



SIRGAS SISTEMA DE REFERENCIA GEOCÉNTRICO PARA LAS AMÉRICAS

IAG Sub commission 1.3b
SIRGAS reference system
On going activities

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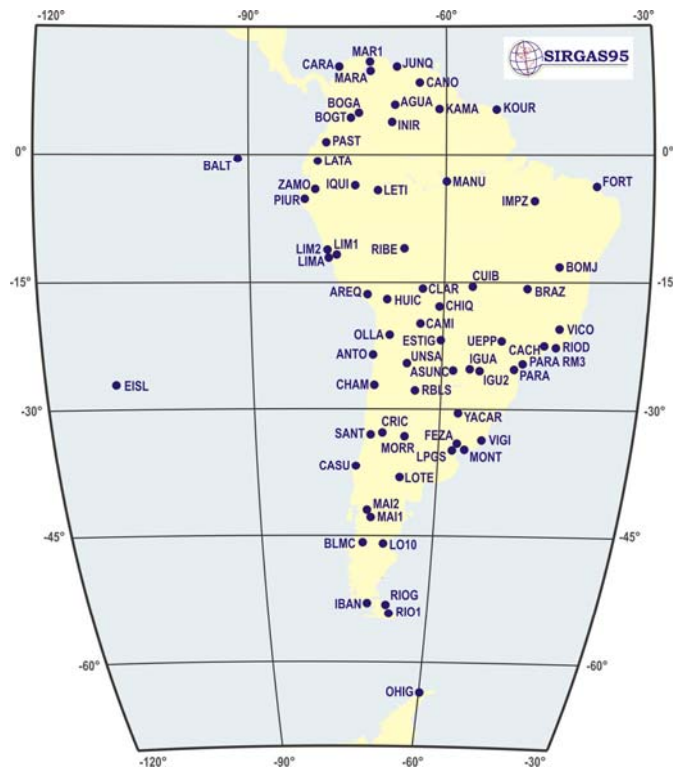
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Introduction

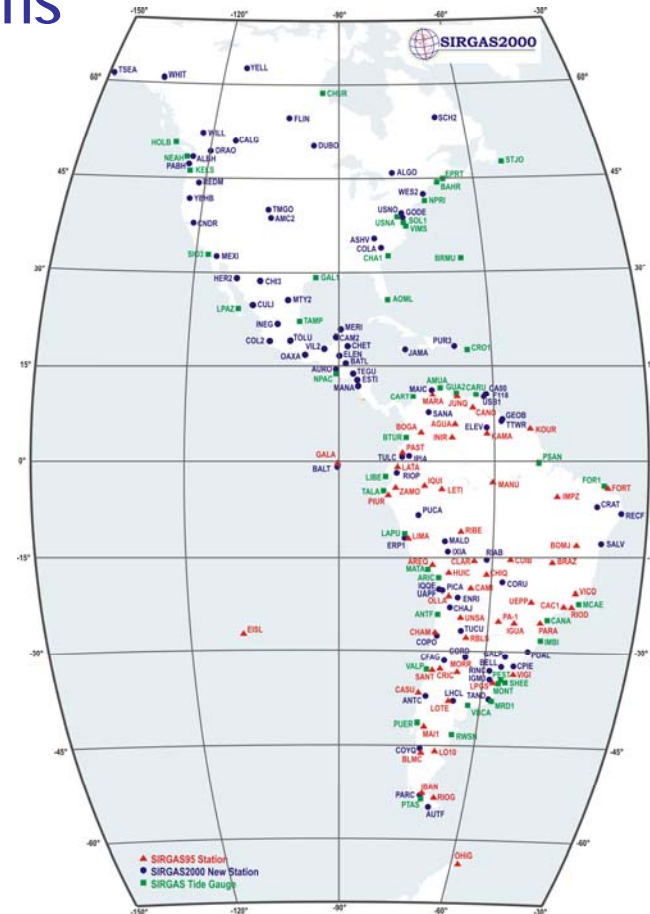
- ❑ **SIRGAS is the Geocentric Reference System for the Americas.** Its definition corresponds to the **ITRS** and it is realized by a regional densification of the **ITRF**.
- ❑ **SIRGAS** is a member of the **IAG Commission 1** (Reference Frames), through the Sub-commission 1.3 (Regional Reference Frames); it is responsible for the regional reference frame for Central and South America.
- ❑ **SIRGAS** is also a working group of the Cartographic Commission of the Pan-American Institute of Geography and History.
- ❑ Besides the geometrical reference system, **SIRGAS** includes the definition and realization of a **unified vertical reference system**, based on ellipsoidal heights as geometrical component and geopotential numbers (referred to a global conventional W_0 value) as physical component.

