Hydrology and Earth System Sciences Discussions

Hydrol. Earth Syst. Sci. Discuss., referee comment RC2
https://doi.org/10.5194/hess-2022-134-RC2, 2022

Comment on hess-2022-134

Anonymous Referee #2

Referee comment on "Technical note: Do different projections matter for the Budyko framework?" by Remko C. Nijzink and Stanislaus J. Schymanski, Hydrol. Earth Syst. Sci. Discuss., https://doi.org/10.5194/hess-2022-134-RC2, 2022

In the Technical Note "Do different projections matter for the Budyko framework" Nijzink and Schymanski argue that different projections of the Budyko framework, either within the E/P or the E/Ep space, can lead to a different estimate of the free parameter n that is used in various formulations of the Budyko framework. The authors use a large set of catchment observations to illustrate differences in the n-values, and estimates of distances to the curves and the physical limits within the Budyko space. They conclude that the projections and potential uncertainties associated with the choice of projection need to be routinely considered in Budyko-type assessments.

The manuscript is well written, and the figures are concise. However, I have a few remarks for the authors to consider before publication.

(1) I appreciate the thorough assessment of differences occurring due to the use of different projections. However, from my point of view, there is a different understanding in the interpretation of the n-value between the two projections per se. The n-value has no apriori physical interpretation and is, technically, a mere mathematical entity. That means there is no necessity for the n-value to be invariant under different projections. Or is there? As much as I appreciate the illustration of your results using real-world data, I think a more mathematically-based discussion of the issue is also needed.

(2) A similar comment can be made concerning the deviations from the curve and the limits. The interpretation of deviations within the E/P and the E/Ep space is different per se. In other words, I do not expect similar deviations in terms of E/P and E/Ep. If this has been used interchangeably within the literature, I think it needs to be highlighted in your manuscript by providing more references and a more in-depth discussion of the issue.

A few more minor comments:

Abstract: Even though it is a Technical Note, the abstract is a bit too technical (and a bit too long) in my opinion. I would appreciate it if you try to condense some of the methodologies and put more emphasis on the interpretation of your results.

Introduction: You introduce the Budyko framework as being super popular in recent years (which is true). However, most of your references are at least 10 years old or older. I would appreciate a slightly more extensive introduction outlining more recent references, highlights, and applications of the Budyko framework and how this connects to the objective of your manuscript.

p.5, l. 8: Would be great to acutally provide the number of arid/humid catchments.

Fig. 2: Maybe consider adjusting the y-axis of the plots to better highlight the differences. Given the current scale, the differences seem rather unremarkable.

Sec. 3.2: Deviations from the curve and the limits can be larger for water-limited catchments by design. For energy-limited catchments, the total range is always smaller than 1. You highlight that in your discussion of the contracted vs. the uncontracted side. However, I was just wondering if you would obtain similar results if you just assess randomly distributed numbers within the Budyko space.