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2004

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International Union of Geodesy and Geophysics

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FOREWORD

Ole B. Andersen (IAG Information Editor)

Every four years, after every General Assembly, the International Association of Geodesy publishes the Geodesist's Handbook as a special issue of the Journal of Geodesy. This is the 7th edition of this Geodesists handbook describing the International Association of Geodesy.

This issue of the Geodesist Handbook describes the new structure of the IAG established prior to and at the IUGG XXXIII General Assembly in Sapporo, July, 2003.

The structuring of the Geodesist Handbook 2004 is also changed compared with previous versions to reflect the new structure of the IAG.

The first part describes the new IAG structure for the period 2003–2007. It contains an introduction, history, the IAG internet pages as well as and overview of the IUGG and IAG structure.

The second part contains the detailed description of the structure and organization of the International Association of Geodesy for the 2003–2007 period.

The third part is a report of the XXXIIrd General Assembly, held in Sapporo in July, 2003. This part contains the presidents address, Guy Bomford price and Levallois price acceptance, Meeting reports, Secretary Generals report and resolutions adopted by the IUGG.

The fourth part describes the administration of the IAG and includes the new statutes and bylaws as adopted on the 8th August, 2001, as well and rules for the IAG.

The fifth part presents scientific and miscellaneous information related to geodesy. The most recent listing of parameters of common relevance of astronomy, geodesy and geodynamics by E. Groten is found. Information on educational establishment, datacenters, national representatives, publications is also found in this final part along with the IAG Directory listing of names and addresses of persons related to the International Association of Geodesy.

I would like to thank all the individuals and institutions, who provided the information to be included in this Geodesist's Handbook 2004 and took the time to send corrections or proof-read documents.

I would like to thank the IAG Central Bureau and C. S. Pedersen as well as Andreas Lemark and Anders Almholt for helping me out in the editing of the individual contributions.

Most of the information contained in this volume is also available on the IAG Web pages

http://www.iag-aig.org

Here you will always find the most recent version of the documents appearing in the Geodesists Handbook, as well as other relevant information to geodesy.

Corrections and updates to the Geodesist's Handbook will be published in the IAG Newsletter, as part of the Journal of Geodesy.

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The New IAG Structure

President of IAG: **G. Beutler** (Switzerland)

Gerhard Beutler

Preamble

The Statutes and By-Laws of the Association, as they were accepted by the IAG Council at the IAG Scientific Assembly 2001 in Budapest, are included in this new edition of the Geodesist's Handbook 2004. Consequently, these introductory remarks concerning the IAG Structure 2003–2007 are redundant, by definition. The only excuse to write these lines resides in the experience that many colleagues – geodesists, surveyors and geophysicists – start yawning when reading expressions like "Statutes" and "By-Laws".

The author of this "Explanatory Supplement" hopes to have extracted the essence of the new IAG in a less formal, but still informative way. As the full text of the Statutes and By-Laws is available in this Volume, it is allowed to mention only the more relevant elements and facts, subsequently.

The restructuring process 1999–2003 was deep and fundamental. The key elements were:

– the new structure should have a focus
– the new structure should be based on the three pillars of modern geodesy, namely the geometric shape of the Earth, the Earth's gravity field, and the orientation of the Earth in space.
– the new structure should (better) incorporate the very successful IAG services, among other by a representation in the IAG Executive Committee.

It is very interesting to look at the "new IAG" from the perspective of history. This was done by Beutler et al. (2004), also included in this Volume.

1 The road from Birmingham (1999) to Sapporo (2003)

The new IAG structure was developed after the IUGG General Assembly in Birmingham in summer 1999. Between the summer 1999 and the summer 2001 a thorough review of the IAG work and structure was performed by the so-called IAG Review Committee, the work of which is documented by Beutler et al. (2002). The list of authors of this document also is identical with the list of members of the IAG Review Committee.

The report was presented to the IAG Scientific Assembly in Budapest in September 2001 in Budapest. The proposed new structure was accepted by the IAG Executive Committee and later on by the IAG Council, which held an extraordinary meeting on September 8,2001 in Budapest. At the same meeting Rummel et al. (2002) proposed to create the the Integrated Global Geodetic Observing System (IGGOS) as IAG's first project. After the Budapest Scientific Assembly the IAG Review Committee was abolished and the IAG Committee for the Realization of the New IAG Structure was created. It was in essence composed of the IAG Executive, augmented by few experts from services and regions. The committee members were:

– Gerhard Beutler (IAG first Vice-President, Chair of Committee)
– Fernando Sanso (IAG President)
– Christian C. Tscherning (IAG Secretary General)
– Alan Dodson (President Section I)
– C.K. Shum (President Section II)
– Michael G. Sideris (President Section III)

- Bernhard Heck (President Section IV)
- Klaus Peter Schwarz (Past President of IAG)
- Ruth E. Neilan (Director IGS Central Bureau)
- John Manning (Representative of Southern Hemisphere)

The work of mapping the old structure into the new one, of creating the planning group for the Inter-commission Committee (ICC) on Theory, and of issuing the call for proposals for the Outreach Branch was given to the IAG Committee for the Realization of the new IAG structure. It was decided furthermore that the creation of a planning group for the IAG Project called IGGOS (Integrated Global Geodetic Observing System) should be left to the initiative of Reiner Rummel and Gerhard Beutler (see Beutler et al. 2004). The IAG Committee for the realization of the new IAG structure held three meeting (on September 6, 2001 in Budapest, on December 11, 2001 in San Francisco, and on April 26, 2002 in Nice).

2 The essence of the new IAG Statutes and By-Laws

The IAG statutes say: "The Mission of the Association is the advancement of geodesy, an Earth science that includes the study of the planets and their satellites. The IAG implements its mission by advancing geodetic theory through research and teaching, by collecting, analyzing, and modeling observational data, by stimulating technological development and by providing a consistent representation of the figure, rotation, and gravity field of the Earth and planets and their temporal variations".

The mission statement is very broad by including our Moon, the planets of the solar system, and perhaps even satellites of other planets (than the Earth) into the sphere of interests and activities of the Association. We will see below that this broad understanding is reflected by the new structure.

The Association's objectives are stated in the IAG Statutes, as well (please consult this document for more information). The scientific work of the Association is further specified in greater detail the new IAG By-Laws: The scientific work of the Association shall be performed within a component-structure consisting of:

- Commissions
- Services
- Inter-commission Committees
- the Communication and Outreach Branch, and
- IAG Projects,

hereafter called the Association components or components. When comparing the previous with the new structure we find that the Services are mentioned for the first time as IAG components on the same level of the hierarchy as the Commissions. The new structure was simplified insofar as the old "section-level" was abolished.

The Communication and Outreach Branch, Inter-commission Committees (ICCs), and IAG project(s) are new structure elements. Let us briefly browse through these elements. We only include the general definitions and remarks. The Terms of Reference of the components for the time period 2003–2007 may be found in this Volume, as well.

2.1 Commissions

Commission 1: Reference Frames
(President: Hermann Drewes)

The objectives of Commission 1 are:

- The establishment, maintenance, improvement of the geodetic reference frames.
- Advanced terrestrial and space observation technique development for the above purposes.
- International collaboration for the definition and deployment of networks of terrestrially-based space geodetic observatories.
- Theory and coordination of astrometric observation for reference frame purposes.
- Collaboration with space geodesy/reference frame related international services, agencies and organizations.

Commission 2: Gravity Field
(President: Chris Jekeli)

The objectives of Commission 2 are:

- Terrestrial, marine, and airborne gravimetry.
- Satellite gravity field observations.
- Gravity field modeling.
- Time-variable gravity field.
- Geoid determination.
- Satellite orbit modeling and determination.

Commission 3: Earth Rotation and Geodynamics
(President: Véronique Déhant)

The objectives of Commission 3 are:

- Earth Orientation (Earth rotation, polar motion, nutation and precession).
- Earth tides.
- Tectonics and Crustal Deformation.
- Sea surface topography and sea level changes.
- Planetary and lunar dynamics.
- Effects of the Earth's fluid layers (e.g., post glacial rebound, loading).

Commission 4: Positioning and Applications
(President: Chris Rizos)

The objectives of Commission 4 are:

- Terrestrial and satellite-based positioning systems development, including sensor and information fusion.
- Navigation and guidance of platforms.

- Interferometric laser and radar applications (e.g., Synthetic Aperture Radar).
- Applications of geodetic positioning using three dimensional geodetic networks (passive and active networks), including monitoring of deformations.
- Applications of geodesy to engineering.
- Atmospheric investigations using space geodetic techniques.

Each Commission has a Steering Committee, with a maximum of twelve voting members, who define the appropriate sub-structure of the Commission, which may consist of the following components:

- Sub-commissions,
- Study Groups.
- Commission Projects

The Commissions were encouraged to set up inter-commission components and components together with the ICCs.

2.2 Services

All services somehow associated with the IAG in the past were invited to become official IAG Services under the new structure. The following services decided to follow this invitation in the sense defined by the new IAG Statutes and By-Laws:

- IERS (International Earth Rotation and Reference Systems Service)
- IGS (International GPS Service)
- ILRS (International Laser Ranging Service)
- IVS (International VLBI Service for Geodesy and Astrometry)
- IGFS (International Gravity Field Service)
- IDS (International DORIS Service)
- BGI (International Gravimetric Bureau)
- IGES (International Geoid Service)
- ICET (International Centre for Earth Tides) (Belgium)
- PSMSL (Permanent Service for Mean Sea Level)
- BIPM (Bureau International de Poids and Measure - time section)
- IBS (IAG Bibliographic Service).

The IAG services work in a relatively independent way. Their decision to join the IAG as services in the sense of the new Statutes and By-Laws could not be "enforced" by the IAG. They are represented in the IAG Executive Committee by three members. This implies that the three representatives do not represent all the services.

IAG has a mix of very old and very young services. Their history is very interesting. Consult Beutler et al. (2004) for more information.

2.3 Inter-commission Committees

The establishment of Inter-commission Committees (ICCs) was not a trivial task. The idea of ICCs emerged when discussing the future of Section IV "General Theory and Methodology" of the old IAG structure. The construction was triggered on one hand by the insight that "theory" should not (and cannot) be handled within one theory-oriented Commission only, but that theory must be an integrated part of all Commissions. It was also clear, on the other hand, that there are disciplines related to theory which cannot be dealt with within one Commission, but which are relevant to all Commissions. For problems of this kind a coordinating entity seemed to be necessary. The opinion of the IAG Committee on the New Structure and (later on) of the IAG Executive Committee (old and new) is very well captured by the definition given in the By-Laws:

"Inter-commission Committees handle important and permanent tasks involving all Commissions. Each Inter-commission Committee shall have a steering committee consisting of the following membership:

- President appointed by the IAG Executive Committee.
- Vice-president appointed by the IAG Executive Committee.
- One representative from each Commission.

The terms of reference for each Inter-commission Committee shall be developed by a planning group appointed by the IAG Executive Committee. The Inter-commission Committees report to the IAG Executive Committee. The Inter-commission Committee will be reviewed every eight years."

When reading the Terms of Reference of the ICCs, one might get the impression that the above definition is not (always) literally observed. There are, e.g., purely internal Working Groups in in the ICC on Theory. This exception was approved by the Executive Committee.

One may be moreover amazed to find not only the ICC on Theory (chaired by Peiliang Xu), but also proposals for an ICC on Planetary Geodesy and for an ICC on Geodetic Standards. The IAG Council authorized the IAG Executive Committee to set up the two ICCs, provided the planning groups could finalize the preparatory work. Currently, the planning groups for both ICCs are finalizing their preparatory work. Intermediary reports of the planning groups are contained in this Volume.

The ICC on Planetary Geodesy is an excellent example for an ICC in the spirit of the above definition: The exploration of the Moon and of planets (other than the Earth) using geodetic techniques is, in particular in view of the "race to Mars" of the prominent space agencies taking place currently, a hot topic and should undoubtedly be addressed by IAG. It is also crystal clear that the topic involves all IAG Commissions. The same is also true in the case of the ICC on Standards: IAG must make available fundamental constants, etc., and speak with one tongue in such questions. This task shall be delegated to the ICC on Standards. In order to accomplish the task, the ICC has to maintain very close links to the Commissions, but in this case also to the IAG Services; in particular to the IERS, maintaining the well-known IERS Conventions.

2.4 The IAG Project

The new structure allows it to create IAG projects. IAG projects are, as a matter of fact, a (and perhaps the) essential element to realize a focus in the work of the Association. Let us again quote the IAG By-Laws:

"IAG Projects are of a broad scope and of highest interest and importance for the entire field of geodesy. These projects serve as the flagships of the Association for a long time period (decade or longer).

The IAG Executive Committee shall appoint planning groups for the creation of each IAG Project. Each IAG Project shall have a Project Steering Committee consisting of the following membership:

- The project chair appointed by the IAG Executive Committee
- One member from each Commission appointed by the Commissions'
- Steering Committees
- Two Members-at-Large proposed by the members of the Project
- Steering Committee and approved by the IAG Executive Committee
- Chairs of the IAG Project sub-groups (if any).

In the IAG Structure 2003–2007 there is exactly one project, the IGGOS, standing for Integrated Global Geodetic Observing System. A planning group for the IGGOS was set up at the IAG Scientific Assembly in Budapest, a first meeting was held in May 2002 in Washington, a second one in October 2003 in Munich. The terms of Reference of the IGGOS project are contained in this volume, as well. More information concerning IGGOS and its importance from the perspective of history may be found in Beutler (2004).

The IGGOS project is chaired by Christopher Reigber from the GeoForschungsZentrum (GFZ) in Potsdam. With this appointment the IAG goes back, at least geographically, to its roots: Friedrich Robert Helmert, the first director of the IAG Central Bureau, was residing in Potsdam as well – as a matter of fact in the same building and at the same desk as the IGGOS president. We of course all assume that the "genius loci" will make IGGOS a great success.

2.5 Communication and Outreach Branch

Nowadays, Communication and Outreach are of eminent importance, not only in politics, but also in science. This aspect shall be in particular dealt with by the so-called IAG Communication and Outreach Branch.

Let us again quote the relevant definition from the IAG By-Laws: "The Communication and Outreach Branch provides the Association with communication, educational/public information and outreach links to the membership, to other scientific Associations and to the world as a whole.

The responsibilities shall include the following tasks:

- Promote the recognition and usefulness of geodesy in general and IAG in particular.
- Publications (newsletters)
- Membership development.
- General information service and outreach.

The Communication and Outreach Branch may also assist the IAG Central Bureau in the following tasks:

- Maintenance of the IAG Web page,
- Setting up Association schools,
- Setting up meetings and conferences,
- Maintaining the Bibliographic Service.

A Call for Proposals was sent out in fall 2002. IAG was very lucky to be able to make its final selection from various excellent proposals. Eventually, the proposal of the Budapest University of Technology and Economics was accepted. Jozsef Adam is the director of the Communication and Outreach Branch. The address of the new IAG homepage is "www.iag-aig.org".

3 Individual Membership

The Membership of the Association consists of Countries, Candidate Members, Individual Members and Fellows. The individual membership is a new element of the new IAG structure. It is the attempt of the Association to improve the "IAG esprit de corps". The rights and privileges of individual members are listed in the IAG By-Laws. The membership lets you take part more actively in the life of the association. It is accompanied by a modest annual fee, which, in the good old IAG tradition is used primarily to support our young colleagues and our colleagues from developing countries. Membership forms may be downloaded from the IAG homepage (www.iag-aig.org). You also find a specimen attached to this report.

4 Concluding Remarks

The IAG Review and restructuring process was long and (to a certain extent) exhausting. The result is interesting and promising. The new structure is, of course, also a compromise of (at times very) different positions, attitudes, and opinions. Be this as it may: The time of restructuring is over. We now have to bring the Association, within the new framework, to life and to work.

I am personally looking forward to four years of hard, but also rewarding work. It will be in particular of greatest importance that the interface between commissions and services is defined properly, that frictions between Commissions and Inter-commission Committees are minimized, and, last but not least, that the IGGOS actually develops into the proud IAG flagship – as it is supposed to be according to the IAG By-Laws.

References

Beutler G, Brunner F, Dickey J, Feissel M, Forsberg R, Mueller II, Rummel R, Sanso F, Schwarz K-P (2002) The IAG review 2000–2001: Executive summary. International Association of Geodesy Symposia, Vol. 125, 603–608

Rummel R, Drewes H, Beutler G (2002) The IAG review 2000-2001:Executive summary. International Association of Geodesy Symposia, Vol. 125, 603–608.

Beutler G, Drewes H, Verdun A (2004) The new structure of the International Association of Geodesy (IAG) viewed from the perspective of history. Geodesist's Handbook 2004. Journal of Geodesy, this Volume.

Membership Application Form 2004

Please complete and send to: IAG Central Bureau, c/o University of Copenhagen, Department of Geophysics, Juliane Maries Vej 30, DK-2100 Copenhagen O, Denmark. Fax: +45 35365357 http://www.gfy.ku.dk/~iag/

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3. Earth Rotation and Geodynamics ☐ 4. Positioning and Applications ☐

I wish to be admitted as a member of the International Association of Geodesy (IAG) because I am/have participated in IAG activities ☐ and/or I work in geodesy ☐

Signature		Date	

The new structure of the International Association of Geodesy (IAG) viewed from the perspective of history

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Abstract. The IAG Executive Committee and the IAG Council decided to invoke a thorough review of the IAG and its structure with the goal to create a new, hopefully simpler structure, meeting the needs of the 21st century, at the IAG General Assembly in Birmingham in 1999. The new structure was implemented in 2003 at the XXIII-rd IUGG General Assembly in Sapporo. The new structure should

- have a *focus*
- be based on the three pillars of modern geodesy, namely the *geometric shape of the Earth, the orientation of the Earth in space*, and the *Earth's gravity field*, and
- better incorporate the IAG services

The new structure may be viewed as an attempt to go back to the roots of the IAG, as they were designed and realized by the eminent geodesists and practitioners of the 19th century.

There are remarkable parallels between this first IAG structure and that of 2003: The focus of IAG in the 19th century was the Central European Arc Measurement, in the 21st century it is the Integrated Global Geodetic Observing System (IGGOS). The creation of the *International Latitude Service* (ILS) was a proud achievement of the "old" IAG, today's IAG services are the modern counterpart. The goals of the 19th century IAG were technically achieved by optical (astrometric) observations and politically by international collaboration. The modern tools are the space geodetic techniques (geometric and gravitational), nothing changed on the political level: Only international coordination and collaboration and long-lasting institutional commitments promise satisfactory results.

Key words. Earth observing systems, reference systems, Earth rotation, gravity field, history of geodesy

1 Geodesy and IAG

By the mid-19th century geodesy was established as an independent scientific discipline with a theoretical foundation (containing specialized concepts) and with dedicated observation methods. In the 1880s, *Friedrich Robert Helmert* (see Fig.1) compiled and refined the mathematical and physical theories related to geodesy in his two-volume oeuvre Helmert (1880). He defined the so-called *higher geodesy as the methods to determine the equipotential surfaces and to measure parts of the Earth's surface of arbitrary size by horizontal projection and heights considering the shapes of the equipotential surfaces.*

According to Torge (2001) and (Torge1996), *geodesy is the science of the measurement of the Earth's surface and its external gravity field including temporal variations.* If "measurement of the Earth" is understood to include also the orientation of the Earth in inertial space, then the above definition may be considered as valid for our purpose. Modern geodesy is based on *three pillars*, namely

- The geometric shape of the Earth (land, ice, and ocean surface) as well as its variations with time,
- The orientation of the Earth in space as a function of time (described by the Earth rotation parameters *precession, nutation, length of day, and polar motion*), and
- The Earth's gravity field and its temporal variations.

This definition of modern geodesy was put forward by Rummel et al. (2002), who also made the following proposal in the same article: *We propose, as a candidate IAG project, an Integrated Global Geodetic Observing System (IGGOS). IGGOS should combine – with utmost precision and consistency – the three fundamental areas of geodetic research into one integrated global observation and analysis system for Earth sciences.* The level of relative precision and consistency was specified to be at least at the order of 10^{-9}.

What is the motivation to invoke a large-scale experiment like IGGOS? There were – as often in such cases – many reasons. Let us give three, which we believe to have been of central importance:

– It was inspiring that Prof. Klaus-Peter Schwarz, president of the Association between 1996 and 2000, was convinced that the Association would need a new focus in the new millennium. His questions, concerns, and his convincing power led, among others, to the organization of the IAG Section II Symposium in Munich in October 1998 (documented in Rummel et al. (2000). Many ideas, how to reorganize IAG and how to realize IGGOS within the Association, were discussed for the first time at this symposium. The name *Integrated Global Geodetic Observing System* and the corresponding acronym IGGOS were coined in 1998 in Munich. It was understood, from this point in time onwards, that IGGOS should be considered as the focus for most of the IAG activities.
– The five-section structure of the IAG was implemented already in 1951 at the General Assembly in Brussels and the most recent serious review of the structure took place at the General Assembly in Hamburg in 1983. This development is documented by Table 1 (taken from Beutler 2000). Many important developments, mainly due to the advent of the space age and the advancement of measuring technology, were not reflected by the IAG structure implemented in 1951 or in 1983.
– According to Levallois (1980), the IAG Sections should define the fundamental directions for geodesy and give as complete a picture as possible of current research and results in their fields. Attached to the sections there could be commissions and special study groups. The commissions had the task of dealing with special problems requiring coordinated international action. Often they were centered around a permanent bureau, implying that commissions had a permanent status, as well.

There was overlap between the sections, but there was no such thing as a focus for the entire association. The definition of the essential research topics was left to the five sections. We conclude therefore that the idea of one focal point for the entire association did not exist (nor did it play any role) in the structure established in 1983. The so-called "permanent bureaus" were *not* considered directly as a part of the Association, but only indirectly through the commissions. This set-up assumes that the permanent bureaus have "only" routine and organizational tasks, but certainly no research duties. Research should be performed in the sections, in particular in the study groups.

With the advent of the new space geodetic services, in particular the IERS and the IGS (International GPS Service), the assumptions underlying the old IAG structure were no longer valid: The space geodetic services are most actively involved in geodetic research – one might even say that they lead the research in important areas and that they are very close to what might be the new IAG focus. This new and exiting development was not at all reflected by the old IAG structure. The service-related aspects will be further discussed in Chapter 4.

It became clear at the Munich Section II symposium in 1998, that not only a new focus, but an entire new IAG structure, allowing the Association to focus on a central issue, was required. This is why the IGGOS project and the new IAG structure cannot be separated from each other. At the IAG General Assembly in Birmingham in 1999 the result of four years of analyses of the IAG were presented and discussed at the symposium called *IAG structure to meet future challenges*. It was decided that an *IAG Review Committee* should be given the task to come up with a proposal for a new IAG structure at the IAG Scientific Meeting in 2001 in Budapest. The IAG Review Committee organized a

Fig 1. Friedrich Robert Helmert (1843-1917)

Table 1. The IAG Sections

Section	Year	Title
I	1951	Triangulation
	1971	Control Surveys
	1983	Positioning
II	1951	Precise Leveling
	1971	Satellite Surveys
	1983	Advanced Space Technology
III	1951	Geodetic Astronomy
	1971	Gravimetry
	1983	Determination of the Gravity Field
IV	1951	Gravimetry
	1971	Theory and Evaluation
	1983	General Theory and Methodology
V	1951	Geoid
	1971	Physical Interpretation
	1983	Geodynamics

retreat in February 2000, where experts from geodesy, Earth sciences, government organizations, etc. were invited to develop, together with the committee, a first proposal for the new structure. The committee did then complete its work in a series of meetings, documented its findings in Beutler (2002), drafted new IAG statutes and ByLaws (see IAG homepage, http://www.gfy.ku.dk/~iag/), and presented its work for approval to the IAG Executive Committee and the IAG Council in September 2001 in Budapest. After slight revisions the proposal was approved. The new IAG consists of

– Commisions
– Services
– A Communication and Outreach Branch
– IGGOS as IAG's first project.

The four elements are represented in the IAG Executive Committee. Commissions and services thus are on the same level in the new IAG structure. Moreover, the new Statutes and ByLaws allow it to create an IAG project and so-called inter-commission committees. More details about the new IAG structure may be found in Beutler (2002) and Beutler (2003).

The attempt to establish IGGOS as IAG's first (and only) project should be compared to the creation of the IAG itself in 1864. This aspect will be further pursued in Chapter 2.

The proposal put forward by the IGGOS planning group to the IAG Executive Committee and the IAG Council at the IAG General Assembly in Sapporo contains definition, vision, and mission statements. Moreover, the objectives are specified, a science rationale is provided, and the plan to implement IGGOS is specified. For the complete information we refer to the original text of the proposal (see IAG homepage, http://www.gfy.ku.dk/~iag/). Here we confine ourselves to reproduce the definition statement:

Definition: IGGOS stands for Integrated Global Geodetic Observing System. *System* should be understood as the basis on which the future advances in geosciences can be built. By considering the Earth system as a whole (including solid Earth, atmosphere, ocean, hydrosphere, ice, liquid core, etc.), monitoring it by geodetic techniques and by studying it from the geodetic point of view, the geodetic community does provide the global geosciences community with a powerful tool consisting mainly of high quality services, standards and references, and theoretical and observational innovations. . . .

IGGOS has a central theme, namely *Global deformation and mass exchange processes in the System Earth*. Under the umbrella of geometry plus Earth rotation plus gravity field, this theme encompasses virtually all facets of geodesy. In addition, it may easily be translated and broken down into tangible individual sub-themes and -products.

IGGOS will be based on the existing IAG Services. It will provide a framework for existing or future services and wants to ensure their long-term stability. IGGOS must be recognized by partners outside IAG, e.g., by UNESCO, ICSU (International Council of Science), IGOS (the United Nations' Integrated Global Observing Strategy), governments, inter-government organizations, WCRP (World Climate Research Program), IGBP (International Geosphere Biosphere Program), etc., as geodesy's most important contribution to Earth sciences.

The initial structure to be established for the *IGGOS definition phase* is simple and compatible with the existing IAG services. The key elements of the initial IGGOS structure are:

– The IGGOS Project Board as the central oversight entity.
– Few well-defined Working Groups. The tasks of the working groups are to a high degree independent of the tasks of the IAG services.
– An IGGOS Science Council representing the geodetic community.

More details may be found in the IGGOS description in this volume.

2 General Baeyer's magnificent enterprise

The history of the IAG till 1996 is very well documented by Levallois (1980) and Torge (1996). Our main interest is related to possible parallels between the birth of the Association and its new structure – if there are any. Our interest was stimulated by the article by Schwarz (2000), who wrote:

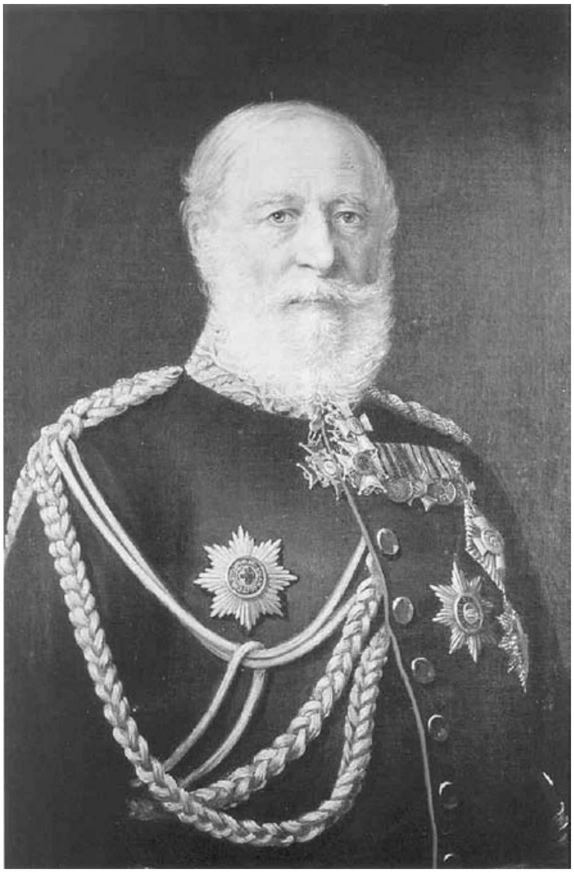

Fig 2. The Prussian General Johann Baeyer (1794–1885)

"The impetus for organizing the international scientific work in geodesy came from J. J. Baeyer, who in 1861, at the age of 66, sent his famous memorandum to the King of Prussia urging the establishment of the Central European Arc Measurement… Baeyer (1861) states:

In this framework, one could compute about 10 meridian arcs at different longitudes and even more parallel arcs at different latitudes; it would also be possible to compare the curvature of the meridians on both sides of the alps, to study the effect of the alpine ranges on the deflections of the vertical and to determine the curvature of the Adriatic and the Mediterranean, as well as the North Sea and the Baltic; in a word, there is a wide field for scientific investigations which have not been considered in any of the arc measurement campaigns and which, no doubt, will lead to interesting and important results…. If Central Europe is therefore willing to unite and use its resources for the solution of this task, it will call into being an important and magnificent work….

The new set of questions that Baeyer proposed to ask had to do with the Earth as a system. He established as guiding principles that the system Earth

– Must be considered as consisting of the solid Earth and the oceans.
– Could be determined by measurement, of both the geometric and gravimetric variety.
– Required the integration of existing components, to provide new insights.
– Needed international cooperation and a scientific organization.

These principles created a focus for geodetic research that could still be felt fifty years later when the First World War interrupted this development."

3 General Baeyer's magnificent enterprise and IAG in the 21st century

The above quotations from Schwarz (2000) may be viewed as the justification from the historical point of view of the new IAG with IGGOS as its central theme. Let us further investigate the parallels between Baeyer's "magnificent enterprise" and the more prosaic IGGOS (at least when judged from the naming point of view).

In 1861 Baeyer was a retired general of the Prussian army, well aware of the engineering, military and economic implications of his proposal. The engineering part of IGGOS is important, as well: The second half of the 20th ***century has seen an unprecedented development of new measurement techniques in geodesy. Extensive use is made of global satellite navigation systems like the GPS (the U.S. Global Positioning System), the Russian counterpart GLONASS, the French system DORIS, and the future European system GALILEO. These systems were neither designed nor are they maintained for scientific reasons, but for everyday applications like airplane and car navigation, hiking and biking, positioning, etc., and (at least for the first two systems) for military use. They must be complemented, for practical reasons, as well, by precise gravity observation systems (terrestrial, airborne, spaceborne) in order to allow for the determination of physical heights, which matter for many engineering applications.***

The proposers of the new IAG structure and of IGGOS are convinced – exactly as General Baeyer was in his epoch – that the available magnificent geodetic high precision instruments must be used for the benefit of science and society – in particular for Earth sciences and astronomy (many of the methods developed in space geodesy could, e.g., be used for *determining size, figure, orientation, and gravity field of the Moon, or other planets of the solar system).*

What Baeyer proposed, and what was eventually realized, was neither the first arc measurement, nor were the first gravimetric measurements performed in the context of the Central European Arc Measurement. The new aspect of the enterprise was the use of mature geodetic measurement techniques and the standardization of observation and analysis, which allowed it to focus on scientific issues, rather than on measurement technology.

A similar situation is encountered today: The revolutionary geodetic techniques designed and deployed in the second half of the twentieth century are mature (or are about to become mature). Their scientific exploitation asks for a magnificent enterprise in the sense of Baeyer. The "initial conditions" for IGGOS may be summarized as follows:

- With the advent of the space age in 1957 satellite geodesy was developed as a new branch of science. Satellite geodesy uses artificial satellites either as measurement targets or as measurement platforms. Thanks to the relative closeness of the targets ("only" a few thousand kilometers) and thanks to new developments in physics, alternative measurement techniques eventually replaced the one and only technique in astronomical geodesy (geodetic astronomy), namely the astrometric determination of the direction of the observer to the celestial object at a particular point in time. The Laser technology could be used to measure precise distances between observatories and satellites (today with a typical accuracy of 1 cm), crystal oscillators and atomic clocks opened the way for using microwave signals (emitted by artificial satellites) to measure distance differences referring to two different epochs and one pair "satellite-receiver".
- The celestial reference frames, previously (from the stone age up to the second half of the 20th century) realized by observing the directions to so-called fundamental stars with optical means, is today defined and maintained by simultaneously observing Quasars (Quasi-stellar radio sources) from different radio-astronomical observatories by using the Very Long Baseline Interferometry (VLBI) technique.
- In the determination of the Earth's gravity field (the third pillar of modern geodesy) the (r)evolution due to the advent of the space age was perhaps even more spectacular than in the area covered by the first two pillars. The revolution took place in three steps:

  1. Whereas only the mass of the Earth and the (dynamical) flattening (corresponding to the C_{00} ***and C_{20}-terms of a spherical harmonics expansion of the Earth's gravity potential) were reliably known before 1957, hundreds of terms emerged from the analysis of the orbits of geodetic satellites using Laser, Doppler, (initially also astrometry) as observation techniques.***
  2. With the uninterrupted tracking of low satellite orbits using spaceborne GPS receivers, the gravity field can be determined with unprecedented accuracy. This is proved with the first results of the German CHAMP mission.
  3. With the advent of satellite gradiometry (based either on extremely precise distance measurements between neighboring low orbiters or on gradiometers realized by a set of accelerometers within one and the same satellite), the Earth's gravity field and its temporal variations may be determined with unprecedented accuracy and (temporal and spatial) resolution. Temporal variations, e.g., caused by the re-distribution of mass in the Earth system consisting of solid Earth, ice fields, oceans, and atmosphere, are the key objective of the GRACE mission. Using gradiometry based on acceleometers it is also possible to determine the stationary part of the Earth's gravity field with unprecedented accuracy – the primary goal of ESA's GOCE mission.

- Triangulation (i.e., the fine art of establishing geodetic networks of regional or even continental size) was well established when Baeyer made his proposal. The tools to measure absolute gravity were a bit lagging behind in the development. It was an essential element of Baeyer's proposal to include both techniques. The situation is similar today: the geometry-related IAG services IGS, ILRS, and IVS monitor (point-wise) the geometrical aspects of the system Earth already now on the 10^{-9}-level. The gravity-related results are about to reach this level with the series of space missions CHAMP, GRACE, and GOCE. Again we are in a situation, where the geometrical aspects related to the system Earth are better established than those related to gravity.
- The consistency of the geometrical and gravity-related methods and results was considered only implicitly and as a side issue in Baeyer's proposal. Within IGGOS consistency of geometry and gravity is a central, probably even the key element. For all applications requiring the knowledge of equipotential surfaces, thus in particular for all research related to global change, this consistency is a prerequisite. Take altimetry as an example! If this consistency, compatible with the accuracy achieved in geometry and in gravity, cannot be guaranteed, sea level changes, ocean currents, etc., cannot be established properly.

4 The IAG services

The incorporation of the IAG services was one of the key element of the IAG restructuring process 1999–2003. Let us therefore briefly review the development of (some of) these IAG units. The history of the IAG services told here is based on information contained in the documentation Mueller (1998), and on the articles, Mueller (2000), Guinot (2000), Wilkins (2000), Yokoyama (2000) and Beutler (2000).

Table 2 from Beutler (2000) lists the currently active IAG services. We should mention that many of them are "not only" linked to the IAG (or, what we consider to be equivalent, to IUGG, the International Union of Geodesy and Geophysics), but also to other scientific associations. The IERS and the IVS, e.g., are services of the IAU, the International Astronomical Union, as well, and the PSMSL, the Permanent Service for Mean Sea Level, is also responsible to IAPSO, the International Association for the Physical Sciences of the Ocean. Most of the services are, moreover, working under the auspices of FAGS, the Federation of Astronomical and Geophysical Data Analysis Services.

It is our understanding that a new IAG service should only be created, if its products are well defined, regularly generated, and of importance for a larger user community. The services are very different in age (the ILS, one of the predecessors of the IERS, started operations in 1899, the IBS (International Bibliographic Service) has roots going back to 1889, whereas the ILRS and the IVS were founded shortly before the end of the 20^{th} *century). **It is, however, interesting to note that even the oldest services are today modern IAG services in the sense mentioned above.***

Table 2. Current IAG Services

Service	Type	Short Name
IERS	Geom	Int. Earth Rotation and Reference System Service
IGS	Geom	Int. GPS Service
ILRS	Geom	Int. Laser Ranging Service
IVS	Geom	Int. VLBI Service
BIPM	Geom	Int. Bureau of Weight and Measures
PSMSL	Geom	Permanent Service for Mean Sea Level
ICET	Grav*	Int. Centre for Earth Tides
BGI	Grav*	Int. Gravimetric Bureau
IGeS	Grav*	Int. Geoid Service
IBS/–	Doc	IAG Bibliographic Service
IBS/–	Doc	Information Service

* = now part of IGFS

There are three types of services, one related to (a) geometry, one to (b) gravity, and one to (c) documentation and information. Only the first two types will be further considered here. The distinctions between the first two types are in some cases arbitrary. There are, e.g., geometric and gravity aspects when studying Earth tides (in the case of the ICET, the International Centre of Earth Tides).

Let us first briefly address the gravity-related services. An interesting and promising development took place very recently: The **International Gravity Field Service (IGFS)**, consisting of

– Bureau Gravimetrique International (BGI)
– International Centre of Earth Tides (ICET)
– International Geoid Service (IGeS) I, in Milano
– International Geoid Service (IGeS) II, at NIMA
– International Centre of Global Earth Models (ICGEM) at GFZ

was created recently to meet the challenges of the *decade of gravity* marked by the German research satellite CHAMP (launched 2000), the U.S./German mission GRACE (launched 2002), and the European mission GOCE (to be launched in 2005). It is expected that the newly created IGFS will play an active role from now on, comparable to that of the services related to space geodesy. The BGI and the ICET are the oldest parts of the new service.

The **BGI**, hosted by the French space agency CNES (Centre National d'Etudes Spatiales), was founded in 1951. The main task of BGI is to collect, on a worldwide basis, all existing gravity measurements and pertinent information about the gravity field of the Earth, to compile and store them in a machine readable data base in order to redistribute them to a large variety of users for scientific purposes. The data consist of gravimeter observations, mean or point-by-point free air gravity anomalies, and gravity maps. BGI also has at its disposal grids of satellite altimetry derived geoid heights from the Geosat, Topex-Poseidon, ERS1 and ERS2, Jason, and ENVISAT missions.

The **ICET** was founded in 1956 to collect all available measurements on Earth tides. The data are evaluated by convenient methods in order to reduce the very large amount of measurements to a limited number of parameters which should contain all the desired information. The data from different instruments and different stations all over the world are compared and their precision and accuracy is evaluated. The major objective is to help solving the basic problem of calibration by organizing reference stations or realizing calibration devices; to fill gaps in information and data; to build a data bank allowing immediate and easy comparison; and to ensure a broad diffusion of the results and information to all interested laboratories and individual scientists.

The **IGeS** was created in 1991 on the occasion of the IUGG General Assembly in Vienna as an operational group of the International Geoid Commission of IAG. The principal objective is to work for the benefit of the international scientific community in general. Specific tasks are the collection and distribution of data and software for geoid computation as well as the performance of geoid computations in support of national and scientific objectives. At the IGeS section in Milano, emphasis is laid on the education and training aspects by organizing courses (International Schools) and issuing bulletins describing activities and information available. The IGeS branch at NIMA is probably the biggest data generator and supplier worldwide.

Regarding the geometry-related entities in Table 2, one should make the distinction between technique-specific services and the IERS, which "blends" the results of the technique-specific services to generate a consistent set of Earth rotation parameters, a terrestrial and a celestial reference frame.

The **PSMSL** was established in 1933. It produces and analyzes in essence sea level records of hundreds of tide gauges over long time spans. The PSMSL data set represents extremely important boundary conditions for global change analyses. The correct interpretation of the tide gauge signals is delicate. It is a recent development that the PSMSL and the IGS work closely together: With the GPS technique it is possible to describe independently the vertical motion of the tide gauge observatories.

The role of the **BIPM time section** (Bureau International de Poids et Mesures) is crystal clear: This section of BIPM generates and disseminates International Atomic Time (TAI) and the Coordinated Universal Time (UTC), where the "power" to introduce leap seconds is with the IERS. As UTC is derived today from atomic time (TAI) and no longer from monitoring Earth rotation (or other astronomical motions), the service is basically physical in nature. Its main concern is the combination of more than 200 atomic clocks worldwide. Therefore, there are important relationships between the BIPM and the IGS, because the GPS may be used to transfer time and frequency very accurately and efficiently between the time laboratories. The BIPM time section is the successor of the **BIH, the Bureau International de l'Heure,** which was created in 1912 to make use of the radio technique to synchronize clocks worldwide. Physically, the BIH was located at the Paris Observatory till 1985, when it became the time section of the BIPM. The BIH played a very active role in the transition phase from the IPMS to the IERS (to be discussed below). At that time the BIH did not only have a time section, but an Earth rotation section, as well. The latter branch of the BIH was melted with the newly established IERS in 1988.

The roots of the **IERS** go back to the year 1899, when the **ILS**, the International Latitude Service, was founded by the (predecessor of) the IAG. Its name is very appropriate: polar motion was derived from latitude observations performed at (initially) six observatories (Mizusawa (Japan), Tschardjui (former USSR), Cagliari (Italy), Gaithersburg (USA), Cincinnati (USA), Ukiah (USA)). The Central Bureau of the ILS was initially located at the Geodetic Institute of Potsdam (Director F. R. Helmert, responsible C.T. Albrecht, then moved to Japan (Mizusawa) in 1922 with H. Kimura as director, then to Italy in 1935, to go back to Japan in 1962 with S. Yumi as director). The foundation of the ILS is clearly an IAG achievement. With the reorganization of the international scientific associations after the first world war, in particular with the creation of the IAU and the IUGG, the ILS became a service working under the auspices of the two big Unions. The IAG, now an Association of IUGG, was *de facto* responsible for the ILS – together with the IAU. A serious review of polar motion work took place in the 1950s. It was decided to considerably expand the polar motion work and that the **IPMS, the International Polar Motion Service**, should succeed the ILS with a much expanded mandate (when compared to the ILS). The IPMS became a service under FAGS and should.

- Advance the study of all problems related to the motion of the pole
- Collect the astronomical observations which can be utilized for the determination of this motion
- analyze and synthesize them
- calculate the coordinates of the pole
- distribute the data required
- publish the initial data and obtained results.

This mandate is close in many aspects to the mandate of the IERS. It is interesting to note, however, that the celestial and terrestrial reference frames, implicitly needed for the work of the IPMS, were not explicitly mentioned in the above list. With the accuracy achievable within the new service, the celestial frame could be taken from astronomy (fundamental catalogs) and the (mean) terrestrial frame from geodesy.

The IPMS Central Bureau stayed in Japan with K. Yokoyama as director until the service was abolished by the end of 1987.

It is interesting to note that it was *not* the IPMS, which embraced the new space techniques, but that this mandate was given to the IAU/IUGG joint working group on the rotation of the Earth in 1978 with G. A. Wilkins as chair and I. I. Mueller as co-chair. This working group initiated and conducted the project MERIT (Monitoring Earth Rotation and Intercomparison of Techniques of observation and analysis). The BIH was the coordinating center of the project. All candidate techniques, in particular optical astrometry, Doppler tracking of satellites, Satellite and Lunar Laser Ranging (SLR, LLR), and Very Long Baseline Interferometry (VLBI) were invited to demonstrate their capabilities for Earth rotation monitoring. A so-called MERIT Short Campaign was held in 1980, followed by the MERIT main campaign from September 1, 1983 to October 31, 1984. The MERIT operations continued (on a best effort basis) thereafter. Based on the experiences gained by the MERIT project and on recommendations made by the project team, the IAU and IUGG decided to set up the IERS (International Earth Rotation and Reference Systems Service), which started operations on January 1, 1988. The mandate of the IERS is to

- Define and maintain the International Celestial Reference Frame (ICRF)
- Define and maintain the International Terrestrial Reference Frame (ITRF)
- Monitor the Earth rotation parameters

– Define the standards, constants, models etc., required for Earth rotation work.

VLBI, SLR, LLR were the techniques originally considered by the IERS. It is interesting to learn from Wilkins (2000) that one option was to consider VLBI as the only technique to define Earth rotation. This solution would have been rather close to the original definition of the ILS, namely to determine polar motion using one technique only, and to base the service on a small number of "identical" observatories. In retrospective it was a wise decision to define the IERS as a multi-technique service. From our perspective it would have been good to include astrometry as well. This would have added a completely independent technique to determine UT1. Also, the transfer problem of the celestial reference frame from the microwave to the optical domain would have been solved in this way. Be this as it may: The understanding of the IERS as a multi-technique service made it very easy for GPS to become acknowledged as an official IERS technique in the 1990s.

The **IGS, International GPS Service** was established in the early 1990s. The IGS planning committee started working after the IAG Scientific Assembly 1989 in Edinburgh under the leadership of I.I. Mueller. The committee wrote and sent out a call for participation for IGS stations, data centers, analysis centers, and central bureau, to take part in the IGS test campaign, and eventually in a future official IGS service. The response to the call for participation was overwhelming: It became clear that the IGS network would consist of dozens of tracking sites distributed worldwide (the current network consists of more than 200 stations), of three global and many regional data centers, and of a handful of analysis centers. The IGS Central Bureau was to be located at JPL (Jet Propulsion Laboratory) in Pasadena. At the IUGG General Assembly in Vienna, the IGS planning committee was dissolved and the so-called IGS Campaign Oversight Committee was created instead, with G. Beutler as chairman. It was the main purpose of this committee to organize a three-month IGS test campaign in 1992. The campaign was a great success. All analysis centers were capable of producing accurate GPS orbits (at least one order of magnitude better than the broadcast orbits) and, in addition, precise station coordinates, high-resolution polar motion and length of day data. The work of the IGS analysis center was regularly compared and evaluated by the analysis coordinator.

The 1992 IGS Test Campaign, scheduled for 21 June–23 September 1992, was, as a matter of fact, so successful that it was decided to continue operations on a best effort basis after the official end of the 1992 campaign in the framework of a pilot service. The IGS products became more and more mature, robust, and reliable. It was therefore only natural that the IAG Executive Committee, at its meeting in 1993 in Beijing, decided to establish the IGS as an official IAG service, with official starting date on January 1, 1994. It was also decided that the IGS analysis coordinator, Jan Kouba from Canada, should not only compare and evaluate the analysis centres' products, but in addition come up with official IGS products, which should be based on all individual solutions. This strategic decision was essential to make IGS products accurate, robust, and clearly understandable for the wider user community (scientific and commercial). The oversight committee was replaced by the IGS Governing Board with G. Beutler as its first chair. Beutler was succeeded by Prof. Ch. Reigber in 1999, who in turn was succeeded by Prof. J. Dow in 2003.

The IGS is a truly interdisciplinary service of IAG: GPS orbits, station coordinates and velocities, time transfer parameters, global ionosphere models, integrated water vapor content (for selected ground stations) are regularly determined by the IGS. This aspect of the IGS is documented in Beutler (1999). The IGS was (and is) widely recognized to be a model service of IAG.

The International VLBI Service for Geodesy and Astrometry (IVS) started its official operations as an IAG service on March 1, 1999. It is the successor of the CSTG (International Coordination of Space Techniques for Geodesy and Geodynamics) subcommission on VLBI, which is in turn the successor of the so-called IRIS (International Radio Interferometric Surveying) subcommission of CSTG, established at the IUGG General Assembly in Hamburg. The IRIS subcommission played an essential role during the MERIT campaign for demonstrating the power of the new space geodetic techniques for Earth rotation monitoring and for the establishment of the celestial and terrestrial reference frames. Today, the IVS is the service officially recognized by IUGG and IAU for the definition and maintenance of the celestial reference frame. Moreover, the (unbiased) determination of UT1–UTC and of precession and nutation, is performed by this service. The VLBI technique was developed by NASA. Today, Japanese and Canadian developments are of greatest importance in this domain, as well. Exactly like the IGS, the IVS is a single-technique service. Its terms of reference and structure are rather similar to those of the IGS.

The International Laser Ranging Service (ILRS) started official operations in fall 1998. The ILRS is the successor of the CSTG subcommission on satellite and lunar laser ranging, which was established in early 1986 as the Satellite Laser Ranging subcommission in 1986. Exactly like the IRIS subcommission, the SLR subcommission played an important role during the MERIT campaign. Today, the ILRS analyses define (in essence) the scale and origin of the ITRF, the IERS terrestrial reference frame. SLR/LLR can play this role, because atmospheric refraction may very well be modelled with sub-cm accuracy by using standard meteorological equipment (measuring pressure, temperature, and humidity recorded at the observing sites). As seen from the IGGOS perspective, the ILRS and its contributions calibrate the microwave observing systems GPS and VLBI. It should be pointed out in addition that – prior to the launch of the CHAMP, GRACE, and GOCE missions – our knowledge of the Earth's global gravity field was essentially based on SLR/LLR (early astrometric satellite observations were also included). The ILRS will also play its role as a calibration technique for the determination of the gravity field with the dedicated gravity missions. The separation of the gravitational and non-gravitational forces is based on accelerometers in the modern spacecrafts, which may be biased in particular in the low-frequency part of the spectrum. This separation of gravitational and non-gravitational forces was done in a very primitive, but transparent way, in the case of the Laser geodetic satellites (like LAGEOS I, II, Starlette) by deploying and observing cannonball satellites and by minimizing the ratio "cross-section:mass" of the satellites. The residual non-gravitational forces are therefore very simple to model.

The IGS, IVS, and ILRS operate global networks of ground stations. The terrestrial part of IGGOS will be based on these technique-specific networks.

5 Summary

The new structure of IAG and its flagship, IGGOS as IAG's firstproject, were reviewed from the perspective of history. Many aspects of the new IAG remind us of General Baeyer's "magnificent experience", which led in 1862 to the birth of the IAG, the International Association of Geodesy.

Exactly like in 1862 the measurement technology, in our case that of the space geodesy (geometrical and gravitational), has reached a high level of maturity and stability. We do not anticipate the advent of revolutionary new geodetic tools within the next decade (except for the expected olympic *altius, citius, fortius*).

The real challenge of the new IAG has to be seen in a set of mutually consistent gravitational and geometric products on the level of 10^{-9} ***(one ppb). These products should be seen as geodesy's (and IAG's) contribution to the wider scientific community and to society in general. IGGOS is the metrological basis for all global change research and for more general questions dealing with mass exchange in the system Earth consisting of solid Earth, oceans, ice sheets, and atmosphere. IGGOS must be successful: Only by a continued monitoring of all geometric and gravimetric signals of the system Earth we obtain the boundary conditions for meaningful global geodynamic models.***

The IAG services played a very important role in the past for the development of geodesy and geodynamics (starting from the creation of the ILS in 1899 to the newly established space geodetic and gravimetric services). The history of these services (in particular the development from the ILS to the IPMS and eventually to the IERS) in the 20th century is fascinating, but also encouraging – obviously it was possible to monitor the geodetic and geodynamic aspects of the system Earth with the state of the art methods for more than a century.

The years since the advent of the space age were years of research and technological development. The next two decades will most likely be a time period of modeling and understanding (of course accompanied by an optimization of the observational tools) relying on measurement series of increasing length and precision – made available through the IAG services. The IGGOS relies on these well established IAG services to monitor and understand the system Earth from the geodesist's perspective.

References

Baeyer JJ (1861) Über die Grösse und Figur der Erde – Eine Denkschrift zur Begründung einer mittel-europäischen Gradmessung. Berlin 1861

Beutler G, Rothacher M, Schaer S, Springer TA, Kouba J, Neilan RE (1999) The International GPS Service (IGS): an interdisciplinary service in support of Earth sciences. Advances in Space Research, Vol. 23, No. 4:631–653

Beutler G, Drewes H, Rummel R (2000) Reflections on a new structure for IAG beyond 2000 - conclusions from the IAG Section II symposium in Munich. International Association of Geodesy Symposia, Vol. 121, 430–437

BEUTLER G (2000) IAG services in the current framework of the International Association of Geodesy (IAG). International Association of Geodesy Symposia, Vol. 121, 419–423

Beutler G, Brunner F, Dickey J, Feissel M, Forsberg R, Mueller II, Rummel R, Sanso F, Schwarz K-P (2002) The IAG review 2000–2001 – executive summary. International Association of Geodesy Symposia, Vol. 125, 603–608

Beutler G (2003). The new IAG Structure. Journal of Geodesy, this Volume

Guinot B (2000) History of the Bureau International de l'heure. IAU Colloquium 178, Astronomical Society of the Pacific, 175–184

Helmert FR (1880) Die mathematischen und physikalischen Theorieen der höheren Geodäsie. Leipzig, Teubner Verlag, 1880–1884

Levallois JJ (1980) The history of the International Association of Geodesy. Bulletin Géodésique, Vol. 54, 249–313

Mueller II (1998) Science Services: International Association of Geodesy (IAG)/Federation of Astronomical & Geophysical Services (FAGS). Special Volume, IAG Scientific Assembly, Rio de Janeiro, Brazil, Sep

3–9, 1997, 62 pages, IAG Central Bureau c/o Department of Geophysics, Copenhagen, Denmark

Mueller II (2000) First decade of the IERS. IAU Colloquium 178, Astronomical Society of the Pacific, 201–213

Rummel R, Drewes H, Beutler G (2002) Integrated Global Geodetic Observing System (IGGOS): A candidate IAG project. International Association of Geodesy Symposia, Vol. 125, 609–614

Rummel R, Drewes H, Bosch W, Hornik H (editors) (2000) Towards an Integrated Global Geodetic Observing System (IGGOS). International Association of Geodesy Symposia, Vol. 120, 1–261

Schwarz KP (2000) An analysis of the current IAG structure and some thoughts on an IAG focus. International Association of Geodesy Symposia, Vol. 121, 407–414

Torge W (1996) The International Association of Geodesy (IAG) – More than 130 years of International cooperation. Journal of Geodesy, Vol. 70, 840–845

Torge W (2001) Geodesy. Walter de Gruyter GmbH & Co., Berlin

Wilkins GA (2000) Project MERIT and the formation of the International Earth Rotation Service. IAU Colloquium 178, Astronomical Society of the Pacific, 187–200

Yokoyama K, Manabe S, Sakai S (2000) History of the International Polar Motion Service/International Latitude Service. IAU Colloquium 178, Astronomical Society of the Pacific, 147–162

IAG on the Internet (http://www.iag-aig.org)

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The IAG maintains an Internet site, which is a valuable source of information not only about the Association itself, but also about its scientific disciplines. The primary goal of the website is to communicate with the IAG members, and make information available to the greater Geosciences community in the world as a whole.

The first IAG website was created in the middle 1990's and it was a well functional website (http://www.gfy.ku.dk/~iag). It was hosted and operated by the IAG Central Bureau at the Department of Geophysics, Copenhagen University, Denmark. This website was maintained by the IAG Secretary General, Professor Carl Christian Tscherning and by the IAG Assistant Secretary General, Ole Baltazar Andersen. The website was structured in the following sections: IAG General, Publications, IAG Awards and IAG Fund, Calendar, Meeting Announcements, Miscellaneous, Bibliographic Services, and Links to Geoscience Organisations.

Since the maintenance of the IAG website belongs to the activities of the Communication and Outreach Branch (COB) established by the new IAG By-Laws, therefore after the 23rd IUGG/IAG General Assembly (Sapporo, 2003) the website was moved to its new address at www.iag-aig.org and is maintained by our Webmaster, Szabolcs Rózsa [szrozsa@sci.fgt.bme.hu]. It is currently hosted at the Department of Geodesy and Surveying of the Budapest University of Technology and Economics (BUTE) with the Research Group for Physical Geodesy and Geodynamics of the Hungarian Academy of Sciences (HAS), Budapest, Hungary.

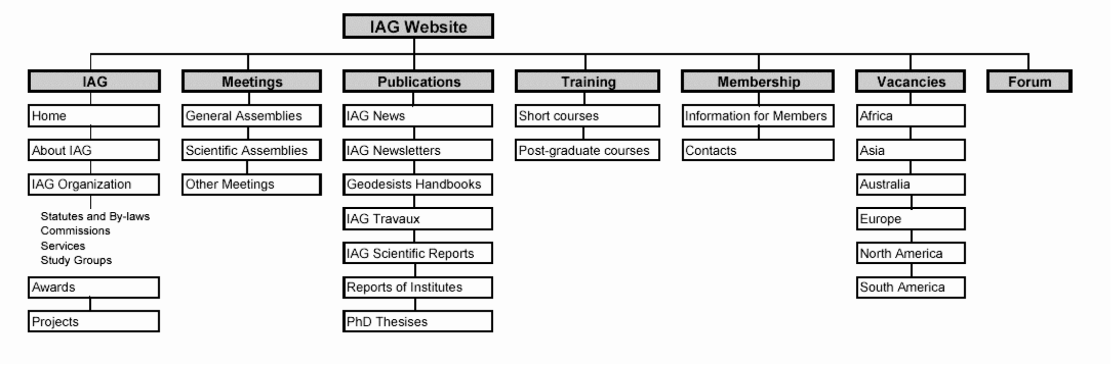
To improve communication about IAG activities and related informations, the IAG home page has been re-designed and the website is under upgrading. It will be a repository of information about IAG history, Meetings, Activities, Resolutions, Commissions, Publications, Officers, and more. Links to important Web pages related to Geodesy, namely

– IAG sponsored symposia,
– IAG Commissions,
– IAG's' old Sections
– IAG Services,
– Satellite Missions,
– IUGG and Associations,
– IAG Sister Societies,
– Geoscience Organisations

can presently be accessed on the new IAG home page. Links to University and Institute Web pages will also be added.

The new IAG website is also in the English Language. It has a counter to record statistics (www.nedstatbasic.net). Up to now (20 October 2003) our new website received 2760 hits.

Layout of the website is as follows and the IAG homepage as a picture is attached to this report.



Structure of the International Union of Geodesy and Geophysics (IUGG) For the period 2003–2007

Bureau

President: **Dr. Uri Shamir** (Israel)
Vice President: **Dr. Tom Beer** (Australia)
Secretary General: **Dr. Jo Ann Joselyn** (U.S.A.)
Treasurer: **Dr. Aksel Hansen** (Denmark)
Bureau Members: **Dr. A. Tealeb** (Egypt),
Dr. H. Gupta (India),
Dr. Y.T. Chen (China)
Assistant Treasurer: **Anders Svensson** (Denmark)
Past President: **Masaru Kono** (Japan)

Executive committee

– The Bureau
– The Past president of the Union
– The presidents of the Associations (listed below):

International Association of Geodesy

President: **Dr. G. Beutler** (Switzerland)
Secretary General: **Dr. C.C. Tscherning** (Denmark)

International Association of Geomagnetism and Aeronomy

President: **Dr. C. Barton** (Australia)
Secretary General: **Dr. B. Hultqvist** (Sweden)

International Association of Hydrological Sciences

President: **Dr. K. Takeuchi** (Japan)
President-Elect: **Dr. Askew** (Switzerland)
Secretary General: **Dr. P. Hubert** (France)

International Association of Meteorology and Atmospheric Sciences

President: **Dr. M. MacCracken** (U.S.A.)
Secretary General: **Dr. R. List** (Canada)

International Association for the Physical Sciences of the Ocean

President: **Dr. S. Imawaki** (Japan)
Secretary General: **Dr. F. Camfield** (U.S.A.)

International Association of Seismology and Physics of the Earth's Interior

President: **Dr. E.R. Engdahl** (U.S.A.)
Secretary General: **Dr. P. Suhadolc** (Italy)

International Association of Volcanology and Chemistry of the Earth's Interior

President: **Dr. O. Navon** (Israel)
Secretary General: **Dr. S. McNutt** (U.S.A.)

The Secretary Generals of the Associations may attend any meeting of the Executive committee of the Union in and advisory capacity.

Finance Committee

Chairman: Chair **Dr. M. Hamlin** (U.K.),
Members: **Dr. D. Jackson** (U.S.A.),
Dr. B. Kennett (Australia),
Dr. K. Suyehiro (Japan),
Dr. J. Vilas (Argentina).

Structure of the International Association of Geodesy for the period 2003–2007

Bureau

President: **Gerhard Beutler** (Switzerland)
Vice President: **Michael Sideris** (Canada)
Secretary General: **C. C. Tscherning** (Denmark)

Executive committee

- The Bureau
- The Past President:
- The Commission Presidents:
- Three Service Representatives.
- President of the Communication and Outreach Branch.
- Two members at large (geographical coverage)

Commission 1 (Reference Frames)
President: **Herman Drewes** (Germany)
Vice-President: **C.K. Shum** (USA)

Commission 2 (Gravity Field)
President: **Christopher Jekeli** (USA)
Vice-President: **Ilias Tziavos** (Greece)

Commission 3 (Earth Rotation and Geodynamics)
President: **Veronique Dehant** (Belgium)
Vice-President: **Mike Bevis** (USA)

Commission 4 (Positioning & Applications)
President: **Chris Rizos** (Australia)
Vice-President: **Pascal Willis** (France)

Members at large:
Luiz P. Fortes (Brazil)
Charles Merry (South Africa)

Service representatives:
Ruth Neilan (USA)
Markus Rothacher (Germany)
Harald Schuh (Germany)

President of the Communication and Outreach Branch
J.Adam (Hungary)

Other officers

Editor in Chief of the Journal of Geodesy
W. Featherstone (Australia)

Assistant Secretaries of the Association
Ole Baltazar Andersen (Denmark)

Honorary Presidents:
F. Sansó (Italy) – Past President
K.-P. Schwarz (Canada)
H. Moritz (Austria)
I. I. Mueller (USA)
W. Torge (Germany)

Honorary Secretaries General
M. Louis (France)
C. Boucher (France)

Secretaries on the sections and the other officers may attend any meeting of the Executive Committee of the Association in an advisory capacity.