SIRGAS realizations

- ❑ SIRGAS has three realizations: SIRGAS95, SIRGAS2000 and SIRGAS-CON



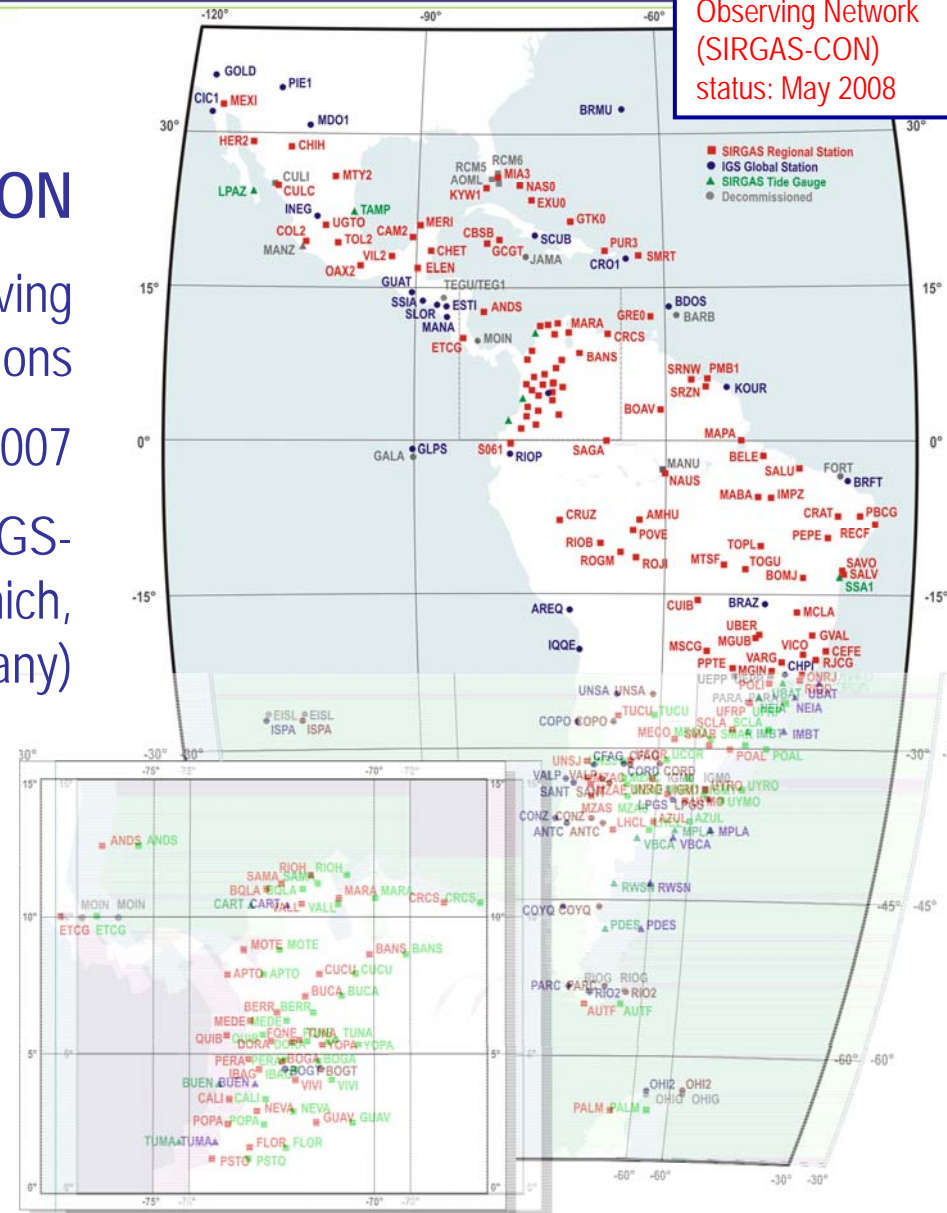
- ✓ SIRGAS95: ITRF94, epoch 1995.4: 58 stations over South America.



