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How landslide debris grainsize controls sediment transport and dynamics

Jun Xie[1,2] and Tom Coulthard[1,2]
[1]Energy and Environment institute,University of Hull, Hull, UK
[2]Department of Geography, Geology and Environment, University of Hull, Hull, UK

The grain size of sediment delivered to a river by hillslope processes is crucial for fluvial erosion, sediment transport and associated geomorphic changes. Grain size distribution (GSD) is increasingly recognized an important factor for the impact of landslides on sediment pulses and long-term erosion rates. Therefore a better understanding of grain size control on landslide generated sediment transport and dynamics is crucial and imperative for post-seismic fluvial process and landscape evolution. In this study, we modelled the recovery of the Hongxi river catchment affected by landslides triggered from the Wenchuan Earthquake under different GSD scenarios. Using the CAESAR-Lisflood (CL) model we simulated three different GSD scenarios (Original, Coarser, Finer) by altering original sediment GSD data set observed from a post-earthquake basin. In particular we analysed the fate of landslide-generated sediment using a new sediment tracing function embedded in CAESAR-Lisflood. This enabled us to evaluate the role of landslide GSD variation on the spatial-temporal heterogeneity of sediment transport and landform changes. Our results show that the GSD variations of landslide material exerts an evident impact on both sediment yield and spatial distribution of sediment transport with Finer scenarios showing an overall higher sediment yield. The content of fine sediment display a predominant control when the daily sediment yield is less than 5*10 m^3 at the basin outlet. The impact of GSD on sediment transport process varies from landslide to landslide based on their characteristics. These findings highlight the importance of grain size distribution of landslide material and thus shed some light to determine the complete role of landslides on basin sediment dynamics.