

UN Global Geodetic Centre of Excellence

- progress from the UN-GGIM Subcommittee on Geodesy

Martin LIDBERG, Sweden, Laila LØVHØIDEN, Norway, Nicholas BROWN, Australia, Johannes BOUMAN, Germany, Anne JØRGENSEN, Norway

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SUMMARY

The United Nations (UN) has called for enhanced cooperation on global geodesy. In February 2015 the UN General Assembly adopted the resolution "A global geodetic reference frame for sustainable development" recognising that the Global Geodetic Reference Frame (GGRF) is the foundation of every aspect of the collection and management of national geospatial information and global monitoring of the Earth. In August 2019, the UN Committee of Experts on Global Geospatial Information Management (UN-GGIM) supported the proposal from the UN-GGIM Subcommittee on Geodesy to establish a UN Global Geodetic Centre of Excellence. The centre will act as an operational hub with the intention to strengthen the capacity to implement the resolution on the global geodetic reference frame. Further, it will support the objectives of UN-GGIM and the Subcommittee, provide technical assistance and capacity building, and encourage open data sharing. The last year the Subcommittee has been working to develop the work plan and the modalities of the centre. This presentation will give a status on the road towards a UN Global Geodetic Centre of Excellence.

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1. INTRODUCTION

At the Ninth Session of the United Nations Committee of Experts (CoE) on Global Geospatial Information Management (UN-GGIM), The UN-GGIM Subcommittee on Geodesy (SCoG) tabled the revised position paper [1] proposing the establishment of a Global Geodetic Centre of Excellence (GGCE) under the auspices of the UN to actively contribute to realising the ambitions of the UN General Assembly resolution “A Global Geodetic Reference Frame for Sustainable Development” (A/RES/69/266) [2], with the aim of ensuring the development, sustainability and advancement of the GGRF, as well as its densification and access by all Member States. The position paper demonstrated that the Global Geodetic Reference Frame (GGRF) is in acute danger of degradation, due to aging infrastructure, insufficient coordination and financing, and diminishing human capacity. The establishment of a centre with the highest expertise to oversee and facilitate the best GGRF possible was recommended as a solution to solve these challenges and as a contribution to achieving the Sustainable Development Goals.

The proposal was well received, with the GGRF receiving the most interventions during the session. This signals a strong interest in advancing the SGoG work program. Of the Member States intervening on GGRF, 67% strongly supported the establishment of a GGCE. The CoE requested the SCoG proceed to describing practical implementation issues of the GGCE including the role, work program and governance structure. The Subcommittee will work closely with the UN Member States when developing the GGCE, recognises and is committed by the Member States to work closely with the International Association of Geodesy (IAG), and the International Federation of Surveyors (FIG) and other organisations to avoid duplication of existing structures and to enhance existing governance arrangements within the geodetic community.

This paper first addresses the need for the GGRF as well as the current challenges for its sustainable realisation and availability. After addressing the embedment of the GGRF and SCoG under the UN-GGIM, the motivation for the establishment of a GGCE is given and the current status on the way forward is highlighted.

2. GEODESY FOR SUSTAINING OUR PLANET

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Referencing all geospatial information

Through geodesy we measure the Earth's shape, rotation and gravitational field, and the way these changes. We live on a dynamic planet. Its seemingly solid surface is always on the move. Because the Earth is in constant motion, an accurate point of reference – a position – is needed for making measurements of almost everything. Geodesy provides this reference system for the whole planet – the Global Geodetic Reference Frame (GGRF). All geospatial information must be referenced to the GGRF, allowing us to truly relate measurements and positions taken anywhere on the Earth with similar measurements taken at a different time or location. The social, economic and environmental benefits of implementing the GGRF are significant; so is its role in underpinning sustainable development and building a better world.

