Session 1: Establishment of the IGRF from national perspectives

Monday, April 11th 13:30 - 19:00 CEST

Sessions Chairs: A. Engfeldt (Sweden) and P. Dykowski (Poland)

13:30 - 13:45	local	**Ludger Timmen** *Can we learn from IAGBN: its development and disappearance?*
13:45 - 13:50	local	**Tim E. Jensen, René Forsberg** *IGRF as a Basic Geodetic Infrastructure for Regional Gravity Surveys*
13:50 - 14:05	local	**H. Wziontek, S. Bonvalot, and the members of IAG JWG 2.1.1** *The International Gravity Reference Frame: Status and Perspectives*
14:05 - 14:20	local	**Andreas Engfeldt** *RG 2000, a modern national gravity network based on observations with several different types of gravimeters*
14:20 - 14:35	local	**Jaakko Mäkinen, Mirjam Bilker-Koivula, Marcin Sękowski, Jyri Näränen, Hannu Ruotsalainen, Arttu Raja-Halli, Heikki Virtanen** *Hierarchical connection of the zero and first order gravity networks in Finland to the IGRF*
14:35 - 14:50	local	**P. Dykowski, J. Kryński, T. Olszak** *Modernization and current status of the Polish gravity control*
14:50 - 15:00		***Discussion***
15:00 - 15:30		***Coffee break & Group Photo***
15:30 - 15:45	local	**Márta Kis** *The Status of the Hungarian Gravimetric Network*
15:45 - 15:50	local	**P. Dykowski, J. Kryński, M. Sękowski, P. Kane, K. Fitzpatrick** *Establishment of a modern gravity control in Ireland*
15:50 - 15:55	local	**Christian Ullrich** *Contribution of Federal Office of Metrology and Surveying (BEV) to the International Gravity Reference Frame*
16:05 - 16:20	remote	**Reinhard Falk, Jan Müller, Andreas Reinhold, Axel Rülke, Hartmut Wziontek** *Status of the German Gravity Nets*

16:20 - 16:35	remote	**Martin Lederer, Otakar Nesvadba, Vojtech Pálinkáš** *The status of the Czech Gravity Network*
16:35 - 16:50	remote	**Victoria A. Smith** *UK Absolute Gravimetry: Status and Future*
16:50 - 17:00		***Discussion***
17:00 - 17:20		***Coffee break***
17:20 - 17:35	remote	**B. Droščák, J. Janák, J. Papčo** *National report on gravity network in Slovakia: Absolute gravity points in Slovakia from perspective of IGRF and other related issues*
17:35 - 17:50	remote	**David Avalos, Apolo Alvarado, Marco Mendoza, Spiros Pagiatakis, Francisco Medina, Jordan Robles, Giovani Sarabia, Javier Arellano** *An assessment on the Mexico gravity network and its integration to IGRF*
17:50 - 17:55	remote	**J. C. Matiz-León, L. J. Moisés-Sepúlveda, G. Gabalda, D. A. Hernandez-Beltrán, Y. J. Pardo-López, D. A. Cortes-Bolívar, S. Bonvalot** *Implementation of the Absolute Gravity Network for Colombia – RGAC*
17:55 - 18:00	remote	**Derek van Westrum** *Absolute Gravity efforts in the United States*
18:00 - 18:05	remote	**Denizar Blitzkow, Ana Cristina Oliveira Cancoro de Matos, Gabriel do Nascimento Guimarães, Iuri Moraes Bjorkstrom** *Reference Gravity in Latin America*
18:05 - 18:45		***Discussion***

Can we learn from IAGBN: its development and disappearance?

