Creeping versus Locking on the Costa Rica Seismogenic Zone

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This was an international effort to collect GPS and seismic observations (on-shore plus off-shore) in Costa Rica. The seismogenic zone is well imaged in the seismic data, and provides critical geometric constraints to determine strain accumulation on the plate interface with GPS. The research indicated that: 1) the plate interface is not fully locked or coupled along the entire subduction zone, and coupling varies greatly, with one or more locked patches within a freely slipping region; 2) the up-dip limit of the locked region is considerably up-dip of the locus of maximum microseismicity. In other words, locked zones are aseismic, while more freely slipping regions have abundant microseismicity. Hence, interseismic microseismicity cannot be used to delineate the zone of rupture in future earthquakes; 3) the currently locked zone is considerably smaller than the rupture area of at least one previous earthquake, implying either that locking is temporally variable, and/or other mechanisms besides earthquake rupture act to relieve accumulated strain.

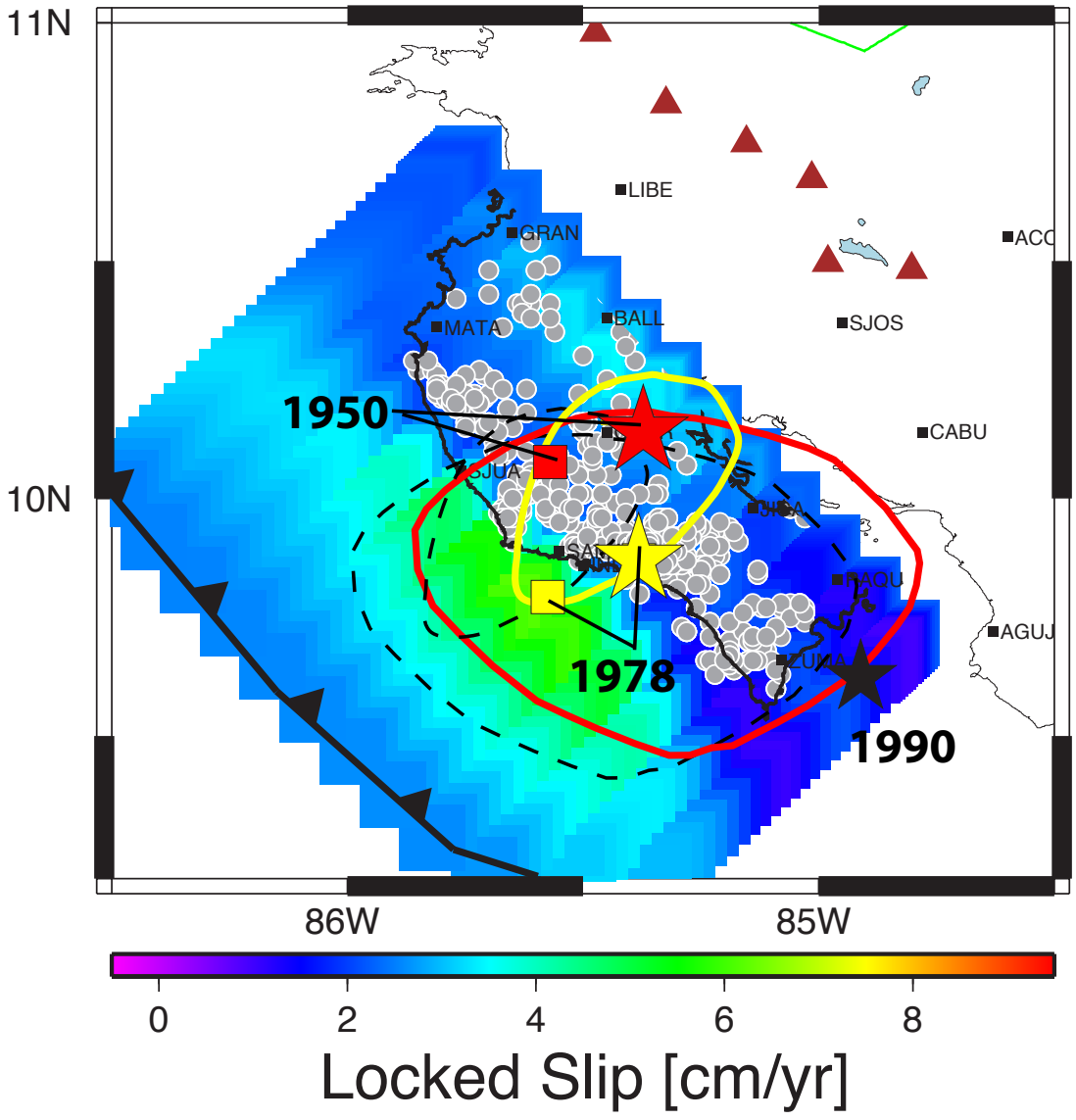

Figure: Comparison of GPS-determined locking on the plate interface, well-located plate interface earthquakes (circles) recorded during our seismic network deployment, and rupture areas of past large earthquakes. Squares and dashed lines show original epicenter and rupture area, respectively, stars and solid lines show relocations, relative to better located 1990 event (black star). Offshore locked patch is up-dip of seismicity, and is less than rupture area of past large events.

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