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Development of high-resolution geophysical monitoring of landslides in the South Wales Coalfield

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The South Wales Coalfield has one of the highest concentrations of landslides in United Kingdom due to its climatic setting, geology and industrial history. A higher incidence of extreme rainfall events associated with climate change is liable to increase the frequency and scale of slope failures in the future. Geophysical techniques can provide a non-invasive, continuous, high-resolution, rapid, low-cost means for investigating landslide dynamics. In this project we are investigating the effectiveness of a range of geophysical techniques, including electrical resistivity tomography, seismic refraction (P and S waves), self-potential and electromagnetics (with Geophex GEM2 instrument). The aim is to determine internal landslide structure and temporal variations in groundwater conditions, leading to a better understanding of landslide mechanics and displacements.

Results are presented from the Mynydd yr Eglwys Landslide, in South Wales, a compound deep seated failure that has reactivated ancient shallow translational debris slides downslope. Morphology is defined by a terrain model based on LIDAR data. Geophysical data calibrated against borehole information are used to characterise subsurface materials and internal structure. Results of repeated resistivity lines and self-potential and electromagnetics mapping are presented. These allow temporal changes in groundwater conditions to be monitored. Over a longer term monitoring period, changes identified through geophysical monitoring will be correlated with landslide movement data from resurvey of surface markers, borehole groundwater levels and rainfall. The methodology developed here will be applied to a number of landslides at different stages in their development within the South Wales Coalfield.