

Unprecedented Imaging of Earthquake Slip Behavior along the Subduction Megathrust below Nicoya, Costa Rica



Dr. Andrew Newman

*School of Earth and Atmospheric Sciences,
Georgia Institute of Technology*

Unlike most subduction environments that exist mostly or entirely offshore, the Nicoya Peninsula's location allows for unique land-based observations of the entire down-dip extent of coupling and failure along the seismogenic megathrust. Because of this geometry and approximately 50-year repeat cycle of mid-magnitude 7 earthquakes there, numerous geophysical studies have taken place there. Most notably of these are the dense seismic and GPS networks collectively called the Nicoya Seismic Cycle Observatory (NSCO). The megathrust environment below Nicoya is notable, additionally for strong along-strike transitions in oceanic crust origin and geometries, including massive subducted seamounts, and a substantial crustal suture. Using GPS data collected from campaign and continuous sites going back approximately 20 years, we established the first-of-its-kind unified analysis of the full continuum of slip using the new locally defined 3D plate interface model. We image how late-interseismic locking is partitioned between continuous creep and slow-slip, followed by large coseismic rupture, aftershocks and afterslip. From here we evaluate how transitions in plate geometry control observed locking and slip, and quantifying how well pre-seismic images of megathrust locking and slow-slip events dictate coseismic and postseismic behavior.

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Mong Man Wai Building**



Enquires: 3943 9624 essc@cuhk.edu.hk