SISTEMA DE REFERENCIA GEOCÉNTRICO PARA LAS AMÉRICAS SIRGAS

The Geocentric Reference Systems of the Americas (SIRGAS)

Claudio Brunini & Laura Sánchez

SIRGAS President & Vice-President

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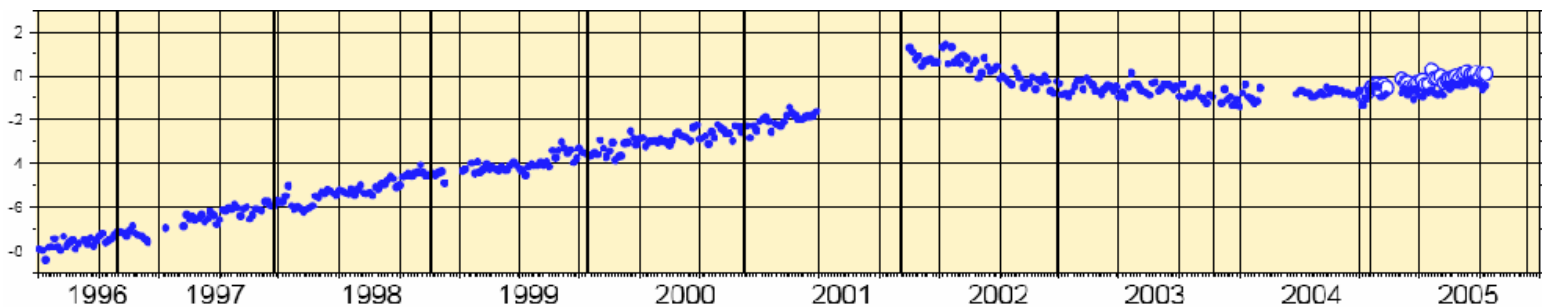
Proyecto de la Comisión de Cartografía del IPGH

Introduction

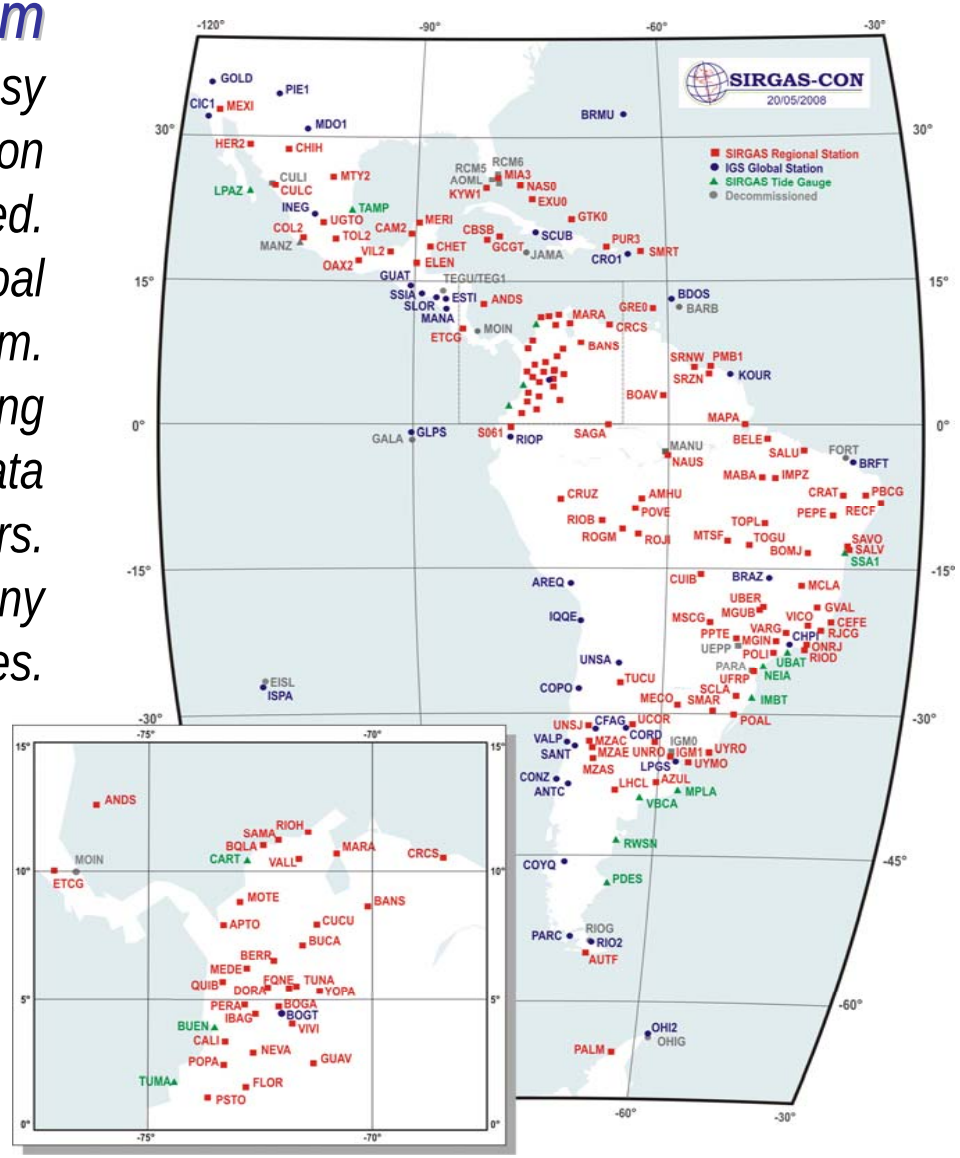
- *Geocentric reference frames are the fundamental layer of the spatial data infrastructures.*
- *State-of-the-art Geodesy demands reference frames capable to support coordinate determinations with mm-level accuracy.*
- *Reference frames consistency must be guaranteed at global scale and their stability must be ensured over decades.*
- *Coordinate changes on time (i.e., velocities) must be determined with 0.1 mm/a accuracy.*
- *The highest level of theory, technology and data analysis are used to realize the International Terrestrial Reference Frame (ITRF).*
- *SIRGAS realizes the ITRF in the Caribbean, Central and South American regions.*
- *The 8th Regional Cartographic Conference of the Americas (United Nations, New York, 2005) recommended SIRGAS for the IDE-Américas.*