Ludger Timmen, Leibniz University Hannover, Institute of Geodesy, Germany

In the 1980th, the development of a new global network started. The objectives of the International Absolute Gravity Basestation Network (IAGBN) were (1) to provide stable locations for repeated testing of absolute gravimeters, (2) to monitor gravity changes with time, and (3) to establish a strong network for the datum definition of IGSN71. The main purpose of the IAGBN activities aimed at geodynamic investigations on large or even global scale. The IAGBN subset A (global control sites) comprised 36 stations. At least 17 sites were observed by at least one absolute meter and were documented by the working group 2 "Word Gravity Standards". Studying literature, the track of IAGBN got lost in 1995.

IGRF as a Basic Geodetic Infrastructure for Regional Gravity Surveys

Tim E. Jensen, René Forsberg, DTU Space, Denmark

The current global network of gravity stations, IGSN71, represents a basic geodetic infrastructure onto which we relate local or regional gravity surveys to ensure global uniformity. During the past 30 years of carrying out airborne and marine surveys around the world, DTU Space has been tracking down a significant number of IGSN71 stations. Our experience is that most stations are not well described, not maintained and often non-existent. In some countries IGSN71 has been replaced by national networks which are better maintained, but does not necessarily ensure the global consistency of a global network. However, this is often not the case in regions requiring large gravity surveys for building geodetic infrastructure.

The International Gravity Reference Frame: Status and Perspectives

H. Wziontek, Federal Agency for Cartography and Geodesy (BKG), Germany, **S. Bonvalot**, Bureau Gravimetrique International (BGI), France, and the members of IAG JWG 2.1.1

After agreement on the definition of the International Gravity Reference System, a major challenge is the realization of the International Gravity Reference Frame. It requires a global cooperation between IAG and institutions, agencies and governmental bodies in charge of geodetic infrastructure. Besides a status update, current efforts of IAG JWG 2.1.1 and next steps are discussed.

RG 2000, a modern national gravity network based on observations with several different types of gravimeters

Andreas Engfeldt, Lantmäteriet, Sweden

The observations in the Swedish national gravity network, RG 2000, were performed with several different types of instruments, of the absolute gravimeter brands FG5 and A10 and the relative gravimeter brands LaCoste & Romberg and Scintrex. Even if the observations are up to 40 years old and spread through time, they are combined in an optimal way forming a very modern and accurate gravity network. Here, it will be described how the different observations are combined, how this network can be adapted to an international reference frame and how other countries can make new reference frames based on the international reference frame.

Hierarchical connection of the zero and first order gravity networks in Finland to the IGRF

Jaakko Mäkinen[1], Mirjam Bilker-Koivula[1], Marcin Sękowski[2], Jyri Näränen[1], Hannu Ruotsalainen[1], Arttu Raja-Halli[1], Heikki Virtanen[1]. 1- Finnish Geospatial Research Institute, FGI, of the National Land Survey of Finland, 2 - Institute of Geodesy and Cartography, Poland

The FGI maintains time series of absolute-gravity (AG) measurements at 19 locations in Finland with the FG5X-221 gravimeter, which is the national standard of free-fall acceleration in Finland. The stations of the AG network are co-located with stations of the permanent GNSS network FinnRef. Together with the FG5X observations, the FinnRef network will form the backbone of all Finnish national reference systems in the future. At present, the AG time series at seven stations are sufficiently long such that gravity trends can be estimated. The AG network has laboratory-type sites. It serves as the zero-order gravity network and is connected to the IGRF through the use of the FG5X-221 and following of the IGRS conventions for processing of the data. This AG network is used for maintaining the gravity reference and for studies of the variation in gravity e.g. due to the Glacial Isostatic Adjustment GIA. On the other hand, access to gravity reference values for more practical purposes, say gravity surveys in geodesy and applied geophysics, is provided by the First Order Gravity Net FOGN. It was first measured in 1962 with a Worden Master gravimeter, covering the whole country with 41 stations and maintained with LaCoste and Romberg meters over the years. The stations are outdoors, attached to monumental buildings like churches, and accessible at any hour without prior arrangements. In 2009-2010 the FOGN was renovated in cooperation with the Institute of Geodesy and Cartography (IGiK, Warsaw). With the A10-020 of the IGiK altogether 51 FOGN stations were occupied, including the original FOGN stations (29 were preserved) or at least their sites wherever possible. We discuss how the FOGN is tied to the IGRF. In the A10-020 campaigns, 7 stations of the AG network were occupied 26 times in all. We derive the datum of the FOGN by comparing the A10-020 results at the AG stations with the time evolution of gravity at them, essentially with the fitted FG5(X)-221 trends. We discuss the model for such a procedure and its implications. We compare them with the method recently adopted for some similar projects where the A10 station values were directly referred to Comparison Reference Values of absolute gravimeter comparisons, bypassing the national AG network/time series.