IAG structure

International Services:

IERS (International Earth Rotation and Reference Systems Service)
Chair of D. B.: **Jan Vondrák** (Czech Rep.)
Director of C. B.: **Bernd Richter** (Germany)

IGS (International GPS Service)
Chair of G. B.: **John Dow** (Germany)
Director of C. B.: **Ruth Neilan** (USA)

ILRS (International Laser Ranging Service)
Chairman of G. B.: **Werner Gurtner** (Switzerland)
Director of C. B.: **Michael Pearlman** (USA)
Secretary: **Carey Noll** (USA)

IVS (International VLBI Service for Geodesy and Astrometry)
Chair of D. B.: **W. Schlüter** (Germany)
Coordinating C. D.: **N. Vandenberg** (USA)

IGFS (International Gravity Field Service)
Chair: **Rene Forsberg** (Denmark)

IDS (International DORIS Service)
Chair of G. B.: **G. Tavernier** (France)

BGI (International Gravimetric Bureau)
Director: **J-P. Barriot** (France)

IGeS (International Geoid Service)
President: **F.Sansò** (Italy)
Director: **R.Barzaghi** (Italy)

ICET (International Centre for Earth Tides) (Belgium)
Chair of D. B.: **Bernard Ducarme** (Belgium)

PSMSL (Permanent Service for Mean Sea Level)
Director: **P.L. Woodworth** (UK)

BIPM (Bureau International de Poids and Measure – time section)
Director Time Section: **E.F. Arias** (France)

IBS (IAG Bibliographic Service)
Chair: **Annekathrin Korth** (Germany)

Commissions:

Commission 1 - Reference Frames

President: **H. Drewes** (Germany)
Vice President: **C.K. Shum** (USA)

Sub-Commissions:

SC1.1: Coordination of Space Techniques
President: **M. Rothacher** (Germany)

SC1.2: Global Reference Frames
President: **Claude Boucher** (France)

SC1.3: Regional Reference Frames
President: **Zuheir Altamimi** (France)

SC1.3 a: Europe
Chair: **Joao Torres** (Portugal)

SC1.3 b: South and Central America
Chair: **Luiz Paulo Fortes** (Brazil)

SC1.3 c: North America
Chair: **Michael Craymer** (Canada)

SC1.3 d: Africa
Chair: **R. Wonnacott** (South Africa)

SC1.3 e: Asia-Pacific
Chair: **John Manning** (Australia)

SC1.3 f: Antarctica
Chair: **Reinhard Dietrich** (Germany)

SC1.4: Interaction of Celestial and Terrestrial Reference Frames
President: **Shen Yuan Zhu** (Germany)

Inter-Commission Projects:

IC-P1.1: Satellite Altimetry
(Joint with Commissions 2 and 3)
Chair: **Wolfgang Bosch** (Germany)

IC-P1.2: Vertical Reference Frames
(Joint with Commission 2)
Chair: **Johannes Ihde** (Germany)

Inter-Commission Study Groups:

IC-SG1.1: Ionosphere Modelling and Analysis
(Joint with Commission 4 and COSPAR)
Chair: **Claudio Brunini** (Argentina)

IC-SG1.2: Use of GNSS for Reference Frames
(Joint with Commission 4 and IGS)
Chair: **Robert Weber** (Austria)

Inter-Commission Working Groups

IC-WG 1: Quality Measures, Quality Control and Quality Improvement
(Joint with ICCT and Commission 2)
(Description: See ICCT)
Chair: **H. Kutterer** (Germany)

IC-WG2: Integrated theory for Crustal Deformation
(Joint with ICCT and Commission 3)
(Description: See ICCT)
Chair: **K. Heki** (Japan)

IC-WG3: Satellite Gravity Theory
(Joint with ICCT and Commission 2)
(Description: See ICCT)
Chair: **N. Sneeuw** (Canada)

Commission 2 (Gravity Field)

President: **Christopher Jekeli** (USA)
Vice-President: **Ilias Tziavos** (Greece)

Sub-Commissions:

SC2.1: Gravimetry and Gravity Networks
President: **Shuhei Okubo** (Japan)

SC2.2: Spatial and Temporal Gravity Field and Geoid Modeling
President: **Martin Vermeer** (Finland)

SC2.3: Dedicated Satellite Gravity Mapping Missions
President: **Pieter Visser** (The Netherlands)

SC2.4: Regional Geoid Determination
President: **Urs Marti** (Switzerland)

Commission Projects:

CP2.1: European Gravity and Geoid
Chair: **Heiner Denker (**Germany)

CP2.2: North American Geoid
Chair: **Marc Véronneau** (Canada)

CP2.3: African Geoid
Chair: **Charles Merry (**South Africa**)**

CP2.4: Antarctic Geoid
Chair: **Mirko Scheinert** (Germany)

CP2.5: South American Geoid
Chair: **Denizar Blitzkow** (Brazil)

CP2.6: Southeast Asian Geoid
Chair: **Bill Kearsley** (Australia)

CP2.7: Gravity in South America
Chair: **María Cristina Pacino** (Argentina)

Study Groups:

SG2.1: Comparison of Absolute Gravimeters
Chair: **Leonid Vitushkin** (France)

SG2.2: Forward Gravity Field Modeling Using Global Databases
Chair: **Michael Kuhn** (Australia)

SG2.3: Satellite altimetry: data quality improvement and coastal applications
Chair: **Cheinway Hwang** (Taiwan)

SG2.4: Aerogravimetry and Gradiometry
Chair: **Uwe Meyer** (Germany)

Inter-Commission Study Groups:

IC-SG2.5: Aliasing in Gravity Field Modeling
(Joint with ICCT)
Chair: **C. Christian Tscherning** (Denmark)

IC SG2.6: Multiscale Modeling of the Gravity Field
(Joint with ICCT)
Chair: **W. Freeden** (Germany)

Inter-Commission Projects:

ICP1.1: Satellite Altimetry
(Joint with Commission 1 and 3)
(Description: See Commission 1)
Chair: **W. Bosch** (Germany)

IC-P1.2: Vertical Reference Frames
(Joint with commission 1)
(Description: See Commission 1)
Chair: **Johannes Ihde** (Germany)

IC-P3.1: GGP Global Geodynamics Project
(Joint with Commission 3.
(Description: See Commission 1)
Chair: **David Crossley** (USA)

Inter-Commission Working Groups:

IC-WG 1: Quality Measures, Quality Control and Quality Improvement
(Joint with ICCT and Commission 1)
(Description: See ICCT)
Chair: **H. Kutterer** (Germany)

IC-WG3: Satellite Gravity Theory
(Joint with ICCT and Commission 1)
(Description: See ICCT)
Chair: **N. Sneeuw** (Canada)

Inter-Commission Study Groups:

IC-SG1.1: Ionosphere Modelling and Analysis
(Joint with Commission 4 and COSPAR)
Chair: **Claudio Brunini** (Argentina)

IC-SG1.2: Use of GNSS for Reference Frames
(Joint with Commission 4 and IGS)
Chair: **Robert Weber** (Austria)

Inter-Commission Working Groups

IC-WG 1: Quality Measures, Quality Control and Quality Improvement
(Joint with ICCT and Commission 2)
(Description: See ICCT)
Chair: **H. Kutterer** (Germany)

IC-WG2: Integrated theory for Crustal Deformation
(Joint with ICCT and Commission 3)
(Description: See ICCT)
Chair: **K. Heki** (Japan)

IC-WG3: Satellite Gravity Theory
(Joint with ICCT and Commission 2)
(Description: See ICCT)
Chair: **N. Sneeuw** (Canada)

Commission 3 (Earth Rotation and Geodynamics)

President: **Veronique Dehant** (Belgium)
Vice-President: **Mike Bevis** (USA)

Sub-Commissions:

SC3.1: Earth Tides
President: **Gerhard Jentzsch** (Germany)

SC3.2: Crustal Deformation
President: **Markku Poutanen** (Finland)

SC3.3: Geophysical Fluids
President: **Richard Gross** (USA)

Inter Commission Projects:

IC-P1.1: Satellite Altimetry
(Joint with Commission 1 and 2)
(Description: See Commission 1)
Chair: **Wolfgang Bosch** (Germany)

IC-P3.1: GGP Global Geodynamics Project
(Joint with Commission 2).
Chair: **David Crossley** (USA)

Inter Commission Working Groups:

IC-WG1: Theory of crustal deformations
(Joint with ICCT and Commission 1)
(Description: See ICCT)
Chair: **Kosuke Heki** (Japan)

Commission 4 (Positioning & Applications)

President: **Chris Rizos** (Australia)
Vice-President: **Pascal Willis** (France)

Sub-Commissions:

SC4.1: Multi-sensor Systems
President: **D. Grejner-Brzezinska** (USA)

SC4.2: Applications of Geodesy in Engineering
President: **Heribert Kahmen** (Austria)

SC4.3: GNSS Measurement of the Atmosphere
President: **Susan Skone** (Canada)

SC4.4: Applications of Satellite & Airborne Imaging Systems
President: **Xiaoli Ding** (Hong Kong)

SC4.5: Next Generation RTK
President: **Yang Gao** (Canada)

Study Groups:

SG4.1: Pseudolite Applications in Positioning & Navigation
Chair: **Dr. Jinling Wang** (Australia)

Inter-Commission Study Groups

IC-SG4.2: Statistics & Geometry in Mixed Integer Linear Models, with Applications to GPS & InSAR
(Joint with ICCT)
Chair: **Athanasios Dermanis** (Greece)

IC-SG1.1: Ionospheric Modelling and Analysis
(Joint with Commission 1 & COSPAR)
(Description: See commission 1)
Chair: **Claudio Brunini** (Argentina)

IC-SG1.2: Use of GNSS for Reference Frames
(Joint with Commission 1)
(Description: See commission 1)
Chair: **Robert Weber** (Austria)

Inter-Commission committees:

Inter-commission committee on Theory (ICCT)

President: **Peiliang Xu** (China)
Vice President: **Athanasios Dermanis** (Greece)

Working Groups:

WG ICCT1: Inverse Problems and Global Optimization
Chair: **Juergen Kusche** (Germany)

WG-ICCT2: Dynamic Theories of Deformation and Gravity Fields
Chair: **D. Wolf** (Germany)

WG-ICCT3: Functional Analysis, Field Theory and differential Equations
Chair: **Jinhai Yu** (China)

Inter-Commission Study Groups

IC-SG2.5: Aliasing in gravity field modeling
(Joint with Commission 2)
(Description: See Commission 2)
Chair: **C.C. Tscherning** (Denmark)

IC-SG2.6: Multiscale Modeling of the Gravity Field
(Joint with Commission 2)
(Description: See Commission 2)
Chair: **W. Freeden** (Germany)

IC-SG4.2 Statistics and Geometry in Mixed Integer Linear Models, with Applications to GPS and InSAR
(Joint with Commission 4)
(Description: See Commission 4)
Chair: **A. Dermanis** (Greece)

Inter-Commission Working Groups

IC-WG 1: Quality Measures, Quality Control and Quality Improvement
(Joint with Commission 1 and 2)
Chair: **H. Kutterer** (Germany)

IC-WG2: Integrated theory for Crustal Deformation
(Joint with Commission 1 and 3)
Chair: **K. Heki** (Japan)

IC-WG3: Satellite Gravity Theory
(Joint with Commission 1 and 2)
Chair: **N. Sneeuw** (Canada)

Inter commission committee on Planetary Geodesy (ICCPG)

President: **David Smith** (USA)
Vice President: **Georges Balmino** (France)

IAG Projects

Integrated Global Geodesy Observing System (IGGOS)

Chair: **Ch. Reigber** (Germany)
Secretary: **H. Drewes** (Germany)

Communication and Outreach

Communication and Outreach Branch

President: **József Ádám** (Hungary)
Vice President: **Szabolcs Rózsa** (Hungary)

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International Earth Rotation and Reference Systems Service (IERS)

web: www.iers.org

Chair of the Directing Board: **Jan Vondrák** (Czech Rep.)
Director of the Central Bureau: **Bernd Richter** (Germany)

Development

The IERS is a service under the Federation of Astronomical and Geophysical Data Analysis Services (FAGS), established in 1987 by the International Astronomical Union and the International Union of Geodesy and Geophysics. Since 2001, the IERS works in a new organizational structure; in 2003, the new name of the Service, without changing its abbreviation, was adopted.

Objectives

The primary objectives of the IERS are to serve the astronomical, geodetic and geophysical communities by providing the following:

- The International Celestial Reference System (ICRS) and its realization, the International Celestial Reference Frame (ICRF)
- The International Terrestrial Reference System (ITRS) and its realization, the International Terrestrial Reference Frame (ITRF)
- Earth orientation parameters required to study earth orientation variations and to transform between the ICRF and the ITRF
- Geophysical data to interpret time/space variations in the ICRF, ITRF or earth orientation parameters, and model such variations
- Standards, constants and models (i.e., conventions) encouraging international adherence

Products

IERS collects, archives and distributes products to satisfy the objectives of a wide range of applications, research and experimentation. These products include the following:

- International Celestial Reference Frame
- International Terrestrial Reference Frame
- Monthly earth orientation data
- Daily rapid service estimates of near real-time earth orientation data and their predictions
- Announcements of the differences between astronomical and civil time for time distribution by radio stations
- Leap second announcements
- Products related to global geophysical fluids such as mass and angular momentum distribution
- Annual report and technical notes on conventions and other topics
- Long-term earth orientation information

The accuracies of these products are sufficient to support current scientific and technical objectives including the following:

- Fundamental astronomical and geodetic reference systems
- Monitoring and modeling earth rotation/orientation
- Monitoring and modeling deformations of the solid earth
- Monitoring mass variations in the geophysical fluids, including the atmosphere and the hydrosphere
- Artificial satellite orbit determination
- Geophysical and atmospheric research, studies of dynamical interactions between geophysical fluids and the solid earth
- Space navigation.

Structure

The IERS accomplishes its mission through the following components:

- Technique Centers
- Product Centers
- Combination Center(s)
- Analysis Coordinator
- Central Bureau
- Directing Board
- Working Groups.

Some of these components (e.g., Technique Centers) may be autonomous operations, structurally independent from IERS, but which cooperate with the IERS. A participating organization may also function as one or several of these components (except as a Directing Board).

Directing Board

Claude Boucher, Carine Bruyninx, Benjamin F. Chao, Daniel Gambis, Gernd Gendt, Chopo Ma, Dennis D. McCarthy, Ron Noomen, Axel Nothnagel, David Pugh, Bernd Richter (Central Bureau), Markus Rothacher, Bob Schutz, Peter Shelus, Jean Souchay, Jan Vondrák (Chair), Pascal Willis, William Wooden, Clark R. Wilson, and Sheng Yuan Zhu.

International GPS Service (IGS)

web: igscb.jpl.nasa.gov

Chair of the Governing Board: **John Dow** (Germany)
Director of the Central Bureau: **Ruth Neilan** (USA)

Overview

The Global Positioning System (GPS) provides unprecedented potential for precise ground and space based positioning, timing and navigation anywhere in the world. Extremely precise use of GPS, particularly for Earth Sciences applications, stem largely from activities of the International GPS Service (IGS). More than 200 organizations in 80 countries contribute daily to the IGS, which is dependent upon a cooperative global tracking network of over 350 GPS stations, as counted in October 2003. Data is collected continuously and archived at distributed Data Centers. Analysis Centers retrieve the data and produce the most accurate GPS data products available anywhere. IGS data and data products are made accessible to users reflecting the organizations' *open data policy*. The IGS is a successful international scientific federation and a model of international cooperation. IGS is proud to be a recognized scientific service of the International Association of Geodesy since1994 and a member of the Federation of Astronomical and Geophysical Data Analysis Services (FAGS) since 1996.

IGS Mission 2002–2007

The International GPS Service is committed to providing the highest quality data and products as the standard for global navigation satellite systems (GNSS) in support of Earth science research, multidisciplinary applications, and education. These activities aim to advance scientific understanding of the Earth system components and their interactions, as well as to facilitate other applications benefiting society.

Long-Term Goals and Objectives

- Provide the highest quality, reliable GNSS data and products, openly and readily available to all user communities.
- Promote universal acceptance of IGS products and conventions as the world standard.
- Continuously innovate by attracting leading-edge expertise and pursuing challenging projects and ideas.
- Seek and implement new growth opportunities while responding to changing user needs.
- Sustain and nurture the IGS culture of collegiality, openness, inclusiveness, and cooperation.
- Maintain a voluntary organization with effective leadership, governance, and management.

IGS History

A number of factors led to the formation of the IGS. By the late 1980's many geodynamics and geodetic organizations recognized the potential of GPS. GPS was used for scientific research applications (e.g., earthquake studies, fault motion, plate tectonics) and many investigators realized the many benefits of this affordable technology. The motivating goal for the solid Earth sciences was millimeter level positioning in support of science anywhere in the world. However, a single civil organization could not assume the capital investment and recurring operations costs for such a globally based system. At this point international groups considered joint partnerships for collecting data and making observations, developing cooperative approaches and defining standards to ensure that the activities would be driven by science requirements.

The idea for an international GPS service began to crystallize at the 1989 International Association of Geodesy (IAG) Scientific Assembly in Edinburgh, UK. It was here that people recognized that a standardized civilian system for using GPS would be beneficial to all. Subsequently a planning committee was established within IAG to transform this recognition into action and agreement.

In 1991 a Call for Participation was organized by this IAG Planning Committee, seeking participants and contributors who would help develop the 'proof of concept' for an international service in form of a demonstration campaign. It requested interested groups to assume the roles of station operations, networks, data centers, analysis centers, and a Central Bureau for coordination of the activity. The response was overwhelming and the project was organized by a Campaign Oversight Committee. The pilot activity took place from June to September 1992 and was highly successful, demonstrating IGS viability. The IGS was officially established as an IAG international service on January 1, 1994.

Products, Achievements and Key Activities

The IGS, as a completely voluntary organization, continues to operate the global civilian GPS tracking system for science and research. Since the pilot project in 1992 the network has grown from approximately 30 permanent GPS stations to more than 350); and the accuracy of the IGS orbits has improved an order of magnitude, from 50 cm to less than 5 cm. The IGS continues developing and improving traditional products such as orbits, clocks, station positions and velocities, as well as fostering projects and working groups that produce additional data products, such as precipitable water vapor (PWV) a valuable input into weather forecasting; and total electron content (TEC) useful for ionospheric space weather research. IGS projects and working groups are dependent upon the infrastructure of the IGS for science applications and include:

A more detailed description of the components, structure of the IGS and how it works can be found here:
http://igscb.jpl.nasa.gov/overview/pubs.html
in the publication *IGS Strategic Plan 2002-2007*

Summary

Through the IGS contributing organizations, its 100+ associate members, hundreds of participating scientists and engineers, and the many respective sponsoring agencies, the IGS operates a collective system that has provided geodetic reference data and related products of enormous benefit to solid earth science research.

IGS Projects	Purpose
IGS Clock Products	Global sub-nanosecond time transfer, joint with the Bureau International des Poids et Mesures (BIPM)
Low Earth Orbiter (LEO) Pilot Project	Orbit determination of LEO satellites that carry onboard-GPS receivers (CHAMP, SAC-C, GRACE, Jason, etc.)
International GLONASS Service Pilot Project (IGLOS-PP)	Include data from the Russian GLONASS system into the IGS processes, producing GLONASS orbits, clocks, station positions, etc.
Tide Gauge Benchmark Monitoring Project	Monitor long-term sea-level change, attempt to de-couple crustal motion/subsidence at coastal sites from their tide gauge records

IGS Working Groups	
IGS Reference Frame Working Group	Global reference frame, Earth orientation, station positions and velocities determined by GPS
Ionospheric Working Group	Ionospheric science research, Global ionospheric maps
Atmospheric Working Group	Water vapor in atmosphere can be estimated from the delay encountered by the GPS signal, useful paramenters for weather forecasting
Real-Time Working Group	Investigate methods for IGS real-time network operations
Global Navigation Satellite Systems (GNSS)	Determine actions necessary for IGS to incorporate new GNSS systems, European Union Galileo system
Data Center Working Group	Address all issues related to data retreival, access, and archive

IGS Governing Board 2003

Chairman: John M. Dow (Germany)
Norman Beck (Canada)
Gerhard Beutler (Switzerland) *Founding Chair*
Geoff Blewitt, (USA) *IAG Representative*
Henno Boomkamp (Germany)
Claude Boucher (France) *IERS Representative*
Carine Bruyninx (Belgium) *IGS Representative to IERS*
Mark Caissy (Canada)
Loic Daniel (France)
Remi Ferland (Canada) *IGS Reference Frame Coordinator*
Gerd Gendt (Germany) *Analysis Center Coordinator*
Manuel Hernandez-Pajares (Spain)
John Manning (Australia)
Ruth E. Neilan (USA) *Director, IGS Central Bureau*
Carey Noll (USA)
David Pugh (UK) *FAGS Representative*
Jim Ray (USA)
Christoph Reigber (Germany) *Past Chair*
Markus Rothacher (Germany)
Tilo Schoene (Germany)
Ken Senior (USA) *IGS Clock Products Coordinator*
Robert Serafin (USA)
James Slater (USA)
Robert Weber (Austria)
Peizhen Zhang (China)
James F. Zumberge (USA)
Angelyn Moore (USA) *Secretariat, IGS Network Coordinator*

International Laser Ranging Service

International Laser Ranging Service (ILRS)

web: ilrs.gsfc.nasa.gov

Chairman of the Governing Board: **Werner Gurtner** (Switzerland)
Director of the Central Bureau: **Michael Pearlman** (USA)
Secretary: **Carey Noll** (USA)

Development

For many years, international SLR activities had been organized under the Satellite and Lunar Laser Ranging (SLR/LLR) Subcommission of the CSTG. The Subcommission provided a venue for organizing tracking campaigns, adopting data formats, reporting on network status, and sharing technology. However, membership and commitment to the Subcommission were informal, and the main focus was on systems and data acquisition rather than on the production of the most meaningful data products for end users. With strong encouragement from the President of the CSTG, the CSTG SLR/LLR Subcommission Steering Committee undertook the formation of the ILRS. A draft Terms of Reference, detailing the mission and the organization of the new service was written and accepted by the CSTG Executive Board in May 1997. A joint CSTG/IERS Call for Participation in the new ILRS was issued on 24 January 1998. Institution proposals in response to the Call were evaluated at a special meeting of the CSTG SLR/LLR Subcommission Steering Committee and subsequently approved by both the CSTG Executive Board and the IERS Directing Board on 18 April 1998. ILRS approval was granted to 46 tracking stations, 4 Operations Centers, 3 Analysis Centers, 4 Lunar Analysis Centers, 18 Associate Analysis Centers, 2 Global Data Centers and 1 Regional Data Center. The Central Bureau was established at the NASA Goddard Space Flight Center. Appointments and elections of Governing Board members were carried out during the summer of 1998. On 22 September 1998, the CSTG SLR/LLR Subcommission was officially disbanded, and replaced by the First ILRS General Assembly, held in conjunction with the 11th International Workshop on Laser Ranging in Deggendorf, Germany. The first ILRS Governing Board meeting was held on 25 September 1998.

Mission

The ILRS collects, merges, analyzes, archives and distributes Satellite Laser Ranging (SLR) and Lunar Laser Ranging (LLR) observation data sets of sufficient accuracy to satisfy the objectives of a wide range of scientific, engineering, and operational applications and experimentation. The basic observable is the precise time-of-flight of an ultrashort laser pulse to and from a retroreflector-equipped satellite, corrected for atmospheric delays and satellite center of mass. These data sets are used by the ILRS to generate a number of fundamental data products, including but not limited to:

- Centimeter accuracy satellite ephemeredes
- Earth orientation parameters (polar motion and length of day)
- Three-dimensional coordinates and velocities of the ILRS tracking stations
- Time-varying geocenter coordinates
- Static and time-varying coefficients of the Earth's gravity field
- Fundamental physical constants
- Lunar ephemeredes and librations
- Lunar orientation parameters

Structure

The ILRS accomplishes its mission through the following permanent components:

- Tracking Stations and Subnetworks
- Operations Centers
- Global and Regional Data Centers
- Analysis, Lunar Analysis, and Associate Analysis Centers
- Central Bureau
- Governing Board and Working Groups

Information on these permanent components can be found in the ILRS website.

ILRS Governing Board 2002

Michael Pearlman, Ex-Officio, Director, Central Bureau
Carey Noll, Ex-Officio, Secretary, Central Bureau
Hermann Drewes, Ex-Officio, CSTG President
Bob Schutz, Appointed, IERS representative to ILRS

Werner Gurtner, Appointed, Eurolas Network Representative
Pippo Bianco, Appointed, Eurolas Network Representative
Hiroo Kunimori, Appointed, WPLTN Network Representative
Ben Greene, Appointed, WPLTN Network Representative
David Carter, Appointed, NASA Network Representative
Jan McGarry, Appointed, NASA Network Representative
Ron Noomen, Elected, Analysis Center Representative
Graham Appleby, Elected, Analysis Center Representative
Wolfgang Seemueller, Elected, Data Center Representative
Peter Shelus, Elected, LLR Representative
Ulrich Schreiber, Elected, at Large Representative
Georg Kirchner, Elected, at Large Representative

Products

The products of the Analysis, Lunar Analysis, and Associate Analysis Centers are made available to the scientific community through the two Global Data Centers:

- Crustal Dynamics Data Information System (CDDIS) at the NASA Goddard Space Flight Center, Greenbelt, MD, USA,
- European Data Center (EDC), Munich, Germany, and one Regional Data Center
- Shanghai Observatory, Shanghai, PRC.

The accuracy of SLR/LLR data products is sufficient to support a variety of scientific, engineering, and operational applications including:

- Realization of global accessibility to and the improvement of the International Terrestrial Reference Frame (ITRF)
- Determining the precise location of the geocenter relative to the global network and its time variations
- Monitoring three-dimensional deformations of the solid Earth
- Monitoring Earth rotation and polar motion
- Monitoring the static and dynamic components of the Earth's gravity field and geoid.
- Supporting, via precise ranging to altimetric satellites, the monitoring of variations in the topography of the liquid and solid Earth (ocean circulation, mean sea level, ice sheet thickness, wave heights, vegetation canopies, etc.)
- Tidally generated variations in atmospheric mass distribution
- Calibration and validation of microwave tracking techniques (e.g., GPS, GLONASS, DORIS, and PRARE)
- Picosecond global time transfer experiments
- Determination of non-conservative forces acting on the satellite
- Astrometric observations including determination of the dynamic equinox, obliquity of the ecliptic, and the precession constant
- Gravitational and general relativistic studies including Einstein's Equivalence Principle, the Robertson-Walker b parameter, and time rate of change of the gravitational constant, G
- Lunar physics including the dissipation of rotational energy, shape of the core-mantle boundary (Love Number k2), and free librations and stimulating mechanisms
- Solar System ties to the International Celestial Reference Frame (ICRF)

Publications

The ILRS Central Bureau maintains a comprehensive website as the primary vehicle for the distribution of information within the ILRS community. This site can be accessed at http://ilrs.gsfc.nasa.gov. Many ILRS and related publications and reports can now be accessed online through the ILRS website including:

- ILRS Terms of Reference and Working Group Charters
- ILRS Annual Reports (first volume published covers year 1999)
- ILRS General Assembly Minutes and Reports
- ILRS Governing Board Minutes
- ILRS Working Group Minutes and Reports
- ILRS Associates Telephone and Email Directory
- ILRS Organizations and Technical Contacts
- Science and Engineering References and Reports

International VLBI Service for Geodesy and Astrometry (IVS)

web: ivscc.gsfc.nasa.gov

Chair of Directing Board: **W. Schlüter** (Germany)
Coordinating Center Director: **N. Vandenberg** (USA)

Development

The International VLBI Service for Geodesy and Astrometry (IVS) is an international collaboration of organizations, which operate or support Very Long Baseline Interferometry (VLBI) components. IVS was established in 1999 and became a service of IAG that year. In 2000 IVS was named a service of the International Astronomical Union. In 2002 IVS became a member of the Federation of Astronomical and Geophysical Data Analysis Services (FAGS). IVS interacts closely with the International Earth Rotation Service (IERS), which is tasked by IAU and IUGG with maintaining the international celestial and terrestrial reference frames (ICRF and ITRF).

Mission/Objectives

The objectives of IVS are:

- To provide a service to support geodetic, geophysical, and astrometric research and operational activities.
- To promote research and development activities in all aspects of the geodetic and astrometric VLBI technique.
- To interact with the community of users of VLBI products and to integrate VLBI into a global Earth observing system.

To meet these objectives, IVS coordinates VLBI observing programs, sets performance standards for VLBI stations, establishes conventions for VLBI data formats and data products, issues recommendations for VLBI data analysis software, sets standards for VLBI analysis documentation, and institutes appropriate VLBI product delivery methods to ensure suitable product quality and timeliness. IVS closely coordinates its activities with the astronomical community because of the dual use of many VLBI facilities and technologies for both astronomy and astrometry/geodesy.

Products

VLBI data products currently available are

- All components of Earth orientation
- Terrestrial reference frame
- Celestial reference frame
- Tropospheric parameters

All VLBI data products are archived in IVS Data Centers and are publicly available.

Structure/Board / Members

IVS accomplishes its goals through Permanent Components. As of 2003 the IVS has:

- 29 Network Stations, acquiring high performance VLBI data.
- 3 Operation Centers, coordinating activities of Network Stations.
- 6 Correlators, processing acquired data, providing feedback to stations and providing processed data to analysts.
- 6 Data Centers, distributing products to users, providing storage and archiving functions.
- 21 Analysis Centers, analyzing the data and producing results and products.
- 7 Technology Development Centers, developing new VLBI technology.
- 1 Coordinating Center, coordinating daily and long-term activities of IVS.

All together there are 73 Permanent Components, representing 37 organizations in 17 countries, and ~250 individuals who are Associate Members. The 37 organizations that support IVS components are IVS Member Organizations. There are also 7 Affiliated Organizations that cooperate with IVS on issues of common interest but do not support an IVS component.

In addition the IVS has a Directing Board to determine policies, standards, and goals.

The current IVS Directing Board consists of the following members (alphabetical):
Ed Himwich (USA) Network Coordinator
Kerry Kingham (USA) Operation Centers and Correlators representative
Yasuhiro Koyama (Japan) At Large member
Chopo Ma (USA) IERS representative
Zinovy Malkin (Russia) Analysis Centers and Data Centers representative
Shigeru Matsuzaka (Japan) Network Stations representative
Arthur Niell (USA) Technology Development Centers representative
Axel Nothnagel (Germany) Analysis Coordinator
William Petrachenko (Canada) At Large member
Wolfgang Schlüter (Germany) Network Stations representative
Harald Schuh (Austria) IAG representative
Nancy Vandenberg (USA) Coordinating Center Director
Patrick Wallace (UK) IAU representative
Alan Whitney (USA) Technology Coordinator

Publications and Meetings

IVS publishes an Annual Report, a thrice-annual Newsletter, and Proceedings from its bi-annual General Meeting. All publications are available from the Coordinating Center and also published on the web site. IVS holds a General Meeting every two years, a Technical Operations Workshop every two years, and an Analysis Workshop every year. Information about all IVS activities is available at the IVS web site http://ivscc.gsfc.nasa.gov.

International DORIS Service (IDS)

web: ids.cnes.fr

Chair of Governing Board **G. Tavernier** (France)

Introduction

DORIS (Doppler Orbit determination and Radiopositioning Integrated on Satellite) has been developed by the Centre National d'Etudes Spatiales (CNES) in conjunction with the Institut Géographique National (IGN) and the Groupe de Recherche de Géodesie Spatiale (GRGS).

The International DORIS Service (IDS) has been officially started on July 1, 2003 as an IAG Service after the decision of the IAG Executive Committee at the IUGG General Assembly in Sapporo.

The IDS mission and products

The primary objective of the IDS is to provide a service to support, through DORIS data and data products, geodetic and geophysical research activities.

The IDS collects, archives and distributes DORIS observation data sets of sufficient accuracy to satisfy the objectives of a wide range of applications and experimentations. From these data sets the following products are derived:

– Coordinates and velocities of the IDS tracking stations.
– Geocenter and scale of the Terrestrial Reference Frame.
– Ionospheric information.
– High accuracy ephemerides of DORIS satellites.
– Earth rotation parameters.

The accuracies of these products are sufficient to support current scientific objectives including:

– Realization of global accessibility to and the improvement of the International Terrestrial Reference Frame (ITRF).
– Monitoring deformations of the solid earth.
– Monitoring crustal deformation at tide gauges.
– Monitoring variations in the hydrosphere (sea level, ice-sheets, etc.).
– Orbit determination for scientific satellites.
– Ionosphere monitoring

Governing Board

Chairman: Gilles Tavernier (CNES)
Analysis Coordinator: Martine Feissel-Vernier
Network's representative: Hervé Fagard
Member at large: John Ries
Analysis Centers' representative: Pascal Willis
Data Centers' representative: Carey Noll

Appointed members
Director of the Central Bureau: Laurent Soudarin (CLS)
Representative of the IERS: TBD
IAG representative: TBD

Chair of Working Group (non-voting)
Station Selection WG:Frank Lemoine (NASA/GSFC)

IDS Representatives to the IERS:
Analysis Coordinater: Martine Feissel-Vernier
Network representative: Hervé Fagard
IDS representative to the IAG: Gilles Tavernier

The principal roles of the Governing Board (GB) are to set policy and to exercise broad oversight of all IDS functions and components. It also controls general activities of the Service, including restructuring, that would be appropriate to maintain efficiency and reliability, while taking full advantage of the advances in technology and theory.

Most GB decisions are to be made by consensus or by a simple majority vote of the members present, provided that there is a quorum consisting of at least six members of the GB. In case of lack of a quorum the voting is by e-mail. Changes in the IDS Terms of Reference and Chairperson of the GB can only be made by a 2/3 majority of the members of the GB, i.e., by six or more votes.

Central Bureau

CLS: Laurent Soudarin, Jean-Jacques Valette
CNES: Gilles Tavernier, Jean-Pierre Granier
IGN: Pascal Willis, Hervé Fagard

The Central Bureau (CB) is the executive arm of the IDS Governing Board and as such is responsible for the general management of the IDS consistent with the directives, policies and priorities set by the Governing Board.

In this role the CB, within available resources, coordinates IDS activities, facilitates communications, maintains documentation, and organizes reports, meetings and workshops.

The CB actively coordinates with the Working Groups and committees and ensures the compatibility of IDS and IERS by interfacing with the IERS. The CB acts as the outreach office and promotes use of IDS data and products, maintaining and expanding the visibility of the IDS. To accomplish these tasks the CB works closely with the independent Analysis Coordinator described above.

The CB supports the Analysis Coordinator in combining the various Analysis Centers products and providing him with all information necessary to validate the final combined products.

The CB operates the information system for the IDS and produces the IDS Annual Reports and directory. The CB coordinates the publication of other documents required for the satisfactory planning and day-to-day operation of the Service, including standards and specifications regarding the performance, functionality and configuration requirements of all elements of the Service.

Data Centers

NASA/CDDIS (Carey Noll)
IGN (Edouard Gaulué)

The Data Centers are in direct contact with the CNES, which provides the DORIS data. They archive the DORIS data as well as any ancillary information required to process these data.

Analysis Centers and Analysis Coordinator

The Analysis Centers are committed to provide at least one of the above IDS products on a regular basis. Their expertise in DORIS data analysis is a key factor of the product accuracy.

The Analysis Coordinator assists the Analysis Centers. The Analysis Coordinator monitors the Analysis Centers activities to ensure that the IDS objectives are carried out.

Specific expectations include quality control, performance evaluation, and continued development of appropriate analysis standards. The Analysis Coordinator, with the assistance of the Central Bureau, is also responsible for the appropriate combination of the Analysis Centers products into a single set of products.

Analysis Coordinator: Martine Feissel-Vernier

Contributing Analysis Centers:
CNES (France), : Jean-Paul Berthias
CSR (USA), John Ries
IGN, (France + JPL, USA)Pascal Willis
INASAN, (Russia), S. Tatevian
LEGOS/CLS (France). J.-F. Crétaux
SSALTO (France), Gilles Tavernier

Analysis Centers

ESA/ESOC (Germany), John Dow
Geodetic Observatory Pecny (Czech Republic)
J. Kostelecky
Geoscience (Australia), Ramesh Govind
IAA (Russia), Eleonora Yagudina
Royal Observatory of Belgium (Belgium)
René Warnant
University of Newcastle (UK), Philip Moore

Satellites carrying a DORIS receiver

In July 2003, DORIS data are provided by CNES (SPOT-2, SPOT-3, SPOT-4, SPOT-5, TOPEX/Poseidon, Jason) and the European Space Agency (Envisat). Additional DORIS satellites, such as Cryosat, Jason-2 and Ple constellation are also foreseen.

Network of Tracking Stations

The IDS network is composed of DORIS permanent tracking stations located at several host institutions and maintained by the IGN (56 in total in July 2003, point of contact: Hervé Fagard).

The network can also include additional DORIS stations observing during specific campaigns of scientific interest and selected by the Station Selection Working Group.

IGFS

International Gravity Field Service (IGFS)
web: TBD

Chair: **Rene Forsberg** (Denmark)

Objectives

IGFS is a unified Service which will take care as far as possible of data collection, validation, archiving and dissemination, as well as software collection, evaluation and dissemination for the purpose of determining, with various degrees of accuracy and resolution, the surface and gravity potential of the Earth or any of its functionals. The necessary temporal variations will also be studied. The determination of such a surface, from both the physical (geoid) and the geometrical (DTMs) viewpoints, is part of the field of action of the new Service.

The data include primarily satellite-derived global models, terrestrial, airborne, satellite and marine gravity observations, GPS leveling data, digital models of the terrain, bathymetry, and dynamic height models of the ocean derived from satellite altimetry. It has to be stated that the collection, analysis, and reduction of radar altimetric data might be the object of other Services within or outside IAG and therefore it does not belong to IGFS, although the products of such an analysis (e.g., global SST models, tidal models, etc.) are indeed of interest to IGFS, together with their various representations and uses.

The software collected and validated by IGFS includes but is not limited to: general purpose pre-processing and validation of data; construction, manipulation and combination of global gravity models; calculus of the gravity fields of various types of bodies, e.g., the topographic masses; calculus of the geoid and of related height datums; calculus of altimetry-derived gravity anomalies; computation of tidal effects.

Structure

The Service is organized by means of the following structure:

- Advisory Board,
- Centres
- Individual members or affiliates.

The Advisory Board is composed of:

- The Directors (or their delegates) of each of the Centres of IGFS
- The Presidents (or their delegates) of the IAG Commissions related to the Service work, as well as a representative of the IAG E.C.; and
- Two members appointed among the affiliates.

The Advisory Board

- Coordinates the overall scientific strategy of the Service in relation to the global IAG strategy
- Coordinates the joint activity of the Centres,
- Suggests the participation of the Service in large international projects or establishes its own projects,
- Coordinates the participation of affiliates in activities of the Service and their relation to the Centres,
- Presents to the E.C. proposals for associating new Centres to the Service.
- Elects the IGFS affiliates upon nomination by one of the Centres or by three other affiliates.

The Advisory Board is in charge four years between the IUGG General Assemblies; the old Advisory Board renews the affiliates list before the General Assembly; the new affiliates elect their representatives to the new Advisory Board, which takes over after the General Assembly.

The starting list of Centres and Affiliates of IGFS is determined according to section 7 (Start up and provisory rules).

The Advisory Board nominates a President to stay in charge for four years, as well as one possible representative to the Executive; the President is then appointed by the IAG Executive Committee; the eventual representative to the Executive is appointed by the Council. Furthermore, the Advisory Board elects a Secretary and its representatives to other IAG bodies.

The Advisory Board meets at least once a year, also exploiting all modern communication technology. It makes decisions by majority vote; it can also vote by e-mail.

The Advisory Board reports to the relevant commissions and to the IAG E.C. through its representatives according to the general IAG bylaws.

IGFS Centres:

Structures that, by exploiting funds, manpower and resources provided by any national or international entity, are committed to producing services and products in the area of gravity field and surface of the Earth research and to the IAG community at large, adopting rules as specified in the IAG bylaws.

The Centres are entitled to act within IGFS under the IAG flag, are determined by the IAG E.C., on request of the A.B.

The Centres will have their own governing bodies, nominated according to internal rules, also taking into account the interests of the supporting entities. In particular, each governing body will have a responsible person that will be called Director, elected according to internal rules.

Centres will maintain a list of data and products, providing them to the general public according to their policy of dissemination; they will deliver Services in the form of data archiving and supply, software testing and availability, training in the use of hardware and software and data analysis and interpretation, measurement campaigns as well as large computations in the framework of projects of international relevance. In particular, data exchange and mutual support between Centres should be visibly facilitated and pursued as a consequence of the participation in a unified IAG Service.

IGFS affiliates:

Are individual scientists wishing to contribute to the Service activities. They are the natural channels relating national agencies, national research groups and the general IAG activities in the area of gravity field and surface of the earth services.

Affiliates participate in the life of IGFS and in particular they are informed of new events and ongoing activity through publications and web news.

Affiliates elect their representatives in the IGFS Advisory Board.

Affiliates are normally attached to the activities of one specific Centre, although they can participate in more than one of them.

The association is concretized through data and software exchanges, participation of affiliates to the organization of training courses, reviewing of publications of the Service, and participation in specific scientific projects of international relevance.

Relation between IGFS, the Centres and IAG

The IGFS Centres are expected to work on the basis of some support provided by sources external to IAG. In addition, already existing Centres have to report to other scientific structures, external to IAG, because their activities are wider in scope and interest than those related to Geodesy. Consequently, we cannot expect that IGFS Centres will be as a whole depending only on the internal IAG structures and Executive Committee. For instance, the Directors of the Centres have to be freely elected according to internal rules, since the supporters might require having a voice on that point. The same reasoning holds for the specific use of funds.

Each Centre has, therefore, to be considered as part of an IAG Service in that, for all its geodetic activities, it fully subscribes to the general IAG rules and regulations. The link of the Centres to IAG is through the Advisory Board, which is then a full IAG body and, accordingly, will have for instance a President elected by the Executive. This structure then provides the necessary flexibility to allow the Centres to act autonomously for part of their activities, while providing connection (information, advice, general rules, etc.) for the part of IAG Service.

The activities of each Centre will be reviewed annually by the IAG E.C. It is, therefore, mandatory that each Centre prepare and submit an annual report. IAG reserves the right to disassociate itself from the a Centre if the relationship does not prove to be beneficial to both parties.

Data and products of the Centres

IGFS will make a special effort in trying to convince all national and international institutions holding data on the gravity field and the surface of the Earth to make them widely available. It is with pleasure that in the past several years we observed a positive trend in this direction. Naturally, this does not eliminate the necessity that data and software be kept at different levels of classification, according to the will of the source and to the special agreements with the Centres receiving them. In this respect, each Centre will follow its own regulations although an effort will be made to make them as uniform as possible. For instance, software should be available to a community as large as possible, especially for scientific projects. All the data actually residing in the Centres will be handled according to the agreements previously signed.

To be more specific, the products of the new service can be divided into several categories:

- Validated data, distributed according to their specific rules.
- Validated software packages and their documentation, serving specific purposes.
- Support to international or national institutions in conducting their projects.
- Tutorials to train young scientists and members of national institutions in the various aspects of the gravity field activity.
- Dissemination of knowledge through publications.

Publication policy

It is clear that IGFS Centres need a Bulletin as a tool to provide information to the scientific community at large on the actual status of the Service, on the archiving of data, software facilities, schools, etc.

The actual situation is that BGI, IGeS and ICET have their own Bulletins. It is the intention of BGI and IGeS to unify their Bulletins and have a publication of two issues per year. As for the content, it is important to keep a reviewed section in the Bulletin, which allows the publication of valid technical papers (i.e., good but not necessarily adding any methodological improvement), with emphasis on relevant recent projects and results. The ICET Bulletin for the moment will continue as it is, though it will contribute news and information to the BGI/IGeS Bulletin.

The problem of electronic publication will be studied and implemented as soon as possible.

Schools

Among the Services provided by IGFS, there are tutorials and technical schools. This didactic work has to have an applied character, and it is important that only widely acceptable, proven techniques be taught. It is important as well that all different ideas from various research Centres be represented in both courses and books of the Service. Particular efforts should be made to bring the courses to developing countries, as a contribution of the Service to the diffusion of IAG. There is an opportunity that BGI and ICET could run joint courses, as well as IGeS and NIMA. Other combinations of tutorials will also be studied.

Start up centers and provisory rules

The actual list of existing Centers of IGFS is BGI, IGeS, and ICET. They have expressed, by contributing to the actual proposal for the creation of the IGFS, their will to join the new Service as well as the acceptance of these rules. The three Directors will then be included in the new Advisory Board.

Two new Centers have been created, to become part of IGFS. Second IGeS Centre at NIMA (St. Louis) is established (contact person: S.Kenyon - kenyons@nima.mil), which will cooperate with the IGeS Centre at PoliMi (Milano), particularly on large continental projects, with data, expertise and manpower. The NIMA IGeS Centre will also provide continuity to the important project of determining global gravity models combining terrestrial and satellite observations (EGM series) and will support the educational IGeS activities.

Second, a new Centre for Global Gravity Models at GFZ (Potsdam) is established with the purpose of collecting all existing global gravity models, validating and distributing them, providing the geodetic community with the necessary software for their manipulation and use in different applications (contact person: P. Schwintzer - psch@gfz-potsdam.de). In addition, this Centre, in cooperation with BGI, will continue its work on the estimation of combined Global Models (GRIM series) and will also contribute to the IGeS schools.

In addition contacts are positively going on with the Faculty of Computing Sciences & Engineering of the De Montfort University (contact person: Dr. Philippa Berry - Pamb@dmu.ac.uk) to establish a new center to provide local and global DTMs.

Implementation

Present status is that a preliminary list of affiliates has been set up which actually includes:

Barriot, J.Pierre (France), Ducarme, Bernard (Belgium), Kenyon, Steve (USA), Schwintzer, Peter (Germany), Berry, Philippa (UK), Blitzkow, Denizar (Brazil), Denker, Heiner (Germany), Duquenne, Henri (France), Forsberg, René (Denmark), Featherstone, W.E. (Australia), Gil, Antonio J. (Spain), Kearsley, W. (Australia), Lemoine, F. (USA), Marti, Urs (Switzerland), Merry, Charles (South Africa), Milbert, Dennis (Australia), Pavlis, N. (USA), Sideris, Michael (Canada), Smith, Dru (USA), Tscherning, C.C. (Denmark), Tziavos, I. (Greece), Veronneau, Marc (Canada)

with the addition of the Directors of the Centers.

Election is actually in place to appoint the two members at large that will seat in the IGFS Advisory Board.

International Gravimetric Bureau (BGI)

web: bgi.cnes.fr

Director: **J-P. Barriot** (France)

Objectives and Terms of Reference

The main task of BGI is to collect, on a world-wide basis, all gravity measurements and pertinent information about the gravity field of the Earth, to compile them and store them in a computerized data base in order to redistribute them on request to a large variety of users for scientific purposes. The data consists of: gravimeter observations (mainly location – three co-ordinates, gravity value, corrections, anomalies...), mean free air gravity values, gravity maps, reference station descriptions, publications dealing with the Earth's gravity field. Other data types are sometimes used for data validation and geophysical analysis, such as satellite altimetry derived geoid height and gravity anomalies, digital terrain models, spherical harmonic coefficients of current global geopotential models.

BGI has been developing various algorithms and software for data validation and analysis, as well as its own data management system. A large number of services are offered to the users (see below).

All kinds of gravity data can be sent to BGI, with or without restrictions of redistribution to be specified by the contributors, sometimes in the form of a protocol of usage.

Program of Activities

- Continue publication of the Bulletin d'Information,
- Continue data collection, archiving and distribution: emphasis will be on those countries which have not, or seldom, contributed to the BGI data bank. First priority is then given to careful data evaluation; Land data and marine data are validated using different software. Satellite altimetry derived free-air anomalies are to be more and more frequently used to validate sea measurements.
- Assist IGGC in setting up the International Absolute Gravity Data Base Station (IAGBN), and assist in the intercomparisons of instrument.
- Establish simple procedures for the collection and archiving of absolute measurements.
- Link with the commission for the Geoid in data preparation in view of geoid computations and evaluations to be performed by the International Service for the Geoid.
- Assist in promoting satellites techniques to improve our global knowledge of the Earth's gravity field: satellite-to-satellite tracking, satellite gradiometry, etc.

Structure and membership

BGI is one of the offices of the Federation of Astronomical and Geophysical Data Analysis Services (FAGS). It may also be considered as an executive office of the International Gravity and Geoid Commission (IGGC).

It has a Directing Board composed of the following members:

Voting members
- BGI Director: J.P. Barriot (France)
- M. Vermeer (Finland)
- R. Forsberg (Denmark)
- M. Sideris (Canada)
- G. Boedecker (Canada)
- J.E. Faller (USA) to be elected
- E. Groten (Germany) to be elected
- P.P. Medvedev (Russia) to be elected
- S. Takemoto (Japan) to be elected

Non voting members
- L. Robertsson (France)
- B. Richter (Germany)
- M. Becker(Germany)
- Secretary: J. Liard (Canada)
- Secretary: E. Klingele (Switzerland)

Ex-officio:
- IGeS Director: F. Sanso (Italy)
- FAGS representative: P. Paquet (Belgium)

The central office is located in Toulouse, France, in the premises of the Observatoire Midi-Pyrénées, of which it is one of the services. The other supporting organizations are: the Centre National d'Etudes Spatiales, the Bureau de Recherches Géologiques et Minières, the Institut Géographique National, the Centre National de la Recherche Scientifique (via the Institut National des Sciences de l'Univers), the Ecole Supérieure des Géomètres et Topographes, the Institut de Recherche pour le Développement, the Service Hydrographique et Océanographique de la Marine. There exists a covenant between these agencies to guarantee their support to the BGI.

Address

Bureau Gravimétrique International
18, Avenue Edouard Belin
31401 Toulouse Cedex 4, France
Phone: 33-5 61 33 29 80
Email: Jean-Pierre.Barriot@cnes.fr

BGI Bulletin d'Information

The office issues a Bulletin d'Information twice a year (generally in June and December). It contains:

- General information in the field of the Bureau itself, about new available data sets,
- Communications at meetings dealing with gravimetry (e.g. IGGC meeting).

Every four years, an issue (which may be an additional one) contains the National Reports of Activities in Gravimetry. The full catalogue of the holdings is issued every two years. The Bulletin is sent free of charge to individuals and institutions, which currently provide information and/or data to the Bureau. In other cases, information and subscription prices can be obtained on request. There exist 85 issues and about 360 subscribers as of December 1999.

Providing data to BGI

Essential quantities and information for gravity data submission are:

Position of the site:

- Latitude, longitude (to the best possible accuracy).
- Elevation or depth.
- For land data: elevation of the site (on the physical surface of the Earth).
- For water stations: water depth.

Measured (observed) gravity, corrected to eliminate the periodic gravitational effects of the Sun and Moon, and the instrument drift.

Reference (base) station (s) used. For each reference station (a site occupied in the survey where a previously determined gravity value is available and used to help establish datum and scale for the survey), give name, reference station number (if known), brief description of location of site, and the reference gravity value used for that station. Give the datum of the reference value; example: IGSN 71.

Give supplementary elevation data for measurements made on towers, on upper floor of buildings, inside of mines or tunnels, atop glacial ice. When applicable, specify whether gravity value applied to actual measurement site or it has been reduced to the Earth's physical surface (surface topography or water surface). Also give depth of actual measurement site below the water surface for underwater measurements.

For marine gravity stations, gravity value should be corrected to eliminate effects of ship motion, or this effect should be provided and clearly explained.

Services

The most frequent service BGI can provide is data retrieval over a limited area. Data are sent on diskettes or printouts or transferred electronically. Data coverage plots may also be provided, usually over 20° * 20° areas. Cases of massive data retrieval requests may be considered; they are studied and may be processed in a specific way. The simplest way for users is to acquire the open files of the BGI database, which are on two CDs.

Other services include:

- Data screening.
- Provision of gravity base station information.
- Data evaluation and gridding.
- Computation of mean values.
- Contouring.
- Supply of, or information on existing maps.

The costs of the services have been established in view of the categories of users-mostly contributors of measurements and scientists, and also considering the large amount of our host organizations. The charging policy is explained in detail in the Bulletin d'Information.

Some of the services may be provided free of charge upon request, to data contributors, individuals working in universities, such as students, and generally to any person who can contribute to the BGI activities on a data or documentation exchange basis.

International Geoid Service (IGeS)

web: www.iges.polimi.it

President: **F.Sansò** (Italy)
Director: **R.Barzaghi** (Italy)

Mission / Objectives

The main tasks of IGeS are

- To collect data referring to the geoid on a worldwide scale, when possible to validate them and to disseminate them upon request among the scientific community: other auxiliary data can also be collected by IGeS, when useful for the geoid determination, and might be made available with the sharp exclusion of gravity anomalies data.
- To collect, test and, when allowed, to distribute software for the geoid determination.
- To conduct researches on the best procedures for the geoid determination, possibly from different sources conveniently combined.
- To provide the international community with technical schools where consolidated techniques of geoid determination, be demonstrated and students trained in the use of the relevant software.
- To produce, at least once per year, an IGeS Bulletin on geoid related matters, which in the next future should be come in IGFS Bulletin, under the name Newton's Bulletin, collecting news and results from the other IGFS Centers too.
- To disseminate special publications on geoid computations, e.g. lecture notes of the schools.

The Bulletin has a technical and applied nature and will not accept papers that could be published on the International Journal of Geodesy.

Data and software given to IGeS remain property of the source, which can dictate the conditions of use and restrict their distribution. IGeS itself can indeed perform geoid computations within different projects, but not in economic competition with Firms or Public Organizations institutionally devoted to that.

Products

- SW for handling global models.
- SW for the local Geoid estimation.
- SW for the evaluation of different functions of the Gravity Field.
- Grids of Global Geoid.
- Grids, for specified areas, of local Geoid.
- Documentation of the SW and of the data sources.
- IGeS Bulletin (future Newtons's Bulletin).
- Lecture notes and special publications.
- International Schools.

Future Programs/Development

Beyond usual activities of IGeS, the following programs are worth of specific mention:

- Participation to the International ESA Gradiometric Mission (GOCE).
- Computation of improved geoids for Italy and the Mediterranean area.
- Study and possibly first computations for the solution of the problem of the unification of height datums.
- Study of improved methodologies for the determination of the geoid at global and local level.
- Organization of International Geoid School, for which contacts are carried on with Dubai and Bulgaria. More schools could be organized in the next period by the two IGeS Centres.

Structure

The Service is for the moment provided by two Centres,one at the Politecnico of Milano, and the other at NIMA (contact person S. Kenyon, kenyons@nima.mil) and by individual scientists, called advisors.

IGeS is related to IAG, being one of the operative arms of the International Commission for the Gravity Field and of the new International Gravity Field Service, operating within IAG.

The IgeS Milano Centre is supported by Italian authorities, which nominate upon recommendation of the IGFS, a President, for its international representation and a Director for the operative management.

Its structure, tools and activities are illustrated in the IGeS reports to the Advisory Board of IGFS. In addition the IgeS advisors are individual members of IGeS, which have had an outstanding activity in the field of geoid determination and also can represent IGeS in both research and teaching activities.

At present the following distinguished scientists are IGeS advisors:

R.Forsberg (Denmark)
C.C. Tscherning (Denmark)
M. Sideris (Canada)
C. Kotsakis (Canada)
W. Kearsley (Australia)
W. Featherstone (Australia)
D. Milbert (USA)
S. Kenyon (USA)
N. Pavlis (USA)
H. Denker (Germany)
P. Schwintzer (Germany)
U Marti (Switzerland)
H. Duquenne (France)
D. Arabelos (Greece)
E. Tziavos (Greece)
A. Jill (Spain)
D. Blitzkow (Brasil)

Finally within the structure of IGeS, Working Groups can be established for specific purposes, limited in time. At present a W.G. on Global Gravity Field validation has been set up with the chair of T. Gruber (thomas.gruber@dlr.de). The purpose of the W.G. is to standardise the procedures of validation and combination of global models using data from the forthcoming gravity field spatial missions and terrestrial measurements. A second WG has been organized on the computation of the new European Geoid, chaired by H.Denker (denker@ife.uni-hannover.de).

International Center for Earth Tides (ICET)

web: www.astro.oma.be/ICET/

Chair of the Directing Board: **Bernard Ducarme** (Belgium)

Terms of Reference and objectives

- As World Data Centre C, to collect all available measurements on Earth tides.
- To evaluate these data by convenient methods of analysis in order to reduce the very large amount of measurements to a limited number of parameters which should contain all the desired and needed geophysical information.
- To compare the data from different instruments and different stations distributed all over the world, evaluate their precision and accuracy from the point of view of internal errors as well as external errors;
- To help solving the basic problem of calibration by organizing reference stations or realizing calibration devices.
- To fill gaps in information and data;
- To build a data bank allowing immediate and easy comparison of earth tides parameters with different Earth models and other geodetic and geophysical parameters.
- To ensure a broad diffusion of the results and information to all interested laboratories and individual scientists.

These goals are achieved essentially by the diffusion of information and software, the data processing, the training of young scientists and the welcome of visiting scientists.

The recent achievements in modeling the response of the "solid" Earth to the tidal potential request to reach an higher accuracy in tidal observations in order to validate the competing models. It means instrumental calibration at the 0.1% level and precise elimination of the oceanic, atmospheric and hydrologic perturbations affecting the body tides. These goals can only be reached now in gravity tides with high precision instruments.

In parallel the interest for tiny geophysical signals still present in tidal residuals after subtracting the best available tidal model is increasing. It can be geoscientists trying to find core modes in continuous gravity registrations obtained by means of cryogenic gravimeters reaching a resolution of 0.1 nms−2 (10−11 g) and stability of the order of 10 nms−2 (10−9 g) per year. It can be volcanologists or seismologists looking for premonitory events in tilt or strain records. These two scientific communities have in common the fact that they are not yet trained in tidal data analysis.

As the groups interested by tidal phenomena are always very small and often only marginally involved in tidal research and as the papers dealing specifically with tidal studies are not fitting so well to international journals, it is still very important to keep a specialized diffusion and information medium. It is the vocation of the "Bulletin d'Information des Marées Terrestres" (BIM). ICET is publishing two eighty pages issues per year.

Data from about 360 worldwide tidal gravity stations: hourly values, main tidal waves obtained by least squares analyses, residual vectors, oceanic attraction and loading vectors. The Data Bank contains also data from tiltmeters and extensometers.

ICET is responsible for the Information System and Data Center of the Global Geodynamic Project (GGP).

Products

- Tidal Analysis Results (available on web-site or on request)
- for station displacements.
- gravimeters.
- tiltmeters.
- strainmeters.
- barometers.
- wells.
- Sofware (e.g. T-Soft, Tidal prediction, ETERNA, NSV, EDAT,...)
- Journal: Bulletin d'Information des Marées Terrestres (BIM)
- Bibliography (on web-site)
- Training of Scientists at ICET
- Organization of Summer schools.

Directing Board

Director: B. Ducarme (Belgium)
G. Jentzsch
M. Feissel-Vernier
D. Crossley (USA)
Hsu Hou Tse (China)
T. Baker (UK)
S. Takemoto (Japan)
H. Schuh (A)
TBD (from South America).

The International Centre for Earth Tides is one of the Federation of Astronomical and Geophysical Data Analysis Services (FAGS).

Permanent Service for Mean Sea Level

The Permanent Service for Mean Sea Level (PSMSL)

web: www.pol.ac.uk

Director: **Dr. P.L. Woodworth** (UK)

Development

Since 1933, the Permanent Service for Mean Sea Level (PSMSL) has been responsible for the collection, publication, analysis and interpretation of sea level data from the global network of tide gauges. It is based at the Proudman Oceanographic Laboratory (POL) which is a component of the UK Natural Environment Research Council (NERC). The PSMSL is a member of the Federation of Astronomical and Geophysical Data Analysis Services (FAGS) established by the International Council of Scientific Unions (ICSU). It is supported by FAGS, the Intergovernmental Oceanographic Commission (IOC) and NERC.

Mission/Objectives

The mission of the PSMSL is to provide the community with a full Service for the acquisition, analysis and interpretation of sea level data. Aside from its central role of operation of the global sea level data bank, the PSMSL provides advice to tide gauge operators and analysts. It occupies a central management role in the development of the Global Sea Level Observing System (GLOSS) and hosts important international study groups and meetings on relevant themes.

Products

The database of the PSMSL contains approximately 50,000 station-years of monthly and annual mean values of sea level from over 1800 tide gauge stations around the world received from almost 200 national authorities. On average, approximately 2000 station-years of data are entered into the database each year. This database is used extensively throughout the sciences of climate change, oceanography, geodesy and geology, and is the main source of information for international study groups such as the Intergovernmental Panel on Climate Change (IPCC).

Data for all stations are included in the PSMSL METRIC (or total) data set. The METRIC monthly and annual means for any one station-year are necessarily required to be measured to a common datum, although, at this stage, datum continuity between years is not essential. The year-to-year datum checks become essential, however, if the data are subsequently to be included in the PSMSL 'Revised Local Reference (RLR)' component of the data set.

The 'Revised Local Reference (RLR)' dataset of the PSMSL contains records for which time series analysis of sea level changes can be performed. Long records from this dataset have been the basis of all analyses of secular changes in global sea level during the last century. The geographical distribution of longer RLR records contains significant geographical bias towards the northern hemisphere, a situation that is being rectified by the establishment of GLOSS.

Structure/Governing Board Members

The PSMSL reports formally to the International Association for the Physical Sciences of the Ocean (IAPSO) Commission on Mean Sea Level and Tides. It is also served by an Advisory Group, which at present consists of Dr.R.Neilan (JPL, USA), Dr.G.Mitchum (University of South Florida, USA), Prof.B.Douglas (University of Maryland, USA), Dr.R.Warrick (University of Waikato, New Zealand), Dr.D.Pugh (Southampton Oceanography Centre, UK) and Dr.Martine Feissel (IGN, Paris, France).

Point of Contact

Permanent Service for Mean Sea Level
Proudman Oceanographic Laboratory
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Bureau International des Poids et Mesures (BIPM) - Time Section

web: www.bipm.fr

Director Time Section: **E.F. Arias** (France)

Development and Functions

Since 1 January 1988 the Bureau International des Poids et Mesures (BIPM) is fully responsible for the maintenance of International Atomic Time (TAI) and of Coordinated Universal Time (UTC).

The BIPM is in charge of:

- Establishing TAI and UTC (except for the UTC leap second occurrence and announcement, in charge of IERS).
- Providing the data making TAI and UTC available in the standard laboratories.
- Participating to the worldwide coordination for time comparisons.

Activities and Services

- **Time scales**

TAI is established on the basis of atomic clock data and atomic frequency standards from some two hundred atomic clocks in nearly 60 laboratories or national centers.

TAI and UTC are made available by the dissemination of corrections to be applied to the readings of the master clocks of the participating laboratories. Since January 1998 TAI has been calculated using one-month blocks of data, instead of two as used previously.

The stability of TAI is about $3 \times 10 - 15$ for averaging times of 1 to 2 months. The TAI scale unit differs from the SI second on the rotating geoid, in values in the range $-5 \times 10 - 15$ s to $+5 \times 10 - 15$ s during 1999 with an uncertainty of $4 \times 10 - 15$ s.

In addition to TAI, the BIPM establishes a scientific time scale TT(BIPM) for applications requiring ultimate long-term stability. A new version of this time scale, based on data reprocessing, is available every year and covers several past years.

