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Hydrology and Earth System Sciences Discussions

Interactive comment on "Evaluation of 1-D tracer concentration profile in a small river by means of Multi-Layer Perceptron Neural Networks" *by* A. Piotrowski et al.

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This paper presents a novel idea on using neural networks to describe the solute concentration versus time (breakthrough) curves in streams following an upstream-induced pulse of solute mass. The authors suggest that this paper would encourage future investigations through which readily measured information in streams can be related to the neural network model parameters. The thought is not fully developed and it would have been useful for readers to understand more why this new approach is useful. The main purpose of the paper is, however, limited in a first step to demonstrate the possi-

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bility to use MLP Neural Networks to evaluate the whole breakthrough curve at several cross-sections of a stream or river.

Input variables for the approach include breakthrough curves and measured water velocity. The authors conclude that the neural networks predicted the main features of the concentration profiles satisfactory. The difference in model behaviour between the learning, validation and testing phases of the neural network development is discussed in terms of error estimates like mean absolute errors and root mean square errors.

This referee comment is focused on the appropriateness of the method for generalising the model approach to other conditions than used in the training and validation phases based on easily measured river properties like sinuosity, channel slope, etc.. This does not address the main aim of the paper, but the model generalisation is suggested as an important future application. Also the motivation to select this new approach in river modelling would rely on its usefulness in comparison to previous approaches. One aspect addressed here is the model formulation and another aspect is the adaptation (optimisation) procedure.

Firstly, one could argue that a model formulation based on a physical description of the system is better suited for generalisation than a neural network model, especially for linking results to independently measured variables. Are there results in this study or other results that would suggest differently and which the authors would like to highlight?

In a physically based model framework different processes are represented individually and these representations act over the entire spectrum of the model applicability regardless of if these processes are important or not in specific model regimes. This requires also individual (if not independent) evaluation of the various processes. The physically based approach directly incorporates independent physical entities that guides our generalisations. On the other hand, such an approach embeds preconceptions of the system that can be misleading for generalisations. It would be interesting to here the authors view point on the feasibility of the MLP neural network approach for generalisation of river transport properties. How would it compare with a physically based model?

Particular problems could be extrapolation outside investigated parameter intervals. This would be an important problem e.g. since most practical applications would occur on time scales longer than used in the experiments referenced in this particular study ($<$ 200 min).

The second issue concerns the importance of evaluation method and its implications for which time scales as well as processes are reflected in the MLP neural network behaviour. Which time scales of the observed breakthrough curve is stressed by the objective function (4)?

Since the MLP neural network approach does not include inherent process time scales, it seems to be particular important to stress specific parts of the breakthrough curve in exactly the right manner to be able to extract the relevant process time scales. Do the authors believe that this procedure (optimisation and choice of objective function) is less or more sensitive compared to alternative model approaches?

Interactive comment on Hydrol. Earth Syst. Sci. Discuss., 4, 2739, 2007.