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Geodetic slip solutions for the Mw=7.4 Champerico (Guatemala) subduction earthquake of November 7 2012

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As the first large subduction thrust earthquake off the coast of western Guatemala in the past 50 years, the 7 November 2012 Mw=7.4 earthquake offers the first opportunity for a geodetic study of coseismic and postseismic behavior for a segment of the Middle America trench where frictional coupling makes a transition from weak coupling off the coast of El Salvador to strong coupling in southern Mexico.
Processing of continuous GPS measurements at 19 stations in Guatemala, El Salvador, and southern Mexico, and at 7 campaign points in Guatemala defines a highly consistent pattern of coseismic offsets during the earthquake, ranging from 47±5 mm of SW movement just inland from the earthquake epicenter to a few mm at sites located in northern Guatemala.
Inversions of these offsets to find their best-fitting fault-slip solution in an elastic half space give a geodetic earthquake moment ranging between 0.75 and 1.1 x 1020 Nm, slightly smaller than the seismic estimates that range between 1.2 and 1.45 x 1020 Nm. Slip inversion using a constant slip model, assuming 293° and 29° for the fault azimuth and dip angle, indicates a nearly reverse slip of 2.8 m (rake 78°) on a fault plane 42 km-long and 20 km-wide, centered at 26 km depth. A variable slip inversion indicates that slip concentrated above depths of 40 km may have extended updip to the trench and reached a maximum of only 0.8 m, less than one-sixth the maximum slip indicated by a recent slip solution (5.3 m) obtained from waveform inversion of seismological data. Detailed model comparisons will be discussed.
Transient postseismic displacements have been recorded at the nearby continuous GPS sites with amplitudes reaching 20-25 mm at some stations. The duration of the phenomenon is short: using an exponential-decay model, the estimated decay time is 90 ± 10 days. This postseismic signal is consistent with afterslip along a significantly broader area (+50%) of the subduction interface than ruptured coseismically. These results will be discussed in the tectonic framework of the area.