

Transferring hydrologic models across similar catchments: lessons in catchment classification and the impact of model error

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Hydrologic models are useful investigative tools to test whether distinct catchments respond in a similar way. In cases where models are effectively transferred between catchments it might be assumed that the hydrologic functioning and dominating processes of these systems are comparable. However, such an approach requires that models are appropriately representative of the hydrologic physical processes with little model error.

In this study, we demonstrate the difficulty in transferring models between catchments that are expected to have similar hydrologic functioning. We share insights gained from two diverse case studies. In the first case, we develop a conceptual and process-consistent hydrologic model following detailed field observations made within an experimental forest in Montana, USA. We assess the transferability and sensitivity of the model across multiple neighboring catchments with known similar hydrologic processes. In the second case, we make use of a data set of over 100 catchments from south-east Australia. Using simple conceptual hydrologic models, we classify catchments according to their model parameters. We examine the dependency of the catchment groups on the specified model structure, the uncertainty in the calibrated model parameters, and the magnitude of model error.

In each case, we investigate the reliance of effective model transference on catchment observations, knowledge of the catchment processes, and appropriate catchment classification. The results presented emphasize that model realism is a critical determinant of model transferability across similar catchments and that model error can obstruct effective catchment classification.