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The response of bedforms and bed elevation to hydrodynamics changes

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To date the majority of research concerning bedform dynamics has been conducted under steady flow conditions in laboratory controlled flumes. However, all fluvial, estuarine and coastal environments exhibit temporal variations in hydrodynamics, that alter the physical interactions between flows and sediment transport, resulting in adjustment of bedforms. Such interactions also introduce time lags and hysteresis between the flow and the bed response to changing conditions.

Our research is based on two series (sudden and gradual changes of hydraulic conditions) in a range of controlled flume experiments. These are used to investigate how bedforms respond to changes in hydrodynamics (velocities and water depths). The results confirm the effect of water discharge (both water depth and velocity) on changes in bedform height and length under steady flow conditions. They also reveal a range of hysteresis based relations between the changes and the response of the bed.

Previous investigations mainly focus on relationship between water discharge and bedform dimensions. However, our results reveal the dynamical sediment transport response to impose flow changes and show that a partitioning between bedload and suspended bedload transport is key in driving the response of the bed to changes in flow. Our results, therefore, provide a more detailed comprehension on interactions between hydrodynamics, sediment transport and bedform adjustment, which may help to improve geomorphic module of numerical models.