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Know the limit – Landslide inventories and climate-change attribution

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Most scenarios of future climate change have prompted predictions about potential increases to the magnitude and frequency of landslides. Such increases may result from more extreme precipitation and temperature regimes in humid temperate mountain regions especially. To satisfy this notion, landslide response to contemporary or past climate change should be detectable in landslide size inventories, their scaling statistics, and eventually inferred erosion rates. We test this notion with Monte Carlo and bootstrap simulations of various probability density functions commonly used to characterize empirical landslide size distributions. We show that significant changes to total volumetric landslide budgets may be smothered by statistically indistinguishable scaling parameters, critically depending on, among others, the size of the largest of landslides recognised. In contrast, seemingly equivalent model parameter values may obscure more than twofold changes to landslide occurrence, and thus inferred rates of hillslope denudation and sediment delivery to drainage networks. The temporal signal of landslide clustering as a means to potentially first-order climatic changes during the Quaternary seems more conclusive. To this end, we examine a time series of Earth's largest mass movements that reveals significant clustering near and partly before the last glacial-interglacial transition and a distinct step-over from white noise to temporal clustering around this period. Elucidating whether this is a global signal of climate-change impact on slope stability or a random transition from short-term statistical noise to long-term steady-state conditions remains an important research challenge.