



Report on the  
**SIRGAS Workshop on Vertical Datum Unification**  
**Dec. 3th to 6th, 2012, Rio de Janeiro, Brazil**  
**Jan. 30th to Feb. 2nd, La Paz, Bolivia, and the**  
**Visits to the Geographic Institutes of Colombia (Jan. 28th-29th)**  
**and Perú (Feb. 4th), 2013**

## **Introduction**

One of the key aspects of the SIRGAS Working Group on Vertical Datum (SIRGAS-WGIII) activities is the organization of a homogeneous, comprehensive database with the geopotential differences regarding the leveling networks of South American countries. However, progress amongst these countries has been heterogeneous toward that goal, varying from completeness (cases where all leveling and gravity information was already sent to SIRGAS WG-III) to total absence of information.

As an attempt to improve the situation, SIRGAS started in 2011 to discuss the organization of a SIRGAS-WGIII workshop in Bogotá, Colombia, by the end of 2012, with the local support of the *Instituto Geográfico Agustín Codazzi* (IGAC) and financial support from the *Pan-American Institute for Geography and History* (PAIGH), the *International Association of Geodesy* (IAG) and the *International Union of Geodesy and Geophysics* (IUGG). The proposed workshop would be focused in the preparation of leveling and gravity data with a unique set of procedures and systems to filter out inconsistencies and gross errors, originated mainly in the digitization of old documents, and to adjust geopotential numbers and compute the correspondent normal heights.

Due to different reasons, the proposed hosting institution was changed in August 2012 to the *Instituto Brasileiro de Geografia e Estatística* (IBGE), which accepted the challenge to organize the workshop with only few months of anticipation. Representatives of the South American Geographic Institutes were informed in a meeting with the SIRGAS Directing Council, October 30th, during the SIRGAS2012 Meeting, and similarly agreed to immediately start efforts aiming to the participation of technical representatives effectively engaged in the national leveling and gravity activities.

The workshop was held in Rio de Janeiro, Brazil, from December 3rd to 6th, with the participation of representatives from Brazil, Ecuador, Peru, Chile, Argentina and Uruguay.

Even before the workshop, the SIRGAS-WGIII started discussions with some of the absent countries to check the possibilities of repetition of the workshop using the positive balance of the financial support assigned by SIRGAS to those countries. The economic context of the high touristic season also played an important role in the decision of which countries would be visited. To avoid the need of an official authorization to leave his country, the President of SIRGAS-WGIII used his vacation period, which was also a restrictive condition.

A new workshop for the *Instituto Geográfico Militar* of Bolivia, in La Paz, was originally planned for the week from January 28th to February 2nd, but a connection in Bogota in the flight between Rio de Janeiro and La Paz allowed the opportunity of a two-days visit to IGAC/Colombia, resulting in a slightly shortened workshop in La Paz. Another long flight connection in Lima, during the return from La Paz to Rio de Janeiro, allowed a short visit to the *Instituto Geográfico Nacional* of Peru.



**Contents of the Workshops held in Rio (Dec.03-06) and La Paz (Jan.30-Feb.02)**

1. Review of terminology and basic theoretical concepts regarding spirit leveling procedures and physical heights;
2. review of the sequence of computation from height differences and gravity values up to physical heights, using excel worksheets;
3. review of the data format used by each country (mainly excel worksheets) and inclusion of formulas for generating standard text-only files from those kind of worksheets;
4. preparation and use of the program LCNIV (evaluation of spirit leveling data organized as lines composed by individual sections, i.e., accumulated height differences and other information between successive benchmarks);
5. preparation and use of the program CRITCO (evaluation and correction of benchmarks coordinates based on the leveled distances between successive benchmarks);
6. preparation and use of the program PREDGRAV (evaluation and interpolation of gravity values);
7. preparation and use of the program AJNIVPAR-OCT (adjustment of leveling networks).

**Participants of the Workshop held in IBGE/Brasil, Rio, Dec.03-06, 2012**

- Antonio da Cruz Castro (IBGE/Brasil)
- Diego Piñon (IGN/Argentina)
- Edgar Huarajo (IGN/Perú)
- Freddy Rodriguez (IGM/Ecuador)
- Ivonne Gatica (IGM/Chile)
- José María Pampillón (SGM/Uruguay)
- Juan Gómez (IGM/Ecuador)
- Maíra Kronemberg Lima (IBGE/Brasil)
- Nívia Régis Di Maio Pereira (IBGE/Brasil)
- Rubén Edgardo Sánchez (IGN/Argentina)
- Salomão Soares (IBGE/Brasil)

**Participants of the discussions in IGAC/Colombia, Bogotá, Jan.28-29, 2013**

- Alberto Umbarila (Geodesia, IGAC)
- Francisco Mora (Geodesia, IGAC)
- Orlando López (Geodesia, IGAC)
- Oscar Álvaro Suárez (Geodesia, IGAC)
- William León (Geodesia, IGAC)
- William Martínez (Geodesia, IGAC)

**Participants of the Workshop held in IGM/Bolivia, La Paz, Jan.30-Feb.02, 2013**

- My. DIM Johnny Yucra Gutierrez (Escuela de Topografía)
- My. DIM Mario Sandoval Nava (IGM – Cálculos)



- Cap. DIM Daniel Castro Revollo (IGM)
- Cap. DIM Pablo Chulver (IGM)
- Cap. Cab. Juan Manuel Molina Patiño (Escuela Militar de Ingenieria – La Paz)
- Sof. 1ro. DEPSS Tito A. Flores Torrejón (IGM – CEPAG)
- Sof. 2do. DEPSS Juan Contreras Valencia (IGM – ARCHIVOS)
- Sof. 2do. DEPSS Daniel Espinoza Condori (IGM – CEPAG)
- Sof. Incl. DEPSS Bernardo Calle Mamani (IGM)
- Sof. Incl. Tgrafo. Rubén de la Cruz Quispe (IGM – CEPAG)
- Sgto. 1ro. Tgrafo. Wilber Delgado (IGM – CEPAG)
- Sgto. 1ro. Tgrafo. Juan Calderón Cusi (IGM)
- Sgto. 1ro. Tgrafo. David Morales Arce (IGM – CEPAG)
- Srta. Alumna 5to. Año Maribel Roca (Escuela Militar de Ingenieria – La Paz)

### **Participants of the discussions in IGN/Perú, Lima, Feb.04, 2013**

- My. Jesús Vargas Martínez (Dirección de Cartografía, IGN)
- My. Julio Enrique Llanos Alberca (Dirección de Cartografía, IGN)

### **Conclusions**

The workshop and further visits to Bolivia, Colombia and Peru were excellent opportunities to put together people responsible for the treatment of leveling data in several countries of South America, who shared their experiences and were able to absorb new procedures and computational tools in an homogeneous point of view. It is expected an increase in quality and coverage of the data to be sent to SIRGAS-WGIII along the next months.

### **Acknowledgements**

SIRGAS deeply acknowledges the economical support provided by the PAIGH, the IAG and the IUGG to facilitate the attendance of some participants to the workshop in Rio and to make possible the travel of the SIRGAS-WGIII president to Bolivia, Colombia and Peru. SIRGAS also recognizes and thanks for the efforts and further support provided by the IBGE and the different Geographic Institutes and National Agencies responsible for the vertical reference networks in the SIRGAS region.

Rio de Janeiro, March 4th, 2013.

Dr. ROBERTO TEIXEIRA LUZ  
President, SIRGAS/WG-III