Commission 3 - Earth Rotation and Geodynamics

http://euler.jpl.nasa.gov/IAG-C3

President: **R. Gross** (USA)
Vice President: **A. Brzezinski** (Poland)

Terms of Reference

Geodynamics is the science that studies how the Earth moves and deforms in response to forces acting on the Earth, whether they derive from outside or inside of our planet. This includes the entire range of phenomena associated with Earth rotation and Earth orientation such as polar motion, length of day, precession and nutation, the observation and understanding of which are critical to the transformation between terrestrial and celestial reference frames. It includes tidal processes such as solid Earth and ocean loading tides, and crust and mantle deformation associated with tectonic motions and isostatic adjustment.

During the last few decades many geophysicists have come to use geodynamics in a more restricted sense to address processes such as plate tectonics and postglacial rebound that are dominantly endogenic in nature. Because the Earth as a mechanical system responds to both endogenic and exogenic forces, and because these responses are sometimes coupled, Commission 3 studies the entire range of physical processes associated with the motion and the deformation of the solid Earth. The purpose of Commission 3 is to promote, disseminate, and, where appropriate, to help coordinate research in this broad arena.

Sub-Commission 3.1 (Earth Tides and Geodynamics) addresses the entire range of tidal phenomena including its effect on Earth rotation. Sub-Commission 3.2 (Crustal Deformation) addresses the entire range of global and regional crustal deformation including intraplate deformation, the earthquake deformation cycle, aseismic phenomena such as episodic tremor and slip, and volcanic deformation. Sub-Commission 3.3 (Earth Rotation and Geophysical Fluids) addresses the space-time variation of atmospheric pressure, seafloor pressure and the surface loads associated with the hydrological cycle, and Earth's (mainly elastic) responses to these mass redistributions. Sub-Commission 3.4 (Cryospheric Deformation) addresses the Earth's instantaneous and delayed responses to ice mass changes, including seasonal (cyclical) mass changes and progressive changes associated with climate change. This group also studies postglacial rebound at all spatial scales and the elastic deformation taking place in the near-field of existing ice sheets and glaciers. Sub-Commission 3.5 (Tectonics and Earthquake Geodesy) addresses the integration of space and terrestrial approaches for studying the kinematics and mechanics of tectonic plate boundary zones, and in particular of the Eurasian/African/Arabian boundary zone.

Commission 3 interacts with GGOS, other Commissions and Services of the IAG as well as with other organizations such as the International Astronomical Union (IAU). For example, the recent space mission GRACE has expanded our common interests with IAG Commission 2 (Gravity Field) since temporal changes in gravity are associated with both the drivers of Earth deformation (e.g. changing ice and loads) and with Earth's response to these and other forcing.

Objectives

- To promote cooperation and collaboration on the theory, modelling and observation of Earth rotation and geodynamics.
- To ensure development of research in Earth rotation and geodynamics by organizing meetings, symposia, and sessions at conferences and general assemblies, by creating working groups on specific topics, and by encouraging the exchange of ideas and data and the comparison of methods and results with the goal of improving accuracy, content, methods, theories, and understanding of Earth rotation and geodynamics.
- To serve the geophysical community by facilitating interactions with organizations that provide the data needed to study Earth rotation and geodynamics.

Structure

Sub-Commissions

SC 3.1: Earth Tides and Geodynamics
Chair: S. Pagiatakis (Canada)

SC 3.2: Crustal Deformation
Chair: M. Poutanen (Finland)
SC 3.2a: Global Crustal Deformation
Chair: J. Freymueller (USA)
SC 3.2b: Regional Crustal Deformation
Chair: M. Hashimoto (Japan)

SC 3.3: Earth Rotation and Geophysical Fluids
Chair: M. Thomas (Germany)

SC 3.4: Cryospheric Deformation
Chair: M. King (UK)

SC 3.5: Tectonics and Earthquake Geodesy
Chair: H. Ozener (Turkey)

Joint Study Groups

JSG 0.1: Application of time series analysis in geodesy
(joint with ICCT and all Commissions, description see ICCT)
Chair: W. Kosek (Poland)

