SIRGAS
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Geoinformation and Navigation supported by the Geocentric Reference System for the Americas

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Layout of the presentation

1. General information regarding SIRGAS, its objective, infrastructure, human resources and products.
2. A few examples of the activities that are being performed in Latin American and Caribbean countries under SIRGAS coordination.

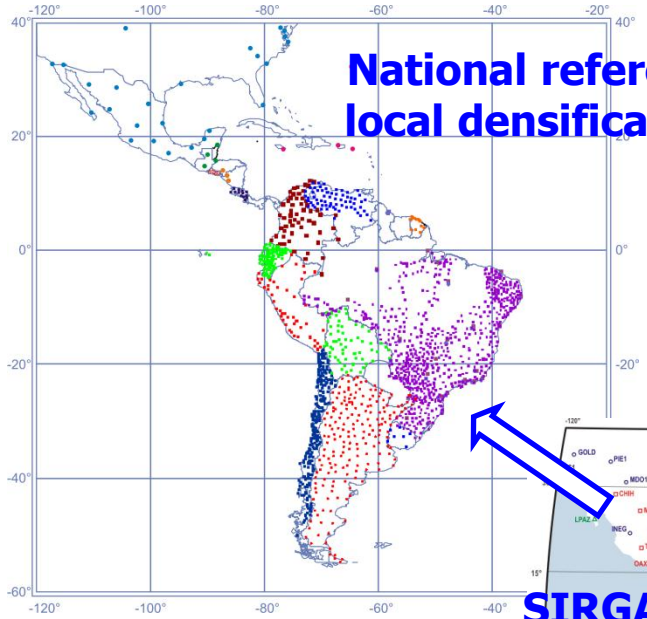
Geocentric Reference System for the Americas

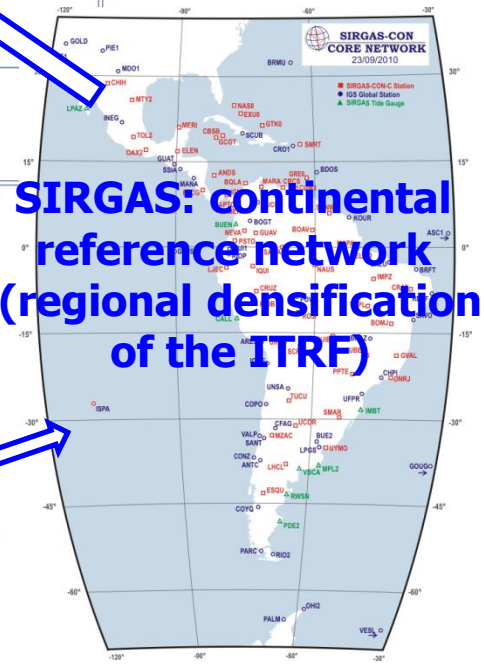
- Established as a Pan-American initiative in 1993.
- Co-sponsored by the International Association of Geodesy (IAG) and the Pan American Institute of Geography and History (PAIGH).
- More than 50 institutions from 18 countries in Latin America and the Caribbean are active in SIRGAS.
- Recommended by the United Nations Cartographic Conference for the Americas as official reference frame for the America's countries.

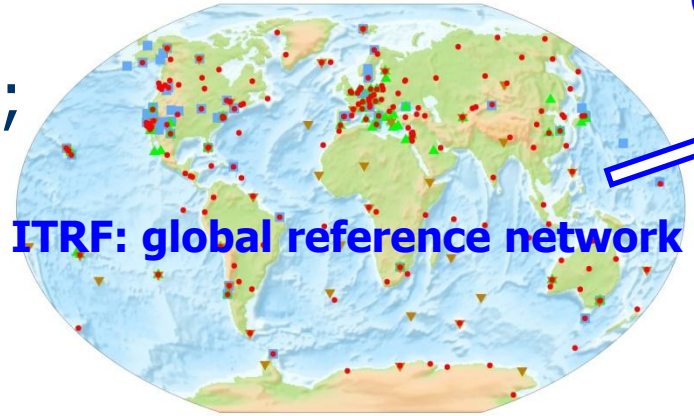
SIRGAS objective

Make the ITRF easily available in all Latin-American and Caribbean countries to:

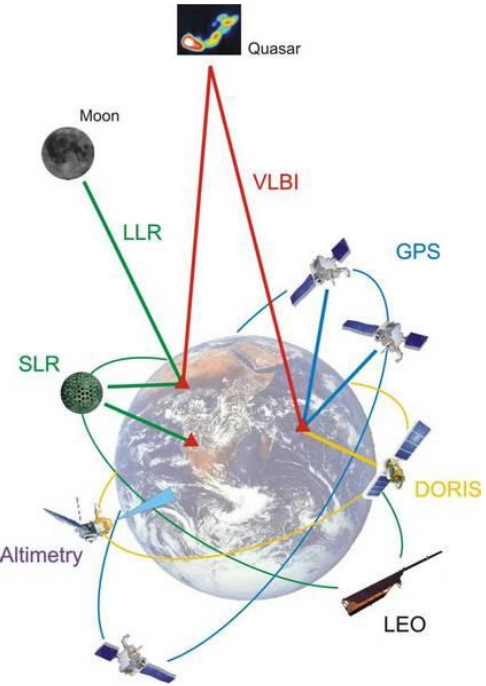
- guarantee consistency between reference stations on the ground and GNSS satellites in their orbits;
- provide the fundamental layer for the national geospatial infrastructure;
- allow global change and geodynamics studies.



