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Patterns of late-interseismic and coseismic locking and release along the subduction megathrust: the case of the 2012 M_W 7.6 Nicoya earthquake in Costa Rica

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On 5 September 2012 a moment magnitude (M_W) 7.6 earthquake struck the seismogenic megathrust of Nicoya, Costa Rica. Though we knew not precisely when, this event was not unexpected, and occurred after the development of substantial geodetic and seismic imaging of the late-interseismic locking along the subduction plate interface. Along with identifying the overall structure of the subduction interface, the pre-event research identified the location and rate changes of ongoing microseismicity [*Ghosh et al., GRL*, 2008], and the location and degree of locking that has developed during the late interseismic period [*Feng et al., JGR*, 2012]. Both prior studies identified a large and locked patch in the central portion of the Peninsula and substantial changes associated with a suture in the downgoing oceanic plate. The geodetic model went on to estimate that the region may have had the potential to fail in up to an M_W 7.8 event, if recent locking was representative of the period since the last major event in 1950. The earthquake that followed matched the expected location and approximate magnitude. Both the locking and rupture areas were bounded both updip and downdip by environments that have recently been observed to fail frequently in episodic silent slip events [e.g. *Jiang et al., G3*, 2012].

Because this study marks the first paired observation of the spatial extent of interseismic locking and subsequent coseismic rupture from a large megathrust earthquake, we have the unique opportunity to present a detailed analysis of the geodetic and seismicity rate images published before the event with the *Protti et al.* [*Nature Geosc.*, 2014] results obtained by postseismic geodetic and seismic observations of the slip area. The results will highlight the utility and some pitfalls associated with using late-interseismic geodetic and seismicity rate information for forecasting future earthquake potential. This work may serve as part of the roadmap for making similar observations elsewhere along convergent megathrust environments.