Critical to satellite positioning

The GGRF supports all satellite positioning technology, and is underpinned by critical and unique globally distributed ground infrastructure including observatories and satellite tracking stations. The physical infrastructure of the GGRF is complemented by a “best-effort” based internationally organized cooperation of data processing centers and analysis teams within governments and the scientific community that, on an ongoing basis and often in real-time, provide products, corrections and models that enable the establishment of, or access to, the GGRF.

Basis for all positioning applications

Location-based positioning applications are increasingly critical for civil engineering and construction, industrial automation, transport, agriculture, mining, and recreation. Because it enables the ‘position’ in precise coordinates, the GGRF is the foundation for the successful and correct use of such applications. In addition, satellite navigation systems provide fundamental services for the operation of electricity grids, telecommunication networks, the financial markets, disaster response and emergency management, environmental studies and scientific research. The GGRF also provides the platform from which Earth Sciences (such as Global Change studies) can be undertaken, monitoring changes in the planet on which we live and rely. The importance and need of the GGRF is growing as new geospatial applications in location-based services, intelligent transport, precision agriculture and industrial automation emerge globally.

3. CHALLENGES

In danger of degradation

However, the GGRF is vulnerable and in danger of degradation in terms of its required accuracy and accessibility by the users. An accurate, stable and reliable GGRF requires effective maintenance of the infrastructure, but also the upgrade on instruments to new technology and the development of existing infrastructure and new sites in locations not currently served by the existing networks. Collectively this needs ongoing investment from all nations. The “best-effort” endeavour to provide both high quality and high integrity data processing is suffering from a lack of redundancy and insufficient budgets to ensure

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consistency, and to allow for the application of new technological developments. Unfortunately, the rapidly increasing competition with other important societal needs is challenging the GGRF sustainability increasing the risk of degradation.

Too little redundancy

The development and sustainability of the GGRF is dependent on the contributions from many nations and often several agencies within these nations. These contributions are presently based on “best-effort” collaboration, with no contractual guarantee of continuity in the long-term. Importantly, some of these contributions are performed by only one or two agencies globally, leaving very little redundancy in key parts of the GGRF value chain. If for one reason or the other, these agencies cease their GGRF contributions and activities, it not only degrades the GGRF but also jeopardises the activities of industry, science and society that are dependent on the availability of the GGRF. For instance, the continuous determination of the Earth Orientation Parameters and the Universal Time (EOPs) is critical for the operation of navigation satellites and many other scientific and societal applications. Changes in the political situation and budgetary cuts may severely restrict the production of the EOPs, the reason being that there is minimal redundancy in parts of the Very Long Baseline Interferometry (VLBI) data processing, which is critical to the continuous determination of the EOPs. Unfortunately, this not only accounts for the VLBI, but also for other geodetic techniques. There is an urgent need for more sustainability and redundancy relating to the GGRF.

In need of global coordination

Several countries have invested in state-of-the-art GGRF infrastructure in recent years, but this is not sufficient to secure a sustainable GGRF globally because it is only part of the value chain. More than ten Member States have invested large sums in new data-intensive GGRF-technology, but the “best-effort” cooperation on processing and storing the data does not have the capacity and capability to utilise the data gathered. Because of this, it is likely that it will take several years before this new technology can completely replace the old, leaving the new technological equipment underutilized. At the same time, the aging equipment is underperforming or at end-of-life and highly vulnerable to potentially severe operational failures. To address this situation, coordinated efforts must be initiated to enhance operational capacity, capability and research on all components of the value chain. The challenge has been that no one entity or one nation exists to see the entire picture to plan and coordinate the work and ensure systematic and consistent development globally. This has resulted in a significant imbalance between national investments in physical infrastructure, and the “best-effort” cooperative activity related to the data processing.

