

## Applications in Landslide Monitoring

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### **Long term monitoring of landslide processes by automated time-Lapse Electrical Resistivity Tomography**

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The stability of natural slopes is transient in nature and is often strongly dependent on the moisture content (water saturation) of the geological materials underlying the slope. In recent years, geoelectrical monitoring techniques have been increasingly applied to landslide monitoring studies due to their sensitivity to the internal moisture dynamics of slopes. Here, one such long term geoelectrical monitoring campaign at an active landslide system, located in the North Yorkshire, UK, is described. Three-dimensional Automated time-Lapse Electrical Resistivity Tomography (4D-ALERT) results are presented alongside conventional investigative techniques, thus enabling soil moisture accumulation to be observed in prior to landslide activation.

Several of the challenges associated with long term monitoring of a transient natural system, such as an active landslide, are outlined and methodological solutions are described and applied. Several types of geoelectrical monitoring results are presented, including: temperature-corrected transfer resistances; time-lapse 3D volumetric resistivity images; time-lapse volumetric images of gravimetric moisture content (determined using laboratory derived relationships between resistivity and soil moisture content).

Results from the BGS Observatory, Hollin Hill, display the spatial and temporal (4D) distribution of moisture related changes within the slope prior to, during and after landslide activation. In particular, they reveal that the ERT monitoring array is sensitive to soil moisture accumulation in response to intense and prolonged rainfall events, and also that landslide activation is typically preceded by a period of decreasing electrical resistance and electrical resistivity, and increasing soil moisture content.