- **Time comparisons**

The activities of the BIPM Time Section are based on accurate time comparisons between remote clocks, which are mostly based on the tracking of GPS satellites. The BIPM organizes these time comparisons by providing international GPS common-view tracking schedules and by checking differential calibration of GPS time receivers. The BIPM treats raw GPS data according to a unified procedure:

- Only strict GPS common views are used to minimize Selective Availability effects.
- The international network figures local stars on continental distances added to two long-distance links between the NIST (Boulder, Colorado, USA), the CRL (Tokyo, Japan) and the OP (Paris, France).

Since July 1999 long-distance links are corrected for measured ionospheric delays obtained from IGS ionospheric maps and for precise satellite ephemerides. The ultimate uncertainty is of a few nanoseconds for a tracking duration of 13 minutes.

Publications

- Circular T (monthly): Corrections to the readings of laboratory clocks to get TAI and UTC. Data on time comparisons Informations.
- Annual Report of Time Section of BIPM: Methods of evaluation of TAI. Data on the clocks and time comparisons. Data from the primary frequency standards, BIPM results on time scales.
- Schedules for GPS and GLONASS satellite tracking (for participating laboratories), issued about twice a year.

Point of Contact

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Pavillon de Breteuil
92312 Sèvres Cedex, France
Phone: + 33 1 45 07 70 72
Email: tai@bipm.fr
web: www.bipm.fr

IAG Bibliographic Service (IBS)

web: www.leipzig.ifag.de

Chair: **Annekathrin Korth** (Germany)

Development

The service is based on the literature database geodesy, photogrammetry and cartography (GEOPHOKA), which is maintained by the Bundesamt für Kartographie und Geodäsie, Branch office Leipzig. Since 1984 there are stored literature entries. They cover the whole subject of geodesy, cartography and photogrammetry and the neighbouring files. Every year 2500 new entries are included into the database.

Objectives

In addition to the Fast Bibliography within the IAG Newsletter of the Journal of Geodesy the IAG Bibliographic Service serves mainly to inform the geodesists who are associated in the IAG about current geodetic literature from all over the world.

For the IAG Bibliographic Service geodetic journals and other periodicals, publications of research institutes, manuals and text books as well as congress papers are analyzed. The documentalists choose such sources for the service which are relevant to the activities of the Sections, Commissions, Special Commissions und Special Study Groups.

These literature sources are available either in the library of the Bundesamt für Kartographie und Geodäsie (BKG)(library symbol F128 or L191) or in the library of the Deutscher Verein für Vermessungswesen (library symbol B729).

The topicality of the sources recorded in the IAG Bibliographic Service is dependent on the date of their arriving at the library of the BKG. German-language literature und conference proceedings on geodesy are processed as a rule within 3 weeks after receipt.

Each literature record contains:

- The bibliographic description of the source according to the commonly known rules.
- The descriptors in German. They inform about the content of the recorded source.
- In most cases an abstract, if possible in English. The abstacts are often taken from the source or are processed by the documentalists on the basis of the summary, the conclusions, or the list of contents of the source.

If the geodesists need a retrieval covering a longer period of time (more than a year) they can turn to the BKG, Branch Office Leipzig. There is a search mask available directly on the internet for retrival on records.

Point of Contact

Bundesamt für Geodäsie und Kartographie,
Außenstelle Leipzig,
Karl-Rothe-Str. 10-14,
Germany
Tel.: (+49 341)5634 0
Fax: (+49 341)5634 415
Web: www.leipzig.ifag.de/cgi-bin/iag.cgi?lang=en

Commission 1 - Reference Frames

web: iag.dgfi.badw.de

President: **Hermann Drewes** (Germany)
Vice President: **C.K. Shum** (USA)

Terms of Reference

Geodetic reference frames are the basis for three-dimensional, time dependent positioning in global, regional and national networks, cadastre, engineering, precise navigation, geo-information, geodynamics, sea level studies, and other geosciences. They are necessary to consistently estimate unknown parameters using geodetic observations, e.g., station coordinates, crustal motions, Earth orientation parameters. Commission 1 is focused on the scientific research associated with the definition and realization of global and regional reference frames as well as the development of analysis and processing methods for relevant geodetic observations. Different terrestrial and space-borne measuring techniques shall be investigated with respect to their strengths and weaknesses for parameter estimation, their respective precision, accuracy and reliability. The proper use of these techniques for geodetic research shall be coordinated and methods for the combination of heterogeneous measurements shall be studied and disseminated. The basis for globally unified reference frames for three-dimensional positioning and monitoring of motions, horizontal and vertical, over land, water and ice, shall be provided and disseminated among the scientific and users community as well as the appropriate IAG Services.

Commission 1 is identical with the Sub-commission B2 of the Scientific Commission B of the ICSU Committee on Space Research (COSPAR).

Objectives

The principal objective of the scientific work of Commission 1 is the basic research on:

- Definition, establishment, maintenance, and improvement of geodetic reference frames.
- Advanced development of terrestrial and space observation techniques for this purpose.
- Analysis and processing methods for parameter estimation related to reference frames.
- Theory and coordination of astrometric observations for reference frame purposes.

Additional objectives of the Commission are the international collaboration:

- For the definition and deployment of networks of observatories.
- With related scientific organizations, institutions, agencies, and IAG Services.

Structure

Sub-Commissions:

SC1.1: Coordination of Space Techniques
President: **M. Rothacher** (Germany)

SC1.2: Global Reference Frames
President: **Claude Boucher** (France)

SC1.3: Regional Reference Frames
President: **Zuheir Altamimi** (France)

SC1.3 a: Europe
Chair: **Joao Torres** (Portugal)

SC1.3 b: South and Central America
Chair: **Luiz Paulo Fortes** (Brazil)

SC1.3 c: North America
Chair: **Michael Craymer** (Canada)

SC1.3 d: Africa
Chair: **R. Wonnacott** (South Africa)

SC1.3 e: Asia-Pacific
Chair: **John Manning** (Australia)

SC1.3 f: Antarctica
Chair: **Reinhard Dietrich** (Germany)

SC1.4: Interaction of Celestial and Terrestrial Reference Frames
President: **Shen Yuan Zhu** (Germany)

Inter-Commission Projects:

IC-P1.1: Satellite Altimetry
(Joint with Commissions 2 and 3)
Chair: **Wolfgang Bosch** (Germany)

IC-P1.2: Vertical Reference Frames
(Joint with Commission 2)
Chair: **Johannes Ihde** (Germany)

Inter-Commission Study Groups:

IC-SG1.1: Ionosphere Modelling and Analysis
(Joint with Commission 4 and COSPAR)
Chair: **Claudio Brunini** (Argentina)

IC-SG1.2: Use of GNSS for Reference Frames
(Joint with Commission 4 and IGS)
Chair: **Robert Weber** (Austria)

Inter-Commission Working Groups:

IC-WG1: Quality Measures, Quality Control and Quality Improvement
(Joint with ICCT and Commission 2)
(Description: See ICCT)
Chair: **H. Kutterer** (Germany)

IC-WG2: Integrated theory for Crustal Deformation
(Joint with ICCT and Commission 3)
(Description: See ICCT)
Chair: **K. Heki** (Japan)

IC-WG3: Satellite Gravity Theory
(Joint with ICCT and Commission 2)
(Description: See ICCT)
Chair: **N. Sneeuw** (Canada)

Program of Activities

The Commission encourages, initiates and supports basic research in the field of geodetic reference frames, exchanges the experiences with the relevant IAG services and COSPAR entities, and disseminates the results. It assists in the coordination of geodetic techniques relevant for reference frames and elaborates concrete methods to improve its quality and reliability. Regular exchange of information via internet by e-mails and the Commission's homepage shall enhance the contact between various groups engaged in reference frames research. An annual bulletin is planned for publishing the results. A close cooperation will be established with the International Earth Rotation and Reference Systems Service (IERS), its Products Centres and Combination Research Centres and working groups. Emphasis will be laid on the assistance to individual countries in establishing their national reference frames.

Steering Committee

President: Hermann Drewes (Germany)
Vice President: C.K. Shum (USA)
President SC1.1: Markus Rothacher (Germany)
President SC1.2: Claude Boucher (France)
President SC1.3: Zuheir Altamimi (France)
President SC1.4: Shen Yuan Zhu (Germany)
Representatives of IERS/IDS/IGS/ILRS/IVS:
Werner Gurtner (Switzerland)
Chopo Ma (USA)
John Ries (USA)
Members at large:
John Manning (Australia)
Richard Wonnacott (South Africa)

Sub-Commission

SC 1.1 - Coordination of Space Techniques

President: **Markus Rothacher** (Germany)

Terms of Reference

The space geodetic observation techniques, including Very Long Baseline Interferometry (VLBI), Satellite and Lunar Laser Ranging (SLR/LLR), Global Navigation Satellite Systems (GNSS) such as GPS, GLONASS, and in future GALILEO, the French DORIS, as well as altimetry, InSAR, and the gravity missions, contribute significantly to the knowledge about and the understanding of the three major pillars of geodesy: the Earth's geometry (point coordinates and deformation), Earth orientation and rotation, and the gravity field as well as its time variations. These three fields interact in various ways and they all contribute to the description of processes in the Earth System. Each of the space geodetic techniques contributes in a different and unique way to these three pillars and, therefore, their contributions should be combined into a consistent Integrated Global Geodetic Observing System (IGGOS), the project of the IAG.

Sub-Commission 1.1 coordinates efforts that are common to more than one space geodetic technique, such as models, standards and formats. It shall study combination methods and approaches concerning links between techniques co-located at fundamental sites, links between techniques co-located onboard satellites, common modelling and parameterisation standards, and perform analyses from the combination of a single parameter type up to a rigorous combination on the normal equation (or variance-covariance matrices) and even the observation level. The list of interesting parameters includes site coordinates (e.g. time series of combined solutions), Earth orientation parameters, satellite orbits (combined orbits from SLR, GPS, DORIS, altimetry), atmospheric refraction (troposphere and ionosphere), gravity field coefficients, geocenter coordinates, etc. One important goal of SC1.1 will be the development of a much better understanding of the interactions between the parameters describing geometry, Earth rotation, and the gravity field as well as the study of methods to validate the combination results, e.g., by comparing them with independent geophysical information.

To the extent possible SC1.1 should also encourage research groups to develop new observation techniques connecting or complementing the existing set of measurements.

Sub-Commission 1.1 has the task to coordinate the activities in the field of the space geodetic techniques in close cooperation with all the IAG Services, especially with the IERS and its Working Group on Combination, and with COSPAR.

Objectives

The principal objectives of the scientific work of Sub-Commission 1.1 are the following:

- Study systematic effects of or between space geodetic techniques.
- Develop common modelling standards and processing strategies.
- Comparison and combination of orbits derived from different space geodetic techniques together with the IGS LEO Working Group.
- Explore and develop innovative combination aspects such as, e.g., GPS and VLBI measurements based on the same high-accuracy clock, VLBI observations to GNSS satellites, combination of atmospheric information (troposphere and ionosphere) of more than one technique, etc.
- Establish methods to validate the combination results (e.g., with global geophysical fluids data).
- Explore, theoretically and practically, the interactions between the gravity field parameters, EOPs, and reference frames (site coordinates and velocities), improve the consistency between these parameter groups, and assess, how a correct combination could be performed.
- Study combination aspects of GPS and InSAR.

Additional objectives of Sub-Commission 1.1 are:

- Promotion of international scientific cooperation.
- Coordination of common efforts of the space geodetic techniques concerning standards and formats (together with the IERS).
- Organization of workshops and sessions at meetings to promote research.
- Establish bridges and common activities between SC1.1 and the IAG Services.

Links to Services

Sub-Commission 1.1 will establish close links to the relevant services for reference frames, namely International Earth Rotation and Reference Systems Service (IERS), International GPS Service (IGS), International Laser Ranging Service (ILRS), International VLBI Service for Geodesy and Astrometry (IVS), and International DORIS Service (IDS).

Working Groups

WG 1.1.1: Comparison and combination of precise orbits derived from different space geodetic techniques
(joint with the IGS LEO WG)

This working group is taking over the role of the former CSTG Sub-commission on Precise Orbit Determination (POD) of Low Earth Orbiting (LEO) Satellites. It will work closely together with the IGS LEO Working Group, but will have a broader research field not focussing on GPS, but on the interplay between different tracking techniques. The main topics of the WG will be:

– Comparison and combination of satellite orbits derived from various tracking techniques, including SLR, DORIS, GPS, altimetry, K-band links, CCD, and possible future observation techniques. Satellite orbits ranging from LEOs up to geostationary satellites (GEOs) should be considered.
– Assessment of systematic errors between different orbit types and observation techniques.
– Study of improved force models and POD strategies based on the combination of techniques.

WG 1.1.2: Interaction and consistency between terrestrial reference frame, Earth rotation, and gravity field (joint with Commission 2, Commission 3, and IGGOS)

This working group has to be a joint working group together with Commission 2, Commission 3, and IGGOS. Its main research topics are:

– Study the theoretical and practical interactions/relationships between parameters and models describing the Terrestrial Reference Frame (TRF), Earth rotation, and the gravity field (e.g., low degree harmonics of the gravity field, Love numbers...).
– Assess and study the consistency between products of these three fields.
– Investigate methods and techniques to combine geometry, Earth rotation, and gravity field parameters (e.g., by including LEO satellites into global solutions).

WG 1.1.3: Comparison and combination of atmospheric information derived from different space geodetic techniques
(Joint with IGS Troposphere WG, IGS Ionosphere WG, and IVS)

The task of this working group shall be the comparison and the combination of information about the atmosphere derived from different space geodetic techniques such as GPS, VLBI, InSAR, altimetry, etc. A very close cooperation with the IAG services, especially the IGS and the IVS are essential. Major research topics are:

– Investigate differences between tropospheric delay parameters estimated by different techniques; assess systematic biases between techniques and the accuracy of each individual technique; consider ways to combine and validate the information of different techniques.
– Study the accuracy of global or regional ionosphere maps or simple delays derived from different techniques; assess systematic biases; compare, combine, and validate results.

Sub-Commission

SC 1.2 - Global Reference Frames

President: **Claude Boucher** (France)

Terms of Reference

Sub-Commission 1.2 is engaged in scientific research and practical aspects of the global reference frames. It investigates the requirements for the definition and realization of the terrestrial reference frame, addresses fundamental issues of multi-technique global geodetic observatories (local ties, site effects…) and studies methods and approaches for the combined processing of heterogeneous observation data. The work will be done in close cooperation with the International Earth Rotation and Reference Systems Service (IERS), in particular with the ITRS Product Centre and the IERS Combination Research Centres (CRC), the other relevant IAG services (IGS, ILRS, IVS, IDS), and the IAG Project "Integrated Global Geodetic Observing System (IGGOS)". Theoretical aspects (e.g., quality measures, relativistic modelling) will be investigated in cooperation with the Inter-Commission Committee on Theory.

Objectives

The following research topics will form the fundamental objectives during the next period:

- Definition of the global terrestrial reference frame (origin, scale and orientation, time evolution, standards, conventions, models);
- Fundamentals of the realization of the global terrestrial reference frame (e.g., co-location problems: local ties; datum problems: coordinates origin, geo-centre; time evolution: linear and non-linear velocities, time series approach; long-term consistency with EOPs and ICRF);
- Analysis of strengths, weaknesses and systematic differences (biases) of individual techniques (VLBI, SLR, GPS, DORIS) and their contribution to specific TRF parameters;
- Combination methodology of individual techniques' solutions and analysis of the underlying models, parameters datum definitions etc.;
- Definition of common standards and models for all techniques.
- Practical implementation of the concept of Global Geodetic Observatories.
- Propagation of the ITRS/ITRF to national and international organizations.

Program of Activities

A Web site and mailing system will be established for a better exchange of information with regard to the mentioned objectives and with the respective components of the IERS, other services and the scientific community.

The necessity of the use of the ITRF as the reference frames for any kind of precise global positioning using space techniques shall be propagated among geodesy, other geosciences and society in general. It will also investigate the opportunity to formally adopt ITRF as primary realization of a common Earth fixed, Earth centred system in all applications: geodesy, surveying, mapping, navigation, geomatics etc. and clarify its relation with systems such as WGS84. Adequate activities have to be developed.

Links to Services

Sub-Commission 1.2 will closely be linked to the relevant services, in particular to the International Earth Rotation and Reference Systems Service (IERS), but also to the International GPS Service (IGS), International Laser Ranging Service (ILRS), International VLBI Service for Geodesy and Astrometry (IVS), and International DORIS Service (IDS).

Membership

President: Claude Boucher (France)

Working Groups

WG 1.2.1: Datum Definition of Global Terrestrial Reference Frames

(Joint with IERS and ICCT)

Chair: **Geoffrey Blewitt** (USA)

The Working Group is to deliver recommendations, in particular to the IERS, on possible datum definitions of Global Terrestrial Reference Frames (GTRFs) with the goal of improving the relevance, stability, quality, and understanding of GTRFs for various potential user groups. The principal objectives are:

- To assist the IERS Analysis Coordinator and ITRS Combination Centres by providing recommendations on datum conventions for future realizations of ITRF.
- To assist the ICCT in drafting conventional definitions of technical terms that refer to the various possible components of GTRFs.
- To identify the needs of potential user groups of GTRFs and address issues of datum definition that might benefit those groups.

- To compile a short summary document that references all recent published journal articles (not just those of the WG) relevant to datum definition of GTRFs, including a summary of the findings, conclusions, and significance of each paper, and to keep such a document updated as a reference document to assist research and informed discussion.
- To study the different types of possible reference system definitions that might be important for different research fields (sea level, geoid, deformation, Earth orientation...) and for what measurements they are important.
- To assess the uncertainties and quality of the various realizations, how they are affected by geophysical processes, and how the effect of these processes can be modelled in time and space to allow a refined realization of the frames.
- To assess how a stable and consistent reference frame can be realized over decades with the limited number of stations and observations.
- To study datum definition in a relativistic framework, in particular in view of the CRS/TRS transformation.
- To study the impact of IAU non-rotating origin on TRS, if any.

WG 1.2.2: Global Geodetic Observatories
(Joint with IERS)

Chair: **Jim Long** (USA)

Global geodetic observatories play a fundamental role in the installation of the global reference frame. They establish the connection between different techniques and provide the basis for the realization of the unique datum.

The reliability of global geodetic observatories, in particular of the local ties between different techniques' observing instruments, shall be investigated in view of the fundamental importance for the inter-technique analysis and combination. The co-location strategies will be investigated, as well as all aspect of local site survey measurement, processing and reporting. The group will in particular provide any guideline to be implemented in the IERS activities, as well as Technique Services.

WG 1.2.3: Integrated Theory for Crustal Deformation and Reference Frames
(Joint with Commission 3 and ICCT)

Chair: **Kosuke Heki** (Japan)

The effect of short-term crustal deformations, e.g., due to loading effects, on the reference frame parameters (heights, velocities, etc.) is important for the definition and realization of global reference frames: To which standard atmospheric pressure refer the coordinates (in particular the heights)? Have non-linear velocities (e.g., periodical) to be estimated?

(Detailed program description see in Inter-Commission Committee on Theory)

Sub-Commission

SC 1.3 - Regional Reference Frames

President: **Zuheir Altamimi** (France)

Terms of Reference

Sub-Commission 1.3 is concerned with definitions and realizations of regional reference frames and their connection to (and the densification of) the global International Terrestrial Reference Frame (ITRF). It offers a home for service-like activities addressing theoretical and technical key common issues of interest to regional organisations.

Objectives

In addition to specific objectives of each regional sub-commission, the main objectives of SC1.3 as a whole are:

- Develop specifications for the definition and realization of regional reference frames, including vertical datums, with full interaction with the Inter-Commission Project ICP 1.2 on Vertical Reference Frames.
- Develop and promote operation of GPS permanent stations, in connection with IGS whenever appropriate, to be the basis for the long-term maintenance of regional reference frames.
- Coordinate activities of the regional sub-commissions focusing on exchange and share of competences and results.
- Encourage and stimulate the emerging development of the AFREF project with close cooperation with IGS.
- Encourage and assist, within each regional sub-commission, countries to re-define and modernize their national geodetic systems, compatible with the ITRF.

Program of Activities

- Organize inter-regional workshop(s) addressing activities, results and key issues of common interest to the regional sub-commissions.
- Develop analysis strategies and compare methods for the implementation of the regional reference frames and their expression in the ITRF, with full interaction with the IGS.
- Consider establishing regional dense velocity fields for, primarily, the long-term maintenance of the regional reference frames.
- Contribute at regional levels to the improvement of local surveys in the collocation sites, with full cooperation with the Sub-commission 1.2 Global Reference Frames.

Links to Services

The regional reference frame activities are tied into the various IAG services through provision of data from individual sites to:

- International Earth Rotation and Reference Systems Service (IERS)
- International GPS Service (IGS)
- International Laser Ranging Service (ILRS)
- International VLBI Service for Geodesy and Astrometry (IVS)
- International DORIS Service (IDS)

Membership

President: Zuheir Altamimi (France)
SC1.3a Chair: João Agria Torres (Portugal)
SC1.3b Chair: Luiz Paulo Fortes (Brazil)
SC1.3c Co-Chairs: Michael Craymer (Canada), Richard Snay (USA)
SC1.3d Chair: Richard Wonnacott (South Africa)
SC1.3e Chair: John Manning (Australia)
SC1.3f Chair: Reinhard Dietrich (Germany)

Working Groups

WG 1.3.1: Inter-regional Technical Working Group

The main task of this WG is to develop harmonized and possibly common specifications for the regional reference frames implementation and ITRF densification.

Sub-Commission

SC 1.3a - Europe (EUREF)

Chair: **Joao Torres** (Portugal)

Terms of Reference

EUREF, the Regional Reference Frame Sub-commission for Europe, deals with the definition, realization and maintenance of the European Reference Frame, focusing on both the spatial and the vertical components, in close cooperation with the pertinent IAG components (Services, Commissions, and Inter-commission projects) and EuroGeographics, the consortium of the National Mapping Agencies (NMA) in Europe.

Program of Activities

- Continue to develop the EUREF Permanent Network (EPN) in close cooperation with IGS, for the maintenance of the European Reference Frame, as a contribution to the ITRF and as infrastructure to support other relevant projects, namely the European initiatives related with GALILEO.
- Extend the Unified European Levelling Network (UELN) and prepare it to be computed under a geokinematic approach.
- Implement the project European Combined Geodetic Network (ECGN) and investigate the discrepancies already identified in the combination of the EUVN (European United Vertical Network) results and the gravimetric geoid (project EUVN_DA), in close cooperation with IAG Commission 2.
- Establish a dense velocity field model in Europe for the long-term maintenance of the European reference frame.
- Consider the contribution to the IAG Project IGGOS (Integrated Global Geodetic Observing System) using the installed infra-structures managed by the EUREF members.
- Promote the adoption of the reference systems defined by EUREF (ETRS89-European Terrestrial Reference System and EVRS2000-European Vertical Reference System) in the European countries and European-wide organizations involved in geo-referencing activities.
- Organize annual symposia addressing activities carried out at national and European-wide level related with the global work and objectives of EUREF.

Membership

Chair: Joao Torres (Portugal)
Secretary: Helmut Hornik (Germany)
Representatives from European IAG member countries
Technical Working Group (TWG) members elected by the plenary Members in charge of special projects and ex-officio members.

Sub-Commission

SC 1.3b - South and Central America (SIRGAS)

Chair: **Luiz Paulo Fortes** (Brazil)

Terms of reference

Sub-commission 1.3b (South and Central America) encompasses the activities developed by the "Geocentric Reference System for the Americas" project (SIRGAS). As such, it is concerned with the definition and realization of a unified reference frame for South and Central America, consistent with ITRF, besides promoting the definition and establishment of a unique vertical reference system in this region.

Objectives

The aims and objectives of the Sub-commission 1.3b are:

- To define, realize and maintain a geocentric reference system for South and Central America consistent with ITRF;
- To establish a geocentric datum, promoting the connection of the national geodetic networks to it;
- To promote the definition and establishment of a unique vertical reference system for this region;
- To facilitate the connection of pre-existing networks;
- To promote and coordinate the efforts of each country to achieve the defined objectives.

Program of Activities

The SIRGAS 2000 GPS campaign was carried out from May 10 to 19, 2000, in order to support the computation of a velocity field for South America and the activities of SIRGAS WG3. In total, 184 stations were established in the Americas, whose coordinates were computed and are available on the project website (http://www.ibge.gov.br/sirgas). The next project activities are:

- To conclude the determination of the velocity field for South America, based on independent computations using collocation and finite elements
- To carry out spirit leveling of the SIRGAS 2000 stations
- To connect the classical vertical networks between neighboring countries
- To compute geopotential numbers for stations of the national vertical networks
- To collaborate with the determination of the sea surface topography
- To contribute to the determination of a unified quasigeoid for the region

Membership

Chair: Luiz Paulo Fortes (Brazil)
Vice-Chair: Eduardo Lauría (Argentina)
Chair WG1.3b.1: the SIRGAS WG1 President
Chair WG1.3b.2: the SIRGAS WG2 President
Chair WG1.3b.3: Laura Sánchez (Colombia)

Working Groups

WG 1.3b.1: Geocentric Reference Frame
WG 1.3b.2: Geocentric Datum
WG 1.3b.3: Vertical Datum

Sub-Commission

SC 1.3c - North America (NAREF)

Chair: **Michael Craymer** (Canada)
Co-chair: **Richard Snay** (USA)

Terms of Reference

To provide international focus and cooperation for issues involving the horizontal, vertical, and three-dimensional geodetic control networks of North America, including Central America, the Caribbean and Greenland (Denmark). For more information, see www.naref.org.

Objectives

In collaboration with the IAG community, its service organisations and the national geodetic organizations of North America, the aims and objectives of this regional sub-commission are to provide international focus and cooperation for issues involving the horizontal, vertical and three dimensional geodetic control networks of North America. Some of these issues include:

- Densification of the ITRF reference frame in North America and the promotion of its use;
- Maintenance and future evolution of vertical datums (ellipsoidal and orthometric), including the North American Vertical Datum of 1888 (NAVD88) and the International Great Lakes Datum (IGLD);
- Collocation of different measurement techniques, such as GPS, VLBI, SLR, DORIS, tide gauges, etc.;
- Effects of crustal motion, including post-glacial rebound and tectonic motions along, e.g., the western coast of North America and in the Caribbean;
- Standards for the accuracy of geodetic positions;
- Outreach to the general public through focused symposia, articles, workshops and lectures, and technology transfer to other groups.

Membership

Chair: Michael Craymer (Canada)
Co-chair: Richard Snay (USA)
Members: Per Knudsen (Denmark), TBD (Mexico), TBD (Caribbean)

Working Groups

WG 1.3c.1: North American Reference Frame (NAREF)
Chair: Michael Craymer
Members: B. Donahue (Canada), H. Dragert (Canada), C. Huot (Canada), M. Piraszewski (Canada), F.B. Madsen (Denmark), M. Cline (USA), B. Dillinger (USA), P. Fang (USA). R. Snay (USA), R. Ferland (Canada, IGS Representative)

To densify the ITRF reference frame in the North American region by organizing the computation of weekly coordinate solutions and associated accuracy information for continuously operating GPS stations that are not part of the current IGS global network. A cumulative solution of coordinate and velocities will also be determined on a weekly basis. The working group will organize, collect, analyse and combine solutions from individual agencies, and archive and disseminate the weekly and cumulative solutions.

WG 1.3c.2: Stable North American Reference Frame (SNARF)

Chair: Geoff Blewitt
Members: M. Craymer (Canada), Mitrovica (Canada), D. Argus (USA), R. Bennet (USA), J. Davis (USA), T. Dixon (USA), T. Herring (USA), D. Lavalleee (USA), M. Miller (USA), W. Prescott (USA), R. Snay (USA), F. H. Webb (USA)

To establish a high-accuracy standard reference frame, including velocity models, procedures and transformations, tied to a "stable North America" which would serve the broad scientific and geomatics communities by providing a consistent, mm-accuracy, stable reference with which scientific and geomatics results (e.g., positioning in tectonically active areas) can be produced and compared.

WG 1.3c.3: Reference Frame Transformations, Chair: Michael Craymer

Chair: Michael Craymer
Members: R. Ferland (Canada, IGS Representative),
R. Snay (USA), T. Soler (USA)

To determine consistent relationships between international, regional and national reference frames/datums, to maintain (update) these relationships as needed and to provide tools for implementing these relationships.

Sub-Commission

SC 1.3d - Africa (AFREF)

Chair: **Richard Wonnacott** (South Africa)

Terms of reference

Sub-commission 1.3d (Africa) is concerned with definition and realization of a unified continental reference frame (AFREF) for Africa which will be consistent and homogeneous with the global International Terrestrial Reference Frame (ITRF).

Objectives

In collaboration with the IAG community and its services organisations and the National and Regional Mapping Organisations of Africa, the aims and objectives of Sub-commission 1.3d (Africa) are:

- To define the continental reference system of Africa. Establish and maintain a unified geodetic reference network as the fundamental basis for the national 3-d reference networks fully consistent and homogeneous with the global reference frame of the ITRF;
- To realize a unified vertical datum and support efforts to establish a precise African geoid, in concert with the African Geoid project activities;
- To establish continuous, permanent GPS stations such that each nation or each user has free access to, and is at most 500 km from, such stations;
- To provide a sustainable development environment for technology transfer, so that these activities will enhance the national networks, and numerous applications, with readily available technology;
- To understand the necessary geodetic requirements of participating national and international agencies and;
- To assist in establishing in-country expertise for implementation, operations, processing and analyses of modern geodetic techniques, primarily GPS.

Program of Activities

It is envisaged that regionalization of AFREF will follow an approach that consists of three major phases:

- The establishment of a framework of permanent or semi-permanent GPS base stations throughout the region that will become part of the worldwide IGS network of stations.
- The densification of the network of permanent or semi-permanent base stations, largely on a country-by-country basis, to determine the relationship between the national geodetic system and the ITRS, and to refine the transformation parameters necessary to relate the national systems to a common ITRF.
- The third and equally important phase of the project will be to address the development of a more refined geoid model for Africa and the definition of a common vertical datum for the continent. This will be done in collaboration with the IAG Africa Geoid Project (Project 2.3 Commission 2).

It is further planned to hold workshops and seminars to strengthen the science and knowledge of geodesy and GNSS within Africa and their application to the development of reference frames.

Membership

Chair: Richard Wonnacott (South Africa)

Sub-Commission

SC 1.3e - Asia and the Pacific

Chair: **John Manning** (Australia)

Terms of Reference

To provide a regional focus for cooperation in the definition, realisation and densification of the International Terrestrial Reference frame (ITRF). This activity will be carried out in close collaboration with the Regional Geodesy Working Group of the Permanent Committee for GIS Infrastructure in Asia and the Pacific which operates under the purview of the United Nations Regional Cartographic Conference for Asia and the Pacific (UNRCC-AP).

Objectives

The objectives of the Sub-commission1.3e are:

- The densification of the ITRF and promotion of its use in the connection and enhancement of national networks;
- To promote the development of a regional vertical reference datum system
- To develop a better understanding of tectonic motions and plate boundaries within the region
- The development of an improved geoid by enhancement of the data from the regional gravity network and global gravity models
- Collocation of different measurement techniques, such as GPS, VLBI, SLR, DORIS, tide gauges, and maintenance of precise local geodetic ties at these sites.
- To outreach to developing countries through symposia, workshops, training courses, and technology transfer.
- Encourage the establishment of further continuous GPS base stations ,(accurately) positioned within ITRF, with data available both locally and to IGS.

Program of Activities

The activities of this sub commission will principally be carried out by the members of national surveying and mapping organisations through the PCGIAP Regional Geodesy Working Group and through the scientific members of the Asia Pacific Space Geodynamics Project (APSG).

In order to densify the ITRF reference frame in the Asia Pacific Region an annual geodetic observation campaign will be held each year to provide an opportunity to connect to national geodetic networks and to determine site velocities. These campaigns include several geodetic techniques:

- SLR, through cooperation with ILRS and WPLTN,
- VLBI, through APSG,
- GPS through PCGIAP.

Computations are undertaken in several countries from a common data set, which includes data from weekly epoch occupations, and continuously operation GPS which are not contributing to the IGS network. Only selected stations from the massive Japanese network are included.

The combination of results is being developed in the region and a PCGIAP workshop on Regional Geodesy will be held each year to strengthen regional cooperation, to discuss and analyse results of the geodetic campaigns, and to promote technology transfer.

Membership

Chair: John Manning (Australia)

Members of the Regional Geodesy Working Group of the Permanent Committee for GIS Infrastructure in Asia and the Pacific (PCGIAP)

Members of the Asia Pacific Space Geodynamics project (APSG)

Sub-Commission

SC 1.3f - Antarctica (SCAR)

Chair: **Reinhard Dietrich** (Germany)

Terms of reference

Sub-commission 1.3f (Antarctica) is focusing on the definition and realization of an unified reference frame for Antarctica which will be consistent with the global International Terrestrial Reference Frame (ITRF). It will establish close links to corresponding activities within the Scientific Committee on Antarctic Research (SCAR).

Objectives

- Maintenance and densification of the precise geodetic reference network in Antarctica by permanent observations and GPS campaigns;
- Realization of an unified vertical datum including GPS ties of tide gauges;
- Providing unified reference for other GPS applications like airborne gravimetry, ground truthing for satellite missions, geodynamics and glaciology;
- Develop technologies for remote geodetic observatories.

Program of Activities

- Organization of GPS campaigns in Antarctica, maintenance of the data archive.
- Data analysis and determination of the Antarctic GPS network as a regional densification of ITRF.
- Support airborne surveys and satellite missions with precise terrestrial reference.
- Organize meetings and workshops on Antarctic geodesy Joint with related SCAR activities in order to strengthen the international cooperation and to make optimum use of field logistics and infrastructure.

Membership

Chair: Reinhard Dietrich (Germany)

Membership and structure of SC1.3f is yet to be finalized in close collaboration with the SCAR program GIANT (Geodetic Infrastructure for Antarctica).

Sub-Commission

SC 1.4 - Interaction of Celestial and Terrestrial Reference Frames

President: **Shen Yuan Zhu** (Germany)

Terms of Reference

All of the high precision techniques in geodesy make use of a quasi-inertial reference frame. Radio source positions of VLBI must be in a barycentric quasi-inertial celestial reference frame, the orbits of satellites can be modelled easily in a geocentric inertial reference frame only, while laser gyroscopes measure the rotation vector with respect to a topocentric inertial reference frame. All these realizations of a celestial reference frame are slightly different; on the other hand, there is only one transformation between a celestial and the conventional terrestrial reference frame, established by the adopted precession and nutation model of the IERS Conventions and the EOP series of the terrestrial frame. Thus, systematic errors are induced in the terrestrial frames (and/or their EOP series) as realized by different techniques.

Objectives

The major objective of the Sub-commission is the study of the interaction of the celestial reference frame and the terrestrial reference frame. Observing data link the terrestrial stations with the celestial sources or the satellites. Any error in the former will affect the latter, and vise versa. In order to remove or reduce systematic errors in the final products, we must begin from the celestial frames. At first we have clearly to understand their theoretical definitions and the relation (transformation) between their different realizations. This includes

- **Resolutions of the XXIVth IAU General Assembly** concerning the revision of the reference systems. The numerical implementation of these resolutions requires some approximations. What kind of approximation is suitable for a given accuracy requirement? Resolution B1.4 (post-Newtonian parametrization) must be worked out before being translated into computer software.
- **Standards:** In the observation equations a lot of constants, "corrections" or "disturbing" models will be involved. In geodesy there are two important standards: IERS Conventions and IAG Fundamental Parameters. We must study whether they are consistent with each other. If not (completely), how will they influence the reference frame and the products? The Sub-commission will cooperate with the "Inter-commission Committee on Geodetic Standards". If this Committee recommends any change or improvement of the Standards, its effect on the realization of reference frames has to be studied.
- **Modelling:** There are uncertainties in each model and/or constant (except the defined ones). But their effects depend on many factors which may cause special systematic errors, e.g. the height of the satellites (different gravity and drag perturbations), the wavelength of the tracking techniques (different ionospheric and tropospheric effects); one-way or two-way tracking (two clocks or one clock), phase centre (electronic or mechanic). The study of the effects of model errors for each individual case, and search the way to remove or reduce them is a long term objective of the Sub-commission.
- **Algorithms:** There are complications when different software uses different standards instead of the internationally agreed ones. Each s/w adopts its own solution strategy and procedure (least-squares or iterative, one-step or two-step, etc.). The solved for parameters may also be different and might absorb certain random and even systematic errors. In order to understand the effects of these differences, the Sub-commission needs a close cooperation and assistance from the Services and Analysis Centres.
- **Datum:** In VLBI one cannot solve source positions and station coordinates completely unconstrained. Any condition for station coordinates (or baselines etc.) is a kind of datum definition. This datum problem affects the realized celestial as well as the terrestrial reference frame. Similarly, for satellite techniques it is impossible to solve orbits, stations, EOP (including UT1), nutations completely unconstrained. One must at least fix UT1 and a nutation value at one epoch and fix the precession constant. All these imply a certain datum definition the effects of which have to be studied.

Links to Services

There will be a close cooperation with the International Earth Rotation and Reference Systems' Service (IERS) and the International VLBI Service, but also with the International Laser Ranging Service (ILRS) and International GPS Service (IGS).

Membership

President: Shen Yuan Zhu (Germany)

Working Groups

WG 1.4.1: Theoretical Aspects of the Celestial Reference System

The effects of the new IAU definitions, the relation between barycentric system (as realized by VLBI) and the geocentric system shall be studied. The celestial and the terrestrial ephemeris origin replaced in 2003 the vernal equinox and the traditional first axis of the terrestrial intermediate frame. Consequently, the earth rotation angle replaced the apparent sidereal time. The Earth orientation parameters consisting of the difference between UTC and UT, the polar motion parameters, and the nutation residuals, connect the CRF and the TRF. That makes it possible to represent each of these frames by the other one plus the earth orientation parameters. A change or error in one of the two frames must therefore be compensated by a corresponding change in the other frame and/or the earth orientation parameters, and any error in the orientation parameters must be reflected by a change in at least one of the two reference frames.

WG 1.4.2: Realization of Celestial Reference Frames (CRF and Transformations)

To achieve further progress regarding the realization of celestial reference frames it is essential to review the current status, to identify deficiencies and to make proposals for improvements. This task is closely related to various components of the IERS (e.g., ICRF PC, CRCs) and the techniques centres (IVS, ILRS, IGS, IDS), and requires a close cooperation between the different groups. The working group shall focus on all space geodetic techniques contributing to the CRF realization, i.e., VLBI to realize a barycentric CRF, satellite methods to realize a dynamic reference frame, and optical methods (future astrometry missions). The activities shall include the survey of the current status of CRF realization, a review regarding the implementation of IERS Conventions and IAG Fundamental Parameters and different space techniques for CRF realization.

WG 1.4.3: Systematic Effects in the CRF Determination

It is well-known that the accuracy achieved today is mainly limited by technique- and/or solution-related systematic biases (effects), which are often poorly characterized or quantified. This issue should be addressed regarding the determination of the celestial reference frame. The WG shall ensure a close cooperation between other relevant groups (e.g., ICRF PC, IVS, ILRS, IGS, IDS). The tasks include the definition of pilot projects regarding CRF determination, CRF computations by different groups with different software, identification and description of inconsistencies (systematic effects, refined models).

WG 1.4.4: Interaction Between Celestial and Terrestrial Reference Frames

A major goal of this WG is to investigate the interaction between the celestial and terrestrial reference frame and the transformation between both (precession, nutation, EOP), and to improve the consistency between ICRF, ITRF and EOP. The WG should ensure a close relation with various components of the IERS (Analysis Coordinator, CRCs, combination centres, product centres, etc.) and with the GGFC. Two different fields shall be addressed, the mathematical and the physical consistency between ICRF, ITRF and EOPs. The first item is the major goal of the IERS combination research centres. The WG should focus on the second aspect. The major tasks include the effect of errors in the CRF on the terrestrial reference frame and other related products, and vise versa, the realization of the NNR-condition for the ITRF (e.g. deformations) and its interaction with EOP determination, comparison with geophysical models, and the interaction with the gravity field.

WG 1.4.5: Satellite Gravity Theory
(Joint with Commission 2 and ICCT)

Satellites are mainly observed from stations with coordinates given in the terrestrial reference frame. Their orbits, however, have to be computed (integrated) in an inertial system. The adequate realization of the celestial inertial system in satellite dynamics shall be studied.

(Detailed program description see in Inter-Commission Committee on Theory)

Inter-Commission Project

IC-P 1.1 - Satellite Altimetry

(Joint with Commissions 2 and 3)

Chair: **Wolfgang Bosch** (Germany)

Terms of Reference

Satellite Altimetry has evolved to an operational remote sensing technique with important interdisciplinary applications to many geosciences. For geodesy, the potential operational, precise and near global mapping and monitoring of the Earth surface is of particular importance. The construction of high-resolution global mean sea surface and potentially its variability will help to globally unify height reference systems. Altimetry contributes to essential improvements of the Earth gravity field. Even with the new dedicated gravity field missions CHAMP, GRACE and GOCE, satellite altimetry will be needed for the determination of the high resolution gravity field. Mapping and monitoring of seasonal and secular changes of the mean sea level helps to understand fundamental processes of the System Earth: the ocean water mass redistribution, one component of the global hydrological cycle, has impact to the Earth center-of-gravity, to Earth rotation by the ocean angular momentum functions, the temporal variations of the Earth gravity field, as well as studies of sea level rise and its impact on environment. The multiple application suggests that satellite altimetry will become a core element of a global observing system. This includes, but is not limited to, the following scientific and organisational aspects:

- the combination of multiple altimeter mission data with different space-time sampling and the adaption and cross calibration of new technologies like laser altimetry (GLAS on ICESat), interferometric altimetry (Cryosat), delay-doppler altimetry (proposed by ABYSS), wide swath-altimetry (proposed on Jason-2), and potentially airborne and spcaeborne LIDARs. A reliable vertical reference system for altimetry is one of the most crucial prerequisite.
- a coordination among space agengies, processing centres, data providers, value-adding entities and the users together with a scientific feedback to ensure data and product quality and improvements for orbits and geophysical parameters. A scientific service appears to provide a most convenient platform.

The interdisciplinary relevance of satellite altimetry with overlaps between research areas of various IAG commissions justify to establish the project as a joint project of commissions 1, 2, and 3.

Objectives

The primary objective of the joined commission project is to identify the scientific requirements to ensure a long and precise time series of utmost consistent altimeter observations with up-to-date geophysical corrections, consolidated geocentric reference and long-term stability. It has to be elaborated, how satellite altimetry is going to contribute to a global observing system, how the data of different missions is to be harmonized and how fast updates of orbits and geophysical parameters can be achieved in order to support scientific and operational applications. More specific, it is required to obtain precise knowledge about the inherent vertical reference system of altimetry and the long-term stability of the altimeter sensors itself, and of auxillary sensors (radiometer). It is also envisioned that this project will provide a forum to foster innovative ideas for research and applications of satellite altimetry relevant to strengthening of the realisation of vertical component of the ITRF and to diverse areas of geosciences.

Program of Activities

- To study the contribution of satellite altimetry to the realisation and stability of the vertical component of the ITRF implied by precise orbit determination, geocenter variations, miscentering of reference frame, as well as long-term performance of altimeter - and auxillary sensors.
- To investigate by an interdisciplinary working group the rationale, feasibility and scope of an International Altimeter Service in order to serve scientific and operational applications of satellite altimetry. The group shall strive for a broad support by other scientific entities.

Links to Services

There will be installed links in particular to the International Earth Rotation and Reference Systems' Service (IERS), the International Gravity Field Service (IGFS) and the Permanent Service for Mean Sea Level (PSMSL).

Membership

Chair: Wolfgang Bosch (Germany)
Representative of Commission 1: C.K. Shum (USA)
Representative of Commission 2: Martin Vermeer (Finland)
Representative of Commission 3: Richard Gross (USA)

Working Groups

WG-ICP 1.1.1: Rationale, Feasibility and Scope of an International Altimeter Service

WG-ICP 1.1.2: Reference System and Long-term Stability of Satellite Altimetry

Inter-Commission Project

IC-P 1.2 - Vertical Reference Frames

(Joint with Commission 2)

Chair: **Johannes Ihde** (Germany)

Terms of Reference

The Earth's surface may be characterized by its geometry and the potential of the Earth gravity field. The determination of heights includes both of these aspects, the geometric part and the geopotential part. Presently, space geodetic techniques allow an accuracy in geometric positioning of about 10–9 in global and continental scales. Gravity field parameters, including the physical height components, can at present be determined only 2 to 3 orders of magnitude less accurate than the geometric parameters. Moreover, the current height reference frames around the world differ in their vertical datum (e.g., the mean sea-level at the fundamental tide gauges) and in the theoretical foundations of the height systems. There is no global height reference system defined and realized like the International Terrestrial Reference System (ITRS). A considerable progress in the definition and realization of a global vertical reference system will be attained from the data of the new gravity field missions. Based on the classical and modern observations, the Project on Vertical Reference Frames shall study the consistent modeling of both, geometric and gravimetric parameters, and provide the fundamentals for the installation of a unified global vertical reference frame.

Objectives

- To elaborate a proposal for the definition and realization of a global vertical reference system (World Height System – WHS);
- To derive transformation parameters between regional vertical reference frames;
- To establish an information system describing the various regional vertical reference frames and their relation to a world height frame (WHF).

Program of Activities

- Harmonization of globally used height data sets;
- Study of combination procedures of height data sets from different techniques;
- Study of information on regional vertical systems and their relations to a global vertical reference system for practical applications;
- Unification of regional (continental) height systems.

Membership

Chair: Johannes Ihde (Germany)

Members: Alireza A. Ardalan (Iran), Carine Bruyninx (Belgium), Milan Bursa (Czech Republic), Tonie van Dam (Luxemburg), Gleb Demianov (Russia), Will Featherstone (Australia), Christopher Jekeli (USA), Adolfientje Kasenda (Australia), Bill Kearsley (Australia), Roland Klees (Netherlands), Gunter Liebsch (Germany), Markku Poutanen (Finland), Laura Sanchez (Colombia), Tilo Schöne (Germany), Steve Shipman (UK), Jaroslav Simek (Czech Republic)

Inter-Commission Study Group

IC-SG 1.1 - Ionosphere Modelling and Analysis

(Joint with Commission 4, IGS and COSPAR)

Chair: **Claudio Brunini** (Argentina)
Vice Chair: **Susan Skone** (Canada)

Terms of Reference

As a result of many years of research the climatology of the ionosphere is today quite well known. However, variations of the solar activity and emissions of plasma from the solar corona change the conditions of the Sun-Earth environment and can dramatically disturb the ionosphere mean conditions.

The development of sophisticated high technological systems for navigation, telecommunication, space missions, etc., created the need of predicting the meteorological conditions of the space around the Earth, giving rise to a branch of knowledge that today is called space weather.

Disruptions of the ionosphere caused by massive solar flares can interfere with or even destroy communication systems, Earth satellites and power grids on Earth. A stringent application of ionosphere models would be to provide real-time corrections and integrity information for aircraft navigation and precision approach.

Ionosphere models are important for many space geodesy observing techniques to correct the delay caused by the ionosphere on the propagation of electromagnetic wave, typical applications being single frequency GPS and GLONASS positioning or real time ambiguity resolution.

The Earth's ionosphere has been studied for more than one hundred years using different observational techniques. A large contribution to the knowledge of the bottom-side ionosphere was done by a global network of 100-200 vertical incidence ionosondes, that started operation during the International Geophysical Year 1957-1958. Incoherent backscatter radars were used after 1958 to extend the exploration of the ionosphere to its topside. In 1957 the space age began enabling topside ionosondes onboard satellites, observations of Faraday rotation on trans-ionosphere signals emitted by geostationary satellites, Doppler method with rockets and satellites and in situ techniques aboard spacecrafts.

Using large data bases of classical observations covering different geographical regions and different solar and geomagnetic conditions, several empirical ionosphere models were established. Among them, the International Reference Ionosphere (IRI) is probably the most widely used. IRI is continuously revised and updated through international cooperative effort of different type sponsored by the Working Group created by the Committee on Space Research (COSPAR) and the Union of Radio Sciences (URSI).

Today ground-based and space-based GPS observations, and in a less extent observations of other space geodetic dual-frequency observing techniques, e.g., satellite altimetry, bring an unprecedented opportunity for ionosphere studies and may well revolutionize science and technology of the ionosphere meteorology. They provide high quality ionosphere information, with global coverage, simultaneity and time continuity and are easy and free available for ionosphere scientists.

Objectives

A first valuable step toward exploiting the GPS potentiality for ionosphere studies was already done by the IGS in 1998 creating the Ionosphere Working Group. In the framework of this group, five centres are computing and making accessible on a regular basis several GPS-derived ionosphere products, mainly two-dimensional worldwide grids of vertical total electron content.

We believe that the efforts to maintain a regular service for processing GPS data to form VTEC maps should be continued, but we are convinced that the effort should be pursued to fully exploit such amount of high quality data and to maximize the benefits for the scientific community.

Therefore, we propose the creation of a study group on Ionosphere Modelling and Analyses, in co-operation with IGS and possibly with COSPAR, to support the already existing Ionosphere Working Groups.

The principal objectives of the Study Group may be summarized as follows:

- To establish a scientific link between geodetic and aeronomy experts in order to maximize the benefit of the ionosphere information provided by geodesy.
- To analyse the ionosphere products derived from GPS and other space techniques and to explore the better use for scientific and practical purposes.
- To study possible improvements of the existing products.
- To propose new products that could be obtained from ionosphere information of GPS and other space techniques.

Program of Activities

An effective two-way link between geodesists and aeronomy physicists will play a key role for both, improving the rather simple physical ionosphere models – either deterministic or stochastic – that are currently used by geodesists, and interpreting the physical phenomena that take place in the complex environment configured by the ionosphere and the Earth magnetic field, under the action of the solar electromagnetic radiation and the solar wind, imbedded in the interplanetary magnetic field.

The planned activities of the Study group are in the first year are the collection and validation of existing physical ionosphere models. They shall then be represented by different methods, e.g., spherical harmonics and wavelets.

The models shall be compared with geodetic observations represented in similar models. The effects on geodetic observables and parameters (reference frames and positions) shall be studied.

Links to Services

The Study Group shall be linked to the corresponding working groups in the IGS and COSPAR.

Membership

Chair: Claudio Brunini (Argentina)
Vice Chair: Susan Skone (Canada)

Members:

Dieter Belitza (USA),
Norbert Jakowski (Germany),
Reinhard Leitinger (Austria),
Sandro Radicella (Italy),
Chris Rizos (Australia),
Stefan Schaer (Switzerland),
Michael Schmidt (Germany),

Inter-Commission Study Group

ICSG 1.2 - Use of GNSS for Reference Frames

(Joint with Commission 4 and IGS)

Chair: **Robert Weber** (Austria)

Terms of Reference

Up to now the operating satellite navigation systems GPS and GLONASS allow a huge user community an easy access to reference frames very close to the most recent realization of the ITRS. The IAG Services IERS (International Earth Rotation and Reference Systems Service) and IGS (International GPS Service) provide the necessary products to tie these frames to the ITRF, which is based upon a set of estimated coordinates and velocities of stable stations observed by all space techniques. The design of the upcoming GALILEO system, its envisaged accuracy and the long-term stability implies, that also GALILEO will become a highly valuable technique for the ITRF. The modernization of GPS and the completion of the GLONASS system will further improve the situation.

The goal of Study Group 1.2 is to evaluate and support the use of Global Navigation Satellite Systems for the definition and densification of the International Terrestrial Reference Frame (ITRF).

Objectives

The principal objectives of the WG will be:

- Document the potential contributions of Global Navigation Satellite Systems to reference frame establishment and maintenance.
- Investigate the ties and their time evolution between GNSS Broadcast Frames like WGS84, PZ-90 and the upcoming GALILEO Reference Frame, and the ITRF.
- Examine deficiencies in the stability of the global GNSS station network, especially focusing on stations contributing to the ITRF2000 catalogue.
- Prepare a consolidated feedback concerning GPS, GLONASS and GALILEO frame establishment and improvement based on relevant experience in areas such as receiver site selection, installation and maintenance.
- Investigate the individual strengths and shortcomings of GPS, GLONASS and GALILEO for Reference System Realisation and work out synergies.
- Study the ties of regional and local frames realized by a permanently increasing number of active real-time GNSS networks.

Program of Activities

Planned activities in the upcoming two years are to compile a clear picture of the individual strengths and shortcomings of GPS and GLONASS for Reference System Realisation. This also includes inspection of stability of global GNSS ITRF core stations, the question of site-selection and maintenance and a documentation of the ties between the GPS and GLONASS broadcast frames WGS84, PZ-90 and the ITRF. Furthermore the contribution of the permanently increasing number of regional and local real-time GNSS networks for frame densification will be investigated.

Later on the Study Group will focus on the upcoming GALILEO system. Based on the agreed reference network design we will investigate the quality of the tie and anticipated time evolution of the GALILEO Reference Frame with the ITRF. In addition the group will concentrate on expected synergies using a real GNSS observation network covering three satellite navigation systems for reference frame maintenance.

A Web-site will be established for a exchange of information, communication, presentation and outreach purposes. The Study Group will hold working meetings at international symposia. Achievements will be summarized in a mid-term review in 2005 and a final document in 2007 and will be presented at the upcoming IAG Conference and at the next IUGG General Meeting.

Links to Services

This Study Group should coordinate closely with the IAG Services IERS and IGS, in particular with the existing GNSS Working Group of the IGS. On condition of approval of the IGS Governing Board both groups may establish a Joint Working Group with united member and objectives lists.

Membership

Chair: Robert Weber (Austria)

Members: Y. Bar Sever (USA), N. Beck (Canada), C. Boucher (France), C. Bruyninx (Belgium), W.Gurtner (Switzerland), R. Galas (Germany), R. Langley (Canada), J. Manning (Australia), H. van der Marel (Netherlands), H.P. Plag (Norway)

Commission 2 - Gravity Field

web: www.ceegs.ohio-state.edu/iag-commission2

President: **Christopher Jekeli** (USA)
Vice President: **Ilias Tziavos** (Greece)

Terms of Reference and Objectives

Knowledge of the gravity field in space and its temporal variations is of prime importance for geodesy, navigation, geophysics, geodynamics, and related disciplines. Efficient and accurate modeling of the field spans a broad spectrum of activities that utilize data from ground, airborne, and satellite systems. An important subset of these modeling efforts includes the precise determination of the geoid for applications ranging from traditional height systems to oceanography.

Commission 2 (the Gravity Field Commission), of the International Association of Geodesy is concerned with promoting, supporting, and stimulating the advancement of knowledge, technology, and international cooperation in the geodetic domain associated with Earth's gravity field. This domain comprises several major themes of long-term interest, each under the purview of a sub-commission. The themes cover terrestrial, airborne, shipborne, and satellite gravimetry; terrestrial relative and absolute gravity networks; precise regional and global geoid determination and geopotential modeling; topographic/isostatic modeling; regional and global temporal variations in the gravity field; dedicated satellite gravity mapping missions; and gravity determination from satellite altimetry.

The Gravity Field Commission essentially continues the work of the former Section III of the IAG (Determination of the Gravity Field), but includes some aspects of satellite geodesy (former Section II), and is designed to have stronger links to other components of the IAG, specifically the Inter-Commission Committee on Theory (ICCT) and Commission 1 (Reference Frames). The sub-commissions cover the major themes listed above, which constitute the principal areas in gravity field modeling, determination, and measurement technology, as well as the specific problems and activities related to regional geoid determination. Study Groups, as under the former structure, continue to look at well-defined subjects over shorter duration. They are placed under the sub-commissions. Projects are established under the Commission to organize work on unique and exceptional areas of interest or particular problems requiring specific international cooperation. The regional geoid determination projects, being of paramount importance, are collected under the Sub-commission 2.4, in order to provide close links between them. Connections to other components of the IAG are created with inter-commission working groups that provide a cross-disciplinary stimulus for work in several topics of interest to the Commission. Finally, the Commission has very strong links to several of the Services in geodesy, particularly the newly established International Gravity Field Service and its component services.

In this modern age of instant change, enabled by electronic forms of information exchange, it is only natural that the structure of Commission 2, its membership, and its connection to other components of the IAG has a dynamic character that will evolve over the current term between IUGG General Assemblies. In fact, this evolution is necessary as the new structure of the IAG takes shape and re-establishes and re-defines its purview over regional and international geodetic activities. The current status of Commission 2, including its structure and membership, may be updated regularly and can be viewed on the internet: www.ceegs.ohio-state.edu/iag-commission2

Structure

Sub-Commissions:

SC2.1: Gravimetry and Gravity Networks
President: **Shuhei Okubo** (Japan)

SC2.2: Spatial and Temporal Gravity Field and Geoid Modeling
President: **Martin Vermeer** (Finland)

SC2.3: Dedicated Satellite Gravity Mapping Missions
President: **Pieter Visser** (The Netherlands)

SC2.4: Regional Geoid Determination
President: **Urs Marti** (Switzerland)

Commission Projects:

CP2.1: European Gravity and Geoid
Chair: **Heiner Denker** (Germany)

CP2.2: North American Geoid
Chair: **Marc Véronneau** (Canada)

CP2.3: African Geoid
Chair: **Charles Merry** (South Africa)

CP2.4: Antarctic Geoid
Chair: **Mirko Scheinert** (Germany)

CP2.5: South American Geoid
Chair: **Denizar Blitzkow** (Brazil)

CP2.6: Southeast Asian Geoid
Chair: **Bill Kearsley** (Australia)

CP2.7: Gravity in South America
Chair: **María Cristina Pacino** (Argentina)

Study Groups:

SG2.1: Comparison of Absolute Gravimeters
Chair: **Leonid Vitushkin** (France)

SG2.2: Forward Gravity Field Modeling Using Global Databases
Chair: **Michael Kuhn** (Australia)

SG2.3: Satellite altimetry: data quality improvement and coastal applications
Chair: **Cheinway Hwang** (Taiwan)

SG2.4: Aerogravimetry and Gradiometry
Chair: **Uwe Meyer** (Germany)

Inter-Commission Study Groups:

IC-SG2.5: Aliasing in Gravity Field Modeling
(Joint with ICCT)
Chair: **C. Christian Tscherning** (Denmark)

IC SG2.6: Multiscale Modeling of the Gravity Field
(Joint with ICCT)
Chair: **W. Freeden** (Germany)

Inter-Commission Projects:

ICP1.1: Satellite Altimetry
(Joint with Commission 1 and 3)
(Description: See Commission 1)
Chair **W. Bosch** (Germany)

IC-P1.2: Vertical Reference Frames
(Joint with commission 1)
(Description: See Commission 1)
Chair: **Johannes Ihde** (Germany)

IC-P3.1: GGP Global Geodynamics Project
(Joint with Commission 3.)
(Description: See Commission 1)
Chair: **David Crossley** (USA)

Inter-Commission Working Groups:

IC-WG1: Quality Measures, Quality Control and Quality Improvement
(Joint with ICCT and Commission 1)
(Description: See ICCT)
Chair: **H. Kutterer** (Germany)

IC-WG3: Satellite Gravity Theory
(Joint with ICCT and Commission 1)
(Description: See ICCT)
Chair: **N. Sneeuw** (Canada)

Program of Activities

The Gravity Field Commission fosters and encourages research in the areas of its sub-entities by facilitating the exchange of information and organizing Symposia, either independently or at major conferences in geodesy. The activities of its sub-entities, as described below, constitute the activities of the Commission, which will be coordinated by the Commission and summarized in annual reports to the IAG Bureau. An Internet web-site for the Commission will contain all information about the Commission, its basic structure, terms of reference, and membership, as well as links to the internet sites of its sub-entities and parent and sister organizations and services.

Steering Committee

President: Christopher Jekeli
Vice president: Ilias Tziavos
President SC2.1: Shuhei Okubo
President SC2.2: Martin Vermeer
President SC2.3: Pieter Visser
President SC2.4: Urs Marti
Rene Forsberg (representative from the IGFS)
Peter Schwintzer (representative from the Int. Center of Global Earth Models)
Jacques Hinderer (representative from GGP)

Sub-Commission

SC 2.1 - Gravimetry and Gravity Networks

President: **Shuhei Okubo** (Japan)

Terms of Reference and Objectives

Sub-commission 2.1 promotes scientific investigations of gravimetry and gravity networks by employing a three-step strategy. The first step is focused on gravity determination at some selected sites with absolute gravimeters (point scale). It provides the gravity community with means to assess the level of accuracy of steadily growing numbers of absolute gravimeters through organizing international inter-comparison campaigns of global and of regional scales. In the second step, the Sub-commission proceeds from the 0-D point-wise gravimetry to 1-D gravimetry: accurate and precise gravimetry/gradiometry around land/sea boarders where significant bias or errors are still observed. The Sub-commission promotes such research and development by stimulating airborne gravimetry and gradiometry. In the third step, it encourages and promotes special absolute/relative gravity campaigns, techniques and procedures for the adjustment of the results of gravity surveys on a regional scale (2-D). The Sub-commission will encourage regional meetings or workshops dedicated to specific problems, where appropriate.

Reports to Commission 2.

Program of Activities

To meet these goals, the Sub-commission sets up Special Study Groups (SSG's) on Inter-comparison of Absolute Gravimeters, Aerogravimetry and Gradiometry, East Asia and Western Pacific Gravity Network, and Gravity in South America (see below).

Membership

President: Shuhei Okubo
Vice President: Gerd Boedecker
Rene Forsberg (Gravity Networks in Polar Regions)
Matthias Becker (Relative gravimetry)
Leonid F. Vitushkin (Absolute Gravimetry)
Uwe Meyer (Aerogravimetry and Gradiometry)
Yoichi Fukuda (East Asia and Western Pacific Gravity Network)
María Cristina Pacino (Gravity in South America)

Sub-commission

SC 2.2 - Spatial and Temporal Gravity Field and Geoid Modeling

President: **Martin Vermeer** (Finland)

Terms of Reference and Objectives

The subjects of study that the Sub-commission supports and promotes can be summarized, without claim to completeness, as follows. Research work in the spatial domain concentrates on:

– Global and regional gravity modeling
– Topographic/isostatic modeling
– Downward and upward continuation problems
– Boundary value problem approaches
– Spectral techniques like (but not limited to) spherical harmonics
– Height theory and height systems
– Geodetic aspects of satellite radar altimetry

Studies in the temporal domain of the gravity field include, among others, the following:

– Tides
– The effect of postglacial land uplift
– Time derivatives of the J_n
– Short/medium term gravity change due to movements of air and water
– Anthropogenic gravity changes

Reports to Commission 2.

