XV Congreso Peruano de Geología. Resúmenes Extendidos.
Sociedad Geológica del Perú, Pub. Esp. N° 9 (2010), Cusco p. 1224-1225

DESPLAZAMIENTO SÍSMICO Y ASÍSMICO EN LA ZONA DEL TERREMOTO DE PISCO

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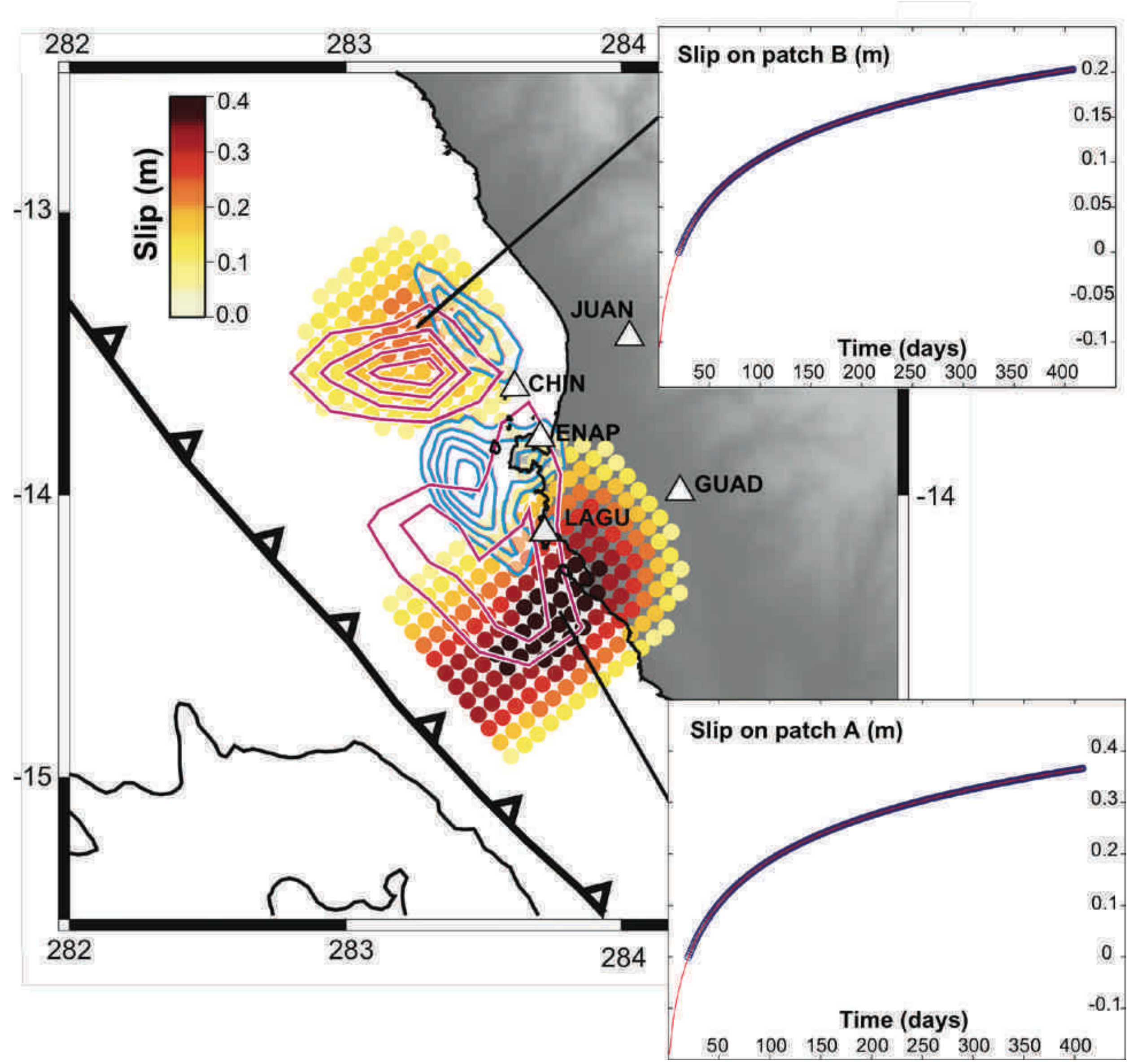
In the last couple of decades, advances in the analysis techniques and instrumentation have improved significantly our capability to document the different stages of the seismic cycle, namely the co-, post- and inter-seismic phases. To this respect, the Mw8.0 Pisco, Peru, earthquake of August 2007 is exemplary, with numerous data sets allowing exploring the details of each phase and studying their relationship. We derive a kinematic model of the coseismic rupture from the joint non-linear inversion of teleseismic and six Interferometric Synthetic Aperture Radar (InSAR) images. Our preferred model indicates a remarkable anti-correlation between the co-seismic slip distribution and the aftershock distribution determined from the IGP seismic network. The proposed source model is compatible with regional run-up measurements and open-ocean tsunami records. In particular, the tsunami observations validate that the rupture did not extend to the trench, and confirm that the Pisco event is not a tsunami earthquake despite its low apparent rupture velocity (< 1.5 km/s). We favor the interpretation that the earthquake consists of 2 subevents, each with a conventional rupture velocity (2-4 km/s). The delay between the 2 subevents might reflect the time for the second shock to nucleate or, alternatively, the time it took for afterslip to increase the stress level on the second asperity to a level necessary for static triggering. The source model predicts uplift offshore and subsidence onland with the pivot line following the changes in curvature of the coastline. This observation set the Pisco earthquake as one of the best examples of a link between the geomorphology of the coastline and the pattern of surface deformation induced by large interplate ruptures. The post-seismic deformation following the mainshock is studied using a local network of continuous GPS stations and the PCAIM inversion method. The inversion indicates that the two patches of co-seismic slip triggered aseismic frictional afterslip on two other adjacent patches. The most prominent of those post-seismic patches coincides with the subducting Nazca ridge, an area also characterized by a locally low interseismic coupling and which seems to have acted as a barrier to seismic rupture propagation repeatedly in the past. The 'seismogenic' portion of the megathrust thus appears to be paved with interfingering of rate-weakening and rate-strengthening patches. The rate-strengthening patches are shown to contribute to an unsuspectedly high proportion of aseismic slip and to determine the extent and frequency of large interplate earthquakes. Aseismic slip accounts for as much as 50-70% of the slip budget on the seismogenic portion of the megathrust of central Peru and the return period of Mw 8.0 earthquakes in the Pisco area is estimated to 250 years.



Desplazamiento post-sismico debido al terremoto de Pisco. La mayoría del desplazamiento post-sismico esta ubicado en continuación del dorsal de Nazca. Las áreas de alto desplazamiento post-sismico coinciden con las zonas de mayor densidad de replicas (contorno rosado). El desplazamiento post-sismico es anti-correlacionado con el desplazamiento post-sismico. Desde ***Perfettini et al., Nature, 2010.***