Analyzing natural bed-level dynamics to mitigate the morphological impact of river interventions

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Abstract

Local river interventions, such as channel narrowing or side channels, are often necessary to maintain safety, ecology, or navigation. Such interventions have different effects on the river's bed morphology during periods of high- and low-discharge events. Mapping the bed-level variations for different discharge levels and understanding these effects can provide new opportunities for the design of interventions in multifunctional rivers. At any moment, the local bed level in a river is composed of bed-level changes that occur at various spatial and temporal scales. These changes consist of bed aggradation/degradation trends on a large scale, on an intermediate scale bed-level variations as a result of discharge fluctuations, and on small-scale moving river bed forms like dunes. Using the river Waal in the Netherlands as a case study, we analyze the intermediate-term bed-level changes resulting from discharge fluctuations (dynamic component) and propose adaptations to the design of floodplain interventions such that possible negative impact on the local bed-level changes is minimized. Time series of bed levels along two 10 km stretches of the case study are considered for a period of 16 years (2005–2020). Using a wavelet transform, we isolate bed-level variations resulting from discharge events. These bed-level variations are presented based on the magnitude of the discharge event and are compiled in an interactive atlas of river morphodynamics, allowing us to mitigate the impact of interventions. This will help river managers in the design of interventions and lead to improved management, operation, and maintenance of multifunctional rivers.

Keywords

Natural bed-level dynamics, mitigate morphological impact of river interventions

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