The geocentric reference system for the Americas

Claudio Brunini

Laura Sánchez
Hermann Drewes

Sergio Cimbaro

Víctor Cioce

David Cisneros

Virginia Mackern
Laura Mateo

Guido González

Marco de Almeida
Alberto da Silva

William Martínez

Norbertino Suárez

Héctor Parra

8th FIG Regional Conference
Montevideo, Uruguay, 26-29 November 2012

Geocentric Reference System for the Americas

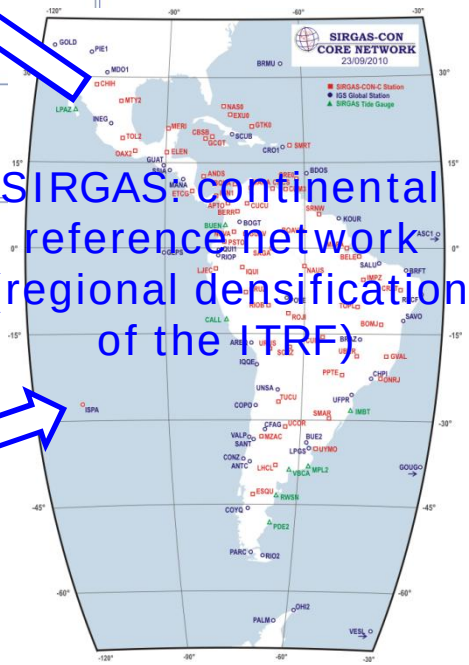
- Established as a Pan-American initiative in 1993.
- Co-sponsored by the International Association of Geodesy (IAG) and the Pan-American Institute of Geography and History (PAIGH).
- More than 50 institutions from 19 countries in Latin America and the Caribbean are active in SIRGAS.
- Recommended by the United Nations Cartographic Conference for the Americas as official reference frame for the America's countries.
- Officially adopted by 18 countries as national reference frame for Geodesy and Cartography and as the fundamental layer of the America's IDEs.

SIRGAS objective

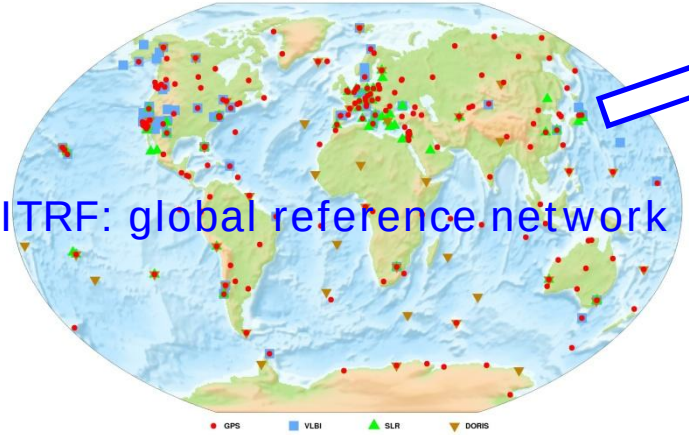
Make the ITRF available in all Latin-American and Caribbean countries to:

- guarantee consistency between reference stations on the ground and GNSS satellites in their orbits;
- provide the fundamental layer for the national geospatial infrastructures;
- support studies aimed at mitigating the impacts of climate change and natural disasters.

National reference networks: local densifications of SIRGAS



SIRGAS: continental reference network (regional densification of the ITRF)