JSG 0.3: Comparison of current methodologies in regional gravity field modelling
(joint with ICCT and Commission 2, see ICCT)
Chairs: M. Schmidt, Ch. Gerlach (Germany)

JSG 0.4: Coordinate systems in numerical weather models
(joint with ICCT and all Commissions, description see ICCT)
Chair: Th. Hobiger (Japan)

JSG 0.5: Multi-sensor combination for the separation of integrated geodetic signals
(joint with ICCT and Commission 2, see ICCT)
Chair: F. Seitz (Germany)

JSG 0.7: Computational methods for high-resolution gravity field modelling and nonlinear diffusion filtering (joint with ICCT and Commission 2, description see ICCT)
Chairs: R. Čunderlík, K. Mikula (Slovakia)

JSG 0.8: Earth system interaction from space geodesy
(joint with ICCT and all Commissions), description see ICCT)
Chair: S. Jin (China)

JSG 3.1: Gravity and height change intercomparison
(joint with IGFS, Commissions 1 and 2)
Chair: S. Rosat (France)

Joint Working Groups

JWG 1.3: Understanding the relationship of terrestrial reference frames for GIA and sea-level studies
(joint with Comm. 1, description see Comm. 1)
Chair: Tilo Schöne (Germany)

JWG 2.4: Multiple geodetic observations and interpretation over Tibet, Xinjiang and Siberia (TibXS)
(joint with Comm. 2, description see Comm. 2)
Chair: Ch. Hwang (China - Taipei)

JWG 2.5: Physics and dynamics of the Earth's interior from gravimetry
(joint with Comm. 2, description see Comm. 2)
Chair: I. Panet (France)

JWG 2.6: Ice melting & ocean circulation from gravimetry
(joint with Comm. 2, description see Comm. 2)
Chair: J. Schröter (Germany)

JWG 2.7: Land hydrology from gravimetry
(joint with Comm. 2, description see Comm. 2)
Chair: A. Eicker (Germany)

JWG 2.8: Modelling and inversion of gravity-solid Earth coupling
(joint with Comm. 2, description see Comm. 2)
Chair: C. Braitenberg (Italy)

JWG 3.1: Theory of Earth rotation
(joint with IAU)
Chair: J. Ferrándiz (Spain)

Program of Activities

Commission 3 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 or geophysics. Some events will be focused narrowly on the interests of the sub-commissions and other entities listed above, and others will have a broader commission-wide focus.

Steering Committee

- President: R. Gross (USA)
- Vice President: A. Brzezinski (Poland)
- Chair SC 3.1: S. Pagiatakis (Canada)
- Chair SC 3.2: M. Poutanen (Finland)
- Chair SC 3.2a: J. Freymueller (USA)
- Chair SC 3.2b: M. Hashimoto (Japan)
- Chair SC 3.3: M. Thomas (Germany)
- Chair SC 3.4: M. King (UK)
- Chair SC 3.5: H. Ozener (Turkey)
- Chair JSG1: S. Rosat (France)
- Representatives of Services:
- IERS: Brian Luzum (USA)
- IGFS: S. Bettadpur (USA)
- Members at large: B. Chao (China - Taipei)

Sub-Commissions

SC 3.1: Earth Tides and Geodynamics

Chair: S Pagiatakis (Canada)
Co-Chair: J Bogusz (Poland)

Terms of Reference

SC 3.1 addresses the entire range of Earth tidal phenomena, both on the experimental as well as on the theoretical level.

Earth tide observations have a very long tradition. These observations led to the discovery of the Earth's elasticity which allows deformation and variations in Earth orientation and rotation parameters. The phenomena responsible for these variations include the full range of periodic and non-periodic phenomena such as Earth tides and ocean tidal loading, atmospheric dynamics as well as plate tectonics and intraplate deformation. The periods range from seismic normal modes over to the Earth tides and the Chandler Wobble and beyond. Thus, the time scales range from seconds to years and for the spatial scales from millimetres to continental dimensions.

