Geocentric Reference System for the Americas
4th Session UN-GGIM Americas
April 2017, Santiago, Chile

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Con apoyo de:
• Definitions and Brief history
• SIRGAS in numbers today
  1-SIRGAS Reference Frame
  2-SIRGAS: National datums
  3-SIRGAS: Unified heights
• SIRGAS in the UN-GGIM context
• Next events 2017 and 2018
SIRGAS stands for The Geocentric Reference System for the Americas. It is identical to the International Terrestrial Reference System (ITRS).

It is the definition, realization and maintenance of the 3D geocentric reference system. Its realization is a regional densification of the global International Terrestrial Reference Frame (ITRF).

It defines and maintains the gravity field-related vertical reference system in the Americas region.

The extension of the SIRGAS frame is carried out by national densifications, which serve as local reference frames.

It is a member of the IAG Commission 1 (Reference Frames)

It is a Working Group of the Cartographic Commission of the Pan-American Institute of Geography and History (PAIGH)
24 years ago

Asunción 1993

International Conference for definition of the Geocentric Datum for South America
• **Recommends** that member countries of the Americas integrate their national geodetic reference systems into a reference system compatible with SIRGAS;

• **Also recommends** that member countries of the Americas provide to SIRGAS gravity data for computation of the geoid as the reference surface of the vertical (height) system;

• **Further recommends** that member countries of the Americas correct their leveling by graviometric observations in order to compute geopotential numbers and connect the leveling networks with neighboring countries, making all these information available to SIRGAS.

Also bearing in mind that SIRGAS is supporting the participating countries in terms of knowledge transfer and training.

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Timeline (2004 – 2012)

2004
+ Central America countries

2005
SIRGAS-CON

2008
+ Local Analysis Centers

2008
+ Open SIRGAS Symposia

2009
First SIRGAS School
Build capacities

2012
First SIRGAS Workshop on Vertical datum

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4th Session, April 3-5, 2017, Santiago-Chile
Timeline (2012 - 2016)

2012
Joint Action Action

2014
Working Group on the Global Geodetic Reference Frame GGRF of the UN-GGIM

2016
Joint Action Plan V. 2

IPGH + SIRGAS + CP-IDEA + GEOSUR
2013-2015 JOINT ACTION PLAN
to expedite the development of Spatial Data infrastructure of the Americas

2012
Joint Action Action

2014
Working Group on the Global Geodetic Reference Frame GGRF of the UN-GGIM

2016
Joint Action Plan V. 2

IPGH + SIRGAS + UN-GGIM: Americas + GEOSUR
2016-2020 JOINT ACTION PLAN

To represent the Americas region in the WG on the UN-GGIM GGRF
SIRGAS coordinates the largest geodetic infrastructure in Latin America and the Caribbean.

More than 50 institutions from 20 countries

≈ 510 colleagues
SIRGAS in numbers today (2/2)

- Number of GNSS SIRGAS-CON Stations:
  - Active: 71.49%
  - Inactive: 13.43%
  - Decommissioned: 15.08%
  - Total: ≈350 GNSS stations

- Fiducial stations
- New Fiducial stations

4th Session, April 3-5, 2017, Santiago-Chile
Extremely accurate

The highest level of theory, technology and data analysis has to be used to achieve positions with mm-accuracy and velocities with 0.1 mm/a. Stability over decades has to be guaranteed.
SIRGAS Reference Frame (2/2)

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SIRGAS-CON

Consistency of the weekly coordinate in the individual solutions

Reliability of the individual solutions (comparison with IGS)

SIR15P01 – VEMOS2015 Model

Period: 2010.2 (2012.2) - 2015.2;
471 stations;
Frame: IGb08 epoch 2013.0;
Precision: N - E = ±1.0 mm/y,
h = ±1.2 mm/y.
### National datums

#### Extremely reliable

National datums are basic for legal affairs (borders), geo-information, and constructions. Required precision is not as high, but it has easily to be handled & results have to be reliable.

