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Co- and post-seismic slip associated with the Mw 7.7 2007 Tocopilla earthquake (North Chile): first results from InSAR and GPS data.

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The November 2007 Tocopilla (Mw 7.7) earthquake occurred in the seismic gap of North Chile, a region where there has been no major thrust event in the last 130 years. A network of continuous GPS stations operated by IPGP, Caltech, DGF and IRD measured the coseismic displacement associated with this earthquake, as well as the subsequent post seismic deformation. By combining the cGPS data with co-seismic interferograms we could retrieve the geometry and slip distribution of the rupture on the subduction interface. The earthquake initiated in the vicinity of Tocopilla city and vanished ∼150km south, below the Mejillones Peninsula, a geomorphic singularity that appears to act as a barrier arresting large earthquakes (1877, 1995 and 2007 events). Tocopilla earthquake broke the deep part of the seismogenic zone down to the transition zone (35-50 km depth) and did not reach the surface.
The slip distribution is characterized by two main slip asperities occurring 30 km apart, consistent with the first results from seismology (Peyrat et al., 2008, Delouis et al. 2008).
We also study the early postseimic deformation using our GPS displacements collected during the months following the main shock and Envisat ASAR interferograms spanning the same period. Our preliminary results show that most of the postseismic slip occurred within the first 10 days after the main shock, and was mostly concentrated at the southern end of the rupture. We attempt to answer the next questions in relation to the postseismic deformation: Where was the postseismic slip located with respect to the coseismic slip? Can we distinguish different mechanisms of post-seismic deformation following the Tocopilla earthquake (afterslip, viscoelastic relaxation)? If yes, where (near field, far field) and when (temporal and spatial evolution of each mechanism)? What amount of afterslip experienced the subduction interface after the earthquake? How much does it represent compared to the seismic moment released by aftershocks that occurred in the area in the same time interval? Is there a temporal and/or spatial correlation between afterslip and aftershocks? What percentage of the main shock moment release does the postseismic slip represent? Can this postseismic slip be compared to the postseismic signature of previous similar earthquakes in the region (e.g. Antofagasta 1995, Arequipa 2001)? Is this postseismic relaxation comparable to the one following earthquakes of similar magnitude that occurred in other subduction zones?

Delouis, B., Pardo, M., Legrand, D., Monfret, T. 2008. The Mw 7.7 Tocopilla earthquake 0f 14 November 2007 at the
southern edge of the northern Chile seismic Gap: Rupture in the deep part of the coupled plate interface. Submitted to
BSSA.

Peyrat et al. (2008). Detailed source process of the 2007 Tocopilla earthquake, Eos Trans. AGU, 89(23), Jt. Assem. Suppl., Abstract S24A-03.