
Erosional Transience Across Timescales and Processes: Insights from ^{14}C – ^{10}Be

Duna Roda*¹

¹Universitat Autònoma de Barcelona = Autonomous University of Barcelona = Universidad Autónoma de Barcelona – Spain

Abstract

Many cosmogenic nuclide applications and landscape evolution models assume steady, diffusion-like erosion. In reality, erosion is often transient and spatially heterogeneous. Processes such as landsliding generate highly variable erosion in space and time, with activity fluctuating across seismic cycles. In addition, glacial and knickpoint retreat reorganize erosion patterns, while climate variability influences erosion rates across catchments, even where diffusive processes dominate. Here, I present three datasets that quantify the influence of non-steady processes on erosion rates.

First, I examine in situ $^{14}\text{C}/^{10}\text{Be}$ ratios from 9 landslides and 19 catchments in New Zealand. In rapidly eroding landscapes, elevated ratios trace landslide-derived sediment and constrain landsliding contributions to catchment-scale erosion. I also assess how sediment storage lowers $^{14}\text{C}/^{10}\text{Be}$ ratios, highlighting the complex coupling between sediment production and storage in landslide-prone settings.

Second, I combine in situ ^{10}Be concentrations from 17 recent landslides with photogrammetry to estimate recurrence intervals on 10^2 – 10^3 year timescales. Integrating these results with decadal frequency–magnitude inventories, published denudation rates, and constraints on co- and post-seismic landsliding, I evaluate landslide contributions to sediment budgets and erosion variability over entire seismic cycles.

Finally, preliminary ^{14}C – ^{10}Be data from two catchments in Calabria (Italy) show accelerated erosion linked to knickpoint retreat, as well as increased recent erosion upstream in relict, landslide-free areas, likely driven by land-use or climate changes.

Together, these results show how paired cosmogenic nuclides, combined with complementary datasets, provide insights into transient erosion across processes and timescales, improving our understanding of landscape evolution.

Keywords: ^{14}C , ^{10}Be , paired nuclides, landslides, erosion, knickpoints

*Speaker