11

Inversion of long time series landslide movements from geoelectrical monitoring data

P. Wilkinson[(1)*], J. Chambers[(1)], S. Uhlemann[(1)], P. Meldrum[(1)], N. Dixon[(2)] and M.H. Loke[(3)]

[(1)] British Geological Survey, Keyworth, Nottingham, UK
[(2)] School of Civil and Building Engineering, Loughborough University, Loughborough, UK
[(3)] Geotomo Software, Penang, Malaysia
* pbw@bgs.ac.uk

As part of a landslide observatory, BGS have been operating a permanently installed 4D geoelectrical monitoring system since 2008 to examine hydraulic precursors to movement. The landslide is an active slow to very slow moving multiple earth slide – earth flow with a mean slope angle of 14°, which typically exhibits movements of 1 – 2 m per year. To obtain reliable inverse geoelectrical models of the subsurface, it is vital that we know where the electrodes are located as a function of time. Currently we rely on repeated site visits to measure the positions of the electrodes in the known-active regions of the site by GPS, coupled with more frequent GPS monitoring of a series of sparsely distributed marker pegs, which are used to interpolate the positions of moving electrodes at intermediate times.

We report the development and testing of an inverse method, using a simplified forward model, to reconstruct the electrode movements in both surface directions on a geoelectrical monitoring grid from the time-lapse apparent resistivity data. The inversion technique was able to recover sequences of movement over short (days) to long (years) timescales. Comparing the reconstructed positions with GPS measurements indicated that the results were typically accurate to within 10 % of the electrode spacing, which was comparable with the accuracy obtained by interpolating marker peg locations. It was also sufficient to correct the majority of artefacts that occurred in the image reconstructions when incorrect positions were used. Over short timescales where the corresponding subsurface resistivity changes were smaller, the constraints could be relaxed and an order-of-magnitude better accuracy was achieved. This enabled the onset and acceleration of landslide activity to be detected within an accuracy of a few days.

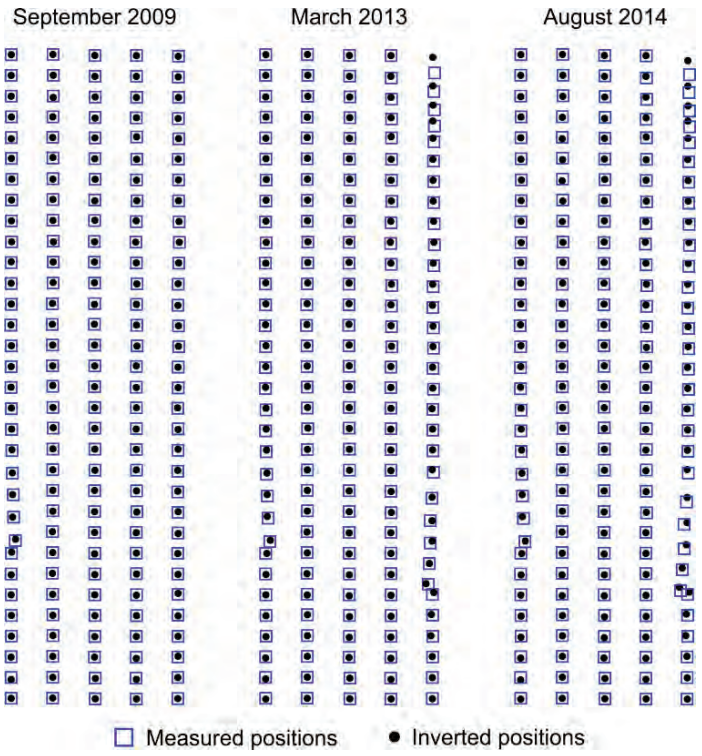

Figure 1 Comparisons of measured and inverted electrode positions