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Hydrology and Earth System Sciences
Discussions



# *Interactive comment on* "Do land parameters matter in large-scale terrestrial water dynamics? – Toward new paradigms in modelling strategies" *by* L. Gudmundsson and S. I. Seneviratne

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We thank all five reviewers for their valuable feedback on our manuscript. After carefully working through their comments, we realised that they agree in their most important concerns. We summarise these as well as the resulting improvements of the manuscript in the following:

**1) Title should be revised because no new modeling paradigm per se is proposed**

This is a fair comment, as we realised that our title could be misinterpreted to imply that we are proposing a concrete new paradigm for land surface modelling. Our re-

sults rather highlight that the community as a whole needs to rethink current modelling paradigms (which give a strong weight to local parameters in the context of large-scale land surface modelling). Hence we see our article as a motivation for the whole community to move towards new approaches, and make this point clearer in the revised manuscript (abstract and conclusions). To avoid this misunderstanding we also simplified the title (removing previous 2nd part). The new title is: "Do land parameters matter in large-scale monthly terrestrial water dynamics?"

**2) Structure is unclear, there is too much material in the appendix**

We tried to keep the article as concise as possible in the previous version of the manuscript. However, following the comments of several reviewers, we realised that there was a need for an improved structure to better clarify our aims, present the methodology and discuss the results. As a consequence, we now substantially revised the structure of the manuscript, aiming at a maximum of clarity in the text. In particular, some of the discussions and analyses previously placed in the appendix have been moved to the main text.

**3) What is new? Why is this exciting? Isn't this expected?**

The results can be understood when one considers the typical scaling analyses applied in related disciplines (e.g. atmospheric dynamics). However, they are novel in the context of land surface modelling, which typically assumes that the same models can be applied independently of the considered scales. Our results strongly suggest that including variations in small-scale parameters (soils, land cover) does not improve the representation of terrestrial water dynamics at large spatiotemporal scales. This finding questions the validity of employing models of high complexity at these scales. This is of importance for several reasons:

1. The small-scale information is often not available with the desired detail or precision, however our results suggest that this may not matter for applications at



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monthly and subcontinental scales.

2. For many applications, in particular in the context of climate change projections, the considered coarse resolution (monthly, $\approx$ 50 km) is relevant (e.g. Earth System models have typically a resolution of $\geq$ 200km, and their output is often analysed at monthly timescales (e.g. for droughts, large-scale water availability)).

We thus suggest that current efforts in land surface modelling should reconsider the scale of application of the respective models more carefully. Especially the fact that high detail and increased complexity do not necessarily lead to improved predictive skill should be considered. Although our aim is not to discard small-scale information in every case (e.g. on soils or land cover), our results suggest that there should be a more careful evaluation of their exact implications for the earth system. In particular, it appears to be important to gain clarity about the spatial and temporal scales at which they matter (e.g. they are likely relevant for extreme events, but not for large-scale and long-term hydroclimatology).

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Interactive comment on Hydrol. Earth Syst. Sci. Discuss., 10, 13191, 2013.