As tidal friction is affecting Earth rotation, all the physical properties of the Earth contribute to the explanation of this phenomenon. Therefore, the research on tidal deformation due to tidal potential and ocean loading are a prerequisite to answer such questions.

Further, direct and indirect tidal phenomena affect the position of fiducial sites and have to be corrected to provide accurate spatial referencing. Such referencing is needed for the observation and monitoring of changes of the Earth's surface at global, regional and local scales. Therefore, there is a considerable contribution of tidal research to global geodynamics as well as to climate change by providing important constraints to geophysical models both, to global and local scales.

Modern gravimetry has helped improve our knowledge on the Earth's global gravity field and its temporal variations, structure and dynamics. Notably, superconducting gravimeters allow continuous monitoring of the gravity signal at selected sites with a precision of better than 10^{-10}. These geophysical observations together with other geodetic observations and geological information provide the means to better understand the structure, dynamics and evolution of the Earth system.

The Chair of SC 3.1 also chairs the Directing Board of the International Centre of Earth Tides - ICET. The Board comprises the Director of ICET, the Chair of GGP plus five additional members. The ICET Directing Board has the responsibility, among others, to monitor the operations of, and provide guidance and supervision to ICET in order to ensure fulfilment of the scientific goals and objectives of the Global Geodynamics Project and of the resolutions of the International Symposia on Earth Tides.

Objectives

Objectives of SC 3.1 include:

- To study and implement new observational techniques and improve existing ones, including clinometric and extensometric techniques;
- To advance tidal data analyses and prediction methods;
- To enhance the models on the interaction among solid Earth, ocean, and atmospheric tides;
- To research the effects of the atmosphere on gravity and other geodetic observations;
- To study the response of the Earth at tidal and non-tidal forcing frequencies;
- To study the interplay between tides and Earth rotation;
- To study tides on the planets;
- To study the effects of ocean loading and global water distribution;
- To create and coordinate working groups on specific topics of interest and relevancy to the understanding of our planet;
- To develop, coordinate and promote international conferences, programs and workshops on data acquisition, analysis and interpretation related to the research fields mentioned above;
- To contribute to the definition and realisation of the International Terrestrial Reference Frame via advanced geodynamic models at global, regional and local scales;
- To promote the systematic calibration and intercomparison of absolute and superconducting gravimeters;
- To promote interdisciplinary research in Earth and planetary tides.

The objectives of the IAG Global Geodetic Observing System (GGOS) are to a significant extent aligned with those of SC 3.1:

- 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 are in close relation to our objectives. Therefore, SC 3.1 also relates to 'Tidal effects in the framework of GGOS'.

Structure and Activities

SC 3.1 has a Chair and a Co-Chair. National representatives are involved in the organization of conferences as well as in the considerations concerning the award of the *Paul Melchior Medal*, formerly known as the Earth Tides Commission Medal.

Besides the organization of special sessions at international meetings, SC 3.1 will continue to organize a symposium every four years. Between these symposia, a comprehensive SC meeting together with the GGP-project will continue to be organized. SC 3.1 will continue to publish the outcome of these meetings in proceedings, either as stand-alone publications or as special issues of scientific journals.

SC 3.1 is linked to the Sub-Commissions 3.2 and 3.3, and the next Earth Tide Symposium will be organized as a joint meeting covering a broad range of topics.

The GGP (Global Geodynamics Project) was promoted by the SC during the previous term, and future cooperation is a main focus of SC 3.1. Other Inter-Commission Projects and Joint Study Groups can be included if possible.

SC 3.1 will also cooperate with GGOS, as mentioned above.

SC 3.2: Crustal Deformation

Chair: M Poutanen (Finland)
Co-Chair: J Freymueller (USA)
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 includes 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 millimetres to continental dimension for the spatial scales.

Space geodetic measurements now provide 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 modelling the planet as a whole, but also for understanding geophysical phenomena occurring at local scales. Some phenomena are potentially hazardous, like earthquake related phenomena. On the other hand, there are many slow deformations which are not hazardous, but in long time scales may have considerable effects. These include steady tectonic deformations and postglacial rebound.

