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An integrated approach to landslide characterisation and ground model development: geophysical, geotechnical and remote sensing methods

Andrew Merritt (1), Jonathan Chambers (2), William Murphy (1), Jared West (1), David Gunn (2), Paul Wilkinson (2), Neil Dixon (3), and Phil Meldrum (2)

(1) Earth Surface Science Institute, University of Leeds, UK. (eeam@leeds.ac.uk), (2) British Geological Survey, (3) University of Loughborough

Landslides are complex, strongly heterogeneous natural phenomena. A considerable number of landslide types exist, exhibiting varying states, distributions and styles of activity. If a better understanding of landslide internal processes is to be achieved, firstly, an understanding of landslide internal structure is required. Here, an example of an integrated approach to landslide characterisation is presented, which makes use of surface and subsurface investigative methods. Surface geomorphology is mapped and interpreted using immersive three-dimensional (3D) visualisation software to interpret airborne LiDAR data and aerial photographs. Subsurface structure is determined by volumetric 3D electrical resistivity tomography (ERT), along with core logging and associated field and laboratory based geotechnical testing. An integrated approach for ground model development, which takes into account both subsurface and surface investigative methods, is shown to improve the conclusions that can be drawn from a given site investigation. This is achieved by calibration of the geophysical results with direct physical property measurements of materials taken from the landslide and its environs. In particular, the use of 3D ERT at different spatial resolutions provides a means of volumetrically characterising the subsurface expression of both site scale (tens of metres) geological structure, and finer (metre to sub-metre) scale earth-flow related structures, which were not effectively revealed by either the 1D information derived from discrete intrusive sampling, or the 2D surface data provided by remote sensing.