### South America: 10 countries

<table>
<thead>
<tr>
<th>Country</th>
<th>National Network / CON</th>
<th>Number of stations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Argentina</td>
<td>POSGAR / RAMSAC</td>
<td>178 / 45</td>
</tr>
<tr>
<td>Bolivia</td>
<td>MARGEN / CON</td>
<td>125 / 7</td>
</tr>
<tr>
<td>Brasil</td>
<td>SIRGAS2000 / RBMC</td>
<td>1903 / 128</td>
</tr>
<tr>
<td>Chile</td>
<td>SIRGAS-CHILE / CON</td>
<td>269 / 9</td>
</tr>
<tr>
<td>Colombia</td>
<td>MAGNA-SIRGAS / MAGNA-ECO</td>
<td>70 / 47</td>
</tr>
<tr>
<td>Costa Rica</td>
<td>CR05 / CON</td>
<td>15</td>
</tr>
<tr>
<td>Ecuador</td>
<td>Red básica GPS / REGME</td>
<td>135 / 37</td>
</tr>
<tr>
<td>El Salvador</td>
<td>SIRGAS-ES2007 / CON</td>
<td>34 / 1</td>
</tr>
<tr>
<td>Guyana</td>
<td>RGFG / CON</td>
<td>7 / 1</td>
</tr>
<tr>
<td>Guatemala</td>
<td>CORS</td>
<td>15</td>
</tr>
<tr>
<td>México</td>
<td>RGNO / REGNA</td>
<td>17</td>
</tr>
<tr>
<td>Panamá</td>
<td>MGN / CON</td>
<td>17 / 7</td>
</tr>
<tr>
<td>Perú</td>
<td>PERU96 / REGPMOC</td>
<td>47 / 14</td>
</tr>
<tr>
<td>Uruguay</td>
<td>SIRGAS-ROU98 / REGNA-ROU</td>
<td>17 / 23</td>
</tr>
<tr>
<td>Venezuela</td>
<td>SIRGAS-REGVEN / REMOS</td>
<td>156 / 3</td>
</tr>
</tbody>
</table>

### Central America: 5 countries

- Argentina
- Bolivia
- Brasil
- Chile
- Colombia

### SIRGAS-RT

The RT Station number and RT casters number are increasing.
SIRGAS: Unified heights

15 Vertical Datums in South America. (L. Sanchez)

Large gaps in leveling lines and gravity

Gravity Densification Network in South/Central America
951,928 points
(Blitzkow et al. 2016)

2) **The International Association of Geodesy** (IAG), as the responsible organization for the advance of Geodesy at the World, drew up a paper describing the scientific bases for the GGRF implementation in order to achieve the UN objectives.

3) **The UN** (through the Resolution and the new **permanent and regional committees for the GGRF**) provides the necessary governmental framework for the promotion and establishment of GGRF.

4) **The IAG** provides the scientific and theoretical foundations, infrastructure observational and analytical methods, and a broad human network composed by hundreds of experts working together in favor of the GGRF.
The establishment of the GGRF (Global Geodetic Reference Framework) is one of the main goals of GGOS (Global Geodetic Monitoring System) and IAG (International Association of Geodesy).

Common reference frame for identifying and describe the geometry and Gravity field of the Earth at any time.

The accurate realization of the GGRS (GGRF) is indispensable to generate reliable geospatial information required in:

* The determination of the changes that take place within the Earth System.
* The generation of policies for sustainable development

SIRGAS has been working, in this, since 24 years in the American region.
The establishment of the IHRF (International Height Reference Frame) is one of the main goals of GGOS (Global Geodetic Observing System) and the IAG.

The concept of IAG on GGRF:

A common reference frame to identify and describe the geometry and gravity field of the Earth at any time.

The coordinates of any point must be given by the geocentric position X,Y,Z, the gravity potential W, its physical height H, and the gravity value g.

SIRGAS has been working on these topics since 1993 in the American region.
The establishment of the IHRF is one of the main goals of GGOS and the IAG.

The main current SIRGAS precepts related to SVRS:

- Referred to the IHRS global reference level W0;
- Performed by physical altitudes \([HP = f(CP)]\);
- Connected to the geometric component of SIRGAS;
- Associated with an specific reference epoch; It should consider the temporal variations.
- Linked to a GGRF station profile.

Implementation of the IHRF in SIRGAS

SIRGAS has selected stations that will be part of the IHRF and the countries have undertaken to carry out complementary measurements of \(\varphi\), \(\lambda\), \(h\) (GNSS), \(H\) (leveling) and \(g\) (gravity) in the sites and their surroundings according to the guidelines of GGOS.
November 22 - 24: Workshop on Real-Time infrastructure, products and applications.

November 27 - 29: Symposium

November 30: Workshop on Satellite Laser Ranging (SLR) instrumentation in Latin America
November maybe.

Symposium
Workshop on: SLR, VRS or RT

We hope you too....
The collaborative effort continues. SIRGAS faces new challenges according to social and scientific needs.

More data, more accuracy, a better distribution...

¡¡ Thank you very much!!

To those who generate data and maintain the stations.
To the data, processing and combination centers.
To those that collaborate with the Working Groups.
To PAIGH and IAG.
To UN-GGIM: Americas

¡See you in Mendoza 2017!