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# Source process of the June 13, 2005 Tarapaca earthquake (Chile)

**S. Peyrat** (1), J.B. deChabalier (1), A. Nercessian (1), M.P. Bouin (1), J. Campos (2), D. Legrand (2), S. Bonvalot (2) and J.P. Vilotte (1)

(1) Département de Sismologie, Institut de Physique du Globe de Paris, France, (2) Departemento de Geofisica, Universitad de Chili, Chile

The northern part of the Chile between Antofagasta and Arica has been identified as one major seismic gap. In 1995, the Mw 8.1 Antofagasta earthquake ruptured the southern part of the gap, and in 2001 the Mw 8.3 Arequipa earthquake ruptured the northern part of the gap. Recently, the high seismic hazard of this region has been reinforced by the occurrence of a Mw 7.8 earthquake in Tarapaca on 13 June 2005. This intermediate depth earthquake, which occurred within the slab, offered the interest to have been detected at once by regional permanent networks and by the worldwide network. The high quality and variety of seismic and geodetic data available for this event provided an unprecedented opportunity to study its source in detail. We studied this earthquake using these different data sets and different methods. Following the earthquake, the permanent regional seismic network has been complemented with a small broadband network (IPGP-INSU) recording aftershocks up to now, which allows us to also analysis the post seismic activity. The Tarapaca earthquake occurs within the permanent GPS network installed by IPGP and IRD in Northern Chili. It shows a maximum of coseismic displacement of about 5cm, both on the vertical and the horizontal components. We also calculated SAR interferograms with the European ENVISAT satellite. The interferograms exhibit coseismic deformation over 150 km x 200km, reaching 15 cm of range increase in the line of sight direction. The depth of the earthquake does not allow to the geodetic data to discriminate between the low-angle west dipping and the high-angle east-dipping plane. We used regional seismic data to relocate earthquakes and constrained the main shock focal mechanism solution using teleseismic bodywave inversion. The Tarapaca earthquake is a slab-pull earthquake and is located approximately at a depth of 110 km. The focal mechanism

obtained has an azimuth which corresponds to the subduction of the oceanic Nazca plate beneath the South American plate, with an east-north-east direction. Analysis of the aftershocks localization tends to favor the horizontal plane as the rupture plane, a solution compatible with the interferometric and GPS observations. We constrain kinematic rupture parameters of the Tarapaca earthquake using a nonlinear inversion method. We used a fully systematic, nonlinear inversion method to estimate kinematic rupture parameters using teleseismic and accelerometric data sets. In this study, we investigate both fault planes in order to determine the preferred one. The kinematic inversion shows a simple slip patch rupture. The data (from geodesy, seismology and distribution of aftershocks) have been independently and jointly analyzed. All of them are consistent with about 6m of slip on a low-angle west-dipping fault of about 50-70 km length that broke the oceanic slab.