Catchment intercomparison and developing process understanding using data-based mechanistic modelling

Neil McIntyre

Imperial College London, Department of Civil and Environmental Engineering, London, United Kingdom (n.mcintyre@imperial.ac.uk)

Using models to inter-compare catchment responses and test hypotheses about processes often suffers from: a) being conditional on one or a small number of conceptual model structures; b) uncertainty in model parameter values; c) lack of knowledge of the origins of and errors in the observed data. These issues may lead to ambiguous or even misleading results. As an attempt to overcome these problems (on a relatively local scale), an analysis of response variability over nine flow gauges within a 6 km2 experimental catchment is presented. The data-based mechanistic (DBM) modelling framework is used to identify parsimonious model structures and statistically optimised parameter values for each gauge. Variability (of linear routing structures and associated parameters) between the catchments is analysed and factors which seem to be driving the variability are identified. The modeller's in-depth knowledge of the data origins, plus field estimation of data uncertainty, assist the interpretation. Deeper DBM analysis of one catchment illustrates the identification of non-linearities, significantly increasing scope for process understanding and intercomparison. In general, however, intercomparison and development of process understanding must be based on relatively rudimentary data sets. Suitable uncertainty methods, and suitable caution about how much we can expect from our data sets, are needed.