- ✓ SIRGAS2000: ITRF2000, epoch 2000.4: 184 stations over the Americas: North, Central and South America

✓ SIRGAS-CON

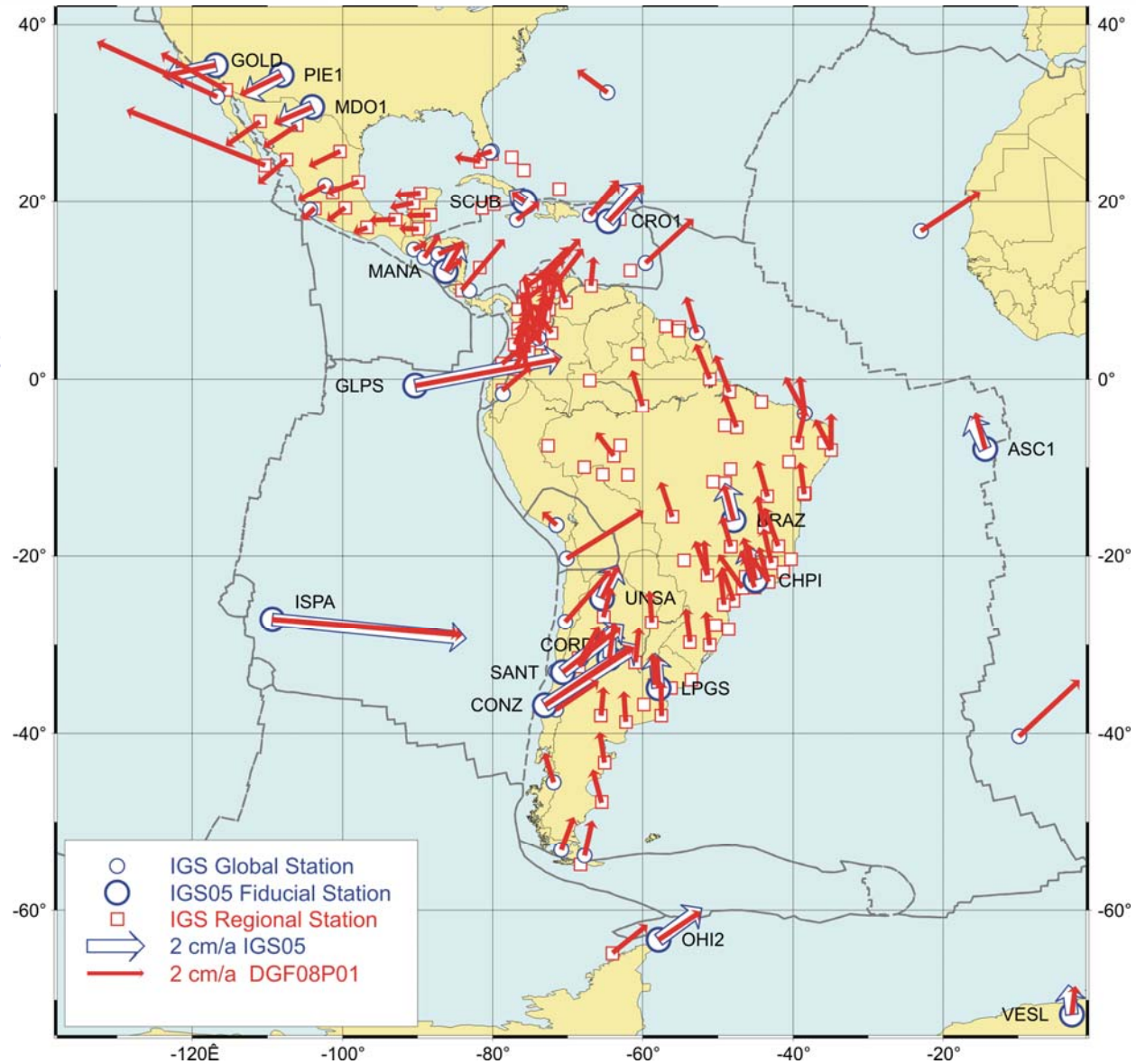
- ✓ More than 160 continuously observing stations
- ✓ 36 new stations since July 2007
- ✓ Contribution to the IGS through the IGS-RNAAC-SIR at the DGFI (Munich, Germany)
- ✓ Installation of 5 processing centres in Latin America (2 in Argentina, 1 in Brazil, 1 in Colombia, 1 in Mexico)
- ✓ Installation of 2 intra technique combination centres in Latin America (1 in Argentina, 1 in Brazil)