Low benefits realisation from Education Training and Capacity Building projects

The Education Training and Capacity Building (ETCB) effort performed by Member States, institutions and organisations in the area of GGRF are, and have been, substantial and undertaken with considerable expertise, and with the best of intentions, and yet questionnaires completed by Member States indicate that in most countries additional capacity building is imperative to the uptake of the GGRF. For instance, ETCB activities that assist developing

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countries to establish and utilize geodetic infrastructure, like for instance GNSS, serve several important purposes, both for the developing country and for the GGRF. Unfortunately, the situation has often been that when the assisting nation steps back leaving the operation of the equipment to the developing nation, the utilisation of the GGRF infrastructure is halted or at least is sub-optimal. This is due to lack of sustained geodetic knowledge or capacity, or other GGRF related resources in the developing nation. It might also be due to other circumstances. For a nation to utilize the GNSS infrastructure, it is a prerequisite to have reliable Internet connection and power supply. This demonstrates that a holistic approach is necessary to ensure that geodetic ETCB-projects are successful, requiring ongoing effective global coordination, while recognising the regional nuances of capacity building.

4. UN GENERAL ASSEMBLY GGRF-RESOLUTION

Recognizing the importance of the GGRF for science and society and recognizing the current existing challenges for its sustainable realisation and availability, the UN General Assembly adopted the resolution “A Global Geodetic Reference Frame for Sustainable Development” in 2015. The resolution was prepared by the GGRF Working Group of the UN-GGIM. The UN Economic and Social Council (ECOSOC) established the UN-GGIM Committee of Experts as the apex intergovernmental mechanism for making joint decisions and setting directions with regard to the production, availability and use of geospatial information within national, regional and global policy frameworks. Led by United Nations Member States, UN-GGIM aims to address global challenges regarding the use of geospatial information, including in the development agendas, and to serve as a body for global policymaking in the field of geospatial information management.

With the GGRF-resolution the UN Member States are requested to:

- encourage, together with relevant international organizations, global cooperation in providing technical assistance, especially for capacity development in geodesy for developing countries;
- openly share geodetic data, standards, and conventions, through relevant national mechanisms and intergovernmental cooperation, and in coordination with the IAG;
- maintain, and improve their national geodetic infrastructures;
- engage in multilateral cooperation that addresses infrastructure gaps and duplications;
- assist in the development of outreach programs that make the GGRF more visible and understandable to society.

In brief, the realization of and access to the GGRF are the two fundamental themes that are addressed. On one hand there is the need to improve the development, sustainability and robustness of the GGRF (realization) and on the other hand there is the need to increase the availability of the GGRF (access).

The GGRF Working Group developed the Roadmap for the Global Geodetic Reference Frame for Sustainable Development. It addresses each of the key areas of action described in

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the operational paragraphs of the UN General Assembly Resolution. The five focus areas to achieve an accurate, sustainable and accessible GGRF are:

- Geodetic Infrastructure (including Data Analysis);
- Policies, Standards and Conventions;
- Education, Training and Capacity Building;
- Outreach and Communication;
- Governance.

For each of these focus areas the Roadmap describes the current situation and measures of success. Recommendations to the Member States to achieve the measures are given as well. In 2018, the UN-GGIM Subcommittee on Geodesy (SCoG) presented the GGRF Road Map Implementation Plan and the Governance Position Paper to the UN-GGIM Committee of Experts. In 2017 the GGRF Working Group was elevated to a permanent subcommittee under the Committee of Experts.

On August 9 2019, Member States of the United Nations Committee of Experts on Global Geospatial Information Management commended the Subcommittee on Geodesy on the revised proposal to establish a global geodetic centre of excellence under the auspices of the United Nations.

5. A GLOBAL GEODETIC CENTRE OF EXCELLENCE (GGCE)

Solutions

It is the informed opinion of the working group that achieving the Sustainable Development Goals (SDG) will be more likely with the establishment of a GGCE to oversee and facilitate the best GGRF possible. The working group therefore proposes to establish a Global Geodetic Centre of Excellence (GGCE) under the auspices of UN-GGIM.