One of the key issues nowadays is the definition and stability of global and regional reference frames. Crustal deformations in all time and spatial scales as well as mass transfer will affect reference frames. Gravimetry, absolute, relative, and nowadays also spaceborne, is a powerful tool providing information to the global terrestrial gravity field and its temporal variations. Combined with GNSS observations providing geometric deformation and data from other geophysical and geological sources provide the means to understand the structure, dynamics and evolution of the Earth system.

Organizational Aspects

The Sub-Commission is divided into two Sub-Sub-Commissions, 3.2a Global Crustal Deformation and 3.2b Regional Crustal Deformation. There will be some inevitable overlap between "global" and "regional", so there are good opportunities for joint discussions and work on these topics between the two parts of the Sub-Commission. There is also a natural relationship with IAG Commission 1, as the reference frame definition must be consistent with the actual crustal deformation.

The work of the Sub-Commissions will be organized as working-group like. There will be invited a core group of people who will agree to meet regularly and try to evaluate different models or approaches for computing or evaluating these effects. Due to global distribution of participants, electronic meetings and e-mails will be an essential part of the organization. The Sub-Commission aims to organize 1-2 topical symposia during the 4-year period.

Objectives

General objectives of the Sub-Commission 3.2 will include:

- To study crustal deformation in all scales, from plate tectonics to local deformation;
- To contribute reference frame related work in order to better understand deformations, and to improve global, regional and local reference frames and their dynamical modelling;
- 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 fields of investigation mentioned above;
- To organize and co-organize meetings and symposia related to the topic.

Objectives of Sub-Commission 3.2a, Global Crustal Deformation will include:

- The long-range impacts of great earthquakes and postseismic deformation on reference frame and relevant geodetic quantities.
- The limits of plate stability and what part of plates could be considered "plate interior" as opposed to "plate boundary" regions.
- Studies to distinguish between slow distributed deformation and errors in the reference frame geocentre, or other non-tectonic effects.

Objectives of Sub-Commission 3.2b, Regional Crustal Deformation will include:

- Studies of deformation during the seismic cycle including episodic slow events and postseismic transients. The strain build-up during interseismic period near the trench axes is one of the central topic in relation to the Tohoku-Oki earthquake.
- The strain partitioning in fault systems with reference to block or continuum mechanics.
- Volcanic and anthropologic deformations also belong among the topics of 3.2b, but activities will be mostly focused on two first items.

SC 3.3: Earth Rotation and Geophysical Fluids

Chair: M Thomas (Germany)
Co-Chair: J Chen (USA)

Terms of Reference

Mass transport in the atmosphere-hydrosphere-mantle-core system, or the 'global geophysical fluids', causes 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 geocentre shifts for all geophysical fluids are the relevant quantities. They are observed using global-scale measurements and are studied theoretically as well as by applying state-of-the-art models; some of these models are already constrained by such geodetic measurements.

Objectives

The objective of the SC is to serve the scientific community by supporting research and data analysis in areas related to variations in Earth rotation, gravitational field and geocentre, caused by mass re-distribution within and mass exchange among the Earth's fluid sub-systems, i.e., the atmosphere, ocean, continental hydrosphere, cryosphere, mantle, and core along with geophysical processes associated with ocean tides and the hydrological cycle.

The SC complements and promotes the objectives of GGOS with its central theme "Global deformation and mass exchange processes in the Earth system" and the following areas of activities:

- quantification of angular momentum exchange and mass transfer;
- deformation due to mass transfer between solid Earth, atmosphere, and hydrosphere including ice.

Program of Activities

SC 3.3 follows the program of activities defined by Commission 3. In order to promote the exchange of ideas and results as well as of analysis and modelling strategies, sessions at international conferences and topical workshops will be organized. In addition, SC 3.3 interacts with the sister organizations and services, particularly with the IERS Global Geophysical Fluids Centre and its operational component with four Special Bureaus (atmosphere, hydro-

logy, ocean, combination) and its non-operational component for core, mantle, and tides. SC 3.3 will have close contacts to the GGOS activities, in particular to the activities of the newly established GGOS Working Group 'Contributions to Earth System Modelling'. Our meetings will be announced through the Commission 3 web site at http://euler.jpl.nasa. gov/IAG-C3.

