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Migration of a slow wave of erosion and its effect on nutrient availability in a tropical rainforest: detrital 10Be signature and soil mineralogy, Luquillo CZO, Puerto Rico

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Rivers draining the Luquillo Mountains Critical Zone Observatory of Puerto Rico exhibit pronounced knickpoints. The largest knickpoints are located over a quartz diorite stock on the southern flank of the massif. They correlate cluster in elevation around the elevation of a flat-lying, dissected surface traceable around the Luquillo Mountains interpreted as an uplifted shore platform formed during the Pliocene. Upstream of the knickpoints, are alluvial, flow on a saprolite and are still graded to that uplifted platform; they drain the relict landscape of a former island about 15 km in diameter. These knickpoints initiated when the platform started to rise above the Caribbean Sea. They subsequently propagated upstream at the front of a slow-moving erosion wave. To evaluate how this wave affects the old-growth El Yunque tropical rainforest we measured cosmogenic in situ 10Be in quartz from river-borne sediment above and below the knickpoints. These 10Be-derived catchment-scale denudation rates document a 30% to 210% increase in denudation associated to the passage of the knickpoints. Differences in retreat efficiency are necessary to bring all knickpoints to their present locations. Such differences are detectable in the 10Be-derived erosion signal measured below the knickpoints. The effect of these knickpoints is fundamental in the variability in nutrient availability in the forest: they separate a downstream, faster-eroding landscape were the saprolite is thin and still contains some primary easily weathered minerals, that provide nutrients to the plant communities. Upstream of the knickpoint, the upper relict landscape is blanketed by a very thick saprolite, thoroughly depleted in primary minerals, where the forest is known to retrieve most of its nutrients mostly from atmospheric inputs.