Modelling of the post-seismic phase of the Iquique earthquake constrained by GNSS and InSAR observations

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Large earthquakes are followed by a post-seismic period during which the stresses induced by the co-seismic phase are relaxed through different processes, mostly the afterslip and the visco-elastic relaxation in subduction context. It is generally considered that the two mecanisms affect different spatial and temporal scales, the afterslip is prevalent the first months in the surrounding of the fault, while the visco-elastic process affects a bigger area and last a longer time.
Our ultimate goal is to study the large-scale interactions between earthquakes in South-America in particular the 2010, Mw8.8 Maule, 2014, Mw8.1 Iquique and 2015, Mw8.3 Illapel earthquakes sequence. Postseismic processes are a key ingredient to understand these interactions, and in this work our aim is to identify the processes involved after the Iquique earthquake.

The post-seismic phase is explored using a finite element model (2D model, using the FEM software Pylith) that is constrained with InSAR and GNSS data. The GPS time series (processed with GipsyX) include 83 stations. The post-seismic signal is isolated using a trajectory model. The InSAR data consist in Sentinel-1 time series processed with the NSBAS chain, they include 514 interferograms starting 7 months after the earthquake up to the end of 2019. In the FEM we impose a co-seismic displacement on the plate interface and consider the relaxation in the medium. We explore the influence on the predicted surface displacement of the structure and the rheology.

Our initial tests reveals that the viscosity in the continental and the oceanic mantle both have an impact on the displacement produced at the surface, also, the difference between these viscosities controls the movements allowed at depth. We also noticed that the crust thickness and the presence of a cold nose have a clear impact to constrain respectively the wavelength and the location of the maximum of amplitude.
We first adjust our model to explain the long-term viscoelastic deformation. The InSAR data show a clear spatial wavelength with a strong signal 150 to 300 km from the trench. The GNSS data cover a broader area. We highlighted also that a different process is needed to fit the first year of data, this will be modelled by considering in our model afterslip and/or transient viscosity.

Mots-Clés : Modelling, subduction, post-seismic, Iquique

Merci de ne rien inscrire dans cette zone et ne pas modifier les marges des pieds de page et entêtes.