



Geodetic science and Geomatic Department at UdeC

Quo vadis?

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01/02/2012



From the beginning



1960 Mw 9.5



We need surveyor
to build a new
infrastructure





From the beginning



undergraduate program

- Technical surveyor (2 Y) 1962
- Surveyor (3 Y) 1968
- Survey Eng. (4 Y) 1986
- Geomatic Eng (5 Y) 2004- up to now



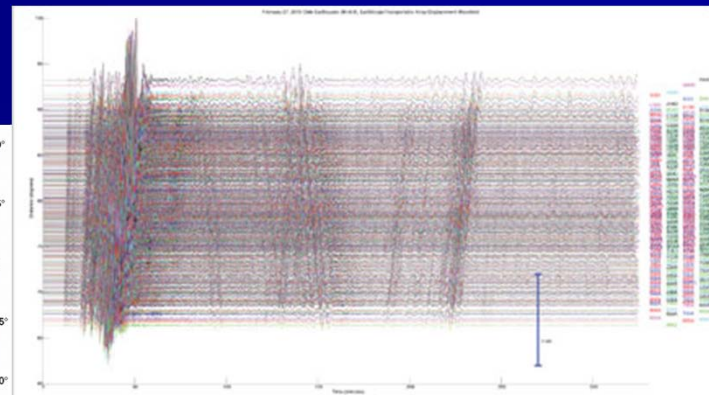
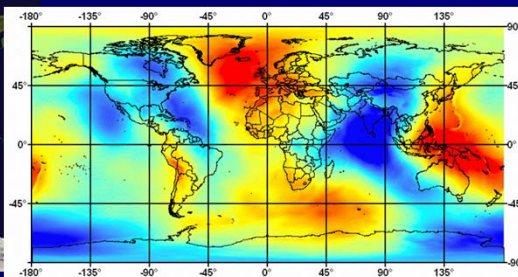
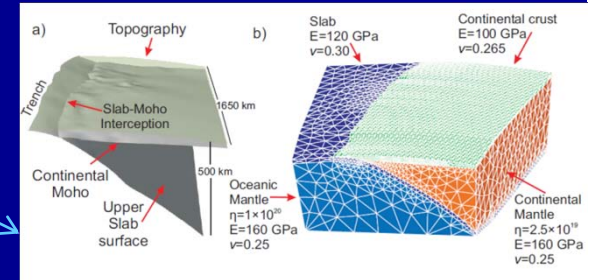
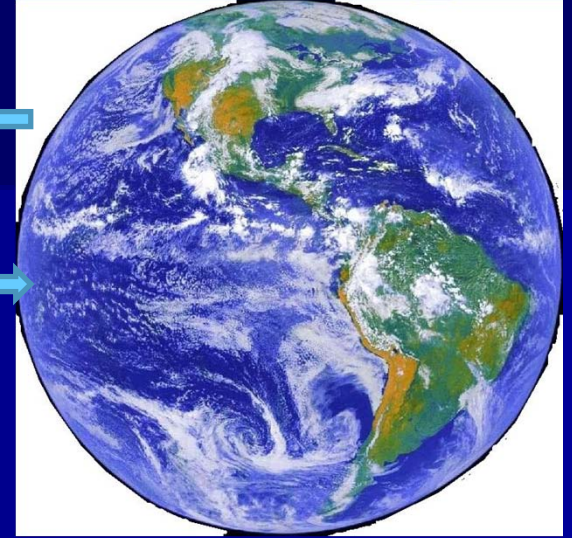
Staff



- 2 surveyors Eng.
- 2 PhD in Geodesy
- 1 Msc. in Geodesy
- 1 Msc. in Cartography
- 1 civil contractor
- 2 Academic collaborators
- 2 technical assistants
- 1 secretary

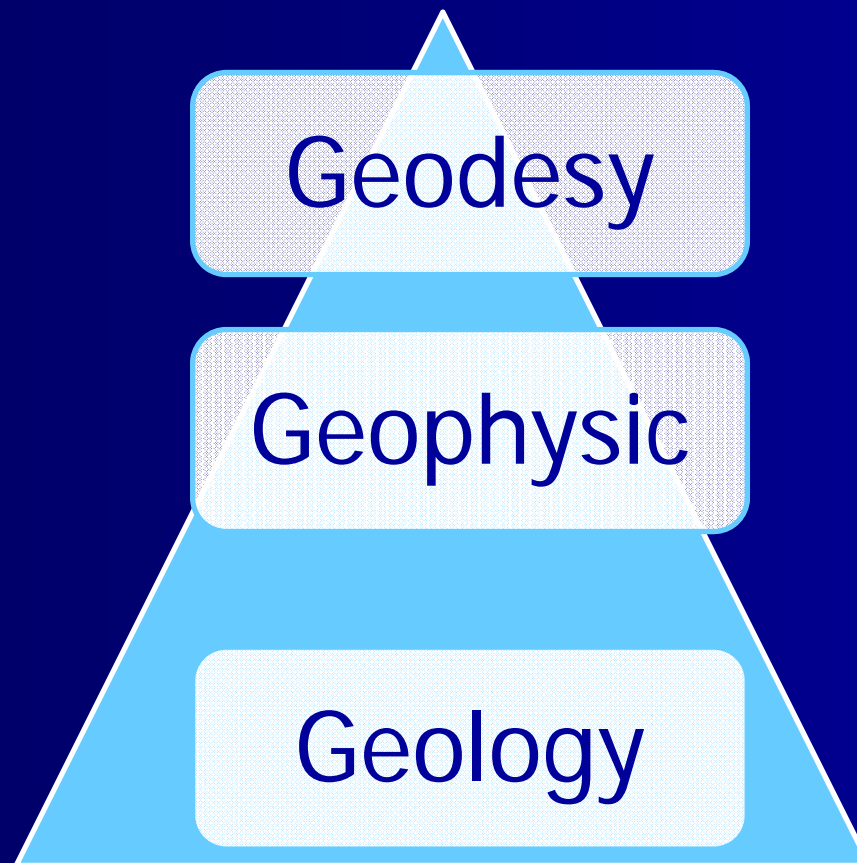


Common vision





Common vision



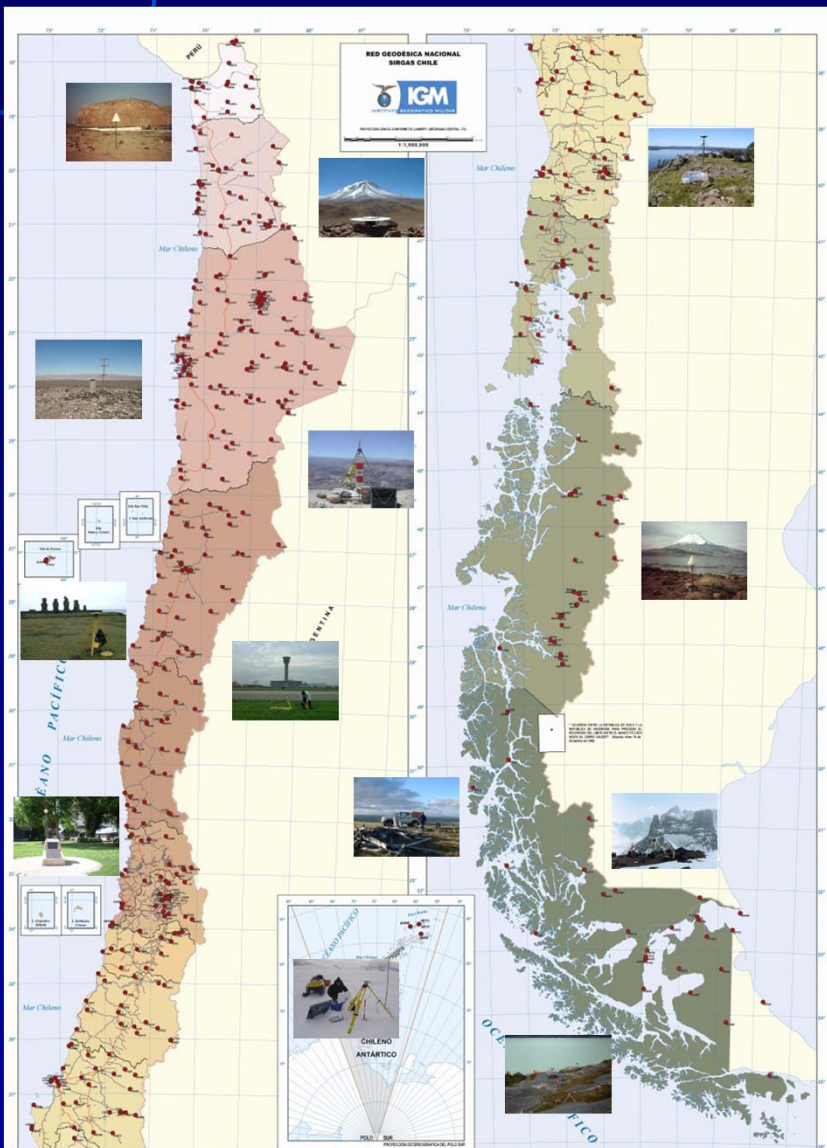
NEW
FACULTY!



