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The performance of the Hydromorphological Index of Diversity (HMID) in a hydropower affected meandering river

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More than half of the Swiss electricity is produced by hydropower. Large price fluctuations cause severe hydropeaking flow regimes due to corresponding production fluctuations, which undisputedly have a negative impact on aquatic biota. Water diversion due to dams on the other hand imposes downstream residual flow regimes. The absence of flood events and regular sediment supply disrupts sediment dynamics and disconnects floodplains, which are habitats of high value, from its main channel.
The residual-flow controlled reach at the Sarine river in western Switzerland is the subject of the present study. The Sarine meanders strongly and the river reach under analysis has a bed incision of locally more than 100 m. Its incision provokes the isolation of the river which is consequently minimally touched by human structures and shows a natural geomorphology. Since the construction of a dam upstream this reach in 1948, aiming at the water abstraction to hydropower, vegetation could establish and the active floodplain decreased its area, as airborne images show. Nevertheless, it is classified as a floodplain of national importance and it has been under protection since 1992. It is supposed to be a valuable habitat for a wide range of organisms.
The Hydromorphological Index of Diversity (HMID) is a simple tool for quantifying the habitat richness in a river reach, taking into account the mean values and the variation of water depth and flow velocity. For channelized rivers, HMID values from up to 5 are expected, while morphological pristine sites with a high spatial variability of water depth and velocity show values of 9 or higher. For the residual flow of the Sarine River, flow depth and velocity were measured using ADCP and ADV. The results are compared with a nearby natural reference river and the outcome of a 2D numerical simulation. Finally, the behaviour and limitations of the HMID, in a hydropower affected river, are discussed. In the close future an artificial flood is expected in the Sarine in order to reactivate the sediment dynamics. Using 2D numerical simulations in combination with a well understanding of the HMID an optimal planning of this event will be implemented.
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