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Characterising landslide processes using a combined remote sensing and geophysical surveying approach: examples from north east England, UK

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The combination of remote sensing, geophysics (electrical resistivity tomography (ERT)) and terrain analysis was applied to characterise landslide processes in northern England. Two different landslide types commonly found on the Jurassic Escarpment slopes in the Cleveland Basin were initially studied: (i) relict, large deep-seated bedrock landslides and (ii) recent, small shallow rotational slides with active earth flows. Interpretation of landslide architectures was supported by detailed surface geomorphological and geological mapping data. When calibrated with borehole control, interpretation of the geophysical ERT data allowed determination of mass movement deposit volumes, movement styles and failure mechanisms, and provided an improved understanding of the depth, geometry and geological factors controlling development and mechanical properties of primary shear surfaces. This new understanding was then used to develop algorithms to perform surface roughness analyses, using a range of DTMs with different spatial resolutions (0.25-5m) derived from airborne LiDAR, airborne radar and photogrammetry. The algorithm was subsequently applied across the region to perform semi-automated landslide recognition, in order to help verify and enhance the regional landslide inventory. A variety of landslide types and other geological features were distinguishable through this surface roughness mapping approach. The combined geophysical and remote sensing approach to landslide characterisation has improved our understanding of the extent and nature of the landslide hazard across the region. This approach is valid for hazard research and civil engineering purposes elsewhere, provided that the DTMs and baseline geological data are available at an appropriate resolution and penetration of vegetation can be achieved.