

Interactive comment on “Process-Based Flood Frequency Analysis in an Agricultural Watershed Exhibiting Nonstationary Flood Seasonality” by Guo Yu et al.

Anonymous Referee #2

Received and published: 6 January 2019

The work presents an investigation of flood frequency in the Turkey River basin in the Midwestern United States. The proposed framework, referred to as “process-based” FFA, uses stochastic storm transposition to generate synthetic storms and a lumped hydrologic model to simulate discharge at the outlet of the basin. The authors carry out a series of simulations and corresponding analyses of flood frequency to investigate the impact of seasonality in FFA and potential changes between past and present conditions. Overall, the work has several nice features and the questions posed by the authors are interesting. However, I have some major concerns about certain elements of the proposed framework that need to be addressed before the work can be considered for publication. I provide below major and minor comments that will hopefully help

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to improve the clarity and the main findings of this work.

Major comments

1. My first and most important concern about the proposed work is related to the choice of the hydrologic model used. The authors mention in different sections themselves that using a lumped model has several limitations. It is good that they acknowledge this limitation themselves but this does not solve the problem. In fact, based on statements as in Line 13, Page 15 “We did not use the snowpack routine. ...it was shown to produce unrealistic streamflow results” and given that snow processes are important in the selected basins, one immediately recognizes that the choice of the model is not appropriate. If we combine this with the author’s statement in conclusions “L22-23, page 22: Poor model representation of key hydrological processes, however, can lead to incorrect conclusions about present and future flood frequency”. ...I am very skeptical about the conclusions derived based on this model’s results. If the model cannot represent well snow processes (particularly flooding due to rain on snow, which should be important in the area) then I fear that the “process-based” FFA is flawed. In this case, the work should be presented at most as a sensitivity analysis and statements such as L1,P22 “helps shed light on the physical processes that shape flood frequency” should be rephrased accordingly.

2. The calibration and validation of the model lacks clarity. Which forcing was used to calibrate the model? And how the model was validated? These points are not clear in section 4.1. Then in section 5.2 L13,P15 “Different HBV parameters are used...” suggests that separate parameterization was used for the different precipitation forcing but no evidence is provided on a) the validation of the model for the two dataset and b) the variability in model parameters. For the later, if the parameters are significantly different, it will highlight further problems with the approach since this will mean that CPC-HBV and CPC-Stage IV simulations treat hydrological processes differently (i.e. may give more weight to different processes in each case). This needs to be investigated and clearly explained in order to understand whether the results can be

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considered “realistic” or are results of a numerical exercise that mixes two different things.

3. For the results in Fig5 right panel: Do you use soil moisture years prior to 1990 for the StageIV process-based approach? Also, you should apply the Bull. 17B for the two periods (1933-1989 and 1990-2016) and add them on the graph for comparison.

Minor comments

1. P1,L18: “a watershed that is undergoing significant climatic... change”. Is the climatic change at the scale of the watershed only? Consider revising.
2. P16L2: “but higher estimates” should be “but gives higher estimates”?
3. Fig.6: Improve caption. What is the upper and what the lower panel?
4. P18L13: “processes in her” should be “processes in his/her”

Interactive comment on Hydrol. Earth Syst. Sci. Discuss., <https://doi.org/10.5194/hess-2018-513>, 2018.