Enhanced chemical weathering by subsurface flow below knickpoints

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Chemical weathering in the Critical Zone may be highly heterogeneous in space with enhanced weathering rates in localized areas [1, 2]. In particular the distribution of subsurface flow is expected to play a key role in the spatial distribution of weathering rates [3, 4]. One way to detect such reactive hot spots is to characterize the longitudinal variability of solute concentrations along streams [5]. Here we report new geochemical observations of major element concentrations and strontium isotopic ratios in the water of Quiock river CZO in Lesser Antilles, showing a strong chemical contrast upstream and downstream of a knickpoint, which represents a steep region along a river profile. Upstream from the knickpoint, Sr isotope signature is very close to atmospheric signature, while downstream from the knickpoint, the Sr isotopic signature is close to the rock isotope ratio. .We developed analytical and numerical models allowing us to investigate the interaction between topography, subsurface flowpaths and the distribution of weathering rates around the knickpoint. The model predicts the spatial distribution of subsurface streamlines around the knickpoint and reproduce the chemical contrast between upstream and downstream from the knickpoint.

References

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