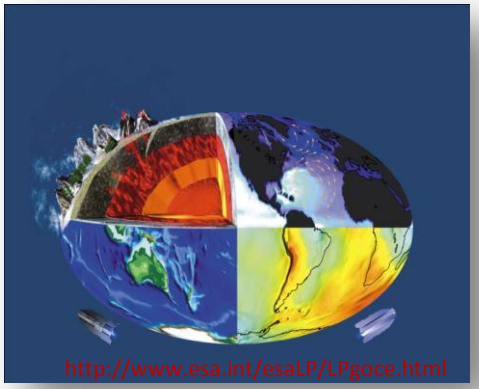




A bridge from quasars to daily life



http://geodesy.hartrao.ac.za/



International Association of Geodesy
- Commission 1 Reference Frames
- Global Geodetic Obsering System

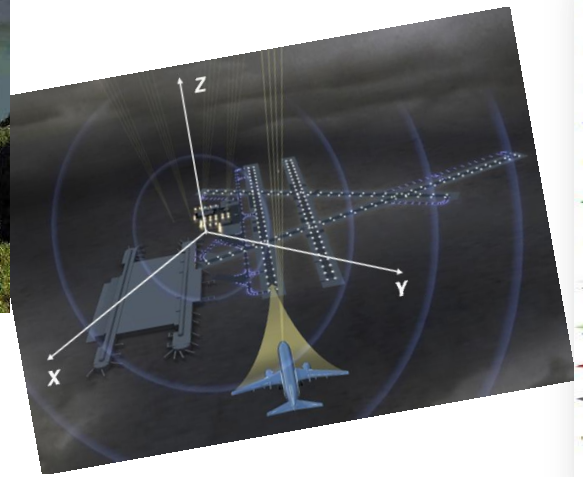
Sub-Comission 1.3b Reference Frame for Central and South America