Modernization and current status of the Polish gravity control

P. Dykowski, J. Kryński, Centre of Geodesy and Geodynamics, Institute of Geodesy and Cartography,
T. Olszak, Department of Geodesy and Cartography, Warsaw University of Technology

Gravity control in Poland had been modernized in the years 2011 - 2015. The goal for the modernization was to renew/remeasure the POGK99 gravity network established in mid 1990s and propose the most efficient way to proceed with the use of the state of the art gravity instruments and methods. The realization of the project consisted of three major steps: 1) the preparation of a detail technical project, 2) gravity surveys, 3) processing of gravity measurements. The review of the POKG99 gravity network showed a 30% of its gravity stations being destroyed or unusable. Thus, the old gravity network could not be remeasured in its original state. The new gravity control was designed to consist of absolute gravity stations only: fundamental stations measured with the FG5 gravimeter, and base stations measured with the A10 gravimeter. To ensure a reliable link to the old gravity control, stations selected for the new gravity control included all possible old gravity network (90) stations that fulfilled the requirements for absolute gravity stations. The technical project also included the requirements for quality control based on gravimeter calibrations and link to the international gravity reference level. Majority of gravity measurements were carried out separately on the fundamental and base stations in 2012 and 2013. Gravity at fundamental stations (28) were measured with the FG5-230 gravimeter (owned by the Warsaw University of Technology), while at base stations (168) - with the A10-020 gravimeter (owned by the Institute of Geodesy and Cartography - IGiK). On each fundamental and base station vertical gravity gradients were determined. Both the A10 and FG5 gravimeters participated in the 2013 ICAG meeting allowing the modernized Polish Gravity Control to be linked to the international gravity reference level. Gravimetric calibration baselines: two meridional ones running from southern border to the Baltic See cost, and two vertical ones, one in the Tatra mountains and one in the Sudety mountains, are integral part of the modernized Polish Gravity Control. Laser, clock and barometer of both A10 and FG5 gravimeters were calibrated at the Central Office of Measures in Poland to assure quality control. Both instruments participated in local AG inter-comparisons as well as performed regular absolute gravity measurements at their designated Observatories in Jozefoslaw (FG5-230) and Borowa Gora (A10-020). In the final stage, processing of the measurements included uncertainty evaluation as well as the developing of the map of differences between POG14 and POGK99 gravity systems. Complementary measurements were done in 2014 and 2015. Additionally, within the EPOS-PL project, IGiK performed regular gravity measurements with the A10-020 on 5 POG stations in the Upper Silesian region as well as regular measurements on the field station at the Borowa Góra Observatory, giving indication on the stability of POG gravity values over time. Time interval for remeasurement of the POG gravity control will be discussed.

