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Impact assessment of river regulations of the past century using 1D morphodynamic modeling on the Upper Hungarian Danube

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Significant river regulation activities have been carried out on the Upper Hungarian Danube since the end of the 19th century. First, a main channel was created in the natural braided channel to improve the navigational conditions. Later, already in the 20th century, in order to facilitate the erosion of larger deposits, groin fields (wing dam system) were installed helping navigation and flood drainage. Finally, at the end of the 20th century, the Gabčíkovo dam was built (10 km upstream from the Slovakian-Hungarian border section), which caused a lack of sediment in the examined section due to sediment trapping. These were the most relevant measures, however, other activities, such as dredging, have also been implemented.

Due to the lack of past measurement data, it is impossible to accurately reconstruct the original morphodynamic state of the river. Even the contribution of individual measures to the morphodynamic processes is unclear. For example, what effect the modification of the braided channel system could have had on the high water levels. Or which intervention contributed to what extent to the significant drop in river bed level experienced in the last century.

In our study, we built a schematic 1D morphodynamic model, which approximates the dynamic equilibrium state based on the bankfull stage. The concept was to implement the morphodynamic effect of the individual interventions in the model. The validation confirmed that the 1D model concept is a promising manner for the qualitative examination of the impact of interventions on morphodynamic processes.