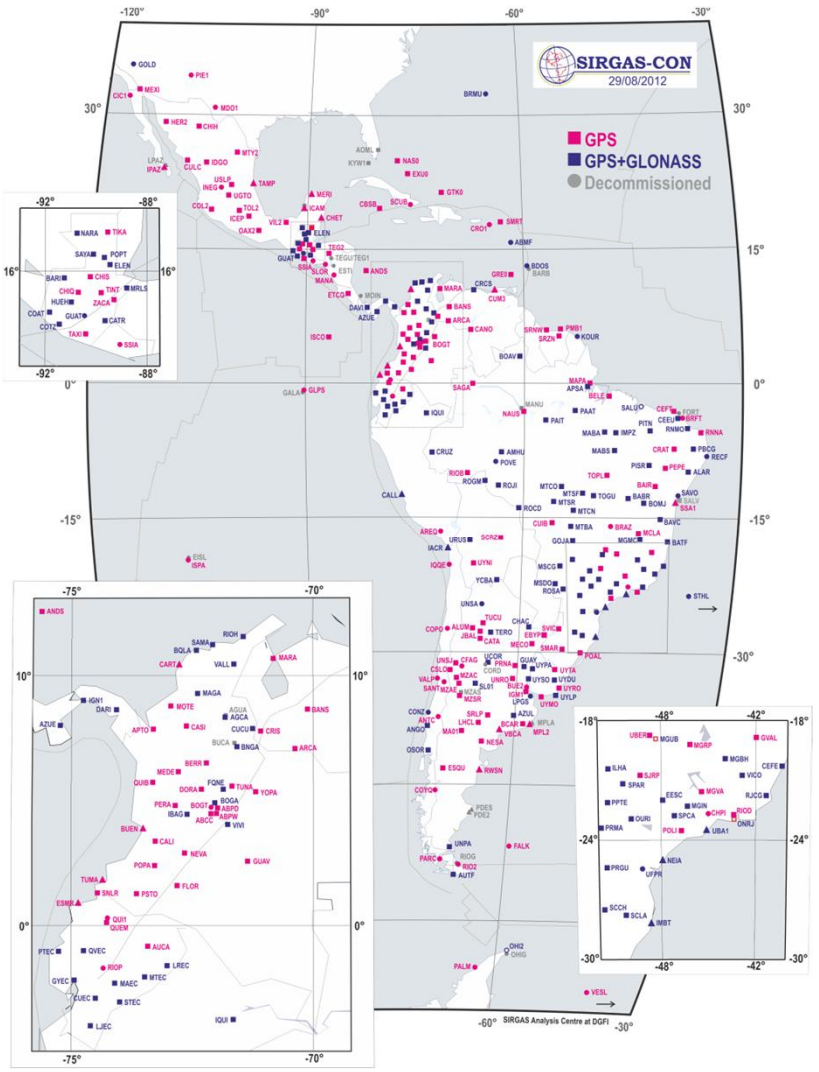
ITRF: global reference network

SIRGAS-CON Network

- Over 280 continuously observing GNSS receivers (70 are common with the IGS core network);
- 10 data centers;
- 10 processing centers (each station is processed by 3 centers);
- 2 combination centers;

