Commission 3 – Geodynamics and Earth Rotation

http://www.earthsciences.osu.edu/IAG-C3

President: Michael Bevis (USA)
Vice President: Richard Gross (USA)

Structure

Sub-commission 3.1:	Earth Rotation and Earth Tides
Sub-commission 3.2:	Tectonic Deformation
Sub-commission 3.3:	Geophysical Fluids
Sub-commission 3.4:	Cryospheric Change and Earth Deformation
IC Project 3.1:	Global Geodynamics Project (GGP)
IC Project 3.2:	Working Group of European Geoscientists for the Establishment of Networks for Earth Science Research (WEGENER)

Overview

The main innovations in the structure of Commission 3 were the generalization of terms of reference of sub-commission 3.1, so that it now addresses earth rotation as well as earth tides, and initiation of an entirely new sub-commission, 3.4, which focuses on earth deformation associated with the changing loads imposed upon our planet by changes in the cryosphere. This latter topic might seem to be a subset of the subject area addressed by sub-commission 3.3, which focuses on 'geofluids' and earth's various responses to the mass fluxes associated with these fluids. However, in practice the geodesists studying glacial isostatic adjustment and also elastic adjustments near present-day ice sheets tend to have a rather different set of shared interests. Sub-commission 3.2 now focuses mainly on *tectonic* deformation, which nevertheless constitutes a very broad subject area.

Sub-Commission 3.1: Earth Rotation and Earth Tides

President: Gerhard Jentzsch (Germany)
Vice-President: Spiros Pagiatakis (Toronto)

During the IUGG General Assembly in Perugia, 2007, Gerhard Jentzsch was asked to continue his presidency. And again, Gerhard Jentzsch asked Spiros Patiatakis to become Vice-President of this Sub-Commission. Since Olivier Francis did not want to continue as Secretary we decided that we would pass on without nominating a secretary.

1. Symposium on New Challenges in Earth Dynamics, including the 16th International Symposium on Earth Tides, together with the other two sub commissions

Because of the re-organization the old 'Earth Tide Commission' was renamed and the scope was extended to 'Earth Rotation and Earth Tides'. The new definition and the development of the terms of reference covered the first months after the IUGG 2007. A main task was the preparation of the 16th International Symposium on Earth Tides to be held in Jena in September 2008 together with the other Sub-Commissions of Commission 3 and including inter-commission projects and study groups. The symposium was a successful event: 116 colleagues from 24 countries took part. The motto of the symposium was "New Challenges in Earth Dynamics". During the symposium, the Earth Tide Commission Medal was awarded to two well known colleagues:

Bernard Ducarme and Tadahiro Sato

The documents as well as the nominating essays written by Walter Zürn for Tadahiro Sato and David Crossley for Bernard Ducarme are published in volume 144 of the Bulletin d'Information Marées Terrestres. This was the third and last time this medal was awarded: The name of the commission has changed, and, thus, the name of the medal has to be changed as well (see below).

The proceedings were split up in two parts: The *first part* contains speeches, reports and organizational details as well as the resolutions and some papers collected for the Bulletin d'Information Marées Terrestres; the first volume no. 144 was already published in December 2008, and at least another one will follow. The *second part* of the proceedings will contain papers suitable for the Journal of Geodynamics; a special volume containing about 40 papers is under preparation. The papers and all the material are now under discussion with the publisher. We expect that the special volume will be published before the end of the year.

Another task was the move of the International Center for Earth Tides to another place, because the Royal Observatory of Belgium did not agree to continue to host ICET after Bernard Ducarme's retirement at the end of 2007. After discussions with several potentially interested institutions, during the last meeting of Sub-Commission 3.1 in Perugia, 2007, it was decided to accept the offer of the University of French Polynesia, Tahiti, to host ICET; Jean-Pierre Barriot will be the responsible scientist.

In connection with ICET we also had to discuss the future of the GGP data base as an integral component of the IAG GGOS program: There exists a cooperation agreement between ICET and GFZ – Potsdam to host and maintain this data base within the GFZ/ISDC. But after some changes involved colleagues have some concerns about the future support. Therefore, during the last symposium Gerhard Jentzsch was asked to discuss the matter with the president of GFZ or the management board. Up to now several letters were written, but without answer.

We hope to receive at least some information before the IAG will start – to be reported during the splinter meeting of Sub-Commission 3.1.