Global Geodetic Centre of Excellence

It is proposed that the GGCE goal would be to maintain and improve the global geodetic reference frame (GGRF) by strengthening the technical capacity of national geospatial agencies, allowing them to sustain, enhance, access and utilize the GGRF to substantively improve national and global prosperity and produce reliable and enduring SDG (sustainable development goal) information. The establishment of the Centre would actively contribute to realising the ambitions of the UN General Assembly resolution “A Global Geodetic Reference Frame for Sustainable Development” (A/RES/69/266), with the aim of ensuring the development, sustainability and advancement of the GGRF, as well as its densification and access by all Member States.

The GGCE would act as a GGRF operational hub that would strengthen capacity to implement the General Assembly resolution, support the objectives of UN-GGIM and the SCoG, provide technical assistance and capacity building, and facilitate and encourage open

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geodetic data sharing. It will enhance the capacity of the SCoG to effectively and efficiently manage global cooperation in the area of geodesy, and provide advocacy and outreach. The GGCE will be globally recognised, and have three initial thematic priorities: Enhance global cooperation; Provide operational coordination; Provide technical assistance and capacity building.

Enhance global cooperation

- Work to ensure that organisations, which collect, manage and are significant users of geodetic information have a significant role to play in strengthening geodetic information and infrastructure management;
- Encourage GGRF-related project sponsors to share experiences on a global level.

Provide operational coordination

- Be the secretarial office for the SCoG and the GGCE governing bodies;
- Guide, coordinate and manage the realisation of the GGRF road map;
- Promote and facilitate the development of clear policies and procedures that commit Member States to open sharing of geodetic data;
- Map, analyse and address operational weaknesses in the GGRF value chains with a view to maintain and improve the GGRF;
- Provide counselling, coordination, advocacy and management support to projects and activities that mend GGRF value chain weaknesses or ensures redundancy;
- Initiate, facilitate, develop and coordinate relevant communication, outreach and engagement programs underpinning and promoting GGRF maintenance and improvement.

Provide technical assistance and capacity building

- Identify and provide technical assistance, knowledge sharing and training to enable nations to
 - Build capacity and establish appropriate geodetic infrastructure (especially GNSS), and
 - Better utilize GGRF infrastructure to improve national to global prosperity;
- Provide advice, communication, and management support to enable nations to realise GGRF development projects and activities that are key to fulfilling the SDGs;
- Be depository and foster communities of practice for exploring and sharing information and transferring capacities and specialized knowledge through training and materials.

GGCE modalities and governance arrangements

Governance arrangement mission

The exact modalities, including the role, work program and governance of the GGCE would be determined by negotiations between the Committee of Experts Bureau, the SCoG and financial donors.

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Financial arrangements

The creation of the GGCE is subject to suitable funding being provided by one or more Member State donor (s). The GGCE could either be hosted by one nation and have a centralized organisational structure, or have a distributed organisational structure with a core-location in a particular Member State, and with single contributions from other Member States.

Under the auspices of UN

To ensure visibility and transparency, the GGCE would report its technical activities through the annual report of the SCoG to the UN-GGIM plenary session, so that Member States and other stakeholders are aware of what efforts are taking place, and can contribute to the discussion and directions the GGCE may be taking. The operational reporting (financial, and accountability of operations) line for the GGCE will be through the UN Statistics Division. Additional oversight would be provided by the governance mechanism put in place for GGCE by the UN-GGIM Bureau, SCoG and financial donors.

Collaboration with geospatial organisations

The SCoG recognises the need to work closely with the International Association of Geodesy (IAG), and the International Federation of Surveyors (FIG), to avoid duplication of existing GGRF governing structures when defining the modalities and governance arrangements for the GGCE.

Possible options for additional oversight of the GGCE include the creation of a Global Geodetic Governing Council, with appropriate UN and donor representation, which would provide strategic oversight and governance at the highest level and would ensure that an appropriate level of dialogue occurs between institutions. Additionally, the creation of an International Advisory Committee that is more technically and operationally oriented may be of value. It could have a structure that ensures that organisations, which collect, manage, and are significant users of geodetic information have a significant role to play in strengthening the management of geodetic information and infrastructure.

