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Comment on hess-2021-176

Anonymous Referee #2

Referee comment on "Deep, Wide, or Shallow? Artificial Neural Network Topologies for Predicting Intermittent Flows" by Farhang Forghanparast et al., Hydrol. Earth Syst. Sci. Discuss., <https://doi.org/10.5194/hess-2021-176-RC2>, 2021

Artificial Neural Network (ANN) can be used as a regression model to simulate streamflow as a continuous variable. This paper added a classification model on top of the regression model to simulate the flow status of intermittent streams. If the classification model outputs a zero-flow status, the flow status of the stream is decided without further running the regression model; if the classification model outputs a flowing status, the regression model will be run to predict a flowrate. Based on this idea, the authors developed two separate ANN models with different structures (wide vs. deep) to simulate streamflow for nine intermittent streams in the Texas, US, and compared the results with that from a solely regression model.

Although the authors argued that the wide and deep models are different in their structures, I disagree and would say that the only difference is the input data to the regressor of the models: the regressor in the wide model takes all input data including both flowing and non-flowing values, while the regressor in the deep model only takes flowing values as input data. Therefore, the wide and deep models are essentially the same and the difference in results are only due to different input data. The study was actually testing the impact of different input data (a full dataset or a partial dataset) on simulation outputs. This fact compromises the whole structure of the manuscript, and the finding that the wide model that takes the full dataset as input showed better performance in simulating flowrates than the deep model that was built only on part of the input data is not surprising.

In addition, more justification should be added to the Introduction (probably to the paragraph beginning from Line 30) to explain why a data-driven method is chosen to simulate streamflow, rather than a hydrological model? By the way, has the authors thought of combining the classification ANN model with a hydrological model to better simulate streamflow in an intermittent stream?

The structure of the Methodology needs improvement as well. Probably starting with an ANN regression model that is conventionally used to simulate streamflow, followed by the introduction of a classification model on top of the regression model. Instead of proposing a deep and wide model, only develop one of them, since they are the same (see previous argument). More descriptive information should be provided for the model evaluation testbeds, such as what is the calibration period / testing period, why choose that, etc.

The caption of Figures and Tables in this study should be standing alone, with more information added.

As there are many comparisons made in the results, log transformed/no transformation, with/without SMOTE, continuous/wide/deep, it is very easy to confuse readers of what the main point of the study. I would suggest the authors only focus on the comparison of regression vs. regression + classification, taking the pathway of SMOTE and log transformation, since they are shown to provide better results, and other comparisons can be included as supporting information.