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Landslide mobilization: global patterns and rates

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Landslides and mass movements are essential geomorphological features driving landscape evolution and causing denudation at different magnitudes. Albeit the number of reported landslide inventories and their quality are continuously growing, global estimates of sediment mobilized through landslides remain poorly constrained. Here we present a first quantification of the contemporary global landslide mobilization rates (LMR). Statistical analyses of a dataset of contemporary LMR observations for 116 study sites worldwide showed that patterns of LMR are mainly controlled by topography (local relief), seismicity and lithology. Based on these results and taking into account uncertainties on the LMR observations, we calibrated and validated a robust empirical model that explains about 62% of the observed variance in LMR. By applying this model globally, we estimate that on average about 56 ± 5 billion m^3 ($\sim$100 gigaton) of landslide material is annually mobilized. Intercontinental and interregional differences are large with the Central and Southeast Asian mountain ranges (a.o. the Himalaya and Karakoram, covering $\sim$2% of the global land mass) generating 50% of this rate. Comparison with observed catchment sediment yields confirms the large importance of landsliding as a denudation process. Nonetheless, our analyses clearly indicate that a large proportion of the landslide derived sediments are stored within catchments, highlighting the important role of internal catchment buffering on sedimentary pathways.