Geodesy (IGM & Báez)



1.-National Geodetic Network

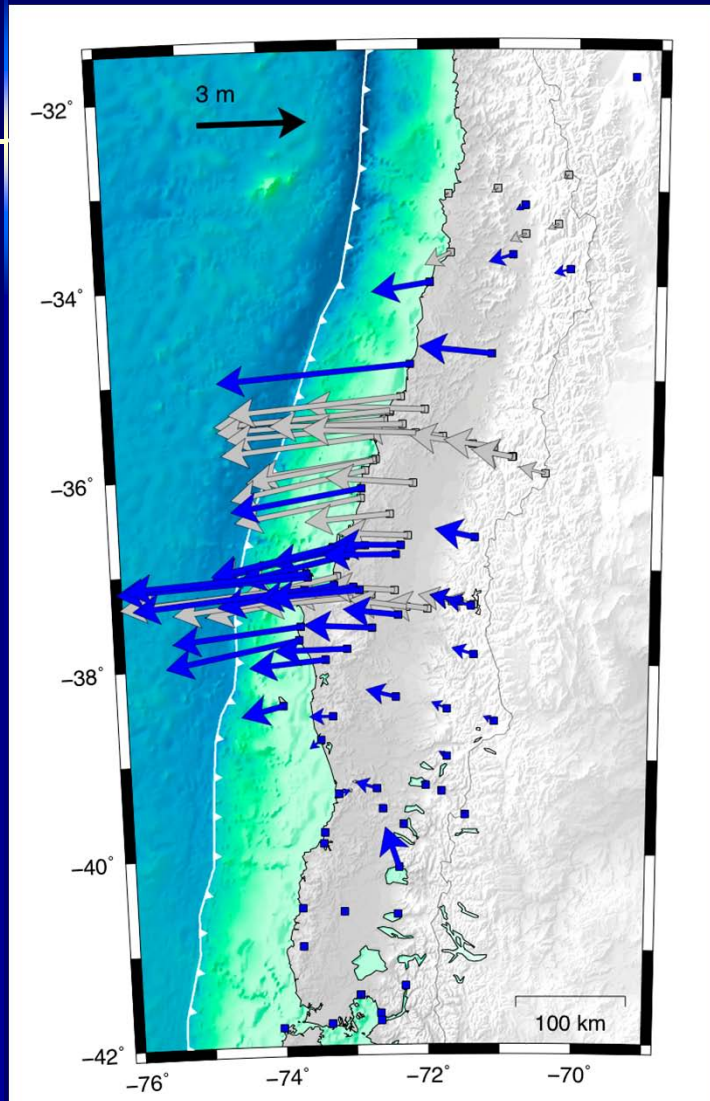




Geodesy (IGM & Báez)



1.- National Geodetic Network



Co-seismic displacement

Dynamic GRF?

1. Increase CGNSS stations (50 km)
2. Include stations from scientific projects
3. Weekly solution for complete network
4. gravity and leveling for height system
5. Time dependency of coordinate
6. 2006 -----

$$X_i = X_0 + V_0(t_i - t_0) + \sum r$$



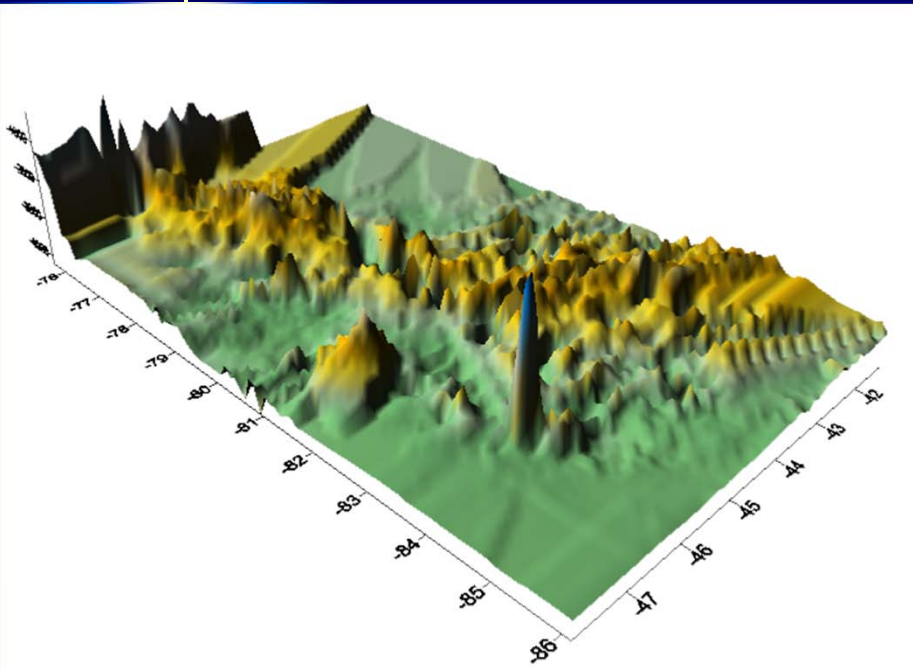
Geodesy (Báez et al)



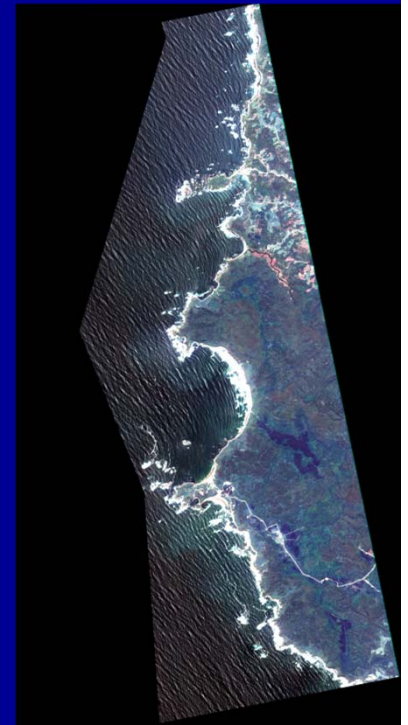
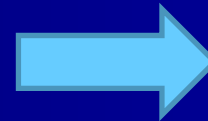
2.-National Scientific Project

can we applied to increase our EEZ, in ocean, under actual international regulations?

