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Hydrology and Earth System Sciences Discussions

Interactive comment on "Multi-criteria validation of artificial neural network rainfall-runoff modeling" *by* R. Modarres

R. Modarres

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RC S2304 Referee #2

General: The paper introduces a comprehensive multi-criteria validation test to evaluate the performance of different models. It recommends not relying on one metric alone to differentiate between different models which may result in inaccurate conclusions. The discussion paper used different topologies for ANN modeling approach, in addition to a regression model, for modeling the rainfall-runoff over the Plasjan Basin to show up the contradicting evaluating results that may avoided when applying the non- parametric tests rather than global statistics measures. It highlighted the importance that the simulated runoff should reflect the relevant hydrological characteristics of the observed runoff in both magnitude and frequency. It has been concluded that

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global statistics could not capture the probability distribution of the observed stream flow. In my opinion, the merits of the paper would therefore lie in (1) a description and discussion of modeling aspects related to the use of ANN as a rainfall-runoff model, (2) a brief review of global statistics to compare between different modeling application results, (3) a comprehensive presentation of additional graphical and numerical tests. Although, the manuscript contains valuable technical information in a well structured and organized format, it requires minor revision to be in a form acceptable for publication

Technical Comments: 1. Page 3452 Line 19: the set of variables is divided into training set and validation set. It is not clear the length of each set and which hydrological characteristics are presented in each set.

REPLY: The length of each data set was mentioned in the revised paper in the percentage of total data.

2. Page 3452, Study area and data: this paragraph needs more elaboration to address the intensity/distribution of available raingauge network over the area of the catchment. Better map is required to show the locations of hydrological and rainfall stations. Also, it is recommended to plot a hydrograph showing the patterns/trends in the data used.

REPLY: He author thinks that the map of the rainguge is not necessary because we are not discussing the effect of spatial distribution of rainfall on the runoff. As mentioned in the text all raingauges are inside the watershed. Also, because the rainfall and runoff data were randomized, the author also believe that the plot of hydrographs is not necessary.

3. Page 3454, Model Development: it is mentioned that the total daily observations was divided into training, validation, and cross-validation sets. The term "Cross Validation" is not clear in definition and use, in addition of not being introduced before. The same comment goes for page 3456 line 6.

HESSD

5, S2568–S2571, 2009

REPLY: The cross-validation was briefly defined in this section and the line 6 of page 3456 was omitted.

4. Page 3454 Line 10: Neither the concept nor the background of randomizing the data sets to avoid the issue of over training of ANN model is clear. Hydrological wise, this randomization may lead to loosing the historical memory of the basin, rainfall 8211; runoff inter-relationship, that should be captured by the model during the training experiment. It was mentioned again in page 3456 line 7.

REPLY: It is true. However, on the other hand, the hydrologists believe that none-randomized data may result in clustering high or low flow with each other and may ruin the network and output of data. It should also be noted that the time delaying network is usually select for the case of that is mentioned by the referee and is usually used for flow forecasting that is not the aim of the present study.

5. Page 3454 Line 20 till end of the page: information given for the CCC between streamflow and selected rainfall variables as well as ACC at different lags need to be better represented briefly in a table format.

REPLY: Perhaps it is true but the author believes that adding a table for just 4 values does not make any advantage and may make problem for the reader to refer to table and text at the same time.

6. Page 3458 Line 4: reference is needed for "Blom’s method".

REPLY: The reference was added.

7. Page 3458 Line 23: More elaboration is required to show the performance of the regression model with MLP4 for Gamma cumulative probability plots (figure 6-b with 8-b).

REPLY: The author does not understand what exactly the referee mean. However, the performances of both normal and gamma probability plots of regression model are now compared with MLP networks in the revised paper.

HESSD

5, S2568–S2571, 2009

8. Page 3458 Line 24: the text mentioned is not corresponded to what is explained by table 2.

REPLY: The table is mentioned here to refer the reader to section 6.2.2 for more detail. In the revised paper, it has now been mentioned.

9. Page 3458 Line 25: justification need to be re-briefed in order to conclude that MLP4 network is a superior model.

REPLY: The last paragraph of section 6.2.1 is change for justification.

10. Page 3460 Line 12: add "8230;8230;8230;.including the regression model can simulate statistical characteristics8230;." REPLY: This comment is not clear to the author. What is “8230”??

11. It should be mentioned somewhere in the manuscript that driven findings and conclusions made need more verification through application of other types of rainfallrunoff models; physical and conceptual models.

REPLY: A sentence was added to the end of the paper to address the merit of empirical, conceptual and physical models.

Editing Comments: 1. Page 3450, end of line 8: delete "but". Should read " ..regression model. The non-8230;" 2. Page 3450 Lines 13, 14 and 17: low, medium, and high flows. 3. Page 3456 Line8: Propagation. 4. Page 3464 Line 15: "An artificial" 5. Headers of all tables do not refer to the regression model, although its results are listed in the tables. 6. Labels a, b, c, and d are not shown in figure 2. 7. Page 3474, figure 5(a): Observed Cumulative Probability. REPLY: The editing comments were applied. However, as the figure 2 is given separately, they are not labeled.

Interactive comment on Hydrol. Earth Syst. Sci. Discuss., 5, 3449, 2008.

HESSD

5, S2568–S2571, 2009

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