Variation on time of the Arequipa coordinate, North component in cm, after W. Seemüller et al., DGFI.

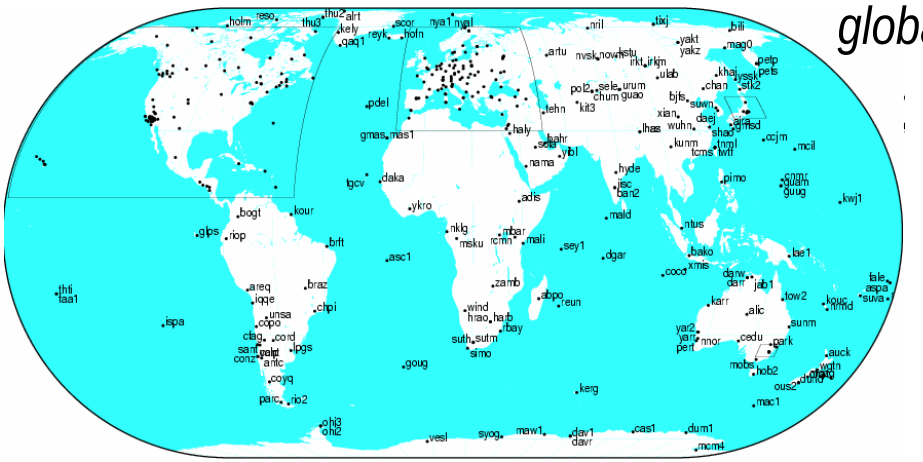
The SIRGAS-CON system

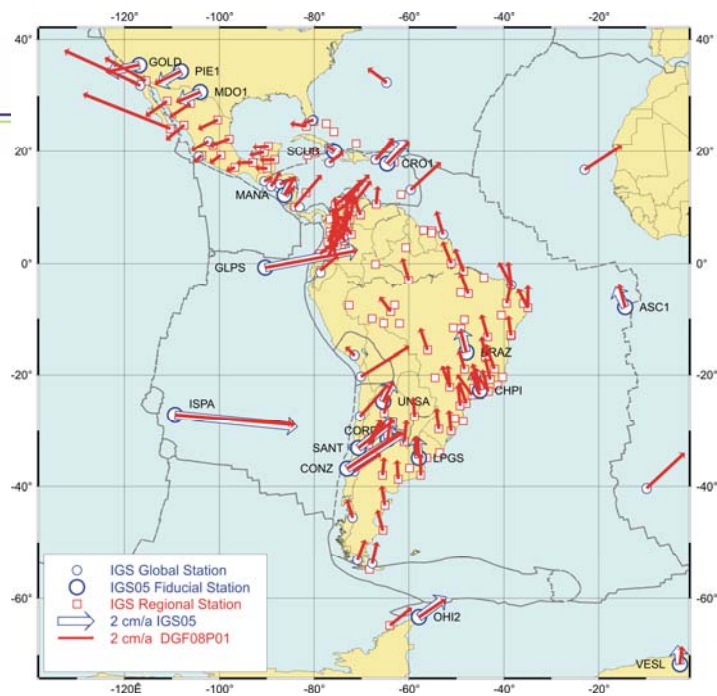
- *The highest standards of modern Geodesy can only be fulfilled if coordinates changes on time are continuously monitored.*
- *The observations needed to achieve this goal are provided by the SIRGAS-CON system.*
- *It encompasses ~200 continuously observing GNSS receivers, communication links, two data centers and four analysis centers.*
- *Receivers are installed and operated by many institutions in different countries.*
- *Data center are operated by the Deutsches Geodätisches Forschungsinstitut (DGFI) and the Instituto Brasileiro de Geografia e Estatistica (IBGE).*
- *This continental-size distributed observatory is coordinated by SIRGAS in a cooperative framework.*

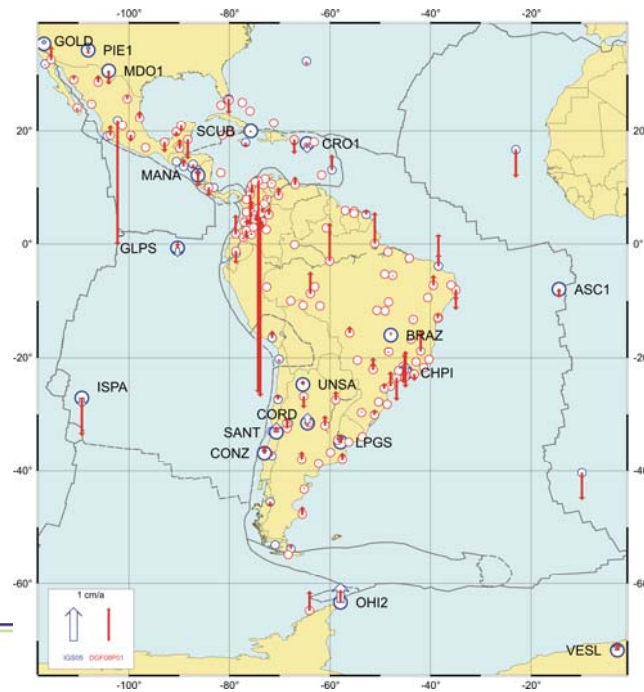


The IGS-RNAAC-SIR

- *SIRGAS-CON observations are continuously processed by DGFI as responsible of IGS Regional Network Associated Analysis Center for SIRGAS.*
- *A set of coordinates for all SIRGAS-CON stations are computed on weekly-basis and delivered to IGS.*
- *IGS Associated Analysis Centers compute weekly global solutions that merge SIRGAS and other regional solutions within the IGS global reference frame.*



