

The 1999 Hector Mine Earthquake, Southern California: Vector Near-Field Displacements from ERS InSAR

by David T. Sandwell, Lydie Sichoix, and Bridget Smith

Abstract

Two components of fault slip are uniquely determined from two line-of-sight (LOS) radar interferograms by assuming that the fault-normal component of displacement is zero. We use this approach with ascending and descending interferograms from the ERS satellites to estimate surface slip along the Hector Mine earthquake rupture. The LOS displacement is determined by visually counting fringes to within 1 km of the outboard ruptures. These LOS estimates and uncertainties are then transformed into strike- and dip-slip estimates and uncertainties; the transformation is singular for a N-S oriented fault and optimal for an E-W oriented fault. In contrast to our previous strike-slip estimates, which were based only on a descending interferogram, we now find good agreement with the geological measurements, except at the ends of the rupture. The ascending interferogram reveals significant west-side-down dip-slip (~1.0 m) which reduces the strike-slip estimates by 1 to 2 m, especially along the northern half of the rupture. A spike in the strike-slip displacement of 6 m is observed in central part of the rupture. This large offset is confirmed by subpixel cross correlation of features in the before and after amplitude images. In addition to strike slip and dip slip, we identify uplift and subsidence along the fault, related to the restraining and releasing bends in the fault trace, respectively. Our main conclusion is that at least two look directions are required for accurate estimates of surface slip even along a pure strike-slip fault. Models and results based only on a single look direction could have major errors. Our new estimates of strike slip and dip slip along the rupture provide a boundary condition for dislocation modeling. A simple model, which has uniform slip to a depth of 12 km, shows good agreement with the observed ascending and descending interferograms.

[[Back](#)]