Editor Report:

Public justification (visible to the public if the article is accepted and published):
Dear Dr. Zhao,

I very much enjoyed reading your scientific comment, the reviewer comments and your related replies. When accepting the OP paper of Gao et al. (2023) for review in 2023, I was convinced that it would stimulate an interesting and necessary debate about a key problem that "is well known, but not well done" in hydrology. The quality of your comment and the related discussion, shows that the debate has extended even beyond the discussion phase of the OP. HESS is definitely the best forum such a debate and I am more than happy to host both the OP paper of Gao et al. (2023) and your scientific comment in HESS.

Being a "believer" in soil physics myself, I absolutely agree that soils play a crucial role in the hydrological cycle. There is no runoff without soils, no soil moisture storage without capillarity, neither roots can grow nor rivers can be formed without soils.

Yet I think that the OP of Gao et al. (2023) reflects, in a provocative way, that your community has been still split about the question "how catchments work" and how to make use of soil physical knowledge in this context for a long time.

During my PhD, which was on reactive transport, I "discovered" that the soil is engineered by earthworms. Worm burrows have a crucial impact on solute transport and surface runoff generation (no news), yet these influences are not straightforward to capture with soil hydraulic functions. Vegetation mediates via plant transpiration the largest hydrological flux on Earth, which means that vegetation dynamics and ecosystem adaption to it's (changing) niche, are key drivers for hydrological change. Yet, I personally think that a "state based" model paradigms are not appropriate to capture such adaptations. Ecological optimality is a testable and promising hypothesis in this respect, as reflected in the recent work of Nijzink et al (2022) and Hunt et al (2021)

That said I am very much inclined to follow the recommendations of Siva Sivapalan and Reviewer 4 i.e. to accept your comment as it stands, and of course I agree that we need more constructive cooperation across both paradigms to move forward and hopefully cut the Gordian knot.

Yet I grant you the possibility for final adjustments of your manuscript in line with your replies.

Looking forward to receive the revised manuscript,

Erwin Zehe

References:

Nijzink, R. C. and Schymanski, S. J.: Vegetation optimality explains the convergence of catchments on the Budyko curve, Hydrol. Earth Syst. Sci., 26, 6289–6309, https://doi.org/10.5194/hess-26-6289-2022, 2022.

Hunt, A. G., Faybishenko, B., and Ghanbarian, B.: Predicting Characteristics of the Water Cycle From Scaling Relationships, Water Resour. Res., 57, e2021WR030808, https://doi.org/10.1029/2021WR030808, 2021

Reply:

Dear Editor Dr. Zehe,

We greatly appreciate your evaluation and the information you shared. This not only helps establish a consistent framework for hydrologic research based on solid scientific principles but also fosters lively discussions and a collaborative research atmosphere, which is particularly important for the OP paper. As mentioned, we look forward to organizing or joining a workshop to develop a shared understanding of the challenges and solutions in catchment hydrology.

We have revised our manuscript by incorporating your suggestions and our responses to the reviewer's comments. If you have any further requirements, please let us know.

Regards

Ying Zhao