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Examining landslide recurrence intervals and landslide-derived sediment fluxes with 10Be concentrations and grain size distributions: preliminary results from the Fiordland and the Southern Alps, New Zealand

Duna Roda-Boluda (1), Taylor Schildgen (1), Hella Wittmann-Oelze (1), Jeff Prancevic (2), Stefanie Tofelde (3), and Aaron Bufe (1)

(1) GFZ Potsdam, Potsdam, Germany (roda@gfz-potsdam.de), (2) ETH Zurich, Zurich, Switzerland, (3) University of Potsdam, Potsdam, Germany

Landslides are a primary erosion process in steep landscapes and are among the most deadly and damaging geohazards. However, it remains extremely difficult to constrain long-term or past rates of landslide activity, because the physical record of landslides is often removed by erosion or vegetation regrowth in $<10^2$ years. Landslide inventories from historical imagery record, at best, the frequency of mass movements over the last decades or cumulative landslide activity over an unknown time interval. This data limitation prevents accurate model development and predictions of landslide activity in the face of climate change. To address this gap, we are using measurements of ^{10}Be, a cosmogenic radionuclide (CRN), to measure landslide recurrence intervals over longer timescales. Additionally, determining CRN concentrations in landslides is important because landslides mobilize material depleted in CRN relative to other erosional processes, and can dominate catchment-averaged CRN concentrations, sometimes hindering the determination of accurate catchment-averaged erosion rates. Here, we present preliminary data on the ^{10}Be concentrations of sand from 11 recent landslides and 4 catchments of the Fiordland and Southern Alps of New Zealand. For each landslide, we combine measured ^{10}Be concentrations with depth-integrated production rate estimates, predicted using digital elevation models of the landslide scars. This allows us to estimate the time interval over which each of the studied hillslopes accumulated CRNs before the landslide event occurred, a timescale that should approximate the landslide recurrence interval of that particular hillslope. We analyze the range of landslide recurrence intervals that we obtain from our CRN data in the context of published landslide recurrence intervals and frequency-magnitude relationships derived from multi-temporal and geomorphic landslide inventories of the study area. Furthermore, we compare landslide depths and estimated recurrence intervals with the grain-size distributions produced by each landslide, to test whether landslide depths and landslide recurrence intervals (and hence, weathering depths and times) influence the sediment size delivered by landslides. Finally, we compare the landslide ^{10}Be concentrations and grain-size distributions with the fluvial, catchment-averaged ^{10}Be concentrations and grain sizes, to examine the role of landslide-derived sediment fluxes in the CRN and granulometric signals of fluvial sediment.