**Quantifying sediment delivery ratios during extreme events using repeat lidar: A case study of Cyclone Gabrielle 2023 in Aotearoa New Zealand.**

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# ABSTRACT

The transfer of sediment from source to sink has often been described as a jerky conveyor belt. The role of large or extreme flood events on the flux of sediment remains poorly understood. The increasing availability of multitemporal high resolution lidar offers new opportunities to begin to quantify the role of extreme events on the sediment transfer process.

In February 2023, Cyclone Gabrielle resulted in a catastrophic flooding along the eastern coast of the North Island of Aotearoa New Zealand. Repeat lidar surveys of the affected areas were conducted immediately following the retreat of floodwaters to quantify the impacts in the most affected areas. Further surveys were conducted in July 2023 at the full catchment scale to develop a catchment-scale sediment budgets for the event, across basins ranging in size from 70-270 km2.

A combination of intense land sliding and the reactivation and transport of stored sediment deposits resulted in damaging deposition in the floodplain in the lower valleys and the loss of major infrastructure and human life. Topographic sediment budgeting from the lidar surveys reveal high sediment delivery ratios during this event, which we hypothesize, are related to increased connectivity of sediment delivery pathways from source to sink. With an anticipated increase in severity of similar extreme events, our results suggest that an increased efficiency of sediment transfer to receiving environments, including distal, urbanized floodplain environments and sensitive marine ecosystems.