

Hydrol. Earth Syst. Sci. Discuss., referee comment RC4  
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## Comment on hess-2021-174

Anonymous Referee #4

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Referee comment on "Exploring the role of soil storage capacity for explaining deviations from the Budyko curve using a simple water balance model" by Jan Bondy et al., Hydrol. Earth Syst. Sci. Discuss., <https://doi.org/10.5194/hess-2021-174-RC4>, 2021

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The authors have investigated the role of catchment-scale soil properties on long-term water balance. In particular, they have allowed soil storage capacity and field capacity parameters of the HBV model to vary and plotted the evaporation ratio values in the Budyko space. The authors argue that the two parameters can explain any deviation from the Budyko. The manuscript is written well. However, I find it hard to appreciate the usefulness of the paper. Below are my comments that the authors may find useful.

- The entire analysis is based on the premise that the HBV model provides a perfect picture of hydrological processes. Ideally, the values of soil storage and capillary storage fraction should come from field observations. I understand it is practically impossible to conduct large scale field measurements, but then the whole reasoning presented by the authors is pretty circular.
- What the authors are saying are not unknowns. Is it surprising to hear that the soil parameters affect long-term water balance?
- It is not very clear how the Budyko curve is helping in improving our understanding here. In my opinion the Budyko curve is an unnecessary entity in the analysis. The same conclusion (that the soil parameters influence long-term water balance) can be drawn without including the Budyko curve in the analysis.

Additional comments:

- The impact of observational errors have not been taken into account. It possible that, at least for some of the study basins, the deviation of the observed EVR value from the Budyko curve is due to observational errors.
  
- Line 125: The reasoning is not clear. Why do you need to select only the catchments with a closed water balance?
  
- Figure 9: Is it possible that number of rainy days is working as a proxy for something else, say mean precipitation? Otherwise, please provide a solid reasoning of why number of rainy days should matter.

Overall, in my understanding the article provides very little novel insight on catchment-scale hydrological processes. The authors may consider including some observed data to strengthen their analysis. Alternatively, they can re-orient their focus to answer some really interesting questions related to hydrological processes. I am sorry, I could not be more encouraging.