

Shallow intraplate seismicity related to the Illapel 2015 Mw 8.4 earthquake:

Implications from the seismic source

Carrasco, Sebastián

Ruiz, Javier A.

Contreras-Reyes, Eduardo

Ortega-Culaciati, Francisco

The September 16, 2015, Mw 8.4 Illapel, Chile earthquake is the first large event occurring in north-central Chile after the 1943 earthquake, filling a known seismic gap in the region. The earthquake took place in a complex tectonic region, nearby an area where transition from erosive to accretionary margin occurs due to the collision of Juan Fernandez Ridge (JFR) along the Chilean margin. We inverted the kinematic rupture process of the 2015 Mw 8.4 Illapel earthquake from the joint inversion of teleseismic body waves and near-field data. The relative weighting between datasets and the weighting of spatial/temporal constraints are objectively estimated by applying the Akaike's Bayesian Information Criterion. The coseismic slip model yields a total seismic moment of 4.92×10^{21} Nm occurred over ~ 120 s. The rupture shows both downdip and updip propagation with slip extending along the thrust interface from ~ 50 km depth to shallow near-trench depths (< 15 km), with maximum slip of ~ 9 m located at shallow depths, where low average rupture speeds ~ 1.8 km/s are estimated. Outer-rise events, triggered within the oceanic Nazca plate after the mainshock, did not penetrate into the mantle and are related to preexisting faults due to both bending of Nazca plate and JFR uplift, which promotes a tensional stress regime in the surrounding area. This seismicity was triggered by static stress transfer from near-trench slip revealed by our source rupture modelling, suggesting outer-rise seismicity as a proxy for near-trench coseismic slip. Crustal seismicity within continental South American plate is observed prior to, and after, the mainshock, mainly related to extensional faulting within eroded and fractured wedge due to tectonic processes along erosive margins. We also show evidence of shallow seismicity after the mainshock associated with a long-lived crustal fault, which can represent a high seismic hazard for La Serena-Coquimbo

conurbation.