- 1.- perform geophysics observations
- 2.- estimate the area which are possible this application
- 3.- estimate the coast line from geodetic method RS, GNSS.
(2008-2018)



Los Muermos area

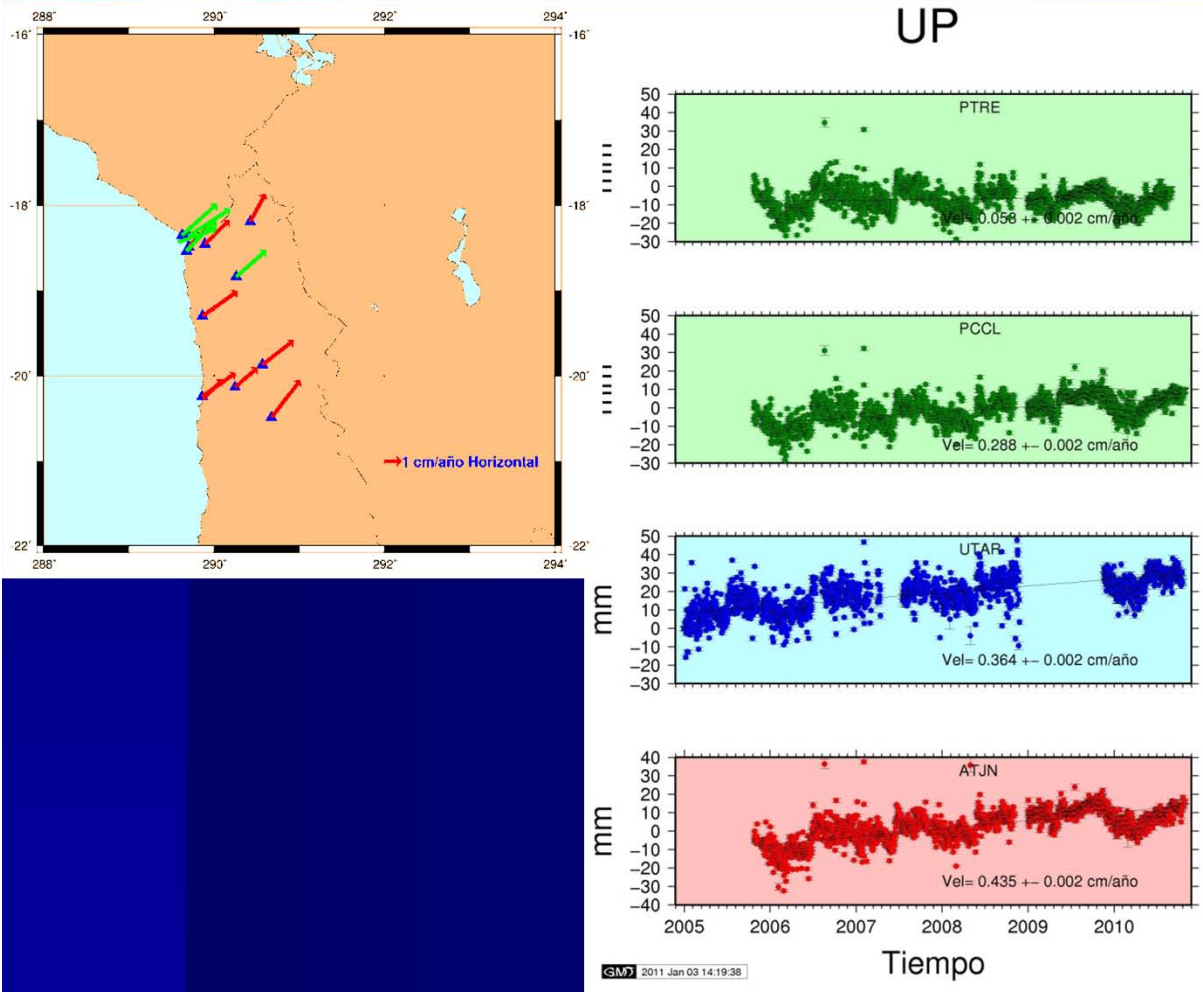




Geodesy (Báez & Bataille)



3.- Geomorphology changes due to crust interactions



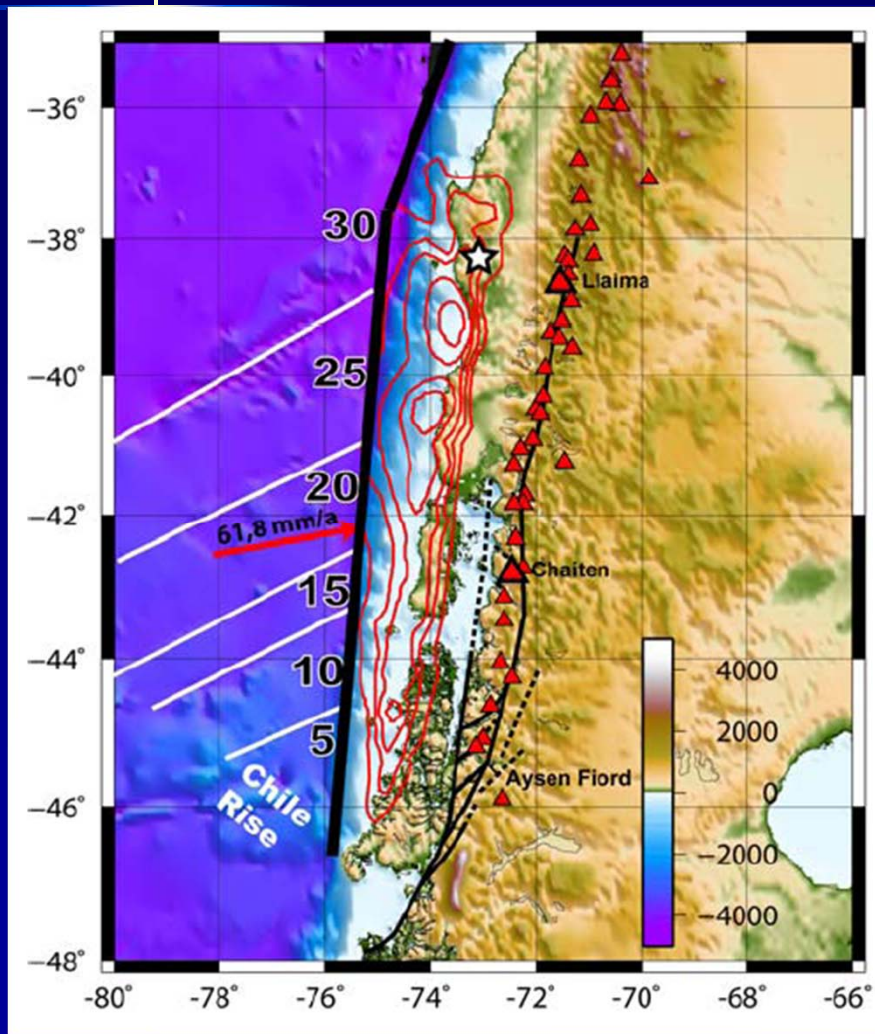
- How plate tectonic interactions can produce geomorphologic changes on surface?
- 1.- collect long term GNSS data
 - 2.- weather data
 - 3.- gravity observations
 - 4.- 2008-2011



Geo et al (Tassara et al)

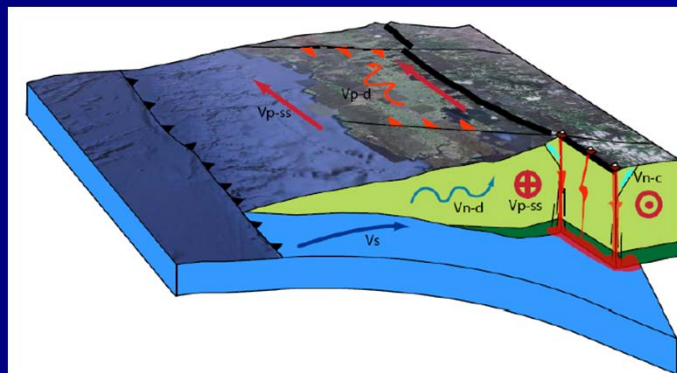


4.-Convergence Partitioning at the Southern Andes Numerical Modeling of crustal deformation (FONDECYT 2010-2013)



What cause convergence partitioning along the Southern Andes and favors the creation, evolution and current activity of the LOFZ?

