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Lag time in evacuation of coarse sediment generated by large earthquakes: a case study of the Melamchi River (central Nepal)

Emma Graf, Hugh Sinclair, and Mikael Attal
School of Geosciences, University of Edinburgh, Edinburgh, United Kingdom (emma.graf@ed.ac.uk)

Large earthquakes can contribute to mountain growth by building topography, but also contribute to mass removal from mountain ranges through widespread mass wasting. On a shorter timescale, large earthquakes also have the potential to significantly alter fluvial sediment dynamics if a significant volume of the sediment generated reaches the fluvial network. For example, up to 18 m of channel bed aggradation were observed following the 1999 Chi-Chi (Taiwan) earthquake. In this contribution, we focus on the Melamchi River in central Nepal. This catchment experienced widespread landsliding associated with the 2015 Gorkha (Nepal) earthquake, and was struck by a devastating high concentration flow in June 2021, resulting in up to 15 m of channel aggradation. Using a time series of high-resolution satellite imagery, we have mapped exposed gravel along the river from 2012-2021 to identify zones of channel aggradation and document changes over time. We show that the increase in exposed gravel following the 2015 earthquake is negligible compared to the signal associated with the 2021 event. We consider whether the scale of the high concentration flow event was amplified by the Gorkha earthquake preconditioning the landscape for large-scale sediment evacuation, which raises the question of whether an event such as the Melamchi disaster could occur in other Gorkha-affected catchments.