Geoscientific Model Development Discussions

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Comment on gmd-2021-212

Anonymous Referee #2

Referee 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-RC2, 2021

Jin et al. present a sensitivity analysis of improving runoff simulation using CLM5 for loess plateau watershed. They evaluate the parameter parameters and significantly improve the simulation performance. I feel this paper is well written with scientific insights. However, I have some serious concerns and suggestions and hope the authors can clarify/answer.

L24: What is the depth of the 150 soil layers?

L27: What's the "higher-resolution"? I suggest adding them explicitly in the abstract.

L71: It's surprising that the authors didn't mention the seasonal and/or extreme precipitation impacts on the surface and subsurface runoff, as well as other physical processes such as erosion in the LP geology.

L92: Another benefit of a hydrological model can be that models output the quantity of different components of water budget (subsurface and/or surface runoff) that are difficult or impossible to be measured directly.

L134: The authors choose one of the largest loess area watershed, but did you address the human activities and their impacts on hydrological analysis? My understanding is that CLM does not explicitly address those activities that makes the evaluation of model difficult in the large scale watershed.

L228: If I understand the authors correctly, this study only evaluates the sensitivity of layer thickness and/or the number of layers, etc. Would the soil properties more important, such as water capacity, or other soil parameters in CLM? Did you use the default options? What about the runoff generation parameters (there are a lot in CLM)?

L233: Did you use the same spin-up for all sensitivity analysis cases, or each sensitivity case uses their own spin-up?

L244: A few details are missing here for how the simulated surface and subsurface runoff are compared to the streamflow gauge observation at the outlet of the watershed. Did the authors use the runoff at the grid cell of the watershed outlet for comparison, or use the total flux over the watershed for the comparison? If the latter option is used, the watershed is relatively large so did you expect any delay in hydrological response time?

L249: Also shown in Figure 2 and 3, the total water budget or accumulated runoff are way more greater than the observation. I think it will be helpful to plot their ratio against the total precipitation.

L298: With more layers, the RMSE still looks great or the simulated total runoff still does fit well to observation. Maybe the number of layers is not a significant variable? Should you examine other parameters or model setup?

L323: Again the NSE value of all of those results are smaller than the default option of CLM. I'm still confused about how this could happen (why the results after changing/improving conditions and model setup) are still worse than the first trial? It seems simulated total runoff are way higher than the observation.

L376: Now I understand that the authors adjust ET parameters to improve the runoff results. But this still doesn't explain why the default options of CLM actually simulate the runoff relatively well? Is the simulated ET also underestimated with the default options of CLM?

L394: If I understand the paper correctly, the authors adjusted the Pgu values to represent the number of river channels in the watershed, but do not explicitly use river network in their model. I feel this sentence can be misleading by letting readers assume they use the river routing model.