Geophysical Research Abstracts,
Vol. 11, EGU2009-9788, 2009
EGU General Assembly 2009

Conditioning rainfall-runoff model parameters for ungauged catchments and land management impacts analysis

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Data scarcity and model over-parameterisation, leading to model equifinality and large prediction uncertainty, are common barriers to effective hydrological modelling. The problem can be alleviated by constraining the prior parameter space using parameter regionalization. A common basis for regionalization in the UK is the HOST database which provides estimates of hydrological indices for different soil classifications. In our study, Base Flow Index is estimated from the HOST database and the power of this index for constraining the parameter space is explored. The method is applied to a highly discretized distributed model of a 12.5km2 upland catchment in Wales. Inspection of the results shows that the model explains the data well with surprisingly low uncertainty. Knowledge of how Base Flow Index and interception losses may change under future land use management interventions was then used to further condition the model. Two interventions are considered: afforestation of grazed areas, and soil degradation associated with increased grazing intensity. It is concluded that using Base Flow Index estimated from HOST is a simple and potentially powerful method of conditioning the parameter space under current and future land management.