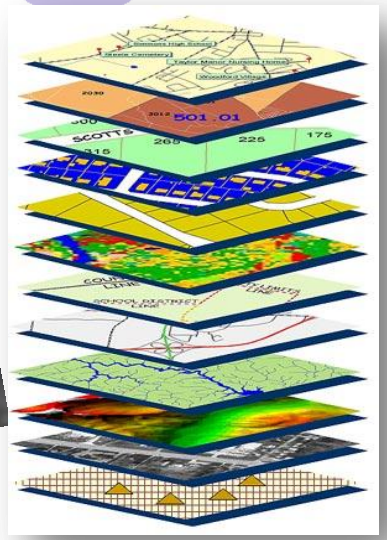
SIRGAS

Working Group of the Commission of Cartography

Pan American Institute of Goegraphy and History
- Commission of Cartography

National Geography Institutes

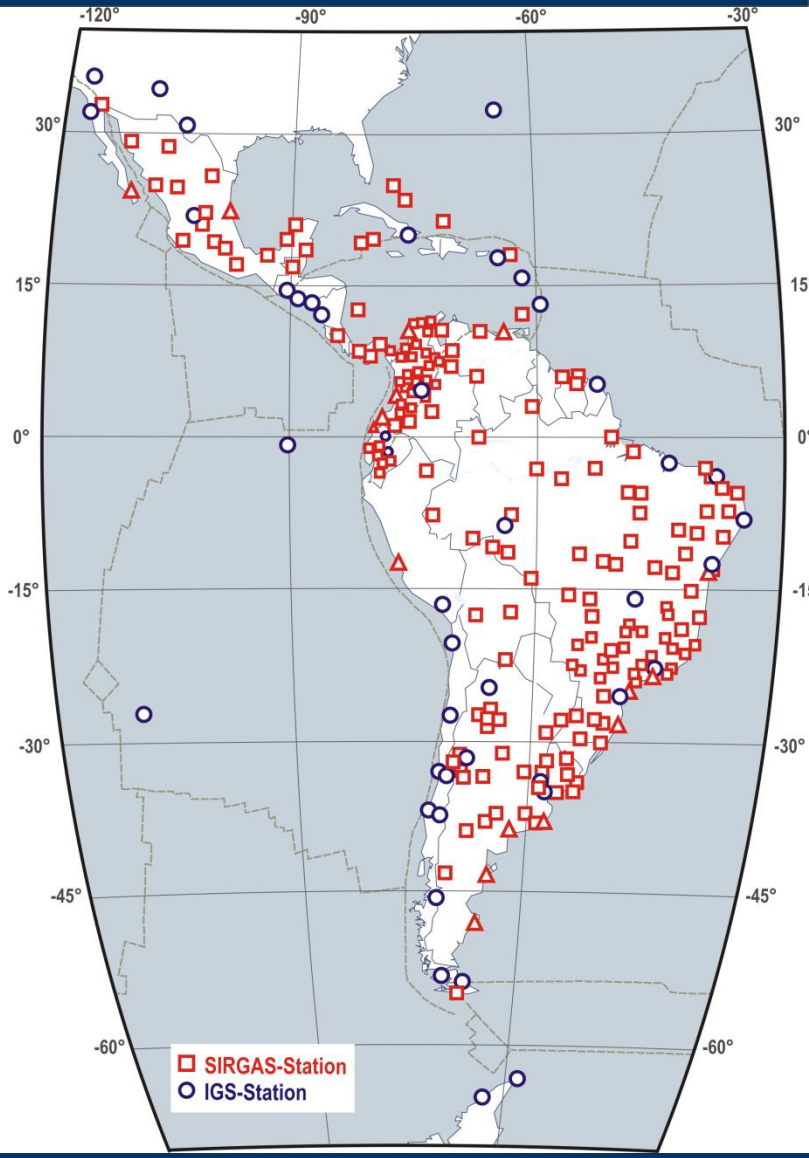




SIRGAS-Con Network

- Over 240 continuously observing GNSS receivers;
- 10 data centers;
- 9 processing centers (each station is processed by 3 analysis centers);
- 2 combination centers;
- Alignment to the global reference frame in two ways:

1. Multi-year solutions (station positions and velocities) w.r.t. ITRF.
2. Weekly station positions w.r.t. IGS weekly solutions.



Processing & Combination Centers

Processing centers		
	CEPGE (ECU), Ecuador	Instituto Geográfico Militar
	CIMA (CIM), Argentina	Universidad Nacional de Cuyo
	CPAGS-LUZ (LUZ), Venezuela	Universidad del Zulia
	IBGE (IBE); Brazil	Instituto Brasileiro de Geografia e Estatistica
	IGAC (IGA), Colombia	Instituto Geográfico Agustín Codazzi
	IGN-Ar (GNA), Argentina	Instituto Geográfico Nacional
	INEGI (INE), Mexico	Instituto Nacional de Estadística y Geografía
	SGM (URY), Uruguay	Servicio Geográfico Militar
	DGFI (DGF), Germany	Deutsches Geodätisches Forschungsintitut
Combination centers		
	IBGE (ibe); Brazil	Instituto Brasileiro de Geografia e Estatistica
	DGFI (sir), Germany	Deutsches Geodätisches Forschungsintitut

Meetings and Schools

SIRGAS activities are reported in yearly meetings, which have been realized since 1993.

Since 2009 SIRGAS teaches the "IAG-PAIGH-SIRGAS School on Reference Systems".

