Denudation and weathering rates from meteoric $^{10}Be/^{9}Be$ ratios in the Amazon basin

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Quantification of river dissolved and particulate fluxes is essential for understanding the role of weathering and erosion in geochemical cycles. The Amazon River is a natural laboratory where novel methods to quantify riverine fluxes can be verified, because of the density of published data on present-day sediment and dissolved loads (e.g. [1-3]) and millenial-scale denudation rates from *in situ*-^{10}Be [4]. Here we present extentive testing of a new method derived from the meteoric ^{10}Be over ^{9}Be (stable) ratio. This new proxy combines a known atmospheric flux tracer, meteoric ^{10}Be, with ^{9}Be released from rocks by weathering. We show how long-term erosion (E), denudation (D), and weathering (W) rates can be determined from only sub gram-sized amounts of almost any fine-grained sediment, or from river water. Denudation rates from $^{10}Be/^{9}Be$ ratios measured in bedload, suspended sediment, and water samples from Amazon Rivers agree within a factor of ca. 2 with published *in situ*-^{10}Be denudation rates. Erosion rates using ^{10}Be concentrations from depth-integrated suspended sediment (DSS) agree well with meteoric denudation rates, implying $E \approx D$. A fraction of ^{9}Be released during weathering of rock to soil of roughly 40% is calculated from DSS samples. This number is invariant from the Andes across the lowlands to the amouth, indicating no weathering of Be-containing minerals in the Amazon floodplain. We anticipate that our promising results will lead to a broad application of this new proxy as former restrictive issues, such as retentivity and grain size, are now better understood and the bias on D from $^{10}Be/^{9}Be$ ratios is small.

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