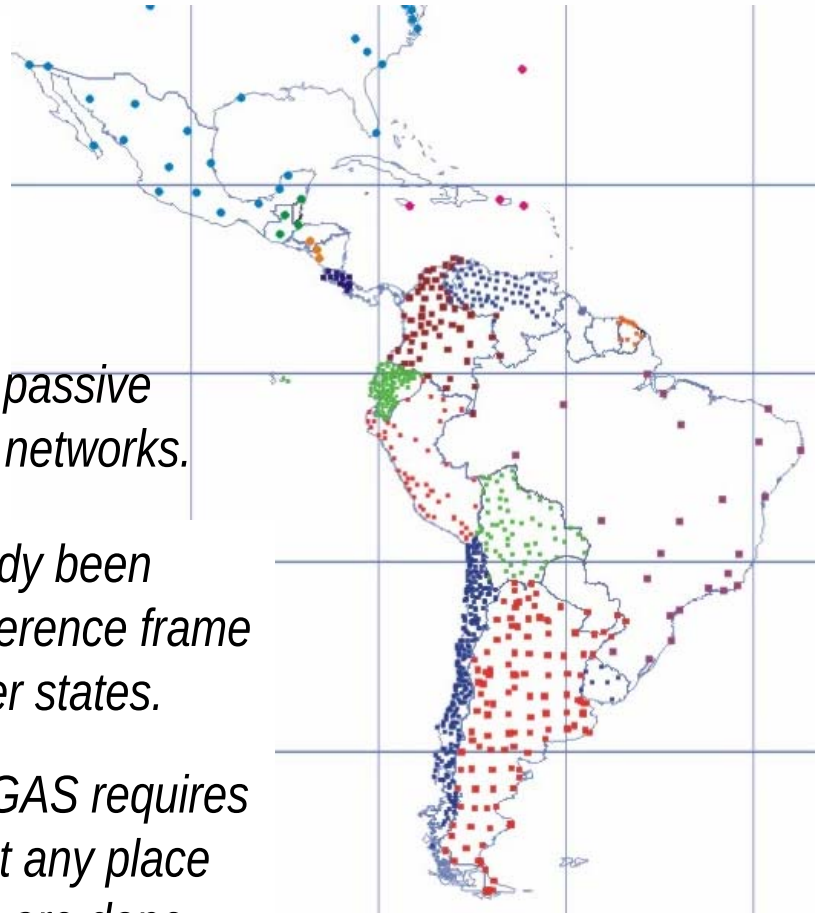




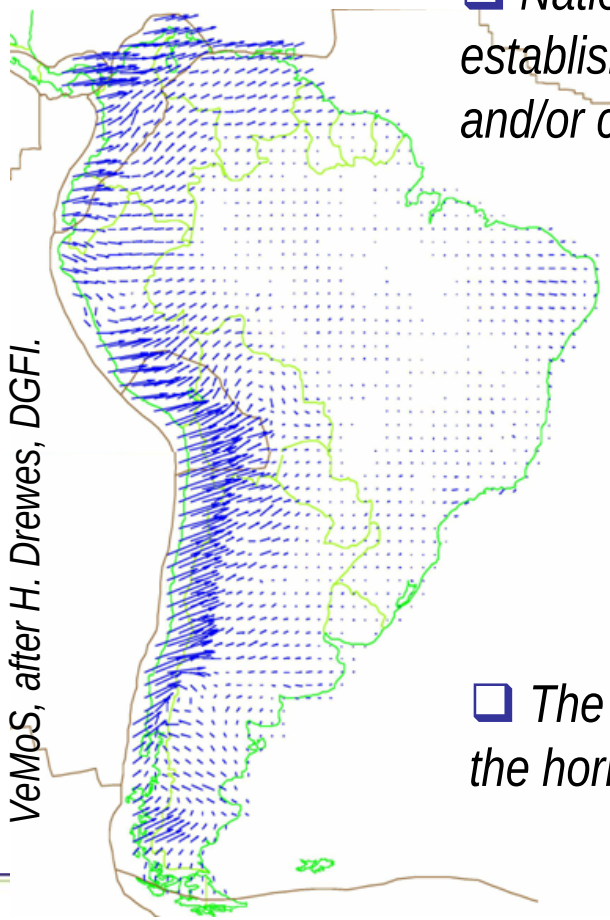
- *Multi-years solutions (coordinates for a conventional epoch and velocities) are periodically computed by IGS-RNAAC-SIR.*
- *The latest one encompasses 272 weeks (Dec 2002 - Mar 2008) and realizes the best reference frame for the Americas.*

SIRGAS in practice

- *Practical uses of SIRGAS are supported by the countries by deploying national densifications.*



