Geophysical Research Abstracts
Vol. 14, EGU2012-5767, 2012
EGU General Assembly 2012

Hypothesise to characterise? A process-driven hypothesis-testing approach to modelling flow and transport in a small catchment in Gårdsjön, Sweden using a particle based model.

J. Davies (1), K. Beven (1,2), L. Nyberg (2,3), and A. Rodhe (3)

(1) Lancaster University, United Kingdom (j.davies4@lancaster.ac.uk), (2) Uppsala University, Uppsala, Sweden, (3) Karlstad University, Karlstad, Sweden

Hydrologic modellers are often faced with the situation where many model structures and parameter sets 'fit' the available data. If fitting is the ultimate goal, then this is not a troublesome situation. However, if the objective is to obtain the right result for the right reasons, then it can be difficult to narrow the possibilities and find a model that informs us of the underlying processes (if indeed there is a model amongst them that does that).
One possible approach to constraining the spectrum of models that may be considered behavioural is to evaluate them with multiple-observational quantities simultaneously. Of course, this relies upon good quality data. Another approach to limiting the field of feasible models may be to form models that are consistent with our evolving perceptual model. These two approaches may be combined by evaluating process-based multi-output models with multi-observation datasets, taking account of limits of acceptability that allow for uncertainties in the data. With these conditions in place, the situation faced is more likely to be too few acceptable models rather than too many, and the modelling procedure then becomes more concentrated on thinking about the processes and forming hypotheses that perform well, rather than sifting through realisations.
Here, catchment-scale isotope data and plot-scale artificial tracer data collected at a small basin in Gårdsjön, Sweden are used in the development of a model for the site.
The Multiple Interacting Pathways (MIPs) methodology is used in the modelling of these data. The MIPs model is a dynamic, scale-independent approach, which represents water in the catchment as a large set of discrete particles. These particles carry with them information such as age and origin, allowing unified simulation of water flow and transport. Flow through preferential pathways is represented using velocity distributions, and movement between these pathways is simulated through use of exchange probabilities. In all, this provides a flexible, physically-meaningful modelling framework, which facilitates the hypothesis testing approach.
Several process hypotheses for the Gårdsjön site are examined using a 3D catchment-scale MIPs model in an attempt to produce consistent results between the longer-term/larger-scale isotopic data and the shorter-term/smaller-scale artificial tracer results.