

Impact of glacier recession on debris-flow fan morphology at Fox Valley, New Zealand, using airborne photogrammetry

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The West Coast of New Zealand annually experiences ~3,000 mm of rainfall at the coast and up to 12,000 mm near the Alpine ridge. Although those important precipitations have helped glaciers reaching 300-400 m asl at Fox Glacier and Franz Josef, present conditions have pushed the glacier terminus of Fox Glacier about 800 m upstreamward from where it was in 2000. This recession has freed a number of tributary valleys that were plugged by the ice. The junction between the main valley stem and the tributary is now occupied by exceptionally large fans, which were generated during the ice recession phase.

In order to understand how the ice recession and the debris-flow have created the debris-flow fans and what morphology was created, we have used an analysis of high-resolution topography.

Because of the quasi-omnipresence of low-clouds in the valley, there are very few aerial data available for the lower Fox Valley. Consequently, we flew in 2015 a commercial helicopter, from which we collected 150 photographs with a SLR camera 35 mm focal. This first dataset was completed by a series of photographs taken from a DJI Phantom2-Vision+ (~350 photographs). Finally, thirty Ground Control Points and 220 Quality Control Points were collected using RTK GNSS (Trimble R8). The data was then processed using the SfM software Photoscanpro, from which the dense pointcloud was exported in ArcGIS, where a DSM was generated. As most of the fan is "vegetationless", the DSM was considered as the DEM.

Results have shown the presence of a series of terraced surfaces imbricated with each other, and which correspond to the past-limits of the glaciers. Those surfaces are now eroded by the debris-flow that reaches the lowered base level. This has therefore resulted in an increase of material reaching the river-bed, generating sediment waves in the sediment cascade.

Keywords: debris flow fan, glacier retreat, sediment cascade, photogrammetry, Fox Glacier, New Zealand

