Geophysical Research Abstracts
Vol. 19, EGU2017-6521, 2017
EGU General Assembly 2017
© Author(s) 2017. CC Attribution 3.0 License.

Interdisciplinary study of the Mw8.3 Illapel earthquake (Chile): Rheology and frictional property of the central Chile megathrust

Piero Poli (1), William Frank (1), Andrei Maksymowicz (2), Sergio Ruiz (2), and Hugo Perfettini (3)
(1) MIT, (2) University of Chile, (3) University of Grenoble

We present an interdisciplinary study for the magnitude 8.3 Illapel earthquake, which stroke the central Chile in September 2015. Our work includes historical seismicity, geological, geodetic and seismological information, and aim at deriving a quantitative seismotectonic model for the study area.
We first analyze the historical seismicity, magnetic data, the bathymetry and geodetic coupling, to recognize creeping areas, located all around the M8.3 asperity. The comparison of the recognized creeping zones with earthquake swarm activity and repeating earthquakes occurring before and after the main shock, suggests that several slow slip episodes took place in the 20 years before the main shock. The same areas are recognized as barrier for the propagation of the Illapel earthquake, and accommodated the large afterslip. By combination of geological and seismological data, we recognize these creeping areas as being fluid saturated fracture zones, thus posing constrains on the rheology of the plate interface.
We then perform a detailed study of aftershocks activity, to study the postseismic slip. We first build a high-resolution aftershock catalog, by using template-matching technique. We then make use of the rate and state formalism to fit the spatiotemporal evolution of aftershocks, and thus deriving quantitative information about the frictional properties of the plate interface. This novel approach is validated with GPS data, and reveals strong variation of frictional properties along the plate interface, in agreement with the presence of fluid saturated regions. These regions modulated the stress evolution before and after the main shock, and controlled the dynamic propagation the Illapel earthquake.
Our study reveals the importance of interdisciplinary study of subduction zones, in providing detailed information about small-scale coupling, which can offer fundamental insights about the earthquake cycle and hazard.