Program of Activities

To meet these goals, the Sub-commission invites the establishment of Special Study Groups (SSG's) on relevant topics, promotes and organizes special sessions at IAG Symposia and other conferences, and reports on the research work in these areas of interest.

Steering Committee

President: Martin Vermeer

Sub-commission

SC 2.3 - Dedicated Satellite Gravity Mapping Missions

President: **Pieter Visser** (The Netherlands)

Terms of Reference and Objectives

The successful launches of the German CHAMP (2000) and US/German GRACE (2002) missions have led to a revolution in global gravity field mapping by space-borne observation techniques and associated activities. These two missions have proven new concepts and technologies, such as space-borne accelerometry and low-low satellite-to-satellite tracking (SST), in combination with more conventional observation techniques, like GPS/SST and satellite laser ranging (SLR). CHAMP and GRACE have already produced the first consistent long- to medium-wavelength global gravity field models and have helped in preparing for the European Space Agency (ESA) GOCE dedicated gravity field mission which will further revolutionize high-accuracy and high-resolution gravity field mapping employing for the first time in history the satellite gravity gradiometry (SGG) observations.

The focus of this sub-commission will be to promote and stimulate the following activities:

- Generation of the best possible static and temporal global gravity field models based on, but not limited to, observations by space-borne techniques (LAGEOS, CHAMP, GRACE,...)
- Preparation for future satellite missions which focus on or support global gravity field mapping (GOCE, COSMIC,…)
- Definition of enabling technologies for the more remote future (GRACE follow-on, GOCE follow-on,...)
- Communication/interfacing with gravity field model user communities (Climatology, oceanography/ Altimetry, Glaciology, Solid-Earth, Geodesy,...)

Program of Activities

To meet these goals, the Sub-commission invites the establishment of Special Study Groups (SSG's) on relevant topics, promotes and organizes special sessions at IAG Symposia and other conferences, and reports on the research work in these areas of interest.

Steering Committee

President: Pieter Visser (DEOS/The Netherlands)
Srinivas Bettadpur (CSR/U.S.A.)
Thomas Grüber (IAPG/Germany)
Cheinway Hwang (NCKU/Taiwan)
Radboud Koop (SRON/The Netherlands)
Nico Sneeuw (Univ. Calgary/Canada)

Sub-commission

SC 2.4 - Regional Geoid Determination

President: **Urs Marti** (Switzerland)

Terms of Reference and Objectives

The sub-commission is concerned with the following areas of investigation:

- Regional geoid projects: data sets, involved institutions,
- comparison of methods and results, data exchange, comparison with global models
- gravimetric geoid modeling techniques and methods, available software
- GPS/leveling geoid determination:
- methods, comparisons, treating and interpretation of residuals
- common treatment of gravity and GPS/leveling for geoid determination
- geoid applications: GPS heights, sea surface topography, integration of geoid models in GPS receivers, vertical datums
- other topics: topographic effects, downward and upward continuation of terrestrial, airborne, satellite data specifically as applied to geoid modeling

Reports to Commission 2.

Program of Activities

To meet these goals, the Sub-commission invites the establishment of Special Study Groups (SSG's) on relevant topics, and of projects on regional geoid determination. It promotes and organizes special sessions at IAG Symposia and other conferences, and reports on the research work in these areas of interest. Also, the sub-commission plans to facilitate the interaction of the various regional geoid projects by organizing links of communication on the Internet.

Steering Committee

President: Urs Marti
Heiner Denker (Project 2.1)
Marc Véronneau (Project 2.2)
Charles Merry (Project 2.3)
Mirko Scheinert (Project 2.4)
Denizar Blitzkow (Project 2.5)
Bill Kearsley (Project 2.6)

Commission Project

CP2.1 European Gravity and Geoid

Chair: **Heiner Denker** (Germany)

Terms of Reference and Objectives

The primary objective of the project is the development of an improved geoid and quasigeoid model for Europe. The previous European Gravimetric Geoid 1997 (EGG97) is based on high-resolution gravity and terrain data and the global model EGM96. The comparison of the EGG97 model with GPS/leveling data from national campaigns and the continental-scale EUVN project reveals long wavelength discrepancies (at the dm level), while the agreement at shorter wavelengths is at the cm level in many cases. For GPS heighting such long wavelength geoid errors are vital and have to be modeled, e.g., by fitting the geoid model to some GPS/leveling control stations.

Since the development of the EGG97 model, several new data sets and computing techniques have become available. Hence, significant improvements (especially at the long wavelengths) can be expected from an updated European geoid model. Besides the new modeling techniques (e.g., wavelets), improvements are expected from the new CHAMP and GRACE global geopotential models, new terrain data sets (e.g., GTOPO30, SRTM results, national data sets), new and more homogeneous gravity data sets for some regions, new altimetric results, an improved merging of ship and altimetric gravity data, and the use of continental-scale GPS/leveling campaigns. The data collection effort will focus especially on the problem areas in the EGG97 computation, i.e., areas where gravity field data is lacking, sparse, or of low quality.

All relevant work within the project requires close international cooperation between all European countries and different IAG bodies. The contacts and successful cooperation with the respective national and international agencies, established within the framework of the EGG97 model development, will be continued and extended. The project is open to all agencies and universities with an interest in the development of a geoid and quasigeoid model for Europe.

The objectives of the project are summarized below:

- Collection, evaluation and homogenization of land and marine gravity data, altimetric data, GPS/leveling data, digital elevation models, and global geopotential models.
- Creation of databases for different data types.
- Investigation of different techniques for regional geoid and quasigeoid determination.
- Investigation of techniques for the combination of gravimetric and GPS/leveling data.
- Development of a new European geoid and quasigeoid model (gravimetric and/or combined model).

Reports to Sub-Commission 2.4

Steering Committee

Heiner Denker (Chair) (Germany)
Jean-Pierre Barriot (France)
Riccardo Barzaghi (Italy)
Rene Forsberg (Denmark)
Johannes Ihde (Germany)
Ambrus Kenyeres (Hungary)
Urs Marti (Switzerland)
Ilias Tziavos (Greece)

Commission Project

CP2.2 -North American Geoid

Chair: **Marc Véronneau** (Canada)

Terms of Reference and Objectives

The primary objective of the Project is the development of a geoid model for North America and surrounding oceans in order to achieve a common vertical datum. Its development will require the determination of the gravity field for an area encompassing Iceland, Greenland, Canada, USA (including Alaska and Hawaii), Mexico and countries forming Central America and the Caribbean Sea, referred to herein as "North America". The geoid model for North America could be used as the common datum to relate national datums or tailored using; for example, "*GPS/Leveling*" in order to depict the official national vertical datum as it is done in Canada and USA. The achievement of a geoid model for North America will be accomplished by coordinating activities between agencies and universities with interest in geoid theory, gravity, digital elevation models (DEM), topographical density, altimetry, sea surface topography, leveling and vertical datum.

The determination of a geoid model for North America is not limited to a single agency, which will collect all necessary data from all countries. The Project encourages theoretical diversity in the determination of a geoid model between the agencies. Each agency takes responsibility or works in collaboration with neighboring countries in the development of a geoid model for their respective country with an overlap (as large as possible) over adjacent countries. Each solution will be compared, the discrepancies will be analyzed, and the conclusions will be used to improve on the next model. Thus, the geoid model for North America will be derived from a "mosaic" of geoid models.

Reports to Sub-Commission 2.4

Program of Activities

The Project will support geoid activities in countries where geoid expertise is limited by encouraging more advanced members to contribute their own expertise and software. The Project will encourage training and education initiative of its members (e.g., International Geoid Service (IGeS) geoid school and graduate studies).

The chair of the Project will meet with the equivalent European and South American projects to discuss overlap regions and to work towards agreements to exchange data. Finally, the members of the Project will keep close contact with all related Special Study Groups of the IAG.

The Project is open to all geodetic agencies and universities across North America with an interest in the development of a geoid model for North America. The meetings of the Commission Project 2.2 are open to everyone with interests in geodesy, geophysics, oceanography and other related topics. A list of members is available on the web site of the North American geoid project:

www.geod.nrcan.gc.ca/˜marc/Html/GGSCNA/ GGSCNA.html. (Username: marc password: private)

Members will communicate primarily using e-mails. However, members of the Project plan to arrange annual meetings. Preferably, these meetings will be held during international conferences where most members will be present; however, some meetings will be held in North America to minimize travel costs. Minutes of meeting will be prepared and sent to all members of the Project.

Membership

Marc Véronneau (chair,GSD/Canada)
Rene Forsberg (KMS/Greenland)
Per Lyster Pedersen (ASIAQ/Greenland)
Antonio Hernández Navarro (INEGI/Mexico)
Dan Roman (NGS/U.S.A.)

Commission Project

CP 2.3 - African Geoid

Chair: **Charles Merry** (South Africa)

Terms of Reference and Objectives:

The principal goal of the Project is very simply to determine the most complete and accurate geoid model for Africa that can be obtained from the available data. Secondary goals are to foster co-operation between African geodesists and to provide high-level training in geoid computation to African geodesists.

The objectives of the Project are summarized below:

- Identifying and acquiring data sets - gravity anomalies, DEM's, GPS/levelling.
- Training of African geodesists in geoid computation.
- Merging and validation of gravity data sets, producing 5' gridded and mean □g.
- Computation of African geoid, and evaluation using GPS/levelling data.

Reports to Sub-Commission 2.4

Membership

Charles Merry (Chair) (South Africa)
Hussein Abd-Elmotaal (Egypt)
Benahmed Daho (Algeria)
Peter Nsombo (Zambia)

Commission Project

CP 2.4 - Antarctic Geoid

Chair: **Mirko Scheinert** (Germany)

Terms of Reference and Objectives

Acknowledging the success of the Arctic Gravity Project similar efforts have to be made to compile gravity data for the entire Antarctic. The availability of Antarctic gravity data should be improved by compiling already existing data and by carrying out new gravity observation campaigns. The main scientific goals are to fill in the southern polar gap and thus to improve the terrestrial gravity data coverage. A completed Antarctic gravity data set will substantially contribute to the determination of the global gravity field in combination with the new gravity satellites and will serve as an excellent basis for regional and continental geoid improvement. The Antarctic Geoid Project (AntGP) should be a focus group for geodesists and geophysicists interested in gravity and geoid in Antarctica.

Reports to Sub-Commission 2.4

Program of Activities

Activities of the Project include the following:

- Initiating and facilitating the exchange of Antarctic gravity field data.
- Collecting and evaluating existing gravity data (surface, airborne and satellite) and GPS data on tide gauges to compute best possible gravity anomaly and geoid grids.
- Promoting new terrestrial and airborne gravity survey activities.
- Promoting new precise gravity ties to older and new traverses and airborne surveys.
- Promoting the measurement of reference gravity stations, especially using absolute gravity meters.
- Acting as liaison to similar data initiatives in solid-earth geophysics, especially SCAR.

Membership

Mirko Scheinert (Chair) (TU Dresden, Germany), Alessandro Capra(Italy), Detlef Damaske (Germany), Reinhard Dietrich (Germany), Rene Forsberg (Denmark), Larry Hothem (USA), Phil Jones (UK), A.H. William Kearsley (Australia), Steve Kenyon (USA), Christopher Kotsakis (Canada), German L. Leitchenkov (Russia), Jaakko Maekinen (Finland), John Mannin (Australia), Uwe Nixdorf (Germany), Kazuo Shibuya (Japan), C.K. Shum (USA), Dag Solheim (Norway), Michael Studinger (USA), (corresponding members), Graeme Blick (New Zealand), John Brozena(USA), Cheinway Hwang (Taiwan)

Commission Project

CP2.5 - South American Geoid

Chair: **Denizar Blitzkow** (Brazil)

Terms of Reference and Objectives

A great effort has been carried out in the last ten years to improve/re-establish the Fundamental Gravity Network in South America, to fill the gravity gaps and to increase GPS observations on the leveling network. Different versions of the geoid (quasi-geoid) were delivered. At the moment it is important to address a renewed focus to reorganize the new gravity surveys, in particular, airborne missions, and to implement new software for the geoid computation. A new geoid model is envisaged to support the SIRGAS altimetric reference system in South America.

The main objectives of the project are:

- To obtain and to maintain files with data necessary for the geoid computations like gravity anomalies, digital terrain models, geopotential models and satellite observations (GPS) in leveling networks.
- To provide a link between the different countries and the International Geoid Services in order to assure access to proper software and geopotential models for local geoid computation.
- To compute a global geoid model for South America with a resolution of $10'$ x $10'$ using the available data. To encourage countries to cooperate by releasing data for this purpose.
- To encourage and eventually support local organizations in different countries endeavoring to increase the gravity data coverage; to improve the existing digital terrain models; to carry out GPS observations on the leveling network and to compute a high resolution geoid.

Reports to Sub-Commission 2.4

Program of Activities

The Project will organize and/or encourage the organization of workshops, symposia or seminars on the geoid determination in South America. Links will be established in the project to the following services to facilitate the exchange of data:

- Bureau Gravimétrique International
- International Geoid Service I – Milan
- International Geoid Service II – St. Louis

Membership

Chair: Dr. Denizar Blitzkow (Brazil, dblitzko@usp.br)
Enga. Maria Cristina Lobianco (Brazil)
Enga. Laura Marlene Sánchez Rodriguez (Colombia)
Dr. Melvin Jesus Hoyer Romero (Venezuela)
Geof. Graciela Font (Argentina)
Rodrigo Maturana Nadal, (Chile)
Alfonso R. Tierra C. (Ecuador)

Commission Project

CP2.6 -Southeast Asian Geoid

Chair: **Bill Kearsley** (Australia)

Terms of Reference and Objectives

This new Project is chartered to promote cooperation in and knowledge of geoid and related studies in the region of South East Asia. The target membership consists of representatives from countries in and associated with ASEAN and countries in the Malaysian Peninsula including: The Philippines, Papua New Guinea, Indonesia, Malaysia, Singapore, Brunei, Thailand, Vietnam, Cambodia, Laos and Myanmar. Some of these countries have not yet responded to requests for support. Others (Laos, Cambodia and Myanmar) will be contacted under the auspices of this new Project.

The executive of this Project will be small to ensure efficiency, and the Steering Committee will comprise one member from each participating country. Because of the need to carry national authority, it is proposed that the national member be the officer in the National Geodetic Authority responsible for the National Geoid and/or National Height Datum matters.

Topics of interest in the Project include:

- Gravity and Related Data: Explore ways in which we may
  - share available gravity data (e.g. via International Gravity Bureau; GETECH, University of Leeds; USGS Data Center)
  - share available DEM's along common borders (National Geodetic Authorities)
  - combine resources for terrestrial gravity surveys along common borders
  - combine resources for airborne gravity surveys in the region.
- Geoid Control: Explore ways in which we may co-operate by
  - sharing geometric (GPS/leveling) geoid control data
  - combining efforts in global GPS campaigns (e. g., IGS'92)
  - undertaking joint campaign for the inter-connection of National Height Datums.

Reports to Sub-Commission 2.4

Membership

Bill Kearsley (Chair)

Commission Project

CP2.7 Gravity in South America

Chair: **María Cristina Pacino** (Argentina)

Terms of Reference and Objectives

A gravity reference network was established in South America and adjusted by, at that time, the Canadian Geological Survey. Most of the stations of that old network are destroyed. In many countries, new reference network has been established recently like Chile, Paraguay, Argentina, Ecuador. It is necessary and urgent to tie the network together and carry out an adjustment. On the other hand, many gaps of gravity data have been filled in the last few years in different countries. In spite of that, other gaps still exist, in particular in the mountains and forests.

This project aims to coordinate efforts of gravity data collections and measurement campaigns in South America. The main objectives of the project are:

- To re-measure the existing absolute gravity stations and to encourage new measurements.
- To validate fundamental gravity networks from different countries in order to establish a single and common gravity network for South America.
- To adjust national gravity networks and to link them.
- To contribute to the "Geoid in South America Project" by obtaining and maintaining files with gravity data necessary for the geoid computation.
- To encourage and eventually support local organizations in different countries to increase the gravity data coverage.
- To organize and/or encourage the organization of workshops, symposia or seminars on gravity in South America.

The following links to organizations will be established in the project: Bureau Gravimétrique International; SIRGAS.

Reports to Sub-Commission 2.1

Membership

María Cristina Pacino (Chair) (Argentina)
Eduardo Andrés Lauría (Argentina)
Felipe Vasquez Moya (Bolivia)
Daniel Flores Vargas (Bolivia)
Rodrigo Maturana Nadal (Chile)
Rodrigo Barriga Vargas (Chile)
Pedro Sandoval Cavanzo (Colombia)
Luis Llerena (Ecuador)
Juan Carlos Torales (Paraguay)
Juan Munoz Curto (Peru)
Roberto P. Rodino (Uruguay)
Jose Napoleon Hernandez (Venezuela)
Jose Gonzales Briceno (Venezuela)

Study Group

SG 2.1 - Comparison of Absolute Gravimeters

Chair: **Leonid Vitushkin** (France)

Terms of Reference and Objectives

Absolute ballistic gravimeters have become the primary standards of the acceleration unit in the field of free-fall acceleration measurements (in brief, standards of free-fall acceleration). Currently the only way to determine the level of accuracy of the absolute ballistic gravimeters and provide the uniformity in absolute measurements of free-fall acceleration *g* is by a comparison ot the results of their measurements.

The principal task of the Special Study Group consists of the organization (in collaboration with the BIPM and CCM WGG, Consultative Committee on Mass and Related Topics Working Group on Gravity) of the four-year period International Comparisons of Absolute Gravimeters (ICAGs) at the BIPM and Regional International Comparisons of Absolute Gravimeters (RICAGs) at the sites selected on a continental scale. It should be noted that the next ICAG should be held in 2005.

The increasing demand for reliability in absolute gravity measurements requires the development of a technical protocol for future ICAGs following the rules proposed in the international Mutual Recognition Arrangement (signed in 1999 by national metrology institutes) for national measurement standards and calibration and measurement certificates.

The relavance to the SG is that its members are the specialists from the geodetic and geophysical communities, as well as the metrological community and this study group is more open to participation than the more official CCM WGG where the membership is related to the institutes responsible for the traceability in gravimetry. Such intercommunications within the Study Group as well as a linkage between this group and CCM WGG will make it possible to develop the ICAGs and RICAGs technical protocol accepted by both communities.

The sites for regional comparisons of absolute gravimeters (in America, Asia, Europe, and Africa) should be recommended by the geodetic-geophysical community and related to the regional structure of metrology community (Regional Metrology Organizations - RMO, for instance, EUROMET - European Metrology Organization, SIM - Inter-American Metrology System, etc.).

Objectives

- The organization (in collaboration with the Bureau International des Poids et Mesures (BIPM) and Working Group on Gravimetry of Consultative Committee on Mass and Related Topics (CCM WGG) of the four-year period International Comparisons of Absolute Gravimeters (ICAGs) at the BIPM and Regional International Comparisons of Absolute Gravimeters (RICAGs) at the sites selected on continental scale.
- The selection of the sites for regional (on a continental scale) comparisons of absolute gravimeters in collaboration with other working groups of Sub-Commission 2.1 and CMM WGG.

Reports to Sub-Commission 2.1

Membership

Leonid Vitushkin (Chair)(France)
Martine Amalvict (France)
Diethard Ruess (Austria)
Enrique Rodriguez Pujol (Spain)
Ian Robinson (UK)
Philippe Richard (Switzerland)
Simon Williams (UK)
Jaakko Mäkinen (Finland)
Michel Van Camp (Belgium)
Shigeki Mizushima (Japan)
Zhiheng Jiang (France)
Alexandr Kopaev (Russia)
Petr Medvedev (Russia)
James Faller (USA)
Artyom Vitushkin (USA)
Gleb Demianov (Russia)
Olivier Francis (Luxembourg)
Tonie van Dam (Luxembourg)
Alessandro Germak (Italy)
Yuriy Lokshin (Ukraine)
Andrzej Pashuta (Poland)
Arkadii Sinelnikov (Russia)
Evgenii Krivtsov (Russia)
Hsien-Chi Yeh (Taiwan)
Chiungwu Lee (Taiwan)
Jacques Hinderer (France)
Gennadii Arnautov (Russia)
Yuri Stus (Russia)
Matthias Becker (Germany)
Roger Hipkin (UK)
Jan Mrlina (Czech Republic)

Study Group

SG 2.2 - Forward Gravity Field Modeling Using Global Databases

Chair: **Michael Kuhn** (Australia)

Terms of Reference and Objectives:

A vast number of data describing the Earth's shape and structure (elevation, density distribution models for crust and mantle) are currently available. Several of these data are given globally with a continuously increasing resolution. One of the greatest density anomaly, for example, is given nowadays by the topographic and ocean water masses as modeled by global digital elevation models (DEM) with resolutions down to 1 km x 1 km. Apart from these (mostly geometrical) data, there also exist global geological and geophysical information about the Earth's interior, describing mainly the structure of the Earth's crust and mantle. The increasing number of these data allows the use of forward gravity field methods (direct application of Newton's integral) in order to perform gravity field recovery and interpretation. In geodesy first attempts in this field have been made in the framework of the former IAG Special Study Group 3.177 (http://www.cage.curtin.edu.au/~will/iagssg3177.html) with very promising results for more detailed studies. Such forward modeling results are of great significance to gravity field modeling and interpretation. Furthermore, the comparison of the forward models with existing gravity field models reveals useful information on the dynamics of the Earth's interior as well as the validity of the forward gravity modeling techniques.

The SG can be seen as a continuation of the IAG SSG 3.177 with a special focus on forward gravity field modeling as well as the modeling of gravity inside the (topographic) masses. Therefore it follows one of the recommendations made in the final report of IAG SSG 3.177.

The main scope of the SG will be the employment of recently released global digital databases with elevation data as well as information on the structure of crust and mantle for gravity field recovery and interpretation. The high resolution of the currently available global data permits the evaluation of high-degree and -order gravity models, while enabling the recovery of the high-frequency content of existing topographic/isostatic models. Furthermore, the forward gravity models can be used to study the behavior of gravity within the (topographic) masses, which is a crucial point in gravity field determination.

The SG will mainly focus on the following items:

- Construction of forward gravity field models using geophysical data.
  - Construction of forward gravity field models from existing global information on the Earth's shape and structure (e.g. global DEM (topography, bathymetry) such as DTM2000.1, global crustal models like CRUST 2.0, global mantle models on seismic velocity and density).
  - Different approaches can be used and tested, such as the numerical integration of Newton's volume integral or the expression of Newton's gravitational potential in spherical harmonics.
  - Following the ideas of SSG 3.177 these forward gravity models also can be used as synthetic Earth gravity field models.

- Interpretation of forward gravity field modeling results.
  - Comparison of the forward gravity models with existing models from satellite and/or terrestrial gravity measurements (e.g. global gravity field models from CHAMP and GRACE).
  - Construction of synthetic Earth Gravity Models after attempting to identify bandwidths with known or apparent geophysical implications.
  - Geophysical interpretation and numerical assessment of the forward gravity field models with case studies over tectonically active regions (e.g. Isostasy and flexure of the lithosphere, dynamics of the mantle).

- Application of forward modelling results in gravity field determination
  - Modeling of gravity inside the topographic masses, which is required in gravimetric gravity field determination (e.g. geoid determination using Stokes's theory).
  - Study the forward gravity field modeling results under the scope to improve the computation of different gravity reductions/effects such as:
    - computation of terrain reductions,
    - downward continuation of gravity anomalies,
    - orthometric corrections,
    - mean gravity and mean gravity gradient inside the (topographic) masses.
  - Study the possibility to express the Earth's gravity field by forward modeling only.

Reports to Sub-Commission 2.2

Program of Acitivities

Activities of the SG will include participation by members who will cover at least one of the above mentioned study areas; meetings at larger conferences such as IAG, AGU, EGS in order to report and discuss matters related to the SG; and. Communication by e-mail and a web-page.

Membership

Michael Kuhn (Chair) (Australia)
Dimitris Tsoulis (Vice Chair) (Germany)
Hussein Abd-Elmotaal (Egypt)
Irek Baran (Australia)
Miroslav Bielik (Slovak Republic)
Heiner Denker (Germany)
William Featherstone (Australia)
Jakob Flury (Germany)
Thomas Gruber (Germany)
Simon Holmes (USA)
Michael Kern (Austria)
Jon Kirby (Australia)
Pavel Novak (Czech Republic)
Spiros Pagiatakis (Canada)
Roland Pail (Austria)
Gabor Papp (Hungary)
Nikolaos Pavlis (USA)
Gabriel Strykowski (Denmark)
Gyula Toth (Hungary)
Tony Watts (UK)

Study Group

SG2.3 - Satellite altimetry: data quality improvement and coastal applications

Chair: **Cheinway Hwang** (Taiwan)

Terms of Reference and Objectives

In a previous IAG SSG, namely, SSG3.186, members have put effort to develop best methodologies for deriving gravity anomaly, geoid, sea surface topography and bathymetry from satellite altimeter data. Despite some achievements, a number of problems in coastal applications of altimetry are not resolved. For example, altimeter data at the immediate vicinity of shores are eliminated due to bad quality. However, for purposes such as coastal geoid and gravity determinations, shallow-water tide modeling and coastal ocean circulation determination, such "bad" data are badly needed. Do we really need to eliminate these altimeter data? Can we improve the quality of coastal altimeter data and how?

One important application of satellite altimetry is to determine local coastal geoid models. Coastal areas are largely heavily populated. Most countries in the world will need a high-precision coastal geoid model for purposes such as national vertical datum determination and connection (for countries with scattered islands), GPS leveling, coastal circulation study and coastal topography mapping. However, satellite altimetry alone cannot fulfill this need, and satellite and terrestrial gravity data (at land and sea) and elevation data (for terrain effects) should be included. The question is how to best combine these heterogeneous data.

It has been shown that use of retracked altimetry can produce improved results in altimetric applications. Currently, only retracked ERS-1 altimetry is used for purposes such as marine geoid and gravity determinations in only a limited number of coastal areas (e.g., polar regions and the China Seas). Retracked altimetry can be also used in shallow-water tide modeling and sea surface topography determination for oceanography.. Another dense data set, namely, Geosat/GM, has not been retracked for coastal applications. The geodetic and earth science communities will surely benefit from a global set of combined retracked ERS-1 and Geosat/GM altimeter data. One objective of this current SSG will be to freely provide a database of retracked ERS-1 and Geosat/GM for members interested in applications of these retracked altimeter data.

The Study Group activities will include:

- Retrack global shallow-waters ERS-1 and Geosat/GM altimeter data and establish a database for members to use.
- Investigate geophysical, geodetic and oceanographic signals with altimetric products using rates higher than 1 Hz. In addition to the radar altimetry, high-rate laser altimeter data from ICESat, which are not corrupted near coasts, will be used. Impact of using JASON-2 WSOA and CRYOSAT altimeter data will be investigated.
- Improve models of geophysical corrections over shallow waters using, e.g., improved shallow-waters tide models, sea state bias estimates and tropospheric corrections and improve quality of altimeter data over shallow waters by, e.g., waveform retracking, adaptive filtering and outlier detection. Selected "difficult" regions of scientific interest such as the Hawaiian Ridges, the Cayman Trench, and the southeast Asia waters will be investigated. The improved models should be distributed to all members.
- Combine coastal altimetry, satellite gravity, land gravity, marine gravity (shipborne or airborne) to enhance the accuracy of coastal geoid (at sea and land).
- Combine altimetry data, LIDAR and remote sensing data for coastal bathymetry determination. LIDAR onboard an aircraft is able to determine ocean depths up to 50 m. Optical sensor data from, e.g., Landsat, can be used to determine depths at shallow waters, provided that a careful calibration is made. Here altimetry data help to determine bathymetry at the deeper part of the oceans. But how exactly do we combine them?
- Define a standard, including theory and data type, to obtain the current best results in marine gravity, geoid and bathymetry from altimetry data.
- Investigate the possibility of determining coastal ocean circulations from satellite altimetry and numerical modeling.
- Create long-term averaged satellite altimetry database for geodetic purposes.

Reports to Sub-Commission 2.2

Membership

Cheinway Hwang (Chair) (Taiwan)
O. Andersen (Denmark)
W. Bosch (Germany)
X. Deng (Australia)
X. Dong (China)
H.-Y. Hsu (Taiwan)
W. P. Jiang (China)
J. Klokocnik (Czech Republic)
P. Knudsen (Denmark)
J. Kostelecky (Czech Republic)
JC Li (China)
J. L. Lillibridge (USA)
Y. Lu (China)
D. T. Sandwell (USA)
C. K. Shum (USA)
T. Urban (USA)
G. S. Vergos (Greece)

Study Group

SG2.4 - Aerogravimetry and Gradiometry

Chair: **Uwe Meyer** (Germany)

Terms of Reference and Objectives

Within the next four years, the SSG on Aerogravimetry and Gradiometry should concentrate on three major items.

– Now that CHAMP and GRACE are operative and first independent, single satellite models are available for the gravity community, and with the GOCE mission on the horizon, aerogravity campaigns should be designed to close the gap between near-surface measurements (land-based, ship-borne) and satellite observations. Taking the GRACE mission as an example, the design of future aerogravimetry surveys should make sure that long wavelengths (minimum of 250 km profile length) are resolved with stable, best possible accuracy with a resolution that fits to medium wavelength features measured on ground (some ten to hundred km). A new generation of scientific survey aircraft available in the next years such as the planned HIAPER aircraft (USA) and HALO aircraft (Germany) that are mainly designed and planned to be used for atmospheric sciences should also be adopted for large scale aerogravimetric surveys. The aircraft will be of the type of Bombardier Express or Gulfstream V which both are capable to fly distances up to 10000 km. Such type of aircraft allows to fly gravimetry in a sub-continental to continental range. The gravimetry community should soon develop surveys for these aircraft as they will be available in 2006/2007.
– In the meanwhile, large unmapped areas as the Amazon Basin and Antarctica should be covered by systematic aerogravimetry surveys. For the Amazon Basin, a Brazilian scientific and commercial community has already claimed a large interest to cover the northern Amazon Basin. As for Antarctica, a special logistic and long standing experience is needed to cover the continent with aerogravimetric surveys. The institutions involved as BAS, AWI, USGS, etc. already have special science plans developed. IAG should give these institutions some official back-up and help in long term coordination of Antarctic aerogravimetry activities.
– The fast development of gradiometer systems for airborne gravimetry opens a complete new spectrum of accuracy and resolution in local to regional surveys. For the scientific community two problems arise to utilize the new instruments for their aims: most developments are purely made on a commercial base and gradiometer systems often operate only on a specially designed aircraft, so the system cannot be swapped between aircraft. Here, a new link between industry and science has to be accomplished. The working group members should enforce the use of gradiometer systems on local targets of special interest. One mid-term aim should be the installation of a gradiometer system on HIAPER or HALO in order to fly on GOCE orbits with as much time synchronization as possible also using laser or radar systems for sea surface measurements over the Atlantic.
– The use of the latest satellite gravity observations encouraged the development of new techniques to process traces of satellite data. Some of the new, emerging ideas might be as well very useful in aerogravimetry data processing. Therefore, a set of aerogravity data from different systems should be made available on the internet to test new methods of processing and evaluation. Already existing and available GPS and aerogravimetry processing software should become accessible for comparison.

Reports to Sub-Commission 2.1

Membership

Uwe Meyer (Chair)
Denizar Blitzkow
John Brozena
Manik Talwani
Micheal Studinger
Phil Jones
Gerd Boedecker
Rene Forsberg
Ilias Tziavos
Roger Bayer
Jerome Verdun, ISTEEM
A. Geiger

Inter-Commission Study Group

IC-SG2.5 - Aliasing in Gravity Field Modeling
(joint with ICCT)

Chair: **C. Christian Tscherning** (Denmark)

Terms of Reference and Objectives

A gravity field observable contain information about all coefficients of its associated spherical harmonic series and of other signals of time-varying character. This makes numerical gravity field procedures prone to aliasing. The effect is most clearly seen when estimating spherical harmonic coefficients, but should also be present when regional models are constructed using Fourier series.

In a first phase, only the effects related to the static gravity field will be investigated. If possible, de-aliasing and time-varying effects will be studied in a second phase.

The joint working group will initially through a series of controlled numerical experiments study the effect of alising. Simplified as well as realistic global or regional datasets will be generated using coefficients from a spherical harmonic expansion from degree N, 2*N, 3*N etc. to a maximal degree, e.g. 1800.

Program of Work

Phase I: The static gravity field.

- Creation of test datasets, including re-use of the positions and attitude angles available from the SC7 datasets for CHAMP, GRACE and GOCE. The generated data will include height anomalies, gravity anomalies or disturbances, gravity gradients or potential differences.
- Creation of datasets with added correlated or uncorrelated noise.
- Estimation of spherical harmonic coefficients
- Estimation (interpolation or extrapolation) of the generated data or of functionals of the anomalous potential.
- Study the magnitude and frequency distribution of the aliasing effects
- Study the effect of various regularisation procedures including minimum variance and minimum noise variance methods.

The datasets, or software able to create the datasets will be made available on the internet.

The members of the group will be persons having the capability of:

- Creating one or more of the datasets.
- Carrying out global or regional gravity field modelling.
- contributing with theoretical analysis of the fundamental aliasing problem or of the results of the numerical experiments.

If phase I is succesfully completed, the following will be implemented:

Phase II:

- Study of de-aliasing procedures for static gravity field determination: removal of high-frequency information, such as topographic effects or filtering.
- Create synthetic data-sets which include time-varying effects (atmosphere, ocean, tides)
- Study the effect of combined gravity field modelling and the determination of (contingently time dependent) parameters.
- Study the effect of mixing data-types with different spectral content such as gravity and altimetry.

Members:

C.C.Tscherning (President) (Denmark)
F.Sansò (Italy)
J. Bouman (The Netherlands)
Annette Eicker (Germany)
W. Freeden (Germany)
Shin-Chan Han (USA)
Pieter Visser (The Netherlands)
Roland Klees (The Netherlands)
Nico Sneeuw (Canada)

Corresponding members:
Rene Forsberg (Denmark)
Jürgen Mueller (Germany)

Inter-Commission Study Group

IC-SG2.6 Multiscale Modelling of the Gravity Field

(joint with ICCT)

Chair: **W. Freeden** (Germany)

Terms of Reference

Future spaceborne observation combined with terrestrial and airborne activities will provide huge datasets of the order of millions of data. A reconstruction of the gravity field from future data material requires a careful multiscale analysis of the gravity potential, fast solution techniques, and a proper stabilization of the solution by regularization. While global long-wavelength modelling can be adequately done by use of spherical harmonic expansions, harmonic splines and/or wavelets are most likely the candidates for medium and short-wavelength approximation since they are 'building blocks' that enable fast decorellation of gravitational data. Thus three features are incorporated in this way of thinking about georelevant harmonic wavelets, namely basis property, decorrelation, and fast computation. But this concept of harmonic wavelets demands its own nature in geodesy which by no means can be developed from the classical theory in Euclidean spaces. The working group intends to bring together scientists concerned with the diverse areas of geodetically relevant wavelet theory in general and its applications. An essential field of research is the specific character of geodetic multiresolution methods used in addition or in contrary to standard spectral techniques based on spherical harmonic framework.

Objectives

Theoretical research in the field of spherical and ellipsoidal wavelets as well as wavelet introduction and modelling on geodetically relevant surfaces (like spheroid, geoid, (actual) Earth's surface). Studies of harmonic wavelets in geodetic boundary-value problems (e.g. Runge-Walsh wavelets, layer potential wavelets, etc).

- Studies on spline/wavelet kernel modelling, multiscale pyramid algorithms via kernel functions known from (least squares) collocation and spline approaches, noise cancellation, least–squares adjustment and spline smoothing vs. multiscale thresholding, etc. Development of specific numerical methods: fast wavelet transform (FWT), tree algorithms, data compression, domain decomposition techniques, fast multipole methods (FMM), panel clustering, data transmission, etc.
- Comparison of spherical harmonic and/or wavelet modelling: Combined spectral and multiscale expansion of the gravitational potential, degree variances vs. local wavelet variances, spectral and/or multiscale signal to noise thresholding, etc. Investigation of different wavelet types in geodetic pseudodifferential equations (using numerical methods such as collocation, Galerkin method, least – squares approximation, etc).
- Regularization of inverse problems by multiresolution, locally reflected multiscale vs. globally reflected spectral regularization, multiscale parameter choice strategies, multiscale modelling in SST, SGG. Time dependent multiscale modelling in boundary value and inverse problems, numerical implementation and application to GRACE–, GOCE–data.

Program of Activities

- Organization of meetings and conferences (e.g. Oberwolfach conference on "Geomathematics", May 2004, Organizers: Freeden (Kaiserslautern), Grafarend (Stuttgart), Sloan (Sydney), Svensson (Lund).
- Organizing of WG meetings or sessions, in coincidence with a larger event, if the presence of working group members appears sufficiently large.
- Email discussion and electronic exchange.
- Launching a web page for dissemination of information, expressing aims, objectives, plus providing a bibliography.
- Monitoring and presentation of activities, either of working group members or interested external individuals.

Members

W. Freeden, Germany (chair)
M. Fengler, Germany
M. Gutting, Germany
W. Keller, Germany
J. Kusche, Netherlands
D. Michel, Germany
V. Michel, Germany
J. Otero, Spain
S. Pereverzev, Austria
F. Sanso, Italy
M. Schreiner, Switzerland
J. Schröter, Germany
H. Sloan, Australia
N. Sneeuw, Canada
L. Svensson, Sweden
C. C. Tscherning, Denmark

Commission 3 - Geodynamics and Earth Rotation

Web: www.astro.oma.be/IAG/index.html

President: **Véronique Dehant** (Belgium)
Vice President: **Mike Bevis** (USA)

Terms of Reference

In the frame of geodesy, geodynamics deals with the natural forces and processes, of the Earth's interior and crust as observed by means of geodetic measurements. The Earth rotation deals with all the Earth orientation parameters, i.e. polar motion, length-of-day variations, precession and nutation, which allow transformation from a terrestrial reference frame to a celestial reference frame or vice versa. These parameters are varying with time and are related to geodynamical processes as well as external tidal forcing. Commission 3 is a part of the International Association of Geodesy for short-term or long-term research that focuses on collecting, analyzing, and modeling observational data in the frame of geodynamics and Earth rotation. This includes in particular, Earth Tides (Sub-Commission 1), tectonics and Crustal Deformations (Sub-Commission 2), as well as the effects of the Geophysical Fluids (Sub-Commission 3) in geodynamics (e.g., post-glacial rebound, loading) and Earth rotation. Geodynamics and rotation studies of the Earth can be extended to those of other terrestrial bodies (planets and moons). Commission 3 has the possibility to promote a project, and in particular the project called Global Geodynamics Project (GGP), which involves measuring and analyzing temporal changes in the Earth's gravity field over a long period and using a global network of measurements. Commission 3 relies on IAG services such as the International Earth Rotation and Reference Systems Service (IERS) or the International Center for Earth Tides (ICET). Commission 3 is closely related to the IAU (International Astronomical Union) Commission 19 on Earth Rotation.

Objectives

To develop cooperation and collaboration in computation, in theory, and in observation of Earth rotation and geodynamics, and to ensure development of research in geodynamics and Earth rotation by organizing meetings, symposia, and general assemblies, by creating working groups on specific topics, and by encouraging exchange of ideas and data, comparisons of methods and results improving the accuracies, content, methods, theories, and understanding of Earth rotation and geodynamics.

To serve the geophysical community by linking them to the official organization providing the International Reference Systems/Frames and Earth orientation parameters (IERS and related bodies), and organizations providing all the other data on which geodynamics and Earth rotation studies can be performed.

Structure

Sub-Commissions:

SC3.1: Earth Tides
President: **Gerhard Jentzsch** (Germany)

SC3.2: Crustal Deformation
President: **Markku Poutanen** (Finland)

SC3.3: Geophysical Fluids
President: **Richard Gross** (USA)

Inter Commission Projects:

IC-P1.1: Satellite Altimetry
(Joint with Commission 1 and 2)
(Description: See Commission 1)
Chair: **Wolfgang Bosch** (Germany)

IC-P3.1: GGP Global Geodynamics Project
(Joint with Commission 2).
Chair: **David Crossley** (USA)

Inter Commision Working Groups:

IC-WG1: Theory of crustal deformations
(Joint with ICCT and Commission 1)
(Description: See ICCT)
Chair: **Kosuke Heki** (Japan)

Representatives

- to ICC on "Theory": Tim Van Hoolst
- to ICC on "Planetary Geodesy": Ozgur Karatekin
- to the Integrated Global Geodetic Observing System (IGGOS) IAG Project: Véronique Dehant
- to IAU Commission 19 on "Earth Rotation": Marcus Rothacher (also, Véronique Dehant who is President of IAU Commission 19)
- to IERS Directing Board: Clark Wilson
- to ICET Directing Board: Gerhard Jentzsch

Steering Committee members

President: V. Dehant
Vice President: M. Bevis
President SC3.1: G. Jentzsch
President SC3.2: M. Poutanen
President SC3.3: R. Gross
President ICP.31: D. Crossley
T. Van Hoolst
O. Karatekin
M. Rothacher
C. Wilson (past President)
M. Feissel-Vernier (past President)

Program of Activities

- Participation in special meetings related to geodynamics and Earth rotation.
  Action item for Commission 3 EC: to stimulate participation in these meetings and to ask IAG for co-sponsorship.
- Participation in the IAG Project Integrated Global Geodetic Observing System (IGGOS).
  Action item for Commission 3 EC and Commission 3 IGGOS representative: to link the IGGOS program with the members and the Commission 3 sub-entities.
- Encouraging and stimulating the services related to Commission 3.
  This is particularly true for Sub-Commission 3.1 on Earth tides and 3.3 on geophysical fluids that should stimulate research related to the ICET and to the IERS Product Center on Global Geophysical Fluids, respectively.
- Linking the Sub-Commission together, in particular provide them with a forum for exchange of information.
  Action item for Commission 3 President: create a forum for exchange of information between Sub-commissions, as for instance between Sub-commissions 3.1 and 3.3.
- Linking Commission 3 with its sister commission of the IAU.
  Action item for Commission 3 President and IAU representative: to provide information from one entity to the other (construction of web-site links), to create joint WG if necessary.
- See program of the three Sub-Commissions as well.

Sub-Commission

SC 3.1- Earth Tides.

President: **Gerhard Jentzsch** (Germany)
Vice President: J. Hinderer

Terms of Reference

The objective of the Sub-Commission is to promote international cooperation and coordination of investigations related to the observation, preprocessing, analysis and interpretation of earth tides. By earth tides, we understand all phenomena related to the variation of the Earth's gravity field and to the deformation of the Earth's body induced by the tide generating forces, i.e. the forces acting on the Earth due to differential gravitation of the celestial bodies as the Moon, the Sun and the nearby planets. The relation between earth tides and Earth rotation is certainly an important perspective of the work of the Sub-Commission. The Sub-Commission collaborates with all international and national organizations concerned with the observation, preprocessing, analysis and interpretation of earth tides. The Sub-Commission encourages and promotes campaigns to develop, compare and calibrate instrumentation for earth tide observations, techniques of operation, procedures for data preprocessing and data analysis. The Commission makes standard software for the prediction of earth tide phenomena and for the processing of earth tide observations available to the scientific community by the www. The Sub-Commission supports the activities of the International Center for Earth Tides (ICET) in collecting, analyzing and distributing earth tide observations. The ICET is considered as the executive office of the Earth Tide Sub-Commission. The Sub-Commission provides an Electronic Information Service with data and software files on its website. The Sub-Commission organizes yearly Earth Tides Symposia when the IAG or IUGG are not organizing general assemblies (next meeting is in Ottawa, 2–6 August 2004). The Sub-Commission creates WGs when necessary and adopts resolutions when necessary. The Sub-Commission has a medal that is delivered to a scientist for her/his outstanding contribution to international cooperation in earth tide research, on the occasion of the International Symposium on Earth Tides.

Steering Committee

President: G. Jentzsch
Vice President: J. Hinderer
B. Ducarme (Director ICET)
D. Crossley (GGP)
S. Takemoto (Past-President)
L. Manshina (WKG1)
Wu Bin (WKG2)
C. Kroner (WKG3)

Working Groups

WG: 3.1.1 Gravitational Physics

The general goal of the WG is to tackle among others the following scientific problems:

- The Problem of Aberration: Modern tidal position catalogs assume that the true position of the tide causing body is responsible for the tidal forces, rather than the apparent position, as in optical astronomy. The problem may have consequences, as it may imply relative velocities between the gravity and optical signals. This is a case for experts in Celestial Mechanics and in Earth Tides.
- The Gravitational Shielding: There is currently no accepted theory of gravity that incorporates or predicts gravitational shielding. The problem is possibly different from the absorption of gravitational radiation by matter. The Earth Tide community should think about, and search for, the consequences of shielding.

WG: 3.1.2 Earth Tides in Space Geodetic Techniques

The general goal of the WG is to strengthen the links between researchers of the tidal community and those who work in space geodetic techniques in both directions:

- The tidal experts provide precise models for the displacements of observation sites on the Earths crust due to the tides and for the tidal variations to the gravitational field of the Earth;
- The space geodetic techniques are used to validate and possibly to improve the tidal models, e.g. the tidal parameters.

Terms of Reference

- Cooperation with the analysis coordinators of the new IAG international services, e.g. IGS, IVS, ILRS, IDS, ... and the Working Groups which exist within these services,
- Comparison of tidal parameters obtained from the different techniques,
- Comparison of results obtained by space geodetic techniques and ground-based tidal measurements,
- Exploring new satellites measurements (CHAMP and GRACE) for Earth tides,
- Using GPS and ground-based gravimeter to study regional ocean tides.

Program:

- Extension of the recommendations concerning the tidal influences given in the IERS Conventions (2000) to facilitate their practical use for space geodetic techniques; upgrade of 'supplements' to the IERS Conventions; establishment of subgroups of experts in order to help the IERS Convention Directing Board;
- Evaluation and comparison of the potential of different space geodetic techniques to monitor tidal effects and to determine tidal parameters; Techniques such as VLBI, SLR, LLR, GPS and GLONASS, DORIS and PRARE, satellite altimetry will be covered;
- Determination of parameters of the tidal models by space geodetic techniques; This requires a priori corrections due to atmospheric and oceanic influences on the Earth's surface and on the geopotential and precise models for tidal influences on the Earth orientation parameters; The effect of pole-tide has also to be considered.

WG 3.1.3 Analysis of Environmental Data for the Interpretation of Gravity Measurements

The general goal of the WG is to identify the environmental parameters should be monitored and the procedure to monitor them, and to recommend the corrections and the related procedures that are necessary in the frame of tidal studies at all timescales.

- Systematic investigation of effects of environmental parameters on the gravity vector, such as air pressure, air humidity, wind, seasonal effects of vegetation, ground water level variations, soil moisture;
- Understanding of the relation between the individual sources and their effects on the gravity vector, both in different periods, and different amplitudes;
- Development of models for the correction of environmental effects and recommendations for the recording of environmental parameters, and recommendations for the application of the corrections.

The WG Will

- Exchange of information by meetings with printed papers in the Bulletin d'Information Marees Terrestres;
- Recommendations and proposals concerning the parameters to be recorded, their sampling and resolution; these parameters are temperature, humidity, precipitations (rain and snow), ground water table variations, snow accumulation, …
- Identify efforts to realize a continuous monitoring of these parameters;
- Identify correlation among these parameters;
- Develop models for the correction of gravity and tilt measurements, and possibly for prediction of these corrections;
- For this, special events could be studied and particular experiments (to be identified) could be done.

Sub-Commission

SC 3.2 Crustal Deformation.

President: **Markku Poutanen** (Finland)

Terms of Reference

There are many geodetic signals that can be observed and are representative of the deformation mechanisms of the Earth's crust at different spatial and temporal scales. The time scales range from seconds to millions of years in the case of plate tectonics and from millimeters to continental dimension for the spatial scales.

Space geodetic measurements provide nowadays the means to observe deformation and movements of the Earth's crust at global, regional and local scales. This is a considerable contribution to global geodynamics by supplying primary constraints for modeling the planet as a whole, but also for understanding geophysical phenomena occurring at smaller scales.

Gravimetry, absolute, relative and nowadays also spaceborn, is a powerful tool providing information to the global terrestrial gravity field and its temporal variations. Superconducting gravimeters allow a continuous acquisition of the gravity signal at a given site with a precision of 10–10. This is important in order to be able to detect and model environmental perturbing effects as well as the weak gravity signals associated with vertical crustal movements of the order of mm/yr. These geodetic observations together with other geophysical and geological sources of information provide the means to understanding the structure, dynamics and evolution of the Earth system.

Objectives

General objectives of the Sub-Commission 3.2 will include:

- to study tectonic motions, including plate deformation;
- to study postglacial rebound, but also glacial dynamics and glacial isostatic adjustment in the currently glaciated area of the Earth, as well as the water and ice mass balance;
- to study local crustal movements, some of which could be potentially hazardous;
- to study sea-level fluctuations and changes in relation to vertical tectonics along many parts of the coastlines and in relation to environmental fluctuations/changes affecting the geodetic observations;
- to promote, develop and coordinate international programs related to observations, analysis and data interpretation for the three fields of investigation mentioned above;
- to promote the development of appropriate models.

There are particular objectives for the different entities, in the frame of the general objectives.

One should also notice, that the objectives of the integrated global geodetic observing system (IGGOS) includes e.g.

- the integral effect on Earth rotation of all angular momentum exchange inside the Earth, between land, ice, hydrosphere and atmosphere, and between the Earth, Sun, Moon, and planets,
- the geometric shape of the Earth's surface (solid earth, ice and oceans), globally or regionally, and its temporal variations, whether they are horizontal or vertical, secular, periodical or sudden, and
- by adding the Earth's gravity field-stationary and time-variable-mass balance, fluxes and circulation.

According to these objectives, SC3.2 should have close contacts to the IGGOS activities, because many of the items are shared in the plans of IGGOS and SC3.2.

Structure and activities

The Sub-Commission on Crustal Deformation comprises sub-entities or working groups corresponding either to different geographical regions or different important and actual topics involved in the field of the Sub-Commission studies. These sub-entities are dealing with main scientific objectives having common general aspects and, in parallel to these objectives, follow the development of technology and measurement techniques capable to best fulfill the scientific objectives.

The SC3.2 will promote itself, but also encourage its working groups and other related groups or institutions to organize meetings or larger scientific conferences for selected scientific or technological subjects. Outcome of these meetings will be published in Proceedings, either separate one or as special issues of scientific journals.

Sub-entities or working groups will be established by the directing board according to the needs or activities. This list will be completed later, and more groups are to be added. Currently, the following group exists

- Geodynamics of the Central Europe, chaired by Janusz Sledzinski (Poland).

Steering Committee

Chair: M. Poutanen
J. Davis
K. Heki
S. Zerbini
J. Manning
J. Sledzinski

Related Working Groups

"Working group of European Geoscientists for the Establishment of Networks for Earth science Research (WEGENER)", chaired by L. Bastos, and earlier being as a sub-entity of Commission XIV is now a separate group. However, close contacts between WEGENER and SC3.2 will be continued.

Sub-Commission

SC3.3- Geophysical Fluids.

President: **Richard Gross** (USA)
Vice President: **A. Brzezinski** (Poland)

Terms of Reference

Mass transports in the atmosphere-hydrosphere-solid Earth-core system, or the "global geophysical fluids", will cause observable geodynamic effects on a broad time scale. Although relatively small, these global geodynamic effects have been measured by space geodetic techniques to increasing, unprecedented accuracy, opening up important new avenues of research that will lead to a better understanding of global mass transport processes and the Earth's dynamic responses. Angular momentums and the related torques, gravitational coefficients, and geocenter shift for all geophysical fluids are the relevant quantities. They are studied theoretically and observed based on global observational data, and/or products from state-of-the-art models some of which assimilate such data.

The objective of the Sub-Commission is to serve the scientific community in providing research and data analysis associated with the geophysical fluids, in areas related to the variations in Earth rotation, gravitational field and geocenter that are caused by mass transport in the geophysical fluids. The geophysical fluids of the Earth system include the atmosphere, ocean, solid Earth, and core, and geophysical processes associated with ocean tides and hydrological cycles.

Steering Committee

President: R. Gross
Vice President: A. Brzezinski
Ben Chao

Inter Commission Project

IC-P 3.1 Global Geodynamics Project (GGP).

(joint with Commission 2)

Chair: **David Crossley** (USA)
Secretary: **Jacques Hinderer** (France)

Terms of Reference

The GGP project began on 1 July 1997 and Phase 1 ended on 1 July 2003. A continuation of the project, GGP Phase 2, was approved to continue until July 1, 2007. The main purpose of GGP was, and remains, to record the Earth's gravity field with high accuracy at a number of worldwide stations using superconducting gravimeters (SGs). An important requirement is the frequent monitoring of absolute gravity at each site to co-determine secular changes. Phase 2 envisages project in which SGs are deployed in regional arrays for limited time periods.

A list of publications related to GGP and SGs is available at the GGP website, as are a number of newsletters published for the benefit of the community. The main website is http://www.eas.slu.edu/GGP/ggphome.html.

The data is being used in an extensive set of studies of the Earth, ranging from global motions of the whole Earth such as the Chandler wobble to surficial gravity effects such as atmospheric pressure and groundwater. The SG stations are run independently by national groups of scientists who send data each month to the GGP database at the International Centre for Earth Tides (ICET) in Brussels.

GGP data is recorded and processed to standards agreed between the SG groups. For some of the GGP sites, the most recent data is temporarily restricted and will become available one or two years after collection. For other GGP sites, the data is available as soon as it has been sent to ICET, without restriction. Interested scientists can contact ICET, or the GGP website, for details. Useful site links and some technical terms involved in gravimetry are also on this site.

GGP has recently endorsed a joint operation between ICET and GFZ as a means of developing the database of SG measurements. ICET provides the front-end organization to which the data is sent, and GFZ provides the technical aspects of maintaining and developing the database. GGP will thereby contribute data to ICET, for as long as ICET remains a service of the Earth Tide Commission and FAGS.

Organization

The activities of the GGP are coordinated by a directorate consisting of a Chairman and Secretary The directorate guides the members who are responsible for all aspects of the GGP such as setting the timetable for the project, setting standards for the data acquisition systems and data exchange protocols and recommending procedures for the database operations. The membership agrees to meet at least once a year, either independently of in conjunction with an appropriate scientific meeting.

Recent Evolution

GGP is currently an inter-union, interdisciplinary project endorsed by SEDI (Study of the Earth's Deep Interior). We have conducted a survey of its members on possible affiliation with IAG, as discussed at the GGP Business Meeting in Sapporro, Japan, on July 6, 2003. Only 15 of approximately 80 members on the mailing list replied to our survey. We interpret this response to indicate that the majority of members do not object to the ideas proposed in our survey. The IAG has approved the proposal.

The following items constitutes GGP Proposal to Commissions 2 and 3 of the IAG:

1. Identity. GGP considers itself to be an unrestricted international scientific ***project*** that also provides a ***service*** to the community. Therefore any affiliation with IAG needs to preserve these two aspects and to allow GGP to continue its current scientific and administrative structure.
2. Affiliation. GGP would like to be affiliated with IAG as an Inter-Commission ***project***, on the understanding that the definition of project (IAG Bylaw 1.2.3) in no way limits the time period over which GGP can operate. We have voted to seek affiliation under the general scientific directives of both Commission 2 (the Gravity Field) and Commission 3 (Earth Rotation) because the mandate of GGP encompasses the terms of reference of both Commissions.
3. Reporting. GGP prefers a mechanism whereby it reports only to one commission, in this case Commission 3 (Earth Rotation), on the assumption that there will be close communication between the commissions on matters concerning GGP.
4. IGGOS. GGP would like to establish a membership within the IGGOS framework and to participate in that organization for the purpose of the exchange of worldwide gravity data.

Scientific Objectives

GGP monitors changes in the Earth's gravity field at periods of seconds and longer. The GGP is named to indicate the application of gravity data to the solution of a number of geodynamic problems; additionally GGP may become a source for absolute gravimeter data as well as other geodynamic data.

The measurements were originally planned over a time span of 6 years at a small number of permanent observatories where a superconducting gravimeter (SG) had been installed. The 6-year period was chosen as the minimum length of data required to separate annual and 14 month Chandler wobble components in the gravity record. A pilot phase of GGP commenced 2 years earlier, in July 1995, so GGP is effectively in its 9'th year of operation.

The SG has been, for the past two decades, the most sensitive, stable instrument for the measurement of the vertical component of the Earth's gravity field. Each of the currently operating SGs is the focus of a national effort to provide a continuous gravity record for geodetic and geophysical research. The GGP is an opportunity for the various SG groups to participate in a global campaign to monitor the gravity field and to exchange the raw data.

Precise global measurements of the Earth's gravity field are essential to answer a number of important questions in geophysics, which we outline in more detail in the next section: (a) Do internal gravity waves (inertial waves if the fluid is neutrally stratified) exist in the Earth's liquid core and are their gravitational effects at the Earth's surface detectable? (b) What is the gravity effect of the global atmospheric loading and mass re-distribution on the solid Earth? (c) Through global tidal analysis, can we refine estimates of the nearly diurnal free wobble of the Earth and models of oceanic loading on the solid Earth? (d) What changes in gravity are associated with slow and silent earthquakes, tectonic motions, sea-level changes and post-glacial rebound? (e) Can we monitor the location of the rotation pole of the Earth on a time scale of minutes? (f) Can SG recordings of the earth's normal modes enhance the global long period seismic and spring gravimeter networks?

Benefits

The aims of GGP are twofold:

- To reassure users of SG data that extreme care has been taken in the sampling and pre-processing of the available data and that all pre-processing steps and other site-specific information such as atmospheric pressure, environmental data and a record of all site disturbances are available to users, and
- To enable global signals to be extracted by various stacking procedures that would not be possible with single station recordings.

Superconducting Gravimeter (SG) Groups

The GGP is open to all organizations with access to the appropriate instrumentation, i.e. a SG. Each independent organization that manages a SG will be called a SG group; there may be several SG groups in any one country. SG groups seek their own sources of financing.

The GGP Agreements encourage SG groups to (a) upgrade existing SG facilities to a common standard of data acquisition, (b) participate in continuous gravity observations by maintaining the SGs in good operating conditions at fixed locations and (c) exchange raw gravity (and other important supplemental) data through the Internet.

Global Data Acquisition and Distribution

As described later, the scientific goals of the GGP include a wide range of signals from periods of seconds to years, covering seismic normal modes, tides, core modes and wobble modes of the Earth to other long period variations in Earth's gravity field such as tectonic deformation.

Many of the Earth parameters of critical interest in global dynamics exist in gravimetric signals at or below the ambient noise level. Examples include internal gravity waves in the fluid core and post-glacial uplift and plate motions. The SG has a frequency-domain sensitivity at the nanogal level and many periodic signals of interest are expected to be in this range. Because the time-domain variability of gravity 'noise' is usually two to three orders of magnitude greater than this, global signals identified on the record of an individual instrument at the nanogal level cannot be considered reliable until confirmed with similar signals from other instruments. For many purposes, these instruments must be distributed widely around the Earth because global gravimetric signals have theoretically predictable spatial and temporal global variations.

Access to worldwide gravimetric data is essential for progress in global geodynamics for several reasons. First, SG data can be used to recover long-period free oscillations of the Earth with unprecedented precision. In real time, an array of SG instruments, as considered in GGP Phase 2, would provide a means for detection of slow and silent earthquakes, co-seismic slip, and tectonic signals. Second, sub-milliarcsecond orientation can be obtained through measurement by an SG network for space-based measurements such as Satellite Laser Ranging and the US-proposed GLRS project to position points on the Earth's surface to the sub-centimeter level through the use of Earth-based retro-reflectors and satellite-based lasers. Third, Earth models that incorporate core resonances require access to gravimetric data at the nanogal level to successfully account for motion in the deep interior in all of the orientation calculations. GGP is striving to make such data available as rapidly as possible to the scientific community, so that all the above tasks can be accomplished.

A number of tectonics-related problems require global gravity field data for their resolution. In particular the problems of long-term secular changes in elevation, caused not only by post-glacial rebound and sea level changes but also by active plate-tectonic related deformation, need long-term gravity variations at continental scales. The long-period stability of SGs is variable, with the best instruments having instrument drift as low as about 1 microgal per year. Wherever this level of stability can be maintained by even a small number of SG stations in a regional network, particularly where confirmed with absolute gravimeters, then GGP will provide useful data for these tectonic problems.

In the past an individual with access to his/her local instrument and a computer could make major progress in the solution of both analytical and data analysis problems. However, the complexity of many problems in global geodynamics is such that measurements on a global scale are needed to make even minimum progress. Concerted effort by cooperating scientists is needed to make any significant advance. Without uniform high precision global data it will be impossible to move toward the solution of the problems of the Earth's deep interior. GGP has responded to this need by agreeing to a monthly transfer of data from all instruments to the ICET / GFZ database in Brussels. This data represents the success of the overall project.

Specific Tasks of GGP

The SG is capable of recording temporal gravity variations from seconds to years and thus the GGP has application to large number of scientific tasks. As indicated above, at long periods (months - years), we highly recommend the use of a SG supplemented by an absolute gravimeter to fully characterize secular trends in gravity.

1. Earth tides and the nearly diurnal free wobble: the estimation of precise tidal parameters (e.g. gravitational delta factors) can contribute to the development of better models for correcting for ocean loading phenomena. In addition, the stacking of global delta factors provides important information on the diurnal free wobble of the Earth which is essential for theoretical work on the structure of the Earth's core.
2. Core modes: the search for internal gravity waves in the Earth's liquid core necessitates global, long-period, long-duration recordings to separate local gravity variations from a global coherent signal. If we are able to detect these waves, this will give direct information on the mechanical equilibrium of the fluid in the core, and thus information on the operation of the geodynamo.
3. Atmospheric interactions: stacking global gravity and pressure data is essential to clarify the nature of the long period phenomena in the atmosphere and for evaluating the effects of global atmospheric surface pressure and mass redistribution on the Earth's gravity field.
4. Hydrology: it has become clear during the first phase of GGP that rainfall, soil moisture, snow cover, and groundwater variations can all affect local gravity. The study of hydrology is therefore a fruitful area for GGP. With the advent of new satellite missions (CHAMP, GRACE, GOCE) it is possible to look at common signals in both ground and satellite data sets, particularly using the European stations of the GGP array.
5. Earth rotation and polar motion: the measurement of the gravity effect of polar motion (orientation of the Earth's rotation axis) requires a global coverage of stations. It should be possible to continuously monitor the location of the rotation pole on the time scale of minutes and therefore provide an independent verification of the same measurement now made with space techniques; connections with the International Earth Rotation Service (IERS) service here will be valuable.
6. Gravity changes due to tectonic motions: the monitoring of long-term changes due to tectonic motions, sea-level changes affecting the survival of coastal cities, post-glacial uplift and the deformation associated with active tectonic events.
7. Enhancing absolute gravity measurements: SGs are a valuable aid to international programs for the determination of absolute gravity values on a global scale as they provide a short-term, relative gravity reference level and they 'fill in' the gravity field behavior between AG measurements.
8. General research tool: GGP provides a high quality, continuous global data set will be a valuable resource for future geodetic and geophysical studies that involve the Earth's gravity.