The resolutions touch different topics:

1. The Earth Tide Commission Medal should be renamed as *Paul Melchior Medal* to acknowledge first the fact that the Earth Tide Commission does not exist any more under this name. More important are the tremendous activities Paul Melchior put into the development of tidal research, especially his activities world-wide, to name this medal after him.
2. The next symposium to be held in Egypt in 2012 (invited by the National Research Institute for Astronomy and Geophysics) should also combine all sub-commissions and inter-commission committees.
3. One scientific point concerns the estimation of ocean tide models which often give the tide height only. Since also the angular momentum of tidal currents is needed to model tidal effects, in future beside tide heights also barotropic tidal currents should be taken into account.
4. Organisational points concern the Global Geodynamics Project (GGP): Its transition from an Inter-Commission project to an IAG Service should be discussed to prepare a proposal to be decided during the next IUGG (2011). Second, the running of the GGP data base should cover several tasks for the benefit of the community of users, like standardisation to 1-minute data, calibration history of the SGs, and providing corrected 1-minute data as well as the results of the tidal analyses to all users.

2. Working groups of SC3.1

The SC3.1 has three working groups which continued during the period 2005-2009:

- Earth Tides in Geodetic Space Techniques, co-chaired by H. Schuh and Wu Bin,
- Analysis of Environmental Data for the Interpretation of Gravity Measurements, chaired by C. Kroner,
- Precise Tidal Prediction, chaired by Y. Tamura

3. Future work

The future work will have two foci:

1. First, we will have to support the new International Center to help to develop its new feature following modern needs and using the available digital and internet facilities. Here, we have to consider that Tahiti is quite far away and not so easy to access like Brussels was.
2. The second focus is the next symposium: It will be the first symposium in Afrika, and a small but quite active group in Cairo will be responsible (of course supported by the National Research Institute for Astronomy and Geophysics). With this symposium in Egypt we hope to advertise for research in geodynamics and long-period crustal dynamics, also in countries not so involved up to now.

Sub-Commission 3.2: Tectonic Deformation

President: Markku Poutanen (Finland)
Vice-President: Jeffrey Freymueller (USA)

Home page: http://iagsc32.fgi.fi/

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. This include the entire range of tectonic phenomena including plate tectonics, intraplate deformation, the earthquake deformation cycle, aseismic phenomena such as episodic tremor and slip, and volcanic deformation. The time scales range from seconds to years 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.

One of the key issues nowadays is the definition and stability of global and regional reference frames. Tectonic deformations in all time and spatial scales as well as mass transfer will affect reference frames. The work done in SC3.2 will deal in information essential to the reference frames.

Events during the period 2007-2009

The Commision 3 of the IAG together with sub-commissions on Earth Tides (3.1), Crustal Deformation (3.2), Geophysical Fluids (3.3) and the Global Geodynamics Project (GGP) organized for the first time a joint meeting in Jena, Germany, September 1-5, 2008. It included the 16th International Symposium on Earth Tides. The assembly provided a unique opportunity to exchange new results and strategies to meet the current challenges of Earth's dynamics from different viewpoints.

Subcommission 3.2 was responsible of plans and arrangements of one session, as well as arranging the review of papers in session submitted for the proceedings. There will be a special issue in Journal of Geodynamics, to be published in 2009. A non-reviewed publication will appear in the series of Bulletin d'Information Marées Terrestres.

The Global Geodetic Observing System (GGOS) of the International Association of Geodesy (IAG) and the International Lithosphere Program (ILP) Regional Co-ordination Committee

DynaQlim organized a joint workshop "Understanding Glacial Isostatic Adjustment" in Espoo, Finland June 23-26, 2009. Local Organisers were the ILP National Committee, and DynaQlim, IAG Subcommission 3.2. Tectonic deformations, Finnish Geodetic Institute, Geological Survey of Finland, and University of Helsinki. The objective of the workshop was to review the current state of the science in modeling glacial isostatic adjustment, to review the use of geodetic measurements to both constrain and to test GIA models, to identify obstacles to improving GIA models, and to identify the improvements to the global geodetic observing system that are required to advance our understanding of glacial isostatic adjustment.

The major outcome of the workshop will be a report summarizing the current state of the science, a description of future research directions, and a description of the future observations that are needed to improve our understanding of glacial isostatic adjustment. The proceedings will be published in the Physics and Chemistry of the Earth, in 2010. For more details see http://DynaQlim.fgi.fi.

