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Paired in-situ 14C and 10Be measurements in a Himalayan catchment: residence time or sediment production process tracer?

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Cosmogenic nuclides in detrital river sediments have been widely applied to derive denudation rates and sediment fluxes across entire catchments. Nuclides, such as 10Be, allow the derivation of denudation rates integrated over several hundreds to thousands of years, but single isotopic systems often provide little information on the intricate dynamics that control the export of sediments from catchments. The quantification of sediment storage and recycling within catchments is nevertheless crucial for a better understanding of the variability of sediments fluxes and their implication for landscape evolution. The paired measurement of 10Be along with cosmogenic, in-situ 14C in river sediments may provide new insides into sediment dynamics over kyr time scales for which other nuclides are not suitable [1,2]. In an effort to better understand the sediment dynamics in active orogens we combine in-situ 14C and 10Be measurements from the Kosi basin in eastern Nepal (∼53 000 km2). Our preliminary 14C/10Be data shows apparent burial/storage ages of 14 to 21 kyr in the sediments currently exported by the river. These elevated burial ages suggest a larger storage component than previously thought in these catchments, even though possible biases associated to the use of 14C/10Be in sediments as burial chronometer have to be considered: First, the short half-life of 14C cannot be neglected and hence basin wide denudation cannot be considered as a simple mixing of sediments from individually eroding surfaces, introducing bias towards higher apparent burial ages in most settings. Second, in steep environments, sediments supplied by deep-seated landslides carry a buried signature that should not be confounded with sediment storage in the catchment. The importance of both biases needs to be quantified carefully, before basin-wide storage can be quantified.

[1] Lauer & Willenbring, 2010 – JGR-Earth, vol. 115, F04018.
[2] Hippe et al., 2012 – Geomorphology, vol. 179, pp. 58-70.