Modelling decisions: a quantification of their influence on model results

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Scientific hydrological modellers make multiple decisions during the modelling process, e.g. related to the calibration period and temporal resolution. These decisions affect the model results. Modelling decisions can refer to several steps in the modelling process. In this study, modelling decisions refer to the decisions made during the whole modelling process, beyond the definition of the model structure. This study is based on an analysis of interviews with scientific hydrological modellers, thus taking actual practices into account. Six modelling decisions were identified from the interviews, which are mainly motivated by personal and team experience (calibration method, calibration period, parameters to calibrate, pre-processing of input data, spin-up period, and temporal resolution). Different options for these six decisions, as encountered in the interviews, were implemented and evaluated in a controlled modelling environment, in our case the modular modelling framework Raven, to quantify their impact on model output. The variation in the results is analysed using three hydrological signatures to determine which decisions affect the results and how they affect the results. Each model output is a hypothesis of the reality; it is an interpretation of the real system underpinned by scientific reasoning and/or expert knowledge. Currently, there is a lack of knowledge and understanding about which modelling decisions are taken and why they are taken. Consequently, the influence of modelling decisions is unknown. Quantifying this influence, which was done in this study, can raise awareness among scientists. This study pinpoints what aspects are important to consider in studying modelling decisions, and can be an incentive to clarify and improve modelling procedures.