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Revisiting the 1992 Landers earthquake: a Bayesian exploration of co-seismic slip and off-fault damage.

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The 1992 Landers earthquake (Mw = 7.3) is one of the two largest events recorded in continental United States over the last 50 years. While several studies have investigated this earthquake, published co-seismic slip models show significant dissimilarities. These discrepancies can primarily be attributed to the ill-posed nature of the slip inversion problem and to the use of unphysical regularization constraints. Going forward, we propose a new co-seismic model obtained from the joint inversion of multiple observations in an unregularized and fully Bayesian framework. We use a comprehensive dataset including GPS, terrestrial geodesy, multiple SAR interferograms and co-seismic offsets from correlation of aerial images. These observations provide a dense coverage of both the fault vicinity and far-field deformation. To limit the impact of modeling uncertainties, we elaborate a 3D fault geometry designed from field observations, co-seismic offsets and the distribution of aftershocks. In addition, we account for uncertainty in the Earth model used to compute the Green's functions. Our solution includes the ensemble of all plausible models that are consistent with our prior information and fit the available observations within data and prediction uncertainties. Previous studies of the Landers earthquake pointed out the eventuality of a slip deficit at shallow depth (<5km) that is not relieved by post- or inter-seismic deformation. Using high-resolution near-fault ground deformation measurements, we investigate off-fault inelasticity and the existence of a compliant fault zone. Using our Bayesian framework, we investigate the impact of off-fault damage on the inferred slip at depth.