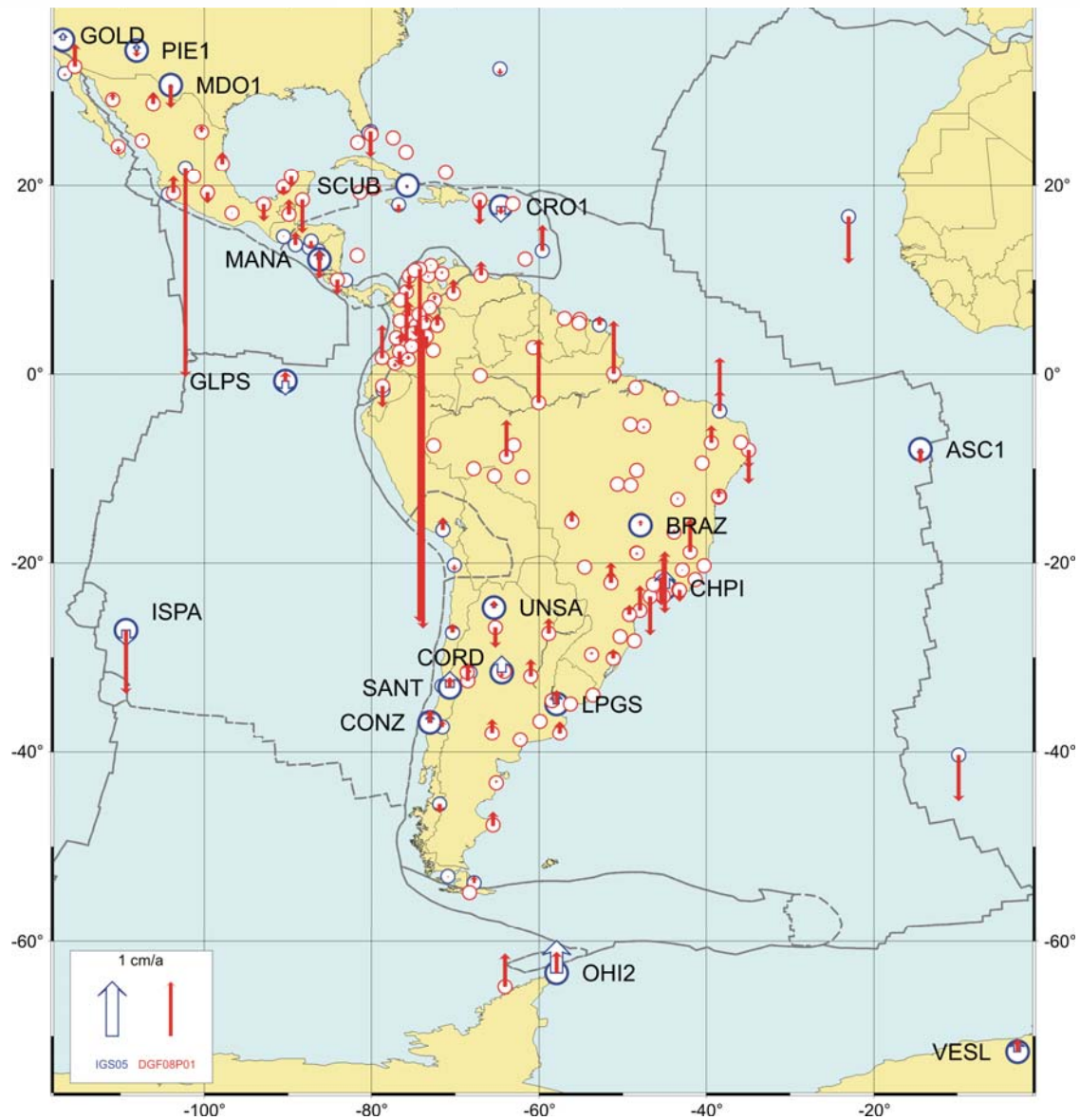
SIRGAS-CON processing strategy

- Absolute PCVs are applied since GPS week 1400 (GPS weeks 1200-1399 are being reprocessed using absolute PCVs).
- Satellite orbits and clocks and EOPs are fixed to the combined IGS solutions.
- The earlier satellite orbits are transformed from ITRF97 or ITRF00 to ITRF05.
- Free normal equations generated by the daily network adjustments are combined to determine an accumulative solution with coordinates and linear velocities.
- Discontinuities and systematic effects to be modelled in the combination are pre-analysed by generating time series of stations coordinates.
- Regional stations with short time series (less than one year) are not included in the cumulative solution.
- The geodetic datum is defined by constraining coordinates and velocities of 17 IGS05 stations to the NNT+NNR conditions.
- The final solution (DGF08P01-SIR) refers to the IGS05 frame, epoch 2003.0.
- Coordinates / velocities precision: $\pm 2,2$ mm (hor), $\pm 4,5$ mm (ver); $\pm 1-2$ m/a (vel).

