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Comment on hess-2022-185

Anonymous Referee #1

Referee comment on "Evaluating the accuracy of gridded water resources reanalysis and evapotranspiration products for assessing water security in poorly gauged basins" by Elias Nkiaka et al., Hydrol. Earth Syst. Sci. Discuss.,
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Summary

In this study, Nkiaka et al. assess the accuracy of global hydrological and land surface models in simulating runoff in 8 African watersheds. In addition, they also evaluate global evaporation products for the same watersheds. Ultimately, they intend to quantify the utility of these datasets for assessing water security in data-scarce regions. Although the objective of the study is relevant, I am particularly not convinced about the design of the study, the rationale behind using water balance-based evaporation as the truth. As it stands it reads like two different studies (evaluating runoff and evaporation separately). I elaborate on the main issues and offer some suggestions on how the study can be improved below.

Major Comments

- Design of the study: The authors need to provide a better explanation of why they decided to evaluate runoff and evaporation from completely different sets of models. All GHMs and LSMs provide estimates of all water balance components, especially when the authors consider GHMs and LSMs as a reanalysis product. Currently, these two parts of the paper are totally distinct from each with no connection to each other. If the objective is to assess water security, I would imagine the end-user would be interested in using estimates of all water balance components from one model or a specific ensemble of models.
- Related to the above comment, if water security is the main intention, would not subsurface water availability be an important variable as well? The authors need to justify only evaluating evaporation and runoff. I am sure most GHMs and LSMs provide data of water storage change.
- The authors claim that the utility of gridded datasets have not been sufficiently explored in Africa. I do not agree with the claim - authors have ignored the

innumerable studies which have used gridded datasets for model calibration, forcings and validation. In fact, gridded evaporation products are routinely used for improving large scale models for African watersheds (Dile et al. 2020, Dembele et al. 2020). The authors themselves have cited many studies which evaluate these datasets over African basins.

- Methodology: The authors do not make a convincing case for comparing the evaporation datasets with water balance-based evaporation estimates, especially (according to the results) when the uncertainties are large. In fact, achieving water balance closure with different sources of P, ET, and TWS is not a trivial task (Lorenz et al. 2015, Koppa et al. 2021, Pan et al. 2012) and is definitely not robust if only one source of data is used for each component.
- Despite previous studies using GRACE at higher resolution, I have serious doubts about the applicability of TWS estimates for basins as small as 9,620 sq.km (an order of magnitude smaller than intended GRACE footprint).
- In summary, the above two points casts serious doubts on the robustness of the ETwb estimates and its use as a reference dataset for evaluating other datasets.

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