Related Working Groups and Associates

During the period 2003-2007, there existed a sub-group Geodynamics of the Central Europe, chaired by Janusz Sledzinski (Poland). Co-operation with this group will be continued. Till 2008 the programme of activities of the IAG Permanent Working Group „GEODYNAMICS OF CENTRAL EUROPE" was coincided and overlapped with very active actions performed by the Section C „Geodesy" of the WG „Science and Technology" of the Central European Initiative (CEI). In 2008 CEI has abolished all the working groups and the IAG WG has to work without any support of CEI. The formal membership list of the IAG WG includes 27 scientists from 12 European countries. The activities of the IAG WG concentrated on the following subjects:

Geodetic and geodynamic programmes

European programmes:

CERGOP = Central Europe Regional Geodynamics Project;

CEGRN = (Central European GPS Reference Network) Consortium,

Local geodynamic projects (projects realised by the subgroups of the CERGOP Study Group CSG.5 "Geotectonic Analysis of the Region of Central Europe") they concern the following regions: Eastern Alps and the North and Eastern Adriatic Sea, Romania Plate; Pannonian Basin; Plitvice Lakes, Croatia; Tatra Mountains; Northern Carpathians; Balkan Peninsula.)

Cooperation CEI Section C "Geodesy"– European Geophysical Society (EGS) / European Geosciences Union (EGU).

A more detailed report will be posted on the SC3.2 web page.

Close contacts with the "Working group of European Geoscientists for the Establishment of Networks for Earth science Research" (WEGENER) will be continued.

An ILP (International Lithosphere Program) Regional Co-ordination Committee CC 1/5 DynaQlim (Upper Mantle Dynamics and Quaternary Climate in Cratonic Areas, chaired by Markku Poutanen) established in 2007 will link SC3.2 geodetic studies in other disciplines like geology, geophysics and seismology. The ILP is charged with promoting multidisciplinary research projects of interest to both the geological (IUGS) and geophysical (IUGG) communities. Joint GGOS/DynaQlim workshop (June 2009) is described above.

Sub-Commission 3.3: Geophysical Fluids

President: Aleksander Brzezinski (Poland)
Vice-President: Mike Thomas (Germany)

Terms of Reference

Charter
Mass transport in the atmosphere-ocean-cryosphere-mantle-core system, or the "global geophysical fluids", cause observable geodynamic effects on broad time scales. 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 of the Earth's dynamic response. Angular momenta and the related torques, gravitational field coefficients, and geocenter shift for all geophysical fluids are the relevant quantities. They are studied theoretically and are observed using global-scale measurements and/or products from state-of-the-art models, some of which assimilate such measurements.

Objectives
The objective of the Sub-Commission is to serve the scientific community by supporting research and data analysis in areas related to variations in Earth rotation, gravitational field and geocenter caused by mass transport in the geophysical fluids, which include the atmosphere, ocean, continental water, mantle, and core along with geophysical processes associated with ocean tides and the hydrological cycle.

The Sub-Commission is aware that its objectives overlap with the objectives of the IAG Global Geodetic Observing System (GGOS) with its central theme "Global deformation and mass exchange processes in the Earth system" and the following areas of activities
- deformation due to the mass transfer between solid Earth, atmosphere, and hydrosphere including ice;
- quantification of angular momentum exchange and mass transfer.

Program of Activities
Sub-Commission 3.3 follows the program defined by Commission 3. In addition, SC 3.3 interacts with the sister organizations and services, particularly with the Global Geophysical Fluids Center (GGFC) of the International Earth Rotation and Reference Frames Service (IERS) and its eight Special Bureaus: for the Atmosphere SBA, Oceans SBO, Tides SBT, Hydrology SBH, Mantle SBM, Core SBC, Gravity/Geocenter SBGG, Loading SBL. Due to the overlapping of the tasks, SC 3.3 should also have close contacts to the GGOS activities.

Report on Activities 2007-2009

The Sub-Commission 3.3 participated, together with the Sub-Commissions 3.1 "Earth Rotation and Earth Tides", 3.2 "Crustal Deformation", and the Inter-Commission Global Geodynamics Project (GGP), in organization of the Earth Tide Symposium 2008 "New Challenges in Earth's Dynamics" in Jena, Germany, 1-5 September 2008. This joint symposium was an important event strengthening interactions between these 3 Sub-Commissions and the GGP. The Organizing Committee of ETS2008 decided to continue the idea of joint symposium with the next ETS, to be held in Egypt.

