

Global Geodetic Observing System

GGOS Days 2020 Report

October 5-7, 2020
Video Conference



IUGG



Global Geodetic
Observing System

ggos.org

Global Geodetic Observing System

GGOS Days 2020 - Report



Contents

1	Introduction.....	2
2	Logistics	2
3	List of Participants	3
4	Group Photos.....	5
5	Schedule	6
	Day 1 - Monday, October 5, 2020 – GGOS Internal & GGOS Bureaus	6
	Day 2 - Tuesday, October 6, 2020 – Outreach Activities.....	6
	Day 3 - Wednesday, October 7, 2020 – GGOS Focus Areas	6
6	General Report.....	7
7	Appendix – Status Reports of GGOS Components.....	9
	7.1 GGOS Bureau of Networks and Observations.....	9
	Present Status and Progress.....	9
	Planned Actions and Milestones	10
	7.2 GGOS Bureau of Products and Standards	11
	Present Status and Progress.....	11
	Ongoing activities and planned actions	11
	7.3 GGOS Focus Area Unified Height System (FA-UHS)	13
	Present Status and Progress.....	13
	Planned Actions and Milestones	13
	7.4 GGOS Focus Area Geohazards.....	15
	Present Status and Progress.....	15
	7.5 Focus Area: Geodetic Space Weather Research	16
	Present Status and Progress.....	16
	Planned Actions and Milestones	17

Global Geodetic Observing System

GGOS Days 2020 - Report



1 Introduction

GGOS Days is the annual meeting of GGOS during which the different components of GGOS meet and report on their activities during the past year and their plans for the coming year.: GGOS Consortium (large steering committee of GGOS), GGOS Coordinating Board (decision making body of GGOS), GGOS Bureau of Networks and Observations, GGOS Bureau of Products and Standards, all 3 GGOS Focus Areas as well as the GGOS Science Panel, GGOS Committees and Working Groups.

2 Logistics

This year the GGOS Days was held as a video conference instead of the common face-to-face meeting due to travel restriction by the COVID-19 crises.

Dates: **Monday, October 5, 2020**
Tuesday, October 6, 2020
Wednesday, October 7, 2020

Duration: **2 hours** each day

Time: every day it started at the same time:

Time Zone	Country	Time
PDT	USA West Coast	06:00-08:00
EDT	USA East Coast	09:00-11:00
GMT-3	Argentina	10:00-12:00
CEST / SAST	Europe / South Africa	15:00-17:00
JST	Japan	22:00-00:00
AEST	Australia East Coast	00:00-02:00 (next day!!)

Venue: Video Conference via GoToMeeting

Chair: Basara Miyahara

Organizer: Martin Sehnal, Basara Miyahara (Contact: co@ggos.org)

Presentations: Please find all presentation slides, the current status reports of GGOS components, GGOS Days Agenda and GGOS Days Report at the GGOS Cloud:
<https://cloud.ggos.org/index.php/s/nn4rb9jzn7FcMPL>.

Global Geodetic Observing System

GGOS Days 2020 - Report



3 List of Participants

Members of the GGOS Consortium, GGOS Coordinating Board, GGOS Bureaus, GGOS Focus Areas, GGOS Science Panel, invited guests and all interested persons were highly welcome to attend this meeting. Over all three days **49 people attended this meeting**, with a maximum of 39 and a minimum of 34 each day.

Participants (Count 49)	Day 1 (37)	Day 2 (34)	Day 3 (39)
Adrian Jäggi	x		
Allison Craddock	x	x	x
Andrew Matthews	x	x	x
Annette Eicker	x		x
Arturo Villiger	x	x	x
Axel Nothnagel		x	x
Basara Miyahara	x	x	x
Christopher Kotsakis	x		
Daniela Thaller	x	x	x
Dariusz Strugarek		x	
Detlef Angermann	x	x	x
Dimitrios Tsoulis	x	x	
Drishti Agarwal	x		
Elizabeth Bradshaw	x	x	x
Elmas Sinem Ince	x	x	x
Felix Perosanz			x
Harald Schuh	x	x	x
Hartmut Wziontek	x		
Hermann Drewes	x		x
Jianliang Huang			x
John LaBrecque	x	x	x
Jose Manuel Ferrandiz	x	x	x
Kirsten Elger	x	x	
Kosuke Heki	x		x
Larry Hothem	x	x	x
Laura Sanchez	x	x	x
Laurent Soudarin	x	x	
Maik Thomas	x	x	x

Global Geodetic Observing System

GGOS Days 2020 - Report



Markku Poutanen	x	x	x
Martin Sehnal	x	x	x
Mattia Crespi	x	x	x
Michael Schmidt			x
Mike Craymer	x		x
Mike Pearlman	x	x	x
Mirko Reguzzoni			x
Paweł Wielgosz			x
Perosanz Felix	x	x	
Reza Ghoddousi-Fard			x
Riccardo Barzaghi		x	x
Richard S Gross	x	x	x
Robert Heinkelmann		x	x
Sean Bruinsma		x	
Sergey Pasynok	x		x
Thomas Gruber	x	x	x
Tilo Schöne	x	x	x
Toshimichi Otsubo	x	x	x
Xinggang	x	x	x
Yusuke Yokota	x	x	x
Zuheir Altamimi	x	x	x