The Status of the Hungarian Gravimetric Network

Márta Kis Ph.D., Supervisory Authority of Regulatory Affairs (SZTFH), Hungary

The Hungarian Gravimetric Network (MGH) has been existing since the early 1950s, it was created and maintained, developed by the Eötvös Lorand Geophysical Institute of the Hungarian State (MÁELGI) and its successors. Presently, as the actual successor of Mining and Geological Survey of Hungary, MGH is handled by the Supervisory Authority of Regulatory Affairs (SZTFH, Budapest, Hungary). The network went through modernization; following the earlier 'Vienna' and 'Potsdam' reference systems it has been absolute-based, since the late 1980s. The latest adjustment of the network was performed in 2013, where the mean error was ±0.01386 mGal. The MGH recently contains 25 absolute (0th order) stations, as well as 435 1st and 2nd order base points. In order to improve the reliability and accuracy of the network, the absolute value of gravity acceleration is redetermined in every 7-10 years on 'normal' absolute stations, furthermore in every 2-7 years on the national gravimetric main base point (in the Budapest-Mátyáshegy Gravity and Geodynamical Observatory). The absolute (0th order) stations of the network form the 'national gravity etalon' in Hungary, where the term is the actualization of absolute g values within 10 years on every station. In Hungary 82 absolute measurements have been carried out since 1978. Hungary doesn't possess absolute gravimeter, the measurements are ordered (ab. 3 stations in every year). From 2007 until now, the absolute measurements in Hungary are carried out by the VÚGTK (Research Institute of Geodesy, Topography and Cartography, v.v.i.), Czech Republik.

Before (or within a short time interval around) the absolute measurements, vertical gravity gradient (VG) values are determined on the stations by LCR-G relative gravity meters, using a 3-level arrangement and at least 6 series of measurements of 2-3 instruments. In 2 observatories operated by the SZTFH, in Budapest and Tihany, changes of gravity field are continuously monitored by relative LCR-G gravity meters. In the 1990s a partial network of MGH consisting of 45 adequately selected 0th, 1st and some 2nd order base points joined the Unified European Gravimetric Network (UEGN). This partial network was then connected to corresponding base points of Austrian and Slovakian networks, based on cooperation with BEV (Federal Office of Metrology and Surveying, Austria) and GKÚ (Geodetic and Cartographic Institute Bratislava, Slovakia). Recent questions, open problems of the network maintenance will be also discussed.

Establishment of a modern gravity control in Ireland

P. Dykowski[1], J. Kryński[1], M. Sękowski[1], P. Kane[2], K. Fitzpatrick[2]. 1 - Centre of Geodesy and Geodynamics, Institute of Geodesy and Cartography, 2 - Ordnance Survey Ireland

The project for the establishment of a modern gravity control for Ireland, entitled Absolute Gravity Network Ireland, had been initiated by Ordnance Survey Ireland (Republic of Ireland) and Land and Property Services (Northern Ireland) with the support of the Institute of Geodesy and Cartography (Poland). This presentation includes the principles behind the design as well as current progress.

The final number of measured stations of the newly established network includes 64 stations of gravity control, including 6 stations of the gravimetric calibration baseline. Whenever possible, gravity network stations had been collocated with GNSS stations. At the same time all stations are connected to national vertical control for a reliable height reference together with a precise position determination in the national reference frame. Gravimetric calibration baseline stations are located indoors. Their design includes maximum gravity difference with minimum driving distance. Survey plan also includes gravity resurvey of all previously established reference stations identified in Ireland (7 locations from 1960s-70s) to create a link between the old and newly established gravity datum. Special emphasis is put on the quality assurance of the reference gravity value following the current developments of the new definition of the International Gravity Reference System.

As stations are designed to be located in the open field, the A10 absolute gravimeter (sn 020), owned by the Institute of Geodesy and Cartography, Warsaw, Poland, was implemented. At all stations where the A10 gravimeter was employed vertical gravity gradient was determined for a reliable reduction of the measured gravity to the benchmark level. This was done with LaCoste&Romberg (LCR) model G gravimeters equipped with feedback systems. The absolute gravimeter employed to gravity determination on network stations will be linked to the international gravity reference level. Additionally the A10 gravimeter sub components (laser, clock, and barometer) were periodically calibrated. The LCR gravimeter throughout the project will be regularly calibrated on Polish calibration gravimetric baselines.