- *National densifications are established by means of both, passive and/or continuously observing networks.*



VeMoS, after H. Drewes, DGFI.

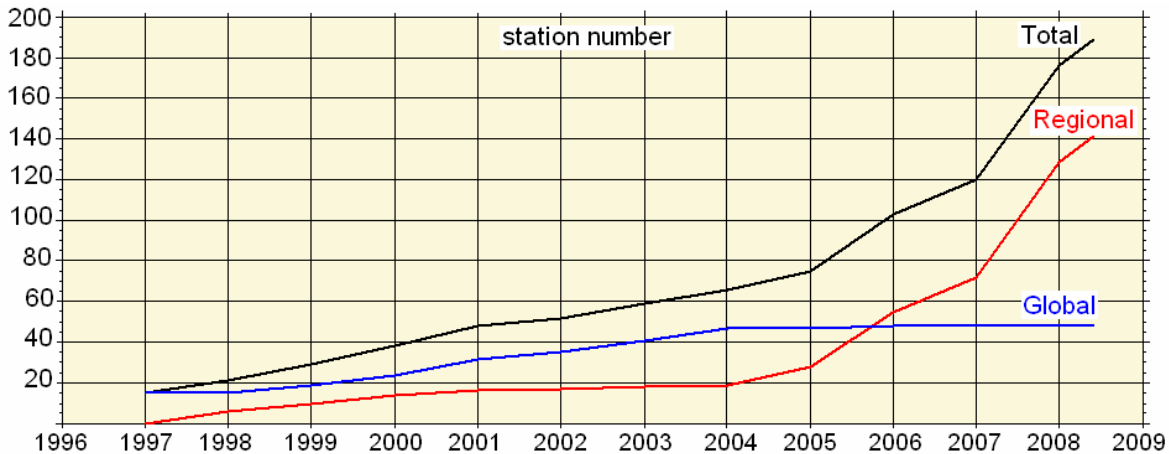
- *SIRGAS has already been adopted as official reference frame by 13 of its 18 member states.*
- *Proper use of SIRGAS requires velocities computed at any place where measurements are done.*
- *The Velocity Model for SIRGAS (VeMoS) allows interpolating the horizontal velocities at any given location in South America.*