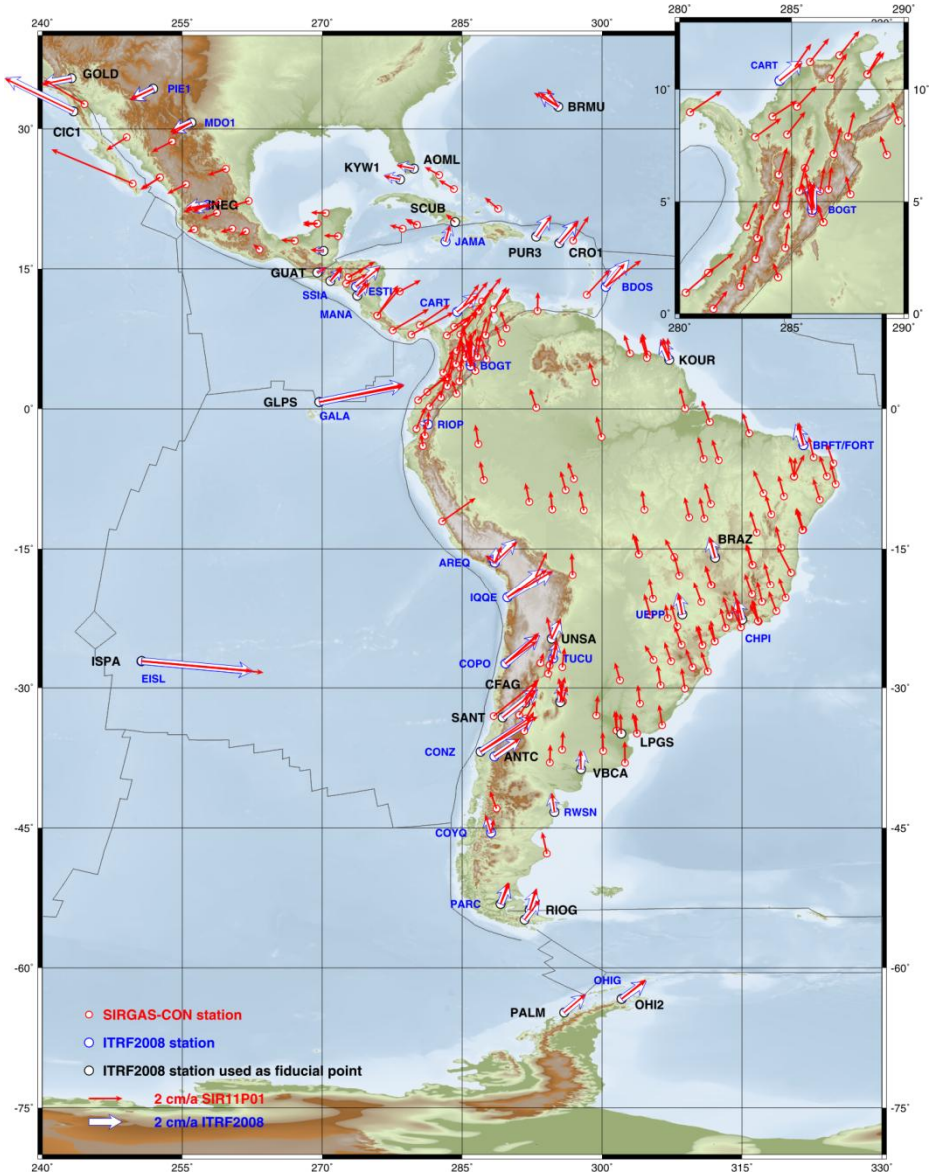
Alignment to the ITRF in two ways:

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



Latest multi-year solution: SIR11P01

- Computed by the DGFI as IGS RNAAC for SIRGAS
- Absolute PCV corrections
- Satellite orbits and EOPs wrt IGS05
- Minimum constrained solution (NNR+NNT conditions wrt ITRF)
- Time period:
  02-01-2000 – 16-04-2011;
- Stations:
  229 (296 occupations);
- Reference frame:
  ITF2008, epoch 2005.0;
- Precision of positions at reference epoch:
  ± 0,5 mm (hor), ± 0,9 mm (up);
- Precision of constant velocities:
  ± 0,4 mm/a



Processing & Combination Centers

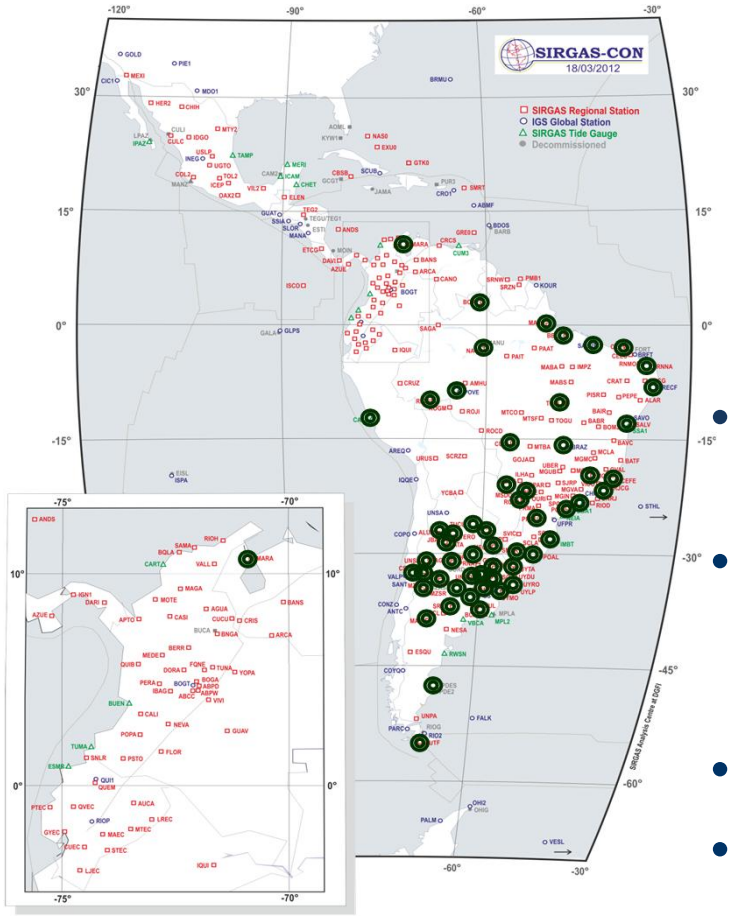
Processing centers		
	CEPGE, Ecuador	Instituto Geográfico Militar
	CIMA, Argentina	Universidad Nacional de Cuyo
	CPAGS-LUZ, Venezuela	Universidad del Zulia
	IBGE, Brazil	Instituto Brasileiro de Geografia e Estatistica
	IGAC, Colombia	Instituto Geográfico Agustín Codazzi
	IGN-A, Argentina	Instituto Geográfico Nacional
	INEGI, Mexico	Instituto Nacional de Estadística y Geografía
	SGM, Uruguay	Servicio Geográfico Militar
	DGFI, Germany	Deutsches Geodätisches Forschungsintitut
	IGM-CI, Chile	Instituto Geográfico Militar
Combination centers		
	IBGE, Brazil	Instituto Brasileiro de Geografia e Estatistica
	DGFI, Germany	Deutsches Geodätisches Forschungsintitut