SIRGAS 2011 Meeting and School, Heredia, Costa Rica, August 2011

116 participants from 17 countries

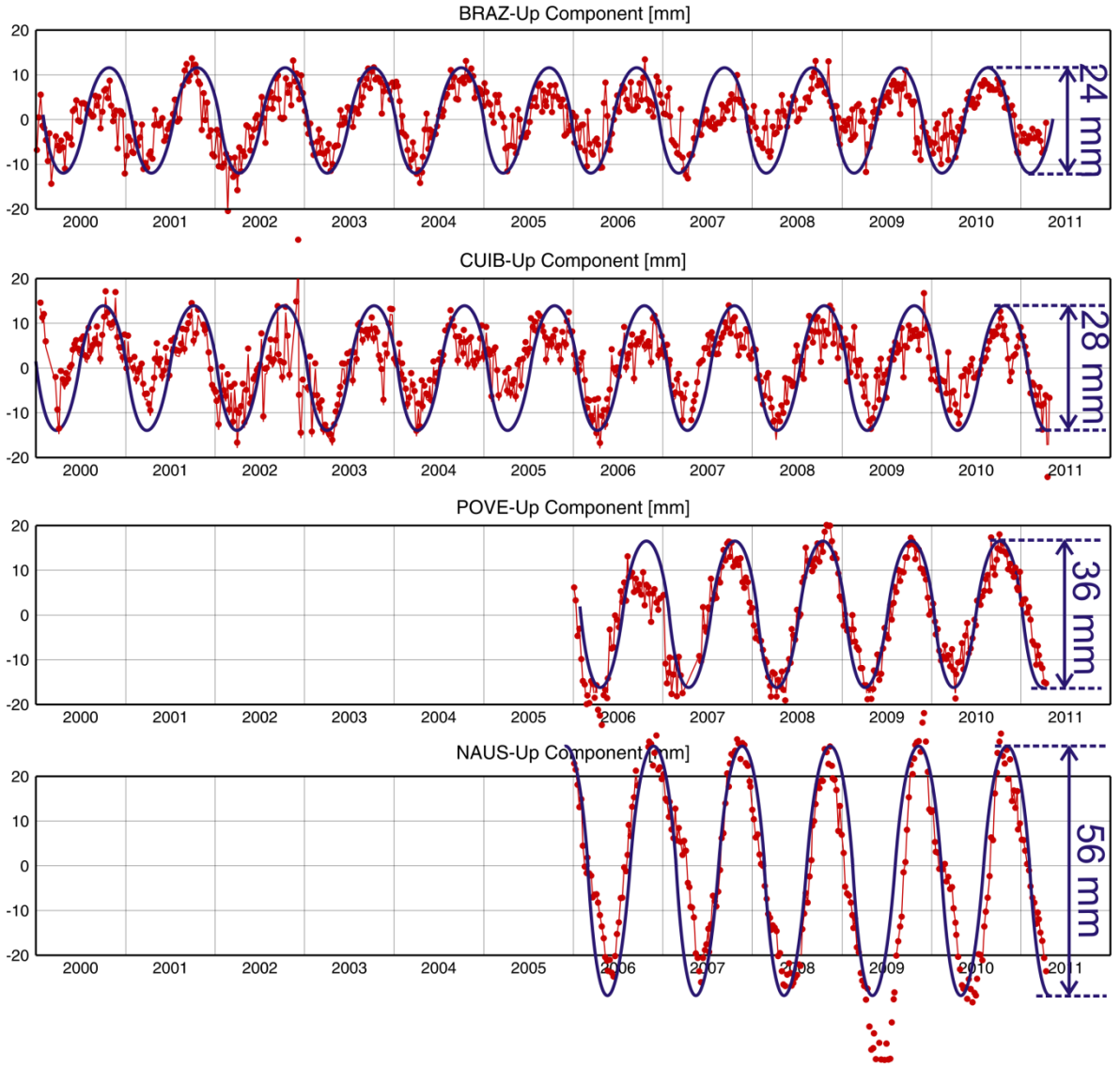
Examples of SIRGAS activities

1. Improving national reference frames by installing more continuously operating GNSS stations to monitor frame deformations.
2. Reference frame definition including seasonal variations.
3. Implementing transformation between pre-seismic and post-seismic frame realizations based on a deformation model derived from discrete (weekly) station positions.

Seasonal position variations

Most of the SIRGAS-CON stations present significant seasonal position variations (mainly in the Up component).

These variations are ignored when constant velocities are computed.



Amplitude (cm) of seasonal variations in the height component of the SIRGAS-CON stations

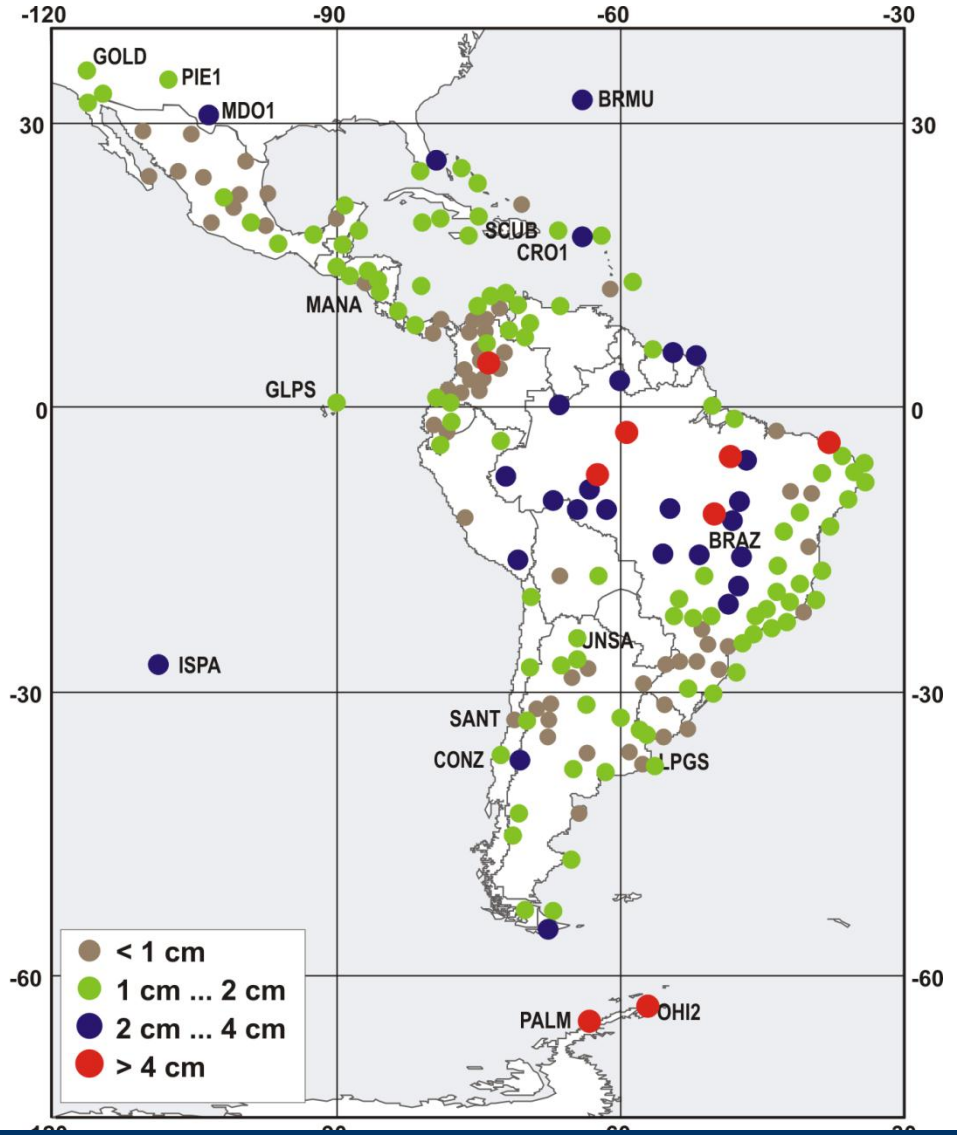
33% of stations → no pattern or amplitude < 1 cm