Steering Committee

- D. Salstein (USA; atmosphere)
- R. Gross (USA; oceans)
- R. Ray (USA; tides)
- J. Chen (USA; hydrology), Co-Chair
- E. Ivins (USA; mantle)
- T. van Hoolst (Belgium; core)
- M. Thomas (Germany; Earth system), Chair
- M. Watkins (USA, gravity/geocentre)
- T. van Dam (Luxembourg; loading)

SC 3.4: Cryospheric Deformation

Chair: M. King (UK)
Co-Chair: Sh. Abbas Khan (Denmark)

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. Of principal interest is geodetic observations that validate, or may be assimilated into, models of glacial isostatic adjustment (GIA) and/or constrain models of changes in present-day ice masses through measurements of elastic rebound. Using geometric measurements alone, elastic and GIA deformations cannot be separated without additional models or observations. Reference frames of GIA models do not allow direct comparison to measurements in an International Terrestrial Reference Frame and ambiguity currently exists over the exact transformation between the two. Furthermore, there is no publicly available and easy-to-use tool for model computations of elastic effects based on observed elevation/mass changes over the spatial scales of interest (small valley glaciers to large ice streams) and including gravitational/rotational feedbacks. This SC will focus on resolving these technical issues and work on dissemination of these measurements within the glaciological community (notably IACS).

Program of Activities

- Organize a workshop to discuss separation of elastic and GIA signals in key regions of interest, including Greenland, Antarctica, Patagonia and Alaska.
- Organize a workshop with WG 2.6.3 "Glacial isostatic adjustment (GIA) Model and Effects" and SC 1.2 "Global Reference Frames" on global reference frames for validation of GIA models.
- Encourage the inter-comparison and public release of elastic computation code, and advertise its existence.
- Interact where possible with those working on alternative measurements of the same signals (gravimetric or Earth rotation).
- Organize a workshop (with IACS) on "Present-day changes in the mass balance of Earth's glaciers and ice sheets".

Steering Committee

- D. Argus (USA)
- V. Barletta (Denmark)
- R. Bennett (USA)
- M. Bevis (USA)
- P. Clarke (UK)
- I. Howat (USA)
- E. Ivins (USA)
- Sh. Abbas Khan (Denmark), Co-Chair
- M. King (UK), Chair
- L. Metevier (France)
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- R. Riva (The Netherlands)
- M. Craymer (Canada)
- J. Davis (USA)
- R. Dietrich (Germany)
- J. Freymueller (USA)
- A. Groh (Germany)
- I. Sasgen (Germany)
- G. Sella (USA)
- G. Spada (Italy)
- P. Tregoning (Australia)
- T. van Dam (Luxembourg)
- P. Whitehouse (UK)
- P. Willis (France)
- F. Wu (USA)

SC 3.5: Tectonics and Earthquake Geodesy

Chair: H. Ozener (Turkey)

Terms of Reference

Space and terrestrial geodesy provide key observations to investigate a broad range of the Earth's natural systems. These data are collected, analyzed, and interpreted by geodesists and other scientists. Studies of crustal deformation rely on the continuous and/or repeated acquisition of geodetic measurements and their analysis in the frame of active tectonics, and on their combination with results obtained from other geological and geophysical investigations (seismology, neotectonics, gravity, rock physics, electromagnetic, ...).

