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Airborne LIDAR investigation of lithological controls on river behavior in a mountainous catchment following a major storm event

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Airborne LiDAR is increasingly being used to investigate sediment dynamics in mountainous catchments. By combining information on hillslope and river dynamics, our understanding of the connectivity between geomorphic units both at micro and macroscopic scales is expected to improve. This work reports a case study from three rivers in the upper Saru River catchment (380 km^2) in the Hidaka Mountain Range, Hokkaido, Japan. The catchment is underlain by either soft Cretaceous marine sedimentary rocks or a solid Cretaceous to Tertiary accretionary complex. Deep-seated landslides, the toes of which often reach valley floors, are common in the former. The streams are also wider and gentler than in the latter geology, through which v-shaped valleys have formed. The catchment experienced aggradation throughout its river courses in a major storm event in 2003. Airborne LiDAR data sets in 2006 and 2010 were employed to examine landslide locations and changes in river form. In the soft rock areas, stream courses were confined at landslide toes and tributary fans, the locations of which affected the pattern of river behavior. While degradation was dominant over this period, local aggradation occurred in places. In contrast, channel incision was intense throughout the hard rock areas, where the entire bed degraded by 2-3 m. Data analysis showed that the alignment of rock types clearly impacted on the residence times of sediment delivered to the channel in 2003. Sediment released from these rivers was accumulating downstream from their confluence point along a 15 km meandering flood plain reach. Aggradation continued until the next confluence point. Field observations showed that fresh materials continue to be supplied from adjoining deep seated landslides and stored in the most upstream part of the catchment, indicating that the next intense storm event could cause a repeat of this process in future.