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Title: Detailed source process of the 2007 Tocopilla earthquake.

Abstract

We investigated the detail rupture process of the Tocopilla earthquake (Mw 7.7) of the 14 November 2007 and of the main aftershocks that occurred in the southern part of the North Chile seismic gap using strong motion data. The earthquake happen in the middle of the permanent broad band and strong motion network IPOC newly installed by GFZ and IPGP, and of a digital strong-motion network operated by the University of Chile. The Tocopilla earthquake is the last large thrust subduction earthquake that occurred since the major Iquique 1877 earthquake which produced a destructive tsunami. The Arequipa (2001) and Antofagasta (1995) earthquakes already ruptured the northern and southern parts of the gap, and the intraplate intermediate depth Tarapaca earthquake (2005) may have changed the tectonic loading of this part of the Peru-Chile subduction zone. For large earthquakes, the depth of the seismic rupture is bounded by the depth of the seismogenic zone. What controls the horizontal extent of the rupture for large earthquakes is less clear. Factors that influence the extent of the rupture include fault geometry, variations of material properties and stress heterogeneities inherited from the previous ruptures history. For subduction zones where structures are not well known, what may have stopped the rupture is not obvious. One crucial problem raised by the Tocopilla earthquake is to understand why this earthquake didn't extent further north, and at south, what is the role of the Mejillones peninsula that seems to act as a barrier. The focal mechanism was determined using teleseismic waveforms inversion and with a geodetic analysis (cf. Campos et al.; Bejarpi et al., in the same session). We studied the detailed source process using the strong motion data available. This earthquake ruptured the interplate seismic zone over more than 150 km and generated several large aftershocks, mainly located south of the rupture area. The strong-motion data show clearly two S-waves arrivals, allowing the localization of the 2 sources. The main shock started north of the segment close to Tocopilla. The rupture propagated southward. The second source was identified to start about 20 seconds later and was located 50 km south from the hypocenter. The network configuration provides a good resolution for the inverted slip distribution in the north-south direction, but a lower resolution for the east-west extent of the slip. However, this study of the source process of this earthquake shows a complex source with at least two slip asperities of different dynamical behaviour.