Categorisation of hidden unit activity in a neurohydrological model

C.W. Dawson (1) and R.J. Abrahart (2)

(1) Department of Computer Science, Loughborough University, Leicestershire, LE11 3TU, UK (c.w.dawson1@lboro.ac.uk / Fax: +44 1509-211586)

(2) School of Geography, University of Nottingham, Nottingham, NG7 2RD, UK (bob.abrahart@nottingham.ac.uk)

Artificial neural networks have been applied to hydrological modelling for well over a decade and the field, often referred to as *neurohydrology*, is now well established. Although it has been shown in many studies that such models are capable of accurately predicting runoff, their uptake in operational applications is limited. This is partly due to the 'black box' nature of these models which means they have difficulty explaining their reasoning. In recent years researchers have begun to investigate the internal behaviour of such models in order to provide some explanation of model behaviour (see, for example, Wilby et al., 2003; Jain et al., 2004; Sudheer and Jain, 2004). In these cases the behaviour of hidden units was explored and related to physical processes that control the rainfall-runoff relationship. In this paper the internal behaviour of the hidden units is examined and a classification system is proposed that helps to categorise various similarities in interrelated mechanistic behaviour over a number of different neural network rainfall-runoff solutions. The experiments are based on four contrasting datasets - two Icelandic catchments (Rivers Jokulsa Eystri and Vatnsdalsa) and two UK catchments (Rivers Ouse and Wye).

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