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Evaluation of Uncertainty of Fluvial Geomorphic Responses to the Removal of dams: A Case study in Shihgang Dam

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Dam removal tends to produce a series of changes in river morphology. In the past, most of the decisions pertaining the removal of dams were evaluated from a deterministic viewpoint. This study developed a stochastic framework by which to evaluate morphological changes in channels with hydrological variability and uncertainty. We combined a short-interval Markov-based synthetic flow model and two-dimensional deterministic SRH-2D model in simulating channel evolution following the removal of a dam, with the aim of elucidating the importance of flow regime in channel morphology. This approach yields probability distributions instead of using a single number for use as a quantifier in decision making, and provides a hydrological-oriented perspective to inspect the issues relate to channel responses. The purposed framework was applied to Shihgang Dam on the Dajia River in central Taiwan as a case study. The longitudinal profile has been evaluated with the focus on the knickpoint uncertainty. Near dam area was found geomorphically sensitive to the effects of the removal of Shihgang Dam. 2D modeling proved beneficial to address the aggradation or degradation of sediment triggered by the meandering of the watercourse. Most of the long-term shifts in thalweg were in the direction of the right bank, the potential lateral variability could be lower with the effect of channelization due to headcutting. This study also investigates the influence of flow regime in geomorphological response using Indicators of Hydrologic Alteration (IHA). It is found that higher flow presents more pronounced channel evolution and vice versa. Similarly, high flow is associated with higher thalweg migration; however, this does not mean that thalweg migration is any less important in situations of low flow. In addition, erosion is prevalent in cases of greater fluctuation, whereas deposition is prevalent in cases of stable flow.