



Data-based mechanistic modelling in catchment hydrology

P. C. Young

Lancaster University, Lancaster Environment Centre, Lancaster, United Kingdom (p.young@lancaster.ac.uk)

Data-Based Mechanistic (DBM) modelling is a general inductive approach to transforming data into models. In contrast to the hypothetico-deductive approach, this inductive methodology does not start with a hypothetical model based on the scientist's perception of the physical system: it relies on the statistical identification of a specific model structure within a generic class of models (normally linear or nonlinear differential equations or their discrete-time equivalents); followed by the interpretation of this identified structure in physically meaningful terms. However, DBM modelling does not reject scientific conjecture on the nature of the system. It assumes that the hypothetico-deductive model provides considerable scientific insight into the nature of the system and that such a model will normally co-exist with the DBM model, to the mutual advantage of both model constructs. Indeed, one primary aim of DBM modelling is to build a bridge between the normally complex hypothetico-deductive simulation model and the parsimonious inductive model, in the form of a 'DBM Emulation Model'. To achieve this, it transforms data from the simulation model into the 'dominant mode' DBM Emulation Model, using the same statistical tools that are used in DBM modelling to analyze real data. This presentation will show how such a multi-faceted DBM modelling approach is applied within the context of catchment hydrology. It will emphasize how there should never be one single model of a catchment; rather there should be a collection of different but related models that serve different purposes: from 'what-if' simulation modelling; through detailed distributed or quasi-distributed inundation modelling; to flow forecasting and even control system design. And it will argue that all such models should reflect in some manner the inherent uncertainty that characterizes the catchment system.