Goldschmidt 2026 Abstract
https://doi.org/10.46427/gold2026.35278

Spatial variability of denudation rates across a watershed by Inversion of 10Be catchment-wide denudation (CWD) rates (The Strengbach Catchment, Vosges France)”

BASTIEN MATHIEUX[1], RAPHAEL DI CHIARA ROUPERT[2], JÉRÔME VAN DER WOERD[2] AND **PROF. FRANCOIS CHABAUX**[2]

[1]ITES CNRS - Université de Strasbourg France
[2]ITES CNRS - Université de Strasbourg

Understanding the spatial variability of bedrock denudation rates is a key challenge for studying the evolution of continental surfaces at the regional scale. In situ ^{10}Be concentrations measured in quartz from river sediments are widely used to estimate catchment-wide denudation rates. However, this approach often yields values that are either too spatially averaged when applied to large regional basins, or too localized when restricted to small headwater catchments. Using the Strengbach watershed—from its headwaters within the Strengbach Critical Zone Observatory to its outlet in the Rhine Graben—we aim to demonstrate how combining in situ ^{10}Be analyses from elementary sub-catchments with a first order characterization of lithological and geomorphological parameters allows spatializing denudation rates at the scale of the larger watershed.

For this study, 12 sediment samples were collected in July 2022 along the main trunk and at the outlets of five tributaries selected for their position along the river profile and their contrasting lithologies. The resulting denudation rates show only low to moderate correlations with individual lithological or geomorphological parameters. This suggests that it is the combined influence of both lithology and morphology that controls the spatial variability of denudation within the Strengbach basin.

To quantify this variability, we subdivide the watershed into major litho-morphological domains and estimate the denudation rate associated with each domain using a Monte Carlo inversion approach. We assume that the denudation rate measured at the outlet of a sub-catchment corresponds to the area-weighted sum of the denudation rates affecting the litho-morphological domains exposed within that sub-catchment.

The Strengbach case study illustrates the relevance of this approach for resolving spatial variations in denudation rates across a watershed. It also provides a more robust framework for interpreting the temporal evolution of landscape instabilities—particularly knickpoints—identified through morphometric analysis. More broadly, this methodology offers a promising way to bridge the gap between local cosmogenic nuclide measurements and regional-scale landscape evolution processes.