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Hydrology and Earth System Sciences Discussions

Interactive comment on "Auto-control of pumping operations in sewerage systems by rule-based fuzzy neural networks" *by* Y.-M. Chiang et al.

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We sincerely thank the reviewer for being interested in and recognizing our article and for providing important and valuable comments and suggestions. The responses to the reviewer's concerns and suggestions are briefly described as follows. Besides, the editorial corrections and the changes in consideration of the reviewer's suggestions are revised in blue in the manuscript.

The paper presents a case study of an ANN application to pump stations operation in sewerage systems. Specifically, the authors built and compared two models in order to predict the number of operating pumps to avoid flooding during heavy rainfall events in an urban catchment at Taipei City. Even if the paper deal with well known tools (neural networks), in my opinion this work is interesting for HESS readers because of its practical usefulness for urban sewerage planning and operation authorities. However, some comments must be done.

1. In the introduction (p.6727, l.24), the authors point out that neural networks have been widely used in the recent years in modelling complex systems. Nevertheless, in my opinion, authors should include here some lines discussing why this modelling is better for their purpose than other possibilities like event or continuous modelling, stochastic modelling,. . . Response: To take the reviewer's suggestion into account, a brief discussion has been added in the revised manuscript as follows: "There are several reasons for adopting fuzzy neural networks as effective operating models. In general, fuzzy neural networks require less information than physical/stochastic models. Besides, physical/stochastic models are usually more complex, relying on the skill and experience of the modeler when calibrating the model structure and parameters, whereas the advantage of the fuzzy neural networks is that it does not require the model structure to be known a priori, in contrast to most of the time series modeling techniques. Furthermore, the individual strengths of ANN and fuzzy logic approaches can be exploited in a synergistic way for the hybrid construction of fuzzy neural network systems. Therefore, the utilization of fuzzy neural networks is an attractive approach especially when dealing with control systems and reservoir/pumping operations. For example, Chang and Chang (2001) proposed an integration of ANN and fuzzy arithmetic for real-time inflow forecasting and showed that the fuzzy neural network helps to improve the efficiency of reservoir operation than the classical models based on rule curves."

2. (p.6734, l.16) As water level predictions are a key input for the model, results from the referred previous study should be briefly summarized, mainly, in the way they were obtained. Response: As the reviewer's suggestion, a brief summary regarding previous study has been given in the revised manuscript as follows. "The predictive water levels were obtained from a three-layer recurrent neural network (RNN) with internal time-

delay feedback loops in both hidden and output layers. For predicting the water level of Station YC10, the input information to the RNN-based hydrological model mostly came from the mean areal precipitations and two upstream water level gauging stations that belong to two sub-drainage systems. The learning target of the RNN model was the water level observations of YC10. To obtain 5-, 10-, 15-, and 20-minute-ahead water level predictions, this study constructed four identical RNN structures, each with a single output. The calibration of model parameters was performed by the gradient descent method via minimizing the forecasting errors. The results show that the RNN is capable of producing satisfactory predictions for 5-, 10-, 15-, and 20-minute-ahead water level predictions at YC10."

3. The last paragraph of conclusions (p.6741, l.4) should be improved as it contains some obvious statements: the role of water levels is obvious and also the forecast lead time considerations are. Response: Agree! Those obvious statements have been removed and the last two paragraphs of conclusions in original version have been merged into one paragraph.

4. Figure 1 is poor and must be improved. The legend could be moved out the picture and rain gauge station symbols enlarged. Besides, a scale should be added. Response: All modifications have been considered in order to conform to reviewer's suggestions, thanks!

Other minor remarks: a) p.6726, l.8. Please correct "counterpropagation" instead of "counterpropagatiom". Reply: Thanks!

b) p.6726, l.21. Please, in the whole paper use "flood/flooding" instead of "inundation". Reply: Thanks! Changes have been made throughout the manuscript according to the reviewer's suggestion.

c) p.6730, l.10. Please add "value" after "a DELTA". Reply: Thanks!

d) p.6733, l.17. Please use "m3/s" instead of "cms". Reply: Thanks!

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e) p.6740, l.6. Please correct “pumps” instead of “pump”. Reply: Thanks!

f) p.6740, l.15. Please correct “predicting” instead of “predict”. Reply: Thanks!

g) Figure 3. Please, add water level to the legend. Reply: Thanks! “water level” has been added to the legend.

h) Figure 4. Maybe axis captions and numbers are too small. Reply: Thanks! Figure 4 has been enlarged.

I consider these comments and remarks should be considered while revising the manuscript and re-writing the final paper that could be published without any major review. Reply: The reviewer’s precious and valuable comments and suggestions have already been incorporated into this revision which enhances further the quality of the paper. We are very much indebted to the reviewer for such achievement.

References Chang, L.C. and Chang, F.J., 2001. Intelligent control for modelling of real-time reservoir operation. Hydrological Processes, 15(9): 1621-1634.

Interactive comment on Hydrol. Earth Syst. Sci. Discuss., 7, 6725, 2010.

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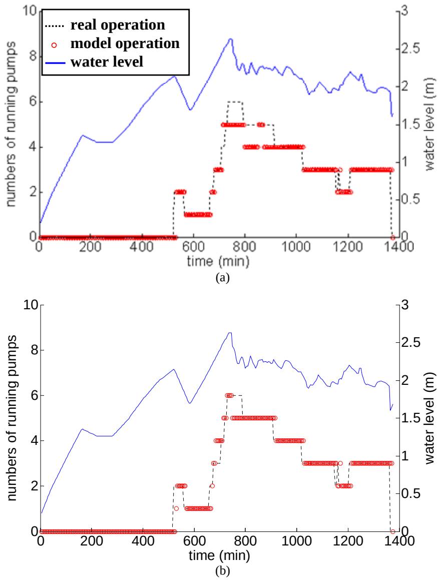

Fig. 1. revised Figure 3