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Title: The Mw 7.7 Tocopilla, Chile, Earthquake of 14 November 2007: A Comprehensive Study Using Teleseismic, Local and InSAR data.

Abstract

A large Mw 7.7 earthquake took place in the Northern Chile subduction zone severely affecting the cities of Tocopilla, Maria Elena, Quillagua and Mejillones . The earthquake was very well recorded by many broadband stations at teleseismic distances and by more than 10 three-component accelerographs in the near field, four of them right above the rupture region. These data plus InSAR interferograms spanning the date of the earthquake were independently analysed and inverted to determine the characteristics of this event. Two main patches of energy release, located along the plate interface, close to the Chilean coast were clearly identified from the waveform inversion. These patches, separated by 60 to 65 km, ruptured from north to south with a velocity between 2.8 to 3.0 km/s. This rupture scenario is consistent with the modelling of InSAR interferograms by Bejar et al (2008) and the kinematic inversion of near field data by Peyrat et al (2008). Most of the early aftershocks, which took place during the two weeks following the main event, occurred near the Southern end of the rupture zone, just North of the Mejillones Peninsula. The majority of them were thrust events with focal mechanisms similar to that of the mainshock, except for the largest aftershock that took place on 16 December at the southern end of the rupture zone. The latter is a compressional event at 40 km depth, with compression along the slab ("slab push" mechanism). This complex pattern of seismicity, in addition to the lack of co-seismic displacement along the plate interface beneath the Mejillones Peninsula, indicates that structures under the peninsula play a significant role in the subduction process.