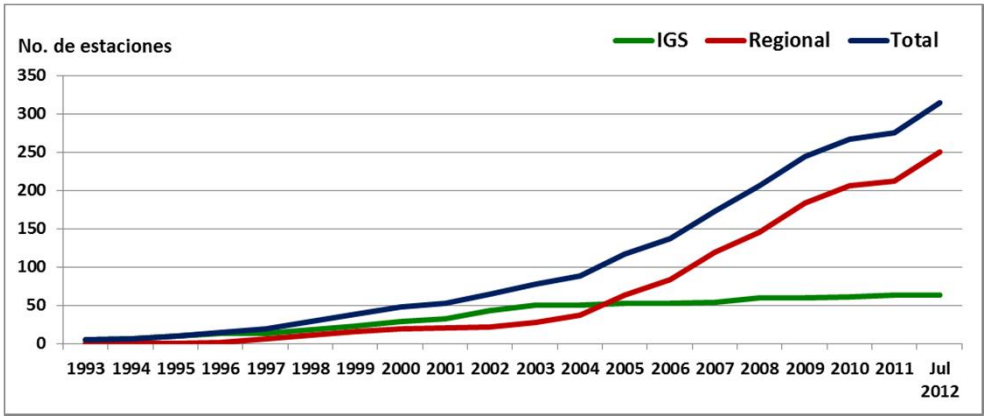
Improving analysis capabilities

SIRGAS aims at installing at least one analysis centre per country:

- A training course to install an experimental analysis centre will be given by SIRGAS experts, next December, at the Escuela de Topografía, Catastro y Geodesia of the Universidad Nacional of Costa Rica;
- Proposals for installing an experimental analysis centers have been received from the Instituto Geográfico Militar of Bolivia and the Instituto Geográfico Nacional of Perú.