- 1) The LOFZ is a reactivated structure
- 2) The LOFZ is extremely weak owing to the close genetic link with the SVZ
- 3) Heterogeneous co-seismic slip along the megathrust is a controlling factor
- 4) Post-glacial rebound promotes the activity of the LOFZ

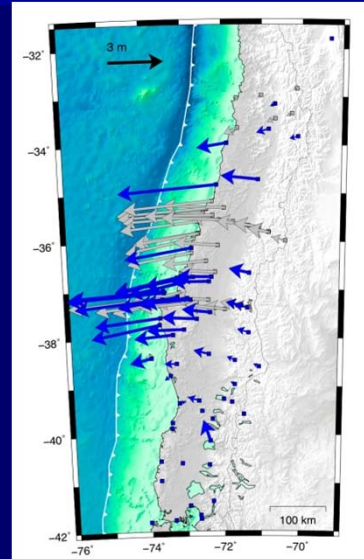




Geodesy



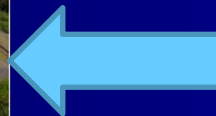
5.-Geodetic observation and analysis system in seismically active regions in Chile 2010-2012 (BMBF CHL 10/018)
(DGFI, UDEC, TUM, IGM)



Short term combinations techniques can be used to upgrade and maintenance of regional GRF?

DGFI-UDEC-TUM-IGM (2010-2012)

- 1.- generate solutions in GNSS
- 2.- generate solutions in VLBI
- 3.- generate solutions in SLR
- 4.- combine and generate global solutions every month. (WG IAG)



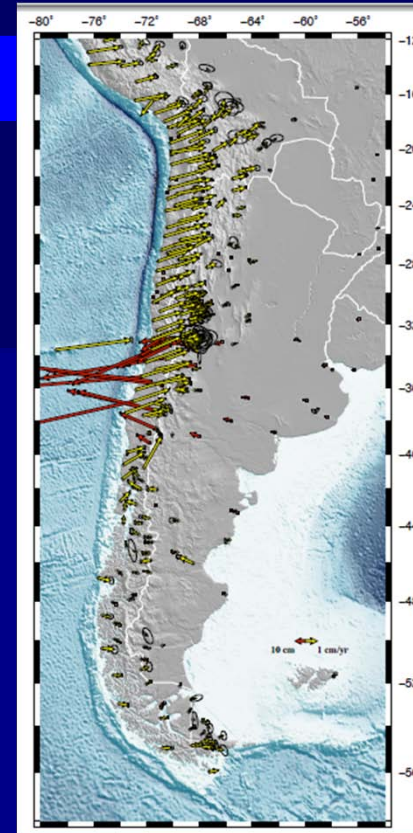
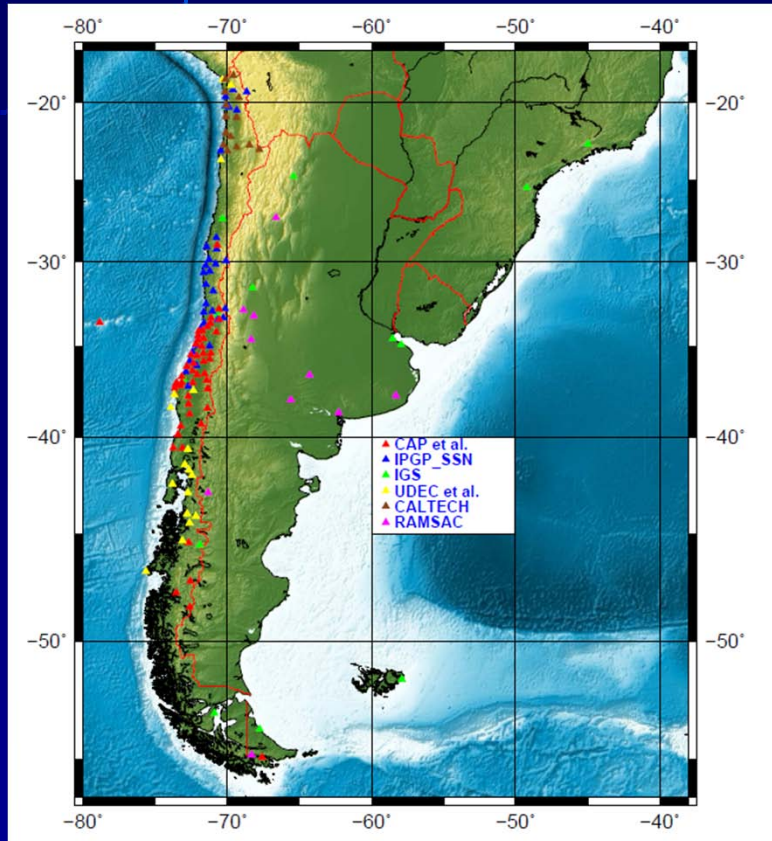
TIGO



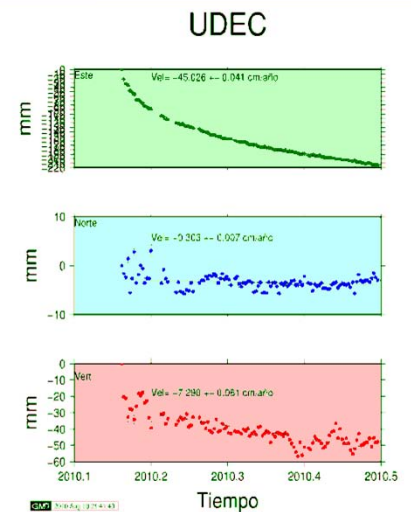
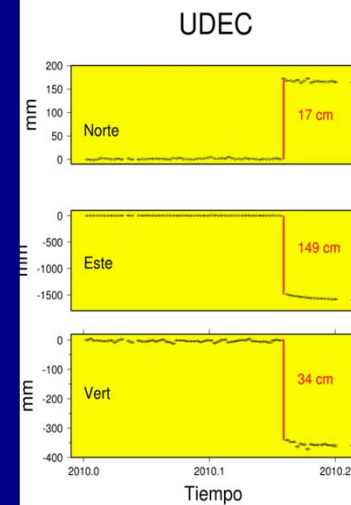


Geo et al

5.-Maule earthquake 27/F/2010 (FENIX)



International WG
OSU, IPGP, SSN, UNAVCO, IGM
UDEEC, CALTECH, LIVERPOOL
MENPHIS, HAWAII, TIGO, DGFI
• OTHERS

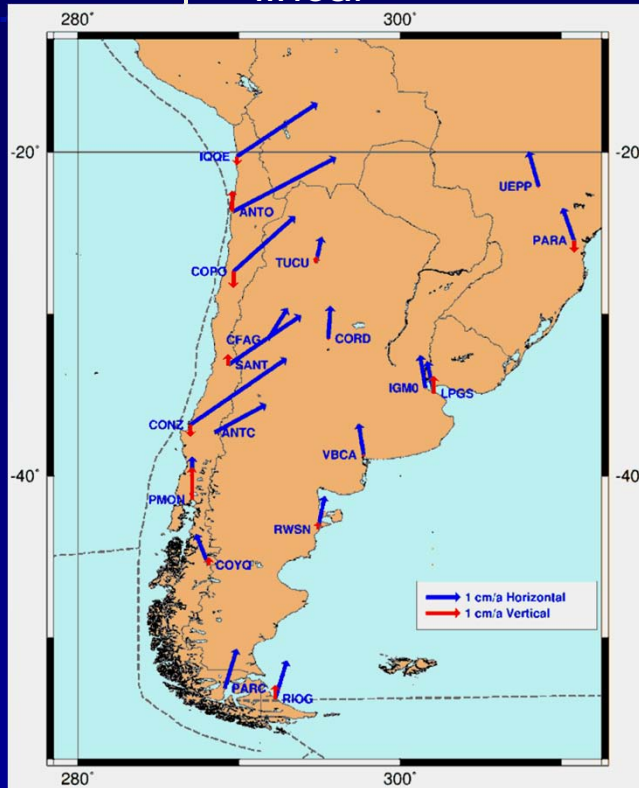




Monitoring no linear effects (MoNoLin) Báez, Cimbaro, Drewes (SIRGAS)



linear



BAEZ et al 2007

Non-linear



Seismic cycle

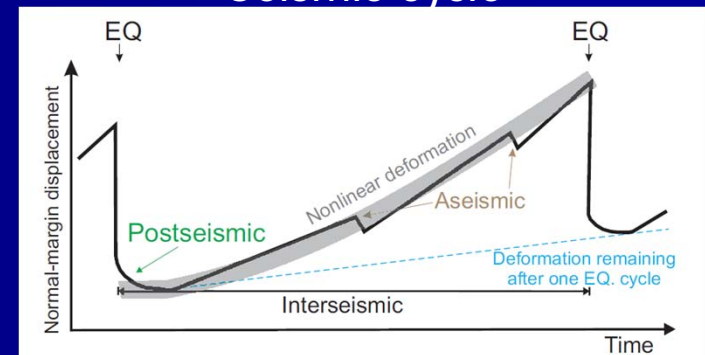


Figure 1.1: Scheme of the earthquake cycle deformation for a surface site above the seismogenic zone in a subduction zone. Periods of transient deformation may be superimposed on interseismic strain accumulation influencing the interface coupling.