Important exchanges of information at meetings occurred at the IERS Workshop in Sevres, France, at the conferences of the series Journées Systèmes de Référence Spatio-Temporels, 2007 in Meudon, France, and 2008 in Dresden, Germany, at the American Geophysical Union meetings, and the European Geosciences Meeting, Vienna, where special sessions were held on "Observing and understanding Earth rotation variability and its geophysical excitation" (2008, 2009), "Geophysical models for the analysis of space-geodetic techniques" (2008) and "Geodetic observations: model advances and time series effects" (2009).

There has been considerable development of the global circulation models of geophysical fluids in recent years. Progress has been attained in modelling the atmospheric circulation, examples being new reanalysis model ERA40 and an experimental model with hourly resolution (Salstein et al., 2007). The IERS Special Bureau for the Atmosphere www.aer.com/scienceResearch/diag/sb.html continues its effort to provide atmospheric data relevant to the study of the Earth's variable rotation. The time series are updated on regular basis and are available in near-real time. The IERS Special Bureau for the Oceans http://euler.jpl.nasa.gov/sbo/ provide data relating to non-tidal changes in oceanic processes such as the global Ocean Angular Momentum (OAM) mass and motion terms. The OAM series based on the ECCO ocean global circulation model are updated up to the recent months and are available for users in two versions, derived by analysis with and without data assimilation. The user should be aware of the fact that the OAM series based on the model with data assimilation, which should be better than the standard series, in general, appear to be corrupted by the tidal effects which have not been removed perfectly form the satellite altimetry observations; see (Gross, 2009) for details. The IERS Special Bureau for the Hydrology www.csr.utexas.edu/research/ggfc/ provides data sets and numerical model results related to the changing distribution of water over the planet, especially over land. Other important data sets concerning the influence of geophysical fluids on the Earth's dynamics are provided by the GGFC www.ecgs.lu/ggfc/ and the remaining special bureaus SBT, SBM, SBC, SBGG, and SBL. It should be noted here that the GGFC will be reconstituted soon. The IERS Directing Board released in May 2009 a Call for Proposal emphasizing the renewal of existing operational products and inclusion of new operational products.

One important problem in estimation of the influence of external fluid components, the atmosphere, the oceans and the land hydrology, on Earth rotation and other geodynamical phenomena is associated with the inconsistencies in the treatment of mass conservation problem in models of those components; see the report of Maik Thomas below for further details. The results obtained from the satellite Gravity Recovery and Climate Experiment (GRACE) are of crucial importance for solving this problem. This experiment measures changes of the Earth's gravity field with monthly time resolution. From the GRACE observations one can estimate the mass redistribution on the planet surface including contribution from the three components mentioned above. Some recent results comparing results using GRACE data and those based on outputs of the available models of geophysical fluids (e.g., Nastula et al., 2007; Brzezinski et al., 2009) are quite promising.

Below we present brief reports provided by the members of the Sub-Commission 3.3: related research projects in Germany (Mike Thomas), concerning the modelling of the atmosphere (David Salstein), the oceans (Rui Ponte), and the gravity and geocenter (Erricos Pavlis).

Report on research concerning geophysical fluids (Maik Thomas, Germany)
In order to consistently represent mass transports in the global hydrological cycle and to estimate variations in global geodetic parameters due to water mass redistributions a model combination for the atmosphere-hydrosphere system has been established at the German

Centre for Geosciences (GFZ). The model combination consists of the hydrological land surface discharge model (LSDM; Dill, 2008) and the ocean model for circulation and tides (OMCT). Both models are consistently forced with operational data from the European Center for Medium Weather Forecasts (ECMWF). The ECMWF-LSDM-OMCT model combination is running on a daily operational basis producing global mass variations, Earth rotation parameters, and gravity field variations in near real time.

In close cooperation with the German research unit "Earth rotation and global dynamic processes" an Earth system model for physically consistent simulations of atmospheric, oceanic and hydrological induced variations of Earth rotation, deformation and gravity field has been developed in a research project supported by DFG with participating German scientists from geodesy, meteorology and oceanography (Hense et al., 2009). The dynamical system model couples numerical models of the atmosphere, of ocean tides and circulation as well as of continental discharge considering consistent mass, energy and momentum fluxes between these near-surface subsystems of the Earth in order to allow for explanations and interpretations of geodetically observed variations of global parameters of the Earth.

