

A GPS Study of the 22 January 2003 $M_W=7.2$ Tecoman Earthquake, Western Mexico

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We use coseismic displacements from GPS measurements at 27 sites in western Mexico to determine the characteristics of the 22 January 2003 $M_W=7.2$ subduction thrust earthquake near Tecoman, Colima, Mexico. Estimates of the earthquake moment, slip direction, and best-fitting slip distribution are derived by optimizing the fit to the GPS displacements for a three-dimensional finite element mesh that simulates the study area. The calculated moment release is 9.1×10^{19} N m ($M_W=7.2$), with maximum slip of 2 m at a depth of 24 km and a maximum rupture depth of 35-40 km. The inversion indicates that coseismic rupture extended down-dip from depths of 9 km to 40 km along an 80 km along-strike region that is bounded by the edges of the Manzanillo Trough. A comparison of the cumulative postseismic slip that can be inferred separately from earthquake aftershocks and GPS measurements indicates that 95% or more of the postseismic deformation was aseismic. Near-term postseismic measurements indicate that slip propagated down-dip to areas of the subduction interface beneath the coast-line within days following the earthquake, as also occurred after the nearby $M_W=8.0$ Colima-Jalisco subduction earthquake in 1995. The similar behaviors and locations of the 1995/2003 earthquake sequence to two earthquakes in June of 1932 suggests that thrust earthquakes along the subduction interface northwest of the Manzanillo Trough may trigger earthquakes in the vicinity of the Manzanillo Trough. However, our modeling of Coulomb stress changes caused by the 1995 earthquake indicates that it induced

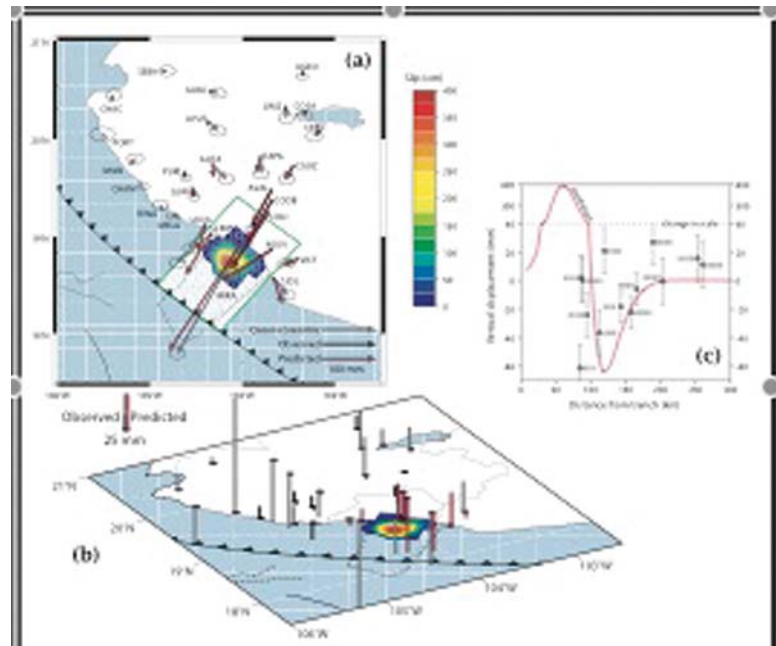


Figure 1. Observed GPS station offsets during the Tecoman earthquake versus offsets predicted by a three-dimensional finite element model. (A) Horizontal station offsets, (B) vertical station offsets, (C) Trench-normal profile of vertical station offsets through center of study area.

only modest unclamping of the subduction interface in the vicinity of the Tecoman rupture. The apparent coincidence of the edge of both the 1932 and 1995/2003 rupture sequences with the edge of the Manzanillo Trough may indicate that the trough is a mechanical barrier to along-strike rupture propagation. This finding implies a limit to the area of potential slip and hence rupture magnitude during future large earthquakes in this region.

Reference

A geodetic study of the 22 January 2003 Tecoman, Colima, Mexico earthquake, Schmitt, S. V., C. DeMets, J. Stock, O. Sanchez, B. Marquez-Azua, and G. Reyes, *Geophys. J. Int.*, in press, 2007.

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