42% → amplitude 1 ... 2 cm

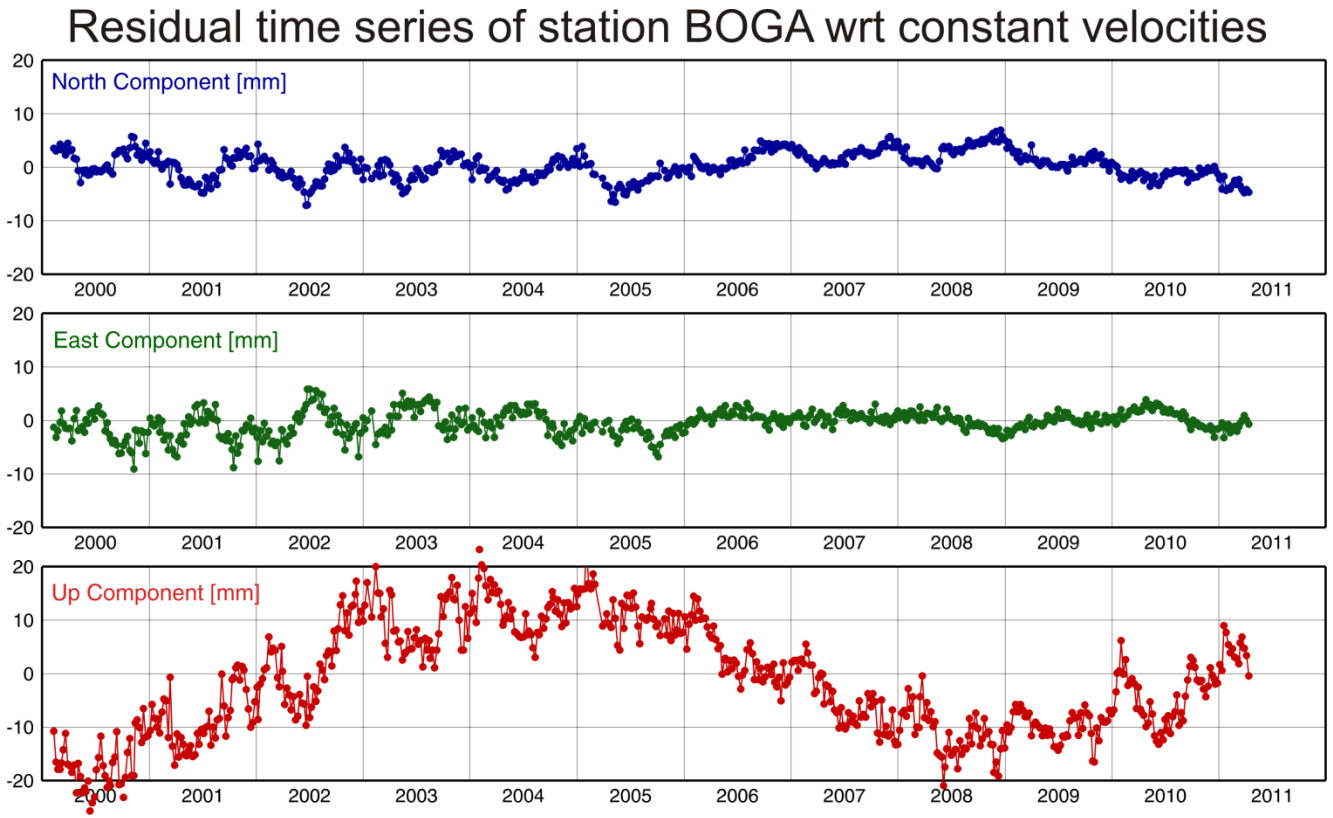
20% → amplitude 2 ... 4 cm

5% → amplitude > 4 cm

→ **Analysis and modelling of seasonal station positions variations within the reference frame computation.**



Constant velocities are highly dependent on the considered time period



Estimates for vertical velocity of BOGA:

2000 -2004
-0,0612 ± 0,0001 m/a

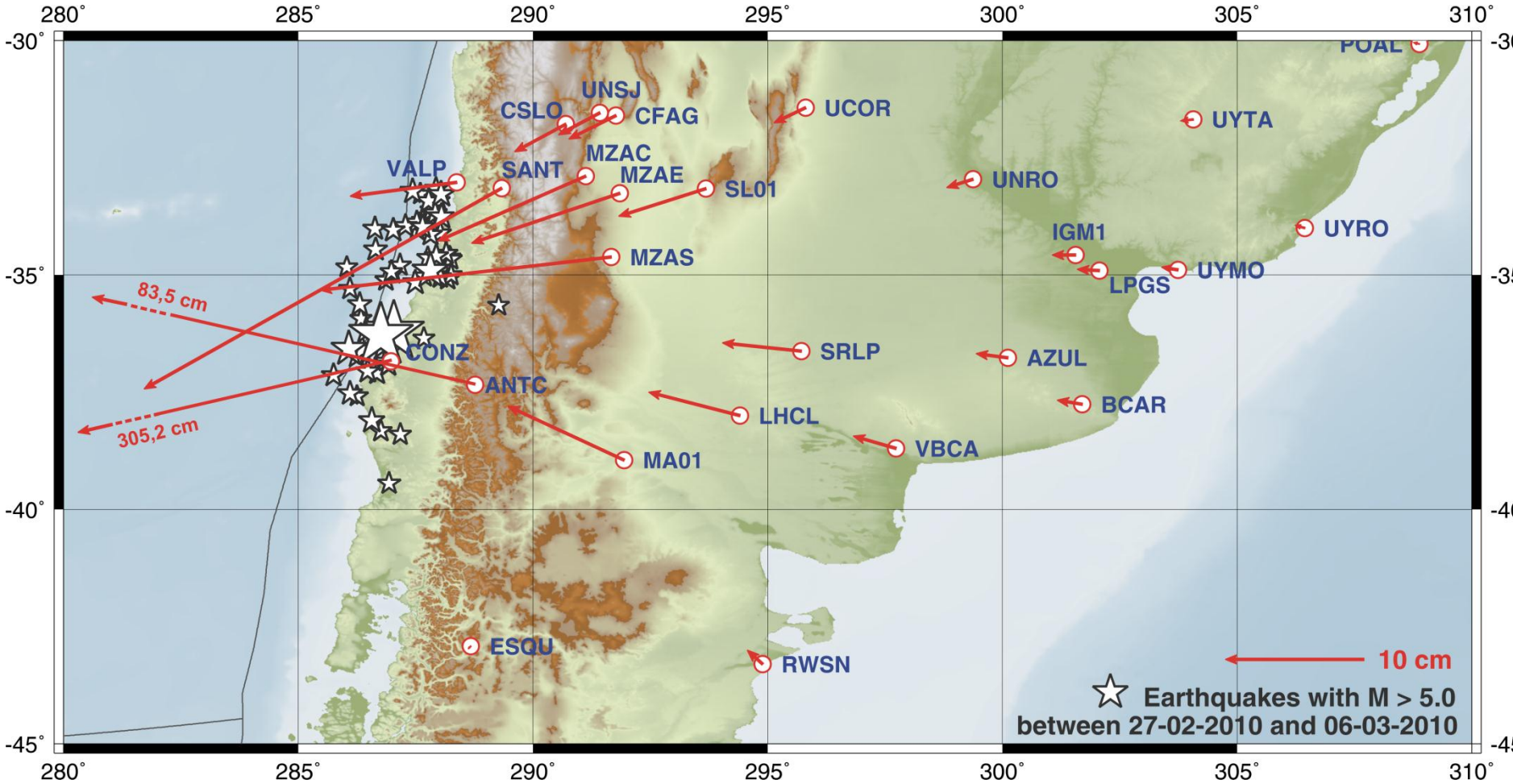
2004 - 2008
-0,0419 ± 0,0002 m/a

→ **Increase length of time series to improve reliability of position variation estimates.**

