LabEx OSUG@2020

Observatoire des Sciences de l'Univers de Grenoble

Ce projet est soutenu par le Laboratoire d'Excellence OSUG@2020 (ANR10 LABX56) financé par le programme d'Investissements d'Avenir lancé par l'Etat et mis en oeuvre par l'ANR.

Titre du projet : Towards a state of the art of the Deformation in the Central Andes Subduction Zone

Volet : Favoriser l'International

Porteur du projet : Jorge Jara Gómez (Ph.D. Student)

Laboratoires impliqués : Institut des Sciences de la Terre (ISTerre, Université Grenoble Alpes, France), Caltech Seismological Laboratory (California Institute of Technology, USA)

Bilan du projet pour l'année 2014

Bilan d'activité *(1 page max)*

The project has provided me with the opportunity to stay 1 month (in January/February 2016) in the Seismological Laboratory of Caltech to work under the supervision of Prof.. Mark Simons.

The aim of the project is the modeling of interseismic velocity field (obtained from cGPS processing) using an asperity model. The study area is located in the seismic gap of southern Peru and Northern Chile. We have followed the strategy proposed by Kanda et al. (2013)[1] in order to understand the fault creep and interseismic deformation process. Several authors have proposed interseismic coupling maps in the area (Bejar-Pizarro et al. (2013) [2], Metois et al. (2013)[3]), following a kinematic strategy to retrieve the coupling factor. Here, the idea is use

[1] Kanda, R. V., Hetland, E. A., & Simons, M. (2013). An asperity model for fault creep and interseismic deformation in northeastern Japan. *Geophysical Journal International*, *192*(1), 38-57.

[2] Béjar-Pizarro, M., Socquet, A., Armijo, R., Carrizo, D., Genrich, J., & Simons, M. (2013). Andean structural control on interseismic coupling in the North Chile subduction zone. *Nature Geoscience*, *6*(6), 462-467.

[3] Métois, M., Socquet, A., Vigny, C., Carrizo, D., Peyrat, S., Delorme, A., ... & Ortega, I. (2013). Revisiting the North Chile seismic gap segmentation using GPS-derived interseismic coupling. *Geophysical Journal International*, *194*(3), 1283-1294.

geodetic data to study, from a rheological point of view, and understand the interseismic velocity field and its relationship with the historical/recent earthquakes in the area. We have started with all the earthquakes that have known slip models, to define the configuration of asperities (Figure 1) following the equations proposed by Kanda et al. (2013). Using this configuration, we have defined the geometry of the subduction using a triangular mesh (Figure 2). This design allows us to calculate the Green's Functions for our model.

We are now working with the code implemented in order to get the Green's Functions and obtain preliminary results in a simple case study (two southern asperities Figure 2). After that, we will perform the modeling over the whole seismic gap. We have thought in testing two main ideas with this model:

1. Is this asperity configuration capable to reproduce the measured interseismic velocity field? Or alternatively, is it necessary to include more historical earthquake records to explain the data? Could the model reveal areas that are prepared to generate upcoming earthquakes?
2. Is there any significant change in the result that we will get with respect to the published interseismic coupling maps in the area? What is the added value of a rheological model with respect to a kinematic model? What are the relationships between both kinds of models?

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Illustrations - avec légende et crédit *(à envoyer également séparément)*

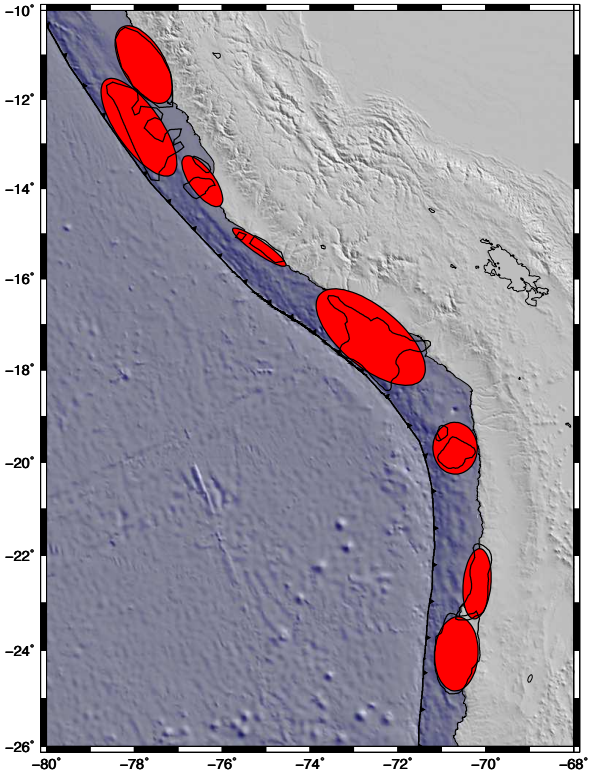

Figure 1 : Slip Models, Asperity configuration in the study area.

Black contours indicate the slip models known from seismological/geodetic inversions. Red ellipses show the asperity configuration performed during our study of the seismicity in the area.

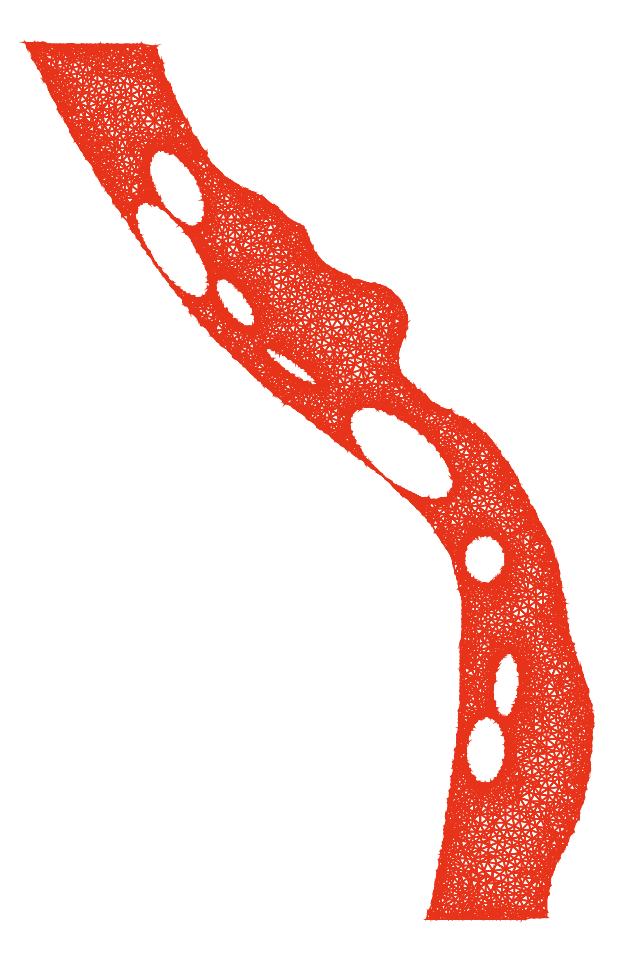

Figure 2 : Triangular Mesh Designed using the Asperity Configuration

The white holes are the asperities that we have removed from the triangular mesh in order to study the effect of the stresses generated in their boundaries from cGPS interseismic velocity field.

Production scientifique *(articles scientifiques, actes de congrès…)*

The study needs to be completed during my last year of PhD thesis.

Bilan financier

- Plane Ticket : 700 euros
- Housing and daily allowance : 1800 euros