SINT-2: Sismotectónica, el ciclo de terremotos y paleosismología a lo largo del margen chileno

Exploring the seismotectonic significance of triggered shallow slip observed with the IPOC Creepmeter Array

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The IPOC Creepmeter Array captures 10-30 triggered displacement events (SDE) per station per year on four different segments along the Atacama Fault System (AFS). The data suggest that shallow fault slip is largely confined to these sudden displacement events with offsets < 1 mm and durations up to 3 min. A continuous creep signal in-between these SDEs is extremely small if existent at all. Since the triggering of upper crustal fault activity is an important issue in estimating the potential hazard of the AFS, in this study we investigate the seismotectonic significance of triggered shallow slip with respect to the long-term fault activity. We quantify the total shallow slip triggered by earthquakes for the past 7 years and compare it to the long-term slip rates in order to determine the slip budget. The Mejillones fault shows extensional SDEs, resulting in a cumulative normal fault parallel slip of up to 0,14 mm/a. This rate is in accordance with the long-term fault slip rate, taking into account some discrepancy due to off-fault displacement. The Chomache fault shows a highly transient accumulation of SDEs including triggered slip from the Iquique 2014 earthquake and its aftershocks. The total cumulative slip derived from triggered SDEs is 0,2 mm for the seven-year period. The sense of displacement we measure is opposite to that documented from the long-term record. The Salar del Carmen fault exhibits a highly transient behavior. In the one-year period prior to the Maule earthquake the total shallow slip accumulated by extensional SDEs is 0.1 mm/a accelerating with a large triggered extensional SDE to 0.4 mm/a for the 6 months after the Maule earthquake. Since the end of 2010 although up to 20 SDEs are triggered per year the cumulative displacement adds up to zero. This variability in shallow slip behavior implies that each of the monitored faults reflects a different shallow slip accumulation pattern or different stages in a long-term cycle. Calculating the slip budget for each of the monitored faults we determine a clear deficit in shallow slip. To understand this shallow slip deficit, we investigate how the duration and intervals in-between SDEs reflect shallow frictional properties and how we can explore this behavior to determine shallow frictional instabilities on the monitored fault zones.