Geophysical Research Abstracts
Vol. 20, EGU2018-3385, 2018
EGU General Assembly 2018

Remote triggering of forearc faulting - surface displacement along the Atacama Fault System monitored with the IPOC Creepmeter Array (N-Chile)

Pia Victor (1), Onno Oncken (1), Monika Sobiesiak (2), and Kemter Matthias (1)
(1) GFZ Potsdam, Potsdam, Germany , (2) Christian-Albrechts-Universität, Kiel, Germany

The 2010 Mw=8.8 Maule Earthquake remotely triggered minor surface displacement along the Atacama Fault System (AFS) located 1500 – 1800 km from the epicenter. The AFS is an active trench-parallel fault system, located in the forearc of N-Chile directly above the subduction zone interface. Due to its well-exposed position in the hyper-arid Atacama Desert it is the perfect target to investigate the interaction between the deformation cycle in the overriding forearc and the subduction zone seismic cycle of the underlying megathrust. We monitor the surface displacement along four target segments of the AFS using 11 creepmeters installed in the framework of the Integrated Plate Boundary Observatory in N-Chile (IPOC) since 2009.
Here we present evidence that the vast majority of surface displacement events are related to earthquakes on the underlying subduction zone interface or to large earthquakes around the world. Our observations document dynamic triggering of upper crustal fault displacement in a forearc setting with unprecedented resolution. Continuous monitoring revealed that up to 30 displacement events per year occur on the monitored fault segments, the vast majority of them triggered by earthquakes in the near or far field synchronous to the passage of the triggering seismic wave. With the data from two collocated seismometers we can clearly attribute far field triggering to the passage of the surface wave and near field triggering to the passage of the body wave. The most distant triggered displacement event monitored at one of the creepmeters occurred after the 2011, Mw=9.0 Tohoku Oki Earthquake located 16468 km away following passage of large amplitude SS waves.
Comparing the here described triggered displacement events with other triggered phenomena like seismicity, volcanic eruptions, hydrological changes as well as with data from the California Creepmeter Array we find that the seismic energy density appropriately describes a magnitude-distance scaling relationship of slip triggering.
All our observations point to an upper plate fault system at critical state that can be triggered dynamically by very small stress perturbations caused by passage of elastic waves from earthquakes following this simple scaling law. A clear relationship between the seismic cycle of the AFS and the seismic cycle of the underlying megathrust is not supported by our data.