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Areas prone to slow slip events impede earthquake rupture propagation and promote afterslip

Jean-Mathieu Nocquet (1,2), Frederique Rolandone (3,1), Patricia Mothes (4), Paul Jarrin (4), Martin Vallee (2), Nadaya Cubas (3), Stephen Hernandez (4), Morgan Plain (4), Sandro Vaca (4,2), and Yvonne Font (1)

(1) Geoazur, IRD, Université Côte D'Azur, CNRS, OCA, Valbonne, France., (2) Institut de Physique du Globe de Paris, Sorbonne Paris Cité, Université Paris Diderot, CNRS, France. , (3) Sorbonne Universite´s, UPMC Universite´ Paris 06, CNRS, Institut des Sciences de la Terre de Paris (ISTeP), 4, Place Jussieu, Paris, France., (4) Instituto Geofi´sico, Escuela Polite´cnica Nacional, Quito, Ecuador

At subduction zones, transient aseismic slip occurs either as afterslip following a large earthquake or as episodic slow slip events during the interseismic period. Afterslip and slow slip events are usually considered as distinct processes occurring on separate fault areas governed by different frictional properties. We present new Continuous GPS results along the Nazca/South America subduction zone in Ecuador during the years before and immediately after the 2016 Mw 7.8 Pedernales earthquake. We will introduce a new approach to extract small transient signals from GPS time series through iterative refinement of the reference frame and an original method for static and kinematic fault slip inversion from geodetic data based on a stochastic approach with non-negativity constraints. By applying these approaches, we find that the early post-seismic period (1 month after the earthquake) shows large and rapid afterslip developing at discrete areas of the megathrust and a slow slip event remotely triggered ($\sim$100 km) south of the rupture of the Pedernales. We further find that areas of large and rapid early afterslip correlate with areas of the subduction interface that had hosted slow slip events during the years prior to the 2016 earthquake. Regardless of whether they were locked or not before the earthquake, these areas appear to persistently release stress by aseismic slip throughout the earthquake cycle and outline the seismic rupture, an observation potentially leading to a better anticipation of future large earthquakes.