

KEYNOTE LECTURE: Geophysical characterization, monitoring and early warning of slope failure: a review of methodological developments at the Hollin Hill landslide observatory

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The Hollin Hill Observatory was established in 2007 to facilitate research into the development of geoelectrical and allied approaches for the monitoring and characterisation of landslides. The observatory is located in North Yorkshire UK on an active landslide characterised as a slow moving earth slide – earth flow. The slope comprises Lower Jurassic Lias Group rocks, which are particularly prone to failure and are a major source of lowland landslides in the UK. The overarching aim of our research at the site has been to develop a methodology for landslide assessment focussed around geoelectrical methods. This has included characterisation and ground model development, integrated monitoring using time-lapse electrical resistivity tomography complemented by conventional geotechnical and environmental sensing technologies, and a supporting programme of laboratory based measurement and modelling to calibrate and support the interpretation of the field-based observations. A key goal of the work has been to use the geophysical data and models to identify precursors to slope failure thereby providing early warning of landslide events, which is now beginning to be realised.

Here we review our approach to geophysical landslide assessment focussing particularly on key elements and advances including: rationale for site selection; three-dimensional subsurface characterisation; development of geoelectrical monitoring instrumentation; time-lapse geophysical data processing, including temperature corrections and electrode movement determination; petrophysical relationships and geophysical model calibration; and determination of geophysically derived property thresholds indicative of imminent slope failure. We conclude with a forward look to ongoing and future challenges in the development of a geophysics-based landslide early warning system.