

Hydrol. Earth Syst. Sci. Discuss., referee comment RC2  
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## Comment on hess-2022-97

Anonymous Referee #2

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Referee comment on "Vegetation optimality explains the convergence of catchments on the Budyko curve" by Remko C. Nijzink and Stanislaus J. Schymanski, Hydrol. Earth Syst. Sci. Discuss., <https://doi.org/10.5194/hess-2022-97-RC2>, 2022

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This study intends to bridge the gap between vegetation optimality model and Budyko framework, which is classic problem in ecohydrology. I found this study is innovative, and fits the scope of HESS. But there are still issues need to be clarified, before considering for acceptance.

- Why did the authors use rooting depth in the vegetation optimality model? Since the conceptual models, e.g. FLEX, used the root zone storage capacity as the term in modeling. What is the relationship between the rooting depth and the root zone storage capacity? Since root zone storage capacity is a more meaningful term to describe the interaction between ecosystems and hydrology in catchment scale, like previous studies (<https://agupubs.onlinelibrary.wiley.com/doi/full/10.1002/2014GL061668>; <https://hess.copernicus.org/articles/20/1459/2016/hess-20-1459-2016.pdf>), rather than their depth. I'd like to hear the authors' thoughts. And this part needs more clarification.
- There are lack of equations described the vegetation model. For readers who did not have enough background about this model, it is very necessary to give some equations, illustrating how the model describes the core processes. Adding a table showing the equations might be a good idea.
- I found the experiment design are hard to follow. And the VOM and three hydrological models are not well linked. A workflow chart might be helpful.
- The Budyko equations are not the same as we widely used. This brings in much difficulty to review this manuscript. I did not see a clear reason to use  $R_n$  rather than potential evaporation ( $E_p$ ) in the traditional Budyko equation.
- The authors conducted the study for 37 years (1-1-1980 until 31-12-2017). I am curious to know whether there were any changes during these 37 years. This needs more clarification and discussion.

Minor comments:

- In Section 2.3.2, what does this mean “a permeable soil block with layers of 0.2 m thickness, and a total thickness of 30 m”?
- The equations used in TUWmodel and FLEX to estimate evaporation are the same, although with a bit different term definition. That is why all three conceptual models have very similar performance. It seems not necessary to use three conceptual models in this study.