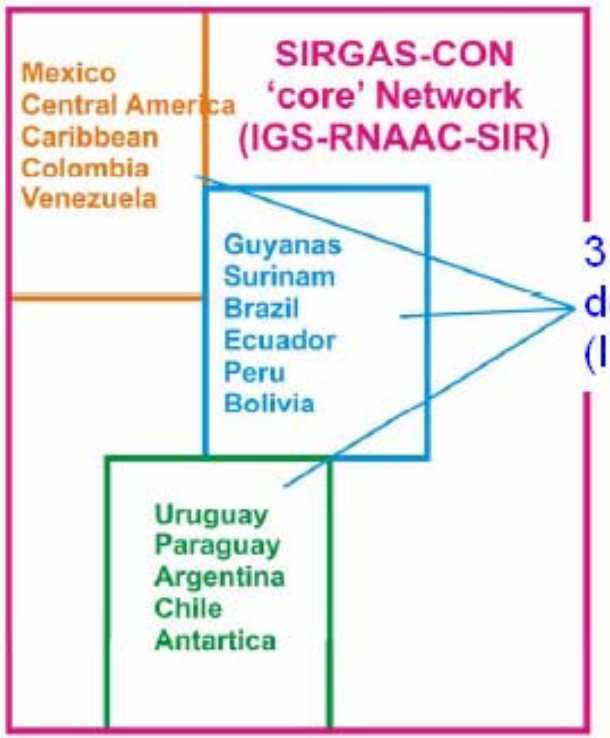
Capacity building

- *SIRGAS promotes capacity building activities in order to maximize the social benefits of geo-positioning products.*
- *Experimental analysis centers (EAC) supported by Latin-American institutions were established in 2006:*
  - ✓ *Instituto Geográfico Agustín Codazzi, Colombia;*
  - ✓ *Instituto Nacional de Estadística, Geografía e Informática, México;*
  - ✓ *Instituto de Geodesia y Geodinámica, Argentina;*
  - ✓ *Instituto Brasileiro de Geografia e Estatisitca;*
  - ✓ *Instituto Geográfico Militar, Argentina*
- *EAC were recently evaluated (SIRGAS meeting, Montevideo, May 2008).*
- *Independent evaluations conducted by DGFI and IBGE concluded that IGAC, IGG and IBGE EAC can be declared official.*

Handling the growth of the SIRGAS-CON system

- *The number of SIRGAS-CON stations has constantly increased since the establishment of the system, in late 1996.*





