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Interseismic Coupling Models and their interactions with the Sources of Large and Great Earthquakes

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Recent observations of heterogeneous strain build up reported from subduction zones and seismic sources of large and great interplate earthquakes indicate that seismic asperities are probably persistent features of the megathrust. The Peru Megathrust produce recurrently large seismic events like the 2001 Mw 8.4, Arequipa earthquake or the 2007 Mw 8.0, Pisco earthquake. The peruvian subduction zone provide an exceptional opportunity to understand the eventual relationship between interseismic coupling, large megathrust ruptures and the frictional properties of the megathrust. An emerging concept is a megathrust with strong locked fault patches surrounded by aseismic slip. The 2001, Mw 8.4 Arequipa earthquake ruptured only the northern portion of the patch that had ruptured already during the great 1868 Mw$\tilde{8}$.8 earthquake and that had remained locked in the interseismic period. The 2007 Mw 8.0 Pisco earthquake ruptured the southern portion of the 1746 Mw$\tilde{8}$.5 event. The moment released in 2007 amounts to only a small fraction of the deficit of moment that had accumulated since the 1746 great earthquake. Then, the potential for future large megathrust events in Central and Southern Peru area remains large. These recent earthquakes indicate that a same portion of a megathrust can rupture in different ways depending on whether asperities break as isolated events or jointly to produce a larger rupture. The spatial distribution of frictional properties of the megathrust could be the cause for a more complex earthquakes sequence from one seismic cycle to another. The subduction of geomorphologic structure like the Nazca ridge could be the cause for a lower coupling there.