Hydrol. Earth Syst. Sci. Discuss.,
https://doi.org/10.5194/hess-2020-596-RC1, 2021

Hydrology and Earth System Sciences
Discussions
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Interactive comment on "A Robust calibration/validation protocol of a hydrological model using hidden Markov states" *by* Etienne Guilpart et al.

Anonymous Referee #1

Received and published: 25 January 2021

- Comments : In this study, it is interesting to apply the HMM to find hidden states in a method for identifying hydro-climatic condition of data used to calibrate/validate hydrological model. It is expected that the method of identifying annual hydro-climatic states by generating hidden state sequences through HMM will be more systematic and useful. However, to improve the completeness of this paper, several supplements are needed as follows:

(1) Apart from the comparison between the Petitt's test and the HMM, it is necessary to present a comparative analysis of whether the climate classification sequence identified by the HMM reflects temporal variations in other meteorological data or land

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use. For example, it would be possible to present any changes in land use or to state whether the temporal behavior of the dry index from annual rainfall and reference evapotraspiration over the same period is similar to the sequence of climatic state identified by the HMM.

(2) The three sub-basin are all located within one same basin. So their flow data show similar temporal behavior with different scale. This makes it difficult to generalize the results of this study. Moreover they show same dramatic changes in climatic conditions. This is rather thought to make it difficult to show the advantages of the proposed method in this study. In the abstract section, the authors mentioned that the results show that when the time series of river discharges does not exhibit a clear climate trend, or when it has multiple change points, classical rupture tests are useless and HMM classification is a viable alternative as long as the climate sub-sequences are long enough. However, the results in section 5 do not adequately explain this. The results show that Pettitt's test is still on of the appropriate tools. Perhaps an addition of another time series (basin) should be considered that clearly illustrates the difference between methods.

(3) The ultimate goal in hydrological modeling would be to obtain a better fit. The HMM's theoretical advantages of more granular and continuous identification is understood, but the results do not seem to support it. The authors noted in Section 5.2 that the HMM could lead to better model performances than the Pettitt's test, but it is difficult to accept the argument that the HMM is a better way with the values provided in Table 3. I think each method has similar NSE (KGE) values. A clearer rationale or explanation is needed for this part.

(4) The sentence for the length of data mentioned in section 6 is not the result of this paper. It was only cited from other paper and no substantive analysis was performed to support this conclusion. A minimal analysis needs to be performed to apply the claims of existing studies to the method proposed in this study.

(5) Please check some typos. ex. Check the isohyets range on the Bakel basin (Table 1). ex. Check T3HMMnor in Climate segments (Figure 4).

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