Moreno et al, 2010

$$X_i = X_0 + V_0(t_i - t_0) + \sum r$$



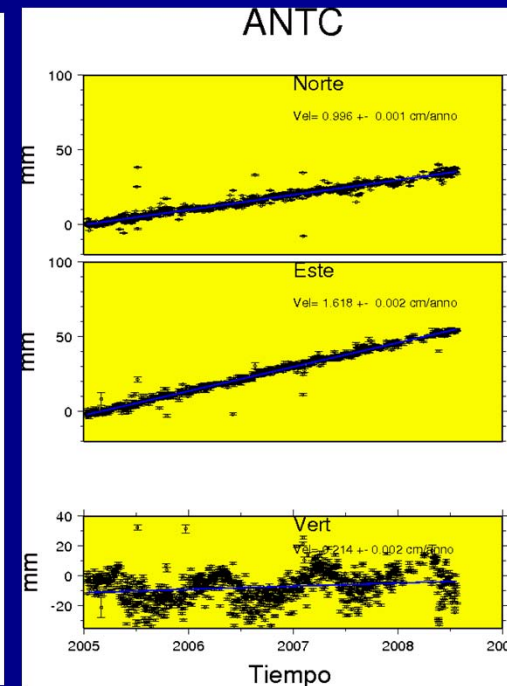
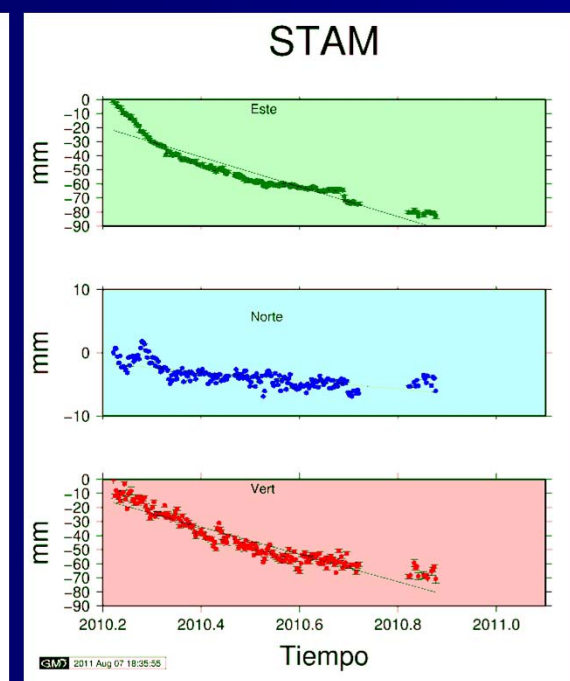
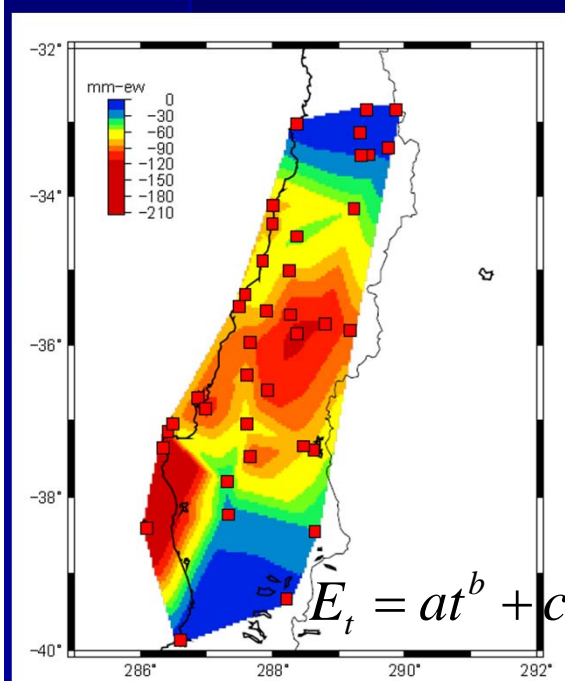
Monitoring no linear effects (MoNoLin) Báez, Cimbaro, Drewes (SIRAGS)



Case 1:

$$X_i = X_0 + V_0(t_i - t_0) + \sum r$$

$$\sum r = \Delta X_{CO} + \Delta X_{POST} + \Delta X_{SILENT} + \Delta X_{SEASONAL} + \varepsilon$$





Monitoring no linear effects (MoNoLin) Báez, Cimbaro, Drewes (SIRAGS)



Case 2:

$$X_i = X_0 + V_0(t_i - t_0) + \sum r$$

$$\sum r = \Delta X_{CO} + \Delta X_{POST} + \Delta X_{SILENT} + \Delta X_{SEASONAL} + \varepsilon$$

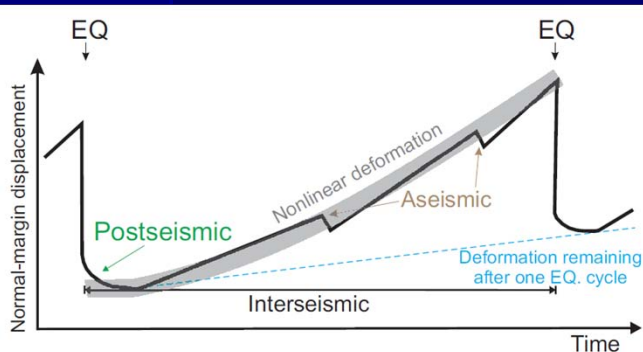


Figure 1.1: Scheme of the earthquake cycle deformation for a surface site above the seismogenic zone in a subduction zone. Periods of transient deformation may be superimposed on interseismic strain accumulation influencing the interface coupling.

