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Insights on the post-seismic geomorphological response to the 2008 Wenchuan Earthquake from detrital cosmogenic nuclides data

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In high-relief mountain ranges bounded by reverse faults, large-magnitude earthquakes can contribute to topographic growth by co- and inter-seismic surface uplift of the hanging wall; meanwhile, earthquakes can also lower relief by causing erosion through extensive landslides. Quantifying evacuation process of co-seismic landslides material is central to our understanding of mass redistribution at the earth surface and the evolution of active mountain ranges. The 2008 Mw 7.9 Wenchuan earthquake in the Longmen Shan range of eastern Tibet provides a valuable opportunity to evaluate such direct impact. Cosmogenic nuclides concentrations in river sands are diluted by the input of low-concentration landslide debris materials after the earthquake (West et al., 2014), and we document the evolution 10Be concentrations in quartz for several years after the Wenchuan earthquake to trace the routing processes of co-seismic landslides. Over the 2008-2013 period we collected river sand samples at 19 locations annually along the rivers that flow through the rupture zone. When compared with published pre-earthquake data, our results show that the 10Be concentration in river sand declined dramatically after the earthquake at all sampling sites. Meanwhile, multi-year time series of 10Be concentration at single sites present roughly constant level of dilution with moderate fluctuations. Our analyses indicate that the 10Be dilution amplitude is closely controlled by local catchment slope and landslide density, rather than by the location of landslides with respect to sampling sites. The perturbation we observed for 10Be concentrations in the 0.25$\sim$1 mm size fraction appears to be sustained over the timescale of our survey with no clear relaxation, which is consistent with independent results from suspended sediment analysis (Wang et al., 2015).