Separate part of the project is related to the evaluation of the ocean tidal loading effect which in Ireland can reach ±15 µGal. The evaluation was done upon tidal records of an LCR model G gravimeter with a self-made recording system at a carefully prepared location in Dublin, Republic of Ireland (record from September 2018 till February 2021).

Contribution of Federal Office of Metrology and Surveying (BEV) to the International Gravity Reference Frame

Christian Ullrich, Federal Office of Metrology and Surveying (BEV)

The Federal Office of Metrology and Surveying (BEV) operates absolute gravity meter since 1987. In Austria and in more than ten European countries absolute gravity measurements were performed. Most of this stations can be used for the IGRF. In Austria the BEV maintains also the national standard for gravimetry, which is validated and confirmed regularly by international comparisons. The Conrad Observatory can provide a Reference station for the main infrastructure of the IGRF with a continuous operation of a superconducting gravimeter (SG) in combination with repeated absolute gravity measurements.

Status of the German Gravity Nets

Falk, R., Müller, J., Reinhold, A., Rülke, A., Wziontek, H., Federal Agency for Cartography and Geodesy (BKG), Germany

The maintenance and periodic observation of the German Basic Gravity Net (DSGN2016) using FG5 absolute gravimeters is a primary task of the BKG gravity group. Also many of the stations of the German Main Gravity net (DHSN2016) in responsibility of the individual German States will be observed using A10 absolute gravimeters by BKG. Both network designs will be presented and latest results discussed.

The status of the Czech Gravity Network

Martin Lederer[1], Otakar Nesvadba[1], Vojtech Pálinkáš[2]. 1 - Land Survey Office in Prague, 2 - Research Institute of Geodesy, Topography and Cartography, v.v.i.

The Czech Gravity Network originated in the fifties of the last century. Four gravity systems have been established up to now. The last two were already connected to the gravity stations observed with a ballistic absolute gravimeter.The recent Czech Gravity System – S-Gr10 - is strongly connected to the absolute value via 36 absolute stations, the Pecny station included.

UK Absolute Gravimetry: Status and Future

Smith, V. A.

Absolute gravity measurements in the UK have been managed from the Space Geodesy Facility (SGF), at Herstmonceux, since 2013 when the two AGs from the National Oceanography Laboratory were added to the existing capability of a single FG5 AG. The UK's AG programme has gone through several iterations over the years but continues to be based on a handful of sites only. Currently only the site at Herstmonceux is active, since 2007, continuing to take weekly AG measurements whenever possible. A new site is in the process of being assessed at the British Geological Survey geomagnetic observatory at Hartland in the SW of England. Early data from Hartland is encouraging both for geodetic research and as a possible site for mini-comparisons. An overview of both of these sites will be given and plans to measure at a handful of other locations in the UK will be discussed. We propose supplying monthly data from the Herstmonceux site for the first ITGRF.

National report on gravity network in Slovakia: Absolute gravity points in Slovakia from perspective of IGRF and other related issues

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Our joint, national authority and university, contribution is prepared as a brief report focused primarily on the present status of the National Gravimetric Network (NGN). NGN represents the gravimetric geodetic controls of Slovakia. NGN consists of three orders of gravity network points. Points of order 0 represent the absolute gravity points stabilised inside of buildings with repeated absolute gravity observations. 1st and 2nd order NGN points are stabilised in the field with the gravity acceleration determined by relative gravimeters by adjustment of relative measurements tied to NGN points of the order 0. Recent Slovakian gravimetric reference system is S-Gr95 is based on 10 absolute gravity points. Currently the modernization of the NGN is planned in a way that it will consist only of 0th and 1st order points with the new absolute gravity measurements. 1st order points will be determined by field absolute gravimeters. Apart from NGS, two gravity calibration lines were built in Slovakia. Microgravity line in Modra-Piesok with 21 mGal gravity difference focused on calibration of micrometer screws of relative gravimeters and vertical gravity baseline Gánovce – Lomnický štít in High Tatra Mountains with gravity difference over 400 mGal for general relative gravimeters calibrations. Determination of final gravity values of the vertical gravimetric baseline is now under preparation. Both NGN and gravity baselines are administered by Geodetic and Cartographic Institute in Bratislava. Research and development in gravity field and theory is mainly done at the Slovak University of Technology in Bratislava (SUT) and Slovak Academy of Science (SAS). SUT operates the gravimetric observatory in Hurbanovo equipped with the tidal gravimeter gPhoneX #108. Hurbanovo station joined the IGETS network in 2021. SUT also perform absolute gravity measurements and research with absolute gravimeter FG5X-247. SAS perform gravity research focused on extensometric measurements, vertical gravity gradients and various geophysical applications.

