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Uniqueness of place and process representations in hydrological modelling

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Abstract. This paper addresses the problem of uniqueness of catchment areas in relation to model representations of flow processes. The uniqueness of field measurements as a limitation on model representations is discussed. The treatment of uniqueness as a residual from a modelled relationship may conceal information about the uniqueness of catchments, while the treatment of uniqueness as a set of parameter values within a particular model structure is problematic due to the equifinality of model structures and parameter sets. The analysis suggests that a fully reductionist approach to describe the uniqueness of individual catchment areas by the aggregation of descriptions of small scale behaviour will be impossible given current measurement technologies. A suggested strategy for the representation of uniqueness of place as a fuzzy mapping of the landscape into a model space is suggested. This will lead to a quantification of the uncertainty in predictions of any particular location in a way that allows a conditioning of the mapping on the basis of the available data. This process can incorporate a hypothesis testing approach to model evaluation but the problem of multiple behavioural models may provide an ultimate limitation on the realism of process representations: not on the principle of realism but on the possibility of unambiguous process representations.

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