Hydrology and
Earth System
Sciences
Discussions

Interactive comment on "Hydrological effects of climate variability and vegetation dynamics on annual fluvial water balance at global large river basins" *by* J. Liu et al.

Anonymous Referee #2

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Understanding the effects and mechanisms of climate variability and vegetation dynamics on fluvial water balance is helpful for hydrological modeling, forecasting and water management. Several studies assessed the impacts of the mismatch in water and energy in terms of a seasonality index (SI) on hydrological cycle, such as Milly, 1994, Woods, 2003. However, previous studies didn't consider the phase difference between seasonal P and E0. Hence, the authors proposed a new index, named climate seasonality and asynchrony index (SAI). They found that the SAI performs much better than the old SI in Budyko framework. On this account, the authors make an important addition to the literature of hydrological studies. In general, the manuscript is in the scope of HESS and I agree with its scientific objective. Especially, the proposed

SAI, and the semi-empirical formula for the spatiotemporal variation of parameter n are valuable for the Budyko framework related hydrological studies. Therefore, I strongly recommend acceptance of this paper in view of its importance and newness in results after minor revisions.

1. Abstract: The first sentence of the abstract, what's the meaning of "The partitioning of water and energy"?

2. Abstract: "a climate seasonality and asynchrony index (SAI) were proposed in terms of both phase and amplitude mismatch between P and E0." Who proposed SAI? Please rephrased this sentence.

3. Introduction: The authors should provide a nicer literature review, so they can have a clearer description of the novelty of this study. Their current lecture review is not sufficient to refer back to the literature. Berghuijs and Woods 2016 and Abatzoglou and Ficklin, 2018 have also considered climate seasonality into Budyko. The authors should state the differences between their work and existing studies.

4. Equation (11): The authors decomposed the changes of parameter n as a function of SAI and M. How does this work? Do they used complementary method? or Total differential decomposition? Please give more details. Either way, the authors should explain how they subdivided series into two periods.

5. Figure 3: the color for the below three subgraphs is difficult to distinguish. I suggest the authors used the larger plots and a discrete color bar with more different colors.

6. In figure 4 and 6, the author used the R2 and MAE to assess the simulation accuracy. I am curious that why they didn't use the Nash-Sutcliffe efficiency. A high R2 just means a high relationship, rather than a high accuracy.

7. The structure of 4.1 section is difficult to follow. They analysis the Figure 3 and 4 in the first paragraph, then they analyze the Figure 3 again in the next paragraph. Please recombine these sentences.

8. The authors descript the mismatch of water and energy in three scenarios in terms of the SAI and 1-DI. However, does the SAI always belong to these scenarios? How about SAI = 1-DI or SAI = DI-1? Given that the SAI is the main innovation of this study, I suggest the authors give some illustrations for these scenarios of SAI.