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Debris flow hazard mapping, Hobart, Tasmania, Australia

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Our mapping on the many dolerite capped mountains in Tasmania indicates that debris flows are a significant geomorphic process operating there. Hobart, the largest city in the State, lies at the foot of one of these mountains and our work is focussed on identifying areas that are susceptible to these events and estimating hazard in the valley systems where residential developments have been established.

Geomorphic mapping with the benefit of recent LiDAR and GIS enabled stereo-imagery has allowed us to add to and refine a landslide inventory in our study area. In addition, a dominant geomorphic model has been recognised involving headward gully retreat in colluvial materials associated with rainstorms explains why many past events have occurred and where they may occur in future.

In this paper we will review the landslide inventory including a large event (∼200 000m3) in 1872 that affected a lightly populated area but since heavily urbanised. From this inventory we have attempted volume-mobility relationships, magnitude-frequency curves and likelihood estimates. The estimation of volume has been challenging to determine given that the area of depletion for each debris flow feature is typically difficult to distinguish from the total affected area. However, where LiDAR data exists, this uncertainty is substantially reduced and we develop width-length relationships (area of depletion) and area-volume relationships to estimate volume for the whole dataset exceeding 300 features.

The volume-mobility relationship determined is comparable to international studies and in the absence of reliable eye-witness accounts, suggests that most of the features can be explained as single event debris flows, without requiring more complex mechanisms (such as those that form temporary debris dams that subsequently fail) as proposed by others previously.

Likelihood estimates have also been challenging to derive given that almost all of the events have not been witnessed, some are constrained by aerial photographs to decade precision and many predate regional photography (pre 1940's).

We have performed runout modelling, using 2D hydraulic modelling software (RiverFlow2D with Mud and Debris module), in order to calibrate our model against real events and gain confidence in the choice of parameters. Runout modelling was undertaken in valley systems with volumes calibrated to existing flood model likelihoods for each catchment. The hazard outputs from our models require developing a translation to hazard models used in Australia. By linking to flood mapping we aim to demonstrate to emergency managers where existing mitigation measures may be inadequate and how they can be adapted to address multiple hazards.