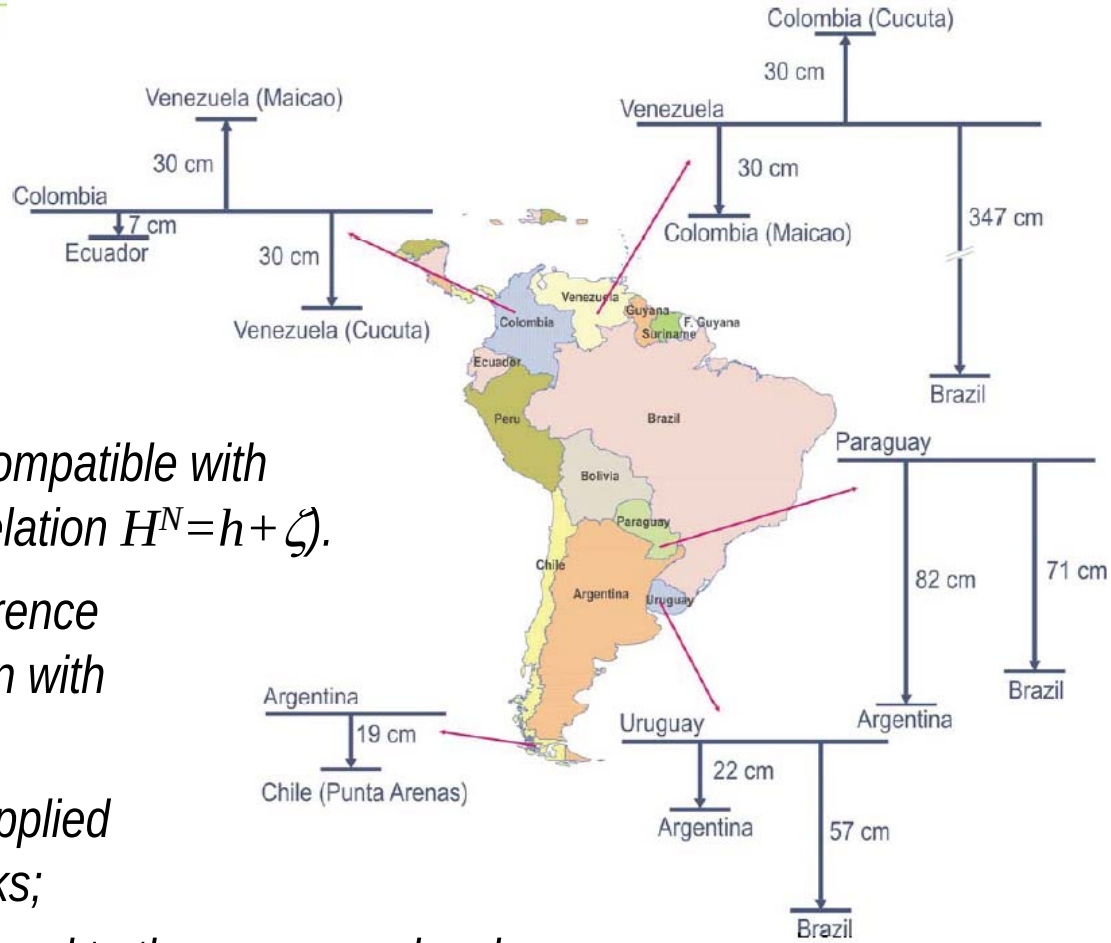
3 SIRGAS-CON densification networks (IGAC, IBGE, IGG)

- *A new strategy for handling the system was recently proposed (SIRGAS meeting, Montevideo, May 2008).*

- *It relays on:*
  - ✓ *1 core network + 3 densification networks*
  - ✓ *2 data centers (DGFI and IBGE)*
  - ✓ *4 analysis centers (IGS-RNAAC-SIR, IGAC, IBGE and IGG)*
  - ✓ *2 combination centers (DGFI and IBGE)*

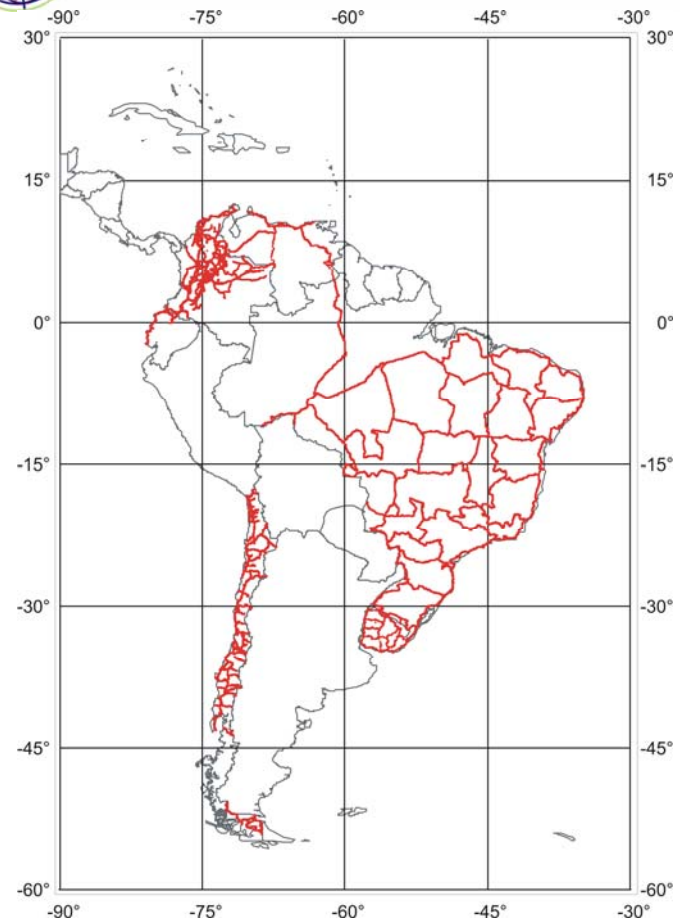
Vertical reference frame

- *SIRGAS objectives include the realization of a gravity-related vertical reference frame based on normal heights (H^N).*

