Geoscientific Model Development Discussions

Geosci. Model Dev. Discuss., author comment AC2
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# Reply on RC1

Jiming Jin et al.

Author comment on "Improved runoff simulations for a highly varying soil depth and complex terrain watershed in the Loess Plateau with the Community Land Model version 5" by Jiming Jin et al., Geosci. Model Dev. Discuss., https://doi.org/10.5194/gmd-2021-212-AC2, 2021

**My main problem with this manuscript is that the authors have misrepresented CLM5 as having a constant soil depth of 8.03 m. This is not true. Variable soil thickness has been implemented into this newest version of the model (see the CLM Technical Note at https://escomp.github.io/ctsm-docs/versions/release-clm5.0/html/tech_note/index.html). With this implementation, the number of hydrologically active layers varies from grid cell to grid cell.**

Response: This part of the model description in the previous manuscript was inaccurate, which was based on the previous versions of CLM. We have corrected the issue throughout the revised manuscript. We have treated the constant soil depth of 8.03 m as a default option as described in Section 2.2.2.1 in Lawrence et al. (2018) and examined how the soil depth changes affect the runoff simulations through the sensitivity tests.

Lawrence, D. et al.: Technical Description of version 5.0 of the Community Land Model (CLM5), National Center for Atmospheric Research, Boulder, Colorado, 2018.

**Therefore, what the authors are investigating here is not the addition of variable soil thickness but the impact of vertical resolution with variable soil thickness. They need to make this crystal clear in Section 5.1. Also, are the bottom of the "soil" columns all at the same depth in each of the SLN sensitivity tests? If so, the authors should state that. If not, the authors should note what the bottom depth in each test simulation is.**

Response: We have revised Section 5.1 based on the suggestion from this reviewer. Yes, the bottom of the soil columns is at different depths across the watershed in each of the SLN sensitivity tests except for the default run with the fixed soil depth of 8.03 m (see Section 2.2.2.1 in Lawrence et al. 2018). The spatial distribution of the soil depth is shown in Figure S1 (in the supplement file), and was also added to the manuscript as Figure 1b.

**The goal of this work is to improve the runoff simulated in this region of interest, the Wuding River Basin. It is clear that the increase in vertical resolution improves the simulations, but the runoff is still biased. I am pleased to see the improvements made by adding the realistic river network and the changes made to improve the evapotranspiration.**

Response: Thanks for the positive comments.

**Of minor note, at Line 134, the authors introduce the acronym WRB without earlier definition in the body of the text. They do define this in the abstract, but they need to define it in the body of the manuscript.**

Response: Thanks! This has been corrected in the revised manuscript.

**Finally, shouldn't the Nash-Sutcliffe efficiency be between 0 and 1 in magnitude?**

Response: The Nash-Sutcliffe efficiencies can range from -infinity to 1.0. Please see the following reference:

Nash, J. E. and Sutcliffe, J. V., River flow forecasting through conceptual models part I — A discussion of principles, Journal of Hydrology, 10 (3), 282-290, https://doi.org/10.1016/0022-1694(70)90255-6, 1970.

Please also note the supplement to this comment:
https://gmd.copernicus.org/preprints/gmd-2021-212/gmd-2021-212-AC2-supplement.pdf