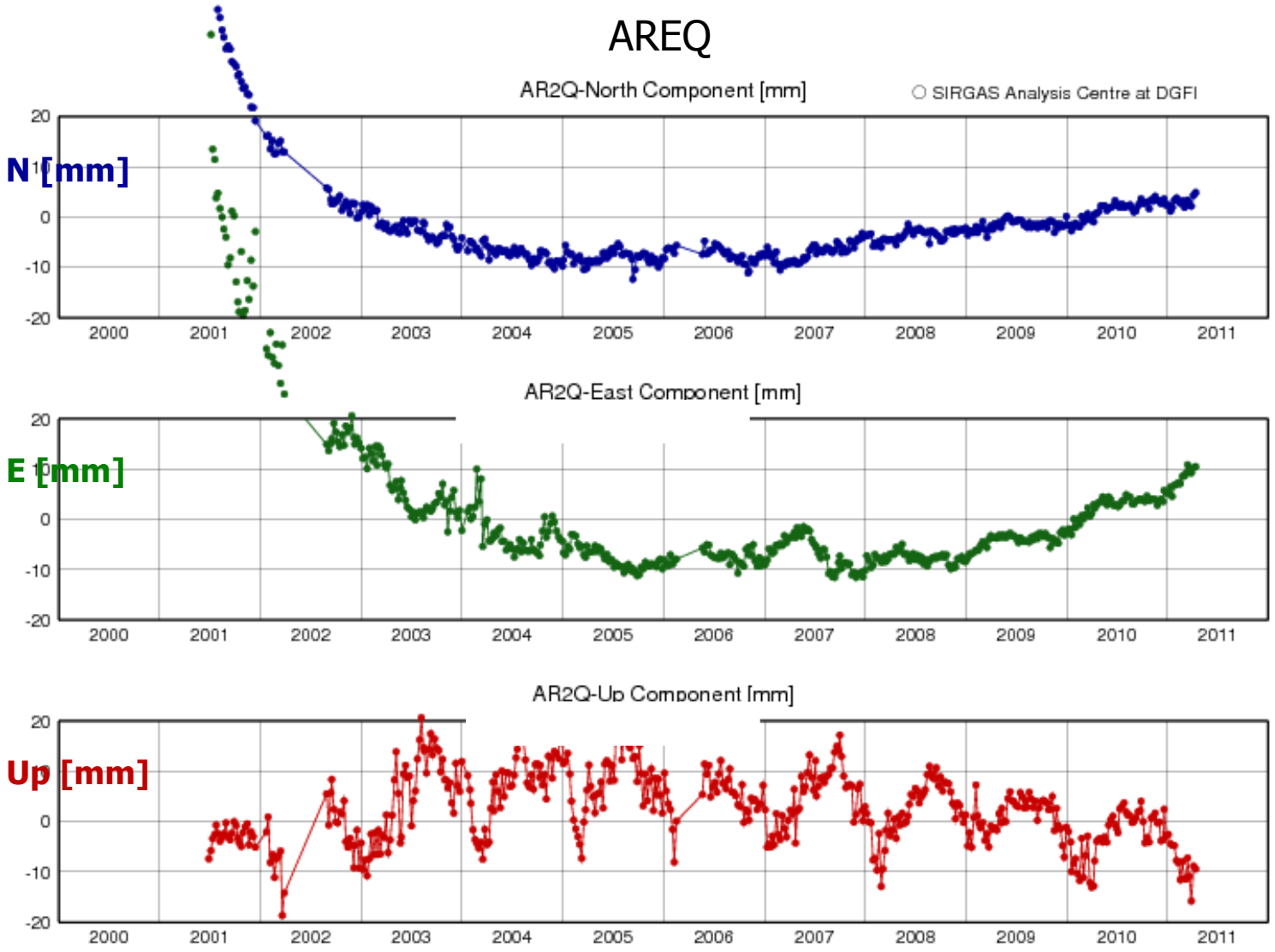
Deformation of the reference frame due to seismic events

Location	Date	Mw	Coordinate change	Affected stations
Concepción, Chile	2011-02-12	6,1	2 cm	CONZ
Mexicali, Mexico	2010-04-04	7,2	23 cm	MEXI
Chile	2010-02-27	8,8	1 to 305 cm	23 stations
Costa Rica	2008-01-08	6,1	2 cm	ETCG
Martinique	2007-11-29	7,4	1 cm	BDOS, GTK0
Copiapo, Chile	2006-04-30	5,3	2 cm	COPO
Tarapaca, Chile	2005-06-13	7,9	6 cm	IQQE
Managua, Nicaragua	2004-10-09	6,9	1 cm	MANA
Arequipa, Peru	2001-06-23	8,4	52 cm	AREQ
El Salvador	2001-02-13	7,8	4 cm	SSIA

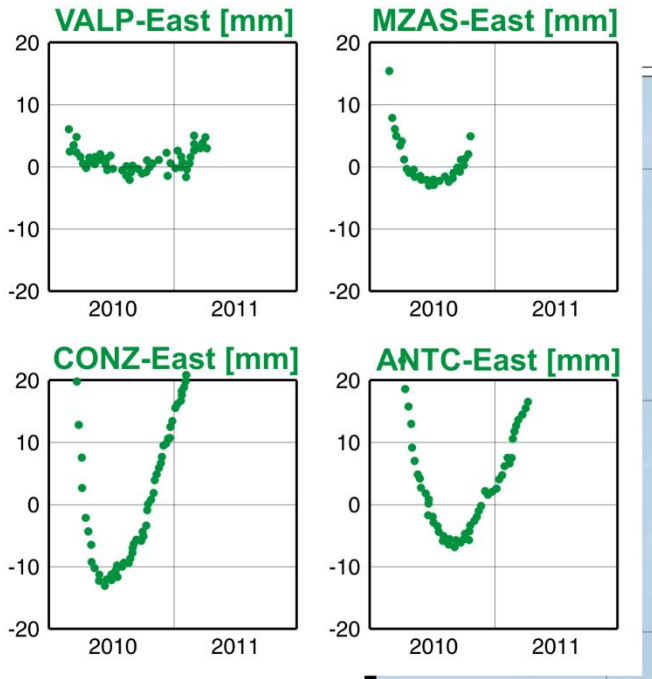
Co-seismic displacements caused by the 'Maule' Earthquake