Slovakia is willing to contribute to IGRF with NGN point/points which fulfil suggested requirements.

An assessment on the Mexico gravity network and its integration to IGRF

David Avalos[1], Apolo Alvarado[1], Marco Mendoza[2], Francisco Medina[1], Jordan Robles[1], Giovani Sarabia[1], Javier Arellano[1] . 1 - National Institute of Statistics and Geography of Mexico (INEGI),
2 - INEGI Spiros Pagiatakis, Department of Earth and Atmospheric Science, York University, Toronto, Ontario, Canada

The National Institute of Statistics and Geography of Mexico (INEGI) has developed a study on the national first-order gravity network (RGBN) to assess its current state in terms of accuracy and reveal the difference between its current gravity values and the corresponding ones. to the new standard prescribed by the International Gravity Reference System (IGRS). As the IAG recommends that National Geodetic Agencies formally adopt the IGRS, it becomes relevant for decision makers to understand the impact of promoting a change in the official geodetic reference frame. In 2018, the IGRS was carried out in Mexico through a set of 19 absolute gravity stations. Twelve of those stations were selected as reference stations in an experimental overall fit of the entire first-order national gravity network, which is composed of nearly 600 base stations linked by more than 9,000 relative gravity observations spanning 38 years (1962- 2020). This represents a robust network that allows the determination of accurate gravity values. We show that the difference between the IGSN71 and IGRF gravity values is on average at the level of 0.050 mGal with some extreme values reaching several mGal, which will be analyzed in a later stage. We present a comprehensive analysis of the results, including estimates of time variation in gravity (g-dot), and provide next steps for further improvement.

Implementation of the Absolute Gravity Network for Colombia – RGAC

Matiz-León, J.C.[1], Moisés-Sepúlveda, L.J.[2], Gabalda, G.[3,4,5], Hernandez-Beltrán, D.A.[2], Pardo-López, Y.J.[1] , Cortes-Bolívar, D.A.[2], & Bonvalot, S.[3,4,5]. 1 - Servicio Geológico Colombiano (SGC), 2 - Instituto Geográfico Agustín Codazzi (IGAC), 3 - Institut de Recherche pour le Développement (IRD), 4 - Bureau Gravimétrique International (BGI), 5 - Geosciences Environnement Toulouse (GET)

