

Interactive comment on “Hydrological model coupling with ANNs” by R. G. Kamp and H. H. G. Savenije

Anonymous Referee #1

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General comments

The paper should describe an application of artificial neural networks (ANNs) for coupling four hydrological models whose input and output variables may be connected in cascade. I confess that the application is definitely not clear to me. The results obtained by a system of four coupled ANNs (using which observed data in input/output?) are compared with those issued by an integrated system formed by four conceptual models? The coupled ANNs are trained using as output variables, instead of observations, the outputs obtained by the integrated system formed by the four conceptual models? A description of all the input (specifying which of them are observations and which are the results of previous simulations) and output variables of each model (both

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conceptual ones and ANNs), along with a description of the connection between them should be provided at the very beginning of the paper, possibly with the aid of a flow chart with input and output variables (including their time scales), in order to understand what the authors are presenting.

The description is confused, for both conceptual and ANN modelling, but the most critical aspect is that I do not see the point of such application. If each ANN substitutes one of the conceptual models, they do not couple the models but “are” coupled models (and the paper would not present anything innovative, but just a suite of ANN modelling experiments that are not properly described and sometimes do not seem correctly implemented, see comments below). Anyway, if this is the case, a detailed description of the separate application of the models should be provided, with each network trained on the proper input and output observed data so that the reader may assess the performances of each of the models before coupling them. In addition, the comparison with a unique ANN having in input all the available information (real observations) and in output the target variables should be added, in order to examine the influence of the propagation of the errors through the models.

Specific comments

Section 2: the conceptual models are not properly described: there is no information at all on the rainfall-runoff model and in the equations describing the other models many variables are not defined. For sake of brevity, having to describe four models, I would suggest to refer the reader to previous literature for a full description, provided that such literature is easily accessible (and not in print, like Fenicia et al., 2006), but a schematic description of the main features of the models (maybe without equations) and especially of the input and output variables must be included in the paper

Section 3: as said above, this part should be completely revised and anticipated at the beginning of the paper, since it should explain what the authors are doing.

Section 4: the case study is not described at all: which are the available data and how

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are they used? Which data are used in calibration and which in validation? Please improve the description of the neural networks, describing separately the networks used for each of the four models: which data are connected to the input layer? And which variables are in output? Why are the hidden layers formed by respectively 7 and 3 neurons? In addition, I guess that the difficulty experienced by ANN in rainfall-runoff modelling is due to the fact that past flow values should be added in input, as it is usually done for distinguishing wet and dry watershed conditions (see Campolo et al., 1999).

Table 1: the shown results are those obtained with which models? And on which period? Calibration? Validation?

All the figures must be cited and briefly described in the text and a detailed caption must be added, describing each panel, since it is not clear what they represent (which models? which data?).

Technical corrections

p. 3631: the meaning of the last paragraph is not clear to me. p. 3632: Eq (3): variable “a” is not defined p. 3635: how is Cdet related to Sf/S? p. 3637: please rephrase ll. 11-17 p. 3639: the HBV parameters are calibrated or not (see l. 25, p. 3635)? Please rephrase ll. 17-19 (the RAM-object??) p. 3640: ll. 14-16: it is not clear the need for smoothing. L. 19: MSL?? p. 3641; please rephrase ll. 7-9.

Fig. 2: Q2 - Q3???

References: M. Campolo, P. Andreussi, A. Soldati, “River flood forecasting with a neural network model”, Water Resour. Res., 35(4), (1999), pp. 1191-1197.

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