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Source processes at the Chilean subduction region: a comparative analysis of recent large earthquakes seismic sequences in Chile

Simone Cesca, Ali Tolga Sen, and Torsten Dahm
GFZ German Research Centre for Geosciences Potsdam, Section 2.1, Potsdam, Germany (simone.cesca@gfz-potsdam.de)

Large intraplate megathrust events are common at the western margin of the Southamerican plate, and repeatedly affected the slab segment along Chile, driven by the subduction of the oceanic Nazca plate, with a convergence of almost 7 cm/y. The size and rate of seismicity, including the 1960 Mw 9.5 Chile earthquake, pose Chile among the most highly seismogenic regions worldwide. At the same time, thanks to the significant national and international effort in recent years, Chile is nowadays seismologically well equipped and monitored; the dense seismological network provides a valuable dataset to analyse details of the rupture processes not only for the main events, but also for weaker seismicity preceding, accompanying and following the largest earthquakes. The seismic sequences accompanying recent large earthquakes showed several differences. In some cases, as for the 2014 Iquique earthquake, an important precursor activity took place in the months preceding the main shock, with an accelerating pattern in the last days before the main shock. In other cases, as for the recent Illapel earthquake, the main shock occurred with few precursors. The 2010 Maule earthquake showed an even different patterns, with the activation of secondary faults after the main shock. Recent studies were able to resolve significant changes in specific source parameters, such as changes in the distribution of focal mechanisms, potentially revealing a rotation of the stress tensor, or a spatial variation of rupture velocity, supporting a depth dependence of the rupture speed. An advanced inversion of seismic source parameters and their combined interpretation for multiple sequences can help to understand the diversity of rupture processes along the Chilean slab, and in general for subduction environments. We combine here results of different recent studies to investigate similarity and anomalies of rupture parameters for different seismic sequences, and foreshocks-aftershocks activities, focusing on the changes in moment tensors, rupture velocities and stress conditions.