Hydrology and Earth System Sciences

Discussions

Open Access

HESSD

Interactive
comment

Interactive comment on "Modeling water balance using the Budyko framework over variable timescales under diverse climates" *by* Chuanhao Wu et al.

Anonymous Referee #1

Received and published: 15 September 2017

The aim of the study is to investigate the suitability of the Budyko framework under different timescales. It seems tempting to apply the simple Budyko model outside the steady state conditions, which are required to derive the water and energy limits; and many authors tried this (Zhang et al., 2008 J.Hydrol., Chen et al., 2013 WRR, Zeng and Cai 2014,2015, Greve et al., 2016 HESS, ...). The application at seasonal time scale requires modelling of water storage - which cannot be measured. Therefore the authors use model output from a land surface model to evaluate the Budyko model. After reading this - it is only mentioned in section 2 - I was tempted to reject the paper right away. This means the whole study is a simple model to model comparison study without even an assessment of the model output with real data. The authors evaluate

the model response of 14 large river basins but again only with the model output. The authors find what other have found as well, at shorter timescale model complexity must be larger. Yet, one finding which I find indeed interesting, is that there seems to be a relationship with the variability in water storage change and the error of using a simple Budyko type of model, shown in Figure 11. That means the larger the water storage changes in a catchment the larger the error using Budyko. Additional analysis on why this is case would be of interest, but is not provided. I guess it follows the reasoning of Zeng and Cai 2015 GRL highlighting the role of terrestrial water storage changes on ET.

I believe the manuscript must be improved in several ways to be of scientific significance.

First is to state right from the beginning that model output is being used to evaluate the Budyko model.

Second is to use actual runoff data of the large river basins to evaluate the Budyko model. Aggregated land surface model output is not very useful to my mind.

Third is an proper statistical assessment of the statement, that the Budyko models works better in arid than in humid areas.

4. the number of figures must be reduced. Some figures may be put into a supplement. One should select one timescale of the type of figures shown in Figures 4-10. Then a table of relevant statistics can be used instead.

5. Figures 11-13 show the same data with different ratios. I recommend to use Fig 11 and cut the remaining ones.

6. Use a better color scaling of the points such that the points get sufficiently different in color.

7. Use similar x and y scales in the panels of a Figure to allow fair visual comparison.

8. The discussion is rather a results section. Move the sections 4 to results. In the discussion please argue why the variability in water storage affects the model performance. Why the Budyko model is better in arid catchments. Please include and discuss your findings with the ones from the literature.

Interactive comment on Hydrol. Earth Syst. Sci. Discuss., https://doi.org/10.5194/hess-2017-441, 2017.