Transient Deformation in Guerrero, Mexico

GPS measurements were critical in establishing the widespread existence of aseismic (transient) slip events in subduction zones. More recently, seismic tremor studies have been correlated with the aseismic slip events. While the GPS data, in particular, are important for determining the slip budget in a particular region and its corresponding seismic risk, the seismic data have greater resolution of the location and propagation of transients. Both geodesy and seismology will be needed to understand the source and periodicity of transients and how they relate to the mechanics of the subduction process throughout the earthquake cycle.

Our study area is located in the Mexican state of Guerrero, which encompasses a ~200 km segment of the Cocos-North America plate boundary. The last great earthquake in the northwest section of the region occurred in 1911. It has been estimated that if the “Guerrero gap” were to rupture, its magnitude would exceed Mw 8. To measure and model crustal deformation rates and to assess seismic hazard in Guerrero using GPS, UNAM and CU began a collaboration in 1997. With funding from CONACYT and NSF, there are currently 10 continuous GPS sites in Guerrero with more projected for installation in the near future. UNAM has installed an equivalent number of sites in nearby Mexican states.

Using these continuous GPS installations and earlier campaign data we can demonstrate that three very large transients have occurred in Guerrero in the last decade (see Figure 1). They are an order of magnitude larger than the periodic transients observed in Cascadia. Smaller transients have also been observed. Broadband seismic data are being collected by California Institute of Technology and UNAM in Jalisco, Guerrero, and Oaxaca and will be studied to assess the presence of tremor. By combining the use of geodesy, seismology, and physical numerical models from the Harvard group, we hope to elucidate the origin and nature of aseismic transients and their impact on the seismic hazard in Guerrero and other subduction zones.

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