Review for "Hydrological effects of climate variability and vegetation dynamics on annual fluvial water balance at global large river basins"

This paper proposed an index of climate seasonality and asynchrony to measure the mismatch of annual precipitation and evapotranspiration. The authors then assessed the impact of climate seasonality and asynchrony on the inter-annual variations of the controlling parameter within the budyko framework, and the evapotranspiration and runoff as well. This paper is well written, well-organized and easy to understand. I have several suggestions listed below to help improve the paper. I think this paper can be published if these issues are well addressed.

Specific comments:

Line 41: was proposed. Please carefully gone through the manuscript to reduce grammatical and punctuation errors.

Line 114: delete therefore

Line 124: were obtained

Lines 145-149: You should introduce more background of the budyko framework and the budyko equations, and explain why you use the choudhury equation. For example, Zhou et al. (2015) has summarized existing budyko equations and suggests the choudhury equation is better than other equations, which can help readers better understand the budyko framework.

Zhou, S., Yu, B., Huang, Y., & Wang, G. (2015). The complementary relationship and generation of the Budyko functions. Geophysical Research Letters, 42(6), 1781-1790.

Line 160: by minimizing the MAE of what? Evapotranspiration or runoff? You should point out this.

Equation (8): Could you explain more of the physical meanings of a and b, and why you define SAI in this way.

Line 234: If the difference operator refers to the changes in the variables, the left and right-hand sides of equations (9a) and (9b) are not equivalent, see Yang et al. (2014) and Zhou et al. (2016). You should point out this.

Yang, H. B., D. W. Yang, and Q. F. Hu (2014), An error analysis of the Budyko hypothesis for assessing the contribution of climate change to runoff, Water Resources Research, 50, 9620–9629, doi:10.1002/2014WR015451.

Zhou, S., Yu, B., Zhang, L., Huang, Y., Pan, M., & Wang, G. (2016). A new method to partition climate and catchment effect on the mean annual runoff based on the Budyko complementary relationship. Water Resources Research, 52(9), 7163-7177.

Equation (10): If you calculate the contributions in this way, readers cannot tell whether the contribution is positive or negative. Please change the numerators to actual values instead of absoluate values.
Please also clearly state how to calculate the partial derivatives. Because these partial derivatives and the changes in the variables. Noting that the partial derivatives may change greatly (also see Zhou et al. (2016)), and will have large impacts on the results. The same issues also exist for the equations (11).

Equation (11): use ≈ instead of = because SAI and M cannot fully explain the variation of the parameter n.

Line 282: have a significant impact

Line 297: b is negative while c is positive

Equation (14): please calibrate the parameter a, b, c in each catchment (add a table or figure for this), and show whether the parameters are robust across different regions.

Line 303: You should check the relationship between SAI and M before the calibration. If SAI and M are correlated, you should not use multiple linear regression because of multicollinearity problems. Please use partial least square regression to calibrate the parameters.

Line 303 and other sentences: change formulae to formula

Lines 301-304: please show the calibrated parameters for the cross-validation, at least in the supporting information.

Lines 315-320: also plot the relationships between the simulated R and E using the equation (14) and the observed values.

Lines 342-343: because of the monsoon variability, see Cook et al. (2010).

Cook, E. R., Anchukaitis, K. J., Buckley, B. M., D'Arrigo, R. D., Jacoby, G. C., & Wright, W. E. (2010). Asian monsoon failure and megadrought during the last millennium. Science, 328(5977), 486-489.

Lines 376-384: The equations (13) and (14) are used to mainly explain temporal variations of the parameter n, and may not be useful to explain the spatial variations, especailly when large variations in land surface characteristics exist. Are the remaining scatters in figure 4 related to different land surface characteristics? I am wondering whether the explanatory power of the equation (13) is larger when it is applied to each one basin, than for all basins.

Lines 396-400: why other factors such as precipitation contribute a small proporation to R and E in the Danube river basin. Please change river to river basin here and other places.

Lines 401-402: n is only a parameter without specific physical meanings.