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Hydrology and Earth System Sciences
Discussions

Interactive comment on "Dissolved oxygen prediction using a possibility-theory based fuzzy neural network" *by* U. T. Khan and C. Valeo

Anonymous Referee #1

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The authors present the application of the Fuzzy Neural Network (originally proposed by Alvisi and Franchini, 2011) for the prediction of the dissolved oxygen concentration in a river. The topic is of interest and within the scope of the journal. The manuscript is well written and technically sound , even though some sections could be shortened. As properly pointed out by the authors in the conclusions, "the proposed model refines the exiting model by (i) using possibility theory based intervals to calibrate the neural network (rather than arbitrarily selecting confidence intervals), and (ii) using fuzzy number inputs rather than crisp inputs."

Indeed, the first aspect represents a valuable, but rather limited, step forward with respect to the existing model.

As far as the second aspect concerns, I really appreciate both the idea of considering

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the inputs of the FNN as fuzzy numbers and the approach used to define these fuzzy inputs. Unfortunately, the manuscript misses to point out the benefits of using the fuzzy inputs. A comparison of the performances of the prediction model featuring fuzzy inputs with respect to the prediction model using non-fuzzy inputs is completely missing. Does the application of fuzzy inputs allows for a more accurate prediction of the DO and, most important, for a reduction of the output uncertainty?

Indeed, the discussion of the result is mainly focused on the benefits of using a FNN with respect to a traditional NN in which uncertainty is disregarded, but this should not be the main task of the manuscript, given that benefits of FNN have already been pointed out in other studies, whereas the attention should be focused on the application of Fuzzy inputs.

Furthermore, I have some concerns also on the benefits of using the FNN with respect to a deterministic NN. Indeed, the authors state that (page 12351) "the FNN method predicts a probability of low DO (even if it is relatively small) on days when the crisp ANN does not predict a low DO event. This value can be used as a threshold by water resource managers for estimating the risk of low DO. For example, if forecasted water temperature and flow rate are used to predict minimum fuzzy DO using the calibrated model, if the risk of low DO reaches 14 %, the event can be flagged." Capability of the FNN of identifying very low DO values is certainly appreciable, but on the other hand, by looking at figure 6, it seems that most of the predicted fuzzy DO numbers features a support which in some way intersects very low (i.e. <5 mg/l) DO values. In other words, according to the criteria proposed by the authors how many events would be flagged? And, how many of these flagged events were low (i.e. <5 mg/l) observed DO events and how many would have been false alarms?

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