Geophysical Research Abstracts,
Vol. 11, EGU2009-11040, 2009
EGU General Assembly 2009

The International Plate Boundary Observatory Chile (IPOC) in the northern Chile seismic gap

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Fast convergence between the oceanic Nazca and the continental South American plate is accommodated by recurrent rupture of large segments of the two plates' interface. The resulting earthquakes are among the largest and, for their sizes, most frequent on Earth. Along the Chilean and southern Peruvian margin, all segments have ruptured at least once in the past 150 years for which there exist historic and/or instrumental records. The one segment that is most mature for re-rupture stretches for more than 500 km along the northernmost Chilean coast between roughly -23° and -18° latitude. It last broke in 1877 in a magnitude ∼8.8 earthquake, triggering a major Tsunami. From the historical record, it has been known to have a recurrence cycle of approximately 110 years. The adjoining segments to the north and south broke rather recently in 1995 and 2001 in M>8 earthquakes and an M 7.7 earthquake encroached the southern part of the gap in 2007.

The IPOC project intends to investigate this segment of the Nazca-South American plate boundary, on which a strong to devastating earthquake is expected to occur within the next years, by monitoring at a variety of time-scales deformation, seismicity, and magnetotelluric fields in the subduction zone at the closing stages of the interseismic cycle before and possibly during occurrence of a big earthquake. For that purpose, installation of long-term observatories in Northern Chile started in 2006 in a close cooperation of the Universidad de Chile (Santiago, Chile), the Universidad Catolica del Norte (Antofagasta, Chile), the Institut de Physique du Globe de Paris (Paris, France), and the German Research Centre for Geosciences (GFZ, Potsdam, Germany). Currently we are operating 14 modern seismological stations equipped with STS-2 broadband seismometers and accelerometers (EPI sensor). At least two more stations will be installed in the near future. To cope with the high resolution and dynamic of the sensors and data acquisition, site installation was accomplished with special care. At each station a cavern was blasted into the bedrock up to 5 meters deep to ensure stable conditions for measurements. Currently five stations are additionally recording continuously GPS signals, another five are also recording meteorological data, and another seven are equipped with Magneto-Telluric (MT) probes (fluxgate magnetometers and electrode lines). It is planned to extend the multi-parameter observation to as many stations as possible. So far ten of the stations are sending continuous data via satellite links (VSAT) to the GEOFON data host at the GFZ. We will be reporting first results on seismicity, transient deformation and MT from the first two years of recording.