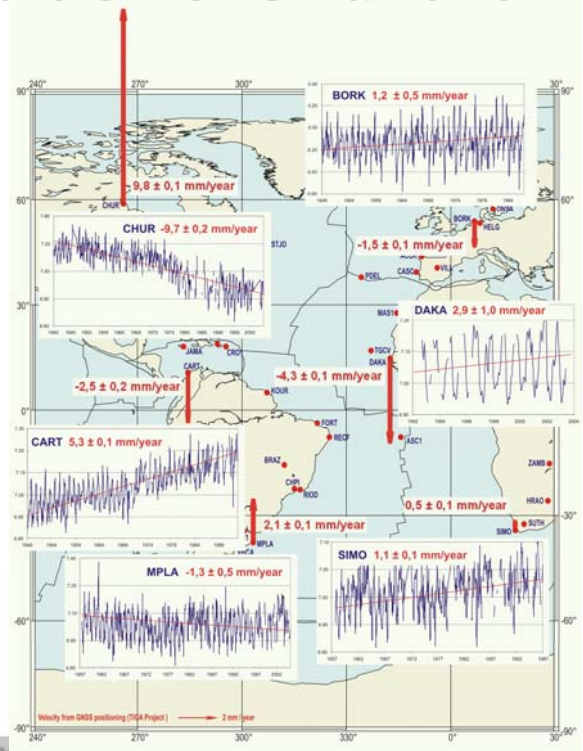


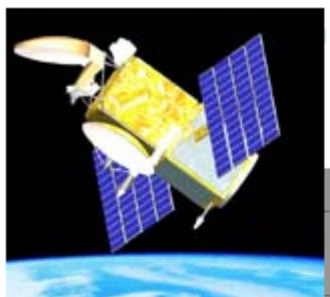
- *It must be globally consistent and compatible with GNSS-derived heights (i.e.: fulfill the relation $H^N = h + \zeta$).*
- *Existing gravity-related vertical reference frames are inconsistent among them an with GNSS-derived heights because:*
  - ✓ *gravitational corrections were not applied to the existing national leveling networks;*
  - ✓ *national leveling networks were referred to the mean sea level (i.e.: they are affected by sea surface topography irregularities); and*
  - ✓ *existing quasi-geoidal models are not enough accurate (a lot of efforts are being done abroad SIRGAS for improving them at continental and global scales).*

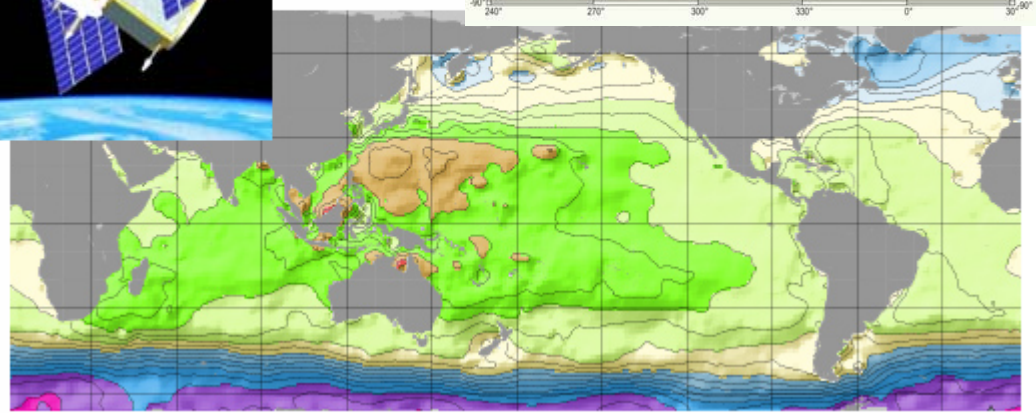
Tasks being done in the SIRGAS framework



- *Define and realize a global-consistent reference level by means of tide-gauges controlled with GNSS and satellite altimetry.*





