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Hydrology and Earth System Sciences
Discussions

Interactive comment on "Predicting Sediment Discharge at Water Treatment Plant Under Different Land Use Scenarios Coupling Expert-Based GIS Model and Deep Neural Network" *by* Edouard Patault et al.

Anonymous Referee #1

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>General comments and suggestions

I read the paper with interest. Its English and presentation are not flawless, but any shortcomings do not prevent a good understanding of the contents. The combination of the conceptual (or Expert-Based) WaterSed and the data-driven model makes sense as a way to model the impact of land use/management scenarios on the sediment discharges generated and conveyed in a karstic catchment. The application of the models is well described and appears to have been carefully undertaken. The validation was taken seriously by the authors, even extending part of their analyses to extreme events

in order to verify the applicability of the model over a wide range of conditions.

Below, I list some of my major concerns. In the attached file the authors can find a few suggestions that may improve the paper, as well as specific questions regarding the methodology and results.

> Major concerns

The first major concern is the significance of the paper (which I am not able to judge, being from a slightly different field). Simplistically, the authors just test different scenarios with the WaterSed model (representing the processes until the sinkholes) with a deep neural network that models the effect of the karst network, transforming in sediment inflow to the sinkholes (the result from WaterSed) into sediment that reaches the outlet of the catchment (in this case a water treatment plant). The approach is valid and ingenious, but perhaps not a large breakthrough.

Another concern is the need for a Deep Neural Network to model the effect of the karst on the suspended sediments. In a superficial analysis of the results, it seems that for all scenarios but eco-engineering, the sediment discharge at the outlet seems to be almost linearly related to the predictions of the WaterSed model. It would be good to try the same approach with a much more simple multi-linear model. It would be good if the authors could include a scatter plot of the sediment discharge vs runoff series predicted by WaterSed (Fig. 3) and another, even more relevant, of sediment discharge predicted by WaterSed vs sediment discharge observed at the outlet (the water treatment plant).

I believe the part of the methodology devoted to the Deep Neural Network could be improved (see the attached file for suggestions). In particular, I would like to understand why the authors used a 3rd hidden layer with one linear node followed by an output layer which - I assume - is linear as well. I believe such a 3rd hidden layer may be redundant.

I have accidentally come across a figure very similar to figure B1 online (https://towardsdatascience.com/time-series-nested-cross-validation-76adba623eb9), in an article about the training and validation of data-driven models for time series. The online article employs much of the same technical words as the authors of the paper and is not cited (or I missed it). The online article is quite good and, if it is the case that the authors used it to validate or strengthen their approach, I do not see a problem in citing it.

Two analyses were introduced only late in the paper and I believe the overall result could benefit from them being treated on par with the others. These are 1) the combined scenario (better farming practices and eco-engineering) and 2) the validation of the approach for extreme values resorting to the GEV distribution.

Finally, to validate the model for extreme values, it would be good to see a plot similar to the ones presented, but with predictions vs observations at the water treatment plant for the highest sediment discharge events on record. This way the natural variability of the phenomenon could be accounted for.

I would like to thank the authors for their efforts. Overall, notwithstanding this rather long text, I found the paper good and worthy of publication after some improvement.

> Specific comments and suggestions

Please refer to the attached file: hess-2020-363_commented.pdf

Please also note the supplement to this comment:
https://hess.copernicus.org/preprints/hess-2020-363/hess-2020-363-RC1-supplement.pdf

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