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Hydrology and Earth System Sciences Discussions

Interactive comment on "Real-time flood forecasting by employing artificial neural network based model with zoning matching approach" *by* M. Sulaiman et al.

Anonymous Referee #2

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In the reviewed paper the ANN-based autoregressive forecasting of water levels for Rantau Panjang station, Malaysia is performed with lead time up to 6 hours.

Major comments:

1. In the Abstract Authors claim that the "optimal performace" of the ANN model is found in a few iterations, but they suggest that the results of forecasting are good for "normal water levels" only. For higher water levels, which are rarely measured, the

results are of poor quality. The paper is focused on an improvement of prediction just for the higher water levels by means of ANN with Zone Matching Approach. However, neither objective function nor training method are clearly presented, hence it is difficult to understand or discuss the reason of quick convergenceof the algorithm and poor performance for higher water levels.

2. In general pure autoregressive models which take into account only historical flow/water level measurements at single cross-section cannot provide adequate forecasts. They simply lack any information about source of water in the catchment. Previously observed flow/water level values are useful for data-based models but only as additional input variables. To predict flows/water levels for a bit longer lead times exogenous variables are required. If only very short lead time is considered, the simplest linear models could be used.

3. The paper lacks focus. It is difficult to read and understand the presented argumentation. A number of ideas are disputable (for example discussion of drawbacks of rainfall-runoff models, see p. 9359, or motivations of application of ANN, p. 9358 and 9360) Some topics are described in a few different parts of the paper (for example the ANN training – see p. 9363 and 9365).

Minor comments:

1. The description of neural network (section 3.1) is poorly presented. The equations 1 and 2 need improvement. For example, the notation of I (from i=0 to N) should be clarified. Note that xo is described but is not used in Eq. 1. Xij is used as input, but with two indices .

2. It is not clear why the forecasting by means of ANN "requires the input data with hourly time step" (section 3.2). In general neural networks do not need the same intervals between inputs.

3. Discussion about overfitting is dubious (section 3.3). The more data we have, the

lower overfitting should be, but this depend on the particular problem and frequently overfitting cannot be easily eliminated even if the number of data is large (see Geman et al., Neural networks and Bias/Variance dilemma, Neural Computation 4, 1-58, 1992). Authors suggest to use the low number of hidden nodes but this is not always sufficient (see Giustolisi and Laucelli 2005, Hydrological Sciences Journal 50(3)). Moreover keeping number of hidden nodes equal to the number of inputs is not well justified requirement. Contrary to the Authors suggestion, this may lead to too large number of parameters.

4. Please, verify the scale on Fig. 3 and 7.

5. The Fig. 4 is not clear. Why the output values from the previous layers become indices of a parameter or variable in the subsequent layer?

6. In Table 4, network model 1, the Nash-Sutcliffe coefficient is above 1. How such result was obtained?

7. Note that sometimes not adequate literature is cited. For example the idea that ANN "mimics information processing in human brain" was not proposed by El-Shafie (2008) or El-Shafie and Noureldin (2011).

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