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Slow-slip events hiding in low-coupled areas of the Chilean subduction zone ?

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The recent expansion of dense GPS networks over plate boundaries allows for remarkably precise mapping of interseismic coupling along active faults. The coupling coefficient is linked to the ratio between slipping velocity on the fault during the interseismic period and the long-term plates velocity. The coupling coefficient is a phenomenological parameter representing the kinematic state of the system, but a physical quantitative description of that parameter is needed for seismic hazard assessment. In other words, which amount of coupling or decoupling is needed to allow for earthquake to nucleate, propagate or stop, would be of great help to build rupture scenarios.

Here, we investigate the link between coupling and present-day seismicity over the Chilean subduction zone. We combine recent GPS data acquired over the 2000 km long margin (38-18°S) with older data acquired at continental scale to get a nearly continuous picture of the interseismic coupling variations on the interface. We identify at least six zones where the coupling decreases dramatically, dividing individual highly coupled segments. These low-coupled areas often behave as barriers to past megathrust ruptures and experience high rates of seismicity during the interseismic period, including swarm-like sequences. We suggest that in these regions, the subduction interface is a patchwork of small velocity-weakening patches surrounded by velocity-strengthening material that would slide during the interseimic period. This relationship is consistent with observations over other subduction zones, notably in Ecuador where shallow aseismic transients have been observed near low coupled swarm-prone areas (Vallée et al. 2013). However for now, no transient event has been recorded yet all over the Chilean megathrust, preventing clear identification of creeping portions of the interface. Here, we test the hypothesis supposing that, similar to the Ecuador 2010 swarm episode, significant slow-slip events related to the observed swarm activity could occur offshore the low-coupled areas, in the shallowest part of the interface, well out of reach from our cGPS inland network.