

Hydrol. Earth Syst. Sci. Discuss., referee comment RC1
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Comment on hess-2021-174

Anonymous Referee #1

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-RC1>, 2021

Dear colleagues,

I was first very enthusiastic when starting to read your paper that I ultimately found too theoretical in its present form:

- The main critic that I would make is that in your analysis of Budyko's *empirical* formulation of water balance you are using... model results. Testing a model with a model... As a starting point it's perfectly OK, but you should at least in a second step try to validate this with actual data. I know it's not easy, because it requires a large dataset with root-zone capacity estimates (but you should be able to get this at least for Germany of the USA ?). A second critic that I would make is that you decide that the soil characteristics are the first-order determinant of the deviations of the the Budyko curve. I don't say you are wrong, but I say this requires to be proved. There are other hypotheses in the literature: for example one of our papers (de Lavenne and Andréassian, 2018), we suggest based on actual streamflow data that the phase synchronicity of precipitation and potential evaporation explains the deviation of the Budyko-type curves.

Minor remarks

- Please change your notations to follow the recommendations of HESS: only one letter for a variable (possibly a subscript)
- 77: please adapt your references : Turc and Mezentsev published their formula 40 years before Choudhury, and Tixeront published his formula almost 20 years before

Fu...

- 83: you write that it is inappropriate to try to represent the deviations of the Budyko-type relationship with a single parameter... I do not agree. Again, in our 2018 paper, we showed that it was possible to parameterize the parameters of the Turc-Mezentsev and the Tixeront-Fu formulation with a climatic index.
- 176: rainfall seasonality is not enough, you need an index that tells you whether rainfall and potential evaporation are in phase or out of phase
- L 572: You write that your research "did not purely take place in the realm of simulations"... but I would object that you almost staid there!

References

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Tixeront, J., 1964. Prév́ision des apports des cours d'eau (Prediction of streamflow), IAHS publication n°63: General Assembly of Berkeley. IAHS, Gentbrugge, pp. 118-126.

Turc, L., 1954. The water balance of soils: relationship between precipitations, evaporation and flow (Le bilan d'eau des sols: relation entre les précipitations, l'évaporation et l'écoulement). *Annales Agronomiques, Série A*(5): 491-595.