A new, open source implementation of the Dynamic TOPMODEL

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TOPMODEL (Beven and Kirkby 1979).is a semi-distributed hydrological model employed successfully in many studies. Its applicability is, however, limited where the model's assumptions such as frequently wetted, relatively thin soils, are not met (Beven 1997). For instance, predictions are generally poor during "wetting-up" periods in catchments where connectivity is broken due to seasonal drying of higher regions (Piñol, Beven, et al 1997)

The Dynamic TOPMODEL (Beven and Freer 2001) was developed partly in order to address problems in the original model associated with the assumptions of static upslope contributing areas. It allows for a much more flexible formulation of catchment "discretisation" whereby grid elements deemed to share similar hydrological characteristics are lumped into Hydrological Similarity Units (HSUs).

This allows for a partial spatially-distributed treatment of hydrological parameters. It introduces an additional parameter, a limiting transmissivity, which simulates a dynamic upslope contributing area as "dried-out" cease to contribute to the catchment response.

Research is ongoing in the following areas:

- Implementation and calibration of an open-source, distributable, version based on the existing FORTRAN code by Beven and Freer, and a possible analytic treatment of drainage in the unsaturated zone;

- Development of a flexible, extensible framework for catchment discretisation that enables geo-referenced data such as geology and soil type classifications to be easily assimilated. Investigation of the trade-off between computational efficiency and increased spatial resolution due to additional landscape categories and narrower discriminant bounds;

- Innovative strategies that utilise free and open source tools such as Google Earth are being explored for data collection and distribution and visualisation of results from models such as the Dynamic TOPMODEL.

  Public engagement with decisions based on computer models has been recognised as an issue facing planners and policy makers (see for example Lane, Odoni et al 2011) We intend to evaluate our techniques' effectiveness for improving stakeholder participation in the modelling process.

We will present some of these visualisations and demonstrate the results of model calibration against a number of events in a well-instrumented upland catchment, the Upper Wye in mid-Wales
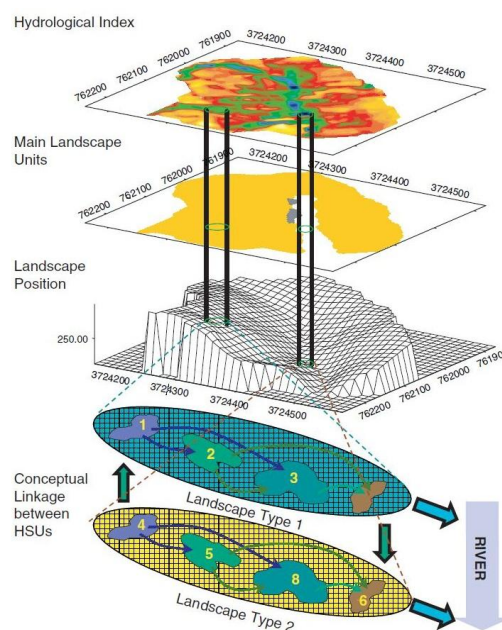
Conceptual diagram of landscape organisation into discrete HSUs within Dynamic TOPMODEL (Page, Beven et al 2007, after Beven and Freer 2001)
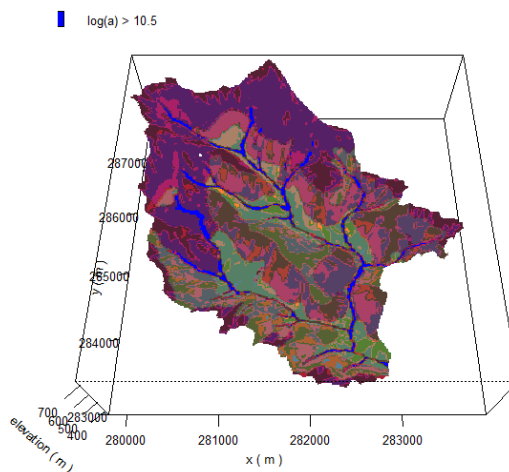
Typical results from a discretisation of the upper Wye catchment (Metcalfe 2012, DEM and soils data CEH 2012)

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