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Towards Conditional Parameter Estimation for Automatic Model Structure Identification: Using Mixed-Integer Calibration for Model Development

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A recently introduced framework for Automatic Model Structure Identification (AMSI) allows to simultaneously optimize model structure choices (integer decision variables) and parameter values (continuous decision variables) in hydrologic modelling. By combining the mixed-integer optimization algorithm DDS and the flexible hydrologic modelling framework RAVEN, AMSI is able to test a vast number of model structure and parameter combinations in order to identify the most suitable model structure for representing the rainfall runoff behavior of a catchment. The model structure and all potentially active model parameters are calibrated simultaneously. This causes a certain degree of inefficiency during the calibration process, as variables might be perturbed that are not currently relevant for the tested model structure. In order to avoid this, we propose an adaption of the current DDS algorithm allowing for conditional parameter estimation. Parameters will only be perturbed during the calibration process if they are relevant for the model structure that is currently tested. The conditional parameter estimation setup will be compared to the standard DDS algorithm for multiple AMSI test cases. We will show if and how conditional parameter estimation increases the efficiency of AMSI.