IGSyyPwww.ssc
Multi-technic solutions



Geo et al → next step



6.- Volcanoes

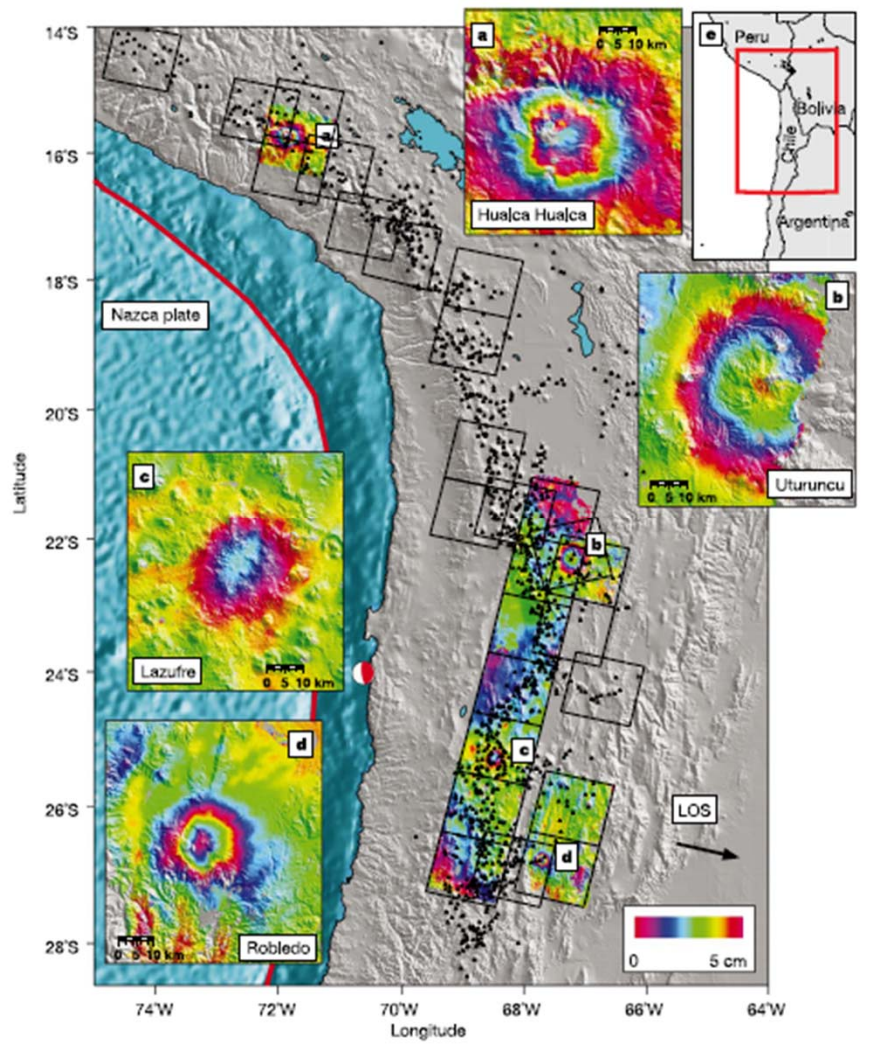




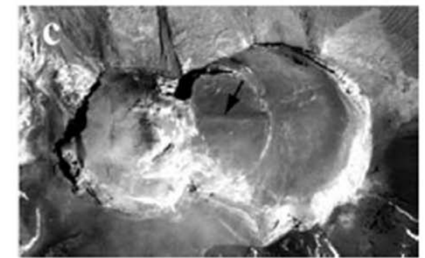
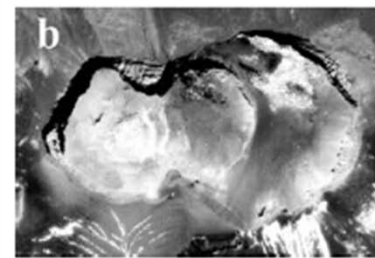
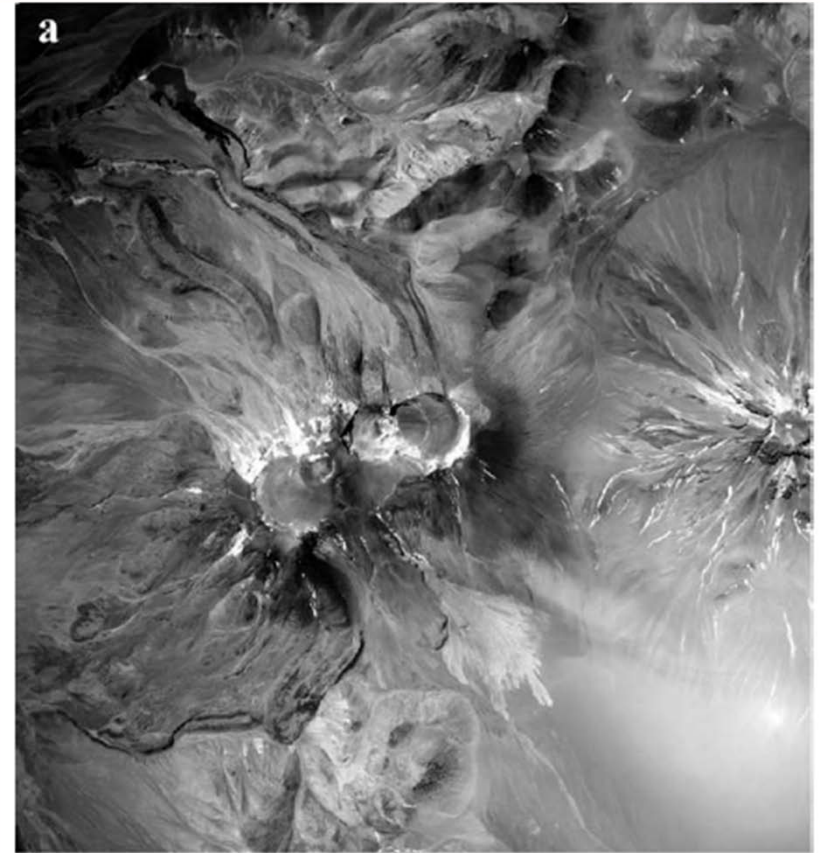
Geo et al → next step



6.- Volcanoes



Froger et al 2007



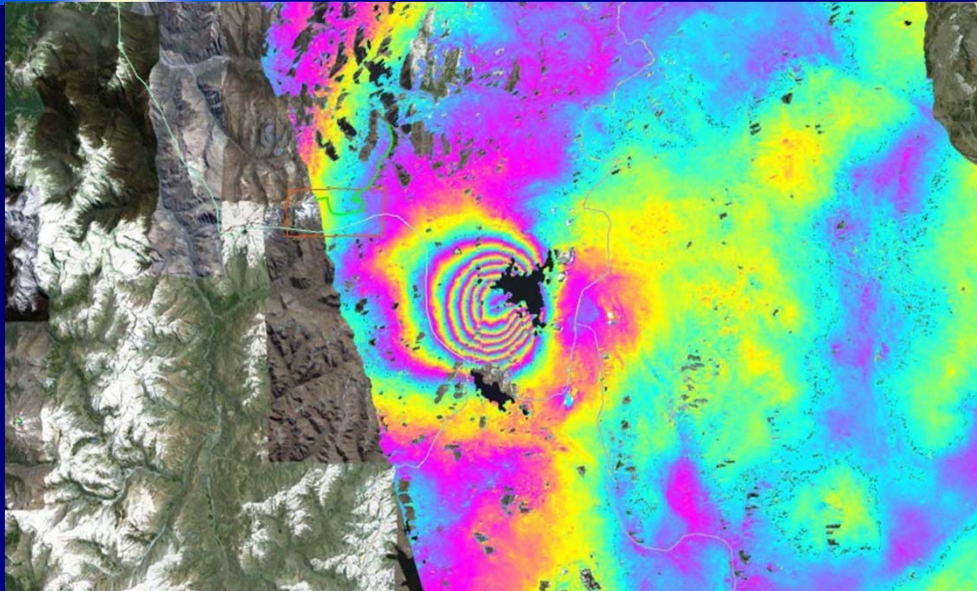
Pavéz et al 2005



Geo et al → next step



6.- Volcanoes



Combine terrestrial observations and space techniques to observe volcanoes deformation zone:

- 1.- GNSS/InSar+corner reflectors
- 2.- gravity observations
- 3.- seismology
- 4.- others (gas)