GGP and Geodesy

There are important connections between the above goals and other scientific programs of national concern. In particular, the geodetic community clearly recognizes the importance of simultaneous geodetic (positional) information and gravity changes at fiducial stations that contain very high quality instrumentation. There are two primary areas in common between GGP and other geodetic programs:

1. Space techniques. Two space techniques that require detailed models of Earth deformation are satellite tracking and Very Long Baseline Interferometry (VLBI). At the proposed sub-centimeter level of accuracy, for projects in the 1990's such as the current

Satellite Laser Ranging (SLR) and the proposed Geodynamics Laser Ranging System (GLRS) mission, precise knowledge of the Earth's dynamics, including resonances in the liquid core, are required. A global net of SGs will give the required information on dynamics of the liquid core.
2. Sea level changes. A satisfactory solution to the problem of defining the origins of sea-level changes requires input from different sources. The necessity of differentiating between the effects of height variations caused by post glacial rebound or plate tectonics and changes in sea level resulting from global warming demands the establishment of a global geodetic/geophysical observatory network, such as FLINN (Fiducial Laboratories for an International Natural Science Network), an IUGG-sponsored project initiated at the Coolfront Workshop in 1989. A central feature of such a network is the monitoring of the gravity field at a smaller group of fiducial stations equipped with SGs as well as precise positioning instrumentation (e.g. SLR, VLBI or GPS) and having accurate connections to the reference tide gauges.

Steering Committee

Chair: D. Crossley (USA)
Secretary: J. Hinderer (France)

Commission 4 - Positioning & Applications

web: www.gmat.unsw.edu/iag/iag_comm4.htm

President: **Chris Rizos** (Australia)
Vice President: **Pascal Willis** (France)

Terms of Reference

To promote research into the development of a number of geodetic tools that have practical applications to engineering and mapping. The Commission will carry out its work in close cooperation with the IAG Services and other IAG Entities, as well as via linkages with relevant Entities within Scientific and Professional Sister Organizations. Recognizing the central role that Global Navigation Satellite Systems (GNSS) plays in many of these applications, the Commission's work will focus on several Global Positioning System (GPS)-based techniques. These include precise positioning, but extending beyond the applications of reference frame densification and geodynamics, to address the demands of precise, real-time positioning of moving platforms. Several Sub-Commissions will deal with precise kinematic GPS positioning technology itself (alone or in combination with other positioning sensors) as well as its applications in surveying and engineering. Recognizing the role of continuously operating GPS reference station network, research into non-positioning applications of such geodetic infrastructure will also be pursued, such as atmospheric sounding.

Steering Committee

President: Chris Rizos (c.rizos@unsw.edu.au)
Vice President: Pascal Willis (Liaison with IGGOS)
Chair SC4.1: Dorota Grejner-Brzezinska
Chair SC4.2: Heribert Kahmen
Chairs SC4.3: Susan Skone, Hans van der Marel
Chair SC4.4: Xiaoli Ding
Chair SC4.5: Yang Gao
IGS representative: Ruth Neilan
Member at Large: Marcelo Santos (Liaison with ICCT)
Member at Large: TBA, Service representatives

Structure

Sub-Commissions:

SC4.1: Multi-sensor Systems
President: **D. Grejner-Brzezinska** (USA)

SC4.2: Applications of Geodesy in Engineering
President: **Heribert Kahmen** (Austria)

SC4.3: GNSS Measurement of the Atmosphere
President: **Susan Skone** (Canada)

SC4.4: Applications of Satellite & Airborne Imaging Systems
President: **Xiaoli Ding** (Hong Kong)

SC4.5: Next Generation RTK
President: **Yang Gao** (Canada)

Study Groups:

SG4.1: Pseudolite Applications in Positioning & Navigation
Chair: **Dr. Jinling Wang** (Australia)

Inter Commission Study Groups

IC-SG4.2: Statistics & Geometry in Mixed Integer Linear Models, with Applications to GPS & InSAR
(Joint with ICCT)
Chair: **Athanasios Dermanis** (Greece)

IC-SG1.1: Ionospheric Modelling and Analysis
(Joint with Commission 1 & COSPAR)
(Description: See commission 1)
Chair: **Claudio Brunini** (Argentina)

IC-SG1.2: Use of GNSS for Reference Frames
(Joint with Commission 1)
(Description: See commission 1)
Chair: **Robert Weber** (Austria)

Sub-Commission

SC 4.1 - Multi-sensor Systems

President: **Dorota Grejner-Brzezinska** (USA)
Vice President: **Naser El-Sheimy** (Canada)

Terms of Reference

To coordinate research and other activities that address the broader areas of multi-sensor system theory and applications, with a special emphasis on integrated guidance, navigation, positioning and orientation of airborne and land-based platform. The primary sensors of interest will be Global Navigation Satellite Systems (GNSS) and inertial navigation systems; however the important role of other techniques used for indoor and pedestrian navigation is also recognized. The SC will carry out its work in close cooperation with other IAG Entities, as well as via linkages with relevant scientific and professional organizations such as ISPRS, FIG, IEEE, ION.

Objectives

- To follow the technical advances in navigation sensors and algorithms, including autonomous vehicle navigation, based on:
  - positioning sensors and techniques such as GPS (and pseudoliltes), INS, including MEMS IMU, wheel sensors, ultrasonic and magnetic sensors, and
  - positioning methods based on cellular networks and their combination with GPS.
- To follow the technical advances in mapping sensors, such as CCD cameras, laser range finders, laser scanners and radar devices.
- To standardize definitions and measurements of sensor-related parameters.
- To study and report on the performance of standalone and integrated navigation systems.
- To stimulate new ideas and innovation in:
  - navigation algorithms, sensor calibration, synchronisation and inter-calibration,
  - real-time sensor information processing and georeferencing
  - sensor and data fusion, and
  - automation techniques for information extraction from multi-sensor systems using expert systems.
- To study and monitor the progress in new applications (not limited to conventional mapping) of multi-sensor systems (transportation, engineering, car navigation, personal navigation, indoor navigation, etc.).
- To study and report on the progress in performance, market availability and pricing of multi-sensor mapping systems and their hardware and software components.
- To promote research and collaboration with countries with no or limited access to modern multi-sensor technology.

Program of Activities

- To stimulate new ideas and innovation in:To study the technology and applications of multi-sensor systems in order to address the objectives for SC4.1 (see above).
- To report on the progress in research, performance, market availability, etc., of multi-sensor mapping systems in various ways, including seminars, position papers and via the SC4.1 web page.
- To organize and to participate in professional workshops, seminars, meetings, etc.
- To establish a web page providing information on SC4.1 activities, technology updates, professional meeting calendar, etc.

Steering Committee

President: Dorota Grejner-Brzezinska (OSU, USA)
Vice President: Naser El-Sheimy (U. of Calgary, Canada)
Secretary: Jinling Wang (UNSW, Australia)
Member-at-Large: Guenther Retscher (Vienna Univ. of Technology, Austria)
Joao Fernando Silva (UNESP, Brazil)

Membership

Dr. C. Glennie (Canada)
Prof. K.P. Schwarz (Canada)
Prof. A. Gruen (Switzerland)
Prof. B. Merminod (Switzerland)
Dr. G. Retscher (Austria)
Mr. L. Hothem (USA)
Prof. D. Li (China)
Dr. R. Li (USA)
Mr. H. Sternberg (Germany)
Dr. D. Grejner-Brzezinska (USA)
Dr. Y.D. Huang (UK)
Prof. A. Vettore (Italy)
Lt. S. Puntavungkour (Thailand)
Dr. H.G. Maas (The Netherlands)
Prof. S. Sugimoto (Japan)
Dr. V. Tao (Canada)
Dr. A. El-Mowafy (UAE)
Dr. Y. Hammada (Canada)
Dr. J. Skaloud (Switzerland)
Dr. M. Aziz, (Kuwait)
Mr. M. Cramer (Germany)
Dr. J. Kwon (Korea)
Dr. S. Nassar (Canada)
Dr. N. El-Sheimy (Canada)
Dr. J. Wang (Australia)
J.F.C. da Silva (Brazil)

Working Groups

WG: 4.1.1 Advances in inertial Navigation and Error Modelling Algorithms
Chair: **Sameh Nassar** (Canada)
Co-Chair: **Jay Kwon** (Korea)

To study and report the performance of the currently used inertial error modeling algorithms, and to promote the development of new methods and techniques for modelling inertial sensor errors. To implement innovative ideas for processing inertial data and integrating inertial systems with other sensors. To report the advances in the development of new inertial sensor technologies.

WG: 4.1.2 Indoor and Pedestrian Navigation
Chair: **Guenther Retscher** (Austria)
Co-Chair: **Bertrand Merminod** (Switzerland)

To promote research and development in the area of indoor and pedestrian navigation using multi-sensor integrated systems, based on medium to low-accuracy small-sized inertial systems, including micro-electro-mechanical systems (MEMS), and other positioning sensors, such as wheel sensors, ultrasonic and magnetic sensors, integrated with imaging sensors. To report progress on positioning methods based on cellular networks and their combination with GPS.

WG: 4.1.3 Advances in MEMS Technology and Applications
Chair: **Mikel Miller** (USA)
Co-Chair: **Jan Scaloud** (Switzerland)

To promote research into the development and integration of micro-electro-mechanical systems (MEMS) based inertial measurement units (IMU) that have practical applications to engineering and mapping. To promote research and development into precise, low-cost, low-power, small-sized, and high reliability IMU's for integration with other position, navigation, attitude, and time systems.

Sub-Commission

SC 4.2 - Applications of Geodesy in Engineering

President: **Heribert Kahmen** (Austria)
Vice President: **Gethin Roberts** (UK)

Terms of Reference

Rapid developments in engineering, microelectronics and the computer sciences have greatly changed both instrumentation and methodology in *engineering geodesy*. To build higher and longer, on the other hand, have been key challenges for engineers and scientists since ancient times. Now, and for the foreseeable future, engineers confront the limits of size, not merely to set records, but to meet the real needs of society minimising negative environmental impact. Highly developed engineering geodesy techniques are needed to meet these challenges. The SC will therefore endevour to coordinate research and other activities that address the broad areas of the theory and applications of engineering geodesy tools. The tools range from conventional terrestrial measurement and alignment technology (optical, RF, etc.), Global Navigation Satellite Systems (GNSS), geotechnical instrumentation, and software systems such as GIS, decision support systems, etc. The applications range from construction engineering and structural monitoring, to natural phenomena such as landslides and ground subsidence that have a local effect on structures and community infrastructure. The SC will carry out its work in close cooperation with other IAG Entities, as well as via linkages with relevant scientific and professional organizations such as ISPRS, FIG, IEEE, ION.

Objectives

- To monitor research and development into new technologies that are applicable to the general field of "engineering geodesy", including hardware, software and analysis techniques.
- To study advances in dynamic monitoring and data evaluation systems for buildings and other manmade structures.
- To study advances in monitoring and alert systems for local geodynamic processes, such as landslides, ground subsidence, etc.
- To study advances in geodetic methods used on large construction sites.
- To study advances in the application of knowledge-based systems in engineering geodesy.
- To document the body of knowledge in this field, and to present this knowledge in a consistent frame work at symposia and workshops.
- Through the SC4.2 Working Groups to promote research into several new technology areas or applications.

Program of Activities

- To study the technology and applications of engineering geodesy in order to address the objectives for SC4.2 (see above).
- To organize and to participate in professional workshops, seminars, meetings, etc.
- To establish a web page providing information on SC4.2 activities, professional meeting calendar, etc.

Steering Committee

President: Heribert Kahmen (Austria)
Vice President: Gethin Roberts (UK)
Secretary: Guenther Retscher (Austria)
Member-at-Large: Wolfgang Niemeier (Germany)

Working Groups

WG: 4.2.1 Measurement Systems for the Navigation of Construction Processes

Chair: **Wolfgang Niemeier** (Germany)
Co-Chair: **Guenther Retscher** (Austria)

To study and report the performance of the currently used navigation/guidance systems for construction machinery, and to promote the development of new methods and techniques for controlling construction processes.

WG: 4.2.2 Dynamic Monitoring of Buildings

Chair: **Matthew Tait** (Canada)
Co-Chair: **Gethin Roberts** (UK)

To study and report the performance of currently used building monitoring systems, including techniques based satellite and terrestrial measurements, and to promote new the application of new sensor technology.

WG: 4.2.3 Application of Knowledge-based Systems in Engineering Geodesy

Chair: **Klaus Chmelina** (Austria)

To study and report on topics such as control of measurement- and guidance-systems, deformation analysis, control of alert systems, and the evaluation of their complex data stream through the use of knowledge-based systems. To implement new research outcomes in Artificial Intelligence for deformation analysis and measurement system control.

WG: 4.2.4 Monitoring of Landslides and System Analysis

Chair: **Gyula Mentes** (Hungary)
Co-Chair: **Zhenglu Zhang** (China)

Worldwide landslides are one of the major types of natural hazards, killing or maiming many people, and causing considerable damage to infrastructure. There has already been done a wide range of research work on landslides. Most of this work had a bias toward one discipline, such as remote sensing or geology. The proposal of the WG is to promote multi-disciplinary integration of different methods. The main goal is to establish an integrated workflow for landslide hazard management.

Sub-Commission

SC 4.3 - GNSS Measurement of the Atmosphere

President: **Susan Skone** (Canada)
Vice President: **Hans van der Marel** (The Netherlands)

Terms of Reference

Over the past decade, significant advances in GPS technology have enabled the use of GPS as an atmospheric remote sensing tool. With the growing global infrastructure of GPS reference stations, the capability exists to derive high-resolution estimates of total electron content and precipitable water vapour in near real-time. Recent advances in topographic modelling and the availability of space borne Global Positioning System (GPS) observations has also allowed 3-D profiling of electron density and atmospheric refractivity. Future plans for the GALILEO system will allow further opportunities for exploiting Global Navigation Satellite Systems (GNSS) as an atmospheric remote sensing tool. Many countries have initiated efforts in this area of research and application. The focus of this Sub-Commission is to facilitate collaboration and communication, and support joint research efforts, for GNSS measurement of the atmosphere. Specific objectives will be achieved through the formation of appropriate Working Group. A Steering Committee will work closely with members and other IAG Commissions/ Sub-Commissions to achieve mutual goals. Collaboration with the International GPS Service (IGS), the SG1.1, and other IAG entities and agencies will be promoted through, for example, joint sponsorship of workshops and conference sessions.

Objectives

This Sub-Commission will focus on the following principal objectives:

– To promote improvement of existing estimation algorithms and (near) real-time processing for atmospheric parameter monitoring using GNSS techniques, from both ground-based and space borne systems.
– To coordinate data collection campaigns, in order to encourage research and development into the measurement of crucial parameters of the atmosphere that impact on GNSS measurements.
– To investigate applications in both the atmospheric and space sciences.

Program of Activities

– To monitor research activities and operational developments in GNSS-based atmospheric parameter measurement related to the objectives for SC4.3 (see above).
– To report on the progress in research, performance, applications, etc., of atmospheric remote sensing using GNSS technology, including seminars, position papers and via the SC4.3 web page.
– To organize and to participate in professional workshops, seminars, data collection campaigns, meetings, etc.
– To establish a web page providing information on SC4.3 activities, technology updates, professional meeting calendar, etc.

Steering Committee

President: Susan Skone (Canada)
Vice President: Hans van der Marel (The Netherlands)
Members-at-Large: Anthea Coster (USA)

Sub-Commission

SC 4.4 -Applications of Satellite & Airborne Imaging Systems

President: **Xiaoli Ding** (Hong Kong)
Vice President: **Linlin Ge** (Australia)

Terms of Reference

Satellite and airborne imaging systems, primarily Synthetic Aperture Radar (SAR) and Light Detection And Ranging (LiDAR) systems, are increasingly being used for geodetic applications such as ground deformation monitoring due to seismic and volcanic activity and man-induced subsidence due to fluid extraction, underground mining, etc. This Sub-commission will endevour to promote and report on hardware/software research into these imaging systems that is relevant to geodetic applications. The SC will also facilitate communications and exchange of data, information and research results, in order to encourage wider application of these technologies, particularly in less developed countries. The SC will carry out its work in close cooperation with other IAG Entities, as well as via linkages with relevant scientific and professional organisations such as ISPRS, FIG, IEEE.

Objectives

- To promote the development of satellite and airborne imaging systems, primarily including Synthetic Aperture Radar (SAR) and Light Detection And Ranging (LiDAR) systems, for geodetic applications.
  To study and report on models and algorithms for the processing and analysis of data from satellite and airborne imaging systems.
- To promote research into the effects of the atmosphere and field conditions on satellite and airborne imaging systems.
- To encourage research and development into the integration of satellite and airborne imaging systems with other geodetic/geospatial technologies such as the Global Positioning System (GPS) and Geographic Information Systems (GIS).
- To promote the development of new applications of satellite and airborne imaging systems.
- To encourage lower SAR image prices for research purposes, and for use in less developed countries.

Program of Activities

- To monitor research activities and operational developments in satellite and airborne imaging systems such as InSAR and LiDAR as related to the objectives for SC4.4 (see above).
- To report on the progress in research, performance, geodetic applications, etc., of InSAR and LiDAR, including seminars, position papers and via the SC4.4 web page.
- To organize and to participate in professional workshops, seminars, campaigns, meetings, etc.
- To establish a web page providing information on SC4.4 activities, technology updates, professional meeting calendar, etc.

Steering Committee

President: Xiaoli Ding (Hong Kong)
Vice President: Linlin Ge (Australia)
Secretary: Makoto Omura (Japan)
Member-at-Large: Ramon F. Hanssen (The Netherlands)

Working Groups

WG: 4.4.1 Permanent Scatterer/ Corner Reflector/ Transponder InSAR

Chair: **Fabio Rocca** (Italy)
Co-Chair: **Chao Wang** (China)

To study and report on the use of permanent scatters, corner reflectors and active transponders to enhance the quality and the scope of applicability of InSAR.

WG: 4.4.2 Atmospheric Effects in InSAR/ InSAR Meteorology

Chair: **Linlin Ge** (Australia)

To characterise the spatial and temporal variations of atmospheric effects on InSAR and LiDAR measurements, and to study methods for the mitigation of the effects.

WG: 4.4.3 InSAR for Polar Regions

Chair: **Makoto Omura** (Japan)

To study and report on the dynamic processes of the earth's polar regions, including the changes in the extent, thickness, and dynamics of ice shelves, ice streams and glaciers in Antarctica, and in Arctic sea ice and permafrost with satellite radar systems.

WG: 4.4.4 Imaging Systems for Ground Subsidence Monitoring

Chair: **Andrew Manu** (USA)

To study and report on ground surface deformation monitoring using satellite and airborne imaging systems, especially ground subsidence associated with, e.g., city development, mining and ground liquid withdrawal, land reclamation and seismic activities.

Sub-Commission

SC 4.5 - Next Generation RTK

President: **Yang Gao** (Canada)
Vice President: **Lambert Wanninger** (Germany)

Terms of Reference

Current carrier phase-based Real-Time Kinematic (RTK) positioning at the centimetre accuracy level requires the combination of observations from two GPS receivers, with one serving as the base station with known coordinates and another as the mobile/user station. One significant drawback for this approach, however, is the practical constraints imposed by the requirement that simultaneous observations be made at the user and reference stations, and that the user station be within the vicinity of the reference station typically up to 20 kilometers. Development of methods and algorithms to eliminate such constraints for increased flexibility and accessibility using RTK therefore presents a current trend. This Sub-Commission will identify, encourage investigation into the important research issues and problems for the development of next generation RTK technologies, report on such developments, and will promote international collaborations among researchers and organizations from academia, government and private sectors. The latter will be done through linkages with sister scientific and professional organizations, and especially with the IAG's International GPS Service (IGS).

Objectives

The objective of the Sub-Commission is to promote collective research efforts on the development of new methods and technologies for next generation RTK and to stimulate strong research collaborations among international organizations, including the industry. The main objectives of SC4.5 will be:

- To identify and investigate important technical issues in next generation RTK system development.
- To investigate and develop data standards and operational procedures for next generation RTK, including the communication protocols and message formats.
- To establish collaborative relationship with other organizations, and especially with the IGS.
- To develop strong links with the industry sector.
- To participate and organize international conferences, workshops and meetings.

Program of Activities

- To monitor research activities and operational developments in real-time GNSS positioning, both for "precise point positioning" and network-based modes as related to the objectives for SC4.5 (see above).
- To report on the progress in research, performance, etc., of next generation RTK, including seminars, position papers and via the SC4.5 web page.
- To focus on the development of standardized terminology for the various RTK systems, and to promulgate relevant standards such as those produced by RTCM, IGS, etc.
- To organize and to participate in professional workshops, seminars, meetings, etc.
- To establish a web page providing information on SC4.5 activities, technology updates, professional meeting calendar, etc.

Steering Committee

President: Yang Gao (Canada)
Vice President: Lambert Wanninger (Germany)
Secretary: Wu Chen (Hong Kong)
Member-at-Large: Mark Caissy (Canada)
Member-at-Large: John Raquet (USA)
Member: Sunil Bisnath (USA)

Membership

Mr. M. Caissy (Canada)
Prof. N. El-Sheimy (Canada)
Prof. J. Raquet (USA)
Mr. R. Muellerschoen (USA)
Dr L. Fortes (Brazil)
Prof. R. Langley (Canada)
Prof. R. Santerre (Canada)
Dr. P. Park (South Korea)
Prof. J. Liu (China)
Prof. T. Moore (UK)
Prof. M. Yang (Taiwan)
Prof. P. Cross (UK)
Prof. C. Rizos (Australia)
Prof. W. Chen (Hong Kong)
Dr. D. Kim (Canada)
Prof. R. Weber (Austria)
Prof. Y. Gao (Canada)
Mr. R. Hatch (USA)
Dr. S. Han (USA)
Mr. B. Townsend (Canada)
Dr. D. Lapucha (USA)
Dr. H. Landau (Germany)
Mr. P. Heroux (Canada)
Dr. H. Euler (Switzerland)
Dr. L. Wanninger (Germany)
Mr. J. Manning (Australia)
Dr. G. Weber (Germany)
Dr. J. Monico (Brazil)
Dr. D. Grejner-Brzezinska (USA)
Dr. P. Wielgosz (USA)
Dr. I. Kashani (USA)
Mr. P. Alves, (Canada)

Working Groups

WG: 4.5.1 Network RTK

Chair: **Lambert Wanninger** (Germany)
Co-Chair: **Ola Ovstedal** (Norway)

To study the various technical aspects of network RTK positioning and to stimulate further research work in this field. To report progress on the development of GNSS reference station networks for RTK positioning.

WG: 4.5.2 Carrier Phase based Precise Point Positioning

Chair: **Sunil Bisnath** (USA)
Co-Chair: **Maxim Kachine** (The Netherlands)

To address and investigate issues and problems related to the development of a new RTK positioning technology based on the processing of un-differenced carrier phase (and pseudo-range) observations without the need of a reference station.

WG: 4.5.3 High Precision Positioning on Buoys and Moving Platforms

Chair: **Wu Chen** (Hong Kong)
Co-Chair: **Mark Dumville** (UK)

To study precise positioning in marine environment including precise positioning algorithms on moving platforms, multipath effects off water surfaces, and data fusion of GNSS and other ocean environment sensors. To promote the collaboration of researchers from different research areas, including geodesy, navigation, oceanography, and meteorology.

Study Group

SG 4.1 - Pseudolite Applications in Positioning and Navigation

Chair: **Dr. Jinling Wang** (Australia)
Vice Chair: **Dr. Gethin Roberts** (UK)

Terms of Reference

In satellite-based precise positioning, the dominant factors are the number *and* geometric distribution of the satellites tracked by the receivers. In the case of Global Navigation Satellite Systems such as GPS, GLONASS, and the planned GALILEO system, four visible satellites are the minimum requirement for precise three-dimensional positioning. In general, the more satellites that are tracked, the more reliable the positioning solutions. However, in some situations, such as in downtown urban canyons, engineering construction sites, and in deep open-cut pits and mines, the number of visible satellites may not be sufficient. In the worst situations, such as in underground tunnels and inside buildings, the satellite signals may be completely absent.

Such problems with existing GNSS systems can be addressed by the inclusion of additional ranging signals transmitted from ground-based "pseudo-satellites" (pseudolites). Pseudolites are an exciting technology that can be used for a wide range of positioning and navigation applications, either as a substantial augmentation tool of space borne systems, or as an independent system for indoor positioning applications.

Objectives

The goal of this study group is to investigate new concepts of pseudolite-related positioning and navigation applications. The objectives of the research activities are to study:

- Pseudolite augmentation of GPS.
- Pseudolite-only positioning scenarios.
- Integration of pseudolites with other sensors, such as INS.

These objectives will be achieved by:

- Promoting dialogue between SG members.
- Encouraging symposia and sessions at conferences with the theme of pseudolite technology and applications.
- Setting up a SG website providing a focus for pseudolite research and applications with the relevant links.
- Developing a comprehensive bibliography for pseudolite research and applications.

Program of Activities

- To monitor research activities in the field of pseudolite development and application, across a wide range of positioning applications, including indoor and outdoor positioning.
- To report on the progress in research, performance, applications, availability, etc., of pseudolite systems, including seminars, position papers and via the SG4.1 web page.
- To organize and to participate in professional workshops, seminars, campaigns, meetings, etc.
- To establish a web page providing information on SG4.1 activities, technology updates, professional meeting calendar, etc.

Membership

Chair: Dr. Jinling Wang (Australia)
Vice Chair: Dr. Gethin Roberts (UK)
Vice Chair: Dr. Dorota Grejner-Brzezinska (USA)
Dr. Joel Barnes (Australia)
Prof. Elizabeth Cannon (Canada)
Prof. Paul Cross (UK)
Assoc. Prof. Peter Dare (Canada)
Dr. Liwen Dai (USA)
Dr. Fabio Dovis (Italy)
Prof. Xiufeng He (China)
Prof. Gunter W. Hein (Germany)
Assoc. Prof. Jonathan P. How (USA)
Dr. Hiroshi Isshiki (Japan)
Assoc. Prof. Changdon Kee (South Korea)
Prof. Alfred Leick (USA)
Dr. Edward LeMaster (USA)
Prof. Jingnan Liu (China)
Mr. Paolo Mulassano (Italy)
Dr. Xiaolin Meng (UK)
Dr. Ivan Petrovski (Japan)
Mr. Ilir F. Progri (USA)
Prof. Chris Rizos (Australia)
Dr. Fredrick von Schoultz (Finland)
Dr. Toshiaki Tsujii (Japan)
Ms. Sandra Verhagen (The Netherlands)
Dr. Guangjun Wen (Singapore)
Assoc. Prof. Ming Xie (Singapore)
Dr. Aigong Xu (Singapore)

Inter-Commission Study Group

IC-SG 4.2 - Statistics and Geometry in Mixed Integer Linear Models, with Applications to GPS and InSAR

(joint with ICCT)

Chair: **Athanasios Dermanis** (Greece)

Terms of Reference

The presence of an unknown number of cycles in GPS observations of phase differences has generated a new challenging theoretical problem, which in its utmost generality may be described as the solution of over-determined equations with both real-valued and integer unknowns. Within this problem these particular issues emerge: (a) the selection and design of an optimality criterion that leads to a unique solution, (b) the development of computationally efficient algorithms for obtaining the optimal solution, especially with respect to the integer unknowns which require search within a discrete set, (c) the new types of distributions of the estimated real-valued and integer parameters, (d) particular geometry in connection with the estimated integer parameters, (e) the assessment of the accuracy of the solution in the presence of both random and systematic errors affecting the observations, and (f) new statistical hypothesis testing techniques.

Objectives

- To attract the attention of researchers beyond geodesy (statisticians, mathematicians) to this fascinating topic, with a view towards finding other possible applications beyond those encountered in geodesy.
- To establish a channel of cooperation on the ground of methodology and support a closer collaboration between "theoreticians" and "practitioners".
- To encourage frontier research in the subject concerning e.g. the evaluation–comparison of various different solution principles (e.g. least squares, Bayesian statistics, best linear estimation) as well as of the different algorithms for the realization of the solutions.

Program of Activities

- Prepare a critical presentation of all relative literature.
- Prepare a "tutorial" monograph introducing the subject to the younger generation of researchers, which will include fundamental background material, but will also lead to the outskirts of advanced current research.
- Perform an extensive test of current methodologies and algorithms based upon real as well as properly designed simulated data.
- Establish a web page, which will serve as an open forum among all those interested in the subject.
  Organize a joint workshop on the subject with statistician and mathematicians and publish its minutes, if possible.

Membership

Chair: Athanasios Dermanis (Greece)
Mohamed Abdel-salam (Canada)
Clara de Lacy (Italy)
Donghyun (Don) Kim (Canada)
Georgia Fotopoulos (Canada)
Brigitte Gundlich (Netherlands)
Hung-Kyu Lee (Australia)
Kentaro Kondo (Japan)
Christopher Kotsakis (Greece)
Andre Lannes (France)
Linyuan Xia (China)
Marcelo Santos (Canada)
Burkhardt Schaffrin (USA)
Sandra Verhagen (Netherlands)

The Inter-Commission Committee on Theory (ICCT)

President: **Peiliang Xu** (Japan)
Vice-President: **Athanasios Dermanis** (Greece)

Terms of Reference

Geodesy as a subject of science has witnessed and has been based on some of the most important mathematical and physical inventions and technological achievements in the history of civilization. For mathematical and physical foundations, we mention Kepler's laws on a planet orbit, Newton's laws (the law of universal gravitation and the second law of motion), Gauss' least squares method and geometry, Stokes' and Bruns' formulae to compute the geoid and Vening Meinesz's formula to compute the deflection of vertical, Einstein's theory of relativity and Kaula's theory of satellite geodesy. For most important technological achievements, we may mention computing technology, information technology and space technology, among others, which not only have fostered more theoretical geodetic research in return but have also completely changed the image of and working environment for geodesists. It is recognized that theoretical breakthroughs in geodesy came only when geodesy demonstrated itself as a great challenge and thus attracted the great intellects of the time. We may also notice that these theoretical breakthroughs had a deep root in solving a practical geodetic or astronomic problem of the time.

As part of the restructuring of the IAG, and in particular, the former IAG Section IV on Geodetic Theory and Methodology, the Intercommission Committee on Theory (ICCT) was formally approved and established after the IUGG XXIII Assembly in Sapporo. According to the IAG By Laws, Inter-Commission Committees are asked to handle "well-defined, important and permanent tasks involving all Commissions". However, from the ICCT point of view, and keeping in mind generality of theory, the ICCT must think and act beyond geodesy. As a result, the ICCT is to continue theoretical research of the former IAG Section IV on General Theory and Methodology, but with emphasis on solving „practical" challenging geodetic problems in mind. With the history of theoretical geodetic research in mind as a mirror, the ICCT will, in particular, encourage and promote active and direct interactions with other IAG Entities that directly deal with measurements, in order to further flourish theoretical research on a solid „practical" foundation.

Objectives

As a result of the IAG restructuring, and recognizing that geodetic observing systems have advanced to such an extent that geodetic measurements: (i) are now of unprecedented high accuracy and quality, can readily cover a region of any scale up to tens of thousands of kilometres, consist of non-conventional data types, and can be provided continuously; and (ii) consequently, demand new mathematical modelling in order to obtain best possible benefit of such technological advance, the ICCT

1. strongly encourages frontier mathematical and physical research, directly motivated by geodetic need/practice, as a contribution to science/engineering in general and the foundations for Geodesy in particular;
2. provides the channel of communication amongst the different IAG entities of commissions /services/ projects, on the ground of theory and methodology, and directly cooperate with and support these entities in the topics-oriented work;
3. helps the IAG in articulating mathematical and physical challenges of geodesy as a subject of science and in attracting young talents to geodesy. The ICCT should certainly try to attract and serve as home to mathematically motivated/oriented geodesists and to applications-oriented applied mathematicians; and
4. encourages closer research ties with and directly gets involved with relevant areas of the Earth Sciences, bearing in mind that geodesy has been playing an important role in understanding the physics of the Earth.

Steering Committee

Peiliang Xu (President of the ICCT, Japan)
Athanasios Dermanis (Vice-President of the ICCT, Greece)
Zhengyuan Zhu (Rep of Commission I, Germany)

Nico Sneeuw (Rep of Commission II, Canada)
Tim van Hoolst (Rep of Commission III, Belgium)
Jinling Wang (Rep of Commission IV, Australia)

Structure

Working Groups:

WG-ICCT1: Inverse Problems and Global Optimization
Chair: **Juergen Kusche** (Germany)

WG-ICCT2: Dynamic Theories of Deformation and Gravity Fields
Chair: **D. Wolf** (Germany)

WG-ICCT3: Functional Analysis, Field Theory and differential Equations
Chair: **Jinhai Yu** (China)

Inter-Commission Study Groups

IC-SG2.5: Aliasing in gravity field modeling
(Joint with Commission 2)
(Description: See Commission 2)
Chair: **C.C. Tscherning** (Denmark)

IC-SG2.6: Multiscale Modeling of the Gravity Field (Joint with Commission 2)
(Description: See Commission 2)
Chair: **W. Freeden** (Germany)

IC-SG4.2: Statistics and Geometry in Mixed Integer Linear Models, with Applications to GPS and InSAR
(Joint with Commission 4)
(Description: See Commission 4)
Chair: **A. Dermanis** (Greece)

Inter-Commission Working Groups

IC-WG1: Quality Measures, Quality Control and Quality Improvement
(Joint with Commission 1 and 2)
Chair: **H. Kutterer** (Germany)

IC-WG2: Integrated theory for Crustal Deformation
(Joint with Commission 1 and 3)
Chair: **K. Heki** (Japan)

IC-WG3: Satellite Gravity Theory
(Joint with Commission 1 and 2)
Chair: **N. Sneeuw** (Canada)

Advisory Committee

Prof E.W. Grafarend (Germany)
Prof B. Heck (Germany)
Dr P. Holota (Czech Republic)
Prof C. Jekeli (USA)
Prof S. Kotz (USA)
Prof R. Rummel (Germany)
F. Sanso (Italy)
C.K. Shum (USA)
S. Takemoto (Japan)
A. Tarantola (France)
P. Teunissen (The Netherlands)
C.C. Tscherning (Denmark)

Working relations.

In order to realize the vision and goals of the ICCT within the new IAG structures, the ICCT has proposed to build up a working relationship with the Commissions by setting up joint study groups. The ICCT is pleased that the IAG Executive Committee approved this unconventional approach. Despite the fact that these joint entities were initiated by the ICCT, some of their descriptions are included under the Description of the Commissions. This "measure" should underline the autonomy of the Commissions within their field and it undoubtedly also underlines the good will of the ICC on Theory to build up a sound working relationship with the Commissions. More specifically, the ICCT is organized as follows: Steering Committee, Advisory Committee, ICCT joint working groups with the Commissions and ICCT internal working groups.

Working Group

WG ICCT1 - Inverse Problems and Global Optimization

Chair: **Juergen Kusche** (Germany)

Terms of Reference

At the Sapporo General Assembly of the IUGG, June 30 to July 11, 2003, the International Association of Geodesy (IAG) has approved the Intercommission Commitee on Theory (ICCT) as a part of its new structure. ICCT is the successor of the former IAG Section IV on General Methodology and Theory. In order to support its work the ICCT establishes internal and joint working groups (study groups). One of these internal working groups will be directed towards the study of inverse problems in geodesy, in theory and applications. The purpose of this document is to describe its background, potential research area and objectives, and terms of reference for the period of 2003–2007.

Background

It is well recognized that many, if not most, geodetic problems are in fact inverse problems: we know to a certain level of approximation the mathematical and physical model that projects the parameter space onto the data space; given a possibly blurred element of the data space, the observations, we want to recover the governing discrete parameters or continuous fields. The situation is further complicated by the fact that these problems are often ill–posed in the sense that only generalized solutions can be retrieved, that non–trivial nullspaces exist or that the solutions do not depend continuously on the data.

In particular gravitational modelling from space gravity missions has been (and will be undoubtly in the future) intensively investigated using Inverse Problem Theory; including the study of regularization methods and smoothing techniques and the quality of gravity models. With the cutting–edge aims of the new gravity missions (recovery of monthly surface mass variations from GRACE, constraining viscosity/lithospheric/postglacial rebound models from GRACE time variable gravity and from GOCE static geoid pattern analysis) it can be expected that Inverse Problem Theory will be even more important for the space gravity community.

But there are other, more classical geodetic problems that have been identified as inverse and ill–posed and attracted researchers: The inverse gravitational problem where we are interested in modelling the earth's interior density from gravity observations, different kinds of downward continuation problems in airborne gravimetry and geoid determination, certain problems in the context of satellite altimetry and gravity modelling, the problem of separating geoid and dynamic ocean topography, the problem of inferring excitations/earth structure parameters from observed polar motion, deriving stress or strain tensors from observational surface monitoring data, or certain datum problems in the definition of reference frames. A very recent problem of ill–posed type is the orbit differentiation problem: non–conventional gravity recovery methods like the energy conservation approach and the acceleration approach require GPS–derived kinematic satellite orbits to be differentiated in time, while counteracting noise amplification at the same time.

Inverse Problem Theory itself as a joint branch of applied mathematics and statistics is concerned with extracting (maximum) information about systems from observed data. It is rapidly evolving, theoretically and computationally. We should keep track with new developments e.g. in multi-parameter regularization schemes, global optimization theory, stochastic inversion, Bayesian methods, data assimilation in general, etc. In geodesy, we also have to develop inverse methods that can be used for large–scale problems, involving high degree and order gravity field models from space gravity missions and high–resolution discretizations of the density field or the dynamic ocean topography, for example.

Finally, it should be noted that the working group will not have to start from the scratch: Several IAG special study groups in the past have been dealing with inverse problems, either directly or in a related sense. In the new IAG structure, close cooperation will take place eg with the inter-commission working group on Satellite Gravity Theory.

Scope

The working group brings together people working on inverse problem theory in general and its applications in geodesy. The central research issue is, besides a thorough theoretical understanding of inverse problems in geodesy, to extract maximum information from data by properly developing mathematical/statistical methods in a uniquely defined sense of optimality, and to apply these methods to geodesy. In particular, the following objectives can be identified:

- Identification and theoretical understanding of the nature of inverse and/or ill–posed problems
- Development and comparison of mathematical and statistical methods for the proper treatment of inverse problems.
- Recommendations and communication of new inversion strategies within the IAG and to the broader community.

The working group will focus activities in the following research areas:

- Studies on the mathematical structure of the nullspace in problems where ambiguous solutions occur.
- Studies on the application and quality of regularization methods in practical geodetic problems: that is, where we are confronted with coloured noise, heterogeneous data, partially over- and under-determination, different sources of ill-posedness like data gaps plus downward continuation, etc.
- Studies on global optimization methods and theory.
- Investigation of formal measures for the quality of regularized or constrained solutions.
- Study on the use of techniques for treating inverse problems locally, e.g. through locally adapted regularization wavelets.
- Studies on the representation of prior information
- Study of Bayesian and Monte Carlo inversion schemes in geodetic and joint geodetic/geophysical problems
- Study on nonlinear inversion in geodetic problems, i.e. avoiding linearization schemes.
- Studies on efficient numerical implementation of inverse methods.
- Studies on theory and application of joint geodetic/geophysical inversion schemes.

Program of Activities

- Email discussion
- Launching a web–page for dissemination of information, expressing aims, objectives, plus providing a bibliography. This would also give members (and other interested individuals) a platform to communicate individual views and results, and stimulate discussions.
- Identification of, and communication with related bodies within the new IAG structure.
- Monitoring and presentation of activities, either of working group members or external, that is relevant for the research area.
- Organizing of WG meeting or session, in coincidence with a larger event, if the presence of working group members appears sufficiently large.

Working Group

WG ICCT2 - Dynamic theories of deformation and gravity fields

Chair: **D. Wolf** (Germany)

Terms of References

Recent advances in ground-, satellite and space-geodetic techniques have detected temporal changes of deformation and gravity covering a wide period range. These changes are related to different types of processes acting near the earth's surface or in its interior.

Forward and inverse modelling of the deformation and gravity changes require the development of dynamic theories for 1-D, 2-D and 3-D earth models.

Program of Activities

- Development of generalized Love-number formalisms for static forcing functions (normal and tangential surface forces, volume forces, dislocations).
- Development of generalized Love-number formalism for periodic forcing functions Fourier-transformed Love numbers) and aperiodic frocing functions (Laplace-transformed Love numbers)
- Development of 3-D viscoelastic earth models for modelling processes responsible for deformation and gravity changes.
- Investigation of effects due to density stratification, compressibility, rheology and lateral heterogeneity.
- Forward modelling of deformation and gravity changes caused by atmospheric, cryospheric, hydrospheric and internal forcing functions.
- Inverse modelling of measured deformation and gravity changes in terms of mantle viscosity and forcing functions.

Membership

Chairman: D. Wolf (Germany), H. Abd-Elmotaal (Egypt), J.-P. Boy (USA), L. Brimich (Slovakia),
B. Chao (USA), J. Fernandez (Spain), L. Fleitout (France), E. Ivins (USA), G. Kaufmann (Germany),
V. Klemann (Germany), Z. Martinec
(Czech Republic), J.X. Mitrovica (Canada),
G.A. Milne (UK), G. Spada (Italy), W. Sun (Japan),
L.L.A. Vermeersen (Netherlands), P. Wu (Canada),
Associate Members
E.W. Grafarend (Germany), J. Hinderer (France),
L.E. Sjöberg (Sweden), P. Varga (Hungary)

Working Group

WG ICCT3 - Functional Analysis, Field Theory and Differential Equations

Chair: **Jinhai Yu** (China)

Terms of Reference

With the rapid development of measurement techniques, in particular, thanks to space GPS geodesy and gravity satellite missions, a huge number of geometrical and physical data, with the unprecedented high accuracy, would become routinely available to study the shape of our planet, its gravity field and time variations. These high quality data would certainly provide new challenges to geodesist, practically and theoretically. In order to meet such challenges and to derive most benefit for geodesy, the ICCT decided to form a working group and investigate existing and new mathematical theory/methods. Also keeping in mind the importance of geodetic boundary value problems, we would like to make this new working group by extending the conventional geodetic boundary value problems to functional analysis, field theory and differential equations.

Objectives

- Investigate frontier research in functional analysis, field theory and partial differential equations, and potential applications in geodesy, in particular, geopotentials and geodetic boundary value problems (GBVP).
- Encourage interdisciplinary research in mathematically modeling different types of geo-data in terms of functional analysis, field theory and differential equations, directly motivated by the IAG concept of Earth Observing Systems, and bearing in mind the importance of interaction between geodesy and other Earth Sciences areas.
- Further theoretical research in stochastic differential equations, nonlinear filtering and possible geodetic applications.

Program of Activities

- Establish a website to serve as an open forum for its members and those who are interested in this subject.
- If possible, there will be working meetings at international symposia.
- Plan to publish a compilation of the most important papers.

Membership

- Chair: Jinhai Yu (China)
- Sten Claessens (Australia)
- Bernhard Heck (Germany)
- Peter Holota (Czech Republic)
- Wolfgang Keller (Germany)
- Juergen Kusche (The Netherland)
- Fei Li (China)
- Lintao Liu (China)
- Hossein Nahavandchi (Iran)
- Jesus Otero (Spain)
- Margarita Petrovskaya (Russia)
- ChungDing Zhang (China)

Inter-Commission Working Group

IC-WG1 Quality measures, quality control, and quality improvement

(joint with Commission 1 and 2)

Chair: **Hansjörg Kutterer** (Germany)

Terms of Reference

Geodesy generates und supplies various products for use in its own community as well as a service for related disciplines. Typically, the respective skills of the creator and of the user of the products are not congruent. Hence, originary products are needed whose essential properties are documented and quantified comprehensively. Up to now, a rigorous quality control is not common in Geodesy. International standards for quality management which are used outside Geodesy for manufacturing and services need to be specified regarding the particular field of interest. Present shortcomings in Geodesy are, e.g., the lack of specific measures of quality and the unsatisfactory assessment of the processes upon which geodetic products are based. In addition, the accuracies of the results from space-geodetic techniques are still too optimistic.

Objectives

There is a need for a thorough scientific foundation of quality in Geodesy. The theoretical delevopments have to be adapted to key applications in Geodesy. Hence, there are two main tasks: the set-up of a general concept and its exemplary application. A literature research which concerns scientific publications as well as documents on standardized quality management is essential to show the range of definitions of quality and the main fields of application.

In order to make quality measurable, the contributors to the quality of the final product have to be identified and defined mathematically. Therefore the process chains to derive geodetic products have to be studied. Their intrinsic properties such as the sometimes unclear rank deficiencies of the respective normal equations have to be compiled and optimised. Side information in data processing and analysis (e.g., for stabilization and regularization in view of consistency) needs to be assessed. Finally, suitable optimisation approaches have to be elaborated under consideration of the related uncertainty.

Once a general concept for quality control in Geodesy is established and recommended, quality improvement can be tackled based on the mathematical quality measures, the analysis of process chains and optimisation techniques.

Membership

Chair: Hansjörg Kutterer (Germany)
Orhan Akyilmaz (Turkey)
Manuela Krügel (Germany)
Rodrigo Leandro (Canada)
Rüdiger Lehmann (Germany)
Stefan Leinen (Germany)
Frank Neitzel (Germany)
Burkhard Schaffrin (U.S.A.)
Steffen Schön (Germany)
Emmanuel Shyllon (Nigeria)
Volker Stahl (Germany)
Mike Stewart (Australia)
Jinling Wang (Australia)
Andreas Wieser (Canada)
Yuanxi Yang (China)

Corresponding members

Jürgen Kusche (The Netherlands)
Reinhard Viertl (Austria)
Rainer Fletling (Germany)

Program of Activities

- Installation of a website for communication, presentation and outreach purposes
- Regular distribution of circular mails on the progress of the work
- Survey on the present handling of quality issues in Geodesy, identification of shortcomings, mainly regarding:
- Quality measures in use
- Uncertainty modelling for space-geodetic techniques (cooperation with IAG Commission 1)
- ISO 9000 ff recommendations
- Side information (rank deficiencies or weaknesses, regularization or stabilization)
- Development of a general quality concept for geodetic purposes
- Compilation and mathematical formulation of quality measures
- Recommendation of proper uncertainty measures (in particular for space-geodetic techniques)
- If possible, there will be a specific workshop
- Publication of a compilation of the most important results such as of the survey on quality modelling

Inter-Commission Working Group

IC-WG2 Integrated theory for crustal deformation

(joint with Commission 1 and 3)

Chair: **Kosuke Heki** (Japan)

Terms of Reference

In the new structure of International Association of Geodesy, establishment of this joint working group was proposed by the Intercommission Committee on Theory (ICCT President: P.Xu), the Commission on Earth Rotation and Geodynamics (President: V. Dehant), and the Commission for Positioning (President: H. Drewes). Owing to recent densification of Global Positioning System arrays in boundary zones of tectonic plates, e.g. in Japan and western North America, there are increasing demands for realistic theoretical models and computational programs incorporating recent theoretical progresses. The joint WG, chaird by Kosuke Heki and composed of about 10 members with expertise in various fields of crustal deformation studies, is expected to strengthen ties between modellers and those working on various observational data of crustal deformation.

Objectives

The WG is supposed to bridge the three commissions by identifying important theoretical problems in crustal deformation studies, looking for solutions, feeding back solutions to research communities. These problems will include, surface deformation of the realistic Earth due to dislocation at depth, crustal movement due to various loads, analysis of time series including jumps and periodic components, combination of data from different techniques, finite element methods to simulate crustal activities in subduction zones, incorporation of viscoelasticity, etc.. The goal is for worldwide researchers to share the most advanced information on models and software packages for particular issues in crustal deformation studies.

Program of Activities

As a task of the WG, it is planned to make a website for standard software packages for crustal deformation studies. In such studies we follow several steps, e.g. time series analysis of GPS, tide gauge, etc., linear regression, identification of jumps, search for set of faults or inflation sources, inversion of complicated slip distribution, temporal evolution of slips, modeling postseismic transients, drawing diagrams, and so on.

For the individual steps, there are public domain software packages used by majority of researchers. Also there may be new programs which will become standards in the future. For example, new programs to calculate surface displacement due to fault dislocation at depth have been developed for spherical and layered Earth cases in addition to the classical half-space.

The website will hopefully provide information on the availability of source codes, their whereabouts, references, example of applications, contact addresses of the authors, etc. That will help the research community, especially those starting crustal deformation studies. During the term of four years, the WG will define items of tasks for which standard software packages are sought (1st year), then make the proto-type webpage (2nd year), reinforce examples and references of each item (3rd year), and let the finished page be directly linked from the IAG website (4th year).

Membership

Chair: Kosuke Heki (Japan)
Danan Dong (USA)
Kazuro Hirahara (Japan)
Teruyuki Kato (Japan)
Shin'ichi Miyazaki (USA)
Barbara Meisel (Germany)
Frank Roth (Germany)
Wenke Sun (Japan)
Kelin Wang (Canada)
Simon D. Williams (UK)
Tetsuichiro Yabuki (Japan)

Inter-Commission Working Group

IC-WG3 Satellite Gravity Theory

(joint with Commission 1 and 2)

Chair: **Nico Sneeuw** (Canada)

Objectives

Against the backdrop of the gravity satellite missions champ, grace and goce, the overall objective of the working group is to be a focus of activities in the following research areas, related to the geodetic boundary value problem (gbvp) of satellite gravimetry:

- Installation of a website for communication, presentation and outreach purposes
- Regular distribution of circular mails on the progress of the work
- Survey on the present handling of quality issues in Geodesy, identification of shortcomings, mainly regarding:

Gravity Field Estimation from Satellite Data

- Novel approaches, e.g. energy integral approach or the use of numerically derived accelerations from leo orbit data (champ), and potential di_erences from grace. Also novel algorithmic approaches to dealing with huge quantities of satellite data.
- Inverse Theory related to satellite gravimetry. In conjunction with the IAG working group on inverse theory.
- Band limitation and filtering: Dealing with bandlimited satellite data, i.e. filtering either explicit or through the stochastic model.

Merging

- Mixed observable normal equations: Weights for normal equation systems from mixed sources—different satellites, terrestrial sets, different observables. Generalized cross validation (gcv), variance component estimation (vce), in combination with Monte Carlo techniques. To be tested and validated with real satellite and terrestrial data sets.
- Regional combination: Optimal combination of global (satellite-only) models and terrestrial data for regional geoid modelling in the overlapping spectral band. Seamless spectral merging by proper weighting and corresponding kernel modification has to be investigated.

Time-Variable Gravity

- Earth sciences: Interface of geodesy with oceanography, hydrology, solid earth science and glaciology.
- Sampling issues: High-frequency aliasing into monthly champ and grace gravity field solutions, orbit decay and ground-track variation. Theory development how the time variable sampling geometry influences the time-variable gravity recovery (also for future gravity missions).
- Unified approach: Time-variable gravity recovery combined with geocenter variations, station loading and/or earth rotation.

Gravity Field Representation

- Multi-resolution: Application of multiresolution representations to satellite geodesy.
- Ultra-high degree spherical harmonics: Algorithmic gains in stability and speed.
- Time-variable modelling: Convenient modelling in its relation to gravity estimation.

Satellite Orbit Dynamics

- Formation flying: Investigation into stability of leo formations and their application to follow-on gravity field missions.

Program of Activities

- Internal email discussions.
- Organization of working group meeting and organization of sessions at larger meetings. Potential candidate venues are the Joint AGU/CGU meeting, Montreal, Canada, 2004 and the Gravity, Geoid and Space Missions meeting, Porto, Portugal, August 2004.
- Launch of a website for communications, information dissemination and links to data sources (satellite data, terrestrial gravity, synthetic earth models,…).
- Monitoring and presentation of activities - either by WG members or external

Membership

Chair: Nico Sneeuw (Canada)
Pavel Ditmar (Netherlands)
Christian Gerlach (Germany)
Rossen Grebenitcharsky (Canada)
Shin-Chan Han (USA)
Michael Kern (Austria)
Christopher Kotsakis (Canada)
J·urgen Kusche (Netherlands)
Jiancheng Li (China)
Philip Moore (UK)
Roland Pail (Austria)
Nikos Pavlis (USA)
Thomas Peters (Germany)
Hanspeter Schaub (USA)
Yunzhong Shen (China)
Isabella Velicogna (USA)
Pieter Visser (Netherlands)
Franziska Wild (Germany)
Dah-Ning Yuan (USA)

Inter-Commission Committee on Planetary Geodesy (ICCPG)

President: **David Smith** (USA)
Vice-President: **Georges Balmino** (France)

Rationale

Geodesy of the planets of the solar system and their satellites is a domain of potential IAG expansion in view of the planetary missions, such as the present missions to Mars, the Moon and the giant planets, and the future missions to Mars, the Moon, Venus, Mercury, Titan, Saturn, the Galilean satellites, etc. A lot of data are already available, and provide the scientific community with a high potential for understanding these planets or satellites, and their evolutions. It is recognized in the scientific community that there is a need to understand the internal structure and crustal evolution of these planets and satellites, their rotation and variations (length-of-day, polar motion, precession-nutation or libration), their surface shape and gravity field, and to establish reference frames for them. The interpretation of the data in terms of their deep interior or shallow interior and their surface evolution has led to unprecedented results. For some of them, such as Mars or Europa, these are of great importance for studying the climate, the existence of water, and the possibility of life and its evolution. The comparison between the planets, including the Earth, has additionally brought considerable interesting and important information to the attention of the scientific community. In addition, the recent progress in analyzing and interpreting the data collected has made the role of planetary geodesy much more prominent in mission design and indicated the need for its continued involvement in planetary missions and operation.

These opportunities must be recognized by the IAG. This is particularly important because the planetary geodesy community has no home within the IUGG. Providing a home for this group within IAG will not only attract these scientists to IAG but it will also increase the visibility of, and respect for, our Association. Recognizing these poten-tial benefits, it is proposed that the IAG EC approve the creation of an ICC on Planetary Geodesy within the IAG.

Terms of Reference

The ICC on Planetary Geodesy will:

1. Support the geodesy of the planets of the solar system and their satellites;
2. Encourage and coordinate research in that domain, in particular the establishment of reference frames to support mapping, navigation and scientific studies concerned with the gravity field, the topography, interior structure, rotation and dynamics of these bodies;
3. Help the IAG in articulating the challenges in planetary geodesy in view of the missions prepared by the space agencies;
4. Guide the planetary geodesy community in the planning and realization of proposed planetary geodetic mission(s);
5. Provide planetary geodesy with a framework for standards, conventions, and where resolutions can be developed in the associated sciences;
6. Bring the attention of the planetary geodesy community within the IAG to the synergy between planetary geodesy and the other components of IAG;
7. Serve as an interface with scientists in other areas of planetary or Earth science, and provide a link to sister organizations such as the IAU, IAF (International Astronautical Federation), Space Agencies, and others.

Steering Committee

President: David Smith (USA)
Vice-President: Georges Balmino (France)
Commission 3 Rep.: Ozgur Karatekin (Turkey)

Members

David Smith (USA)
Georges Balmino (France)
Ozgur Karatekin (Turkey)
Maria Zuber (USA)
Frank Lemoine (USA)
Chuck Yoder (USA)
Bill Folkner (USA)
Jean-Pierre Barriot (France)
Nicole Rappaport (France)
Bruce Bills (USA)
Greg Neumann (USA)
Alex Konopliv (USA)
Philippa Berry (UK)
Miles Standish (USA)
Kyle O'Keefe (Canada)
Suriya Tatevian (Ru)
Andrea Millani (I)
Tim Van Hoolst (B)
Olivier de Viron (B)
Edwin Wnuk (Pol)
Alexander Kopaev (Ru)
Zdislav Sima (CZ)

IAG Project:
Integrated Global Geodetic Observing System (IGGOS)

Chair: **Ch. Reigber**, (Germany)
Secretary: **H. Drewes**, (Germany)

Terms Of Reference

Following the IAG ByLaws, IGGOS was developed by a planning group from 2001 to 2003. The proposal prepared by the IGGOS Planning Group was accepted by the IAG Executive Committee and the IAG Council at their meetings at the XXIII IUGG General Assembly in Sapporo in summer 2003. The IGGOS was endorsed by the IUGG through Resolution No. 3 at the same General Assembly.

IGGOS stands for *Integrated Global Geodetic Observing System*. "System" should be understood as the basis on which future advances in geosciences can be built. By considering the Earth system as a whole (including the geosphere, hydrosphere, atmosphere and biosphere), monitoring Earth system components and their interaction by geodetic techniques and studying them from the geodetic point of view, the geodetic community provides the global geosciences community with a powerful tool consisting mainly of high quality services, standards and references, theoretical and observational innovations.

The **vision of IGGOS** may be characterized as follows:

– IGGOS integrates different techniques, different models and different approaches in order to achieve a better consistency, long-term reliability and understanding of geodetic, geodynamic and global change processes.
– IGGOS provides the scientific and infrastructure basis for all global change research in Earth sciences.
– In the frame of IGGOS, the Earth system is viewed as a whole by including the solid Earth as well as the fluid components, the static and time-varying gravity field in its products.
– IGGOS is geodesy's contribution (products and discoveries) to Earth sciences and the bridge to the other disciplines; it asserts the position of geodesy in geosciences.
– IGGOS integrates the work of IAG and emphasizes the complementarity of the broad spectrum of geodetic research and application fields.

The **mission of IGGOS** is:

– to collect, archive and ensure the accessibility of geodetic observations and models;
– to ensure the robustness of the three fundamental fields of geodesy, namely
  – *geometry and kinematics,*
  – *Earth orientation and rotation*, and
  – *gravity field and its variability*;
– to identify a consistent set of geodetic products and to establish the requirements concerning the products' accuracy, time resolution, and consistency;
– to identify IAG service gaps and develop strategies to close them;
– to stimulate close cooperation between existing and new IAG services;
– to promote and improve the visibility of the scientific research in geodesy;
– to achieve maximum benefit for the scientific community and society in general.

IGGOS is geodesy's central interface to the scientific community and to society in general.

Objectives

– IGGOS aims at maintaining the stability of and providing the ready access to the existing time series of geometric and gravimetric reference frames by ensuring the generation of uninterrupted time series of state-of-the-art global observations related to the three pillars of geodesy.
– IGGOS focuses *in the first phase* on all aspects relevant to ensure the *consistency of geometric and gravimetric products*. This includes space-borne and terrestrial aspects.
– The targeted overall accuracy and consistency of IGGOS products is of the order of 10-9 or better.
– IGGOS ensures the consistency between the different geodetic standards used in the geosciences community, in agreement with the international unions.
– IGGOS aims at improving the geodetic models at the level required by the observation.

– IGGOS shall be *established* as an official partner in the *IGOS*, the United Nation's *Integrated Global Observing Strategy*.

Science Rationale

IGGOS shall have a *central theme* and a *master product*. The theme **Global deformation and mass exchange processes in the System Earth** must be scientifically sound, broad and include all the activities IGGOS might envisage in future.

Under the umbrella of *geometry* plus *Earth rotation* plus *gravity field* this theme encompasses virtually all facets of geodesy. In addition, it may easily be translated and broken down into tangible individual sub-themes and -products. From the general theme *one general product* may be derived, encompassing the following scientific questions/areas:

– The global patterns of tectonic deformation (global with, in addition, "enlargements" of regional maps) including inter-plate and intra-plate deformation,
– The global patterns of height changes (in one datum, and on all time scales, of geodynamic as well as of anthropogenic origin) on land, of ice covers (including glaciers), and of sea level,
– Deformation (loading as well as expansion) due to the mass transfer between atmosphere, hydrosphere including ice and solid Earth,
– Separation of effects of mass changes from motion and from thermal expansion,
– Separation of ocean effects from solid earth effects ("absolute" sea level),
– Quantification of angular momentum exchange, and mass transfer,
– Assessment of the angular momentum and mass balances in the Earth system model, and
– Quantification of mass exchange between the components of the System Earth.

The above list is not meant to be final and will be further developed.

The master theme and the results (products) derived from it will address the relevant science issues related to geodesy and geodynamics in the 21st century, but also issues relevant to society (global risk management, natural resources, climate change, ocean forecasting and others). It is an ambitious project of a dimension that cannot be achieved by the geodetic community alone, and which requires a strong cooperation inside and outside this community.

In order to shape IGGOS through its master-theme and its master-products, a sound and comprehensive **IGGOS Science Plan** is required. The IGGOS Science Plan shall provide a logic framework for the work of IGGOS. The master theme and the corresponding product(s) must be put into a broader science and application context. It should also include an analysis of the state-of-art in the science field under discussion, strength and deficiencies, recommendations of what should be done.

The IGGOS Science Plan should serve as the basis for the implementation of IGGOS in 2005. A work plan should be derivable from it. Furthermore it should become an attractive document for presentation to potential future partners and clients.

Structure

The IGGOS Planning Group proposed to establish the following key elements of IGGOS:

1. The ***IGGOS Project Board*** as the central oversight entity.
2. ***Working Groups***. The tasks of the working groups are to a high degree independent of the tasks of the IAG services.
3. A ***Science Council*** representing the geodetic and geophysical community.

The proposal was accepted by the IAG Executive Committee.

The IAG ByLaws ask for the establishment of a Steering Committee consisting of members appointed by the commissions, two members at large, and the chairs of the IAG project sub-groups. The Steering Committee is a subset of the IGGOS Project Board. The Steering Committee members are marked by an asterisk in the following list of members of the initial IGGOS Project Board:

IGGOS Project Board and Steering Committee (2003-2005)

– Chair: *Chris Reigber**
– Members related to reference frames: *Claude Boucher, Hermann Drewes (Repr. Commission 1 *), Markus Rothacher*
– Members related to gravity field and sea level: *Rene Forsberg (Repr. Commission 2 *), Reiner Rummel, C.K. Shum*
– Members related to Earth rotation and geodynamics: *Veronique Dehant, Kosuke Heki, Suzanna Zerbini (Rep. Commission 3 *)*
– Members related to services for geometry: *Norman Beck, Chopo Ma, Mike Pearlman*
– Members related to services for gravity and sea level: *Fernando Sanso, Phil Woodworth, Mike Watkins*
– Members related to networks: *Wolfgang Schlüter, John Manning, Ruth Neilan*

The initial composition of the project board is to a large extent the same as the composition of the IGGOS Planning Group (2001-2003).

