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Derivation of hydrological flood routing parameters for reproducing hydrodynamic processes of river restoration measures

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Nature-based retention measures are an essential part of a sustainable and integrated flood protection strategy in different scales. Thereof, channel restorations such as flow path extension, channel widening, or uplifting the channel bottom are effectively used and widely discussed. Coupled with flood plain measures, retention and translation effects of flood events are possible. These effects are commonly computed using two-dimensional hydrodynamic modelling approaches. However, these simulations are characterized by high spatial and temporal resolutions which generally rely on a high computational demand and are therefore time and cost expensive. Thus, the evaluation and derivation of flood routing parameters for hydrological models to simulate channel restoration scenarios and the resulting translation and retention effects can provide a fast and effective computation of nature-based retention measures.

The key aim in the present study is the adaption of flood routing approaches which can account for the effects of channel restoration and flood plain measures in hydrological models. For this purpose, common flood routing approaches and the corresponding parameters used in hydrological models (e.g. LARSIM, WaSiM) are investigated for catchments of various scales and for different flood events. The respective results are compared, and a sensitivity analysis is subsequently conducted to identify decisive parameters and conceptual processes of the flood routing methods. To determine the effects of restoration and flood plain measures in the investigated study sites, detailed two-dimensional hydrodynamic models (HYDRO_AS-2D) are set up for the current state and the corresponding restoration scenarios. Based on these results the parameters of the flood routing approaches are calibrated in order to match the catchment specific restoration effects obtained by the hydrodynamic models. Following this evaluation, catchment and scale dependent (dominating valley type, flood plain slopes) parameter sets are derived to simulate specific channel restoration measures and the resulting translation and retention effects. The flood routing approaches and the derived parameters of the hydrological model are eventually validated with additional river sections of the hydrodynamic models.
Finally, the reliability of the new flood routing parametrization of the hydrological models is discussed as an alternative resource efficient way of calculating the effects of restoration measures.