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Abrupt sediment grain size transitions drive rapid changes in Himalayan channel dynamics

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Rivers draining the largest mountain ranges on the planet carry huge quantities of sediment, most of which is ultimately delivered to the sea hundreds to thousands of kilometres downstream. As sediment is transported downstream by rivers it undergoes a series of transformations, but in virtually all rivers an abrupt transition in river bed grain size from gravel to sand occurs, also known as the gravel-sand transition. Whilst migration of the gravel-sand transition is commonly thought to reflect environmental forcing, such as changes in basin subsidence rate or water and sediment discharges, little is known about whether the transition may also act as a driver of environmental or morphological change. Here we present new point-depth suspended sediment concentration and grain size data between the Himalayan mountain front and immediately downstream of the gravel-sand transition on the Karnali River (west Nepal) to examine changes in sediment transfer and large-scale channel dynamics across a gravel-sand transition.

Our initial results suggest that near-bed sediment concentration rapidly increases across the gravel-sand transition from $\sim$4 g/l to >110 g/l between sampling locations only a couple of kilometres apart. Combining this with optical satellite imagery and new OSL ages of palaeochannels in the Karnali River floodplain (between the Himalayan mountain front and gravel-sand transition) we also demonstrate a stark contrast in the rate and style of channel migration upstream and downstream of the gravel-sand transition. Using suspended sediment concentration and water discharge measurements, a substantial increase in sediment flux is observed across the gravel-sand transition. These data suggest that suspended sediment transfer and deposition across the gravel-sand transition has an immediate effect on rates of floodplain recycling and large-scale channel dynamics downstream of the Himalayan mountains.