Working Groups

Setting up the IGGOS working groups the following general principles are observed:

– IGGOS will be based on the existing IAG Services. It is in particular *not* taking over tasks of existing, and well working IAG services. IGGOS will provide a

framework for existing or future services and ensure their long-term stability.
– New entities will be established only if there is a stringent requirement.
– IGGOS must be the recognized by partners outside IAG, e.g., by UNESCO, ICSU, IGOS, GOOS, GTOS, governments, inter-government organizations, WCRP, IGBP, etc., as geodesy's most important contribution to Earth sciences. For this purpose contacts have to be established to these organizations.
– IGGOS must promote its master product and the related sub-products.
– IGGOS must promote interdisciplinary research in geodesy.
– IGGOS will provide standards and enforce quality management (validation, calibration, ensure the 1 ppb level) either by a new IGGOS entity or by delegating this task to one or several of the existing services.

Science Council

The primary task of the science council is to develop the IGGOS science plan based on the science rationale. The Inter-Commission Committee on Theory shall be represented in the Science Council.

The initial IGGOS structure (for the definition phase 2003-2005) is illustrated by Figure 1.

Program Of Activities

WG on IAG Services' Synergies: The key issue within this WG is a thorough analysis of the existing IAG structure. Does it make sense to combine certain services into one? What new services should be set up? Is it correct to distinguish within IAG between *level 1 services* (e.g., IGS, ILRS, IVS), dealing with raw observations and generating products which are more or less based on these observations only, and *level 2 services* (e.g., IERS) using the products of several level 1 services and generating new products, which are consistent with all the information from level 1? Shall additional level 2 services be established?

WG on Strategy and Funding: In the long run, funding has to be addressed by all permanent IAG entities requiring a complex infrastructure. As IGGOS per se (at least initially) will be based – exactly like all IAG services – on voluntary contributions of the relevant research organizations in the field, an IGGOS funding strategy must be developed in close coordination with these organizations. It seems therefore appropriate to establish a working group related to this topic. This aspect is clearly not dealt with at a sufficient rate within the existing IAG services structure.

WG on Integration of IGGOS in IUGG entities: This WG has the task to set up (so-to-speak) the foreign ministry of IGGOS. It must be the goal to have IGGOS acknowl-

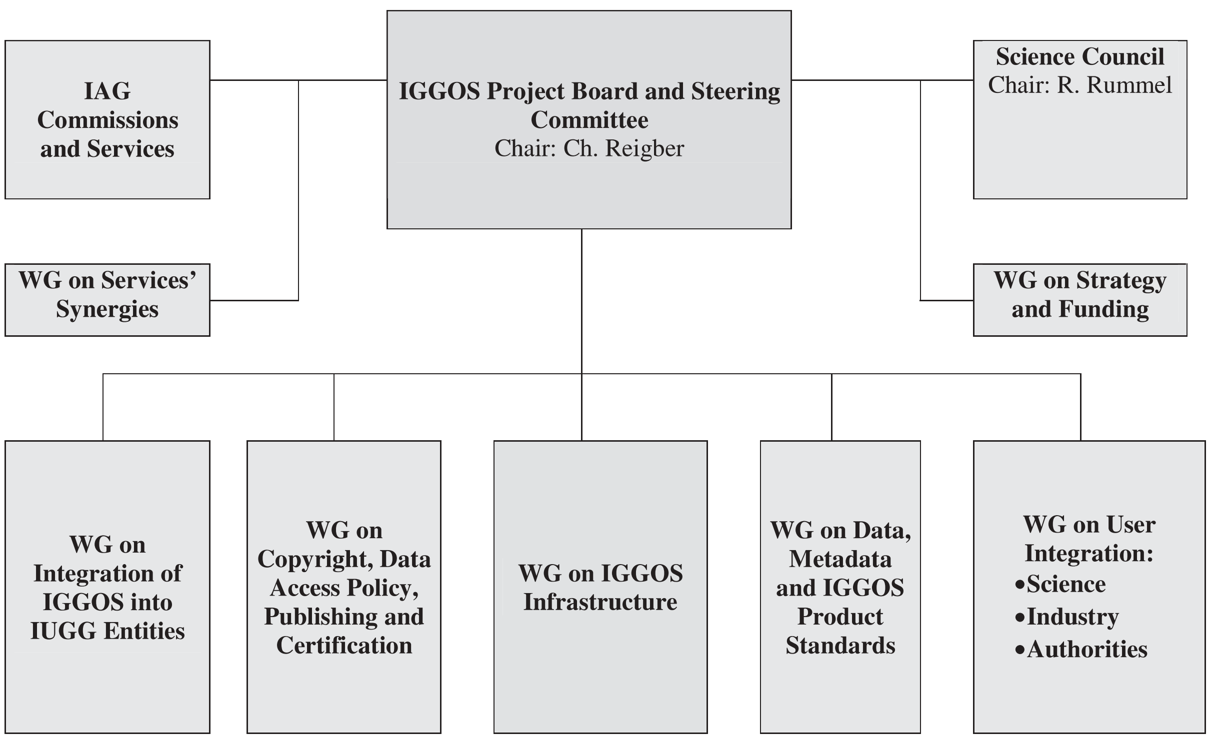


Fig. 1. Initial IGGOS Structure

edged as a member in the important international programs dealing with global change, etc. The IGOS is but one important example.

WG on Copyright, Data Access Policy, Publishing and Certification: This WG should deal with the consistent assignment of the *Digital Object Identifier* (DOT®) framework for IGGOS products and the usage of *Data Set Citation* rules in metadata documents for the definition and realization of copyright, data access, publishing and certification objectives.

WG on Data, Metadata, and IGGOS Product Standards: This WG has to deal with IGGOS products and standardization issues. The definition of IGGOS *Products* consisting of data and metadata, driven by user, application and service requirements using international *Standardization* specifications, constitutes the precondition for the creation of state-of-the-art value-added public and science IGGOS services.

WG on User Integration: This task is in part dealt with by the IAG services. A common policy on the IAG level is, however, missing. This WG must be set up in close cooperation with the services.

Schedule for the Realization of IGGOS

The following plan to develop IGGOS is based on the decisions taken at the last IGGOS planning group meeting in Sapporo.

1. The IGGOS definition phase lasts from 2003-2005. The main tasks are:
   – Definition of the final IGGOS structure
   – Development of the IGGOS Science Plan
2. The "final" IGGOS structure and the science plan will have to be approved by the IAG Executive Committee at the IAG Scientific Assembly in Cairns, Australia.
3. The IGGOS, as IAG's first project, should become operational in 2005.
4. IGGOS, in particular the science plan developed between 2003 and 2005, will be a central issue of the IAG Scientific Assembly 2005.

Point of Contact:

Chair: Ch. Reigber (reigber@gfz-potsdam.de)
Secretary: H. Drewes (drewes@dgfi.badw.de)

Communication and Outreach Branch

http://www.iag-aig.org

President: **József Ádám** (Hungary)
Secretary: **Szabolcs Rózsa** (Hungary)

Development

The Communication and Outreach Branch (COB) was created in the frame of the new Statutes and By-Laws by the IAG Council at its special meeting in Budapest, 7 September 2001. A *Call for Participation* was issued by the IAG Central Bureau (CB) to fill this position. Two offers were received to host the COB from the Finnish Geodetic Institute and from the Hungarian Academy of Sciences (HAS)/Budapest University of Technology and Economics (BUTE). The offer of the HAS/BUTE was elected by the Executive Committee (EC) at its meeting in Nice, 11 April, 2003. EC established a planning committee headed by Michael G.Sideris, IAG Vice-President for establishing the COB. IAG Council in Sapporo has confirmed this election. Thus the COB started its activities in July 2003, after the 23rd IUGG/IAG General Assembly (Sapporo, Japan, 30 June-11 July, 2003).

Terms of Reference

According to the new by-laws (§ 1.5) of the IAG, the Communication and Outreach Branch provides the Association with communication, educational/public information and outreach links to the membership, to other scientific Associations and to the world as a whole.

The responsibilities of the COB include the following tasks:

- promotion of IAG (at meetings and conferences);
- membership development;
- maintenance of the IAG Website;
- publications (newsletters);
- creation of a resource base for educators, developing countries and our global community;
- promotion of IAG activities: Schools, meetings, publications;
- promote contact and interaction with sister organizations and the general public;
- promote contact to national survey organizations, Universities, private companies and international organizations, and
- liaise with the IAG Bibliographic Service and publish bibliographic listings.

Program of Activities

According to the new modernised structure of the IAG, the individual membership has been introduced in addition to the traditional National Members. However the individual membership requires a more commercial, member oriented operation of the Association. The main purpose of the COB is to promote communication and interaction among all of its members and to facilitate the work of IAG in general. Therefore the COB will be a permanent IAG office for publication, publicity and visibility of the Association.

The planned activities of the COB will be split into:

- communicational activities, and
- membership developments and promotional activities which enable the growth of the IAG itself.

One of the major tasks of the COB is to create the channels of the communication within the Association. Our intention is to make a simple, structured way of communication using various Information technologies (IT). The ***communication of the IAG*** will be done using the following channels:

- the official IAG website,
- mailing lists for the various topics,
- publication of the IAG Newsletters and Geodesist's Handbook.

The official *IAG website* will act on one hand as the most important interface to the outside community, and on the other hand it will be the first pillar of the communicational infrastructure of the Association. Therefore the content of the new website is defined to support both roles. The IAG website is re-designed and functional at http://www.iag-aig.org on a new purchased Compaq ML350G3 server in Budapest (see address). The backend of the website has been developed. Hence all of the documents can be edited and maintained through a simple web browser. The documents are stored in a MySQL database, which enables fast data retrieval and also searching in documents.The new website contains updated information on IAG meetings, Commissions, Services, publications, officers and more. The site will be frequently updated. For more information on the website see the article „IAG on the Internet" in this issue.

All relevant documents and informations of the old website will be migrated to the new web. Due to the totally new structure of the website, all of the documents has to be partly re- edited. In the future the IAG website, and IT infrastructure behind it, could not only enhance the communication among the members of the Association, but could improve some activities and services. It will act as an agent for organising conferences.

The websites of the IAG components (Commissions, Services) should follow some rules concerning the graphical layout of their own websites. These rules will be specified by the COB.

The new server operating in the IAG COB, will handle *mailing lists,* which will be the major source of information for the members. The members will get all of the announcements and Newsletters via e-mail. Our intention is to operate many mailing lists. Issues for creating/maintaining user database/lists for advertising, circular e-mails, surveys, etc are as follows:

- users can register themselves by giving contact information and topics of interest (e.g. GPS, Gravity Field, Reference Frames, etc.) for notification;
- registration should be entirely web-based using confirmation e-mails;
- users can access/update/delete their personal contact information with username and password;
- privacy statement is necessary for keeping personal data confident;
- several statistics for geographical user distribution can be shown in simple charts on the IAG website;
- benefits should be clearly stated to be on the user list.

The *IAG Newsletter* will be published monthly. It will have an unique logo which is *a)* unmistakable and unambiguous, *b)* easy to read and perceive even when printed in black/white, and *c)* simply designed and reproduces to any size. It will be available in different formats for distribution: *(i)* plain text for e-mail, *(ii)* HTML for e-mail and website, and *(iii)* PDF for downloading from website. Visitors will have following options regarding the distribution of the IAG Newsletter:

- view the Newsletter online or download it directly;
- browse/view/download past issues in the Newsletter archive;
- sign-up for e-mail notification of availability of current issue of the Newsletter with short summary of content;
- each user can freely modify his account or remove himself from the Newsletter distribution list.

The ***membership developments and promotional activities*** are further our most important tasks. The COB will focus not only on increasing the number of members in the IAG, but also on providing science information service to the members. The COB has already started collecting individual members. For the *membership developments* a Membership Application Form (MAF) was designed and it is put in the new IAG website. The user can click into the Form and fill his/her data electronically in Adobe Reader. There is a separate room in the MAF for members who wish to make a contribution to the IAG Fund, too. In the frontpage of our new website there is an indication to download the Membership Application Form.

The major channels of *promotional activities* will be the IAG website, and the mailing lists. All of the promotional leaflets will be sent out as e-mail too. Some brochures and leaflets will be printed, which

- introduce the IAG to the global community,
- emphasize the mission statement of IAG, and
- describe the advantages of being an IAG member.

Our intention is that these brochures should be available at every conference organized and/or sponsored by IAG. Therefore the COB should also represent IAG at all major meeting (including not only IUGG General Assemblies, IAG Scientific Assemblies, AGU and EGS meetings, but also at IAG-sponsored meetings) with a booth with different IAG materials (brochures, CDs, ties etc). Moreover, a short video spot will be made to promote IAG, which could be avaiable for downloading from the web. Using various materials, a multimedia CD-ROM will be created to introduce IAG to the global community, to private companies, and international organisations.

Steering Committee

The COB has a Steering Committee (SC) with the following members:

József Ádám, President (Hungary)
Szabolcs Rózsa, Secretary (Hungary)
Gyula Tóth (Hungary)
Michael G. Sideris (Canada)
Christina Schneider-Pedersen (Denmark)
Markku Poutanen (Finland)

Ex officio:

Carl-Christian Tscherning (Denmark)
Will Featherstone (Australia)

Address

The COB operates an office (with the webserver, computer and multimedia tools) of which address is a follows:

IAG Communication and Outreach Branch
c/o Department of Geodesy and Surveying
Budapest Univ. of Technology and Economics
P.O.Box 91
H-1521 Budapest, Hungary
Phone: 36-1-463 3222/1204
Fax: 36-1-463 3192
E-mail: jadam@sci.fgt.bme.hu
szrozsa@sci.fgt.bme.hu

DOI 10.1007/s00190-003-0371-0

Presidential Address
XXIII IUGG General assembly, Sapporo, Japan July 2003

by Fernando Sansó

Ladies and gentlemen,

Dear friends and colleagues

Four years have passed since the last IUGG General Assembly in Birmingham and, as customary, the IAG President has to address all geodesists convened here in Sapporo, or better all geodesists that want to listen to us, with a speech where the point is made on the development of our science and of our organization, the International Association of Geodesy.

This implies looking at the last four years work, to our achievements, to how good we have been in promoting Geodesy and then looking at the future trying to understand where geodesy is going, at the sill of the new millennium and how we should best serve the purposes of our science in terms of an international scientific organization, but before doing that let us remember those geodesists that can not be with us anymore:

P.V. Angus-Leppan (Former President of IAG)
S. Bakkelid (Norway)
T.K. Colic (Croatia)
J.F. Dracup (U.S.A.)
R.C.A. Angle (U.K.)
L.A. Haller (Sweden)
J. Lerch (U.S.A.)
J.J. Levallois (Former IAG General Secretary)
A.R. Robbins (U.K.)
T. Vincenty (U.S.A)
H.G. Wenzel (Germany)
J. O'Keefe (USA)

As for the past period I shall be very short because we have decided to leave room to Section presidents to present directly their own reports and it would be a waste of time just repeating what they will say in a better way.

To me is only left the duty to comment on the quality of the work done by our Sections and the underlying structure of Commissions, Special Commissions, Special Study Groups, Services and whatever other group has worked in the name of IAG. I hereby want to acknowledge formally that all the body of IAG, its officers, and primarily our Section Presidents Alan Dodson, C.K. Shum, Mike Sideris, Bernard Heck and Clark Wilson, have comprehensively done an excellent job which is witnessed by the number and the quality of Symposia, scientific meetings, schools, proceedings, books, publications of any kind in our own journals and even more in journals of our sister sciences.

In particular I have to mention the great success of our Scientific Assembly in Budapest where, with the effort of all of us and also thanks to our policy of promoting and supporting the participation of young scientists and scientists from developing countries, we have been able to run, to my knowledge, the largest IAG meeting, showing that IAG can indeed collect the interest of a larger community and provide focus and guidance for the international geodetic research.

This is done by firmly advocating our scientific identity and by strengthening the cross-fertilization of ideas, methods and results that come from one sector of our geodetic activity into the other.

So we are here back again to define what is geodesy because this is necessary to look into the future.

Geodesy is an applied science; as a science it is defined by its object and its methods, as an applied science it is defined by its products and services.

Objectives:

Here I would like to use a pseudo-Helmert definition; the object of Geodesy is knowing the surfaces of the earth: the geometric surface by positioning and e.m. surveying, and the physical surface, i.e the gravity field, by land, marine or satellite gravimetry, and their time variations.

This "object" is naturally interlaced with other physical properties of the earth both through deep processes affecting its surface and through the gravity field at all

PHYSICS

Fundamental Physics and Astronomy
→
Measurement Principles Devices (e.g. time)

Gravitation Theory

Celestial Mechanics

Solid Earth Geophysics
→
Link between Geodetic Ref. System and Physical Ref. System

Crustal Deformation
Tectonics
Isostasy, Rheology

Physical Surface of the Earth
D.T.M.

Oceanography
→
Earth Rotation
Bottom Friction
Costal Interaction

Marine Geoid

Global Circulation Models

Atmospheric Physics
→
Rotation and Atmosphere Circulation (DTM)

E.M. Signal Transmission
Meteorology
(SAR, GPS)

MATHEMATICS

Functional Analysis
→
Potential Theory

B.V.P.

Approximation Theory

Numerical Analysis
→
Large Networks

Finite Elements

Large matrix inversion

Numerical Simulation

Statistics
→
Estimation Theory

Integer Variables

Bayesian Theory

Field Estimation

Dynamic Systems

Probability Theory
→
Random Fields

Random Systems

Non normal sampling distributions and testing

ENGINEERING

Informatics
→
Computational Devices (HW)

Data Bases (SW)

Parallel Calculus

Neural Networks

Electronics Mechanics
→
Measurement devices:

Classical (Gravity-meter, theodolite, level)

IMU

Lidar

SAR

Space Technology
→
Satellites

Space Navigation

Mapping Surveying Photogrammetry
→
D T M

GIS/Maps

Image analysis (R.S.)

Structural control

Natural Hazards

different scales from the global to the regional and local, where most engineering applications take place.

Methods:

Are typically those of modelling observation equations including as many physical effects as can be identified by specific measurement techniques and then studying the statistical nature of residuals by several means.

In the end we are then left with an optimal estimation problem where the unknowns can be either discrete in nature (sometimes even integers) or continuous like time signals or spatial fields, either governed by precise system equations or by approximated laws and henceforth either deterministic (at least in the average) or stochastic in full right.

In manipulating an increasing catalogue of physical phenomena showing up into the observations of geodetic quantities we have enormously extended the baggage of knowledge which has to be in our arsenal of geodesists and the fields of their applications.

I have been trying to outline the main interfaces of Geodesy with other Sciences, which I have grouped into 3 families: **Physics, Mathematics** and **Engineering.** I'm sure this picture is far from being complete, however I hope it is representative and I will need it later in this talk.

General Products:

Are indeed the knowledge of the objects of our investigation, i.e. the geometric surface of the earth and its gravity field jointly with their time variations.

In this respect we have to stress that knowing the geometric surface means also being able to attach precise coordinates to points lying on it and this can be done only by defining on the same time a unique reference system to which all positions have to be referred.

This is one of the most important general products of IAG, provided to all the other geo-sciences and techniques; namely how to refer any spatial event on the earth and in the surrounding space to a unique reference system attached to the earth.

In a very similar fashion when we speak of the knowledge of the gravity field, particularly in terms of one of its equipotential surfaces, we implicitly mean that we are able to accomplish the unification of the many more or less local representations of it for instance identifying in a unique mode the queen of these surfaces, the geoid, to serve as a unique reference surface for heights on the earth, i.e. the unified worldwide height datum.

Services:

Are structures, that have autonomously accepted to serve under the IAG banner, although they might on the same time be working for other organizations too, that are focussed on providing specific products and spreading them among the users.

The actual list of Services working in the IAG framework is:

IGS International GPS Service
ILRS International Laser Rancing Service
IVS International VLBI service for Geodesy and Geodynamics
IDS International Doris Service (New)
IERS International Earth Rotation Service
IGFS International Gravity Field Service
BGI International Gravimetric Bureau
ICET International Center of Earth Tides
IgeS International Geoid Service (Milano)
PSMSL Permanent Service for Mean Sea Level
BIPM Bureau International des Poids et Mesures, Sec.2

As you can see in the case of the gravity field a federation of different centers has been implemented and I think some unification process could be advisable as well in the galaxy of Services related to different space techniques.

Now that we have shortly re-defined what we are, let us try to understand from where most likely we shall receive impulses for progress. Apart from our internal strength we try to look into the external sources of fuel for our machine. Without any doubt our first resource is the investment that the society in general is willing to do in matters concerned with geodesy.

In this respect we have to be clear that, as for the past, the resources will be most easily provided at a national level for the purpose of some specific geodetic job (e.g. setting up a national positioning service or computing a high resolution local geoid), while it is more difficult to achieve a strong support for those activities that, though fundamental from a scientific point of view, have no immediate direct impact on the social life, like the global geodetic monitoring of the earth and the maintenance of a global Reference Frame.

For instance when it happens to me to say to a politician that I'm a geodesist, and this has to do with the monitoring of the earth, even in the best case from the cultural point of view, I'm usually required to give opinions on earthquakes predictability.

All that has two important consequences: the first is that we should never think of our new and challenging global scientific work as a killer of the local level geodetic work. Rather the contrary, the local level work can help us in claiming that we need, as we do, a worldwide unification of the geodetic information, which is essential to be able to distinguish the local features from global effects. The second consequence is that IAG has to produce a large and well organized effort in order to let the general community understand the importance of what we do for the other sciences and techniques and, ultimately, for the Society itself.

Apart from economic and social matters, I think that scientific and technological impulses on geodesy, in the next 10 years, will come from:

- Informatic HW and SW development. In particular the exponential low for the development of computing power has not yet exhausted its trend and completely new technologies are close to enter into the market
- More advanced technology in geodetic instrumentation with two main characteristics : one is the usual trend in improving accuracy, the other is to increase enormously the mass of information, also thanks to the diffusion of a large number of geodetic apparatus with may be a lower accuracy performance but also with a very low cost, which makes them accessible to a large community of users (as an example think of GPS)
- More advanced spatial technology for an improved surveying both at a global scale (think for instance of the new gravity missions CHAMP, GRACE and GOCE) and at a local scale (think for instance of the high resolution imagery or the inSAR surveying), to the effect of continuously growing the mass of information available to us; and all that, not only for the Earth but also for the other planets, which are our job as well (let us take the occasion to wish the greatest success to the recent missions to Mars)
- more advanced knowledge of the physics of the solid Earth, e.g. to facilitate the modelling of the crust deformation in geodetic surveying, of the ocean, e.g. in improving the knowledge of the global circulation pattern thus making more usable the satellite altimetry for the estimate of the marine geoid, of the atmosphere, e.g. providing better corrections for the effects of the propagation of our GPS signals,
- certainly a stronger progress in mathematics (e.g. in the area of dynamic systems or that of random fields) as well as in statistics and data handling, driven by the great possibilities provided by the new electronic tools.

Of course I don't even attempt to be exhaustive but I think that the mentioned items will really impress a strong push to geodesy. So we can ask now, what will Geodesy do for the other sciences?

First of all we shall pursue our general scopes, and in that we will serve all the other geosciences by providing a global geodetic reference frame maybe with an accuracy in the millimetric range and a unified height datum, maybe in the centimetric range.

In this respect let me be clear; I know we have talked about the 1cm geoid since years, however we are still far from this goal in absolute sense, and maybe with the help of the new gravity satellite missions we will be able to approach that figure as an overall upper bound of the error.

Already being able to bridge at such a level of accuracy between the geometrically/kinematically defined reference frame and the physical reference systems, both in the sense of the gravity field and of the rotation of the earth, is an enormous step ahead in understanding the physical behaviour of this complicated "system Earth" and geodesy seems to be in pole position not only to provide the necessary experimental information, but also to solve the difficult knot of modelling the interactions of the subsystems of the earth.

In addition we expect geodesy to take the leadership of the new concept of continuously surveying the Earth from space even at a regional level, exploiting its natural skill in combining different observation equations in a unique system.

To do this I'm sure that an improved structure of IAG Services will play a major role in providing data and specific products, for instance in such fields as engineering positioning and navigation, regional crustal deformation, digital elevation modelling, gravity and gravity variations surveying, atmospheric parameters monitoring, steady oceanic circulation and variability etc.

On the other hand geodesy, with its new big challenge of optimal combination of different huge data sets, will be able to work out, as it happened in the past, original methods of field modelling and spatio/temporal signal analysis thus giving contributions to different areas of mathematics in terms of interesting problems and advanced solutions, for instance for items like satellite dynamics, boundary value problems, random fields analysis, general estimation theory with integer variables etc.

Remember that all the other sciences, including classical signal analysis, have been living for more than one century on the concept of least squares, which has been worked out in a geodetic context and thus is in its full right a contribution of geodesy to all other sciences.

I wish and I believe it will be possible that something similar will happen in the next years for instance by proposing a unified view on the very general item of field estimation, especially for inverse and improperly posed problems theory.

I think we have the human potential to achieve all that, but is IAG ready to help with its structure this process?

When I Answer yes, I'm very confident that I'm just saying the truth. The deep reorganization of IAG and the new Status and ByLaws, which have been voted by the IAG Council at the extraordinary meeting in Budapest and are now implemented after the General Assembly, have been illustrated several times and will again be presented by our new (in a few days) IAG President Gerhard Beutler, who had a very large part in driving the renovation process.

Here I want only to recall the three main principles of our restructuring:

1. we have added lots of flexibility to our organization; in fact we have eliminated one layer in the structure creating new Commissions which will be able to set up different substructures or disband them, when necessary, in a very fast and informal way, for instance giving rise to joint Study Groups with other Commissions and / or other Services,

2. we have greatly enhanced the role of Services who are now directly represented in the IAG E.C. through 3 regular members; in addition Services, which are now at the same level as new Commissions, can organize their own work in terms of projects, working groups etc. where individual scientists are invited to participate,

3. we have created new structures to give a much greater visibility to IAG among other sciences and to the general public; such is the Communication and Outreach Branch and in a sense also the IAG project IGGOS that will help to let the great job done by services to be know to a very large community and hopefully acknowledged.

Somehow corresponding to these three principles we can identify also three main lines of the IAG policy:

1. The flexibility should be a factor of internal strength to better cooperate among us and to open the doors to any scientist willing to approach IAG and work with us.

2. The enhanced role of Services is on one side the guarantee that all the other geosciences and techniques that do need us now, will continue to need us for a long time; on the other side their activity, proposed also to individual scientists interested in some particular cooperation, can be a powerful tool to penetrate more the world of national services and agencies showing to them how they can valuably contribute at an international level; and this can be very effective in particular for the diffusion of IAG into developing countries.

3. The communication and outreach branch is somehow the diplomatic structure of IAG to help our scientists to be recognized in general as well as in the environment of the disciplines that mostly communicate with us.

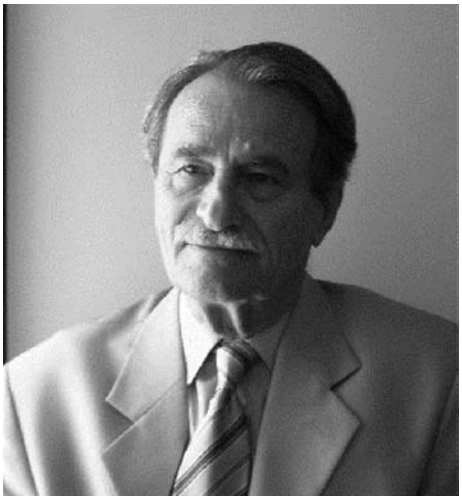
Based on these concepts I would like to close with a small warning and a wish.

I'm absolutely in favour of so many of us working in geodesy as well as in our sister sciences, but I warn you to do that without forgetting where you came from.

My wish is that in the next 10 years geodesists would spread in all geosciences and techniques, but at the same time they would find the work of IAG so interesting in itself, that they could become just ambassadors of geodesy demonstrating the usefulness of its international organization, the interest of participating in its symposia, of publishing in its journals and bulletins so that in the end we could really look at ourselves and be proud of being IAG members because this means being an engine of human knowledge of the Earth and the planets.

Levallois Medal Citation for George Veis

By Ivan I Mueller



George Veis

The Committee consisting of all (living) IAG Past Presidents unanimously recommended to award at this General Assembly the Levallois Medal to George Veis. I have the honour (unfortunately not in person) to present the citation.

George was born in Athens in 1929. In 1951 he graduated in Surveying Engineering from the National Technical University of Athens (NTUA). In 1955 he was the recipient of a Greek state fellowship for advanced studies in Paris at the Sorbonne and the Ecole Nationale des Sciences Geographiques. He spent some time also at the Observatoire de Paris and at the Bureau Gravimetrique International. Starting in 1957 he continued his post-graduate studies at the Ohio State University where he was awarded with his PhD in 1958, after defending his famous dissertation on the "Geodetic Applications of Observations of the Moon, Artificial Satellites and Rockets".

I arrived at OSU on January 1, 1959, just missing him, when he left for the Smithsonian Astrophysical Observatory (SAO, later the Harvard Smithsonian Center for Astrophysics). to arrive on the scene of satellite geodesy at its birth. The SAO had designed, built and deployed a global network of Baker Nunn Satellite Tracking Cameras. Though there were concerns about even being able to track satellites, there were plans to use satellite tracking for geodetic, and other scientific research.

George made the leap between those early hopes and their realisation. During 21 years as SAO's principal scientific consultant, he became the guiding hand of the program as it evolved from satellite surveillance to a satellite geodesy program. His contributions included the early idea of the Differential Orbit Improvement Program, which evolved over the years into the main analysis tool for satellite tracking, geopotential, station coordinate determination, and satellite drag research. He defined the fundamental reference system used for many years, which in fact now forms the basis of modern models of earth rotation, precession, and nutation. Seeing the need and feasibility he initiated the SAO Star Catalogue project, which provided a uniform all sky catalogue for precision camera observations, and was used for many years all over the world.

In the early sixties George Veis returned to the National Technical University of Athens where he was elected Professor of Surveying (renamed later Higher Geodesy and Cartography) to develop satellite geodesy in Greece. In 1969 he established the tracking station at Dionysos, installed a Baker-Nunn camera there, and began developing a laser ranging system. He had the vision of a complete geophysical observatory with, of course, satellite tracking, a meteorological observatory, earth tide monitoring, strain gauges, etc. He also developed surveys based on Transit Doppler measurements and GPS when the equipment became available. Dionysos contributed to the MERIT, MEDLAS, WEGENER and other programs. Between 1965 and 1984 George also organised the famous series of international symposia, in Lagonissi and Athens, on the "Use of Artificial Satellites for Geodesy and Geodynamics". The five volumes of the proceedings of these symposia document a great part of 20 years of geodetic history.

George Veis's career as a science-administrator is also rich. As a member of the NTUA's senate and the Dean of the Faculty of Surveying Engineering, he suffered a short but painful imprisonment by the military dictatorship at that time in Greece, because of his proper academic comportment during students protest which caused the furious reaction of the regime. He was the Secretary General of the Hellenic Committee for Geodesy and Geophysics, its President from 1982 to 1990 and he is now a regular member of this Committee. He was President of the Board of the Athens National Observatory and the President of the Observatory's Scientific Council. He was the President of the Cadastre and Mapping Organization of Greece and the President of the National Consultative Council for Research. He also presided over several IAG/IUGG and COSPAR organizations.

George retired from the NTUA in 1997. The ETH of Zurich honored him with an Honorary Doctor's degree. He still is active, in fact in a key position as the President of the important Supreme Council for Personnel Selection, a state authority responsible for the selection of personnel for the public administration in Greece. George Veis is an endlessly creative, engaging, seducing, elegant, modern and forever young scientist, who shares his ideas with enthusiasm, and has helped everyone he has had contact with.

I have the great pleasure and honour to hand over (in spirit) the Levallois Medal in recognition of his distinguished service to the science of geodesy to my old friend and colleague George Veis.

Bomford lecture, 2003
Haphazard occurrences of reality: the link between opportunism, geodesy, and satellite radar interferometry

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Dr.ir. Ramon Hanssen

Bomford Prize winner 2003

Hendrik Casimir, the renowned Dutch physicist, quoted in his autobiography the aphorism: "When telling a true story one should not be over-influenced by the haphazard occurrences of reality." He implied that as long as the main message (the true story) of an anecdote is correct, the anecdote may be worth telling, even if it has no factual basis. Although I do not intend to dwell on anecdotes in this brief retrospective, I was struck by the implications of the aphorism to my studies on the geodetic applications of satellite radar interferometry.

The haphazard occurrences of reality reflect a concept well known in contemporary geodesy: repeatedly measuring a physical parameter (reality) will result in stochastically dispersed numerical observations. In this context, the haphazard occurrences of reality are in fact a nuisance, one would rather know the true story instead of having to interpret dispersed observations. Nevertheless, geodetic science has learned to live with this concept, for example by introducing redundant observations and network optimization to determine not only the parameter of interest, but its higher-order stochastic moments as well. Concepts such as reliability enable quantitative statements on the tuning between the functional and the stochastic models. Many types of geodetic surveying techniques, from terrestrial triangulation to the global satellite navigation systems, are built on these concepts. All of these techniques have in common that they are based on some kind of prior knowledge. For example, for monitoring a deformation signal its existence should be anticipated, but also its type, size, and properties. Rarely observations are performed without any a priori ideas on the parameter of interest.

Satellite radar interferometry (interferometric synthetic aperture radar, InSAR) is one of the techniques where this paradigm cannot be applied straightforwardly. For example, since the complex radar observable is formed by the many reflections of a radar wave on the earth's surface –a deterministic process but usually impossible to model - we actually do not know what we are measuring. Distilling the desired geometric information from this observable is a non-trivial task. Redundant observations are usually not available, leading to poor-mans' redundancy, based on harsh assumptions of ergodicity. Due to the fixed orbital schedule of the radar satellites, optimization of the survey strategy for, e.g., deformation monitoring is limited only to a few experimental situations. On the other hand, one could argue that since the millions of observations in each radar image are routinely available, and that every position on earth can nowadays be observed with a revisit time of days, the application of the technique deserves a sound geodetic foundation. In fact, the challenge is to find the true stories from the haphazard occurrences of reality. Identification (and, later, interpretation) of observations that are physically meaningful is the key issue here. Applied to deformation measurements, it can be a tool not only for observing anticipated deformation signals, but also allows for the detection of new, unexpected phenomena.

Radar interferometry can be used for observing topography, surface deformation, and integrated atmospheric refractivity, depending on the interferometric configuration [1,5,8,10]. Topographic mapping has been successfully applied in e.g. the topography mission of the Space Shuttle, leading to the first consistent and uniform elevation model of the world between +/− 60 degrees latitude [11]. Currently, several proposals for InSAR satellite missions for elevation mapping are under serious consideration. Atmospheric mapping can be regarded as a side-topic for most geodetic applications, but the concept of measuring the fine-resolution water vapor distribution using interferometric imaging radar has revealed unprecedented views of meso-scale atmospheric phenomena, sparking new ideas in meteorology and improved stochastic models in space-geodesy [4,6,7]. Nevertheless, the most spectacular scientific advances have been made in the field of deformation monitoring, considering geodesy as well as geophysics [5].

Geodetic deformation monitoring using radar interferometry was boosted when the first interferograms of the coseismic displacement field due to earthquakes were published on the cover of Nature [9]. These semi-continuous images were among the first realizations of an 'opportunistic' technique - exploiting the opportunity of combining an archived radar image with a newly acquired one. Since the satellite ERS-1 was not designed for interferometry, these 'by-products' were indeed a major achievement, although they created lofty expectations as well.

The expectations based on the successes with earthquakes, glacier and volcano dynamics, and subsidence created a belief that any problem of deformation could now be monitored from space, routinely, with minimal costs, and maximum accuracy. While proceeding to deformations with smaller displacements, in more humid environments, and over longer time periods, it did not take long to acknowledge the opportunism in the InSAR successes. Under these more unfavorable conditions, radar interferograms reduced from the cheerful color-fringes to explosions of pure and uninterpretable noise. Moreover, elevation products started showing artificial mountain chains, an effect of unaccounted atmosphere. The stories were truly obscured by the haphazard occurrences of reality.

The problems encountered set the stage for new approaches and improved algorithms. The problem of the atmospheric signal, embedded in the phase observations, is challenged by using a multitude of radar acquisitions, exploiting the lack of correlation of the signal between subsequent acquisitions. More important, a systematic approach for discerning coherent radar reflections from incoherent ones reveals only those observations that are physically interpretable [2,3]. Single pixels in the radar image, even fractions of pixels, can now be interpreted in terms of their deformation, elevation, and atmospheric error. Formal precisions for these parameters could be in the range of sub-mm/y for (linear) deformation and submeter for elevation [3]. Solving these parameters is possible only if tens of radar acquisitions are available for analysis.

Even though these possibilities are beyond imagination considering satellites at 800 km altitude, the observations are still opportunistic. Although the measurements may show the displacement of an object with a precision better than one millimeter per year, there is no guarantee that a similar result may be obtained for another object in the radar image. Whether a target is coherent depends on the combination of its physical and geometric characteristics with the specific point of view and characteristics of the radar sensor. Two topologically identical objects with a different orientation may behave completely different in the radar image. The adage is therefore, again, opportunism—results cannot be predicted until the data are processed and interpreted. On the other hand, it is important to realize that (i) in many cases the radar data are the only data available, (ii) experience in many case studies showed that often good results can be anticipated, especially in an urban environment, (iii) the temporal update frequency is much higher compared to many conventional techniques, (iv) archives of radar data allow for an a posteriori analysis of areas of interest, and (v) future plans for SAR satellites indicate an increasing amount of data to be available.

In the evolution of methodology and algorithms for interferometric radar many hurdles have been taken. Nevertheless, there are still many open questions where geodesy can play a leading role. For example, the stochastic model of the radar observations needs to be better defined, integer ambiguities in the phase observations (both spatially as well as temporally) need to be solved, and the observations of the different radar satellites and additional geodetic techniques need to be integrated systematically to estimate the parameters of interest. Many numerical problems related to the number and size of the data sets need to be resolved. Additionally, the observation of very local geophysical or geotechnical deformation phenomena requires a close collaboration with disciplines such as hydrology, geophysics, geology, and civil engineering.

In conclusion, I hope that the advent of 'opportunistic' techniques such as radar interferometry and their related problems and challenges has demonstrated their complementary value in the field of geodesy. Although we have to deal with the 'haphazard occurrences of reality', there are many great stories to be told.

Acknowledgment

I regard it as an embracement of radar interferometry in the arena of geodetic techniques, and a great honor for me to receive the Guy Bomford prize of the International Association of Geodesy. I would like to thank the bureau of the IAG for awarding this prize. Additionally, I would like to acknowledge my main tutors Reiner Rummel, Peter Teunissen, Roland Klees, Richard Bamler, Philipp Hartl, Howard Zebker, and my dear friends and colleagues in Delft and elsewhere in the world. A special thanks to Willem Baarda, for sharing his historical perspective.

References

Richard Bamler, Philipp Hartl Synthetic aperture radar interferometry. Inverse Problems, 14, R1–R54, 1998

Alessandro Ferretti, Claudio Prati, and Fabio Rocca. Nonlinear subsidence rate estimation using permanent scatterers in differential SAR interferometry. IEEE Transactions on Geoscience and Remote Sensing, 38(5), 2202–2212, September 2000

Alessandro Ferretti, Claudio Prati, Fabio Rocca. Permanent scatterers in SAR interferometry. IEEE Transactions on Geoscience and Remote Sensing, 39(1), 8–20, January 2001

Ramon Hanssen, Ilona Weinreich, Susanne Lehner, Ad Stoffelen. Tropospheric wind and humidity derived from spaceborne radar intensity and phase observations. Geophysical Research Letters, 27(12), 1699–1702, June-15 2000

Ramon F Hanssen. Radar Interferometry: Data Interpretation and Error Analysis. Kluwer Academic Publishers, Dordrecht, 2001

Ramon F Hanssen, Arnout J Feijt, Roland Klees. Comparison of precipitable water vapor observations by spaceborne radar interferometry and Meteosat 6.7-m radiometry. Journal of Atmospheric and Oceanic Technology, 18(5), 756–764, May 2001

Ramon F Hanssen, Tammy M Weckwerth, Howard A Zebker, Roland Klees. High-resolution water vapor mapping from interferometric radar measurements. Science, 283, 1295–1297, February-26 1999

Didier Massonnet, Kurt L Feigl. Radar interferometry and its application to changes in the Earth's surface. Reviews of Geophysics, 36(4), 441–500, November 1998

Didier Massonnet, Marc Rossi, Cesar Carmona, Frederic Adagna, Gilles Peltzer, Kurt Feigl, Thierry Rabaute. The displacement field of the Landers earthquake mapped by radar interferometry. Nature, 364(8), 138–142, July-8 1993

Paul Rosen, Scott Hensley, Ian R Joughin, Fuk K Li, Soren Madsen, Ernesto Rodriguez, Richard Goldstein. Synthetic aperture radar interferometry. Proceedings of the IEEE, 88(3), 333–382, March 2000

S Suchandt, H Breit, N Adam, M Eineder, B Schattler, H Runge, A Roth, E Mikusch. The shuttle radar topography mission. In ISPRS Workshop, High Resolution Mapping from Space, Hannover, Germany, 19–21 September 2002, pages 235–242. ISPRS, September 2001

Report of the Secretary General XXIIIrd IUGG General Assembly, Japan, July, 2003

by C.C.Tscherning

The Secretary General of the International Association of Geodesy is pleased to submit to the XXIIIth General Assembly his report on the activities of the Association for the period between the XXIIth and the XXIIIth General Assemblies.

In accordance with the Statutes and By-Laws, the Secretary General reports on the administrative and financial affairs, the President reporting on the scientific work of the Association.

I *Administrative activities of the Association*

During the past period the main administrative activities were:

- meetings of the Bureau and Executive Committee where decisions were taken on future actions of the Association
- publication of scientific and administrative information.

I.1 Meeting of the Executive Committee

During this period the Executive Committee met seven times:

- in Birmingham, UK, during the XXII General Assembly
- in Como, Italy, November 1999
- in Nice, France, April 2000 and April 2001
- in Budapest, Hungary during the Scientific Assembly, September 2001
- in Nice, France, April 2002 and April 2003.

All those meetings were prepared by meetings of the Bureau. The detailed reports of these meetings were published in the IAG Newsletter which is published in the Journal of Geodesy and on the IAG home-page. A large parts of those meetings were devoted to the preparation of the Scientific Assembly in Budapest, the new IAG Structure and of the present General Assembly.

I.2 Publications

I.2.1. Journal of Geodesy - This is the official journal of the IAG which has been published since 1991 January 1st by Springer Verlag. The Editor-in-Chief, Prof. P.Teunissen, will deliver a report on the Journal at the General Assembly.

The Journal of Geodesy also includes the IAG Newsletter in generally each issue. This Newsletter is edited by Dr Ole B. Andersen, IAG Assistant Secretary and contain information about IAG activities, symposia announcements and reviews, book reviews, bibliography. The content of the newsletter is also found on the Internet as a part of the IAG Home-page (I.3). The Journal is distributed free of charge to the members of the Executive Committee, the National representatives and to a few selected libraries.

I.2.2. Geodesist's Handbook - The Handbook reporting on the last general assembly and the structure of IAG was edited by the Assistant Secretary General in the spring of 2000. Due to his effort the handbook was created on digital form, so that it could be made available immediately after its publication through the IAG Home-Page. It has been corrected and maintained during the period 1999–03 by the Central Bureau. Especially the maintenance of the address list has been a major task. The next Geodesist's Handbook will be published by Springer Verlag in 2004 in place of one regular issue of the Journal of Geodesy. This publication is now well appreciated by geodesists and non-geodesists, and the Bureau will try to make it available early after the General Assembly. Dr Ole Andersen will also act as the editor of this forthcoming issue.

I.2.3. Travaux de l'Association Internationale de Géodésie - Two volumes of the Travaux have been published by the Central Bureau of IAG. They contain the bi-annual and quadrennial reports concerning the activities of Sections, Commissions, Special Study Groups, Bureaus, and other Permanent Services, with the relevant bibliography. Dr Ole Andersen has been the editor of these two issues which have been distributed on a CD-ROM free of charge at the Scientific Assembly and at this General Assembly.

I.2.4. Publication of Symposia Proceedings - The IAG Symposia Proceedings are published in a special series by Springer Verlag, having the association president as the editor. This procedure has been used for the publication of several Symposia (Proceedings no. 115 to 120). The following have been published since Birmingham:

Volume 121: Schwarz, K.-P. (Ed.) Geodesy Beyond 2000: The Challenges of the First Decade

Volume. 122: Benciolini, Battista, (Ed.) IV Hotine-Marussi Symposium on Mathematical Geodesy

Volume. 123: Sideris, Michael G., (Ed.) Gravity, Geoid and Geodynamics 2000

Volume. 124: Drewes, Hermann; Dodson, Alan H.; Fortes, Luiz P.S.; Sanchez, Laura; Sandoval, Pedro, (Eds.) Vertical Reference Systems

Volume. 125: Adam, Jozsef; Schwarz, Klaus-Peter, (Eds.) Vistas for Geodesy in the New Millennium

All proceedings are listed at:
http://www.springer.de/geosci/geophys/geo/geophys.html#iag

For the other Symposia and Workshops which are only sponsored by IAG or which are organised by IAG bodies (such as meetings of commissions or SSG) the organisers are free to choose their own publishing agency. They are however requested to have the proceedings published early after the Symposium and to inform the Central Bureau.

I.3 IAG Information System

The IAG Information System is a web-based system maintained by the Central Bureau since 1995 (http://www.gfy.ku.dk/~iag/). This system includes information on various topics of potential interest which are partly identical to sections of the Geodesist's Handbook: directory of addresses which was permanently updated and includes more than 2400 items: geodetic data centers, educational institutions, symposia related to Geodesy, bibliography, IAG and IUGG links to other geodetic home-pages

I.4 Scientific meetings

I.4.1. Symposia and Workshop - The list of meetings sponsored by IAG is given in Appendix A. One can note the large variety of topics treated and the effort towards a good geographical distribution. It is necessary to receive from the organisers information in due time on announcement, report and publication of proceedings. This information is redistributed as soon as possible by the Central Bureau through the IAG Newsletter and announced on the home-page.

I.4.2. Scientific Meeting - was held in Budapest, September 2001. It was the fifth General Meeting of IAG after the first one in Tokyo, May 1982. As the previous ones, this meeting was a real success (much due to the effort of Dr. Adam and co-workers) with a very active participation of geodesists from all continents. Proceedings are published as Volume 125 of the proceeding series (see I.2.4.)

II *Finance*

The financial report for the period 1999–2002 is presented in Appendix B. The following comments may be added:

II.1 Receipts

The receipts were stable from subvention point of view. The incomes from sales of publications did considerably decrease. The "head charge" per participant, (at both the Birmingham and the Budapest meetings), is an important new source of income. Furthermore IAG has been successful in obtaining grants from IUGG.

II.2 Expenditures

The expenditures were close to what was predicted with some minor differences. A significant increase of travel supports for scientists (young and from developing countries) was possible due to the extra income from the "head charge" and from the IAG Fund.

II.3 IAG Funds

The IAG Fund is now well established through voluntary contributions from IAG affiliates and fellows.

The fund is primarily used to provide travel grants for young scientists and scientists from developing countries.

II.4 Bomford Prize

Dr. Ramon Hanssen was declared the winner of the Bomford Prize 2003 by the IAG Bureau, on the recommendation of a review committee consisting primarily of the Presidents of Section. A cheque of 2000 US $ will be presented to him during this session.

III Educational Activities.

Several schools have been successfully organised, with participation from many countries:

- XIII International Course on Engineering Surveying, Munchen, Germany, 13–17 March, 2000.
- The 3.rd School on the Determination and use of the Geoid organised by the International Geoid Service was held in Milano, Feb. 15–19 1999.
- The 4.th School on the Determination and use of the Geoid, organised by the International Geoid Service was held in Malaysia, 21–25 Feb. 2000
- The 5.th School was organised by the International Geoid Service in collaboration with the University of Thessaloniki from August 30 to Sep. 5, 2002.
- Joint BGI/ICET Summer School 2002 on Terrestrial gravity data acquisition techniques, Louvain-la-Neuve, Belgium, Sept. 4–1, 2002.
- International Workshop on Satellite Altimetry for Geodesy, Geophysics and Oceanography, September 8–13, 2002, Wuhan, China.
- Workshop on vertical crustal motion and sea-level change. Toulouse, France, Sept. 17–19, 2002. (Organized jointly with IAPSO, and sponsored by IUGG).

An Educational Working Group was established at the EC meeting in November, 2000 aiming at preparing the foundation for further coordinated educational activities. A report was delivered, but no action taken.

IV *Conclusion and Outlook.*

As a part of the New Structure a "Communication and Outreach Branch" will be organised. The EC has decided to locate the Branch in Budapest, and have nominated J.Adam as the president of the Branch. It will take over many of the present activities of the Central Bureau such as the maintenance of the home-page, and the preparation of the newsletter. It also has the tasks of promoting IAG and of recruiting individual members. The Central Bureau will still handle all financial issues, such as the collection of the membership fee.

Much assistance has been obtained from the Department of Geophysics, University of Copenhagen. Especially thanks are due to the Department Secretary, Mrs. C. S. Petersen, who also has functioned as the secretary of the Association.

Appendix *A*
Sponsored meetings and symposia.
2000.

International Workshop on Perspectives of Geodesy in South-East Europe Dubrovnic, Croatia, May 2–6.

South American Geoid 2000 workshop, Sao Paulo, May 17–19.

EUREF Symposium, Tromsoe, Norway, June 22–24.

Int. Symp. on Gravity, Geoid and Geodynamics 2000, Banff, Canada, 31 Jul–4 Aug

14th International Symposium on Earth Tides Mizusawa, Japan, 28 Aug–1. Sep

10th General Assembly of the Wegener Project San Fernando, Spain, 18–22 Sep.

Dynamic evolution of Active Faulting in the Mediterranean Region, Algiers, 9–11 Oct

2001.

3rd Int. Workshop on Mobile Mapping Technology, Cairo Egypt, Jan. 3–5.

Int. Winter Seminar on Geodynamics, Sopron, Hungary, Feb., 19–21.

Int. Symposium on Vertical Reference Systems. Cartagena, Columbia, Feb. 20–23.

1. Int. Symposium on Robust Statistics and Fuzzy Techniques in Geodesy and GIS, Zurich, Switzerland, March 12–16.

IAG/IAPSO Joint Working Group on Geodetic Effects of Nontidal Oceanic Processes, March 29.

6. Int. Seminar on GPS in Central Europe, Penc, Hungary, 2–4 May.

11th Symposium of the EUREF Subcommission, Dubrownik, May 16–19.

Int. Symposium On Kinematic Systems in Geodesy, Geomatics and Navigation, Banff, Canada June 5–8.

Int. Symposium on Recent Crustal Movements, Helsinki. Finland, Aug. 27–31, 2001.

IAG Scientific Assembly, Budapest, Hungary, Sept. 2–8.

Optical 3D measurement techniques, Vienna, Austria, Oct. 1–3.

IAG/IAPSO Symposium, “Gravity, geodesy and the ocean circulation as inferred from altimetry”, Mar de la Plata, Argentina, 21–28 Oct.

2002.

Int. Congress on Geodesy and Cartography, Caracas Venezuela, March 18–22, 2002.

Second Symposium on Geodesy for Geotechnical and Structural Engineering, Berlin, Germany, May 21–24,

2002 EUREF Symposium, Ponta Delgada, Azores Island, Portugal, June 5–8, 2002.

V Hotine-Marussi Symposium, Matera, Italy, June 10–14, 2002.

Eleventh General Assembly of the Wegner Project, Athens, Greece, June 12–14, 2002.

International Workshop on Satellite Altimetry for Geodesy, Geophysics and Oceanography, September 8–13, 2002, Wuhan, China.

3rd. Meeting of the International Gravity and Geoid Commission, Thessaloniki, Greece, Aug. 26–30, 2002.

Celebrating 50 Years of Geodetic Science at Ohio State University 1–5 October 2002, Ohio, USA

IAG International Symposium On Recent Crustal Deformations In South America And Surrounding Areas, and VII International Congress of Earth Sciences 2002 October 21–25 , 2002 Santiago, Chile

2003.

2003 EUREF Symposium ,Toledo, Spain, June 3–6, 2003

(3.2) **Other meetings**.

Conference on technical aspects of maritime boundary delineations and delimination including UNCLOS articles 76 (ABLOS), Sept. 9–10, 1999, Monaco.
GPS 99, 18–22 Oct. 1999 in Tsukuba, Japan.

Appendix B:

Financial report for 1999–2002

	Expenditures			**Receipts**	
11	**Administration:**	30.763,31	15	IUGG Allocation	103.931,70
11.2	Quarters	4.888,13	3	Other Grants	18.595,96
11.4	Communication	3906,00	5	Sale of Publications	80,76
11.5	Travel	24.924,33	6	Miscellaneous receipts:	22.440,64
11.6	Miscellaneous	5.094,96	6.1	Gains on exchange	184,91
11.7	Depreciation of Equipment	1.488,83	6.2	Interest	2.328,49
12.5	Purchase of Birmingham Proceedings	9.367,70	6.3	Others	11.890,59
12.6	Purchase of Rio proceedings	11.243,01	6.6	Rio fees and Rio Proceedings	7.552,50
13.1	Organization	28.500,00	6.7	Payments for EGG-97 CD	8.997,69
14	Symposia & Scientific meetings:	1.241,30	6.8	Sale of IGeS Lecture Notes and CD	988,98
14.1	Symposia & Scientific meetings: organi	36.165,58	6.11	Sale of Birmingham Proceedings	8.084,19
14.2	Symposia &Scientific meetings: travel	29.966,08	6.12	Receipt of IAG Fund	3.837,54
16	Grants (Permanent Services, etc.)	45.000,00	7	Total receipts	**188.913,95**
16.1	Bomford prize	2.108,67			
16.2	Best Paper Award	2.054,33			
18.2	Bank charges	1.870,28			
18.3	Loss on exchange	9.357,48			
18.4	Outlay Department of Geophysics	274,66			
18.5	Expenses IAG Fund	3.522,20			
18.6	PBS International (fee)	923,38			
19	Total Expenditures	**252.660,23**			
				Deficit	63.746,28
	Total	**252.660,23**		**Total**	**252.660,23**

	Balance 2002 in USD **Assets**			**Liabilities**	
20	Bank 31.12.2002	30.360,59		Net Capital	30.360,59
22	**Total**	30.360,59	10	**Total**	30.360,59

	Net Capital 2002 in USD				
				Open 1.1.1999	94.106,87
	Balance 31.12.2002	30.360,59		Deficit 31.12.2002	−63.746,28
		30.360,59			30.360,59

Appendix C

Budget for the period 2003–2006

	Expenditures			**Receipts**	
11	**Administration:**	100.000,00	15	IUGG Allocation	120.000,00
12	Publications	1.000,00	3	Other Grants	10.000,00
13	Organization	3.000,00	5	Sale of Publications	1.000,00
14	Symposia & Scientific meetings:	40.000,00	6	Miscellaneous receipts:	35.000,00
			6.11	Membership fees	30.000,00
16	Grants (Permanent Services, etc.)	31.000,00	6.12	Receipt of IAG Fund	7.000,00
18	Miscellaneous	12.000,00	7	Total receipts	**203.000,00**
19	Total Expenditures	**187.000,00**		Surplus	−16.000,00
	Total	187.000,00		Total	187.000,00

Balance 2006

	Assets		**Liabilities**	
20	Bank 31.12.2006	56.000,00	Net Capital	56.000,00
22	**Total**	**56.000,00**	**Total**	**56.000,00**

Net Capital 2006			
		Open 1.1.2003	30.000,00
Balance 31.12.2006	56.000,00	Surplus 31.13.2006	26.000,00
	56.000,00		**56.000,00**

Summary of the Council and Executive Committee Meetings during the IUGG XXIII General Assembly in Sapporo, July, 2003

by Ole B. Andersen, (IAG information editor)

During the IUGG XXIII General Assembly in Sapporo, Japan, June 30th–July 13th, the International Association of Geodesy had the following meetings.

– Executive committee: 1 July, 5 July, 7 July

– Council: 1 July, 7 July.

At the meeting of the EC (July, 1,5,7) the following were attending

Fernando Sansó (FS), C.C. Tscherning (CCT), Ole Andersen (OA), Gerhard Beutler (GB), Denisar Blitzkow (DB), Chris Rizos (CR), Pascal Willis (PW), Michael Sideris (MS), Clark Wilson (CW), Bernhard Heck (BH), Veronique Dehant (VD), Shuzo Takemoto (ST), Klaus-Peter Schwarz (KPS), Peter Teunissen (PT), Herman Drewes (HD)

At the meetings of the Council (July, 1,7), the following National representatives were present

Australia (Will Featherstone), Austria (Erhard Erker), Belgium (Bernard Ducarme), Brazil (Denisar Blitzkow), Canada (Marcelo Santos), China (Yamin Dang), Colombia (Laura Sanchez), Czech Republic (Petr Holota), Denmark (Niels Andersen), Finland (Markku Poutanen), France (Pascal Willis), Germany (Bernhard Heck), Greece (Dimitris Arabelos), Hungary (József Ádám), Indonesia (Hasanuddin Z. Abidin), Italy (Susanna Zerbini), Japan (Shuzo Takamoto), Malaysia (S. Bin Haji Aby), Netherlands (Ramon Hanssen), New Zealand (Groeme Blick), Norway (Björn Geirr Harsson), Poland (Jan Krynski), Portugal (João Agria Torres), Romania (Crisan Demetresen), Russia (Petr Medvedev), South Africa (Charles Merry), Sweden (Bo Jonsson), Switzerland (Alain Geiger), Thailand (Chaiwat Promthong), Turkey (Ali Kilicoglu), UK (Philippa Berry), USA (David Sandwell)

During these meetings, topics concerning the activities and administrative affairs of the International Association of Geodesy were treated. Decisions or conclusions were drawn as follows.

1. *Finances*.

The Financial Report of the IAG for the period 1st January 1999 to 31st of December 2002 was presented by the Secretary General C. C. Tscherning during the IAG opening session (a copy can be found in this issue).

In terms of IAG by-law 54 an ad-hoc Audit Committee must be appointed by the Council to "examine all expenditures and ensure that they were in accordance with the proposals previously approved". The Audit Committee appointed by the Council on 1th July 2003 consisted of:

Dr. Bjorn Geirr Harsson, Statens Kartverk, Norway
Dr. Jan Krynski, Institute of Geodesy and Cartography, Poland
Ass. Prof. William Featherstone, Curtin University of Technology, Australia

The Audit Committee performed the following functions

Examined a random selection of receipt and bank statements of both IAG accounts (one in US dollars and the other in Danish kroner) for the period January 1999 to December 2002. The final quadrennial report and interim annual reports had been checked by Hans Borge Nielsen, a firm of authorized public accountants.

Checked the balances appearing in the annual and quadrennial IAG reports

Examined expenditure to ensure conformity with the 1999–2003 budget as approved at the IUGG General Assembly in Birmingham in July 1999.

Made some enquiries that were clarified by C.C. Tshcerning (IAG Secretary General) and Christina Pedersen (Department of Geophysics at the University of Copenhagen)

The Audit Committee makes the following observations and comments on the IAG accounts

A2.1 The previous IAG fund is now incorporated into the IAG account in accordance with the recommendation made by the IAG Council in 1999.

A2.2 The accounts were generally well presented and all expenditure was supported by receipts and bank statements.

A2.3 A few slight discrepancies were found between the receipts and audited figures. The audit committee had the understanding that this was due to Hans Borge Nielsen requiring some expenditure to be accounted for in different line items. These discrepancies were of the order of a few hundred US dollars, so the Audit Committee considered these to be insignificant in relation to the cost of a new audit by Hans Borge Nielsen.

A2.4 During the review period, the IAG made an operating loss of approximately USD 28,000. This amount therefore had to be taken from the IAG reserve, leaving reserves of USD 30,000.

A2.5 The Audit Committee found that the IAG had over spent by approximately USD 70,000 in relation to the budget approved in Birmingham. However, this must be balanced against an increase of approximately USD 42,000 in additional income that was not predicted in Birmingham. This additional funding was mainly through unforeseen grants and the sale of publications, notably the International Geoid School notes and the EGG97 CD-ROM.

The Audit Committee makes the following recommendations

A3.1 The two separate accounts (one in Danish kroner and the other in USD) should be combined, which will reduce some of the bank fees and charges associated with transferring between accounts and currencies.

A3.2 The IAG should consider using a firm of public accountants that is not as expensive as the one currently used, so as to reduce the administrative costs associated with auditing the IAG accounts.

A3.3 The IAG should consider negotiating with the existing bank, or find another bank, where the fees and changes can be reduced or waived (e.g., some banks do not charge fees for association accounts)

A3.4 Given the reduction of the IAG reserve during the reporting period, it is now timely that a modest membership fee is introduced.

A3.5 The IAG should continue to seek external funding from grants and enterprises similar to the sale of the International Geoid School notes and the EGG97 CD-ROM.

A3.6 The IAG should seek to build its reserve so as to offset the operating loss made during the 1999–2003 quadrennium.

On behalf of the IAG Council, the Audit Committee has the following acknowledgements and thanks

A4.1 The Department of Geophysics at the University of Copenhagen for administrative and other support, notably the secretariat staff.

A4.2 The International Geoid Service (Polytechnic of Milano, Italy) and the University of Hannover for providing the International Geoid School notes and the EGG97 CD-ROM, respectively.

2. *Elections*

The elections were prepared in advance due to the new structure of IAG. *The report of the Nomination committee is included as appendix A*. The elections resulted in the following structure of the IAG.

The new Excecutive Committe is:

President: Gerhard Beutler
Vice-President: Michael Sideris
Secretary General: Carl Christian Tscherning
President of Commission 1: Herman Drewes
President of Commission 2: Christopher Jekeli
President of Commission 3: Veronique Dehant
President of Commission 4: Chris Rizos
Members at large: Luiz P. Fortes and Charles Merry
Service representatives: Ruth Neilan, Markus Rothacher and Harald Schuh
President of the Communication and Outreach Branch J.Adam

The following structure of IAG was established.
International Services:

The following services were either continued or established.

