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A multi-sensor approach to landslide monitoring of rainfall-induced failures in Scotland.

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Landslides are of significant interest in upland areas of the United Kingdom due to their: complex mechanics, potential to channelize into hazardous debris flows and their costly potential impacts on infrastructure. The British Geological Survey National Landslide Database contains an average of 367 landslides per year (from 1970). Slope failures in the UK are typically triggered by extended periods of intense rainfall, and can occur at any time of year.

In any given rainfall event that triggers landslides, most potentially vulnerable slopes remain stable. Accurate warning systems would be facilitated by identifying landslide precursors prior to failure events. This project tests whether such precursors can be identified in the valley of Glen Ogle, Scotland (87 km north-west of Edinburgh), where in summer 2004 two debris flows blocked the main road (A85), trapping fifty-seven people. Two adjacent sites have been selected on a west facing slope in Glen Ogle, one of which (the control) has been stable since at least 2004 and the other failed in 2004 and remains unstable.

Understanding the immediate causes and antecedent conditions responsible for landslides requires a multi-scale approach. This project uses multiple sensors to assess failure mechanisms of landslides in Glen Ogle: (1) 3-monthly, high (1.8 arcsec) resolution terrestrial laser scanning of topography to detect changes and identify patterns of movement prior to major failure, using the Riegl VZ-1000 (NERC Geophysical Equipment Fund); (2) rainfall and soil moisture data to monitor pore pressure of landslide failure prior to and after hydrologically triggered events; (3) monitoring ground motion using grain-scale sensors which are becoming lower cost, more efficient in terms of power, and can be wirelessly networked these will be used to detect small scale movement of the landslide. Comparative data from the control and test sites will be presented, from which patterns of surface deformation between failure events will be derived.