Geophysical Research Abstracts, Vol. 9, 03900, 2007
SRef-ID: 1607-7962/gra/EGU2007-A-03900

Seismicity, focal mechanisms, and the state of stress of the Chilean subduction Zone at 42°S

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The convergent margin from Southern Chile is the focus of studies within the largescale, multi-discipline experiment TIPTEQ (From The Incoming Plate to megaThrust EarthQuake Processes). A temporary, amphibious seismic network was deployed on the island of Chiloé, the corresponding continental region around Chaitén and the offshore forearc between 41.5°S and 43.5°S. Our studies focus spatially on the central zone of the Mw=9.5 1960 Chile earthquake.

Focal mechanisms have been determined from P wave first motion polarities from small to moderate size (1.5<=M<=5.1) earthquakes that occurred within the forearc of the southern Chilean subduction zone from November 2004 until October 2005. Additionally, we inverted moment tensors using an amplitude-spectra time-trace inversion.

The seismicity is found in the downgoing plate (both at the trench and down to 100 km depth), within the crust beneath the volcanic arc, and at the interface between upper and lower plate. The strongest events in the Benioff zone (down to 55 km depth) show mainly N-S striking thrust type mechanisms thus allocating them in the coupling or seismogenic zone between the two plates. The average compressional stress (P axis) direction for the strongest events is approximately perpendicular to the trench. The present angle of obliquity of the Nazca-South America plate convergence vector with respect to the orthogonal to the trench is approximately 26°S thus suggesting stress partitioning at this latitude. Crustal events suggest that part of the trench-parallel stress component is accommodated by the Liquiñe-Ofqui strike slip fault zone located within the volcanic arc at 42°S.

The focal mechanisms will be jointly interpreted with the findings of surface geological studies and moment tensors from teleseismic measurements. The analysis of the stress field will contribute to the structure and dynamics of the forearc, of the oceanic plate (fracture zones, wedge) and of the coupling zone.