Report on research concerning the atmosphere (David Salstein, USA)
During this period we continued the archives of the atmospheric angular momentum series at the IERS Special Bureau for the Atmosphere. We used GRACE and other gravity and hydrological data as information for excitations of polar motion by hydrology, supplementing the other geophysical fluids (Nastula et al., 2007). We examined the high frequency series from hourly fields using an experimental series from U.S. NASA (Salstein et al., 2007). We assessed the quality of data sets including the surface pressure for various geodetic applications, including surface pressure fields needed for the GRACE mission (Salstein et al., 2008). We analyzed the partition between tropospheric and stratospheric angular momentum series, and found a negative correlation between the angular momentum in these two regions (Zhou et al., 2008). Lastly, we partitioned the regional excitations of polar motion, due to equatorial atmospheric angular momentum into their temporal bands, and discovered where the atmospheric impact has the greatest variability on polar motion. (Nastula et al., 2009).

Report on research concerning the ocean (Rui Ponte, USA)
Among the activities pursued in the period 2007-2009, we have continued to produce global estimates of the ocean circulation and mass fields need for calculation of ocean angular momentum (OAM) and related quantities, in collaboration with our ECCO partners (Wunsch et al., 2009). Other efforts were focused on evaluating the quality of available atmospheric pressure fields (Salstein et al., 2007) and including their effect on ocean circulation estimates (Ponte and Vinogradov, 2007), and on using GRACE data for assessing and improving the quality of OAM variables (Nastula et al., 2007; Ponte et al., 2007; Quinn and Ponte, 2008). Observations from GRACE also permitted a new study of how wind stress torques are balanced quickly by bottom pressure torques acting on bottom topography (Ponte and Quinn, 2009). The potential importance of sea level observations for determining the oceanic mass fields was studied in detail by Vinogradova et al. (2007).

Report on research concerning the gravity/geocenter (Erricos Pavlis, USA)
My main contribution to SC 3.3 is in the development and maintenance of time series of "geocenter" variations with respect to each ITRF. A series is updated weekly with a new vector estimate referenced to the middle of the week, based on the analysis of LAGEOS 1 & 2 and ETALON 1 & 2 satellite laser ranging (SLR) data. We simultaneously solve for the second-degree terms of the gravitational field, so series of those harmonics are also available for the same time period. Up until a year ago the series were still with respect to ITRF2000.

However, with the reanalysis of all SLR data since 1983 in view of the ITRF2008 project, a new series was obtained which is referenced to ITRF2005S (i.e. the version of ITRF2005 that has the correct scale).

Another area of contribution is the improved modeling of geodetic data used to monitor geophysical fluids and their motions. An area that required improved models for increased accuracy SLR analyses was that of the atmospheric delay modeling. The 1973 model used up until recently has now been replaced by a model that was derived in part to support the above activities and it has been adopted by the ILRS and IERS as the standard for optical wavelengths (Pavlis et al., 2008). Going further, we have now established an approach (Hulley and Pavlis, 2007) that utilizes meteorological fields to more accurately approximate the atmospheric delay with data beyond the observing SLR station and to account for horizontal atmospheric gradients.

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Sub-Commission 3.4: Cryospheric Change and Earth Deformation

President: James Davis (USA)
Vice-President: Detlef Wolf

Introduction

The creation of Subcommission 3.4 (Cryospheric Change and Earth Deformation) is new for 2007–2009, and is intended to focus on those methods and techniques in Geodesy that focus on the deformational response of the Earth to changes in glacier mass balance. This area is thus an important component of the geodesy of the Earth system. Although, for consistency's sake, there is some minor overlap with other subcommissions, the focus on Earth deformation brings in a host of geodetic methods and techniques, including ground-based space geodetic observations for local and regional deformational studies, InSAR, and others.

The members' activities are a mixture of observational and theoretical, covering short-term (i.e., ongoing melting) and longer-term (i.e., glacial isostatic adjustment) soli-Earth response to cryospheric changes. (See also the Terms of Reference, below.) Members of the subcommission include: J. Davis, R. Dietrich, P. Elósegui, H. Geirsson, E. Ivins, S. A. Khan, M. King, O. Kristiansen, G. A. Milne, I. Sasgen, D. Wolf, and X. Wu.