6. CURRENT WORK TOWARDS THE ESTABLISHMENT OF THE GGCE

The subcommittee is planning to undertake consultation on the practical implementation of the Centre, that is, to decide on modalities, function, financial arrangements, and a program of work.

In order to ensure coherence and avoid duplication of effort, consultation will be made in direct coordination with the Committee of Experts and relevant geodetic stakeholders, including the International Association of Geodesy (IAG), International Federation of Surveyors (FIG), and the regional geodetic committees of the UN-GGIM.

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The plan is to present the initial centre work program to the UN-GGIM Bureau in April 2020, engage in Member State consultation and with ongoing progress and status to be reported at the UN-GGIM Tenth session in August 2020.

The Subcommittee on Geodesy welcomes all Member States to take part in the practical implementation of the GGCE.

The journey towards a global geodetic centre of excellence (GGCE):

2015: UN General Assembly resolution on the GGRF

2016: UN-GGIM Committee of Experts requested a position paper on governance

2018: UN-GGIM Committee of Experts requested a broad consultation of the position paper on governance

Intersessional period:

Position paper consultations with UN-GGIM regions, interalia proposal to establish coordinating unit

2019: UN-GGIM Subcommittee on Geodesy revised the position paper based on the consultations and published it as part of the UN-GGIM Ninth session meeting documents and presented at side event;

Forum on GGRF

2019: UN-GGIM Committee of Experts supported the proposal to establish a GGCE

Coming period:

Work to fill the requests from UN-GGIM Committee of Experts

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BIOGRAPHICAL NOTES

Dr. Martin Lidberg is head of the Geodetic Infrastructure Department at Lantmäteriet, the Swedish mapping, cadastral and land registration authority. He has a MSc in Surveying and mapping from the Royal Institute of Technology (Stockholm, Sweden) in 1988, and got his PhD from Chalmers University of Technology (Gothenburg, Sweden) in 2007. He has been working at Lantmäteriet since 1988. Martin is also since 2019 chairman of EUREF.

Laila Loevhoeiden is head of department for Global Geodesy in the Norwegian Mapping Authority. She is educated thesis engineer in petroleum science and has a second masters degree in innovation and technological development. Previously co-chair of the United Nations Subcommittee on Geodesy. Presently chairing the UN Subcommittee on Geodesy's Working group on governance.

Nicholas Brown from Geoscience Australia is the Director of National Geodesy and Co-Chair of the UN-GGIM Subcommittee on Geodesy. Nicholas is responsible for the development and refinement of the Australian Geospatial Reference System; the collection of datums, geoid models, transformation tools and standards required for 4D positioning. Nicholas has a Bachelor of Applied Science in Geomatics from RMIT and a Masters in Geophysics (Space Geodesy) from ANU.

Dr. Johannes Bouman is Head of the Department Geodesy at the German Federal Agency for Cartography and Geodesy (BKG). He has a MSc in Geodesy from Delft University of Technology (Delft, the Netherlands) in 1993, and got his PhD also from Delft University of Technology in 2000. After previous stations at SRON Netherlands Institute for Space Research and the German Geodetic Research Institute (DGFI-TUM), he has been working at BKG since 2016.

Anne Jørgensen is senior communications advisor responsible for strategic communications at the Norwegian Mapping Authority. Educated journalist. A true geospatial enthusiast; leading the UN-GGIM Subcommittee on Geodesy's Communication and Outreach Working Group. Previously Co-Chair of the UN-GGIM Global Geodetic Reference Frame Working Group. As a result the UN General Assembly adopted the resolution "A global geodetic reference frame for sustainable development" in 2015.

CONTACTS

Dr Martin Lidberg
Lantmäteriet
Lantm'terigatan 2c
SE-801 82 Gävle
SWEDEN
Tel. +46 26 633842
Email: martin.lidberg@lm.se
Web site: www.lantmateriet.se

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