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Seismicity distribution and interseismic coupling on the Ecuadorian Seismogenic Zone

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In Ecuador, the Nazca plate is subducting beneath the North Andean Block. This subduction triggered, during the last century, 4 major earthquakes of magnitude greater than 7.7. Between 1994 and 2007, the Geophysical Institute (Escuela National Politecnica,Quito) recorded 40,000 events in the whole subduction system ranging from Mb 1.5 to 6.9. This study describes the earthquake distribution on the frontal part of the Ecuadorian subduction zone determined from a 3D hypocenter determination approach. This approach includes (1) the construction of a 3D geo-realistic a priori seismic velocity model, (2) a selection of aseismic station sub-set to correct the effect of station densitydisequilibrium between coastal and volcanic regions and (3) the use of the improved3D MAXI techniquefor earthquake location and quality selection. The ensuing catalogueimproves the image ofactivedeformation in the vicinity of the interplate seismogenic zone (ISZ).Seismicity previously detected before trench occurs indeed between the trench and the coastal range. Relatively to previous major earthquakes, the rupture zone of the 1958 M7.8 event appears to be seismically silent while, $\sim$150 km to the south, the seismogenic activity on the 1942 M7.9 asperity happens to affectthe deeper part of the assumed seismogenic interface ($\sim$15 to 40 km depth). This later seismogenic surface is limited to the north, within the 1942 rupture zone, by a lineament perpendicular to the trench and mainly located on the seismogenic interface. This trench-normal lineamentmatches thesouthern limit of a highly locked zone (60%, $\sim$1°N) deduced from the GPS data. South of the 1958 rupture zone, facing the subducting Carnegie Ridge, seismicity is shallower ($\sim$8 km and 35 km depth), mainly distributed along the ISZ and organized in large and recurrent seismic swarms.ISZ seismic activity fades at a depth right beneath the surface topography of coastal range, and, laterally, interrupts abruptly at 1.6°S. Those dense swarms define a quiescent region in the center (around 0.5°S), comparable in size and shape to the 1942 M7.9 asperity. However, this quiescent region is associated to a mainly creeping area with a coupling rate lower than 30%. The surrounding denser seismic swarms, north and south of the aseismic region, corresponds to local and highly coupled zone ($\sim$50% at 0.25°S and $\sim$80% at 1.5°S).