

"Interseismic Megathrust Coupling near Nicoya, Costa Rica Between 1994 and 2010"

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We develop new geodetically constrained models of megathrust coupling near the Nicoya Peninsula of Costa Rica. Rapid observed plate convergence here is  $\sim 85$  mm/yr, leading to rapid strain accumulation causing large moment magnitude 7.8+ earthquakes approximately every 50 years, with the most recent occurring in 1950. Using published GPS from field campaigns in 1994, 1996, 2000 and 2003 [LaFemina et al. G3, 2009], and a new campaign in 2010, we determine a robust value of Nicoya Block sliver transport (11.5 mm/yr) and apply the stress-minimization method to determine new megathrust locking models characterizing the spatial and temporal changes in strain accumulation along the subduction interface. Contrary to previously published results that suggested a diffuse zone of approximately 50% locking, our models suggest locking is strongly localized, with dominant fully-locked patches adjacent to freely-slipping zones. A complex image of locking is observed for the period between 1994 and 2005, with two elongate fully-locked zones occurring in the northwest where East-Pacific Rise crust is subducted (one patch each updip and downdip of microseismicity) and a single patch updip of microseismicity in the southeast where Cocos-Nazca Spreading Center crust exists. Changes in locking features may represent the continued maturation of the megathrust interface overprinted by transient aseismic slip events, including one in 2007, which may make regions appear partially locked when observations periods are relatively short.