Conceptual model building inspired by field-mapped runoff generation mechanisms

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Since the beginning of hydrological research hydrologists have developed models that reflect their perception about how the catchments work and make use of the available information in the most efficient way. In this work we develop hydrologic models based on field-mapped runoff generation mechanisms as identified by a geologist. For four different catchments in Austria, we identify four different lumped model structures and constrain their parameters based on the field-mapped information. In order to understand the usefulness of geologic information, we test their capability to predict river discharge in different cases: (i) without calibration and (ii) using the standard split-sample calibration/validation procedure. All models are compared against each other. Results show that, when no calibration is involved, using the right model structure for the catchment of interest is valuable. A-priori information on model parameters does not always improve the results but allows for more realistic model parameters. When all parameters are calibrated to the discharge data, the different model structures do not matter, i.e. the differences can largely be compensated by the choice of parameters. When parameters are constrained based on field-mapped runoff generation mechanisms, the results are not better but more consistent between different calibration periods. Models selected by runoff generation mechanisms are expected to be more robust and more suitable for extrapolation to conditions outside the calibration range than models that are purely based on parameter calibration to runoff data.