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Model integration through Artificial Neural Networks

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Integrated water management is becoming more important in resolving conflicting interests between various water users. Flooding, wastewater, water quality and drinking water are key issues. The subject of this paper is to provide a fast, cheap and generic coupling method for hydrological computer models. The objective of this paper is to develop a method by which different hydrological models can be connected through Artificial Neural Networks (ANNs).

Integrated water management results in the need for integrated computer models. Due to costs, technical limitations, strategic issues or legal problems, online coupling is not always possible. This paper considers a methodology to set up quick connections between hydrological computer models. Usually it is difficult to integrate different type of computer models due to limited and expensive model frameworks. Online numerical model integration and different time scales (e.g. groundwater models versus hydraulic flow models) also require extensive computer resources. ANNs are fast simulators that can encapsulate relevant model knowledge and become an easy, fast and adequate alternative. An improved and validated method will show possible advantages for use in practise.

With this methodology it is possible to make cross-links more easily without interference with the individual programs, adjustments to software code or connection to a different framework. ANNs are computer models that can encapsulate model knowledge based on input/output relations in data. The ANNs can therefore be used as fast simulators and couple different hydrological models as an interface.

In this paper the ANN will be trained to represent some basic hydraulic situations computed by classical hydrological models. The experiment focuses on different flow profiles e.g. rectangular channels, trapezoidal channels, channels with storage basin

and composed channel with a local constriction or widening. In practical situations a model consists of a combination of these components. In a next phase different models will be coupled. The network structure, training algorithms, neuron functions and other ANN design parameters are chosen on the basis of other hydrological ANN model designs and experiments.