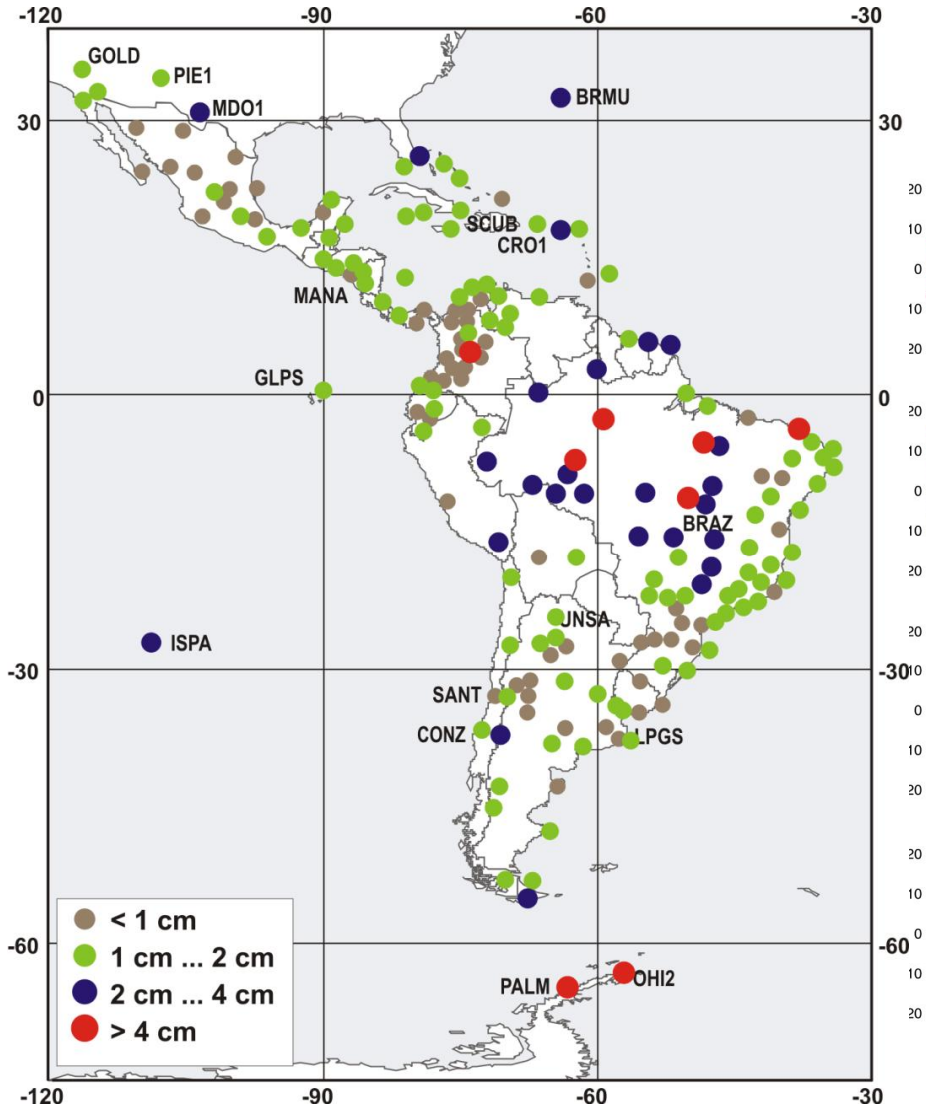
Improving SIRGAS-CON



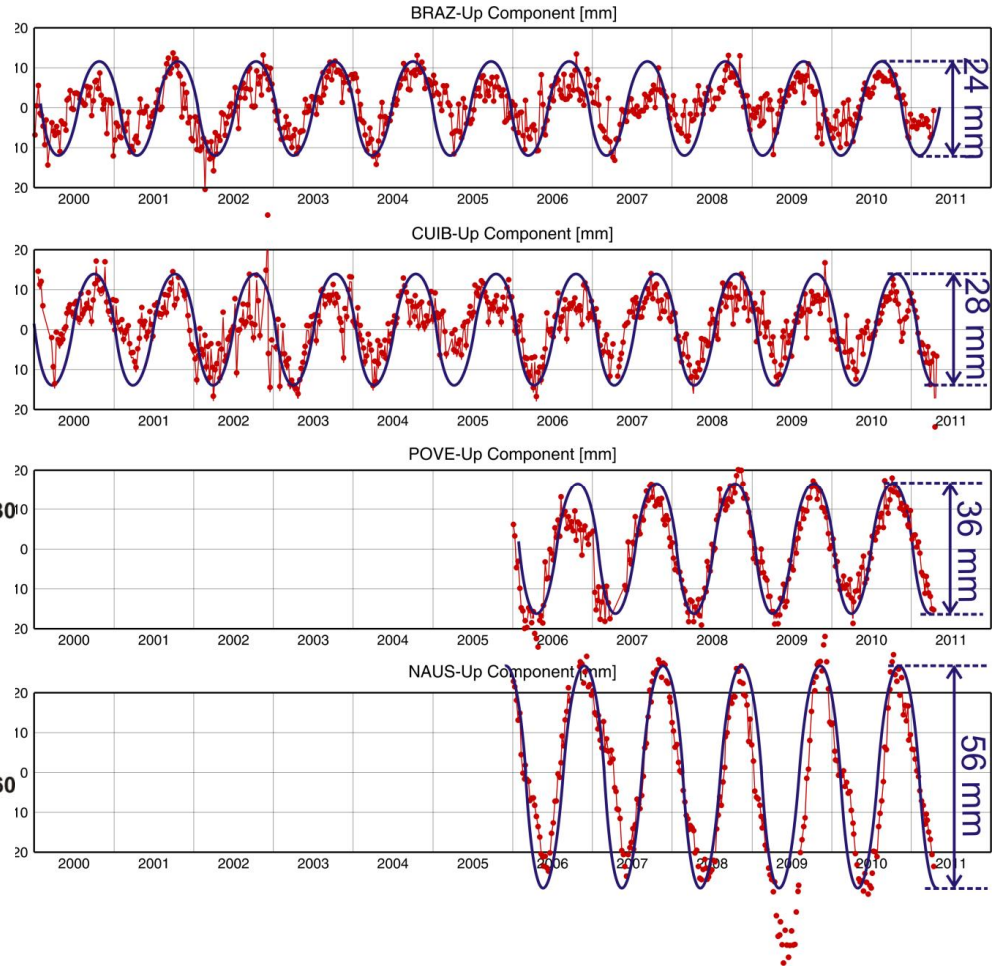


- ~40 new stations per year added to the network;
- 40 SIRGAS-CON stations were recently added to the IGS network (now, 70 stations are common with the IGS core network);
- 127 stations track GPS and GLONASS;
