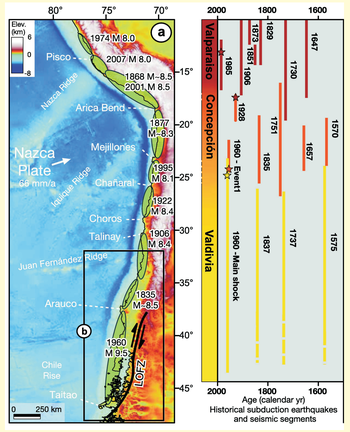
Post-seismic deformation for 2010 Maule earthquake, Chile

Yu-nung Nina Lin,[1] Mark Simons,[1] Anthony Sladen,[1] Benjamin A. Brooks,[2]
Eric J. Fielding,[3] Francisco Ortega,[1] and Jean-Philippe Avouac[1]

1. Devision of Geological and Planetary Sciences, California Institute of Technology
2.Hawaii Institute of Geophysics and Planetology, University of Hawaii
3. Jet Propulsion Laboratory, California Institute of Technology

INTRODUCTION

The February 27, 2010 Mw 8.8 earthquake struck southern Chile on the primary fault that defines the interface where the Nazca Plate subducts below the South American continent at an average rate of approximately 6.6 cm/yr. The ruptured areaapproximates 400 km in the along strike direction and 200 km in the down dip direction. We use InSAR, continuous GPS measurements and teleseismic waveforms to constrain the coseismic slip model on the subduction interface. We further apply Principal Component Analysis-based Inversion Method (PCAIM, Kositsky & Avouac 2010) to carry out a preliminary analysis of the postseismic slip.

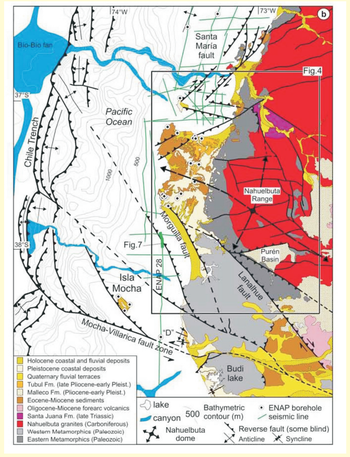


(Melnick et la., 2009)

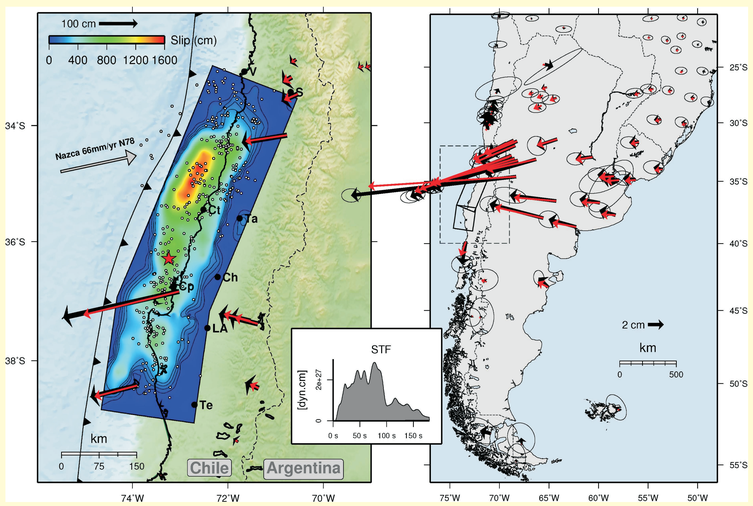
COSEISMIC SLIP MODEL

Our solution indicates a large slip patch right to the north of the hypocenter, whereas the slip around the Arauco Peninsula is relatively mild, different from the analysis of Delouis et al. (2010). Our result is less biased by GPS deployment because of the full coverage and two orbit directions of InSAR data.

Vertical deformation on the Arauco Peninsula suggests coseismic back-tilting, which is also observed on Pleistocene MIS-5, MIS-7 and MIS-9 marine terraces (Melnick et al., 2009). This pattern suggests that these marine terraces may partially be formed during subduction earthquakes in the Concepcion segment.

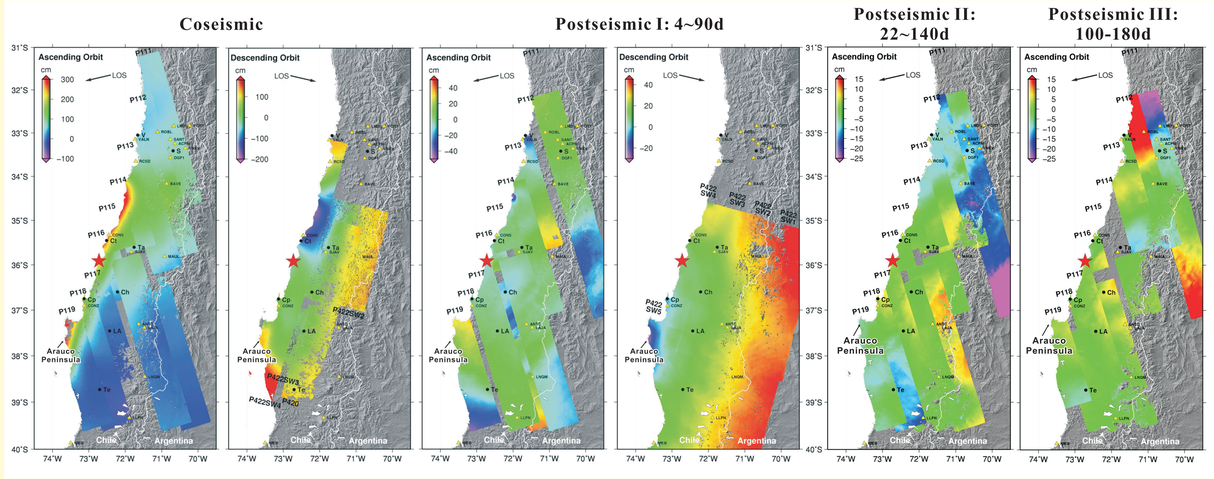


(Melnick et la., 2009)

