HANDOUT 3 B

An Example of a Literature Review- with a focus on the critique

(Taken from Dawson & Wilby 1998)

The United Nations General Assembly declared the 1990s to be the International Decade for Natural Disaster Reduction with the specific intent to "disseminate existing and new information related to measures for the assessment, prediction, prevention and mitigation of natural disasters" (WMO, 1992). A prominent element within this programme has been the development of operational flood forecasting systems. **These systems have evolved through advances in mathematical modelling** (Wood & O'Connell, 1985; O'Connell, 1991; Lamberti & Pilati, 1996), the installation of telemetry and field monitoring equipment at critical sites in drainage networks (Alexander, 1991), through satellite and radar sensing of extreme rainfalls (Collier, 1991), and through the coupling of precipitation and runoff models (Georgakakos & Foufoula-Georgiou, 1991; Franchini *et ai,* 1996). **However, in practice, successful real-time flood forecasting often depends on the efficient integration of all these separate activities (Douglas & Dobson, 1987).** Under the auspices of the World Meteorological Organization (WMO, 1992) a series of projects were implemented to compare the characteristics and performance of various operational models and their updating procedures. **A major conclusion of the most recent intercomparison exercise** was the need for robust simulation models in order to achieve consistently better results for longer lead times even when accompanied by an efficient updating procedure.

PREVAILING VIEW

CONTRAST IN IDEAS

ALIGNMENT IN THOUGHT

The attractiveness of Artificial Neural Networks (ANNs) to flood forecasting is threefold. Firstly, ANNs can represent any arbitrary nonlinear function given sufficient complexity of the trained network (see below). Secondly, ANNs can find relationships between different input samples and, if necessary, can group samples in analogous fashion to cluster analysis. Finally, and **perhaps most importantly**, ANNs are able to generalize a relationship from small subsets of data whilst remaining relatively robust in the presence of noisy or missing inputs, and can adapt or learn in response to changing environments. **However, despite these potential advantages, ANNs have found rather limited application in hydrology and related disciplines.**

PREVAILING VIEWS - SUMMARY

PREVAILING VIEW

CRITICAL COMMENT

For example, French *et al.* (1992) used a neural network to forecast rainfall intensity fields in space and time, whilst Raman & Sunilkumar (1995) used an ANN to synthesize reservoir inflow series for two sites in the Bharathapuzha basin, South India. Similarly, Hewitson & Crane (1994) described a range of climatological ANN applications such as snowfall prediction, classifying arctic cloud and sea ice, precipitation and, more recently, climate change impacts modelling (Hewitson & Crane, 1996).

EMERGENT THEME/ GAP IN LITERATURE

The use of artificial neural networks for flood forecasting is an area which has yet to be fully explored (Cheng & Noguchi, 1996). **Up until now the majority of work in this area has been mainly theoretical**, concentrating on neural network performance with artificially generated rainfall-runoff data (Minns & Hall, 1996). However, **these theoretical approaches tend to overlook the difficulty in converting** and applying actual data to artificial neural network topologies. Hall & Minns (1993) go some way to address this criticism by applying neural networks to a small urban catchment area. However, **their discussion is limited to the performance of a neural network on a small number of events.**

GAP/ WEAKNESS IN CONTRIBUTION

GAP IN THE LITERATURE

This paper goes one stage further by discussing how artificial neural networks may be developed and used on "real" hydrological data. It discusses the problems that need to be addressed when applying neural networks to rainfall-runoff modelling and demonstrates the effectiveness of artificial neural networks in this particular domain. **By applying a neural network to flood simulation in two UK catchments, the prospects for the use of ANNs in real-time flood forecasting are evaluated.** Finally, suggestions are made concerning necessary refinements to the existing ANN prior to transfer to operational use.

CURRENTLY WHAT THE LITERATURE IS ADDRESSING

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