SIRGAS-CON station velocities
 ✓ horizontal component

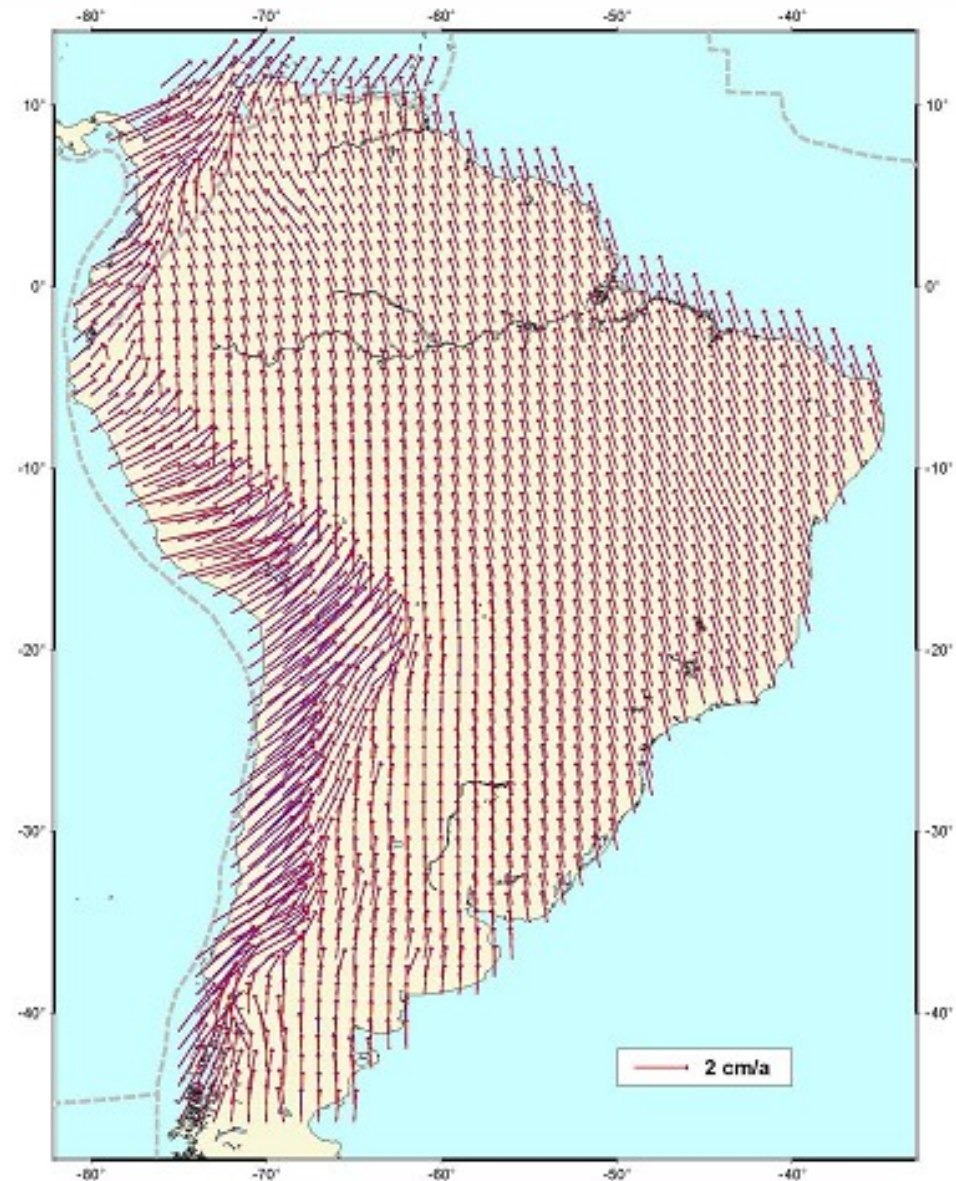


SIRGAS-CON
station velocities
✓ vertical component



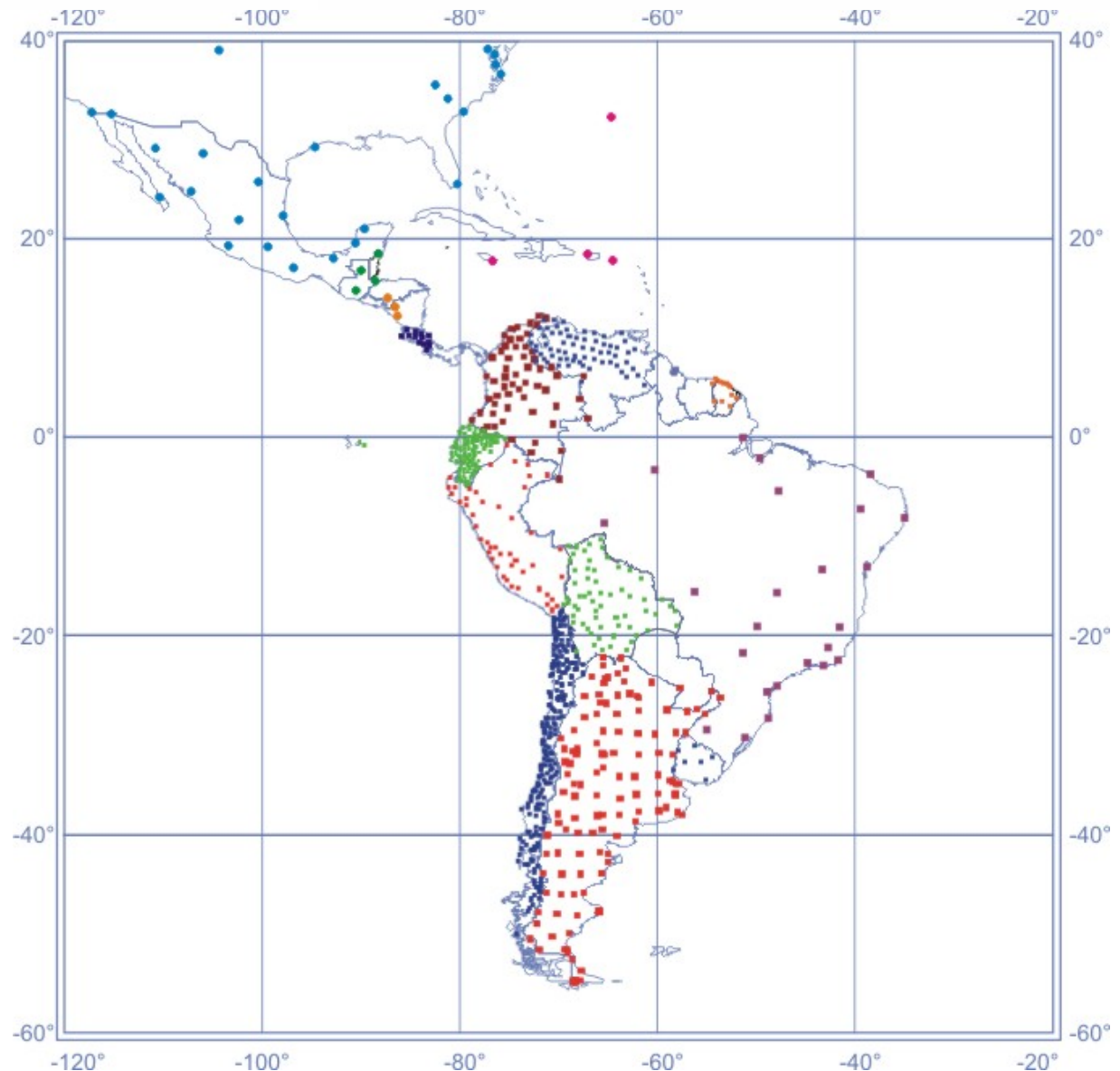
Velocity model for SIRGAS

- ❑ Released in November 2003 (available at www.sirgas.org)
 - ❑ Input data
 - ✓ SIRGAS95 coordinates
 - ✓ SIRGAS2000 coordinates
 - ✓ IGS RNAAC-SIR velocities
 - ✓ Other velocities from geodynamic projects in South America (CAP, CASA, SAGA, SNAPP)
- ❑ The continuous velocity field results from the combination of two solutions: one by least-squares collocation and another by finite elements.
- ❑ Efforts are currently done in order to improve the velocity model.



National densifications of SIRGAS

- 13 of the 18 SIRGAS's members countries have already introduced **SIRGAS** as the official national reference system.
- The national reference frames correspond to densification networks of **SIRGAS** by continuously observing stations and/or passive marks.



Vertical reference system

Geometrical Component

- ✓ Coordinates: ellipsoidal heights, h , referred to the **SIRGAS** system, i.e. ITRS realized by ITRF2000, epoch 2000.4.
- ✓ Reference surface: GRS80 (SIRGAS datum).
- ✓ Time dependency: dh/dt from continuous GNSS positioning.

By adoption of **SIRGAS** as Reference System in the Region, the geometrical component is realized!

Physical component

- ✓ Coordinates: Normal heights H_N derived from geopotential numbers.
- ✓ Reference surface: quasigeoid model (GGM + refined terrestrial gravity data).
- ✓ Time dependency: $dH_N/dt \approx dh/dt$.

