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Input sensitivity analysis of neural network models for flood event prediction in ungauged catchments

Christian W Dawson (1) and Robert J Abrahart (2)

(1) Loughborough University, Computer Science, Loughborough, United Kingdom (c.w.dawson1@lboro.ac.uk), (2) School of Geography, University of Nottingham, Nottingham, NG7 2RD, UK

Artificial neural networks have now been applied to problems within hydrology for nearly twenty years – primarily in rainfall-runoff modelling and flood forecasting. In recent years the scope of this research has expanded to encompass more theoretical issues and address some of the earlier criticisms of such models - including the internal behaviour of neural networks and the link with physically-based models.
While there has been some work on the application of neural network models to predicting flood events in ungauged catchments, such research is limited to only a few studies in a handful of regions worldwide. In this paper neural network models are developed using the UK Environment Agency's HiFlows-UK dataset released in 2008. This dataset provides catchment descriptors and annual maximum series for over 900 sites across the UK. The neural network models predict the index flood (median flood) based on four catchment characteristics: area, standard average annual rainfall, index of flood attenuation due to reservoirs and lakes, and baseflow index. These models are assessed using a novel sensitivity analysis procedure that is designed to expose the internal relationship that has been implemented between each catchment characteristic and the index flood. Results provide some physical explanation of model behaviour – linking catchment characteristics to the calculated index flood. The results are compared with the FEH QMED mathematical model and with older equivalent models developed on the original FEH data set.