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Hydrology and Earth System Sciences
Discussions

Interactive comment on "The effect of water storage change in ET estimation in humid catchments based on Budyko framework and water balance models" *by* Tingting Wang et al.

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The authors perform a multi-method assessment of ET in wet basins in Southern China and attempt to assess the role of assuming change in water storage as negligible (DS=0) in their calculations at the annual and muti-annual time scales. They also propose that this assumption may be the cause of poor annual ET estimates from three models (Fu, abcd and Xin'anjiang model) when compared to the ET from the water budget estimate at the annual scale. They find that including the estimates of Delta S at the annual scale from the abcd model reduces the variability of ET predictions. I think the subject is interesting and is nowadays gaining a lot of attention due to the wide use of the Budyko-type studies. The use of the abcd model to calculate DS sounds like

a good idea, and to compare ET Budyko with ET Budyko + ΔS. The scientific basins of this study is sound, at least from what I managed to extract from the extremely-difficult-to-understand manuscript. The exploration of change in water storage is interesting and resourceful (Fig. 7-10).

But I have some concerns that must be fixed in this manuscript:

1. Language. As it is now, I think the manuscript is unpublishable in HESS or any other decent scientific journal. The use of English is of poor quality. Some parts of the manuscript cannot be judged with scientific criteria because it is just impossible to understand what the authors are referring to. I myself do not have English as a native language, so I understand how frustrating it is to express your findings in another language. However, this manuscript needs to be written from beginning to end with the aid of a native English speaker. I recommend taking it to a professional writer or similar. I started fixing grammatical issues, but then I realized there was no case in doing this and I should better focus on the science.

2. Literature review on water storage and Budyko needs to be improved and updated. The authors have omitted important pieces of research dealing with the importance of water storage changes within the Budyko framework and specifically in "wet" regions. Some examples,

-[Moussa and Lhomme, 2016] – This study should give some insight on the possible mathematical formulations that the authors could further explore, apart from their multi-method assessment. -[Jaramillo and Destouni, 2015] – I know that the basins that the authors are studying are "humid", so irrigation is highly unlikely. However, flow regulation by water impoundment in reservoirs or water transfers affect the evaporative ratio ET/P in the long term, and it is not due to the water stored in the reservoirs as the authors suggest by citing Mao (2016). They find that flow regulation acts like a proxy of land and water use that can explain ET/P changes more than PET/P changes. -[Destouni et al., 2013] – Budyko analysis cannot get "wetter" than in cold and wet

Sweden. This study shows that accounting for surface water storage changes at the annual scale does not change long-term trends in basin-scale ET/P. -[Gudmundsson et al., 2016] – They find that changes in water availability are only dominated by changes in the aridity index in very humid climates.

3. I think the authors need to be clearer in what they refer with DeltaS. Moisture S and storage S. How can we know which is which. Is ïĄĎΔS=ΔS+ΔG.

4. I think they should justify their work in a better way. Saying that the effect of storage change in ET calculations in wet regions is scarce is just not true.

5. What is the multiannual scale? How did you measure DS (storage, not moisture) at this scale? How is it different from the annual scale? This is not clear at all. You never specify the periods

6. Line 420 to 421. The improvement of R2 from 0.02 to 0.58 sounds quite extraordinary. You should show this scatter plot due to its importance.

Other issues:

49. controlled instead of captured 53. What is humid= PET/P<1? 58. around the globe... and scales like 60. region(s), research is limited 61-64 Could not understand this 64-66 This is because these models do not account for all drivers of change in ET/P. For instance, look at [Jaramillo and Destouni, 2014]. 74% of all movements in Budyko space cannot be explained by only changes in PET/P during long periods of time.

Jaramillo, F., and G. Destouni (2014), Developing water change spectra and distinguishing change drivers worldwide, Geophys. Res. Lett., 41(23), 8377–8386, doi:10.1002/2014GL061848.

L. 71 Delete “exist” 81-82 This is obvious. 86 theoretical ET 89 specifically 90. The Mao study has one big problem. They calculate Δ"ET"= ΔP-ΔR-ΔS and not Δ"ET"=ΔP-ΔR-Δ(ΔS), which is incorrect. That is why they get such a big effect of storage change

in the ET calculations. 105. Again, this is because not all drivers of change are taken into account with Budyko-type models. 111 “It would prone”? 183 proved 224 Is DS = DG + DS? You have to differentiate storage from soil moisture, they are both S and confuses 257. Excellent? Change this word 282 Terrestrial feature? 303. Wy do you use the NSE. For what? Explain 306. You should state p-values for all R2 values that you give 342-349 Improve language. Impossible to understand due to the language. 356 “launched” Figure 6- Something does not fit here. ET+S+Q=ET/P?? Sometimes I feel that there is a confusion between variability, variance and R2. Please check this along the manuscript.

References

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