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Tracing the sources of fine sediment in a nickel mining catchment using fallout and geogenic radionuclides (Thio River, New Caledonia)

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Soil erosion and subsequent sediment transfer in rivers are exacerbated in tropical regions exposed to heavy rainfall. In New Caledonia, an island located in the southwestern part of the Southern Pacific Ocean, a significant fraction of this sediment is likely originating from tributaries draining nickel mining sites that are known to increase the terrigenous inputs to the rivers and, potentially to UNESCO World Heritage listed coastal lagoons. However, downstream contributions from these tributaries remain to be quantified.

A pilot sediment tracing study has therefore been conducted in the 400-km² Thio River catchment. Fallout and geogenic radionuclides have been measured in sediment deposits collected in potential sources, i.e. (i) tributaries draining mines, (ii) tributaries draining ‘natural’ areas affected by landslides, and (iii) the main stem of the Thio River.

Thorium-228 and Caesium-137 provide the best discrimination between sediment originating from the two tributaries. A distribution modelling approach was used to quantify the relative sediment contributions from these tributaries to the Thio River main stem. Results demonstrate that tributaries draining mining sites supply the majority of sediment (67–84%) to the main river.

In the future, the validity of these results obtained on sediment deposits collected in April and May 2015 should be verified over a longer time period by applying a similar approach to sediment cores collected in the Thio river deltaic plain. Once validated, this method will be applicable to other catchments draining mines in New Caledonia to design appropriate measures to limit sediment supply to the lagoon.