- Pilot project to combine GPS and GLONASS measurements;
- Increasing number of station with RT capabilities;
- Pilot project to develop RT GNSS positioning capabilities based on SIRGAS.

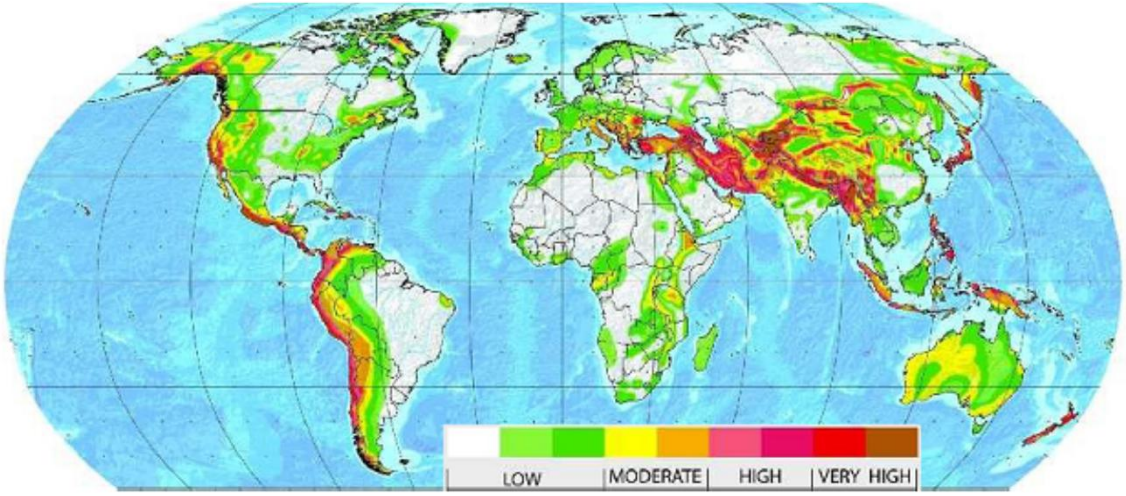
Improving reference frame maintenance



Most of the SIRGAS-CON stations present significant seasonal variations in their positions.

