2.b. Using a NEURAL NETWORK to develop a model of stream flow rate

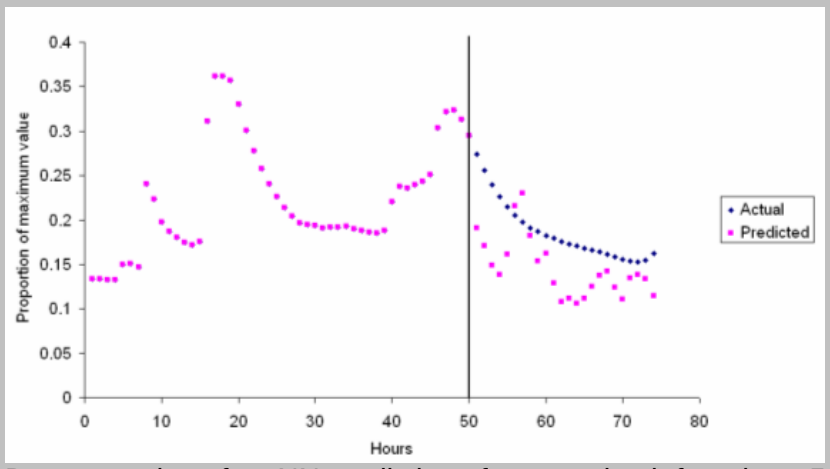
Matt Aitkenhead
Remote Sensing & AI Development
Macaulay Institute
Craigiebuckler
Aberdeen AB25 2RD UK
email: m.aitkenhead@macaulay.ac.uk

The problem
What will the depth, temperature, chemistry etc. of my stream be in one hour´s time?

Data available
Historical hourly data for stream depth, rainfall, any other relevant variables from field-based weather monitoring equipment.

Why use neural networks (NNs) and not another method?
When complex relationships exist between input and output variables, or the data is noisy and has many variables, normal statistical methods are of less use. NNs can extract information from data and describe complex relationships without user intervention.

Simple description of how it was done
Create a training file with several hundred lines of data, each holding input values for t-1, t-2 etc., and the output values (t-0). The neural network reads the data, activates the input nodes and transmits via connections to the output nodes, which give a response. The differences between the target outputs and that given by the network are used to adjust the connection weightings, and over several hundred iterations the system becomes better and better at predicting the output values. Aitkenhead *et al.* (2003) contains a specific description of the mathematics as applied to this problem.



Demonstration of an NN prediction of stream depth from hour 50 up to 24 hours ahead

Software used and alternative generic packages that could be used
Visual Basic, C++, few if any generic NN packages with sufficient flexibility for user requirements exist so some programming is usually required.

Reference
Aitkenhead, M.J., McDonald, A.J.S., Dawson, J.J., Couper, G., Smart, R.P., Billett, M., Hope, D., Palmer, S., 2003. A novel method for training neural networks for time-series prediction in environmental systems. Ecological Modelling 162, 87-95.

Further reading
Wikipedia (http://en.wikipedia.org/wiki/Neural_networks)