Terms of Reference

Past and present changes in the mass balance of the earth's glaciers and ice complexes induce present-day deformation of the solid earth on a range of spatial scales, from the very local to global. The earth's deformational response to cryospheric change is complex due to a number of factors, including: complexities in the viscoelastic structure of the earth; the spatial and temporal variability of the mass changes; and the interaction between the cryosphere and the ocean, which lead to a redistribution of cryospheric mass in a highly dynamic system. These complexities pose both observational and modeling challenges. The purpose of Subcommission 3.4 is to promote, and where appropriate, to help coordinate research involving geodetic observation and modeling of earth deformation due to past and ongoing cryospheric changes, with emphasis on present-day deformation taking place in the near field of existing ice sheets and glaciers and the extent to which this deformation is a response to climate change.

Activities 2007–9

GIA Observation and Modeling
The modeling of glacial isostatic adjustment (GIA) is becoming more complex as both the Earth models [e.g., Klemann et al, 2008] and ice history [e.g., van den Berg et al., 2008; Milne et al., 2008] evolve. At the same time, new geodetic observations are acquired and new methods for extracting the geodetic information are being developed [e.g., Tamisiea et al., 2007; Hill et al., 2008; Tamisiea et al., 2008]. Observations continue to be used to test and assess available GIA models [e.g., Khan et al., 2008].

Present-day mass glacier mass changes and GIA
One of the most difficult tasks facing us is the separation of present-day mass changes and GIA signals. Several studies use combinations of observations [e.g., Dietrich et al., 2008; Sasgen. et al, 2008] to approach this issue. During this period, the GRACE data set achieved much attention, and was used alone or in combination with ground-based data sets to study

GIA or separate GIA from present-day effects [e.g., Boehm et al, 2008; Dietrich et al., 2008; Ivins and Wu, 2008; Ivins et al., 2008; Sasgen et al, 2007a; Sasgen et al, 2007b; Sasgen et al, 2008].

Deformation due to present-day glacier melting

Ground-based observations on regional or local scales presented us with new specific information on the mass balance of glaciers and how they are impacted by the climate [e.g., Árnadóttir et al., 2008; Khan et al., 2007; Khan et al., 2008; Pagli et al., 2007]. Of great importance is the POLENET project [Wiens et al., 2007]. Now called Anet (Antarctic network), the network consists of 25 GNSS sites in Antarctica. Its "antipodal sister" is Gnet, consisting of 45 GNSS sites.

Relevant publications and talks by subcommittee members

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Inter-Commission Project 3.1: Global Geodynamics Project (GGP)

D. Crossley and J. Hinderer

Recent Reports
GGP recently submitted a report (12 June 2009) to Leonid Vitushkin for inclusion in his Report of Subcommission 2.1 (Gravimetry and Gravity Networks). There have been no significant developments over the summer, so that report is also the basis for this document, with some new details.

GGP Newsletter #19.
The scientific status of the GGP network was thoroughly reviewed in GGP Newsletter #19, attached to this report, and available online at: http://www.eas.slu.edu/GGP/ggpnews19.pdf. Also distributed was a separate Newsletter (#19a) to Station Managers concerning the upgrading of information regarding stations and instruments http://www.eas.slu.edu/GGP/ggpnews19a.pdf. This upgrading of GGP information is timely considering the possibility that GGP may become a more formal IAG service.

Key Points

1. Of particular relevance to IAG (through Commissions 2 and 3) was the distribution of a Questionnaire in May to all GGP members asking their opinion of a plan to recast GGP as an IAG service. The outcome of the survey was positive – there were no objections from GGP members concerning the proposed change.

2. We, together with Corinna Kroner (GFZ, Potsdam; FSU Jena), are therefore pursuing a formal request to IAG for consideration at the upcoming IAG General Assembly in Buenos Aires. We are sending a short proposal to selected IAG representatives for consideration at the appropriate meeting, asking advice for how to proceed with the transition.

3. GGP was happy to learn from Herbert Wilmes about the merger of the Agrav database with the pre-existing BGI absolute gravity service. Because of the strong connections within BKG (the home of Agrav) between GGP and absolute gravimetry, the merger is consistent with the proposed move of GGP towards an IAG Service. Ultimately both directions should support the goals of GGOS.

