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Multi-temporal Reconstruction of a 35km reach of the Dart River Valley, New Zealand with the Structure-from-Motion pipeline (SfM).

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Two discrete surveys, May 2014 and May 2015, were undertaken to capture the topography of a 35km reach of the Dart River, immediately downstream of a significant landslide that initially dammed the river in January 2014. Repeat surveys provide the opportunity to broadly quantify morphological response in terms of elevation change through Dem-of-Differencing. Such an approach requires the generation of consistent surfaces devoid of systematic bias across each epoch that are accurately geo-referenced and of a research specific, minimum accuracy. For this study, the highly automated cost effective method of SfM has been used to generate catchment models at a x, y resolution of 0.5m. This was achieved through the helicopter mounted capture of ∼2,000 nadir only images, using a Nikon D90 (2014) and ∼10,000 convergent images using two Nikon D750'S (2015) at a height of 350m above ground at a flight speed of 85 knots. Both surveys were geo-referenced by 100 Ground Control Points (GCP) measured with Real-Time-Kinetic (RTK) GPS, with additional control in the form of a series of TLS scans across the length of the catchment. Initial results from 2014 show prevalent systematic errors from both inadequate camera network geometry and ground control. The following survey from 2015 makes use of a convergent network with increased ground control to theoretically provide catchment topography with minimal bias. In the absence of a convergent network, results from 2014 may be improved via additional ground control to extend the 3-dimensional radius of control, beyond which, results are often inferred. In this instance the 2015 data set has been used to provide additional reference through the identification of concurrent features which are unlikely to have moved between surveys, such as town buildings. The final reconstructions from both 2014 and 2015 are sufficiently accurate to provide us with the opportunity to perform detailed analysis to answer a range of geomorphological questions. Results are presented to illustrate both the feasibility of undertaking a SfM study at the catchment scale, whilst producing valid results and the ability to update existing datasets with new positional data to limit systematic bias. Ultimately the findings of this study will be used to assess how the propagation of sediment from a high magnitude event through the Dart catchment manifests itself.