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Hydrology and Earth System Sciences Discussions

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

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This paper deals with the issue of hydrological model coupling which arises in the context where the information produced by a particular model is need for operating other models. This is an important hydrological issue and it is of great importance to researchers, practising hydrologists and software developers. The artificial neural networks (ANNs) are used as instruments to achieve model coupling. This is a very interesting application of ANNs in its own right.

This paper has many weaknesses, which need attention. It suffers from the lack of clear objectives and reported details about the model coupling case study. Furthermore, the models and the methodology used in the paper are not very well described. Although this paper is about "Hydrological Model coupling with ANNs", this paper does

not adequately explain “coupling” and “ANNs” the main subjects of the paper. Furthermore, referencing of relevant previous work is rather limited and mainly confined to the previous work of the authors and their colleague at IHE-UNESCO and Delft University of Technology.

The following are detailed comments addressing the above weaknesses and other issues:

Introduction

There is a need to give an explicit definition what is meant by model coupling as well as a discussion about the different model coupling types (loose, tight etc). This is essential as model coupling is not a very recurring topic in the hydrological literature

The relation between model coupling and integrated modelling is not very clear. The introduction is unbalanced with regards to the use of the terms “coupling” and “integrated. The term integrated appears in the introduction much more that the term coupling. This will pose a question whether or not there is a need to change the title of the paper to address this imbalance.

“This research investigates the ability of ANNs to set up quick connectionsĚ”. It is not clear from the objectives what are the specific aspects of model coupling are being addressed in the paper. A schematic diagram illustrating how modelling coupling is achieved in this paper. This is essential to enable the reader to know what has been done in this paper.

There is a mismatch between objectives and results. This paper claims that it uses ANNs as fast simulators for model outputs. However, the methodology and the results presented in this paper mainly address the accuracy of ANNs as a simulator of other models. The methodology doesn’t address the question of the computational “CPU” time taken by the ANN for model simulation.

The introduction does not give any information about the rationale behind the selection

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of the four hydrological models. What is interesting about these four models?

The introduction does not provide adequate referencing to the previous work on model coupling as well as the previous applications of ANNs.

Model Description

The description provided for the ANNs is not satisfactory as it ignores basic facts e.g. the layer types. Furthermore, the equations provided are applicable to hidden and output neurons. What about the operation of the neurons in the input layer?

There is imbalance in the description of the four models. For example, only few lines are devoted for the description the HBV model while a page is devoted for the description the salt intrusion model.

The information provide for the HBV is limited. This section can be expanded by explaining the rationale behind selecting the Alzette basin, providing a schematic diagram of the model and including a list of model parameters, their descriptions and the parameter values used in this study.

Methodology

It is not clear how the coupling is achieved and how the integrated model was built.

There is a need to state clearly that the ANN is evaluated under two scenarios. The first (decoupled) scenario is concerned with their performance in emulating each of the four models while the second scenario is concerned with their performance in the cascade model coupling situation

Design and Training: The description of model efficiency indices should emphasis the fact the observed values used in conjunction with ANNs are those obtained from other models.

The strategy used in selection of the numbers of hidden layers and the number of neuron in each hidden layer is not provided.

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Correct the misspelling in Sutcliff

HBV results: The results can be improved by using the outputs of an auxiliary of model (e.g. a linear model) or the previous outputs ANN can used as inputs to the ANN to represent the catchments states (wetness).

RAM-object is not defined.

1-D, Salt intrusion & Secchi model: It is not very clear from the paper to know what inputs and how many inputs used in conjunction with the ANN.

The titles of some figures and table are not very informative. For example, the title of table 1 “Simulation results” leads to the misleading conclusion that the results displayed in the table are those of the individual models.

Conclusions “For training and testing five years of daily precipitation and potential evaporation are ” This sentence is misleading. Precipitation and potential evaporation are not directly used in training in all of the cases.

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