The implementation of the Absolute Gravity Network for Colombia (RGAC) was carried out during February-March 2022, with 26 stations in about 21 cities of the Colombian territory. The objectives of the RGAC consisted of densifying absolute vertices throughout the country for improving the national gravity infrastructure in various fields of applications such as: (i) the realization of the gravity networks of order 1, 2 and 3, (ii) the generation of calibration lines with for the relative gravimeters; (iii) the availability of reference absolute gravity values in the vicinity of exploration areas of subsoil resources such as geothermal resources, hydrocarbons, minerals, among others; (iv) the inclusion of the gravity variable for GNSS stations used in the International Height Reference Frame (IHRF) and the contribution to the establishment of the International Gravity Reference Frame ; (v) the possibility of calculating with less uncertainty the geopotential numbers of the gravity field in Colombia, updating the geoidal model. According to these objectives, the measurements were performed in different places including several types of conditions: possible long term maintenance and stability of the site, easy access facilities for different users from industry and academia, possible colocation with permanent GNSS station, etc. The selected points were located in 12 universities, 1 museum, 1 private company and 2 governmental entities (and their different national headquarters). In turn, they were located in 19 permanent GNSS tracking stations, 1 tide gauge, 3 stations related to the IHRF. A calibration line was also created between the stations located in the urban part of the city of Bogota (National Astronomical Observatory, IGAC, SGC, UD and UMNG) between 2556 m and 2640 m, and the Guadalupe station at 3270 m. The coverage and extension of the RGAC is national in scope, and focuses on the entire Andean component (Eastern, Central and Western Cordilleras), part of the Pacific and a large sector of the Atlantic coast, covering an area of about 400,000 square kilometres. The RGAC was developed by the Servicio Geológico Colombiano (SGC) through its Geothermal Research Group, the Instituto Geográfico Agustín Codazzi (IGAC), the French Research Institute for Development (IRD) with the support of the Bureau Gravimetrique International (BGI). The absolute gravity measurements were carried out with the Micro-g Lacoste (MGL) A10 #014 from IRD/GET/BGI, and the local gravity gradients were determined with Scintrex CG6 gravity meters from SGC and ICAG. We present here the main objectives and results of the Feb-March gravity survey.

Absolute Gravity efforts in the United States

Derek van Westrum, NOAA - National Geodetic Survey

I will provide a brief update on the absolute gravity activities conducted by NGS as well as those of other agencies in the U.S. I will also provide some details on the upcoming ICAG2023 to be hosted at Table Mountain, Colorado.

Reference Gravity in Latin America

Denizar Blitzkow, Laboratório de Topografia e Geodesia, Programa de Pós-graduação em Engenharia de Transportes, Escola Politécnica da Universidade de São Paulo, São Paulo, Brazil and Centro de Estudo de Geodesia - CENEGEO, São Paulo, Brazil. **Ana Cristina Oliveira Cancoro de Matos**, Centro de Estudo de Geodesia - CENEGEO, São Paulo, Brazil. **Gabriel do Nascimento Guimarães,** Faculdade de Engenharia Civil, Universidade Federal de Uberlândia, Minas Gerais, Brazil. **Iuri Moraes Bjorkstrom,** GeoVertentes Engenharia Geográfica, São Paulo, Brazil.

The establishment of the Reference Gravity (IGRF) with the absolute gravimeter A10, serial number 032 (A10#032) in Latin America has been undertaken under the coordination of the EPUSP/LTG (Escola Politécnica da USP / Laboratório de Topografia e Geodesia) and CENEGEO (Centro de Estudos de Geodesia), with the support of the IGC (Instituto Geográfico e Cartográfico do Estado de São Paulo) and countless institutions in different countries. In Brazil, measurements were taken in the states of São Paulo, Minas Gerais, Paraná and along a profile from Manaus (Amazonas) to Sant'Ana do Livramento (Rio Grande do Sul). Out of Brazil, measurements were taken in Argentina, Costa Rica, Ecuador, Uruguay and Venezuela. In the future, it is intended to extend the efforts with new stations in Brazil and Paraguay. The absolute gravimeter A10#032 is manufactured by Micro-g LaCoste, purchased by IGC. The instrument has a nominal accuracy of ± 10 µGal. The results are usually above the nominal value due to the station noise conditions and other factors. It works through the free fall of a prism, inserted in a vacuum chamber. Laser interferometry allows the determination of the time of the fall with high accuracy. A rubidium atomic oscillator is part of the equipment. Recently, a new effort has been carried out to improve the determination of the local gradient. Measurements have been undertaken in Brazil, Argentina and Ecuador with CG5 relative gravitymeter.