4. GGP is very concerned in the apparent hiatus at GFZ Potsdam over making decisions that are necessary to support Bernd Ritschel and colleagues at the ISDC. Note, however, we have not been updated in this respect since May, 2009. Ritschel has done an outstanding job in the last decade of providing the functionality for the GGP database, as a service to ICET, and we hope that he will receive the necessary high-level support from GFZ management. Any influence within IAG to resolve the problem is welcome.

5. Progress in realizing a new online ICET database at Tahiti has been slow, but we are assured by Jean-Pierre Barriot (University of French Polynesia) that by later this year he will have reinstated the important aspects of the previous ICET operations at ROB (Brussels, under B. Ducarme). The physical remoteness of the ICET operation is obvious, but the lack of communication with Jean-Pierre is in contrast with the style of the previous Director of ICET.

6. The flow of GGP data to the ICET/ISDC database has slowed significantly in the last year or two. Many new sites have been started, particularly in Asia, but frequently they have not sent data. Consequently, as some stations have been retired the overall volume of GGP has decreased. This we believe to be partially a question of the inexperience on the part of the new SG groups in gravimetry, as well as other factors such internal restrictions on data release (e.g. in India). GGP is working to resolve these problems.

7. One new station in Europe (Pecny, Czech Republic) has recently come under threat of government closure due to economic hardship. This is one of our best new stations and has been very well managed by our colleague Vojtech Palinkas. GGP has sent a letter of support of this station to the Czech authorities.

Inter-Commission Project 3.2: Working Group of European Geoscientists for the Establishment of Networks for Earth Science Research (WEGENER)

Chair: Susanna Zerbini (Italy)

Members

B. Ambrosius (Netherlands), A. ArRajehi (Saudi Arabia), L. Bastos (Portugal), M. Becker (Germany), R. Bingley (United Kingdom), C. Bruyninx (Belgium), L. Combrinck (South Africa), J. Dávila (Spain), J. LaBrecque (USA), S. Mahmoud (Egypt), T., Mourabit (Morocco), J.M. Nocquet (France), M. Pearlman (USA), R. Reilinger (USA), F. Rocca (Italy), W. Spakman (Netherlands), S. Stein (USA), S. Tatevian (Russia), K. Yelles (Algeria), S. Zerbini (Italy).

Representative of Commission 1: Alessandro Caporali (Italy)
Representative of Commission 3: Tonie van Dam (Belgium)

Terms of reference

The evolution of geodetic techniques in the past decade, with unprecedented achievements in the precise detection and monitoring of 3D movements at the millimeter level has opened new prospects for the study of Earth kinematics and hence dynamics. However, those achievements also raised new issues that have to be properly taken into account in the processing and analysis of the data, demanding a careful inter-disciplinary approach.

Areas in Europe, primarily in the broad collision zone between Europe, Africa and Arabia, provide natural laboratories to study crucial and poorly understood geodynamic processes. These have been systematically monitored in the last decade by different research groups using a variety of space geodetic and other techniques. However, in general data analysis has been done from the perspective of one discipline and processing procedures have not always followed a standard approach.

The existence of these geodata, never completely explored, justifies a new insight by using a really integrated approach that combines data from different observational techniques and input from other disciplines in the Earth Sciences. This should lead to the development of interdisciplinary work in the integration of space and terrestrial techniques for the study of the Eurasian/African/Arabian plate boundary deformation zone, and adjacent areas, and contribute to the establishment of a European Velocity Field.

With that purpose it is important to promote stronger international cooperation between Earth-Scientists interested in the study of that plate boundary zone. Towards that goal the WEGENER project aims to:

- Actively encourage the cooperation of all geoscientists Eurasian/African/Arabian plate boundary deformation zone, by promoting the exploitation of synergies;
- Be a reference group for the integration of the most advanced geodetic and geophysical techniques by developing the adequate methodologies for a correct data integration and interpretation;
- Act as a forum for discussion and scientific support for geoscientists from all over the world interested in unraveling the kinematics and mechanics of the Eurasian/African/Arabian plate boundary deformation zone;

- Promote the use of standard procedures for geodetic data, in particular GPS data, quality evaluation and processing.

