Temporal evolution of detrital cosmogenic denudation rates in transient landscapes from *in situ*-produced and meteoric ^{10}Be

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In equilibrium landscapes, ^{10}Be concentrations within detrital quartz grains are expected to quantitatively reflect basin-wide denudation rates. In transient landscapes, though detrital quartz is derived from both the incising, adjusting lowland and the unadjusted, relict upland, the integrated ^{10}Be concentrations still provide a denudation rate averaged across the two domains. Because field samples using in situ-produced ^{10}Be can only provide a snapshot of the current upstream-averaged erosion rate, we employ a numerical landscape evolution model to explore how ^{10}Be derived denudation rates vary over time and space during long-term transient adjustment. Model results suggest that the longitudinal pattern of mean erosion rates is generated by the river's progressive dilution of low-volume, high-concentration detritus from relict uplands by the integration of high-volume, low-concentration detritus from adjusting lowlands. The proportion of these materials in any detrital sample depends on what fraction of the upstream area remains unadjusted.

On shorter timescales, a single storm can induce transience in a landscape. Meteoric ^{10}Be concentrations can be measured in submilligram-sized sediment samples and this attribute enables us to measure suspended sediment through a hydrograph. The meteoric ^{10}Be concentration in river sediment changes with the source areas and fluxes of material supplied to the stream. The average concentration from the couplet of the rising and falling limbs of the hydrograph can differ from the concentration of the sediment that is preserved in depo-centers. Using this short timescale system, we reconsider how to interpret paleoerosion rates from depo-centers derived from meteoric and *in situ*-produced ^{10}Be concentrations.

Temporal Variability of Coastal Rainwater Fe(II) Concentration and Wet Deposition to Surface Seawater

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The concentration and stability of dissolved Fe(II) in rainwater collected in Wilmington, North Carolina, USA, have decreased by more than an order of magnitude in the preceding decade. Rainwater Fe(II) during the winter of 2003 was stable for more than 96 hours, whereas in 2011, concentrations decreased by 60% within 4 hours. A decade ago, rainwater Fe(II) was strongly complexed by organic ligands which stabilized it against oxidation. Currently Fe(II) appears to be present in rainwater predominantly as photochemically produced inorganic Fe^{2+}(aq). Spectral slope data indicates rainwater dissolved organic carbon (DOC) has become less conjugated and smaller in average molecular weight, consistent with less iron complexation. These changes in DOC may result from improved control of automobile emissions. Inorganic Fe^{2+}(aq) can be rapidly oxidized by H_2O_2 and, in rains with pH > 5 (half of all rains), by O_2. H_2O_2 has doubled in the last decade due to lower emissions of SO_2 (a sink for H_2O_2), which increases the oxidation rate of Fe^{2+}(aq) by approximately 30%.

A decade ago, rainwater was a source of soluble Fe(II) to surface seawater, where it is a phytoplankton nutrient. Because of the decreased concentration and stability of Fe(II) in rain, Wilmington NC rainwater is now a much smaller source of soluble Fe(II) to North Atlantic surface seawater, which may reduce primary productivity and hence lower CO_2 uptake in this region.

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