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Geodetic measurements of the Guerrero slow slip events: implications for large earthquakes in the Guerrero Gap

Stress accumulated in the Guerrero seismic gap (Mexico) has been estimated to be capable of producing a Mw 8.0-8.4 earthquake. Yet several slow slip events have been observed in the area. It remains unclear how slow slip events change the stress field in the Guerrero seismic region, and what their implications are for future devastating earthquakes. On 18 April 2014, a Mw 7.2 earthquake, followed by a Mw 6.4 aftershock on 6 May 2014, occurred on the western edge of the Gap, while a slow slip event was ongoing, suggesting that it may have triggered the earthquake.
Slow slip studies have mainly relied on GNSS. In Guerrero the low station distribution restricts their ability to determine the spatial extent of the slow slip. We apply a time-series Interferometric Synthetic Aperture Radar (InSAR) analysis to estimate the spatial extent and magnitude of deformation caused by a slow slip event in 2006, and jointly invert GNSS and InSAR for slow slip on the subduction interface. We assume rectangular dislocation patches, and use Markov chain Monte Carlo sampling to obtain a full error distribution of the model unknowns. Correlation between our slow slip region and the location of non-volcanic tremor, as well as an ultra-slow velocity layer, support the hypothesis of a common source potentially related to high pore pressures. We find slow slip extends up to 7 km depth, well within the Guerrero Gap seismogenic zone. We observe a spatial correlation between slow slip and a high slip deficit region. Even accounting for the stress released in slow slip, we find the Guerrero Gap still has the potential for an equivalent Mw ~8 earthquake.
In addition, we present results for the 2014 event, using Radarsat-2 data. We assess whether slow slip could have triggered the earthquakes, by investigating the spatial extent of the slow slip and its relationship to coseismic slip. The results have implications for the timings of megathrust earthquakes in other subduction zones.