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Temporal variability in detrital CRN concentrations in large Himalayan catchments

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Accurately quantifying sediment fluxes in large rivers draining tectonically active landscapes is complicated by the stochastic nature of sediment inputs. Cosmogenic ^{10}Be concentrations measured in modern river sands have been used to estimate 10^2-10^4 year sediment fluxes in these types of catchments, where upstream drainage areas are often in excess of 10,000 km^2. It is commonly assumed that within large catchments, the effects of stochastic sediment inputs are buffered such that ^{10}Be concentrations at the catchment outlet are relatively stable in time. We present eighteen new ^{10}Be concentrations of modern river and dated Holocene terrace and floodplain deposits from the Ganga River near to the Himalayan mountain front. We demonstrate that ^{10}Be concentrations measured in modern Ganga River sediments display a notable degree of variability, with concentrations ranging between ∼9,000-19,000 atoms g^{-1}. It is proposed that this observed variability is driven by two factors. Firstly, by the nature of stochastic inputs of sediment (e.g. the dominant erosional process, surface production rates, depth of landsliding, degree of mixing) and, secondly, by the evacuation timescale of individual sediment deposits which buffer their impact on catchment-averaged concentrations. Despite intensification of the Indian Summer Monsoon and subsequent doubling of sediment delivery to the Bay of Bengal at ∼11-7 ka, we also find that Holocene sediment ^{10}Be concentrations documented at the Ganga outlet have remained within the error of modern river concentrations. We demonstrate that in these systems, sediment flux cannot be simply approximated by converting detrital concentration into mean erosion rates and multiplying by catchment area as it is possible to generate considerably larger volumetric sediment fluxes whilst maintaining comparable average ^{10}Be concentrations.