



Rupture process of the August 15, 2007 $M_w = 8.0$ Peru earthquake

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The great 2007, Peru earthquake, is the second great earthquake to have struck Peru since the start of the 21st Century, and caused significant damage to communities about 200km to the Southeast of Lima, with more than 500 people killed and nearly 40,000 buildings damaged or destroyed. This earthquake occurred just 6 years after the June 23, 2001, M_w 8.4 earthquake. That earthquake was, at the time of its occurrence, the largest earthquake worldwide since the 1960s and ruptured an area immediately to the South of the Nazca Ridge. The 2007 earthquake ruptured an area immediately to the North of the Nazca ridge. The ~ 250 km long portion of trench between the Northern edge of the 2001 rupture and the Southern edge of the 2007 earthquake is largely filled by the rupture areas of very large earthquakes in 1996 and 1942, thus it seems unlikely that there will be further great earthquakes off the coast of Peru between $\sim 13^\circ\text{S}$ and 18°S in the near future. To the South of the Arica bend, in Northern Chile, the increased probability of a great gap-filling earthquake in the rupture area of the great, magnitude $\sim 8.8 - 9.0$ 1877 event still remains. Further North, the stress accumulated since the great Lima earthquake of 1974 is not equal to the stress released in that event so, although the 2007 earthquake will have increased the loading on the trench in this area, it is unlikely that the trench is close to maturity in its seismic cycle. In these respects, the 2007 earthquake appears to be a classic “gap-filling” event.

Here we present the preliminary results of seismic inversions to investigate the earthquake rupture evolution and Interferometric Synthetic Aperture Radar (InSAR) studies which show the final slip distribution. Both indicate the fault ruptured mainly on a

plane dipping at a much shallower angle than the 28° suggested by the Global CMT solution, with the majority of slip on a fault dipping at $10\text{-}15^\circ$. Both studies indicate peak slip of approaching 5m close to the earthquake's hypocentre, with much of the slip deep on the fault plane or under the coast of Peru. This would provide an explanation for the subdued tsunami formation associated with this event. The seismic inversions demonstrate that the majority of the slip in the earthquake occurred relatively late in its history between ~ 55 and 80 seconds after its initiation with rupture terminating after ~ 90 seconds.