Pritchard pers. com. 2011, Laguna del Maule

Just stating with OVDAS and ONEMI



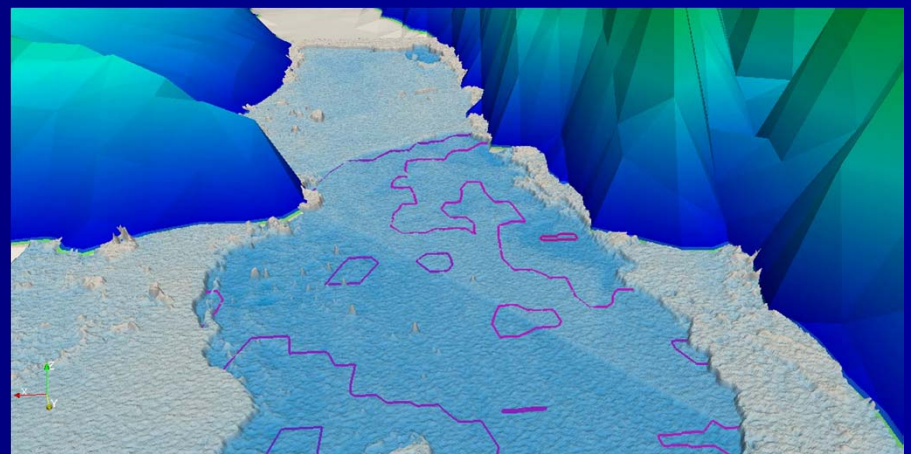
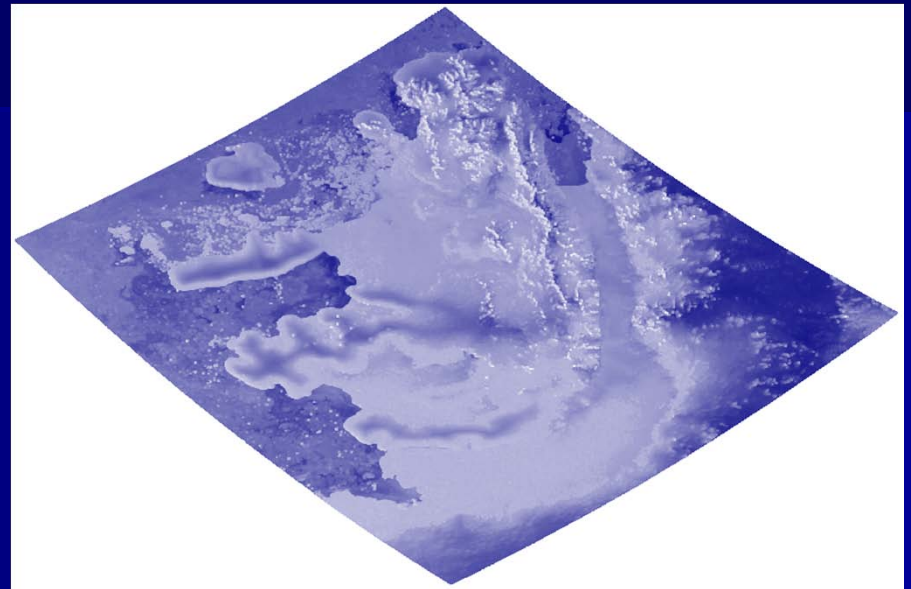
Ice shelf (Staub et al)



George VI Ice Shelf, in order to understand impact of climate change on Antarctica

Consideration of ocean and atmosphere parameters to study their correlation with front variations

Generation of 3D/4D multi sensor models for visualization purposes

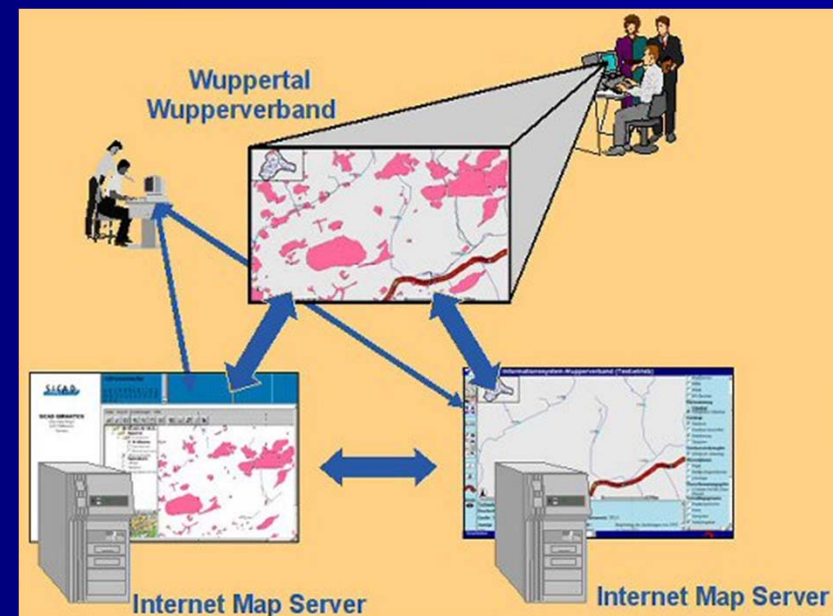
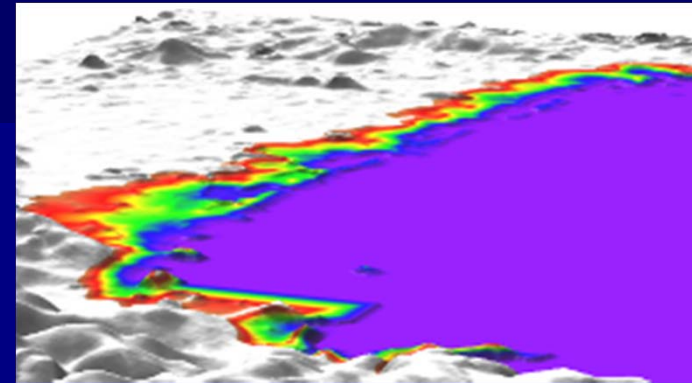




Natural disasters (Staub et al)



Study about usability of
ASTER GDEM V1 to predict
impact of Tsunami
(Case study Bahía Concepción)
Development of a demonstrator
for Disaster Management
(Proposal under review BMBF;
Cooperation UdeC/
UniBW/Wupperverband/
TU Dresden)
Feasibility Study for disaster
implementation (Proposal under
review Fondecyt/BMBF;
Cooperation UdeC – UniBW)

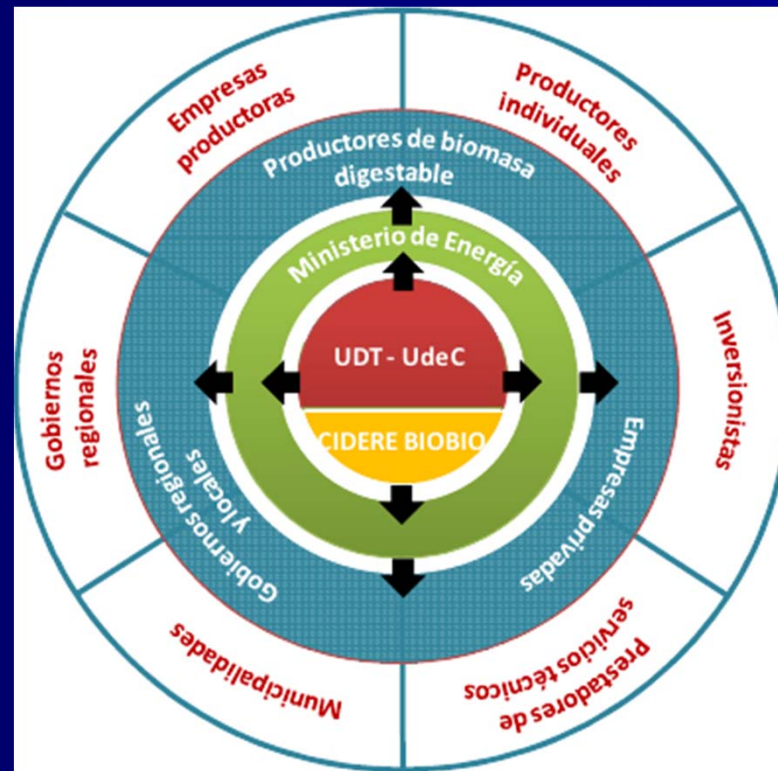




Renewable energy (Staub et al)



Biomass Cadastre and Logistics (Proposal under review GORE-BB)
Tools for decision making in bioenergy projects (Proposal under review FONDEF)

