The response of the authors are noted in blue.

Anonymous referee 2

Comments

The objective of the paper is to assess the ability of the $ISBA_{DF}$ land surface scheme to simulate drainage at the bottom of the soil column by comparing the simulations with data from a set of lysimeters located in two places in France, and having various soil characteristics and vegetation cover. The data are also used to compare various models for the retention and hydraulic conductivity curves used in the modeling.

I had already revised an earlier version of this paper submitted to Hydrology and Earth System Sciences. The authors have addressed the comments I had on their manuscript and I have only a few additional comments to provide.

After reading comments on the earlier version of the manuscript and those already available on the present version, I have the feeling that the authors should better specify the context of their study in the introduction. Their context is the one of Land Surface Models (LSMs) that are applied regionally or at the global scale. This context explains why numerical simulations and parameter specification are generally simplified for the model to be applicable in different contexts, without specific calibration, except in the case of some validations using in situ data at specific sites.

The present study aim is to assess the ability of the current model to simulate accurately groundwater recharge. For that, the model is applied at the local scale, using data from several lysimeter experiments. But this is not the general application context of the model, where soil parameters are computed from soil texture using PedoTransfer Functions (PTF) and the soil profile is assumed homogeneous.

The interest of the study is to show that:

- When parameters and model configuration (in particular soil vertical heterogeneity, but also lower boundary condition) is specified using in situ data, the model performance is satisfactory
- In such configuration, some combinations of soil water retention and hydraulic conductivity models provide better simulations
- Model performance is significantly decreased when vertically homogeneous soil profiles are used or when PTFs are used

The study leads to interesting conclusions with regards to the specification of soil parameters in LSMs that could be better highlighted in the abstract and the conclusions.
In view of your comments, we propose to add these comments in the text:

- Abstract (L2): *In this study, we evaluate the soil hydrology and the soil water drainage, simulated by the Interaction-Soil-Biosphere-Atmosphere (ISBA) land surface model currently used for hydrological applications from the watershed scale to the global scale, where parameters are generally not calibrated.*
- Introduction (L45): *In this context, the challenge of LSMs is to find a compromise between a simple application and an application that is powerful enough to reproduce the full water cycle. For example, in the unsaturated zone, hydrodynamic parameters are generally not calibrated and are estimated with soils properties (Decharme et al., 2011; Decharme et al., 2019; Lemoigne et al., 2020).*
- Discussion and Conclusion (L546): *In the context of LSMs that can be used at regional or global scale, the major challenge is to simplify the numerical simulations and parameter calibration, to be applicable in different contexts, without specific calibration, and to reproduce as much as possible the water cycle. This study at local scale increases the confidence that LSMs are powerful tools to simulate the recharge of groundwater, in different environmental conditions, with many soils and vegetation covers, and therefore can be used for many applications in hydrology at both the regional and the global scales.*

Minor comments

Line 313-314: the sentence is truncated.
We thank you for this remark.

Line 548: sensitivity instead of sensibility
We thank you for this remark.

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