Geophysical Research Abstracts
Vol. 14, EGU2012-12754, 2012
EGU General Assembly 2012

The Relation Between Aftershock Seismicity of the 27 February 2010 Maule Earthquake to Postseismic Displacements from GPS

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On 27 February 2010 the Mw 8.8 Maule earthquake in Central Chile ruptured a seismic gap where significant strain had accumulated since 1835. The postseismic phase was monitored by a network of temporary seismic stations (IMAD) and GPS stations along and around the whole rupture zone. Here, we examine the relation between the spatial-temporal properties of the aftershock distribution and postseismic displacements from GPS. Using scaling relations derived from global data, we calculate the slip and size of individual aftershocks and relate these to preliminary afterslip models. Events larger than Mw=5 result in slip of more than $\sim$20 cm and some of these events presumably exceed locally the cumulative afterslip from 2 months period. Along the whole rupture the small patches ruptured by the aftershocks do not fill up the whole rupture, which is reflected by the observation that the cumulative moment of aftershock seismicity is significantly smaller than the total moment released by afterslip. The time-series of Earth's surface postseismic displacements analyzed here show rapid transient deformation immediately following the Maule earthquake. Results show a first order linear relationship between cumulative displacement with the cumulative number of aftershocks. Similar relations have been observed for other earthquakes. This indicates that both processes decay obeying a similar physical law. Due to the higher number of GPS stations along the Maule 2010 rupture the ratio of displacement (afterslip) per aftershock event might allow to infer rheological properties when mapped along the rupture zone. Furthermore, we discuss the relation between the azimuths of co-seismic, interseismic and postseismic displacement vectors and compare these with the strike directions of focal mechanisms. We compare the results from the Maule 2010 rupture area with the 2005 Nias and the 2011 Tohoku-Oki earthquakes.