Extent of low-angle normal slip in the 2010 El Mayor-Cucapah (Mexico) earthquake from differential lidar

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Abstract

We investigate shallow slip in the 4 April 2010 Mw 7.2 El Mayor-Cucapah (Mexico) earthquake using three-dimensional surface deformation computed from pre- and post-event airborne light detection and ranging (lidar) topography (Glennie et al., 2014). By profiling the displacement field at densely-sampled (_˜300 m) intervals along the multi-segment rupture, and computing fault offsets in the E-W, N-S and vertical components, we map out the surface slip vector distribution. A principal goal is to resolve the discrepancy between field observations that are interpreted to reflect widespread low angle normal slip, and geodetic and/or seismological models which support rupture of sub-vertical faults. Since the computed slip vectors must lie in the plane of the fault, whose strike is known, we can calculate the dip (and rake) of the fault along strike and thus test these models explicitly. Along most of the fault trace, we find that coseismic faulting is moderately- to steeply-dipping. However, a short (_˜5 km) section of the Paso Superior fault hints at local reactivation of a low-angle (< 30 degree) structure.

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