The evolution of geodetic techniques in the past decade, with unprecedented achievements in the precise detection and monitoring of 3D movements at the millimetre level has opened new prospects for the study of Earth kinematics and geodynamics. However, these achievements also raise 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 that involve the broad collision zone between Europe, Africa and Arabia, provide natural laboratories to study crucial and poorly understood geodynamic processes. The recent occurrence of giant earthquakes (with Mw > 9), unexpected and in subduction areas with weak geodetic monitoring provide further challenges to the scientific community. Although these active zones were systematically monitored in the last decade by different research groups using a variety of space geodesy and other methods, in general the data analysis and interpretation have been done from the perspective of one discipline and have rarely followed an integrated approach. Never completely explored, the existence of these data (geodata) justifies a new, integrated approach including different observational techniques and input from other disciplines in the Earth sciences (geology, seismology, tectonics, ...). This should lead to the development of interdisciplinary work in the integration of space and terrestrial approaches for the study of, for instance, the Eurasian/African/Arabian plate boundary deformation zone (and adjacent areas), and contribute to the establishment of a European Velocity Field. With this objective, it is important to promote stronger international cooperation between Earth scientists interested in plate boundary zones.

Towards this goal the SC aims to:

- Actively encourage the cooperation between all geoscientists studying the Eurasian/African/Arabian plate boundary deformation zone, by promoting the exploitation of synergies;

- Reinforce the study of subduction zones in Mediterranean regions and elsewhere by increasing and developing infrastructures and geodetic stations;
- Be a reference group for the integration of the most advanced geodetic and geophysical techniques by developing consistent methodologies for data reduction, analysis, integration, and interpretation;
- Act as a forum for discussion and scientific support for international geoscientists investigating the kinematics and mechanics of the Eurasian/African/Arabian plate boundary deformation zone;
- Promote the use of standard procedures for geodetic data acquisition, quality evaluation, and processing, particularly GNSS data;
- Promote earthquake geodesy and the study of seismically active regions with large earthquake potential;
- Promote the role of Geodesy in tectonic studies for understanding the seismic cycle, transient and instantaneous deformation, and creeping versus seismic slip on faults.

Objectives

The primary goals of the SC are to:

- Continue as a framework for geodetic cooperation in the study of the Eurasian/African/Arabian plate boundary zone;
- Identify and develop a “Wegener Supersite”;
- Develop scientific programmes in earthquake geodesy for subduction zones (e.g., Hellenic Arc) and possible occurrence of giant earthquakes and associated tsunamis;
- Foster the use of space-borne, airborne and terrestrial hybrid techniques (high-resolution GNSS, InSAR, GOCE, GRACE, ENVISAT, SENTINELLE, LIDAR, ...) for Earth observation;
- Define effective integrated observational strategies for these techniques to reliably identify and monitor crustal movements and gravity variations over all time-scales;
- Facilitate and stimulate the integrated exploitation of data from different techniques in the analysis and interpretation of geo-processes;
- Organize periodic workshops and meetings with special emphasis on interdisciplinary research and interpretation and modelling issues;
- Reinforce cooperation with African and Arab countries and colleagues with scientific projects, that can contribute to understanding the kinematics and dynamics of the Eurasian/African/Arabian plate boundary zone and promote the growth of such research and geodetic expertise in these countries.

Program of Activities

- Build a web-portal and an associated geo-database that enables access to metadata, processed results, and when possible historical data from continuous GNSS stations and episodic geodetic campaigns, as well as other derived products such as strain rates, velocity fields, etc.;
- Promote the application of standards for GNSS network establishment, data acquisition, and guidelines for data processing and reliability checks;
- Define strategies for a full exploitation of different geodata (GNSS, gravimetry, InSAR, etc.);
- In coordination with the IGS and other relevant organizations, establish a GNSS analysis centre specially dedicated to process permanent and episodic campaign data, not analyzed by other GNSS centres, which will contribute to the development of a joint velocity field (EUROVEL) that can support kinematic and geodynamic modelling;
- Organize bi-annual conferences to serve as high-level international forums in which scientists from all over the world can look at a multi-disciplinary interpretation of geodynamics, and strengthen the collaboration between countries in the greater Mediterranean region.