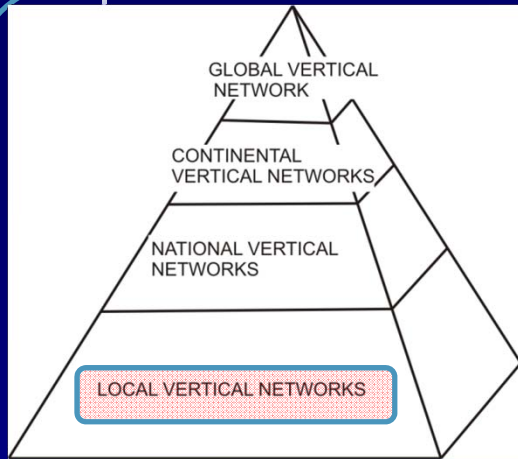




Height System Unification on Satellite Gravimetry and improvement spectral methods



Montecino et al



Classic definition of the local height systems

Sea Surface Topography (SST)
+
Geographic difficulties

Global Geopotential Model

$$\zeta(\varphi, \lambda) = \zeta_{MGG}(\varphi, \lambda) + \zeta_{RTM}(\varphi, \lambda)$$

Linked to a Global Vertical Reference Frame

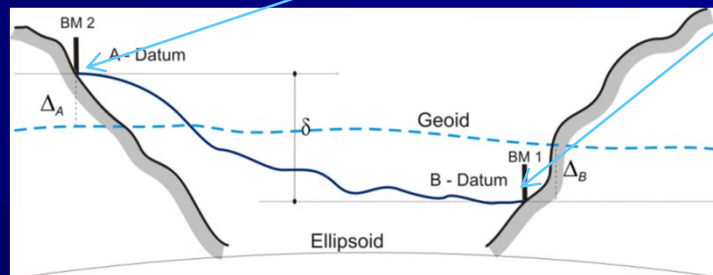
Reference surface for connection with local vertical datums

Residual Terrain Model (Based on DEM information)

$$V_{RTM} = \int_V \frac{dx \cdot dy \cdot dz}{r} = \int_{x_1}^{x_2} \int_{y_1}^{y_2} \int_{z_1}^{z_2} \frac{dx \cdot dy \cdot dz}{r}$$

$$\zeta^{prism} = \frac{V}{\gamma_0} \rightarrow \zeta^{RTM} = \sum_{i=1}^k \zeta^{prism}(i)$$

>100 height systems and inconsistencies due to realization

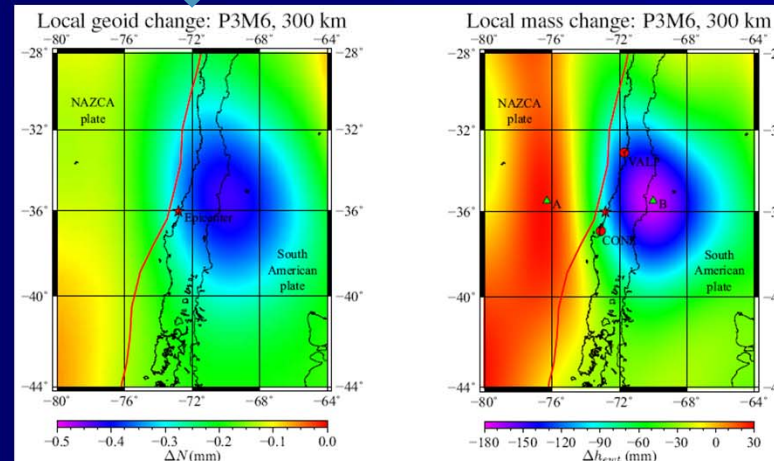
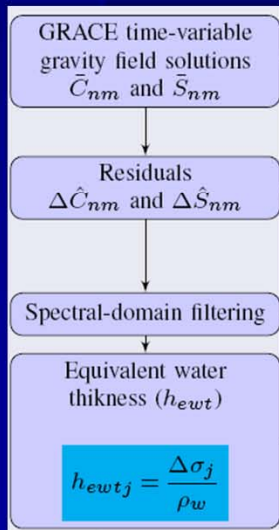
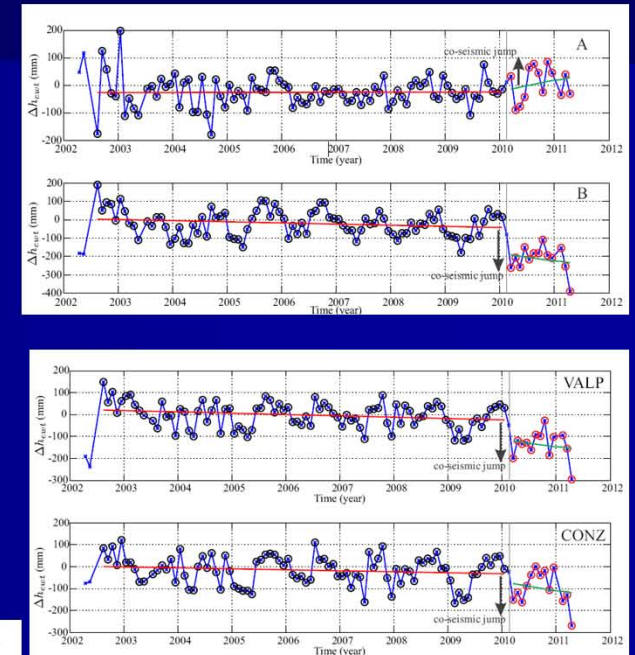
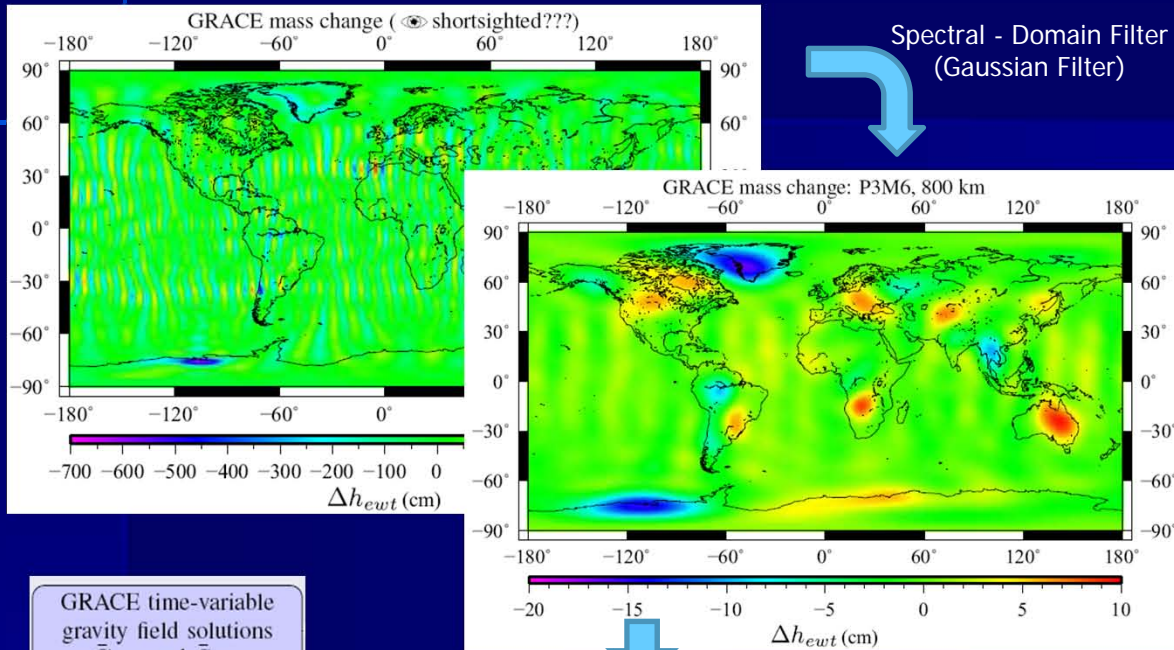




A preliminary investigation of the co-seismic jump for the Maule earthquake from monthly GRACE data



Montecino et al



Point	Co-seismic (cm)	
	GRACE	GPS
VALP	-13	-13
CONZ	-7	-5
A	+3	-
B	-17	-



Many thanks!

Gracias!

Vielen Danke!



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