments

Section 2: This section is quite atypical for a scientific paper. Part of the content concerning the rationale/motivation of this study (e.g. section 2.3), background information on parameter estimation workflow (section 2.1 and 2.2) should be moved to a dedicated paragraph in Introduction. There are also methodological statements that belong to a method section. The IT details given in 2.2 (e.g. line 148-152) may not be relevant in the main part of the paper, I suggest including them in additional material.

We agree with the reviewer that this is an atypical section for a manuscript. We introduced this section to provide an explicit example that is easy to understand for modellers, a group we would like to address explicitly. Following the advice from reviewer 3, we will move Section 2.4 to the beginning of Section 3. Following your advice, we will shorten lines 148-152.

The current structure of the paper is difficult to read. The data section which is in appendices should be a main section of the paper. Also, a method section is clearly missing. Overall the structure of the paper needs to be improved since sometimes method, model description and results are included in the same section that does not facilitate the reading of the paper.

The data section provides information on the data fields used as predictor variables. They are deliberately moved to the appendix. We believe the information is not essential for understanding the functionality of the MPR tool and it distracts users from the core messages of the results section. The main purpose of the manuscript is the introduction of the MPR tool, not the benchmark of the land-surface models, which are chosen as example. This paper introduces a new software tool. Thus, section 3 is the method section.

The objective of section 4.4.1 is not clear, why comparing the results from both models ? as underlined the models have very different configurations that make their comparison quite hazardous. Maybe I missed the objective here.

We would like to thank you for this comment. We will elaborate more the objective of section 4.4.1 that will be added to the introduction. The objective is to show the use of MPR for model intercomparison studies. MPR enables model comparison studies specifically comparing the use of predictor variables, transfer functions and upscaling techniques in each model. Yet, comparisons can be hazardous, as model parameterizations and forcings can be different. This is the case here, as pointed out by the reviewer. We will explicitly add in the beginning of the Section that it is not the purpose of this Section to provide a rigorous model intercomparison. However, we show

that for the examples of Noah-MP and HTessel, conclusions of the impact of model parameters on long-term fluxes can be made for Noah-MP, but not for HTessel (due its more complex process implementations). Since both models are run for the same domain, we find it essential to discuss the differences between them.

References

Samaniego, L., Kumar, R., Thober, S., Rakovec, O., Zink, M., Wanders, N., Eisner, S., Müller Schmied, H., Sutanudjaja, E. H., Warrach-Sagi, K., and Attinger, S.: Toward seamless hydrologic predictions across spatial scales, *Hydrol. Earth Syst. Sci.*, 21, 4323–4346, <https://doi.org/10.5194/hess-21-4323-2017>, <https://www.hydrol-earth-syst-sci.net/21/4323/2017/>, 2017