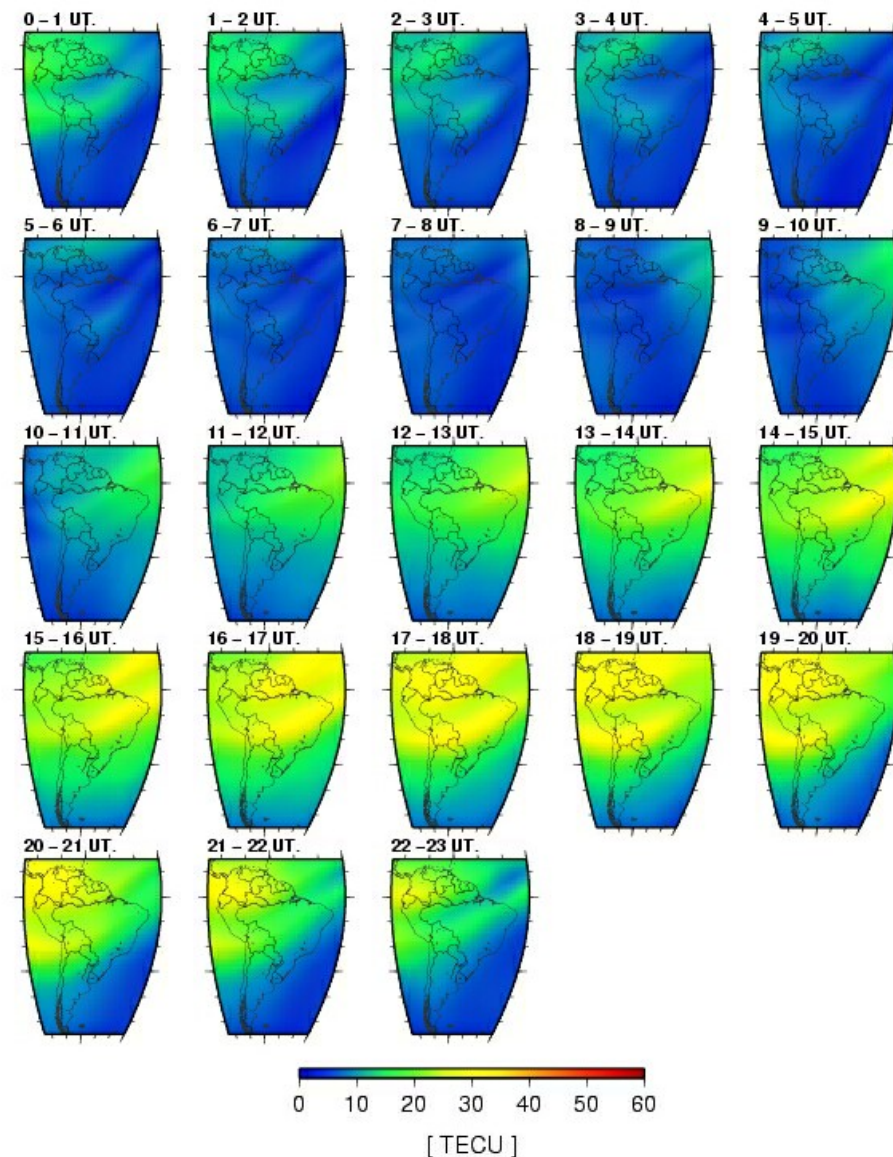
Current activities for the vertical reference system realization

- ❑ The South American countries are concentrated on:
 - ✓ Controlling first order levelling networks.
 - ✓ Checking terrestrial gravity data.
 - ✓ Levelling reference frame and tide gauge stations.
 - ✓ Connecting neighbouring levelling networks.

- ❑ Near future objectives:
 - ✓ Determination and continental adjustment of geopotential numbers wrt a unified and globally determined W_0 value.
 - ✓ Estimation of a high resolution quasigeoid model for the region.

Regional ionosphere maps for SIRGAS

- ❑ The operational infrastructure of the **SIRGAS-CON** network is also used for atmospheric studies.
- ❑ Hourly maps of vertical total electron content (vTEC) are routinely produced since July 2007 (available at www.sirgas.org).
- ❑ Here, 1-hour **South American Regional Ionosphere Maps (SAIM)** for August 3, 2007.



Main objectives for the incoming years

- To extend the **SIRGAS-CON** network into those countries with few (or without) GNSS continuously operating stations.
- To improve (specially the **vertical component**) the South American deformation (velocity) model by including the new stations of the **SIRGAS-CON**.
- To install (initially) five **GNSS processing centres** and two **intra-technique combination centres** in Latin America.
- To support the densification and the official adoption of **SIRGAS** in the **Central American and Caribbean countries**.
- To realize a **global vertical reference system** in the **SIRGAS** region

... more in www.sirgas.org

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