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Co-seismic and shallow post-seismic slip during the 2016 central Italy earthquake sequence revealed by differential terrestrial laser scanning and photogrammetry

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The three M>6 earthquakes that struck central Italy during August-October 2016 were captured using photogrammetry and terrestrial laser scans. Surface ruptures were identified in the field for each of these three events. Following the Mw=6.2 event in August that ruptured both the Vettore and Laga faults the shallow post-seismic deformation across the Vettore fault was measured using repeat photogrammetry over 40 days following the earthquake alongside mobile GNSS stations deployed in the days following the event. The Mw=6.1 earthquake on 26th October produced a surface rupture of the Mt Bove fault scarp that was captured using terrestrial laser scanning. During the Mw=6.6 event on 30th October both the Vettore fault and the Mt Bove fault ruptured again producing larger and more extensive surface ruptures when compared with the previous two earthquakes. In addition to the Mt Bove fault scarp, two other locations were scanned prior to the Mw=6.6 earthquake. Each of these sites was then re-scanned following the earthquake thus producing the first known instance of co-seismic surface ruptures to be captured by differential terrestrial laser scanning. We also performed repeat laser scans in the aftermath of the M=6.6 earthquake to assess shallow post-seismic afterslip and deformation across the surface ruptures. Co-seismic and post-seismic deformation was resolved to a vertical accuracy of <5mm through the use of iterative closest point algorithms to finely register the pre and post-earthquake scans into the same reference frame. We will present both the co-seismic and shallow post-seismic deformation that accumulated both during the sequence of three earthquakes and in the days-months following the earthquake sequence.