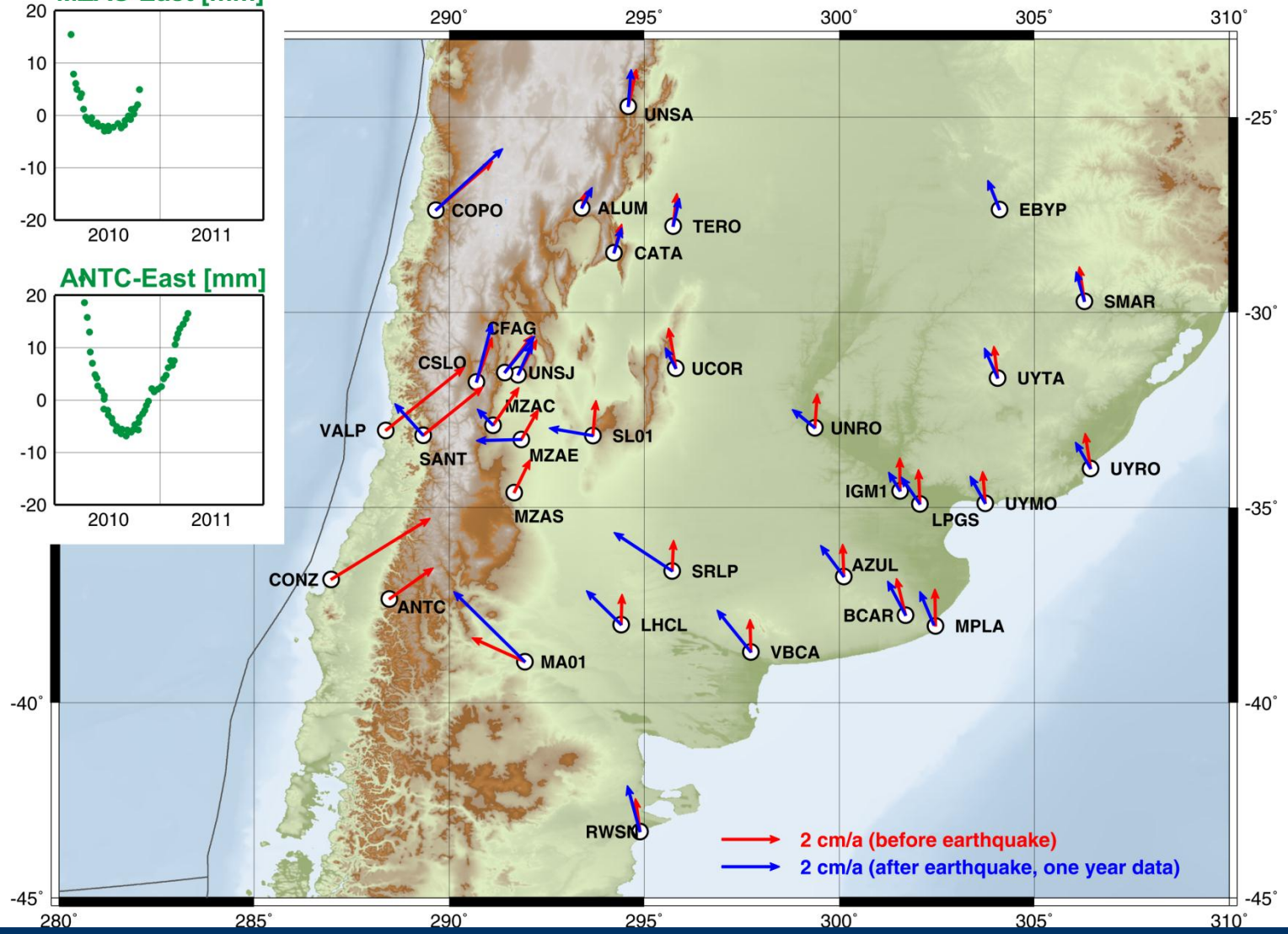
Not only co-seismic jumps, but also changes in the "normal" movement



Comparison of pre-seismic and post-seismic (constant) velocities



Residual time series w.r.t. constant velocities



Final remarks

SIRGAS is the regional densification of the ITRF in Latin America and the Caribbean.

SIRGAS is the backbone for all projects based on the generation and use of geo-referenced data in a national as well in an international level.

Besides to provide the reference coordinates for the development of practical applications such as engineering projects, digital administration of geographical data, geospatial data infrastructures, global navigation, etc., SIRGAS is also the platform for a wide range of scientific researches related to global change and geodynamics.

SIRGAS is also a capacity building platform in the Latin American and Caribbean region.

Many thanks for your attention

See more in www.sirgas.org