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Hydrology and Earth System Sciences Discussions

Interactive comment on "Artificial Intelligence Techniques for river flow forecasting in theSeyhan River Catchment, Turkey" *by* M. Firat

Anonymous Referee #3

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General comments:

This paper addresses the issue of comparing different models, based on Artificial Neural Networks, Fuzzy Logic and Autoregressive methods, to forecast daily river flows. Models are learnt and verified from daily flows recorded in the Seyhan River in Turkey. It is shown that the best model is an ANFIS model with two input nodes.

This paper raises a comparison of four techniques, taken from the Artificial Intelligence field, applying them to a hydrological case. This is an interesting topic, evaluating weaknesses and strengths of each model and their applicability to a daily river flow forecast, but some important tasks must be commented.

Firstly, the author uses a scientific language, but it must be reviewed because there

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are several errors, mainly the use of singular and plural forms in verbs and nouns, like: Page 1370; Line 8: “river flow gauges station”; Page 1370; Line 9: “The data set are divided”; Page1378, Line 14: “These parameters affects”.

From a technical point of view, there are the following comments that could be further clarified:

1) River flow depends on many variables: Rainfall, antecedent moisture content, catchment physiographic characteristics, antecedent river flow, etc. This is said in the paper, but models have been built solely with antecedent river flow variables. It can be very difficult to forecast future river flows, mainly peak flows, without taking into account the rainfall and proposed models in the paper could be improved including some more nodes of rainfall and antecedent moisture content variables.

2) The number of flow records used in training, testing and verification processes is not clear. Firstly, it is said in the abstract that “The training and testing data set include totally 5114 daily river flow data and the number of verification data points is 731”. In Page 1378; Line 19: “Totally 4383 daily river flow data were obtained [..] for the time period 1986-2000”. Page 1379; Line 11: “The verification data set consisted of the last two years (1998-2000). The training and testing data set include the daily river flow record at time period 1986-1998”. This must be clarified.

3) Since models only use river flow variables, it could be very interesting to verify them dividing the hydrograph in peak and low-flow discharges, in order to evaluate the accuracy and ability of each model to forecast peak flows without taking into account the rainfall.

Specific comments:

Title: It seems very general and it could include the word “comparison”, because this is the main issue of the paper.

P.1370, L. 4. The paper compares four models: An ANFIS model, two ANN models

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and an Autoregressive model. This must be best clarified in the abstract.

P. 1370, L. 10. It could be clarified how many daily river flows are available and how many have been used for every process.

P. 1371, L. 14. (Sajikumar et al., 1999) must be included in References.

P.1371, L. 21. Reference Tingsanchali and Gautam, 2000 seems to be Tingsanchali and Gautam, 1999.

P.1371, L. 26. (Zadeh 1965) must be included in References.

P.1373, L. 8. There are more types of fuzzy inference system, like Tsukamoto type, but the most widely used are the Sugeno and Mamdani inference systems.

P. 1373, L. 15. Sugeno inference system has been selected. This selection should be justified.

P. 1376, L. 6. 'Is' has been included in the subscript of variable Yout.

P.1377, L. 18. Seyhan River basin could be described in more detail, including basin area, hydrological and physiographic basin characteristics, rain and discharge gauge stations located in the basin, rain and discharge available data, etc.

P. 1379, L. 2. Cross correlations between variables could be included in a Table.

P. 1379, L. 19. Equations 14, 15 and 16 could be reviewed. Subscript 't' could be included in variables QY and QD to take into account the sum in different lead-times.

P. 1380, L. 6. Nash-Sutcliffe Efficiency coefficient and RMSE could be explained in more detail, commenting their ability to asses the forecast power of the computed hydrograph and to give more power to greater values accuracy.

P. 1380, L. 20. It seems that RMSE should be E.

P. 1382, L. 26. AR (2) model could be explained in more detail.

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P. 1383, L. 6. AR model could be described in more detail. Coefficients obtained from training data set and validation results could be included in the paper. Training, testing and verification graphics of this model could be included in the paper.

P. 1383, L. 19-23. It seems like these sentences could be included in the previous section.

P. 1385, L. 18. Reference Cigizoglu, 2005 has not been cited in the paper.

P. 1385, L. 26. Reference Fejer et al., 1981 has not been cited in the paper.

P. 1387, L. 9. Reference Sen, 2004 has not been cited in the paper.

Table 1. Training and testing statistical parameters could be calculated separately.

Table 4. Title must be corrected.

Table 6. Title must be corrected.

Fig 1. The arrow between Defuzzification and Decision System seems that could go from Decision System to Defuzzification.

Fig. 10. E, CORR and RMSE training values for each model could be included.

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