International VLBI service (IVS)
Chair: Wolfgang Schlüter (Germany)
Director CB: Nancy Vandenberg (USA)

International Laser Ranging Service (ILRS)
Chair: Werner Gurtner (Switzerland)
Director CB: Mike Pearlman (USA)
Secretary: Carey Noll (USA)

International Earth Rotation and Reference System Service (IERS)
Chair Jan Vondrák (Czech Rep.)
Director CB: Bernd Richter (Germany)

International Doris Service (IDS)
Chair: Gilles Tavernier (France)

International Gravimetric Bureau (BGI)
Director: J-P. Barriot (France)

International Geoid Service (IGeS)
President: F. Sanso (Italy)
Director: R.Barzaghi (Italy)

International Centre for Earth Tides (ICET)(Belgium)
Chair: Bernard Ducarme (Belgium)

Bureau Internation de Poids and Measure (BIPM, time section:
Chair: Felicitas Arias (France)

Internatinal GPS Service (IGS):
Chair John Dow (Germany)
Director CB: Ruth Neilan (USA)

Permanent Service for Mean Sea level (PSMSL)
Chair: Philip Woodworth (U.K.)

International Gravity Field Service (IGFS)
Chair: Rene Forsberg (Denmark)

International Bibliographic Service for Geodesy (IGBS)
Chair: Annekathrin Korth (Germany)

Commissions:

Commission 1 (Reference Frames)

President: Herman Drewes (Germany)
Vice-President: C.K. Shum (USA)

The commission completed its Substructure after the IUGG meeting

Commission 2 (Gravity Field)

President: Christopher Jekeli (USA)
Vice-President: Ilias Tziavos (Greece)

The commission completed its substructure after the IUGG meeting

Commission 3 (Earth Rotation and Geodynamics)

President: Veronique Dehant (Belgium)
Vice-President: Mike Bevis (USA)

The commission completed its substructure after the IUGG meeting

Commission 4 (Positioning & Applications)

President: Chris Rizos (Australia)
Vice-President: Pascal Willis (France)

The commission completed its substructure after the IUGG meeting

IAG project

IGGOS (Integrated Global Geodetic Observing System)
President: Chris Reigber (elected by the EC)

Inter-Commission Committees

ICC of Geodetic Theory.

President P. Xu. (Japan)

The Council approved the establishment of this ICC on Geodetic Theory.

ICC on Planetary Geodesy

The Council approved the establishment of this Inter-Commission committee on Planetary Geodesy in the 2003–2007 timeframe, provided the finalized proposal is approved by the EC.

ICC on Geodetic Standards

The Council approved the establishment of this Inter-Commission committee on Geodetic Standards in the 2003–2007 timeframe, provided the finalized proposal is approved by the EC.

Communication and Outreach Branch.

The EC elected The Budapest University of Technology, Hungary for hosting the Communication and Outreach Branch (COB) of the IAG. The EC nominated József Ádám as president for the COB. The Council elected unanimously J. Ádám as president of the COB.

Journal of Geodesy.

The EC nominated Will Featherstone (Australia) as new Editor in Chief of the Journal of Geodesy. Will Featherstone replaces Peter Teunissen (The Netherlands).

3. *Awards.*

The Bomford prize

The Bomford prize 2003 was awarded to Ramon Hanssen, Delft University of Technology, The Netherlands, for outstanding contribution to geodesy.
The Bomform prize and the certificate was presented to R. Hanssen by President F. Sanso during the opening ceremony of the General Assembly.

The Levallois Medal

The Levallois Medal was awarded to George Veis, National Technical University of Athens, Greece in recognition of distinguished service to the Association and to the science of geodesy in general.
George Veis was unable to attend the General Assembly and therefore the Levallois medal and the certificate were presented to Dimitris Arabelos on behalf of G. Veis by the honary president of IAG Klaus Peter Schwarz during the opening ceremony.

4. *Resolutions.*

The council nominated the following members of the Resolution Committee:
Prof. Dr. Gerhard Beutler (Chairman) (Switzerland)
Laura Sanchez (Colombia)
Dr. David Sandwell (USA)
Prof.-Dr. József Ádám (Hungary)

IUGG Resolutions

Eleven resolutions related to Geodesy and Geophysics were presented and accepted by the council of IUGG. The text of the resolutions can be found as a separate chapter of this issue of the Geodesists handbook.

IAG Resolution on thanks.

The IAG has experienced two weeks of extraordinary hospitality. We cordially thank our Japanese hosts for providing the basis for this great IAG general assembly.

5. *New IAG fellows*

The IAG executive committee appointed the following fellows of the International Association of Geodesy for an outstanding job for IAG. The new Fellows are:

Y.Yuanxi (EC)
S. Han (1.179)
H. van der Marel (1.180)
R. Weber (1.181)
M. Stewart (1.182)
R. Scharroo (2.162)
R. Hanssen (2.183)
R. Kursinski (2.192)
P. Visser (2.193)
P. Berry (3.184)
N. Sneeuw (3.185)
C. Hwang (3.186)
W. Keller (4.187)
G. Strykowski (4.188)
C. Hwang (3.186)
A. Marchenko (SC 5)
R. Lehmann (SC3)
S. Kenyon (Arctic Gravity Project)
R. Gross (WG)
J.-P. Barriot (BGI)
D. Gambis (BdL)
J. Vondrak (IERS)
N. Vandenberg (IVS)
W. Schlueter (IVS)
E.F. Arias (TS)
B.G. Harsson (ABLOS)
C. Tiberius (JoG)
C. Brunini (JoG)
T. Schoene (2.194)
W. Gurtner (ILRS)
G. Gendt (IGS)
Carine Bruyninx (IGS/EUREF)
Susan Skone (1.180)
Leonid Vitushkin (Intercomparison of Absolute Gravimeters)
H. Kutterer (4.190)

6. *IAG scientific Assembly 2005*

The IAG scientific Assembly will be held in Cairns, Australia in early August, 2005.

7. *IUGG General Assembly 2007*

The IUGG General Assembly will be held in Perugia, Italy in 2007

Resolutions Adopted at the IUGG XXIIIrd General Assembly

Sapporo, Japan, July, 2003

Resolution *1*

Geophysical seafloor observations (IAG, IAPSO, IAGA, IASPEI)

IUGG,

Considering that:

- Measurements of the Earth's time varying gravitational field will soon be available, in particular over the oceans, from the CHAMP and GRACE satellite missions; and
- The gravitational field over the oceans and the pressure at the bottom of the oceans are both sensitive to changes in the distribution of mass within the oceans; and
- The magnetic field over ocean areas, which is to-day monitored by several satellites, undergoes variations related to activity in the core, induction, and global ocean circulation; and
- Significant improvement of seismological observations can be achieved by enhanced coverage in the ocean basins.

Recognizing that:

- The value of assimilating data into ocean models; and
- The importance of validating and calibrating satellite data and ocean models using *in situ* measurements; and
- The benefits of enhanced global coverage of information on seismic sources and earth structure.

Recommends that:

- Regional and global networks of multidisciplinary geophysical seafloor observatories be deployed in all ocean areas; and
- Efforts in this regard be coordinated through the International Ocean Network Committee.

Resolution *2*

Ocean Modelling:

IUGG,

Noting:

- The value of ocean models for current, future and retrospective studies of the influence of the oceans on the Earth's rotation, deformation, gravitational field, and geocenter; and
- The importance of having available models that conserve mass and are forced by atmosphere surface pressure.

Recognizing:

- The major investment in resources required to develop, maintain, and operate the ocean models that are used in such studies; and
- The value of assimilating data into ocean models.

Recommends that:

- Support for such modelling activities be continued, including support for the development of forecast ocean models that conserve mass and are forced by surface pressure; and

Encourages:

- The continued collaboration between geodetic and ocean modelling groups.

Resolution *3*

Integrated Global Geodetic Observing System (IGGOS)

IUGG,

Recognizing:

- The great progress made in the use of space and terrestrial techniques for monitoring the phenomena and processes in the System Earth during the last decades; and
- The efforts made towards the integration of space techniques in the management of observations, data processing, evaluation, and modelling of the observable parameters, in particular by the different international services; and
- The urgent need to further develop and strengthen the scientific and organizational collaboration of geodesy within the geosciences; and
- The necessity of generation and accessibility of consistent products for users in Earth sciences, neighbouring disciplines and society in general.

Considering:

- That the International Association of Geodesy (IAG) has taken an initiative towards the realization of IUGG Resolution no.1 adopted at the 22nd General Assembly in Birmingham 1999 by installing the integrated Global Geodetic Observing System (IGGOS).

Strongly supports:

- The establishment of the IGGOS Project within the new IAG structure as geodesy's contribution to the wider field of geosciences and as the metrological basis for the Earth observation programs within IUGG and the international organizations mentioned in the 1999 Resolution no.1.

Urges That:

- Associations cooperate with the new project by providing data, models, products, and know-how useful for IGGOS and the benefit of geosciences; and
- The participating in the IGGOS project by joining the relevant components in its structure and assisting its symposia and meetings.

Resolution *4*

Adoption of the resolutions B1.1 through B1.9 of IAU

24th General Assembly, 2000

IUGG,

Noting that:

- The International Astronomical Union (IAU) adopted the resolutions appended below at its 24th General Assembly in Manchester, England, August 2000, concerning definition of the celestial reference system, time scales, and Earth's precession and nutation; and
- The celestial reference system and the nutation-precession model have a practical influence on geodetic observational processing and their geodynamic interpretation.

Recognising that:

- The International Earth Rotation Service (IERS), a service jointly affiliated with the IAU and IAG has adopted these IAU resolutions in its calculations and publications, but continues in parallel with the calculations in the previous system; and
- Adoption of these IAU resolutions by the IERS has been undertaken in a way that makes a smooth transition in geodetic time series, almanac publications, and other services relevant to practical navigation, geodesy, and geodynamics; and
- The full operational implementation of these IAU resolutions may require more time than originally proposed in the resolutions.

Endorses:

- Resolutions B1.1, B1.2, B1.3, B1.4, B1.5, B1.6, B1.7, B1.8, B1.9 of the 24th General Assembly of the IAU; and

Recommends that:

- The IERS continues to provide users with data and algorithms for the conventional transformations, as well as those recommended by the IAU 24th General Assembly, to ensure continuous operation of astronomical and geodetic systems.

Resolution *5*

The impact of Biomass-burning aerosols on precipitation (IAMAS, IAHS, IAPSO)

IUGG,

Considering:

- Biomass burning from agricultural practices, household consumption and wildfires produces substantial quantities of aerosol particles that can increase small cloud droplet number concentration.

Realizing that:

- Higher concentrations of small cloud droplets affect their coalescence and the formation of precipitation and thus the water supply.

Welcoming:

- The recognition of the potential effect of all aerosol sources on precipitation by Congress XIV of the World Meteorological Organization, WMO, in May 2003 and its projected actions focused on biomass burning plumes.

Urges:

- The scientific community to undertake systematic studies of the impact of biomass burning aerosol on precipitation formation on all scales. Feedback effects on climate as well as the competing effects of industrial fine particle aerosols and natural coarse particle aerosols such as sea salt and soil dust should be included.

Recommends that:

- A body be established to undertake an international program of study and assessment of the rain related effects of biomass burning in collaboration with WMO and other international organizations; and
- This body creates a mechanism to assemble the scientific evidence needed to lay the groundwork for a UN sponsored conference on pollution effects on precipitation and hence water supply; and
- This body reports in the IUGG Newsletters and the GA in 2007 on the steps taken and the progress made.

Resolution *6*

Data access under the Comprehensive Nuclear Test Ban Treaty

IUGG,

Recognising that:

- Free, open, international exchange of data has been the basis of advances in seismology and related sciences; and
- The International Monitoring System for the Comprehensive Nuclear Test Ban Treaty (CTBT) provides a significant global network of seismic, infrasound and hydroacoustic sensors; and
- Article IV Section A.10 of the Comprehensive Nuclear Test Ban Treaty states that "The provision of this Treaty shall not be interpreted as restricting the international exchange for scientific purposes"; and
- The Federation of Digital Seismographic Networks (FDSN) is prepared to accept and disseminate waveform and parametric data to the scientific community.

Resolves that:

- The Preparatory Commission for the CTBT organization be requested to set in place mechanisms for open scientific access to waveform and parametric data from the International Data Centre with minimal delay. In the case of recognized emergencies due to natural catastrophic events, data should be available in near real time.

Resolution *7*

Monitoring the Earth with Synthetic Aperture Radar

IUGG,

Recognizing that:

- We are approaching the 50th anniversary of the International Geophysical Year which was the dawn of international co-operation in exploration of the Earth from space; and
- The new technology of Synthetic Aperture Radar Interferometry (InSAR) offers a unique view of surface displacements due to earthquakes, volcanoes, ground water withdrawal, ice streams and flood water levels that are indicators of natural and anthropogenic changes of interest to society and science; and
- Our host country of Japan has shared its InSAR data with all scientists and thus is a role model for other countries.

Noting:

- With concern that this technology has important military uses and commercial applications and is thus prone to restrictions.

Recommends:

- The open access to all InSAR data; and
- That space agencies allow unrestricted data sharing among scientists; and
- The integration of InSAR observations with other geodetic systems; and
- The co-ordination of InSAR space and ground systems of member countries for optimal scientific utilization of these assets for the benefit of society.

Resolution *8*

MST/IS Radar in Antarctica

IUGG,

Considering that:

- Planetary waves, atmospheric tides and gravity waves play a key role in the dynamics of the polar middle atmosphere, including the formation and termination of ozone holes and coupling between the lower and upper atmospheres; and
- Our limited knowledge of the physics of clouds that occur only in the polar stratosphere and mesosphere and which are important for monitoring natural and anthropogenic effects on climate; and
- Mesosphere-Stratosphere-Troposphere / Incoherent Scatter (MST/IS) radars are the only observational tools capable of quantitative studies of the dynamics of the atmosphere from the troposphere to the ionosphere; and
- The orographic forcing of waves is different between the hemispheres and that the different separation between the geographic and geomagnetic poles means that the impact of the dynamics of the middle and upper atmospheres will be different between hemispheres; and
- Substantial solar wind energy enters through the magnetosphere into the polar ionosphere and excites aurora, strong currents, winds and waves through plasma-neutral coupling; and
- Combined incoherent scatter / MST radar observations at conjugate points in the polar regions provide an unparalleled tool to study these complex processes.

Noting that:

- There are no MST/IS radar systems in the entire Antarctic region, which leaves a major gap in the global radar network.

Recommends that:

- MST/IS radars be established at the earliest opportunity in the Antarctic region in order to fill this gap and provide invaluable information to the scientific community.

Resolution *9*

Release of Airborne & Marine Magnetic Data

IUGG,

Considering:

- The importance of magnetic anomaly mapping for global geological and tectonic interpretation.

Noting:

- The existence of numerous sets of low-level airborne and marine magnetic anomaly data, and the rapid progress made in storing and compiling such data; and
- That many data sets remain classified or confidential, even after most have outlived their original purpose; and
- That the situation has not significantly improved following IAGA resolution 3 of 1997.

Recommends that:

- The custodians of such data sets develop suitable mechanisms to release them into the public domain as soon as possible.

Resolution *10*

Inter-operability and Protection of Global Navigation Satellite System signals

IUGG,

Noting:

- The extensive use of the Global Positioning System (GPS) over the past decade and incredible potential of combining multiple Global Navigations Satellite Systems (GNSS), anticipated by the addition of European GNSS Galileo; and
- The broad user base of the GPS/GNSS system within IUGG and sister organizations as a tool for science, multidisciplinary applications and societal benefits.

Recognizes:

- The need to foster and protect GNSS system.

Recommends that:

- GNSS providers are strongly encouraged to cooperate and coordinate closely to
- Ensure inter-operability and compatibility in developing, deploying and operating the systems now and in the future.
- Maximize common frequencies and signals.

- Scientists in IUGG and sister organizations are encouraged to engage in continual activities to protect the signal and spectrum of collective GNSS, to secure long-term availability of these satellite signals.

Resolution *11*

Courtesy Resolution

The International Union of Geodesy and Geophysics Gratefully records its appreciation for the organization, arrangements made, and generous financial support for the XXIII General Assembly. IUGG particularly acknowledges the gracious presence of their majesties the Emperor and the Empress of Japan for their warm welcome and message they extended to all participants and for their informal interaction with delegates from around the world. On behalf of all participants, the Council expresses its warm thanks to the Japanese National Committee for IUGG, to the Science Council of Japan and 16 Japanese geophysical societies, to the Japan Marine Science and Technology Center, to the Local Organizing Committee, to the Program Committee, and to all others involved in making the XXIII General Assembly a success and an enjoyable meeting in Sapporo.

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IAG Statutes

As adopted by the IAG Council, Sept. 8, 2001

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1 The International Association of Geodesy

The International Association of Geodesy, hereafter called the Association or the IAG, is a constituent Association of the International Union of Geodesy and Geophysics, hereafter called the Union or IUGG, and is subject to the Statutes and Bylaws of the Union as well as to these Statutes.

2 Mission Statement

The Mission of the Association is the advancement of geodesy, an earth science that includes the study of the planets and their satellites. The IAG implements its mission by advancing geodetic theory through research and teaching, by collecting, analyzing, and modeling observational data, by stimulating technological development and by providing a consistent representation of the figure, rotation, and gravity field of the earth and planets and their temporal variations.

3 Objectives

The IAG shall pursue the following objectives to achieve its mission:

1. Study, at the highest possible level of accuracy, all geodetic problems related to the following:
   i. Definition, establishment, and maintenance of global and regional reference systems for interdisciplinary use.
   ii. Rotation of the Earth and Planets.
   iii. Positioning and deformation studies.
   iv. Gravity field determination.
   v. Ocean and sea level.
   vi. Time transfer.
   vii. Signal propagation through the planets' atmospheres.
2. Support the maintenance of geodetic reference systems for continuous, long-term observations and archival of results.
3. Provide observational and processed data, standards, methodologies, and models in a form that ensures the broadest possible range of research and application.
4. Stimulate development and take advantage of emerging space and other technologies to increase the resolution and accuracy of geodetic data and products in order to advance geodetic and interdisciplinary research.
5. Initiate, coordinate, and promote international cooperation and knowledge exchange through symposia, workshops, summer schools, training courses, publications, and other means of communication.
6. Foster the development of geodetic activities and infrastructure in all regions of the world, taking into consideration the specific situation of developing countries.
7. Collaborate with the international science and engineering community in supporting the application of geodetic theory and techniques and the interpretation of results.
8. Cooperate with national and international agencies in establishing research goals, missions, and projects.

4 Structure

The Association's structure shall comprise of a small number of components: Commissions, Services, IAG Projects and a Communication and Outreach Branch. Sub-components, such as Sub-commissions, Commission Projects, Inter-commission Committees, and Study Groups may be formed as provided for in the Bylaws.

5 Administration

The administration of the IAG comprises of the General Assembly, the Council, the Bureau and the Executive Committee.

5.1 Membership

of the IAG shall comprise of countries and individuals.

Any member country of the IUGG shall be regarded as a **National Member** of the IAG and may, through its adhering body, appoint a **National Delegate** to the Association. National Delegates represent their countries in IAG Council meetings and act as correspondents for their countries between General Assemblies.

Individual scientists may become **Members, Candidate members, or Fellows** as provided for in the Bylaws.

5.2 General Assembly

The IAG General Assembly, shall consist of the fellows, members and candidate members.

5.3 Council

Responsibility for the direction of the Association affairs shall be vested in the Council. Decisions of the Council shall be reported to the General Assembly. In the case that the majority of those present at a General Assembly meeting disagree with the decisions of the Council, the Council shall reconsider the question, and make a decision, which shall be final.

5.3a Constitution

The Council consists of the National Delegates, formally accredited by the adhering body of the member countries, on the basis of one delegate per country. The delegates must have participated in IAG activities. The President of the Association shall preside over the Council meetings, without vote, except in the case of a tie as provided in Article 5.3b f) hereafter.

5.3b Voting in the Council

Voting in the council shall follow the following rules:

a. Each National Delegate may represent only one member country. A member country which is not represented at a Council meeting may vote by correspondence on any specific question, provided that the matter has been clearly defined on the final agenda distributed in advance, and that the discussion thereon has not produced any significant new considerations or change in its substance, and that the said vote has been received by the President prior to the voting.
b. In order that the deliberations of the Council shall be valid, the number of National Delegates present must be at least half of the member countries represented at the General Assembly of the IUGG. If the meeting is not held at the same time as an IUGG General Assembly, the number present at the most resent IUGG Assembly is used.
c. On questions not involving matters of finance, the voting in Council shall be by member countries, each having one vote, provided that its IUGG subscriptions shall have been paid up to the end of the calendar year preceding the voting.
d. On questions involving finance, the voting in Council shall be by member countries, with the same provision that a voting country shall have paid its IUGG subscriptions up to the end of the calendar year preceding the voting in Council. The number of votes allotted to each member country shall then be equal to the number of its category of membership as defined by the IUGG.
e. Before a vote in a Council meeting, the President shall decide whether or not the matter under consideration is financial in character and whether the procedure of voting by correspondence applies.
f. Decisions of the Council shall be taken by a simple majority, except as otherwise specified in these Statutes. If a tie should occur in a Council vote, the President shall cast the decisive vote. Simple and two-thirds majorities are determined by the proportion of affirmative votes to the sum of all votes (affirmative, negative and abstention). Blank and invalid ballots and votes not cast by delegates present are counted as abstentions.
g. Except as otherwise provided in the Statutes or Bylaws, meetings of the Council as well as those of other IAG administrative bodies shall be conducted according to Robert's Rules of Order.

5.4 The Bureau and the Executive committee

Between meetings of the Council, the direction of the affairs of the Association shall be vested in the Bureau and the Executive Committee, the respective composition and responsibilities of which are defined hereafter.

5.4a The Bureau

The Bureau of the Association shall consist of the President, the Vice-President, and the Secretary General, all of whom shall be elected by the Council. The duties of the Bureau shall be to administer the affairs of the Association in accordance with these Statutes and Bylaws and with the decisions of the Council and the Executive Committee. No member of the Bureau of the Association shall serve as a delegate of a country.

5.4b The Executive Committee

The executive committee shall consist of the Bureau, the immediate Past President, the Presidents of the Commissions, three representatives of the Services, the President of the Communication and Outreach Branch, and two Members-at-Large to improve geographical and organizational balance.

Presidents of the Inter-commission Committees, Chairs of the IAG Projects and the Assistant Secretaries shall attend any meeting of the Executive Committee, with voice but without vote.

The Past Presidents and past Secretary Generals may attend any meeting of the executive committee, with voice but without vote.

The duties of the Executive Committee shall be to further the objectives of the Association through effective coordination and through the formulation of general policies.

The members of the Executive Committee shall attend meetings of the Council, with voice but without vote.

6 Changing the Statutes and Bylaws

Changes in the statutes and bylaws shall be made as follows:

a. The Association shall review the Statutes and Bylaws to ensure an up-to-date structure of its scientific organization every eight years. To achieve this goal a Review Committee will be appointed by the Executive Committee at its first meeting after the General Assembly in periods where a review must be performed. Proposals for a change of any article of these Statutes must reach the Secretary General at least six months before the announced date of the Council meeting at which it is to be considered. The Secretary General shall notify all member countries of any proposed change at least four months before the announced date of the Council meeting.
b. The Statutes may not be modified except by the approval of a two-thirds majority of votes cast at a Council meeting, and shall come into force at the close of the meeting.
c. The Council shall have the power to adopt Bylaws within the framework of the Statutes.
d. The Bylaws may be modified by a simple majority of votes cast at a Council meeting, and shall come into force at the close of the meeting.

7 Dissolution of the Association

In the event of the dissolution of the association, its assets shall be ceded to the IUGG.

IAG Bylaws

As adopted by the IAG Council, Sept. 8, 2001

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1 Structure

The scientific work of the Association is performed within a component-structure consisting of Commissions, Services, the Communication and Outreach Branch, and IAG Projects, hereafter called the Association-components or **components**. The Council decides the respective responsibilities of these components on recommendation of the Executive Committee. Because of the complex interrelations among various activities of the Association, interaction between the individual components is implied.

The list of all components and sub-components shall be published in the Geodesist's Handbook after each General Assembly.

The Association may also participate in joint bodies of the IUGG and other scientific organizations, especially those belonging to the International Council for Science (ICSU). These bodies shall be administered according to their specific rules. Their relationship with the Association will be placed under the responsibility of either the IAG Executive Committee or a specific Association component, and handled by the IAG representatives.

1.1 Responsibilities

The components are led by Component Steering Committees under the leadership of presidents/chairs. Their responsibilities shall be as follows:

The **Component Presidents** are responsible for the scientific development within the interest of the component. They shall coordinate the work of the bodies assigned to the component (**sub-components**), and keep the officers of the component as well as the Bureau informed of the component's activities, on an annual basis. Sub-components are treated later in the Bylaws.

The reports of the sub-components (if any) should reach the President of the relevant component two months before each General Assembly, if not otherwise stated. These reports and the reports of the components are published in the "Travaux de l'Association Internationale de Géodésie".

The **President** shall receive suggestions for new sub-components, and suggestions for continuation of existing ones, shall coordinate them and transmit recommendations to the IAG Executive Committee.

The **Component Steering Committee** shall meet at least once per year and at least once during each General Assembly. At the General Assembly, at the IAG Scientific meeting or on some other appropriate occasion, the Committee shall review the activities of the bodies assigned to the component over the past period, and for those which will be recommended for continuation, review their programs for the forthcoming period. The constitution of the Component Steering Committees is described later in the Bylaws.

The Central Bureau should receive copies of all relevant correspondence of components and sub-components of the Association.

Components as well as the sub-components are free to hold scientific meetings. Scientific symposia are subject to the approval procedure of the IAG Executive Committee. A scientific symposium has to be sponsored by one or more component or sub-component.

1.2 Commissions

Commissions shall promote the advancement of science, technology and international cooperation in their field. They establish the necessary links with sister disciplines and with the relevant Services. Commissions shall represent the Association in all scientific domains related to their field of geodesy.

The Commissions are one of the main components of the IAG structure. In addition to their main tasks they are also responsible for their sub-components: the Sub-commissions, Commission-Projects, Study-Groups, and Joint Sub-components.

1.2a List of Commissions

There are at present four commissions which are listed below with their main topics/tasks indicated:

Commission 1: Reference Frames

a. Establishment, maintenance, improvement of the geodetic reference frames.
b. Advanced terrestrial and space observation technique development for the above purposes.
c. International collaboration for the definition and deployment of networks of terrestrially-based space geodetic observatories.
d. Theory and coordination of astrometric observation for reference frame purposes.
e. Collaboration with space geodesy/reference frame related international services, agencies and organizations.

Commission 2: Gravity Field

a. Terrestrial, marine, and airborne gravimetry.
b. Satellite gravity field observations.
c. Gravity field modeling.
d. Time-variable gravity field.
e. Geoid determination.
f. Satellite orbit modeling and determination.

Commission 3: Earth Rotation and Geodynamics

a. Earth Orientation (Earth rotation, polar motion, nutation and precession).
b. Earth tides.
c. Tectonics and Crustal Deformation.
d. Sea surface topography and sea level changes.
e. Planetary and lunar dynamics.
f. Effects of the Earth's fluid layers (e.g., post glacial rebound, loading).

Commission 4: Positioning and Applications.

a. Terrestrial and satellite-based positioning systems development, including sensor and information fusion.
b. Navigation and guidance of platforms.
c. Interferometric laser and radar applications (e.g., Synthetic Aperture Radar).
d. Applications of geodetic positioning using three dimensional geodetic networks (passive and active networks), including monitoring of deformations.
e. Applications of geodesy to engineering.
f. Atmospheric investigations using space geodetic techniques.

Each Commission shall have a Steering Committee, with a maximum of twelve voting members, which shall define the appropriate sub-structure of the Commission, which may consists of the following components:

a. Sub-commissions.
b. Study Groups.
c. Commission Projects.

Sub-commissions and Commission Projects are long-term components, Study Groups are of a short-term nature (maximum of four years). The IAG Executive Committee shall approve the structure and changes to the structure of the Commission.

The **Commission Steering Committee** shall be set up at each General Assembly, following the election of the Association officers. It shall be composed of the following membership:

a. President elected by the Council.
b. Vice-president appointed by the IAG Executive Committee.
c. Chairs of the long-term components.
d. Up to three representatives of the Services relevant to the work of the Commission.
e. Up to two Members-at-Large to balance geographical and member country representation.

Commission Presidents and Vice-presidents shall serve in general for one four-year period. Re-elections are possible in exceptional cases. The representatives of the services are appointed by the services.

The Commission President and Vice-president appoint the **Members-at-Large** and the chairs of the long-term components within two months following the General Assembly. The IAG Executive Committee shall approve the appointments. Members-at-Large are appointed for a four-year period without reappointment.

The Commission Steering Committee is responsible for maintaining IAG activities in its domain, between and at the General Assemblies. This includes the following:

a. Review the Commission's field of interests and objectives.
b. Liaison with the other IAG commissions, the Inter-commission Committees, and with similar organizations outside the IAG, as appropriate.
c. Foster active participation of young geodesists and geodesists from under-represented countries.
d. Coordinate and review the work of its components and report at the time of the Scientific Assembly to the Executive Committee on the progress and performance of the components.
e. Organize Commission and interdisciplinary symposia and/or sessions at major geodesy related international meetings.
f. Maintain a commission web page and e-mail service.
g. Nominate up to three editors for the Journal of Geodesy.

The Commission Steering Committee shall meet at least once per year.

1.2b Sub-Commissions

Sub-commissions deal with long-term issues/topics in the field of the Commission. They are established for long time periods (typically several four-year cycles). The Commission Steering Committee before each General Assembly shall regularly review their work and the need for their continuation.

A Sub-commission shall be set up for topics where the Commission claims to play a leading or coordinating role. Each Commission shall contain a reasonably small number of Sub-commissions.

Guidelines for the establishment of Sub-commissions are established by the Executive Committee and published in the Geodesist's Handbook.

1.2c Commission Projects

Commission projects may be established when a new scientific method or a new technique is being developed, or when it seems appropriate to apply an existing technique to a specific geographic area where international collaboration is required.

Commissions shall establish only a reasonably small number of Commission Projects. They should be viewed as flagships for the Commission.

The Commission Project is initially established for four years, and it may be extended for another four-year period, subject to a successful review.

Commission Projects are established and terminated by the IAG Executive Committee upon recommendation from the Commission.

Guidelines for the establishment of Commission Projects are established by the Executive Committee and published in the Geodesist's Handbook.

1.2d Study Groups

Study groups address clearly defined well-focused scientific topics of limited scope within the field of the Commission over a limited time period of maximum four years.

Study Groups may be set up at any time by the Commission Steering Committee upon recommendation of one or more members or by individual scientists at one of the committee's regular meetings. Approval by the IAG Executive Committee is required for the establishment or termination of a Study Group. Guidelines for the establishment of Study-Groups are established by the Executive Committee and published in the Geodesist's Handbook.

The **Chair of a Study Group** is responsible for initiating and directing its work and appointing its members. Study Group membership should be balanced so as to reflect international cooperation in its subject and shall be limited to a number not exceeding 20. Corresponding members maybe selected.

The Chair of each Study Group shall issue a brief description of the work to be performed and a list of members, to be published in the Geodesist's Handbook after each General Assembly.

To assist communication and cooperation within each Study Group, its members and the commission steering committee should be kept informed, on an annual basis, of results achieved and of outstanding problems.

1.2e Joint sub-commissions

Commissions are encouraged to establish interdisciplinary joint sub-commissions, study groups and projects. in topics involving more than one Commission. They are also encouraged to set up joint Commission Projects and/or Study Groups with the appropriate services. A lead-Commission shall be specified for such undertakings. Coordination amongst Commissions is the responsibility of the IAG Executive Committee.

1.3 Services

Services are part of the Association's work and generate products, using their own observations and/or observations of other services, relevant for geodesy and for other sciences and applications. Accuracy and robustness of products, quality control, timeliness, and state of the art quality are the essential aspects of the Services.

Such a Service shall set up its Terms of Reference as appropriate to accomplish its mission. Each Service works autonomously. However, at least one official IAG representative shall be a voting member of the Service's directing/governing board, and the IAG Executive Committee shall approve its Terms of Reference.

Services shall collaborate on a scientific basis with the Commissions, establish joint Service / Commission Projects, and help compile the Commissions' list of themes for Study Groups.

Services are linked to at least one of the Commissions and may be also linked to other scientific organizations, such as the International Astronomical Union (IAU) or the Federation of Astronomical and Geophysical data analysis Services (FAGS).

Services represent the Association in all domains related to the services' products.

At the present time the Association related Services are the following:

a. International GPS Service
b. International VLBI Service
c. International Laser Ranging Service
d. International Gravimetric Bureau
e. International Geoid Service
f. International Center for Earth Tides
g. International Earth Rotation Service
h. Permanent Service for Mean Sea Level
i. Time Section of the International Bureau of Weights and Measures

The Services shall have a total of three representatives in the IAG Executive Committee. They represent the interests of all services. Their election procedure is defined in Art.2.8 c).

1.4 IAG Projects

IAG Projects are of a broad scope and of highest interest and importance for the entire field of geodesy. These Projects serve as the flagships of the Association for a long time period (decade or longer).

The IAG Executive Committee shall appoint planning groups for the creation of each IAG Project. Each IAG Project shall have a Project Steering Committee consisting of the following membership:

a. The project chair appointed by the IAG Executive Committee
b. One member from each Commission appointed by the Commissions' Steering Committees
c. Two Members-at-Large proposed by the members of the Project Steering Committee and approved by the IAG Executive Committee
d. Chairs of the IAG Project sub-groups (if any)

Guidelines for the establishment of IAG Projects are established by the Executive Committee and published in the Geodesist's Handbook.

1.5 Communication and Outreach Branch

The Communication and Outreach Branch provides the Association with communication, educational/public information and outreach links to the membership, to other scientific Associations and to the world as a whole.

1.5a Responsibilities

The responsibilities of the Communication and Outreach Branch shall include the following tasks:

a. Promote the recognition and usefulness of geodesy in general and IAG in particular.
b. Publications (newsletters).
c. Membership development.
d. General information service and outreach.

The Communication and Outreach Branch may also assist the IAG Central Bureau, see 2.7, in the following tasks:

a. Maintenance of the IAG Web page.
b. Setting up Association schools.
c. Setting up meetings and conferences.
d. Maintaining the Bibliographic Service.

The Communication and Outreach Branch has a steering committee, the president of which is elected by the Council.

The IAG Executive Committee establishes the Branch on a long-term basis. Based on a Call for Participation, the responding organization(s) and the IAG Executive Committee shall negotiate the Terms of Reference and other conditions.

The General Secretary and the Editor-in-Chief of the Journal of Geodesy shall be ex-officio members of the Branch Steering Committee.

1.5b IAG Publications

The IAG publications include the Journal of Geodesy, the IAG Newsletter, the Geodesist's Handbook, the "Travaux de l'Association Internationale de Géodésie,", IAG Special Publications, and the IAG Symposia series.

The Association's journal is the **Journal of Geodesy**, hereinafter referred to as the journal. The journal is published monthly through an agreement between the Association and a publishing company, or by other arrangement approved by the Executive Committee. The terms of any agreement for publication of the journal shall be negotiated by the President and ratified by the Executive Committee.

The journal publishes peer-reviewed papers, covering the whole range of geodesy, including applications.

There shall be one **Editor-in-Chief** for the journal, hereinafter referred to as the Editor. An Assistant Editor-in-Chief may assist the Editor. The Editor shall be advised and assisted by a Board of Editors, hereinafter referred to as the Board. To ensure broad expertise, each of the Commissions may nominate up to three members of the journal's editorial board.

The Editor shall be responsible for the scientific content of the journal. The Editor shall make the final decision on whether a refereed scientific manuscript is accepted for publication. The Editor shall keep the Executive Committee informed of the activities and status of operations of the journal.

At the time of each General Assembly (GA), the Editor shall, in consultation and agreement with the Bureau and after consideration of suggestions from the geodetic community, recommend candidates for membership on the new Board of Editors, which is to hold office for the next period. This list of candidates shall be published on the IAG web site at least two months in advance of the General Assembly. During the assembly, the current Board shall nominate the members of the new Board from those recommended. After taking office, the new Board shall nominate one, or more, Editors(s) for the next period. The Executive Committee shall approve the nomination of the Editor(s) and concurrence with the publisher will be sought. The Editor and the members of the Board, shall each hold office for one period, but may be eligible to be re-elected for one further period.

The **IAG Newsletter** is under the editorial responsibility of the Communication and Outreach Branch. It is to be published and distributed both in paper form and electronically.

After each General Assembly, a special issue of the Journal of Geodesy shall be published under the name of "**The Geodesist's Handbook**". This issue provides the actual information on the Association, including the reports of the President and Secretary General presented at the previous General Assembly, the resolutions taken at that assembly, and the Association structure for the running period, as well as relevant scientific information.

After each General Assembly, a collection of the reports by the Association components shall be published in the "**Travaux de l'Association Internationale de Géodésie**". This publication is supplied free of charge to the officers of the Association and to the adhering body of each member country.

Proceedings of IAG symposia may be published in the **IAG Symposia Series**. The series editor is the President of the Association, with the symposia convenors acting as volume editors. All manuscripts are subject to a refereeing process, and the volume editor shall make the final decision on whether a manuscript is accepted for publication.

At every General Assembly each member country is encouraged to supply either an adequate number of copies of its **National Report** on geodetic work done since the previous General Assembly in hard copy or a digital copy of its national report to be placed on the IAG web site. These National Reports, as far as available, are distributed by the Central Bureau of the Association in the same manner as the "Travaux de l'Association Internationale de Géodésie".

1.6 Inter-Commission Committees

Inter-Commission Committees shall handle well-defined, important and permanent tasks involving all commissions. Each Inter-commission Committee shall have a steering committee consisting of the following membership:

a. President appointed by the IAG Executive Committee.
b. Vice-president appointed by the IAG Executive Committee.
c. One representative from each Commission

The terms of reference for each Inter-commission Committee shall be developed by a planning group appointed by the IAG Executive Committee. The Inter-commission Committees report to the IAG Executive Committee. The Inter-Commission Committee will be reviewed every eight years.

2 Administration

The Administration of the IAG is handled by the Membership, the General Assembly, the Council, the Executive Committee, the Bureau, and the Assistant and Assembly Secretaries.

2.1 Membership

Membership of the Association consists of Countries, Candidate Members, Individual Members and Fellows.

The IAG Executive Committee, upon the recommendation of the Secretary General accepts individuals as **Members**. Applications for individual membership are made to the Bureau. Benefits of individual membership include:

a. Substantial reduction on the individual subscription rate to the Journal of Geodesy.
b. The right to participate in the IAG election process both as a nominator and a nominee (provided IUGG laws are observed).
c. Application to become a member of the IAG Commission of choice.
d. Reduction of the registration fee for IAG meetings (as defined by the by-laws 3.2, 3.3)

The Executive Committee sets the suggested membership fee per annum. Donations in addition to this amount will be used for the IAG Fund in support of young scientists. Discounts and in some instances full remission can be obtained by application. Membership is terminated if the membership fee is not paid or if an application for discount or full remission has not been received one year after the fee was due.

Past officers of the Association shall be eligible for appointment as **Fellows** and shall be invited to become such. The IAG Executive Committee makes these appointments.

Persons elected as officers of the Association, or nominated as members of its components, shall automatically become **Candidate Members** at the next General Assembly.

Persons from member countries who apply, indicating previous participation in Association activities, or providing a recommendation from their national adhering body or a recommendation from an officer or a Fellow of the Association, shall be eligible to become Candidate Members upon recommendation by the Bureau.

2.2 General Assemblies

The Association shall hold its own general assemblies in conjunction with the ordinary General Assemblies of the IUGG, at the same time and in the same country. In addition the Association may hold Scientific Assemblies, independently of IUGG, generally mid-way between the ordinary General Assemblies.

Before any General Assembly, the Bureau of the Association prepares detailed agendas for the Council. Executive Committee, the opening and the closing sessions. As far as the scientific work is concerned, the Executive Committee draws up the agenda. This agenda is sent to the member countries and to all the officers of the Association so as to reach them at least two months prior to the assembly. In principle, only matters on the agenda may be considered during the sessions, unless a decision to do otherwise is passed by a two-thirds majority in the Council concerning the agenda of the council, or in the Executive committee concerning the scientific program.

At each General Assembly, the President shall present a detailed report on the scientific work of the Association during his/her tenure. The Secretary General shall present a detailed report on the administrative work and on the finances of the Association for the same period. They both should submit proposals regarding work to be undertaken during the coming period, within the limits of expected resources. These reports are published in "The Geodesist's Handbook".

Joint Symposia covering topics interesting two or more Associations within the Union may be arranged.

At each ordinary General Assembly, the work of each Commission, each Service, the Communication and Outreach Branch, and each IAG Project shall be reported by its President / Chair. IAG Representatives report to the Executive Committee.

A screening committee will be set up by the IAG President, in due time, to decide about the acceptance of scientific papers for presentation at the General Assemblies. The committee shall consist of one member of the Bureau and the Presidents of Commissions, Chairs of the Services and IAG Projects.

Individual authors are responsible for the reproduction of their scientific papers. The Central Bureau prior to the meeting distributes these papers to the delegates where they are presented. They may be published in the IAG Symposia Proceedings or in the Journal of Geodesy, subject to its editorial policy, or on computer disks or on the Association's web site.

2.3 The Council

The council, in general, shall have the following duties:

a. Examine questions of general scientific policy or administration, and propose actions deemed necessary.
b. Elect the members of the Bureau and of the Executive Committee, and the Presidents of Commissions.
c. Receive reports from the Secretary General and consider for approval the decisions or actions taken by the Bureau and the Executive Committee since the last Council meeting.
d. Appoint the three members of the ad hoc committee created for examining the finances of the Association, consider its recommendations and adopt the final budget.
e. Consider proposals for changes in the Statutes and Bylaws.
f. Decide on the venue of scientific assemblies.
g. Approve the extablishment of Inter-Commission Committees and IAG Projects.
h. The President of the Association convenes the Council. It shall meet at least once during each General Assembly, and may be convened at other times, normally coinciding with and IAG scientific assembly.

2.4 The IAG Executive Committee

The IAG Executive Committee, in general, shall have the following duties:

a. Initiate actions and issue guidelines, as required, to guide the Association towards the achievement of its scientific objectives.
b. Fill vacancies occurring between General Assemblies, in accordance with the present Statutes and Bylaws.
c. Set up and dissolve Association components and approve their internal structure.

d. Make recommendations to the Council on matters of general policy of the Association and on the implementation of its objectives.
e. Appoint Fellows of the Association, upon the recommendation of the Bureau.
f. Accept individuals as Members of the Association.
g. Appoint planning groups for Inter-commission Committees and IAG Projects.
h. Establish Inter-commission Committees and IAG Projects.
i. Appoint an IAG Review Committee every eight years.
j. Appoint the Assistant Secretaries of the Association.
k. Confirm the links between Commissions and Services.
l. Adopt the suggested membership fee
m. Appoint the Vice-president of commissions.
n. Appoint representatives to external bodies.

In addition, the Executive Committee has the right to establish a fund (**IAG Fund**) for supporting specific IAG activities as defined in the IAG Fund Rules, to be published in the Geodesist's Handbook. The fund is under the direct responsibility of the President; the fund's resources are administered by the Secretary General.

The Executive Committee may also establish **awards** for outstanding contributions to geodesy and distinguished service to the Association. The rules for the awards are published in the Geodesist's Handbook.

The President of the Association convenes the Executive Committee. It shall meet at General Assemblies and its members are expected to attend the meetings of the Council, with voice but without vote. It shall also meet normally at least once a year, especially one year before the General Assembly, in order to prepare the scientific agenda and the timetable of the next General Assembly.

At a meeting of the Executive Committee, no member may be represented by any other person, except a President of Commission who may be represented by the Vice-President. In order that the deliberations of the Executive Committee shall be valid, at least half of its members must be present or represented.

The agenda for each meeting of the Executive Committee shall be prepared by the Bureau and sent to the members at least three months prior to the meeting.

2.5 The Bureau

The Bureau, in general, shall have the following duties:

a. Draw up the agenda of the meetings of the Council and Executive Committee.
b. Ensure the adequate administration of the Association. It shall normally meet before each meeting of the Executive Committee.
c. Receive applications for individual memberships.
d. Recommend to the Executive Committee Candidate Members, individual Members, and Fellows.

2.5a The President

The President of the Association, in general, shall have the following duties:

a. Provide general leadership for the Association in all matters.
b. Convene and preside over the General Assembly and over all meetings of the Council, Executive Committee and Bureau.
c. Represent the Association in its dealing with national or international organizations or institutions.
d. Submit a report to the General Assembly on the scientific work of the Association during his/her tenure.

2.5b The Vice President

The Vice President shall act as the President whenever the President is not present or is unable to perform any of the President's duties, and shall perform such tasks as may be assigned by the President, the Executive Committee or the Council.

2.5c The Secretary General

The Secretary General shall have the following duties:

a. Serve as secretary of the General Assembly, the Council, the Executive Committee and the Bureau; arrange for meetings of these bodies, distribute promptly the agenda and prepare and distribute the minutes of all their meetings.
b. Director of the Central Bureau.
c. Manage the affairs of the Association, attend to correspondence, and preserve the records.
d. Circulate all appropriate information related to the Association.
e. Prepare the reports of the Association's activities.
f. Perform such other duties as may be assigned to him by the Bureau.

2.6 Assistant Secretaries

The Secretary General is also assisted by a small number of assistant secretaries, one of whom is located in the same office as the Secretary General. The function of the Secretary General and the Assistant Secretaries are unpaid and only expenses incurred in connection with them are repayable.

Assembly Secretaries shall be appointed by the Council on the recommendation of the adhering body of the country in which the next Ordinary or Scientific Assembly will take place. In cooperation with the Bureau, the Assembly Secretary has responsibility for liaison with the organizers working on the preparation of the Assembly.

2.7 Central Bureau
To assist the Secretary General, the Association establishes the Central Bureau, after invitation from a host country.

2.8 Elections
Elections shall take place by mail vote before each General Assembly and should be completed one month before the assembly.

a. The President of the Association, after taking advice from the Executive Committee, shall appoint a Nominating Committee consisting of a Chair and three other members. The Nominating Committee, after taking advice from the adhering bodies of the member countries, officers, fellows, and members of the Association, shall normally propose at least two candidates for each position to be filled by election in the Council. Candidates shall be asked to signify their acceptance of nomination and to prepare a resume, maximum 150 words, outlining their position, research interests and activities relating to the Association. The member countries and the individual membership shall be informed of these nominations three months before the General Assembly.
b. During the following month further nominations can be submitted by the National Delegates. Such additional nominations shall be in writing, shall be supported by at least two members of the Council, and shall be submitted with resumes as described above to the Chair of the Nominating Committee. Delegates shall be informed of these further nominations and resumes and of their supporters. Elections shall be by mail ballot by majority vote. In this case the national delegates form the council. No person may hold more than one of the following offices at the same time: President of the Association, Vice-President, President of a Commission, President of a Service, President of the Communication and Outreach Branch, Chair of an IAG Project.
c. The Services' representatives to the IAG Executive Committee shall be elected as follows: The Chair of the Nominating Committee shall write to all services asking them for one nomination from each service. The Nominating Committee shall recommend normally two nominees for each of the Services' three slots, considering appropriate scientific and national distribution.

The Council will then elect the three representatives as the other Executive Committee members.

The time interval between the closures of two successive ordinary General Assemblies of the Association is called here a period.

The Vice-President is elected for one period and may not be immediately re-elected to the same office.

The President of the Association is elected for one period.

The Secretary General is elected for one period initially. He/she may be re-elected for two additional periods. The same rules apply to Assistant Secretaries.

A member of the IUGG Bureau or of the IUGG Finance Committee may not occupy the post of President, of Vice-President or of Secretary General of the Association.

Should the position of President become vacant in the interval between two ordinary General Assemblies, his duties devolve to the Vice-President until the closure of the next ordinary General Assembly.

Should the post of Secretary General become vacant, the President shall arrange without delay for the Executive Committee to elect a replacement by correspondence so as to ensure the continuity of the work of the Central Bureau. This election has effect until the closure of the next ordinary General Assembly.

2.9 International Cooperation
The Association shall initiate international cooperation in scientific work of international and interdisciplinary character. This includes the adequate participation in international programs and projects and the representation at scientific congresses, symposia etc. of organizations with related activities. The President of the Association decides on the proper participation or representation.

Representatives to international programs and projects shall be appointed by the Executive Committee and shall keep the President informed on the activities, on a biannual basis. The representatives shall also prepare a report to be presented at the General Assembly.

3 Scientific Meetings

Scientific meetings relevant to IAG generally are the Scientific Symposia, Scientific Assemblies, and IAG sponsored Symposia. The latter two may take place at any time.

The IAG Newsletter shall include on a regular basis, a **Calendar** of IAG Symposia and other scientific meetings organized or sponsored by the IAG or its components.

The Executive Committee shall appoint an official **IAG Representative** for each of the scientific meetings to be governed by these rules. The representative is obliged to remind the organizers to obey the rules for scientific meetings and to report back to the Executive Committee.

3.1 Scientific Symposia
Scientific symposia take place at IAG General Assemblies and generally shall be organized by Association component (including the sub-components), under the chairmanship of the Chairs of the components. The study of some questions may require joint meetings of several

components under a chair, appointed by the Executive Committee. A committee consisting of the component Chairs shall decide on the agenda and on the inclusion of scientific presentations.

At each General Assembly **Joint Scientific Symposia** covering topics of interest to two or more Associations within the IUGG and/or other international scientific organizations may be arranged. Though the IAG may be asked to act as convenor or co-convenor, these symposia shall follow the rules issued by the IUGG. The IAG may participate also in joint symposia at any other time outside of the General Assemblies obeying the same procedures.

The arrangement of a scientific symposium shall be subject to the usual approval procedure provided by the Geodesist's Handbook.

3.2 Scientific Assemblies

Scientific assemblies are generally held at mid-way between the General Assemblies and shall consist of a group of component meetings and/or a group of Scientific Symposia, held at the same time and place.

3.3 IAG Sponsored Symposium

The IAG may sponsor a symposium covering broad parts of geodesy and having large attendance at any suitable time outside the General or Scientific Assemblies, and shall call it an **IAG Sponsored Symposium**, provided the following conditions are fulfilled:

a. One or more Association component or sub-component shall sponsor it or at least two Study Groups.
b. Host organization of the symposium shall accept a Scientific Organizing Committee (SOC) appointed by the IAG Executive Committee.
c. The symposium shall be open to all bona-fide scientists in accordance with the ICSU rules.
d. The symposium proceedings shall be published within 6-8 months.

The SOC shall be responsible for a high scientific level of the symposium. A Local Organizing Committee (LOC) shall take care of the organization and logistics. Applications for approval of an IAG Symposium should be submitted to the Secretary General at least two years before the intended date of the meeting. Detailed guidelines for such applications, and the expectations from the SOC and LOC, may be found in the Geodesist's Handbook quoted above.

4 Finance

The Finances of the Association derive from the following sources:

a. Contributions of IUGG member countries of which a proportion, determined by the IUGG Council on recommendation of its Finance Committee, is paid to the Association by the Treasurer of the union.
b. Sale of publications.
c. IAG Fund collected from individual contributions for specific purposes.
d. Membership fees.
e. Other sources e.g., grants, interests, and funds remaining after a symposium.

The Secretary General is responsible to the Bureau and to the Council for managing the funds in accordance with the Statutes and Bylaws, with the decisions of the Council, and with the recommendations of the IUGG Finance Committee.

The Secretary General alone shall be responsible for control of the financial operations of the Association.

At each General Assembly of the Association the budget proposal for the next period shall be presented by the Secretary General and submitted for approval to the Council. The budget as approved by the Council shall be implemented by the Secretary General.

During the next General Assembly, the Council shall examine all expenditures to ensure that they were in accordance with the proposed budget previously approved. The Council shall appoint an ad hoc committee for carrying out this examination in detail.

In addition, these accounts shall be audited by a qualified accountant and shall then be reported to the IUGG Treasurer, as prescribed in Article 20 of the IUGG Bylaws.

Rules for the Guy Bomford Prize, and Levallois Medal

The Guy Bomford Prize

Purpose:

The Guy Bomford Prize is awarded by the International Association of Geodesy for outstanding contribution to Geodesy. It was established by the British National Committee for Geodesy and Geophysics to mark the contributions to geodesy of Brigadier G. Bomford, formerly of the University of Oxford and a Past President of the International Association of Geodesy. It has been inaugurated by the I.A.G. in 1975. The Prize is normally awarded at intervals of fours years on the occasion of the General Assembly of the I.A.G. held concurrently with the General Assembly of the International Union for Geodesy and Geophysics. The following rules for the award of the Guy Bomford Prize may be altered by the I.A.G. Executive if a majority of its voting members sees a necessity to do so.

Eligibility:

The Guy Bomford Prize is awarded to a young scientist or to a team young scientists for outstanding theoretical or applied contributions to geodetic studies, particularly in the four year period preceding the General Assembly at which the award is made. Scientists who are under 40 years of age on December, 31, of the year preceding the Assembly at which the award is made, are eligible for the award.

Nominations:

Nominations will be invited by the I.A.G. Bureau from all National Committees of I.U.G.G. member countries at least one year ahead of the General Assembly. Each committee can make one nomination which has not necessarily to be from its own country. The deadline for nominations will normally be six months before the next General Assembly and will be explicitly started in the letter of invitation.

Nominations must be accompanied by:

The full name, address, age, academic and/or professional qualifications and position of the candidates and the name of the National Committee making the nomination.

An outline of the reasons for the nomination including a general summary of the career and scientific achievement of the candidate.

A review of the recent achievements of the candidates which would merit the award, including references to key papers, published, alone or jointly, during the preceding four-year period.

A curriculum vitae, publication list, and copies of up to two key papers which are considered to justify candidature.

The name and address of two referees who could be consulted.

Selection procedure:

A screening committee will be appointed consisting of the presidents of the I.A.G. Sections and two other members to be appointed by the I.A.G. Bureau. Based on the material submitted by the National Committees, each member of the screening committee will rank the nominations and send a short list of three to the I.A.G. Bureau. The decision among the three top ranking candidates will be communicated to all National Committees, and the successfull candidate(s). The Prize may be withheld if, in the opinion of the I.A.G. Bureau, there is no sufficiently qualified candidate.

Presentation of award:

The Prize shall be presented to the successfull candidate at the opening at the opening Plenary Session of the I.A.G. Assembly. He or she shall be invited to deliver a lecture during the course of the I.A.G. Assembly.

Levallois Medal

Purpose:

The **Levallois Medal** was established by the International Association of Geodesy in 1979 to honour **Jean-Jacques Levallois**, and to recognize his outstanding contribution to the I.A.G., particularly his long service as Secretary General, 1960–1975.

The award of the Medal will be made in recognition of distinguished service to the Association, and/or to the science of geodesy in general.

The Medal is normally awarded at four year intervals, on the occassion of the General Assemblies of the International Association of Geodesy and International Union of Geodesy and Geophysics; but the award may be omitted if it is considered that there is no candidature of sufficient merit, and an additional award may be made at any time if justified by exceptional circumstances.

A nomination for the award shall be made by an ad hoc committee consisting of the Honorary Presidents and must be confirmed by the I.A.G. Executive Committee. The ad hoc committee shall prepare a citation, suitable for publication, setting out the grounds for the proposed award before the General Assembly.

Rules for IAG Scientific Meetings

These new Rules were prepared during the Executive Committee meeting held in Paris, 3–10 March 1988. After some amendments they were adopted by the Bureau and then the Executive Committee.

They now become effective and especially applicable to scientific meetings organized by the association itself. They do not conflict with those rules contained in the By Laws which more generally concern Symposia and workshops approved or sponsored by the IAG. These new rules must be considered as a necessary and more detailed complement to Chapter VII of the By Laws, should they be approved by the Council.

1. Scientific Meetings relevant to IAG may take place
   1. during Ordinary General Assemblies of IAG, held at the same time and in the same country with the Ordinary General Assemblies of the IUGG,
   2. during Scientific General Assemblies and/or General Meetings of IAG, held in the period between successive Ordinary General Assemblies,
   3. at times and places outside of the General Assemblies and General Meetings of the IAG.
2. During the (Ordinary and Scientific) General Assemblies the scientific meetings generally take place Section by Section (including the respectively assigned Commissions and Special Study Groups) under the Chairmanship of the Section Presidents (called Section Meetings). The study of some questions may require joint meetings of several Sections under a chairman, appointed by the Executive Committee. The inclusion on the agenda of scientific papers for presentation at sessions of a General Assembly is decided by a Committee consisting of the Presidents of Sections. Besides the scientific sessions the Sections, Commissions, and Special Study Groups are free to hold working meetings of their members under the responsibility of the respective Presidents.
3. If one or more Sections, Commissions, or Special Study Groups wish to arrange a scientific symposium during the General Assembly this is subject to the usual approval procedure for IAG-Symposia (ref. 7). Symposia should be arranged only if the topic covers at least the frame of one Section, one Commission, or two Special Study Groups.
4. General Meetings of IAG may be considered as a group of IAG-Symposia and Section Meetings held at the same time and place.
5. At each General Assembly joint Symposia covering topics interesting two or more Associations within the Union and/or other international scientific organizations may be arranged.

Though the IAG may be asked to act as convenor or co-convenor these Symposia follow the rules issued by the IUGG in these particular cases.

6. The IAG may participate also in Joint Symposia at any other time outside of the General Assemblies obeying the same procedures.
7. The IAG may sponsor scientific Symposia covering broad parts of Geodesy and having large attendance at any suitable time outside of the General Assemblies and/or General Meetings, and may call them IAG-Symposia if the following conditions are fulfilled:

– the Symposium has to be sponsored by one or more Sections or Commissions or at least by two Special Study Groups of IAG ;
– the host organization of the symposium must accept a Scientific Committee appointed by the Executive Committee of IAG with the advice of the proposer of that symposium;
– the symposium must be open to all bona-fide scientists in accordance with the ICSU Rules;
– the proceedings of the Symposium shall be published within 6–8 months after the end of the Symposium.

IAG expects that immediately after the end of the symposium the Chairman of the Scientific Committee supply a short summary to be published in the Journal of Geodesy.

8. Applications for approval as IAG-Symposium by the Executive Committee of IAG should be submitted to the Secretary General of IAG at least tow years before the proposed date of the Symposium. The following information is essential to the proposal:
   1. Title
   2. Date and duration
   3. Location
   4. Sponsoring and co-sponsoring Sections, Commissions, SSG's of IAG, other co-sponsoring scientific organization: letters enclosed.
   5. Suggested composition of the Scientific Committee
   6. Suggested Local Organization Committee, host organization
   7. Name and address for maintenance of contact
   8. Estimated number of participants
   9. Financial support expected from sources other than the IAG
   10. Names of the proposed Editors of Proceedings
   11. The outlined Scientific Programme

12. A detailed account of why the proposed Symposium is useful and necessary at the time proposed and its relationship with other meetings.

9. Guidelines for the agenda of the symposium
- Activities of the Scientific Committee
- Activities of the Local Organizing Committee (LOC)
- Financial considerations
- Publication of the Proceedings.

9a) IAG-Symposia have to be performed at a high standard of scientific value and organized in a very effective way. The agenda may consist of any or all of the following:
a) Invited Review Papers,
b) Invited Papers,
c) Contributed Papers,
d) Contributed Poster Papers,
e) Video Film,
f) Discussion, including Panel Discussions.

Discussion following papers is regarded as an essential form of communication. It should be necessary to devote at least 1/3 of the total meeting time to discussion. The Scientific Committee should pay particular regard to adequate provision for poster sessions.

9b) The Scientific Committee if responsible for a high standard of scientific value of the Symposium. The Chairman of the Scientific Committee
a) Invites participants after the Symposium is approved by the Executive Committee,
b) Accepts or rejects requested invitations,
c) Invites contributions and sets a dead line for ubmissions of abstracts,
d) Informs the Secretary General of all important things about the Symposium immediately after.

9c) The Local Organizing Committee takes care of the smooth running of the Symposium. It does not receive financial help from the IAG, the necessary expenses being met by the local funds or by contributions from the participants.

The requirements of local organizations are generally as follows:

1)
a) Meeting Rooms suitable for the expected number of participants and for the presentation of scientific papers should be reserved.
b) Adequate space for poster sessions should be reserved. It is important that the LOC make provision for a supply of pins, sticky tape, etc... for mounting poster material and for notification of participants of the time and venue of poster displays.
c) Arrangements should be made for the display of visual materials: overheads, slides, films and videos. Participants should be advised of the film and video standard(s) available at the meeting venue.

2) Arrangements should be made for the reproduction of participant's documents.
3) Sufficient secretarial and technical assistance should be secured, with careful attention to the requirement for projection equipment microphones, tape recorders, etc.
4) In conjunction with the requirements of the Scientific Commitee, arrangements should be made to record verbal discussion. Reliance on tape recordings if often unsatisfactory and providing each contributor with a sheet of paper on which to record or summarize his remarks is advisable.
5) Information on accommodation (hostels, hotels, etc...) should be agreed with the Chairman of SOC and sent
a) to the Executive Committee for acceptance and
b) to prospective participants in good time Block reservations are often advisable.
6) All participants should be asked to send their wishes as regards accommodation, excursions and social events to the LOC.
7) Receptions and excursions can be organized during a free period within the meeting, or just before or after the meeting. A Guest Programme is usually welcome.
8) Participants should be informed of the reservations made for them and how to reach their hotel or the meeting rooms on arrival.
9) The LOC should provide a Preliminary and a Final Programme, including useful auxiliary information, to be distributed to each participant at the appropriate time; A list of Participants, produced on about the second day of the meeting is also extremely valuable if it corresponds closely with those actually present.

10. The IAG has to arrange all proceedings of the IAG-Symposia, that means the Symposia held during the General Assemblies and the General Meetings of IAG, and the Symposia approved in accordance with point 7 -in a series and giving each of them a number starting with the first IAG-Symposium which was performed after the 19th General Assembly of IAG, held in August 1987 in Vancouver, Canada.
11. The IAG Executive Committee shall recognize also the scientific meetings organized by the Commissions, their Subcommissions, and working groups, and the Special Study Groups of IAG alone or jointly with other international and national groups and bodies at any time outside of the General Assemblies, if they have been approved by the Executive Committee at the advice of the respective Section President in due time before the first announcement. If so the Meeting may be announced as "International Meeting, organized by the...... of IAG".

