Geophysical Research Abstracts
Vol. 21, EGU2019-396, 2019
EGU General Assembly 2019

The use of near-surface geophysics for monitoring a slow-moving landslide affecting transport infrastructure

Jessica Holmes (1,2), Jonathan Chambers (2), Paul Wilkinson (2), Philip Meldrum (2), Shane Donohue (3), David Huntley (4), and Peter Bobrowsky (5)

(1) Queen's University Belfast, Belfast, United Kingdom (jeho@bgs.ac.uk), (2) British Geological Survey, Nottingham, United Kingdom, (3) University College Dublin, Dublin, Ireland, (4) Geological Survey of Canada, Vancouver, British Columbia, Canada, (5) Geological Survey of Canada, Sidney, British Columbia, Canada

Environmental change is likely to increase the frequency of slope failure due to a predicted increase in rainfall, which increases pore water pressure and reduces slope stability. On the transport network, long-term monitoring of unstable slopes is required to mitigate failure and to avoid the need for costly remedial works. Geophysical monitoring offers an alternative to cost- and time-intensive geotechnical monitoring and unreliable visual monitoring of earthworks assets, which are commonly used in the transport industry. Geophysical monitoring techniques can be implemented relatively inexpensively, and can provide near-real time information about large volumes of the subsurface, including changes in moisture content over time. Here, the use of Electrical Resistivity Tomography (ERT) will be assessed in terms of its applicability to monitoring natural slopes that affect transport infrastructure through an assessment of geophysical monitoring of the Ripley Landslide, southwestern British Columbia.

The Ripley Landslide is a small (0.04 km^2), slow-moving translational landslide in the Thompson River Valley, which threatens the integrity and serviceability of two major railway lines. Elements at risk from the failure of this slope include railway infrastructure, terrestrial and aquatic ecosystems, public safety, communities, local heritage, and the economy. A Proactive Infrastructure Monitoring and Evaluation (PRIME) system, installed on the Ripley Landslide in December 2017, provides near real-time ERT data. The system addresses a pair of 2D electrode arrays with a total line length of 145 m and an effective depth of investigation of 15 m. The PRIME system is controlled via a wireless modem for measurements scheduling and data retrieval enabling remote near-real-time monitoring of the site. Here we report on the first 12 months of PRIME monitoring at the site. These results are supported by several years of other monitoring data, including displacement monitoring (InSAR, Global Positioning System (GPS), Fibre Optic monitoring) terrestrial-based geophysics (ERT, Ground Penetrating Radar (GPR), Fixed Frequency Electromagnetic Induction (FEM), Seismic Refraction, Multichannel Analysis of Surface Waves (MASW)), and waterborne geophysics (ERT, GPR, FEM, Acoustic Bathymetry). The resistivity images captured by the PRIME system reveal the hydrogeological structure of the subsurface and variations through time as the slope responds to changes in precipitation, including freeze-thaw processes, and to changes in river elevation at the toe of the slide. This aids the interpretation of previous monitoring data and provides a guide for the future monitoring of the Ripley landslide, with the long-term aim of predicting the timing of failure at this site.