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# Understanding sediment dynamics in rivers using fallout radionuclides: How to move forward from the lessons learnt in a tropical catchment

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Land use change and the concomitant acceleration of soil erosion have led to an increase in sediment supply to rivers worldwide. This degradation results in significant on-site (e.g., decrease in soil fertility) and off-site impacts (e.g., reservoir siltation and degradation of water quality). To implement effective sediment mitigation measures, it is necessary to clearly understand catchment sediment sources and their spatial temporal dynamics. Fallout radionuclides characterized by different half-lives and origins (Be-7 – 53 d; Pb-210 – 22 y; Cs-137 – 30 y) provide important information required to quantify the dominant sources of sediment and also their temporal dynamics. However, the current methods have several limitations, and the hypotheses underpinning this technique require further verification.

To examine these assumptions, we investigated sediment dynamics in a 10-km$^2$ catchment in Northern Laos during the first flood of the monsoon in June 2014. Before this event, Be-7 that labelled soil and sediment during previous storms in 2013 had completely decayed, and the material stored in the river channel was shown to be depleted in Be-7. A large set of samples (n=97) was collected to characterize the sources that may supply sediment to the river. In addition, suspended sediment (n=17) was collected in the river at several stations during this the first flood of the monsoon. A distribution modelling approach was used to quantify the relative contributions of surface and subsurface sources. Further we modelled the proportions of material eroded during this storm compared to material that previously eroded before the storm and was remobilized during this recent event.

The results demonstrate that the majority of sediment transported during the first erosive storm of the year consists of older, remobilized material. Furthermore, the contribution of sediment supplied to the river by subsurface sources (i.e. channel bank erosion) increases downstream. In the future, this approach should be tested in larger catchments to improve our understanding of sediment propagation in river systems.