Where does all the gravel go? Tracking landslide sediment from the 2015 Gorkha earthquake along the Kosi River, Nepal

Emma Graf, Hugh Sinclair, and Mikael Attal
School of Geosciences, University of Edinburgh, United Kingdom

Rivers draining the Himalaya and feeding the Indo-Gangetic plain support around 10% of the world’s population. However, these rivers are also prone to frequent and often devastating floods such as the 2008 Kosi floods which displaced more than 2.5 million people. Changes in sediment supply from the Himalaya influence the magnitude and distribution of floods through changing capacity and routing respectively. Widespread landsliding following the 2015 Gorkha (Nepal) earthquake increased suspended sediment supply to the river network and is expected to result in some degree of coarse bedload aggradation and increased rates of channel migration at the mountain front. Given the significant amounts of channel aggradation observed in the aftermath of similar events, understanding the timescales of sediment transport following the 2015 Gorkha earthquake and the impact of any resulting sediment wave on flooding in the Gangetic plains is crucial. We track the gravel size fraction of the landslide sediment along the Kosi River (East Nepal) by mapping zones of sediment input from optical satellite imagery and constructing a time series of high-resolution channel cross-sections using an Acoustic Doppler Current Profiler (ADCP) in the years following the earthquake. We use these datasets to identify zones of channel aggradation and migrating sediment, and test whether the changes are consistent with the location of sediment sources (landslides) and magnitude of the monsoon floods with the aid of landslide inventories and flow data. While initial results show a marked increase in coarse sediment following the 2015 monsoon, we see little evidence of large-scale downstream migration of any sediment pulse, indicating the Gorkha landslides may have less of an impact on flood and sediment dynamics on the Indo-Gangetic plains than expected from comparison with similar events. We suggest that the Gorkha landslides may not be connected to the fluvial system to the same extent as for similar events and revegetated rapidly, and therefore did not release significant amounts of sediment into channels after the initial post-2015 monsoon pulse.