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# A Case Study for Testing Automatic Model Structure Identification as a Tool for Identifying Hydrologic Change

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Analyzing the effects of land use change on the catchment scale is difficult and requires a significant amount of experimental data. Not every catchment is equipped with an extended measurement network at the time of change. Datasets that are generally available for many catchments include precipitation, discharge and temperature. Using these minimum requirements for hydrological modelling, this work is testing an automatic model structure identification framework for identifying and estimating changes in the hydrological functioning of a catchment after severe land use change.
The catchment used for this case study is situated in the Bohemian Forest, the largest contiguous forested area in Central Europe. The 19.1 km2 Große Ohe catchment is part of the Bavarian Forest National Park and has been subject to a severe bark beetle outbreak leading to a tree die-off of 58% by 2014. The catchment is used to study and analyze different phases of land use change: previous to, during and after the bark beetle infestation. For each phase the most appropriate model structure out of a predefined model space is identified by using an automated model structure identification framework. The framework consists of the flexible hydrological modelling framework RAVEN and the evolutionary optimization algorithm CMA-ES in its mixed integer version. The first version of the automated model structure identification framework is based on two coupled soils storages, representing a fast and slow runoff component respectively. For the description of the interactions in-between the storages as well as with their environment, 10 different process descriptions can be utilized. These can be turned on and off during the model structure identification process. By calibrating against discharge, the most appropriate structure to represent the rainfall runoff behavior of the catchment is selected through the optimization framework. Parameter optimization is conducted simultaneously. The optimized model structures and their functionality are compared to hypothesis of the runoff behavior of the catchment. These hypothesis originate from extensive analysis of hydrological and hydrochemical measurements, including statistical analysis, runoff component analysis and hydrograph separation. The potential of the automatic model structure identification for identifying hydrologic change in a catchment will be tested and evaluated.