Links to Services

The SC will establish links to relevant services, such as:

- EUREF;
- International Earth Rotation and Reference Systems Service (IERS);
- International GNSS Service (IGS);
- International Laser Ranging Service (ILRS);
- International VLBI Service for Geodesy and Astrometry (IVS);
- International DORIS Service (IDS);
- Regional Reference Frame Northern Africa (AFREF);
- Global Geodetic Observing System (GGOS);
- Supersites;
- UNAVCO.

Steering Committee

- H. Ozener (Turkey), Chair
- S. Zerbini (Italy)
- R. Reilinger (USA)
- M. Meghraoui (France)
- B. Ambrosius (The Netherlands)
- L. Bastos (Portugal)
- M. Becker (Germany)
- C. Bruyninx (Belgium)
- A. Caporali (Italy)
- L. Combrink (South Africa)
- J. M. Davila (Spain)
- T. Mourabit (Morocco)
- J. M. Nocquet (France)
- W. Spakman (The Netherlands)
- S. Stein (USA)
- S. Tatevian (Russia)
- T. van Dam (Luxembourg)
- S. Kahlouche (Algeria)
- S. M. Mahmoud (Egypt)
- A. ArRajehi (Saudi Arabia)
- Meghan Miller (USA)

Joint Study Groups

JSG 3.1 Gravity and Height Change Intercomparison

(joint with Commissions 1 and 2)

Chair: S. Rosat (France)
http://www.srosat.com/iag-jsg/

This Study Group is joint between the International Gravity Field Service (IGFS), Commission 1 on Reference Frames, Commission 2 on Gravity Field, and Commission 3 on Earth Rotation and Geodynamics. The activities of this new JSG will be concerned with the comparison of ground and space gravity measurements with geometric measurements of surface deformation.

The motivation of this JSG is to study surface deformation by comparing site displacement observations with both ground- and space-based gravity measurements. Issues that will arise when comparing site displacement with gravity measurements are differences in spatial and temporal scales and differences in sensitivity.

Terms of Reference

Surface deformations are continuously recorded from space or from the ground with increasing accuracy. Vertical displacements and time-varying gravity are representative of various deformation mechanisms of the Earth occurring at different spatial and temporal scales. We can quote for instance post-glacial rebound, tidal deformation, hydrologic loading, co-seismic deformation and volcanic deformation. The time scales involved range from seconds to years and the space scales range from millimetres to continental dimension. Large-scale deformation are well monitored by space geodetic measurements from monthly spatially-averaged GRACE measurements while local deformation are precisely monitored by daily GNSS or VLBI solution and sub-daily gravimeter data at a site. The intercomparison of the space- and ground-gravity measurements with vertical surface displacements enable to infer more information on the structure, dynamics and evolution of the Earth system. In particular, we will focus on the transfer function of the Earth at various time scales related to the elastic and visco-elastic properties of the Earth.

The activities of this JSG will interact with the SC 1.2 on Global Reference Frames and with GGP (Global Geodynamics Project), reporting to the IGFS, Commission 1 (Reference Frames), Commission 2 (Gravity Field), and Commission 3 (Earth Rotation and Geodynamics).

Objectives

The objectives of this JSG are:

- Love numbers determination (*h, k, l*) using co-located gravity and displacement measurements;
- Study of the gravity-to-height ratio *dg/du* at various time and length scales in order to discriminate vertical motion from mass transfer;
- Development of standardized procedures and tools to convert surface gravity points of measure into space-comparable gravity field (e.g. EOF);
- Tidal deformation analysis at long periods in displacements (from VLBI and GNSS) and in gravity (from superconducting gravimeters);
- Applications to co-seismic deformation, volcanic deformation, hydrological loading, ice-melting unloading.

Program of Activities

This JSG will propose a session at the 17th Earth Tides Symposium in Cairo, Egypt, 24-28 September 2012.

A session will be also proposed at the next IAG Scientific Assembly in 2013 and at the next IUGG General Assembly in 2015.