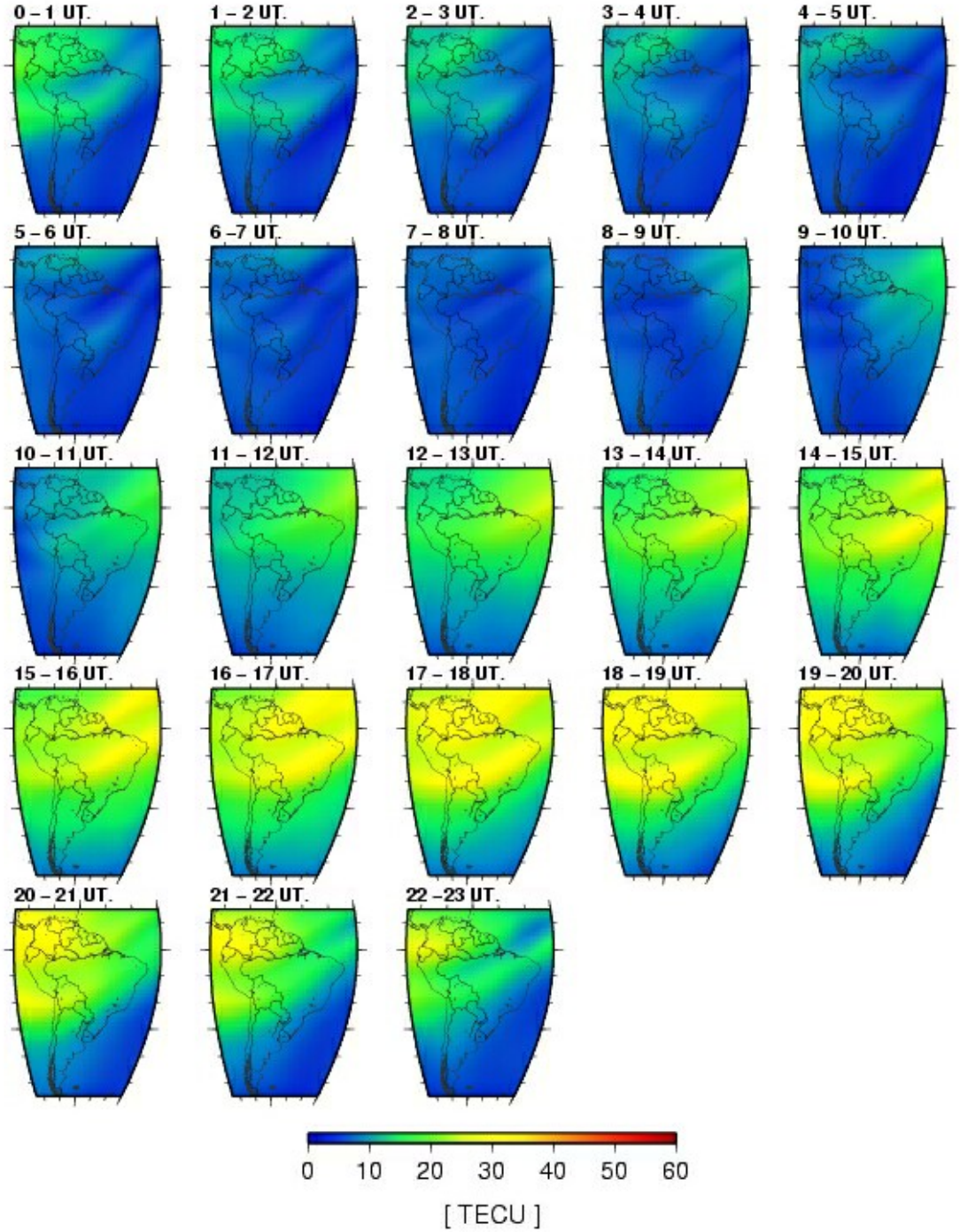


- *Compute geopotential numbers for the first-order national leveling networks and reefer them to a global-consistent reference level.*

SIRGAS

Expanding SIRGAS-CON applications

- *Understanding and forecast ionospheric conditions is necessary for practical applications (e.g.: global navigation, communications, etc.).*
- *The Central and South American ionosphere presents challenging problems for aeronomers.*
- *Since July 2006, SIRGAS operates an Ionospheric Analysis Center under the responsibility of La Plata National University, Argentina.*
- *Hourly regional maps of Vertical Total Electron Content (TEC) are computed and delivered to the community.*



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Many thanks for your attention

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