Geophysical Research Abstracts
Vol. 17, EGU2015-15200, 2015
EGU General Assembly 2015


# Modeling subduction megathrust earthquakes: Insights from a visco-elasto-plastic analog model

Stéphane Dominguez, Jacques Malavieille, Stéphane Mazzotti, Nicolas Martin, Yannick Caniven, Rodolphe Cattin, Roger Soliva, Michel Peyret, and Serge Lallemand

Geosciences Montpellier, University of Montpellier, Place E. Bataillon, cc60, 33095 Montpellier, France

As illustrated recently by the 2004 Sumatra-Andaman or the 2011 Tohoku earthquakes, subduction megathrust earthquakes generate heavy economic and human losses. Better constrain how such destructive seismic events nucleate and generate crustal deformations represents a major societal issue but appears also as a difficult scientific challenge. Indeed, several limiting factors, related to the difficulty to analyze deformation undersea, to access deep source of earthquake and to integrate the characteristic time scales of seismic processes, must be overcome first. With this aim, we have developed an experimental approach to complement numerical modeling techniques that are classically used to analyze available geological and geophysical observations on subduction earthquakes. Objectives were to design a kinematically and mechanically first-order scaled analogue model of a subduction zone capable of reproducing megathrust earthquakes but also realistic seismic cycle deformation phases. The model rheology is based on multi-layered visco-elasto-plastic materials to take into account the mechanical behavior of the overriding lithospheric plate. The elastic deformation of the subducting oceanic plate is also simulated. The seismogenic zone is characterized by a frictional plate interface whose mechanical properties can be adjusted to modify seismic coupling. Preliminary results show that this subduction model succeeds in reproducing the main deformation phases associated to the seismic cycle (interseismic elastic loading, coseismic rupture and post-seismic relaxation). By studying model kinematics and mechanical behavior, we expect to improve our understanding of seismic deformation processes and better constrain the role of physical parameters (fault friction, rheology, ...) as well as boundary conditions (loading rate,...) on seismic cycle and megathrust earthquake dynamics. We expect that results of this project will lead to significant improvement on interpretation of geophysical data, satellite observations and seismological records.