The need to involve different research areas demands for collaboration with different IAG Commissions and in particular with Commission 1 and Commission 3. Commission 1 is responsible for regional and global reference frames, for the coordination of space techniques and for satellite dynamics. WEGENER can contribute significantly to each one of these areas and, in particular, to regional and global reference frames by making available, in its study area, quality-tested regional data sets acquired with different space and terrestrial techniques, as well as relevant quality-tested solutions. Additionally WEGENER can contribute by carrying out studies, already being developed by WEGENER member groups, on the definition of effective integrated observational strategies. Commission 3, is responsible for earth rotation and geodynamics. WEGENER will provide its main contribution in the field of geodynamics by studying, regionally, both short and long-term crustal motions.

Objectives

The primary goals of the WEGENER project are to:
- Provide a framework for geodetic/geophysical/geological cooperation in the study of the Eurasian/African/Arabian plate boundary zone;
- Foster the use of space-borne, airborne and terrestrial hybrid techniques for earth observation;
- Define effective integrated observational strategies for these techniques to reliably identify and monitor crustal movements and gravity field variations over all time-scales;
- Facilitate and stimulate the integrated exploitation of data from different techniques in the analysis and interpretation of geoprocesses;
- Organize periodic meetings with special emphasis on interdisciplinary research and interpretation and modeling issues;
- Reinforce cooperation with African and Arabian countries and colleagues, which can both contribute to understanding the kinematics and dynamics of the Eurasian/African/Arabian plate boundary zone and promote the growth of such research in these countries.

Activities

- A GEO Data and Analysis Center (GEODAC) has been established at the University of Porto (http://geodac.fc.up.pt). The main objective of GEODAC is to provide a platform to the whole interested scientific community for European GPS and geo-data data archiving/linking, reprocessing of old data series in a unique reference frame, and an open data bank which will include, when available, environmental parameter series. Examples of some specific GEODAC functionalities are the computation of atmospheric loading corrections for stations that are not provided by the IERS Special Bureau for Loading, and realistic error bars for the trends in continuous GPS data analysis.
- In fall 2008, a large proposal entitled PLEGG (Platform for European GNSS Geo-products) was submitted to the EU to respond to the call FP7-INFRASTRUCTURES-2007-1. This project aimed at the integration of existing European initiatives, experiences and know-how by implementing a coordinated single e-infrastructure for an easy access of a wide user community of European researchers to high quality GNSS data, products and services. The proposal was submitted by a team of 13 European groups, 11 of which are actively involved in WEGENER since many years. The proposal coordinator is the University of Porto (Portugal). The project was recommended for funding although, due to limited budget, was not supported. A new submission is being prepared.

- Standards for GPS networks establishment, data acquisition and guidelines for data processing and reliability checks have been defined;
- Strategies for a full exploitation of different geodata (GPS, gravimetry, seismic, etc.) have been defined;
- WEGENER members actively fostered the co-operation with the African countries in the framework of AFREF (AFrican REference Frame) and other specific scientific projects. Such collaborations extend to the entire continent since that it is necessary to understand the geodynamics of the different African tectonic units (Nubia, Somalia and other blocks in the East African Rift) in order to properly constrain the interaction between these tectonic plates with Eurasia and Arabia In this respect, new GNSS stations have been installed in several countries by the WEGENER community (e.g., Ethiopia, Morocco, Egypt, Cape Verde, S. Tomé e Príncipe, Malawi, Tanzania, Mozambique, Mauritius). In addition, WEGENER members are collaborating with AFREF Scientific Committee in the definition and implementation of procedures to compute the first AFREF solution.
- In the framework of the IAG GGOS project, WEGENER contributes to the activities of subtask DA-09-02-c (Global Geodetic Reference Frames) of the Group on Earth Observations (GEO).
- Every two years General Assemblies are organized to serve as a high-level international forum, in which scientists from all over the world can discuss multidisciplinary interpretation of geodynamics, and strengthen the collaboration between Countries. The last two conferences were hosted by Géosciences Azur, CNRS-University of Nice on September 4-7, 2006, in Nice (France) and by the Institute of Physical Geodesy at the Conference Center of the Technische Universitaet Darmstadt on September 15-18, 2008 (http://www.ipg.tu-darmstadt.de/projekte/wegener2008/home/index.de.jsp). The next Assembly will be held in Istanbul, Turkey, in September 2010 and will be hosted by the Istanbul Technical University.

To keep close contacts among the Directing Board members and to coordinate the activities, teleconferences are being held regularly. Directory board meetings are held in association with the annual EGU meetings.