ONE Planet Doctoral Training Partnership

Natural Environment Research Council

Project title: Debris flow risk: global assessment and local risk reduction

Ref: OP2425

Keywords: *debris flow; risk reducation; big data*

One Planet Research Theme:

Climate & Climate Change ☒ | Earth System Processes ☒ | Anthropocene ☐ | Environmental Informatics ☒

Lead Supervisor: Dr Stuart Dunning, Newcastle University

Key Research Gaps and Questions:

1. Can we find all hazardous debris flow fans on Earth using remote sensing?
2. Can we assesss potential debris flow runout and risk to life and infrastructure at a global scale?
3. Use our new knowledge to identify key areas at risk suited to monitoring & early warning.

Mt Cook Village – built on debris flow fans

Project Description:

Sudden onset debris flows pose a threat to life and infrastructure globally – 78,000 people have been killed from 1950-2011 (Dowling & Carson, 2014). Debris flows are expected to increase in frequency with climate warming and increasing frequency of intense rainfall, and, are a key hazard in landscapes adjusting to past earthquakes where people are often already even more vulnerable.

However, in many locations debris flows are repeat events, with risk often focussed on debris flow fans and their torrents. Debris-flow dominated fans are morphologically distinctive and can be identified using geomorphic metrics derived from freely-available global DEMs. Since debris flow runout pathways can be modelled and associated impacts mitigated against, this makes risk on debris flow fans a tractable problem, in which meaningful risk reduction is possible, particularly in developing countries where vulnerability is high. What limits this risk reduction is the lack of a global inventory of debris flow fans, an assessment of debris flow occurrence and an understanding of their mobility, combined with a quantitative understanding of who and what is exposed on these fans.

In this project you will: 1) Use global elevation models, remote sensing, simple landslide runout models and global infrastructure datasets to fill this research gap (environmental infomatics); 2) Identify key 'at risk' catchments to conduct fieldwork in to refine/validate the global modelling (Earth system processes); 3) Assess measures to reduce risk, possibly through engineering, and, or monitoring based early warning systems (EWS).

Depending on your interests and the results, field work (not mandatory) could include: New Zealand, Canada/US, High Mountain Asia, European Alps, Africa, UK.

Skills gained: remote sensing, GIS, Google Earth Engine, monitoring equipment, data processing (MATLAB, Python or R), field planning.

Prerequisites: We are looking for a candidate with good remote sensing and/or GIS skills, with any use of MATLAB, Python or Earth Engine a desirable skillset.

For more information, please contact Stuart Dunning (stuart.dunning@ncl.ac.uk).

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