Geomorphic signatures of different debris-flow release processes in Ísafjörður, north-western Iceland

Costanza Morino[1,6]*, Susan J. Conway[1], Matthew R. Balme[2], Colm Jordan[3], John Hillier[4], Þorsteinn Sæmundsson[5], Tom Argles[6]

[1] Laboratoire de Planétologie et Géodynamique de Nantes, Université de Nantes, Bâtiment 4, 2 Chemin de la Houssinière, 44300 Nantes, France
[2]School of Physical Science, The Open University, Walton Hall, Milton Keynes, MK7 6AA, UK
[3]British Geological Survey, Environmental Science Centre, Keyworth, Nottingham NG12 5GG, UK
[4]Geography and Environment, Loughborough University, Loughborough, LE11 3TU, UK
[5]Department of Geography and Tourism, University of Iceland, Askja, Sturlugata 7, IS-101 Reykjavík, Iceland
[6]School of Environment, Earth & Ecosystem Sciences, The Open University, Walton Hall, Milton Keynes, MK7 6AA, UK
**Corresponding author, e-mail: costanza.morino@univ-nantes.fr*

ABSTRACT

Debris flows, fast-moving bodies of poorly sorted debris material mixed with water and/or air, pose a direct threat to many towns in Iceland. Distinguishing the release processes of debris flows and their associated geomorphic features help in anticipating new events. Two initiation mechanisms have been recently hypothesised for the debris flows occurring on the slope above Ísafjörður (NW-Iceland): slope failure and the "fire hose" effect. Slope failure is characterised by discrete failures that evolve into debris flows, favoured by steep slopes and high pore-water pressures. The "fire hose" effect arises when debris accumulated within a pre-existing channel is remobilised and transported by a surge of water, developing into a debris flow. We identify the geomorphic evidence to distinguish between these two debris-flow initiation mechanisms. We compare two datasets of airborne LiDAR elevation models and aerial photographs collected in 2007 and 2013. We report that a new generation of debris flows is initiated by slope failure, meanwhile older generations may be regenerated by the "fire hose" effect when debris accumulated in channels is remobilised by a later injection of water. These older channels can store deposits at rest angles over 35°, and form a potential hazard for inhabited areas downslope.