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Neural network modelling of sediment-discharge relationships: Pictorial analysis of six computational methodologies applied to two rivers in Missouri

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Neural networks can be trained to model the sediment-discharge relationship: numerous illustrative applications exist. The standard method of reporting involves using a scatterplot of observed versus predicted records, plus a handful of global statistics, to support an assessment of model skill. This traditional approach will nevertheless result in undesirable side effects since it reinforces the 'black box' criticisms and associated demonisation that is sometimes levelled at computational intelligence solutions: no 'line-of-best-fit' is ever supplied. This paper in contrast compares and evaluates six computational methods for modelling the sediment-discharge relationship from a structural and behavioural standpoint in which the exact nature of each model is visualised for the purposes of diagnostic appraisal and scientific enlightenment. The following methods are compared: backpropagation neural network; corrected power function; simple linear regression; piecewise linear regression using an M5 Model Tree; LOWESS; and Robust LOWESS. Modelling is restricted to a consideration of bivariate relationships. The models were developed on daily river discharge and sediment concentration datasets for two rivers in Missouri: Lower Salt River and Little Black River. Each dataset was divided into two parts using different methods and each model was first calibrated on one sub-set and thereafter tested on the other. The datasets were next swapped over and the process repeated. Each model is also evaluated using statistical measures calculated in HydroTest (http://www.hydrotest.org.uk/). The need for more benchmarking exercises of a similar nature is highlighted.