Members

- Chair: S. Rosat (France)
- J. A. Sampedro (Spain)
- O. Francis (Luxembourg)
- Y. Fukuda (Japan)
- R. Haas (Sweden)
- S. Lambert (France)
- L. Metivier (France)
- Y. Rogister (France)
- H. Steffen (Canada)
- P. Tregoning (Australia)
- P. Valty (France)

Corresponding Members

- C. Kroner (Germany)
- S. Zerbini (Italy)

Joint Working Groups

JWG 3.1 Theory of Earth Rotation

(joint with IAU)

Chair: J. Ferrándiz (Spain)
Vice-Chair: Richard Gross (USA)
http://www.srosat.com/iag-jsg/

Purpose:

To promote the development of theories of Earth rotation that are fully consistent and that agree with observations and provide predictions of the Earth rotation parameters (ERPs) with the accuracy required to meet the needs of the near future as recommended by, e.g., GGOS, the Global Geodetic Observing System of the IAG.

Justification:

Recent efforts have not led to improvements in the accuracy of theoretical models of the Earth's rotation that approach the required millimetre level, so there is a strong need to develop such theories to meet the current and future accuracy of the observations.

Terms of Reference:

1. A main objective of the Working Group (WG) is to assess and ensure the level of consistency of ERP predictions derived from theories with the corresponding ERPs determined from analyses of the observational data provided by the various geodetic techniques. Consistency must be understood in its broader meaning, referring to models, processing standards, conventions etc.
2. Clearer definitions of polar motion and nutation are needed for both their separation in observational data analysis and for use in theoretical modeling.
3. Theoretical approaches must be consistent with IAU and IAG Resolutions concerning reference systems, frames and time scales.
4. Searching for potential sources of systematic differences between theory and observations is encouraged, including potential effects of differences in reference frame realization.
5. The derivation of comprehensive theories accounting for all relevant astronomical and geophysical effects and able to predict all ERPs is sought. In case more than one theory is needed to accomplish this, their consistency should be ensured.
6. There are no *a priori* preferred approaches or methods of solution, although solutions must be suitable for operational use and the simplicity of their adaptation to future improvements or changes in background models should be considered.
7. The incorporation into current models of corrections stemming from newly studied effects or improvements of existing models may be recommended by the WG when they lead to significant accuracy enhancements.

Desired Outcomes

1. Contribute to improving the accuracy of precession-nutation and ERP theoretical models by proposing both new models and additional corrections to existing models.
2. Clarify the issue of consistency among conventional ERPs, their definitions in various theoretical approaches, and their practical determination.
3. Establish guidelines or requirements for future theoretical developments with improved accuracy.

It is clear that the overall goals of the Working Group cannot be achieved within only 3 years, but the first term of the WG should be used to develop a solid concept of how to reach its aims.

We are aware that the proposed subject is too broad for a single WG, and also that the existence of independent WGs for different sub-fields implies a risk that their results will not be consistent with each other. Thus, we propose to establish one WG with the following three SubWGs:

1. Precession/Nutation

Chair: Juan Getino (Spain)
Members: Y Barkin (Russia), V Dehant (Belgium), A Escapa (Spain), Y Rogister (France), J Souchay (France)
Correspondents: M Folgueira (Spain), A Gusev (Russia), T Herring (USA), H Schuh (Germany), V Zharov (Russia)

2. Polar Motion and UT1

Chair: Aleksander Brzezinski (Poland)
Members: BF Chao (Taipei), J Ray (USA), D Salstein (USA), F Seitz (Germany), YH Zhou (China)
Correspondents: W Chen (China), H Schuh (Germany), QJ Wang (China)

3. Numerical Solutions and Validation

Chair: Robert Heinkelmann (Germany)
Members: W Chen (China), D Gambis (France), B Luzum (USA), Z Malkin (Russia), H Schuh (Germany)
Correspondents: BF Chao (Taipei), V Dehant (Belgium), E Gerlach (Germany), JF Navarro (Spain), Y Rogister (France), ME Sansaturio (Spain), F Seitz (Germany), QJ Wang (China)

The subjects of SWG 1 and 2 are self-explanatory. SWG 3 will be dedicated to numerical theories and solutions, relativity and new concepts and validation by comparisons among theories and observational series.