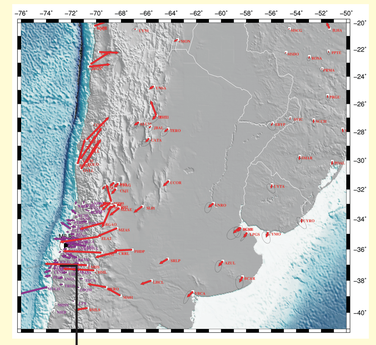


POSTSEISMIC DEFORMATION

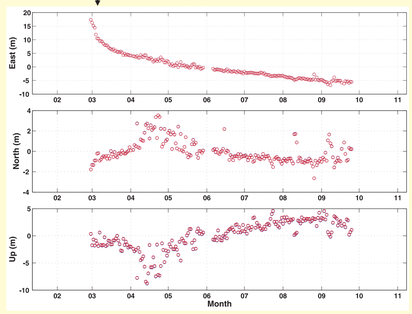
ALOS interferograms suggest significant deformation even up to 90 days after the earthquake. The amplitude decays so that later interferograms show more tropospheric signals than tectonic signals. GPS measurements shows strong deformation even in the far field, indicating possible slip in the deeper part of the subduction interface. Here we carry out Principal Component Analysis-based Inversion Method (PCAIM) analysis by using GPS data only. After properly resampling InSAR data, we will be able to carry out joint PCAIM analysis by using both GPS and InSAR datasets, which may give even better constraints on the slip along the megathrust.



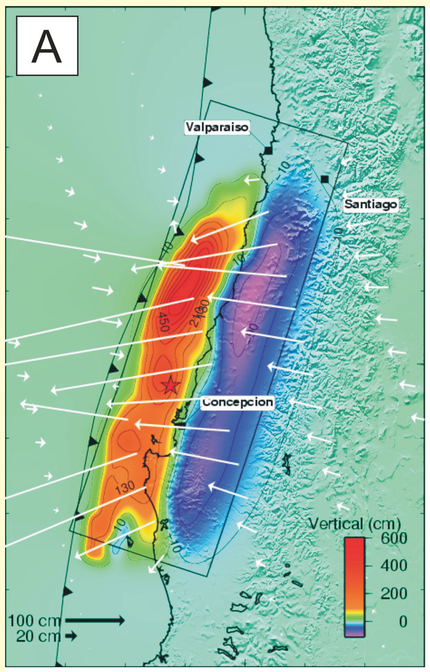
Postseismic GPS: 0~200d



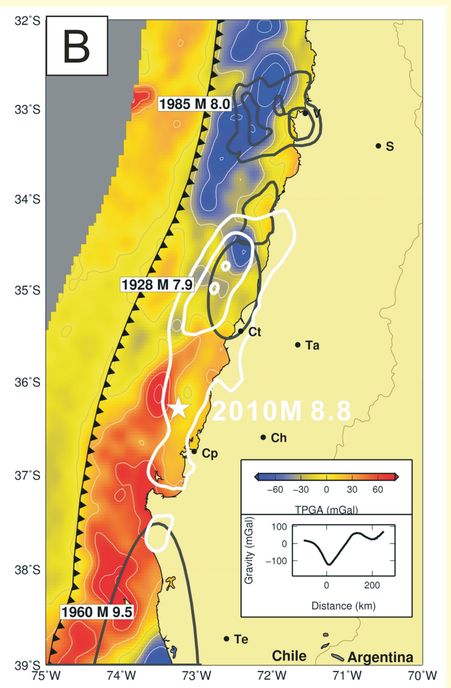
CONZ



Predicted deformation from coseismic slip model

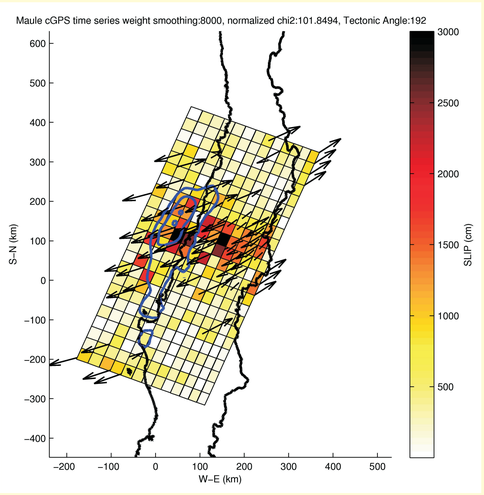


Comparison of subduction zone asperies with Trench Parallel Gravity Anomaly (TPGA)



POSTSEISMIC SLIP MODEL & IMPLICATIONS

Our preliminary postseismic slip model indicates slips both on the major coseismic asperity and in some deeper patches. The slip polarity reverses from shallow to deep part along the fault.



Acknowledgment

We would like to than Alaska Satellite Facility for their help in acquiring and transferring ALOS data. We also thank the Gordon and Betty Moore Foundation for their support on this project.