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Post-seismic slip on the 6th April 2009 L'Aquila earthquake surface rupture, measured using a terrestrial laser scanner (tripod-mounted lidar)

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Terrestrial laser scanner (lidar) systems have the capability to very accurately build 3D topographic models and detect millimetric-scale changes caused by tectonic movements. We have measured post-seismic deformation at 5 locations along the 6th April L'Aquila earthquake surface rupture. Our first survey was undertaken 8 days after the earthquake, and the sites were subsequently re-occupied in May and August. Our survey has detected post-seismic motions at rates of millimetres per day, declining in the months after the mainshock, with significant lateral variation along strike. The data have been compared to robotic surveying total station data available from a site where a water pipe ruptured coseismically, and with strain meter data collected nearby.

Our near-field deformation measurements are compared to InSAR results for equivalent time periods, allowing us to differentiate short- and long-wavelength deformation. Such comparative analysis allows us to examine whether deformation was driven by fluid and poro-elastic effects, visco-elastic creep in the underlying crust and mantle, afterslip on fault zones within the shallow crust, or a combination of the above. Our work may help discriminate between the relative contributions of coseismic and postseismic slip for historic/palaeoseismic earthquake ruptures where measurements of offset are made many years later.