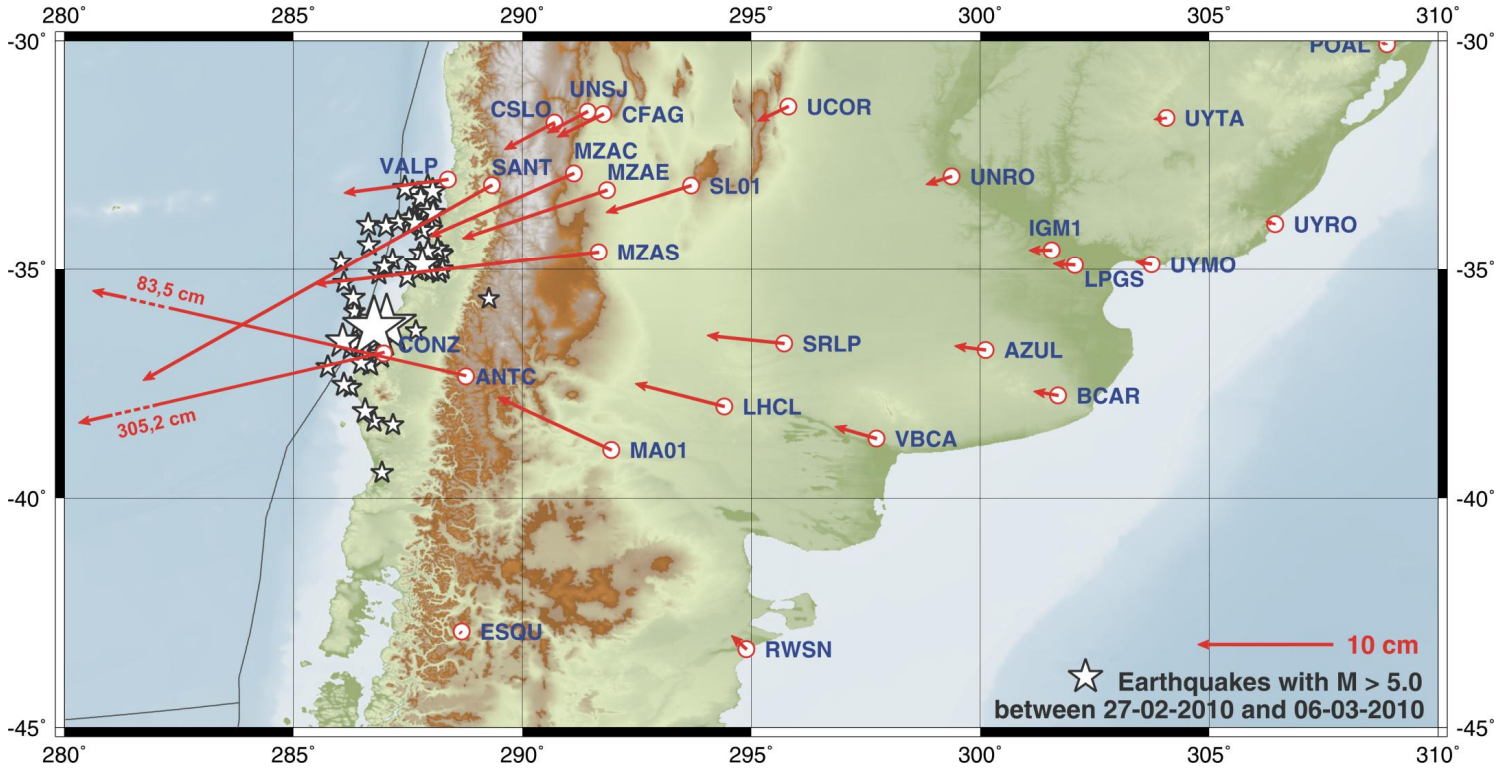


Improving reference frame maintenance

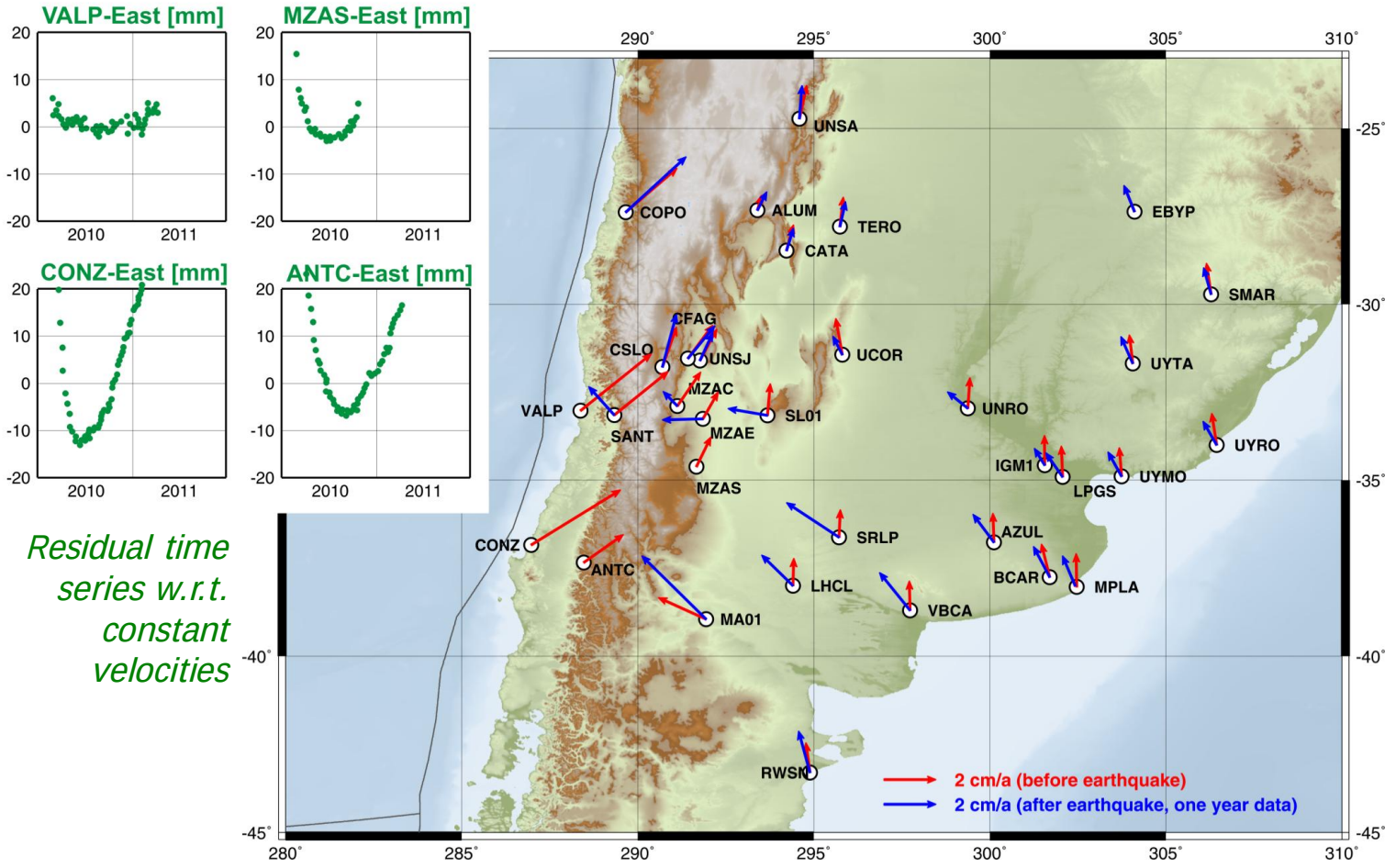


A great extension of the SIRGAS territory is affected by intense earthquakes.

Co-seismic displacement caused by the February 2011, 'El Maule' Earthquake.



Improving reference frame maintenance



Residual time series w.r.t. constant velocities

Strong seismic events suddenly change position and velocity coordinates; velocities need long time to stabilize in a new (approximately) constant value.

Improving reference frame maintenance

1. Installing more continuously operating GNSS stations to monitor frame deformations;
2. Establishing a deformation model (derived from measured station positions) to transform between pre- an post-seismic frame realizations;
3. Accounting for seasonal and other not linear movements of the station positions;

Final remarks

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

It provides the reference frame for practical applications such as cadastre and land management.

Besides, SIRGAS provides the unique reference frame capable of supporting climate change studies (sea level rise, water cycle, etc.) and natural disaster monitoring (seismicity, volcanic activity, etc.).

Many thanks for your attention

See more in www.sirgas.org