    It is not permitted to use the term IAG-Symposium.

12. The IAG is willing to recognize also scientific meetings, organized by national bodies as important scientific event with benefit for the international geodetic community and to sponsor them if the respective meeting shall be open to all bona-fide scientists

according to the ICSU Regulations and will be sponsored by one or more Sections, Commissions, or Special Study Groups of IAG and if the organizer shall obey the organisational standard for IAG-Symposia.

These Meetings may be announced as "International Meeting, organized by....., sponsored by IAG". It is not permitted to use the term IAG-Symposium. Sponsorship by the IAG means only official recognition and does not imply financial support by the IAG. IAG may appoint an official representative to that meeting. IAG expects that the Proceedings of the meeting will be prepared by the local organizers and published within 6–8 months after the end of the meeting.

Applications for sponsorship should be submitted to the Secretary General not later than 18 months before the intended date of the meeting.

13. In its decision about approval and/or sponsorship the Executive Committee takes into account a balanced selection of meetings, a representative coverage of subjects and a good geographical distribution. The IAG intends to avoid duplication, overlapping and undue frequency.

    The Secretary General shall publish annually a calendar of future IAG-Symposia and other scientific meetings organized by IAG-bodies or sponsored by IAG in the Journal of Geodesy.

14. The Executive Committee shall appoint an official representative of the Association for each of the scientific meetings to be governed by these rules. The representative is obliged to watch the way in which the organizer of the meeting obey the IAG Rules for Scientific Meetings and to report about it to the Executive Committee in due time.

IAG Fund

IAG Fund

The IAG Fund aims at supporting specific IAG activities. Its primary goals are:

- to provide travel support for young scientists to attend IAG Symposia and workshops,
- to assist in the organisation of IAG workshops in developing countries, and
- to provid an annual IAG Young Authors Award for young scientists.

The fund was established by the IAG Executive Committee at its meeting in Columbus, Ohio, 1992, see Bulletin Geodesique, Vol. 68, pp. 41–42, 1994.

Contributors are divided in 3 groups:

- Presidents Club (cummulative contributions of $ 1000 or more)
- Special contributors (annual contributors of $ 100 or more)
- Contributors (annual contributions of less than $ 100)

The rules for the IAG Young Authors Award and for the IAG Travel award for yound scientists are given in a seperate section of the Geodesists Handbook.

I wish to contribute to the IAG fund.

Annual basis ☐ One-and-for-all ☐

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Phone: ____________________

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Signature: ____________________

IAG Young Authors Award – IAG Travel Award

IAG Young Author Award

Purpose:
To draw attention to important contributions by young scientists in the Journal of Geodesy and to foster excellence in scientific writing.

Eligibility:
The applicant must be 35 years of age or younger when submitting the paper for publication. The paper must present the applicant's own research, and must have been published in the two annual volumes of the Journal of Geodesy (J of G) preceding either the IAG General Assembly or the IAG Scientific Assembly. Although multiple author papers will be considered, single author papers will be given more weight in the selection process.

Award:
The award consists of a certificate and a cheque of US $ 1000. Presentation of the awards will be made at each IAG General Assembly and each IAG Scientific Assembly. Up to two awards will be presented on each occasion for the two-year period corresponding to the annual volumes specified above.

Nomination and selection:
For each two-year period the Editor-in-Chief of the Journal of Geodesy will propose a minimum of three candidates for the award. In addition, proposals made by at least three IAG Fellows or Associates will be considered for the competition. The voting members of the IAG Executive Committee will make the final selection. It will be based on the importance of the scientific contribution, which may be either theoretical or practical, and on the quality of the presentation. The name and picture of the award winner and a short biography will be published in the Journal of Geodesy.

Procedure:
Each year the conditions for the award will be announced in the Journal of Geodesy. Nominations should be sent to the General Secretary of the IAG, giving name, address, and age of the author (at date of submission), the title of the paper on which nomination is based, and a brief justification. Nominations must be received by March 1 of the year in which either an IAG General Assembly or an IAG Scientific Assembly takes place.

IAG Travel Award

Purpose:
To assist young scientists from member countries to present results of their research at IAG meetings (general meetings, workshops, etc...)

Eligibility:
The applicant must present results of his or her research at the meeting and must be 35 years of age or less at the date of the application. The application must be supported by at least one IAG Fellow or two Associates.

Type of awards:
There are two awards, one for meetings in the applicant's own country, the other for meetings outside the applicant's country. The first group is called **IAG National Travel Award** and has a maximum financial value of US $ 400. It is available for meetings in developing countries. The second award is called the **IAG International Travel Award** and has a maximum financial value of US $ 800. The amounts can occasionally be adjusted by the IAG Executive Committee. Normally, the total number of awards are limited to 10 in any given year.

Application procedure:
Applicants are asked to send their application at least three months before the meeting to:

IAG Central Bureau, General Secretary,
University of Copenhagen, Dept of Geophysics,
Juliane Maries Vej 30,
DK-2100 Copenhagen O, Denmark.

As a minimum, the application should contain: title, authors, and abstract of the paper to be presented, acceptance by the organising committee (if available), travel budget and sources of additional funding. The letter(s) of support (one IAG Fellow or two Associates) should be sent separately.

Selection procedure and criteria:
Selection of applicants will be done by the IAG Bureau. It will be based on the letter(s) of support and the applicant's ability to actually attend the meeting. Priority will be given to candidates from developing countries.

Additional benefits:
The IAG will encourage organisers of meetings to waive registration fees for all IAG Travel award winners.

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Fundamental Parameters and Current (2004) Best Estimates of the Parameters of Common Relevance to Astronomy, Geodesy, and Geodynamics by

Erwin Groten, IPGD, Darmstadt

At present, systems of fundamental constants are in a state of transition. Even though the uncertainties of many constants have substantially decreased, the numerical values themselves did not substantially change. On the other hand, relativistic reductions and corrections underwent a variety of revisions that, however, did not yet find final agreement within the scientific working groups of international committees in charge of evaluating relevant quantities and theories. Consequently, substantial changes and revisions still have to be expected in IAU, IERS, IUGG etc. within the next few years.

Therefore SC 3 (i.e. the old structure), after lengthy discussions and considerations, decided not to propose, at this time, any change of existing geodetic reference systems such as WGS 84 (in its recent form updated by NIMA, 1997) and GRS 80. This would only make sense in view of relatively small numerical changes which would not justify, at this moment, complete changes of systems and would rather produce more confusion within user communities – as soon as working groups within IAU, IERS etc. have made up their minds concerning the background of new systems and will be prepared to discuss new numerical values. This should be around the year 2004.

The present situation is also reflected by the fact that in view of substantial progress in evaluating temporal changes of fundamental "constants" and related accuracies, we should better speak about "fundamental parameters" instead of "fundamental constants".

Interrelations between IERS, IAU, IAG etc. make it, however, more difficult to implement necessary changes in fundamental systems. This was particularly realized in discussing adoption of new fundamental constants. This fact may be explained by the discussion of small changes inherent in the adoption of particular tidal corrections which became relevant in view of higher accuracies of $\pm\ 10^{-8}$ or $\pm\ 10^{-9}$. It turns out to be almost impossible to explain to other scientific bodies the modern relevance of the dependence of the numerical value of the semi-major axis "a" of the *Earth* on specific tidal corrections. Other temporal variations imply similar difficulties.

From the view point of users, i.e. in deriving fundamental parameters, it is, to some extent, confusing that a variety of global or/and regional systems exist; it would be best to use only one global terrestrial and one celestial system such as ITRF, referred to a specific epoch, and an associated celestial system, unless precise transition and transformation formulae are available such as those between ETRF, ITRF, EUREF, and perhaps WGS 84 (in updated form), IGS, GRS 80 etc. where IERS-systems, in general, could serve to maintain transformation accuracy and precision.

However, the consequent replacement of "a" by a quantity such as the geopotential at the geoid W_0 (which is independent of tides) in a geodetic reference system (or a similar system) was not well understood and not supported by other working groups so that we finally gave up the idea of a reformation of systems of fundamental constants in this way even though quantities such as W_0 are now precisely determined by satellite altimetry etc. Whether seasonal variations (Bursa et al. 1998a) of W_0 are significant or not is still an open question, when expressed in $R_0 = GM/W_0$ they amount to a few centimeters in global radius.

SI units are used throughout (except for the TDB-value (value below (4))

(SI-value can be associated with TCB or TCG)

– velocity of light in vacuum

$$c = 299\ 792\ 458\,\mathrm{m\ s^{-1}}. \qquad (1)$$

– Newtonian gravitational constant

$$G = (6\ 672.59 \pm 0.30) \times 10^{-14}\,\mathrm{m^3\,s^{-2}\,kg^{-1}}. \qquad (2)$$

– Geocentric gravitational constant (including the mass of the Earth's atmosphere); reconfirmed by J. Ries (1998, priv. comm.)

$$GM = (398\ 600\ 441.8 \pm 0.8) \times 10^6\,\mathrm{m^3\,s^{-2}}. \qquad (3)$$

For the EGM 96 global gravity model $GM = 398\ 600\ 441.5 \times 10^6\,\mathrm{m^3\,s^{-2}}$

was adopted. E. Pavlis (2002) found GM = 398 600 441.6 and 1.7, respectively. For details see (Groten, 2004).

In TT units (Terrestrial Time) the value is

$$GM = (398\ 600\ 441.5 \pm 0.8) \times 10^6\,\mathrm{m^3\,s^{-2}}. \qquad (4)$$

Note that if expressed in old TDB units (solar system Barycentric Dynamical Time), the value is

$$GM = 398\ 600\ 435.6 \times 10^6\, m^3\, s^{-2}.$$

Based on well known transformation formulas we may relate GM in SI-units to TT/TCG/TCB; see IERS-Convention 1996 p. 85. The well known secular term was not originally included in the GM(E)-analysis, therefore it was related to TT, neither to SI nor (TCG, TCB); as still satellite analysis occurs without the secular term, GM(E) in TT is still of geodetic interest; GM(E) = GM of the Earth.

– Mean angular velocity of the Earth's rotation

$$\omega = 7\ 292\ 115 \times 10^{-11}\ \mathrm{rad\ s^{-1}}. \tag{5}$$

Table 1. Mean angular velocity of the Earth's rotation 1978–1999

Year	ω [10^{-11} rad s^{-1}]	Year	ω [10^{-11} rad s^{-1}]	Mean LOD [ms/day]
min: 1978	7 292 114.903	1995	7 292 114.952	–
max: 1999	292 115.063	1996	.992	–
		1997	.991	–
		1998	115.031	1.37
		1999	.063	0.99

– Long-term variation in ω

$$\frac{d\omega}{dt} = (-4.5 \pm 0.1) \times 10^{-22}\, rad\ s^{-2}. \tag{6}$$

This observed average value is based on two actual components:

a) due to tidal dissipation

$$\left(\frac{d\omega}{dt}\right)_{tidal} = (-6.1 \pm 0.4) \times 10^{-22}\, rad\ s^{-2}. \tag{7}$$

This value is commensurate with a tidal deceleration in the mean motion of the Moon n

$$\frac{dn}{dt} = (-25.88 \pm 0.5)\, arcsec\ cy^{-2}. \tag{8}$$

b) non-tidal in origin

$$\left(\frac{d\omega}{dt}\right)_{non-tidal} = (+1.6 \pm 0.4) \times 10^{-22}\, rad\ s^{-2}. \tag{9}$$

– Second-degree zonal geopotential (Stokes) parameter (tide-free, fully normalized, Love number $k_2 = 0.3$ adopted), in agreement with EGM 96,

$$\bar{J}_2 = 4.84165371736 \times 10^{-4} \pm 3.56 \times 10^{-11} \tag{10}$$

To be consistent with the I.A.G. General Assembly Resolution 16, 1983 (Hamburg), the indirect tidal effect on J_2 should be included: then in the zero-frequency tide system (JGM-3)

$$J_2 = (1082\ 635.9 \pm 0.1) \times 10^{-9}. \tag{11}$$

Table 2. The Stokes second-degree zonal parameter; marked with a bar: fully normalized; $k_2 = 0.3$ adopted for the tide-free system

Geopotential model	Zero-frequency tide system $\bar{J}_2$ [10^{-6}]	J_2 [10^{-6}]	Tide-free $\bar{J}_2$ [10^{-6}]	J_2 [10^{-6}]
JGM-3	484.16951	1082.6359	484.16537	1082.6267
EGM 96			484.16537	

– Long-term variation in J_2

$$\frac{dJ_2}{dt} = -(2.6 \pm 0.3) \times 10^{-9}\, \mathrm{cy}^{-1} \tag{12}$$

– second-degree sectorial geopotential (Stokes) parameters (conventional, not normalized, geopotential model JGM-3)

$$J_2^2 = (1574.5 \pm 0.7) \times 10^{-9}, \tag{13}$$

$$S_2^2 = -(903.9 \pm 0.7) \times 10^{-9}, \tag{14}$$

Table 3. The Stokes second-degree sectorial parameters; marked with a bar: fully normalized

Geopotential model	$\bar{C}_2^2$ [10^{-6}]	$\bar{S}_2^2$ [10^{-6}]
JGM-3	2.43926	−1.40027
EGM 96	2.43914	−1.40017

$$J_{2,2} = \left[(J_2^2)^2 + (S_2^2)^2\right]^{1/2} = (1815.5 \pm 0.9) \times 10^{-9}. \tag{15}$$

Only the last decimal is affected by the standard deviation.

For EGM 96 Marchenko and Abrikosov (1999) found more detailed values:

Table 3a. Parameters of the linear model of the potential of 2nd degree

Harmonic coefficient	Value of coefficient $\times 10^6$	Temporal variation $\times 10^{11}$[yr^{-1}]
$\bar{C}_{20} = -\bar{J}_2$	−484.165371736	1.16275534
$\bar{C}_{21}$	−0.00018698764	−0.32
$\bar{S}_{21}$	0.00119528012	1.62
$\bar{C}_{22} = -\bar{J}_2^2$	2.43914352398	−0.494731439
$\bar{S}_{22}$	1.40016683654	−0.203385232

– Coefficient H associated with the precession constant as derived in (Mathews et al., 2000)

$$\mathrm{H} = \frac{C - \frac{1}{2}(A + B)}{C} = 3.2737875 \times 10^{-3}. \tag{16}$$

(with an uncertainty better than 0.2 ppm); with Fricke's corrected precession constant we had

$$\mathrm{H} = (3\ 273763 \pm 20) \times 10^{-9}. \tag{16a}$$

For a more detailed discussion of non-linear changes in see (Groten 2004). Associated changes of the semi-major axis of the earth ellipsoid and its current best estimate are given in the same paper.

The value of H as derived by Mathews et al. (ibid.) contains the full permanent tide (direct and indirect effects) (Mathews, priv. Comm., 2000) in principle, this fact depends on the VLBI-data, on which the semi-empirical solution is based; if the permanent tide is not fully included there, a different tidal reference is being used. Fukushima (2003) just reported his best estimate as $\mathrm{H} = (3.2737804 \pm 0.0000003) \times 10^{-3}$.

– The geoidal potential W_0 and the geopotential scale factor $R_0 = GM/W_0$ derived by Bursa et al. (1998) read

$$W_0 = (62\ 636\ 855.611 \pm 0.5)\,\mathrm{m^2s^{-2}}, \tag{17}$$

$$R_0 = (6\ 363\ 672.58 \pm 0.05)\,\mathrm{m}.$$

$W_0 = (62636856.4 \pm 0.5)\ \mathrm{m^2s^{-2}}$ J. Ries (priv. comm, 1998) found globally.

If W_0 is preserved as a primary constant the discussion of the ellipsoidal parameters could become obsolete; as the Earth ellipsoid is basically an artifact. Modelling of the altimeter bias and various other error influences affect the validity of W_0-determination. The variability of W_0 and R_0 was studied by Bursa (Bursa et al. 1998) recently; they detected interannual variations of W_0 and R_0 amounting to 2 cm.

The relativistic corrections to W_0 were discussed by Kopejkin (1991); see his formulas (67) and (77) where tidal corrections were included. Whereas he proposes average time values, Grafarend insists in corrections related to specific epochs in order to illustrate the time-dependence of such parameters as W_0, GM, J_n, which are usually, in view of present accuracies, still treated as constants in contemporary literature.

Based on recent GPS data, E. Grafarend and A. Ardalan (1997) found locally (in the Finnish Datum for Fennoscandia): $W_0 = (6\ 263\ 685.58 \pm 0.36)$ kgal m.

The temporal variations were discussed by Wang and Kakkurμi (1998), in general terms.

– Mean equatorial gravity in the zero-frequency tide system

$$g_e = (978\ 032.78 \pm 0.2) \times 10^{-5}\,\mathrm{m\,s^{-2}}. \tag{18}$$

– Equatorial radius of the Reference Ellipsoid (mean equatorial radius of the Earth) in the zero-frequency tide system (Bursa et al. 1998)

$$a = (6\ 378\ 136.62 \pm 0.10)\,\mathrm{m}. \tag{19}$$

– The corresponding value in the mean tide system (the zero-frequency direct and indirect tidal distortion included) comes out as

$$a = (6\ 378\ 136.72 \pm 0.10)\,\mathrm{m} \tag{20}$$

and the tide-free value

$$a = (6\ 378\ 136.59 \pm 0.10)\,\mathrm{m}. \tag{21}$$

The tide free-value adopted for the new EGM-96 gravity model reads a = 6 378 136.3 m.

– Polar flattening computed in the zero-frequency tide system, (adopted GM, ω, and J_2 in the zero-frequency tide system)

$$1/f = 298.25642 \pm 0.00001 \tag{22}$$

The corresponding value in the mean tide system comes out as

$$1/f = 298.25231 \pm 0.00001 \quad (23)$$

and the tide-free

$$1/f = 298.25765 \pm 0.00001 \quad (24)$$

– Equatorial flattening (geopotential model JGM-3).

$$1/\alpha_1 = 91\ 026 \pm 10. \quad (25)$$

– Longitude of major axis of equatorial ellipse, geopotential model JGM-3

$$\Lambda_a = (14.9291^\circ \pm 0.0010^\circ)\mathrm{W}. \quad (26)$$

In view of the small changes (see Table 3) of the second degree tesserals it is close to the value of EGM 96. We may raise the question whether we should keep the reference ellipsoid in terms of GRS 80 (or an alternative) fixed and focus on W_0 as a parameter to be essentially better determined by satellite altimetry, where however the underlying concept (inverted barometer, altimeter bias etc.) has to be clarified.

Table 4. Equatorial flattening α_1 and Λ_a of major axis of equatorial ellipse

Geopotential model	$\frac{1}{\alpha_1}$	Λ_a [deg]
JGM-3	91026	14.9291 W

– Coefficient in potential of centrifugal force

$$q = \frac{\omega^2 a^3}{GM} = (3\ 461\ 391 \pm 2) \times 10^{-9}. \quad (27)$$

Computed by using values (3), (5) and a = 6 378 136.6

– Principal moments of inertia (zero-frequency tide system), computed using values (11), (15), (3), (2) and (16)

$$\frac{C-A}{Ma_0^2} = J_2 + 2J_{2,2} = (1086.267 \pm 0.001) \times 10^{-6}. \quad (28)$$

$$\frac{C-B}{Ma_0^2} = J_2 - 2J_{2,2} = (1079.005 \pm 0.001) \times 10^{-6},$$

$$\frac{B-A}{Ma_0^2} = 4J_{2,2} = (7.262 \pm 0.004) \times 10^{-6};$$

$$Ma_0^2 = \frac{GM}{G} a_0^2 = (2.43014 \pm 0.00005) \times 10^{38}\, kg\, m^2, \quad (29)$$

(a_0 = 6 378 137 m);

$$C - A = (2.6398 \pm 0.0001) \times 10^{35}\ \mathrm{kg\,m^2},$$

$$C - B = (2.6221 \pm 0.0001) \times 10^{35}\ \mathrm{kg\,m^2}, \quad (30)$$

$$B - A = (1.765 \pm 0.001) \times 10^{33}\ \mathrm{kg\,m^2};$$

$$\frac{C}{Ma_0^2} = \frac{J_2}{H} = (330\ 701 \pm 2) \times 10^{-6}, \quad (31)$$

$$\frac{A}{Ma_0^2} = (329\ 615 \pm 2) \times 10^{-6},$$

$$\frac{B}{Ma_0^2} = (329\ 622 \pm 2) \times 10^{-6}; \quad (32)$$

$$\begin{aligned} \mathrm{A} &= (8.0101 \pm 0.0002) \times 10^{37}\ \mathrm{kg\,m^2}, \\ \mathrm{B} &= (8.0103 \pm 0.0002) \times 10^{37}\ \mathrm{kg\,m^2}, \\ \mathrm{C} &= (8.0365 \pm 0.0002) \times 10^{37}\ \mathrm{kg\,m^2}, \end{aligned} \quad (33)$$

$$\alpha = \frac{C-B}{A} = (327\ 353 \pm 6) \times 10^{-8},$$

$$\gamma = \frac{B-A}{C} = (2\ 196 \pm 6) \times 10^{-8},$$

$$\beta = \frac{C-A}{B} = (329\ 549 \pm 6) \times 10^{-8}.$$

II *Primary geodetic Parameters, discussion*

It should be noted that parameters a, f, J_2, g_e, depend on the tidal system adopted. They have different values in tide-free, mean or zero-frequency tidal systems. However, *W_0 and/or R_0 are independent of tidal system* (Bursa 1995). The following relations can be used:

$$\mathrm{a\,(mean)} = \mathrm{a\,(tide\text{-}free)} + \frac{1}{2}(1+k_s)R_0\frac{\delta J_2}{k_s}, \quad (34)$$

$$\alpha\,(\mathrm{mean}) = \alpha\,(\mathrm{tide\text{-}free}) + \frac{3}{2}(1+k_s)\frac{\delta J_2}{k_s};$$

$$\mathrm{a\,(zero\text{-}frequency)} = \mathrm{a\,(tide\text{-}free)} + \frac{1}{2}R_0\delta J_2; \quad (35)$$

$$\alpha\,(\mathrm{zero\text{-}frequency)} = \alpha\,(\mathrm{tide\text{-}free}) + \frac{3}{2}\delta J_2;$$

k_s = 0.9383 is the secular Love number, δJ_2 is the zero-frequency tidal distortion in J_2. First, the *internal consistency* of parameters a, W_0, (R_0) and g_e should be examined:

(i) If
$a = 6\ 378\ 136.7$ m
is adopted as primary, the derived values are

$$W_0 = 62\ 636\ 856.88\,m^2\,s^{-2}, \quad (36)$$

$$(R_0 = 6\ 363\ 672.46\,m), \quad (37)$$

$$g_e = 978\ 032.714 \times 10^{-5}\,m\,s^{-2}. \quad (38)$$

(ii) If

$$W_0 = (62\ 636\ 855.8 \pm 0.5)\,m^2\,s^{-2},$$

$$R_0 = (6\ 363\ 672.6 \pm 0.05)\,m,$$

is adopted as primary, the derived values are (mean system)

$$a = 6\ 378\ 136.62\,m, \quad (39)$$

$$g_e = 978\ 032.705 \times 10^{-5}\,m\,s^{-2}. \quad (40)$$

(iii) If (18)

$$g_e = (978\ 032.78 \pm 0.2) \times 10^{-5}\,m\,s^{-2},$$

is adopted as primary, the derived values are

$$a = 6\ 378\ 136.38\,m, \quad (41)$$

$$W_0 = 62\ 636\ 858.8\,m^2\,s^{-2} \quad (42)$$

$$(R_0 = 6\ 363\ 672.26\,m). \quad (43)$$

There are no significant discrepancies, the differences are about the standard errors.

However, the inaccuracy in (iii) is much higher than in (i) and/or (ii). That is why solution (iii) is irrelevant at present.

If the rounded value

$$W_0 = (62\ 636\ 856.0 \pm 0.5)\,m^2\,s^{-2} \quad (44)$$

$$R_0 = (6\ 363\ 672.6 \pm 0.1)\,[m] \quad (45)$$

is adopted as primary, then the derived length of the semimajor axis in the mean tide system comes out as

$$a = (6\ 378\ 136.7 \pm 0.1)\,m, \quad (46)$$

(for zero-tide: 6 378 136.6)

which is just the rounded value (20), and (in the zero frequency tide system)

$$g_e = (978\ 032.7 \pm 0.1) \times 10^{-5}\,m\,s^{-2}. \quad (47)$$

However, SC 3 recommends that, at present, GRS 1980 should be retained as the standard.

III *Consistent set of fundamental constants (1997)*

It is important to realize the consistency problem: In "current best estimates" the best available numerical values are given. In sets of fundamental constants such as the Geodetic Reference System 1980 (GRS 80) consistent sets are demanded. When fundamental parameters are derived (incl. time variations) from one data set, as is often the case with satellite derived data, then this principle is often violated ; see, e.g., the dependence of GM and a. Similarly, when data derived from systems with different "defining constants", as is often the case for time systems, similar inconsistency problems arise. The typical case of an inconsistent system is the WGS 84 global systems which, contrary to GRS 80, is inconsistent but being widely used.

– Geocentric gravitational constant (including the mass of the Earth's atmosphere)

$$GM = (398\ 600\ 441.8 \pm 0.8) \times 10^6\,m^3\,s^{-2},$$

[value (3)]

– Mean angular velocity of the Earth's rotation

$$\omega = 7\ 292\ 115 \times 10^{-11}\,rad\,s^{-1}$$

[value (5)]

– Second-degree zonal geopotential (Stokes) parameter (in the zero-frequency tide system, Epoch 1994)

$$J_2 = (1\ 082\ 635.9 \pm 0.1) \times 10^{-9}$$

[value (11)]

– Geoidal potential

$$W_0 = (62\ 636\ 856.0 \pm 0.5)\,m^2\,s^{-2},$$

[value (44)]

– Geopotential scale factor

$$R_0 = GM/W_0 = (6\ 363\ 672.6 \pm 0.05)\,m$$

[value (45)]

– Mean equatorial radius (mean tide system)

$$a = (6\ 378\ 136.7 \pm 0.1)\,m$$

[value (46)]

– Mean polar flattening (mean tide system)

$$1/f = 298.25231 \pm 0.00001$$

[value (23)]

– Mean equatorial gravity

$$g_e = (978\ 032.78 \pm 0.1) \times 10^{-5}\,m\,s^{-2},$$

[value (18)].

Grafarend and Ardalan (1999, 2001) have evaluated a (consistent) normal field based on a unique set of current best values of four parameters (W°, ω, J_2 and GM) as a preliminary "follow-up" to the Geodetic Reference System GRS 80. It can lead to a level-ellipsoidal normal gravity field with a spheroidal external field in the Somigliana-Pizetti sense. By comparing the consequent values for the semimajor and semi-minor axes of the related equipotential ellipsoid with the corresponding GRS-80 axes (based on the same theory) the authors end up with axes which deviate by -40 and -45 cm, respectively from GRS 80 axes and within standard deviations from the current values such as in (21); but no g-values are given until now.

IV *Appendix*

A1. *Zero-frequency tidal distortion in J_2*

$(J_2 = -C_{20})$

$$\delta J_2 = k_s \frac{GM_L}{GM}\left(\frac{\bar{R}}{\Delta_{\oplus L}}\right)^3\left(\frac{\bar{R}}{a_0}\right)^2(E_2+\delta_{2L}) + k_s \frac{GM_S}{GM}\left(\frac{\bar{R}}{\Delta_{\oplus S}}\right)^3\left(\frac{\bar{R}}{a_0}\right)^2(E_2+\delta_{2S}).$$

$$E_2 = -\frac{1}{2}+\frac{3}{4}\sin^2\varepsilon_0,$$

$$\delta_{2L} = \frac{3}{4}\left(\sin^2 i_L - e_L^2\right)+\frac{9}{8}e_L^2\left(\sin^2\varepsilon_0-\sin^2 i_L\right),$$

$$\delta_{2S} = -\frac{3}{4}e_S^2\left(1-\frac{3}{2}\sin^2\varepsilon_0\right),$$

$$\bar{R} = R_0\left(1+\frac{25}{21}v^3 q-\frac{10}{7}v^2 J_2\right)^{1/5}$$

$GM_L = 4\ 902.799 \times 10^9\ m^3s^{-2}$ (selenocentric grav. Const.),
$GM_S = 13\ 271\ 244.0 \times 10^{13}\ m^3s^{-2}$,
$\Delta_{\oplus L} = 384\ 400$ km (mean geocentric distance to the Moon),
$\Delta_{\oplus S} = 1$ AU $= 1.4959787 \times 10^{11}$ m,
$a_0 = 6\ 378\ 137$ m (scaling parameter associated with J_2),
$\varepsilon_0 = 23°26'21.4''$ (obliquity of the ecliptic),
$e_L = 0.05490$ (eccentricity of the orbit of the Moon),
$i_L = 5°0.9'$ (inclination of Moon's orbit to the ecliptic),
$e_S = 0.01671$ (eccentricity of the heliocentric orbit of the Earth-Moon barycenter),
$v = a_0/R_0 = 1.0022729$;
$k_s = 0.9383$ (secular-fluid Love number associated with the zero-frequency second zonal tidal term);
$\delta J_2 = -\delta C_{20} = (3.07531 \times 10^{-8})\ k_s$ (conventional);
$\delta\bar{J}_2 = -\delta\bar{C}_{20}(1.37532 \times 10^{-8})\ k_s$ (fully normalized).
L = Lunar
S = Solar

A2. *Definition*

Because of tidal effects on various quantities, the tide-free, zero-frequency and mean values should be distinguished as follows:

- A tide-free value is the quantity from which all tidal effects have been removed.
- A zero-frequency value includes the indirect tidal distortion, but not the direct distortion.
- A mean tide value includes both direct and indirect permanent tidal distortions.

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References

Ardalan AA, EW Grafarend (2001) Somigliana-Pizetti Gravity – The International Gravity Formula – accurate to the sub-nanoGal level (Manuskript)

Bursa M (1992) The four primary geodetic parameters. Studia geoph. et geod. 36, 199–206

Bursa M (1995) Special Commission 3, Fundamental Constants (SCFC), Report submitted to IAG, IUGG Gen. Ass., Boulder, Travaux IAG, Tome 30, 370–384, Paris 1995

Bursa M, J Kouba, K Radej, SA True, V Vatrt, M Vojtiskova (1997) Monitoring geoidal potential on the basis of Topex/Poseidon altimeter data and EGM 96. Geodesy on the Move, IAG Sci. Ass. Rio de Janeiro, Sept. 3–9, 1997, Springer Verlag 1998, 352–358

Bursa M, K Radej, Z Sima, SA True, V Vatrt (1997) Tests for accuracy of recent Geopotential models. Intern. Geoid Service, Bulletin 6, 167–188, Milano

Bursa M, J Kouba, K Radej, SA True, V Vatrt, M Vojtisková (1998a) Monitoring Geoidal Potential on the Basis of Topex/Poseidon Altimeter Data. Aviso Altimetry Newsletters 6, 130–131

Bursa M, J Kouba, A Muller, K Radej, SA True, V Vatrt, M Vojtiskova (1998b) Determination of Geopotential Differences between local vertical Datums and realization of a world height system. Pres. Symp. IAG, München

Bursa M, GV Demianov, MI Yurkina (1998c) On the determination of the earth's model – the mean equipotential surface. Studia geoph. et geod. 42, 467–471

Bursa M, J Kouba, K Radej, SA True, V Vatrt, M Vojtiskova (1998d) Mean earth's equipotential surface from Topex/Poseidon altimetry. Studia geoph. et geod. 42, 459–466

Bursa M, J Kouba, K Radej, SA True, V Vatrt, M Vojtiskova (1998e) Final Report on testing accuracy of geopotential models EGMX05. EGM 96. Intern. Geoid Service, Bulletin N. 7

Bursa M, J Kouba, M Kumar, A Müller, K Radej, SA True, V Vatrt, M Vojtiskova (1999) Geoidal geopotential and world height system. Studia geoph. et geod. 43, 327–337

Cheng MK, RJ Eanes, BD Tapley (1992) Tidal deceleration of the Moon's mean motion. Geophys. J. Int. 108, 401–409

Defraigne P, V Dehant (1996) Toward new non-rigid Earth nutations. Proc. Journ. de Reference 1995, ed. N. Capitaine, Warsaw, 45–52

Dehant V, M Capitaine (1997) On the luni-solar precession, the tilt-over-mode, and the oppolzer terms. Celest. Mech. (Manuscript in press)

Dehant V, P Defraigne (1997) New nutation for a non-rigid Earth. Proc. Journ. Syst. de Reference, Sept. 1996 Paris, ed. N. Capitaine (Manuscript in press)

Dehant V, N Capitaine, P Defraigne (1997) Comparison between values of the dynamical flattening of the Earth derived from various kinds of observations. Precession J_2 Seismology, Proc. Journ. Syst. de Reference, Sept. 1996 Paris, ed. N. Capitaine (Manuscript in press)

Dickey JO, PL Bender, JE Faller, XX Newhall, RL Ricklefs, JG Ries, PJ Shelus, C Veillet, AL Whipple, JR Wiant, JG Williams, CF Yoder (1994) Lunar laser ranging: a continual legacy of the Apollo program. Science 265, 482–490

Fukushima T (1993) IAU Standards – What's it? Pres. IAG. Gen. Ass. Beijing

Fukushima T (1994) Time ephemeris. Proc. of 26th Symp. on "Cel. Mechanics", Tokyo, Japan, Jan 12-13, eds. H. Kinoshita and H. Nakai, 149–159

Fukushima T (2003) A new precession formula. Astron. J. 126, 494–534

Grafarend E, F Sanso (1984) The multibody space-time geodetic boundary value problem and the Honkasalo term. Geophys. J. R. astr. Soc. 78, 255–275

Grafarend E, AA Ardalan (1997) W_0: an estimate in the Finnish Height Datum N60, epoch 1993.4, from twenty-five GPS points of the Baltic Sea Level Project. Journal of Geodesy, 71: 673–679

Grafarend E, AA Ardalan (1999) The form parameters of the Somigliana-Pizetti level ellipsoid from current best estimates of fundamental geodetic parameters based on a functional analytical review of the Somigliana-Pizetti gravitational field. Submitted to J. Geodesy

Grafarend E, AA Ardalan (1999) World Geodetic Datum 2000. Journal of Geodesy 73: 611–623

Groten E (1994) A comment on fundamental geodetic constants. IAG-SCFC 1991–1995, pres. at IAU General Ass. The Hague

Groten E (1994) Global tidal parameters. Studia geoph. et geod. 38, 221–234

Groten E (2004) Fundamental constants and their implications. Allg. Vermessungsnachr. (in press)

Kinoshita H (1994) Is the equatorial radius of the Earth a primary constant, or a defining constant? Studia geoph. et geod. 38, 2, 109–116

Kopejkin SM (1991) Relativistic manifestations of gravitational fields in gravimetry and Geodesy. Manuscripta Geodaetica, 16, 5, 301–312

Lemoine et al. (1996) The development of the NASA GSFC and NIMA joint geopotential model. Paper presented at IAG Symposium, Tokyo, Sept. 1996, McCarthy DD ed. (1992) IERS Standards. Technical Note 13, Observatoire de Paris

Marchenko AN, OA Abrikosov (1999) Evolution of the Earth principal axes and moments of inertia. J. Geodesy, (in press)

Mathews, PM, TA Herring, BA Buffett (2000) Modelling of nutation-precession: New nutation series for non-rigid earth, and insights into the earth's interior, paper pres. IAU Coll. 180 Washington, D.C. March 2000

McCarthy DD (1996) IERS Conventions

Nerem RS, BF Chao, AY Au, JC Chan, SM Klosko, NK Pavlis, RG Williamson (1993) Temporal variations of the Earth's gravitational field from satellite laser ranging to LAGEOS. Geophys. Res. Let. 20, 7, 595–598

Nerem RS, FJ Lerch, RG Williamson, SM Klosko, JW Robbins, GB Patel (1994) Gravity model improvement using the DORIS tracking system on the SPOT 2 satellite. JGR 99, B2

Nerem RS, FJ Lerch, JA Marshall, EC Pavlis, BH Putney, BD Tapley, RJ Eanes, JC Ries, BE Schutz, CK Shum, MW Watkins, SM Klosko, JC Chan, SB Luthcke, GB Patel, NK Pavlis, RG Williamson, RH Rapp, R Biancale, F Nouel (1994) Gravity model development for TOPEX/POSEIDON: Joint gravity models 1 and 2. JGR 99, C12, 24, 421–24, 447

Nesvorný D, Z Sima (1994) Refinement of the geopotential scale factor R_0 on the satellite altimetry basis. Earth, Moon, and Planets 65, 79–88

NIMA, National Imagery and Mapping Agency (1997) Technical Report TR 8350.2, Third Edition, Department of Defense, World Geodetic System, 1984, Its Definition and Relationships with Local Geodetic Systems

Pavlis, E (2002) Dynamical determination of origin and scale in the earth system from satellite laser ranging. IAG Symposia, Vol 125, Scientific Assembly, Budapest, Hungary, Sept. 2–7, 2001, Springer Verlag, Heidelberg, 36–41

Rapp RH (1987) An estimate of equatorial gravity from terrestrial and satellite data. GRL 14, 7, 730–732

Rapp RH (1993) Geoid undulation accuracy. IEEE Transaction on geoscience and remote sensing 31, 2, 365–370

Rapp RH, Y Yi, YM Wang (1994) Mean sea surface and geoid gradient comparison with Topex altimeter data. JGR 99, C12, 24, 657–24, 667

Ries JC, RJ Eanes, CK Shum, MM Watkins (1992) Progress in the determination of the gravitational coefficient of the Earth, GRL 19, 6, 529–31

Ries JC (1998) Personal communications

Stephenson FR, LV Morrison (1994) Long-term fluctuations in the Earth's rotation: 700 BC to AD 1990. Phil. Trans. Royal Soc. (London) Ser. A

Wang Z, J Kakkuri (1998) The time dependency of gravity potential on the geoid. (Submitted to J. Geodesy)

Williams JG, XX Newhall, JO Dickey (1993) In contributions of space geodesy to geodynamics: Earth Dynamics, eds. DE Smith, DL Turcotte. Geodynamics series 24, AGU, Washington, 83

Williams JG (1994) Contributions to the Earth's obliquity rate, precession and nutation. Astron. J. 108, 2, 711–724

Yan HJ, E Groten (1994) The celestial and terrestrial departure points and their various aspects in geodesy and astrometry. Studia geoph. et geod. 38, 2, 117–130

Yurkina MI (1993) Determination of Stokes' constants respecting zero-frequency tidal term due to the Moon and the Sun. Studia geoph. et geod. 37, 4, 317–325

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nivel.euitto.upm.ed/dict/index.html

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Surveying and Mapping School, 06100 Cebeci, Ankara, Turkey

Technical University of Istanbul, Geodesy and Photogrammetry Department, Ayazaga, Istanbul, Turkey
http://www.itu.edu.tr/FAC/CIE/GEP/GEP.HTML

Yildiz University, Geodesy and Photogrammetry Department, Yildiz, Istanbul, Turkey
Internet: http://www.yildiz.edu.tr/index2.php

United Kingdom

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Internet: http://www.ge.ucl.ac.uk/

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Internet: http://geomatics.ncl.ac.uk/

Department of land Surveying, University of East London, Longbridge Road, Dagenham, Essex RM8 2AS, United Kingdom Phone: (44)-181-590-7722 Fax: (44)-181-590-7799
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Internet: http://www.nottingham.ac.uk/iessg/

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Massachusetts Institute of Technology, Department of Earth, Atmosphere and Planetary Science, 77 Massachusetts Avenue, Cambridge, MA 02139, USA
Internet: http://www.geo.cornell.edu/

Ohio State University, Department of Geodetic Science, 1958 Neil Avenue, Columbus, OH 43210-1247, USA
Internet: geodesy.eng.ohio-state.edu/

Scripps Institution of Oceanography A-25, Institute of Geophysics and Planetary Physics, La Jolla, CA 92093, USA Internet: sio.ucsd.edu/

State University of New York, Geophysics Program, Department of Geological Sciences and Environmental Studies, Binghamton, NY 13902, USA

University of California Los Angeles, Department of Earth and Space Sciences, Los Angeles, CA 90024, USA
Internet: www.ess.ucla.edu/

University of Maine, Department of Surveying Engineering , Boardman Hall, Orono, ME 04469, USA
Internet: http://www.umaine.edu/set/svt/

University of Colorado, Department of Aerospace Engineering and Science, Campus Box 431, Boulder, CO 80309, USA
Internet: http://snowwhite.colorado.edu/

Geodetic Publication Series

Acta Geodaetica, Geophysica et Montanistica Hungarica
Akadémiai Kiadò, H-1117 Budapest,
Prielle K.u. 19-35,
Editorial Office: Geodetical anf Geophysical Resarch Institute, H-9401 Sopron, P.O. Box 5, Hungary
Email: actagg@sun10.ggki.hu

African Geodetic Journal
University of Lagos, Department of Surveying,
Lagos, Nigeria.

Air Force Geophysics Laboratory-Technical Report
Air Force Geophysical Laboratory,
Hanscom AFB, MA 01731, USA

Allgemeine Vermessungs-Nachrichten
H. Wichmann Verlag, Rheinstrasse 122,
7500 Karlsruhe 21, Germany

American Cartographer (The)
American Congress on Surveying and Mapping,
210 Little Falls St., Falls Church,
VA 20046, USA

Annales Geophysicae
Bordas, Dunod, Gauthier-Villars, Paris, France.

Artificial Satellites
Polska Akademia Nauk,
Centrum Badan Kosmicznych 01-237,
Warsawa Ordona 21, Poland.

Australian Journal of Geodesy, Photogrammetry and Surveying
University of New South Wales,
School of Surveying, P.O. Box 1, Kensington,
New South Wales, 2033, Australia.

Australian Surveyor (The)
Institution of Surveying of Australia,
65 York Street, Sidney, Australia.

Bolletin de Informacion
Servicio Geografico del Ejercito,
Dario Gazapo 8, 28024 Madrid, Spain.

Bollettino di Geodesia e Scienze Affini
Instituto Geografico Militare Italiano,
10 Via Cesare Battisti, 50100 Firenze, Italy.

Bollettino di Geofisica Teorica e Applicata
Osservatorio Geofisico Sperimentale,
34123 Trieste, Italy.

Bulletin-American Congress on Surveying and Mapping
American Congress on Surveying & Mapping,
210 Little Falls St., Falls Church,
VA 20046, USA

Bulletin de la Societe Belge de Photogrammetrie-Teledetection et Cartographie
50, Boulevard du Jardin Botanique, B.P. 38,
B-1010 Bruxelles, Belgique.

Bulletin des Journées Luxembourgeoises de Géodynamique
Observatoire Royal de Belgique,
3, Avenue Circulaire, B-1180 Bruxelles, Belgique.

Bulletin d'Information du Bureau Gravimétrique International
B.G.I., 18 Avenue Edouard Belin,
F-31055 Toulouse, France.

Bulletin du Comité Francais de Cartographie
140, rue de Grenelle, 75700 Paris, France.

Bulletin du Groupe de Recherches de Géodésie Spatiale
G.R.G.S., 77, Avenue Denfert-Rochereau,
F-75014, Paris, France.

Bulletin Hydrographique International
Bureau Hydrographique International, 7, Avenue du President Kennedy, B.P. 345, Monaco.

Bulletin of the Earthquake Research Institute
Earthquake Research Institute, University of Tokyo,
Tokyo 113, Japan.

Bulletin of the Geographical Survey Institute
Geographical Survey Institute, Kitasato 1 Yatabe-Machi
Tsukuba-Gum, Ibaraki 300-21, Japan.

Bundesamt für Landestopographie-Bulletin des Rechenzentrums
Federal Office of Topography, Seftigenstrasse 264,
CH-3084 Wabern, Switzerland.

CISM Journal ACSGC
The Canadian Institute of Surveying, Box 5378,
Station F, Ottawa, K2C 3Jl Canada.

Cartographic Journal (The)
British Cartographic Society J.S. Keats, Department of Geography, University of Glasgow W2, Scotland.

Cartographica
University of Toronto Press Inc., 5201 Dufferin Street,
North York, Ontario, M3H 5T8, Canada.

Celestial Mechanics
D. Reidel Publ. Co., Dordrecht, The Netherlands.

Chartered Surveyor-Chartered Minerals Surveyor
The Royal Institution of Chartered Surveyors,
12 Great George Street, London SW7 2AR (U.K.).

Circolari Della Stazione Astronomica Internazionale di Latitudine
Universita di Cagliari, Istituto di Astronomia,
09100 Cagliari, Italy.

Circular Time and Latitude Service
Polish Academy of Sciences, Astronomical Latitude Observatory, Borowiec, 63-120 Kornik, Poland.

Comm. of the Geodetic and Geophysical Research Institute of the Hungarian Academy of Sciences
Research Inst. of the Hungarian Academy of Sciences
Museum U. 6-8, POB 5, H-9401, Sopron, Hungary.

Cospar Information Bulletin
Committee on Space Research, 51 Boulevard de Montmorency, 75016 Paris, France.

Deltion
Service Geographique de l'Armee Hellenique,
S.G.A.H., Pedion Areas, Athens, Greece.

Department of National Development Division of National Mapping Technical Report
Division of National Mapping,
P.O. Box 548, NSW 2620 Queanbeyan, Australia.

Deutsche Geodatische Kommission bei der Bayerischen Akademie der Wissenschaften
Reihe A : Höhere Geodäsie
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Reihe D: Tafelwerke
Reihe E : Geschichte und Entwicklung der Geodäsie
Marstallplatz 8, D-8000 München 22, Germany

Eidgenossische Technische Hochschule Zurich - Institut für Geodäsie und Photogrammetrie - Bericht (Report)
Institut für Geodäsie und Photogrammetrie,
ETH-Honggerberg, CH-8093 Zurich, Switzerland.

Engineering Geodesy
The Kiev Institute of Engineering Construction

EOS-Transactions AGU
American Geophysical Union, 2000 Florida Av.,
Washington D.C. 20009, USA

ESA Bulletin
European Space Agency, 8-10, Rue Mario Nikis,
75738 Paris 15, France.

ESA-Journal
Earth observation Quarterly
European Space Agency, 8-10, Rue Mario Nikis,
75738 Paris 15, France.

European Space Agency Special Publication
European Space Agency, 8-10, Rue Mario Nikis,
75738 Paris 15, France.

Fisica de la Tierra
Editorial Complutense
Cl. Moreto, 3, 28014, Madrid, Spain.

Geodatische Arbeiten Österreichs für die Internationale Erdmessung
Austrian Geodetic Commission, Bundesamt für Eich- und Vermessungswesen, Schiffamtsgasse 1-3, Postfach 50, A-1025 Vienna, Austria

Geodatisch-Geophysikalische Arbeiten in der Schweiz
Schweizerische Geodätische Kommission,
ETH-Honggerberg, CH-8093 Zürich, Switzerland.

Geodatische und Geophysikalische Veroffentlichungen
Nationalkomitee für Geodäsie und Geophysik bei der DDR, 1500 Potsdam, Telegrafenberg A17, Germany

Geodesy and Cartography
The Chief Administration of Geodesy and Cartography under the Council of Ministers of the USSR.

Geodesy and Photogrammetry in Mining
Publisher: the Sverdlovsk Mining Institute.

Geodesy, Cartography and Air-Survey
Publisher: the Lvov Polytechnical Institute.

Geodeticky a Kartograficky Obzor
Spalena 51, 11302 Praha 1, Czechoslovakia.

Geodezia és Kartogràfia
Hungarian Society of Surveying, Mapping and Remote Sensing, *Editorial Office*: H-1860 Budapest, 55,
PO Box 1, Hungary.

Geodezja i Kartografia
Politechnika Warszawska, Instytut Geodezji Wyzszej 1, Koszykowa 75, 00661 Warszawa, Poland.

Geomatica
Canadian Institute of Geomatics, PO VBox 5378, Merivale Depot, Ottawa, Ontario, K2C 3J1, Canada

Geomatics Canada - Geodetic Survey Division - Contract and Technical Reports
Natural Resources Canada, Geomatics Canada
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Géomètre
102, Rue de Charonne, 75011 Paris, France.

Geophysical Journal of the Royal Astronomical Society
The Royal Society, 6, Carlton House Terrace,
London SWl Y 5AG, U.K.

Geophysical Research Letters
American Geophysical Union, 2000 Florida Avenue N.W.,Washington, D.C. 20009, USA

Geophysical Surveys
D. Reidel, Publ. Co., Dordrecht, The Netherlands.

Geophysical Transactions
Eötvös Lorànd Geophysical Institute of Hungary, H-1440 Budapest, P.O. Box 35, Hungary.

Geophysics Division-Report
Department of Scientific and Industrial Research, Geophysical Division, New Zealand.

Geowissenschaftliche Mittelungen
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Gerlands Beitrage zur Geophysik
Akademische Verlagsgesellschaft Geest & Portig K.G., Leipzig, Germany

GPS solutions
Springer Verlag Heidelberg, Tiergartenstr 17
D-69121 Heidelberg, Germany

Harita Dergisi
Harita Genel Komutanligi, 06100 Cebeci, Ankara, Turkey.

IEEE Transactions on Geoscience Electronics
IEEE, 445 Hoes Lane, Piscataway,
New Jersey 08854, USA

IERS Technical Notes
Bureau Central de l'IERS
77, Avenue Denfert Rochereau, 75014 Paris, France.

Improvement of Technology of Topographic and Geodetic Operations
Publisher: the Chief Administration of Geodesy and Cartography under the Council of Ministers of the USSR.

Institut für Geodäsie und Photogrammetrie an der Eidgenossischen Technischen Hochschule Zürich-Mitteilungen
Institut für Geodäsie und Photogrammetrie,
ETH-Honggerberg, CH-8093 Zürich, Switzerland.

Institut Geographique National-Géodésie-
I.G.N., 2, Avenue Pasteur, B.P. 68,
94160 Saint-Mandé, France.

Instituto de Astronomia y Geodesia - Publications
Facultad de Matematicas, Universidad Complutense
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Instituto de Astronomia y Geodesia - Cursos y Seminarios
Facultad de Matematicas, Universidad Complutense
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Istituto di Geodesia e Geofisica dell' Universitã di Trieste-Pubblicazione
Istituto di Geodesia, Via dell Università 7,
34123 Trieste, Italy.

Istituto di Miniere e Geofisica Applicata, Universitã, Pubblicazioni
Piazzale Europa 1, 34127 Trieste, Italy.

ITC Journal
ITC, The Netherlands.

Jenaer Rundschau
VEB Carl Zeiss Jena, Carl-Zeiss-Str. 1, 6900 Jena, Germany

Jet Propulsion Laboratory, California Institute of Technology - Technical Publications
Jet Propulsion Laboratory, 4800 Oak Grove Drive,
Pasadena, CA 91109, USA

Journal of Geodesy
Journal Production Department
Heidelberger Platz 3, 14197 Berlin, Germany
Publisher: Springer-Verlag

Journal of Geophysical Research
American Geophysical Union (AGU),
2000 Florida Avenue N.W.,
Washington, D.C. 20009, USA

Journal of Physics of the Earth
Center for Academic Publications Japan
Yayoi 2-4-16, Bunkyo-ku, Tokyo 113, Japan.

Journal of Spacecraft and Rockets
AIAA Technical Information Service,
750 3rd Avenue, New York NY 10017, USA

Journal of Surveying Engineering
American Society of Civil Engineers, 345 East 47th Street, New York, NY 10017-2398, USA

Journal of the Geodetic Society of Japan
Geodetic Society of Japan,
1 Kitasato, Tsukuba, Ibaraki 305, Japan

Journal of the Wuhan College of Geodesy Photogrammetry and Cartography
Wuhan, China.

Kern Bulletin
Kern & Co. Ltd., CH-5001 Aarau, Switzerland.

Kort-og Matrikelstyrelsen
(National Survey and Cadaster)
Skrifter 4 Raekke (Publications 4 series)

Kort-og Matrikelstyrelsen
Geodetic Division, Technical Reports Rentemestervej 8, DK-2400 Copenhagen NV, Denmark

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Marées Terrestres-Bulletin d'Information
ICET, Observatoire Royal de Belgique,
3, Avenue Circulaire, B-l180 Bruxelles, Belgique.

Marine Geodesy
Crane Russat & Co. Inc., 3 East 44th Street,
N.Y., New York 10017, USA

Maritime Gravimetric Studies
Publisher: the Moscow State University.

Matériaux pour la Geologie de la Suisse-Géophysique
Kummerly & Frey Ltd., Editions géographiques,
CH-3001 Berne, Switzerland.

Methods of Engineering Geodesy in Construction
Publisher: the Rostov Institute of Engineering Construction.

Mining and Geodesy
Publisher: the Leningrad Mining Institute.

Mitteilungen aus dem Institut für Theoretische Geodäsie der Universität Bonn
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Mitteilungen aus dem Institut für Astronomische und Physikalische Geodäsie Technische Universität München
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Mitteilungen des Instituts für Geodäsie und Photogrammetrie an der Eidgenossischen Technischen Hochschule Zürich
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Mitteilungsblatt des Deutschen Vereins für Vermessungswesen (DVW)
Vorstand des DVW, Alexandrastrasse 4,
D-8000 München 22, Germany

Monthly Notes of the International Polar Motion Service
International Latitude Observatory, 2-12 Hoshigaoka
Mizusawa-shi, Iwate-Ken 023, Japan.

Nachrichten aus dem Karten- und Vermessungswesen
Institut für Angewandte Geodäsie, Richard-Strauss-Allee 11, 6000 Frankfurt a.M. 70, Germany

NASA Special Publication
NASA Headquarters, 600 Independance Avenue,
S.W., Washington, D.C. 20576, USA

NASA Technical Papers and Notes & Special Publications
NASA Headquarters, 600 Independance Avenue,
S.W., Washington, D.C. 20576, USA

NASA/GSFC Documents & Technical Memoranda
NASA Headquarters, 600 Independance Avenue,
S.W., Washington, D.C. 20576, USA

National Land Survey-Professional Papers
National Land Survey of Sweden, S-801 82 Gävle,
Sweden.

National Oceanic and Atmospheric Administration-
Manual NOS NGS, Professional Papers, Technical
Memorandum
National Geodetic Survey, NOAA,
6001 Executive Blvd, Rockville, MD 20852, USA

Naval Surface Weapons Center-Dahlgren Laboratory
Naval Surface Weapons Centre (NSWC),
Dahlgren, VA 22448, USA

Navigation
Institut Francais de Navigation, 3, Avenue Octave
Gréard, 75340 Paris Cedex 07, France.

Navigation - Journal of the Institute of Navigation
The Institute of Navigation, Suite 832, 815,
15th Street, N.W., Washington, D.C. 20005, USA

Netherlands Geodetic Commission-Publications on Geodesy-New Series
Netherlands Geodetic Commission,
Thijsseweg 11, 2629 JA Delft, The Netherlands.

New Zealand Surveyor (The)
New Zealand Institute of Surveyors,
Box 831, Wellington, New Zealand.

News of Higher Educational Institutions Series "Geodesy and Air-Survey"
Publisher: the Ministry of Higher and Secondary
specialized Education of RSFSR.

Observatoire Royal de Belgique-Communications-Serie 3-Serie Géophysique
Observatoire Royal de Belgique,
3, Avenue Circulaire, 1180 Bruxelles, Belgique.

Österreichische Zeitschrift für Vermessungswesen und Geoinformation
Schiffamsgasse 1-3, Postfach 50, A-1025 Wien, Austria.

Ohio State University-Reports of the Department of Geodetic Science and Surveying
Department of Geodetic Science and Surveying, 1958 Neil Avenue, 43210 Columbus, Ohio, USA

Ordnance Survey Professional Paper
Ordnance Survey of Great Britain (OSGB), Romsey Road, Maybush, Southampton S09 4DH, U.K.

Periodica Polytechnica - Civil Engineering
Technical University of Budapest
H-1521 Budapest, PO Box 91, Hungary.

Physics of the Earth and Planetary Interiors
Elsevier, Amsterdam, The Netherlands.

Planetary and Space Science
Pergamon Press Ltd., Headington Hill Hall, Oxford OX3 OBW, U.K.

Prace Instytut Geodezji i Kartografii
Polish Academy of Science, Space Research Centre, Department of Planetary Geodesy, Pkin P. 2313, 00901 Warszawa, Poland.

Proceedings of the Central Research Institute of Geodesy, Air Survey and Cartography
Publisher: the Chief Administration of Geodesy and Cartography under the Council of Ministers of the USSR.

Proceedings of the International Latitude Observatory of Mizusawa
International Latitude Observatory, 2-12 Hoshigaoka, Mizusawa-Shi, Iwate-Ken 023, Japan.

Proceedings of the Moscow Institute of Land-Use Engineers
Publisher: the Ministry of Agriculture of the USSR.

Proceedings of the National Astronomical Shternberg Institut
Publisher: the Moscow State University.

Proceedings of the National Research Institute of Geomechanics and Mining Geodesy
Publisher: the Ministry of Coal Industry of the USSR.

Proceedings of the Novosibirsk Institute of Geodesy, Air-Survey and Cartography

Proceedings of the Research Institute of Applied Geodesy
Publisher: the Chief Administration of Geodesy and Cartography under the Council of Ministers of the USSR.

Proceedings of the State Research and Productional Center "Priroda"
Publisher: the Chief Administration of Geodesy and Cartography under the Council of Ministers of the USSR.

Proceedings of the Tomsk State University
Publisher: the Tomsk State University

Proceedings on Geodesy of the Vilnus Institute of Engineering Construction
Publisher: the Vilnus Institute of Engineering Construction.

Procés-Verbaux des Seances de la Commission Géodésique Suisse
Commission Géodésique Suisse, ETH-Honggerberg, CH-8093 Zurich, Switzerland.

Pubblicazioni dell'lstituto di Geodesia, Topografia e Fotogrammetria—Politechnico di Milano
Istituto di Topografia, Fotogrammetria e Geofisica, Piazza Leonardo da Vinci 32, 20133 Milano, Italia.

Publications of the International Latitude Observatory of Mizusawa
International Latitude Observatory, 2-12 Hoshigaoka, Mizusawa-Shi, Iwate-Ken 023, Japan .

Pure and Applied Geophysics (PAGEOPH)
Birkhauser Verlag, Bale, Switzerland.

Reports of the Department of Geodesy
Royal Institute of Technology, S-100 44 Stockholm, Sweden.

Reports of the National Astronomical Shternberg Institute
Publisher: the Moscow State University.

Research in Geodesy, Air-Survey and Cartography
Publisher: the Moscow Institute of Engineers of Geodesy, Air-Survey and Cartography.

Reviews of Geophysics and Space Physics
American Geophysical Union (AGU), 2000 Florida Avenue N.W., Washington, D.C. 20009, USA

Revista Brasileira de Cartografia
Societade Brasileira de Cartografia de Artes Graficas, Rua Riachuelo 128, Rio R5, Brazil.

Revista Cartografica
Instituto Panamericano de Geografia, Ex-Arzobispado n° 29, Mexico 18, D.F., Mexico.

Revue Hydrographique Internationale
Bureau Hydrographique International (BHI-IHB), 7, Ave du Pdt Kennedy, BP 345, 98000 Monaco.

Revista del Catastro e dei Servizi Tecnici Erariali
Rotation and Tidal Deformations of fhe Earth
Publisher: the Institute of Geophysics of the Academy of Sciences of the Ukrainian SSR.

Royal Greenwich Observatory, Time and Latitude Service
Royal Greenwich Observatory, Herstmonceux Castle, Hailsham, Sussex BN27 1 RP, U.K.

Schriftenreihe des Studiengangs Vermessungswesen der Universität der Bundeswehr München
Universität der Bundeswehr München
85577 Neubiberg, Germany

Smithsonian Astrophysical Observatory Special Report
Smithsonian Astrophysical Observatory,
Cambridge, Massachusetts 02138, USA

South African Survey Journal (The)
Central Council of Land Surveyors, Department of Land Surveying, University of Capetown, Private Bag, Rondebosch 7700, South Africa.

Studia Geophysica et Geodaetica
Academy of Sciences, Geophysical Institute, Czech. Acad. Sci., Bocni II Praha 4, Sporilov, Czech Rep.

Suomen Geodeettinen Laitoksen Julkaisuja (Publications of the Finnish Geodetic Institute)
Geodeettinen Laitos Geodetic Institute,
Ilmalankatu lA, SF-00240 Helsinki, Finland.

Suomen Geodeettinen Laitoksen Tiedonantoja (Reports of the Finnish Geodetic Institute)
Geodeettinen Laitos Geodetic Institute,
Ilmalankatu lA, SF-00240 Helsinki, Finlano.

Survey Review
Directorate of Overseas Survey, Kingston Road,
Tolworth Surbiton, U.K.

Surveying and Mapping
American Congress on Surveying and Mapping, 210 Little Falls Street, Falls Church, VA 20046, USA

Tecnica Topografica
Colegio Oficial de Ingenieros Tecnicos en Topografia,
Paseo de la Castellana 210, 28046 Madrid, Spain.

Tectonophysics
Elsevier Scientific Publishing Company,
Amsterdam, The Netherlands.

Tokyo Astronomical Observatory; Time and Latitude Bulletins
Tokyo Astronomical Observatory, Osawa Mitaka,
Tokyo 181, Japan.

Topografia y Cartografia
Colegio Oficial de Ingenieros Tecnicos en Topografia
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University of New South Wales,
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University of Calgary - Publications of the Division of Geomatics Engineering
The University of Calgary, 2500 University Drive N.W., Calgary T2N 1N4, Canada.

University of New Brunswick-Department of Surveying Engineering - Lecture Notes
University of New Brunswick,
P.O. Box 4400, Fredericton N.B. E3B 5A3, Canada.

University of New Brunswick - Department of Geodesy and Geomatics Engineering - Research Reports
University of New Brunswick,
P.O. Box 4400, Fredericton N.B., E3B 5A3, Canada.

University of New Brunswick - Department of Geodesy and Geomatics Engineering - Technical Reports
University of New Brunswick,
P.O. Box 4400, Fredericton N.B., E3B 5A3, Canada.

University of New South Wales-Monographs
University of New South Wales,
School of Surveying, Sydney, Australia.

Vermessung, Photogrammetrie, Kulturtechnik
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Hochschule Aachen

Veröffentlichungen der Bayerischen Kommission für die Internationale Erdmessung
Bayerische Kommission für die Internationale Erdmessung, Marstallplatz 8, 8000 München 22, Germany

Wissenschaftliche Arbeiten der Fachrichtung Vermessungswesen der Universität Hannover
c/o Geodätisches Institut, Nienburger Strasse 7,
3000 Hannover 1, Germany

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