Global Geodetic Observing System

GGOS Days 2020 - Report



4 Group Photos

Day 1:



Day 3:



Global Geodetic Observing System

GGOS Days 2020 - Report



5 Schedule

Day 1 - Monday, October 5, 2020 – GGOS Internal & GGOS Bureaus

Welcome and Instruction (B. Miyahara)

GGOS Internal:

- 10 min: **GGOS & IAG Report** (B. Miyahara)
- 10 min: **GGOS Affiliates – GGOS Japan Report** (T. Otsubo)
- 10 min: **Working Group on “DOIs for Geodetic Data Sets”** (K. Elger)
- 10 min: **GGOS Days 2021** (B. Miyahara, D. Angermann)

GGOS Bureaus:

- (Status report, ongoing work, open questions, discussion)
- 30 min: **BNO - Bureau of Networks and Observations** (M. Pearlman)
- 30 min: **BPS - Bureau of Products and Standards** (D. Angermann)

General discussion (All)

Day 2 - Tuesday, October 6, 2020 – Outreach Activities

GGOS External – Outreach Activities - Strategic Plan

- 20 min: **GGOS External Interactions and Partnerships** (A. Craddock)
- 20 min: **New GGOS Website** (M. Sehnal)
- 20 min: **GGOS Newsletter - Popular Articles about Geodesy** (M. Sehnal)
- 20 min: **GGOS Special Issue** (L. Sánchez)

General discussion (All)

Day 3 - Wednesday, October 7, 2020 – GGOS Focus Areas

GGOS Focus Area

- (Status report, ongoing work, open questions, discussion)
- 30 min: GGOS Focus Area: **Unified Height System** (L. Sánchez)
- 30 min: GGOS Focus Area: **Geohazards** (J. LaBrecque)
- 30 min: GGOS Focus Area: **Geodetic Space Weather Research** (M. Schmidt)

General discussion / Any other Business (All)

6 General Report

Basara Miyahara (GGOS President) welcomed all participants to the GGOS Days 2020. He presented the schedule of this meeting and asked for a minute of silence in memorial of Günter Stangl, former director of the GGOS Coordinating Office from 2016 to 2017, who suddenly passed away in the first years of his retirement (<http://ggos.org/memoriam-guenter-stangl/>).

All **presentations**, the current **status reports of GGOS components**, the **agenda** and the **report** of this meeting are available for public in the **GGOS Cloud** and are accessible via following link: <https://cloud.ggos.org/index.php/s/nn4rb9jzn7FcMPL>. The major outcome of discussions is shown in the following summary:

GGOS Days 2021

The next GGOS Days are planned as a two days in-person conference from October 4-5, 2021 in Munich, Germany. GGOS proposed IERS to hold it in conjunction with the UAW (Unified Analysis Workshop). This can take place from October 6-8, 2021.

New GGOS Website

The GGOS Coordinating Office is currently working on redesigning the GGOS Website, which should be available for public until end of 2020. The new developing website <https://www.ggos.org> is accessible only for testing purpose and a login is required (User: bev | password: Ggos!2020). It will be published in December 2020.

The geodetic products and their classification were discussed. It was mentioned that GGOS has to be very careful in defining of product lists and categories. And the GGOS Committee on Essential Geodetic Variables (EGV) should be involved in the process.

For the Services Page it was mentioned that for the official IAG classification divides the services in Geometry-, Gravity- and General-Services (only PSMSL is now assigned to it). This can be also used for the GGOS website.

GGOS Newsletter - Popular Articles about Geodesy

It was mentioned, that the copyright should be well defined in the author guidelines. The author and GGOS must be cited when publishing these popular articles.

It might be complicated to find enough authors and/or peer reviewer. Therefore, it was mentioned to define two categories: reviewed and unreviewed articles. In addition, it was proposed to contact other IAG components to share experiences with a newsletter service.

Documentary film about GGOS by AGU-TV

GGOS was asked by AGU-TV to make a short 5-7 minutes documentary film about GGOS. The expenses are \$22,500 USD for a “one-day film” (incl. all preparation and all post-editing, ...) and \$7,000 USD for each additional day. The host of the GGOS Coordinating Office, the BEV, could cover only parts of the costs. John LaBrecque is very interested to take part in a film with his Focus Area Geohazards. He could get fundings for it. All other organizations are welcome to take part in this film.

Global Geodetic Observing System

GGOS Days 2020 - Report



GGOS Bureaus and Focus Areas

You can find the current brief status reports of the GGOS **BNO (Bureau of Networks and Observations)**, GGOS **BPS (Bureau of Products and Standards)**, GGOS Focus Area **Unified Height System**, GGOS Focus Area **Geohazards and** GGOS Focus Area **Geodetic Space Weather Research** attached.

7 Appendix – Status Reports of GGOS Components

7.1 GGOS Bureau of Networks and Observations

Mike Pearlman, Carey Noll, many others

(1) Center for Astrophysics

(2) NASA GSFC

Present Status and Progress

- Bureau talks at UAW (Paris), IAG IWS (Buenos Aires), ILWS (Stuttgart), SIRGAS (Rio de Janeiro) – Met with groups in Latin America; very strong interest; tried to encourage partnerships and station upgrades;
- Continued recruiting for the GGOS Affiliated Network; Draft MOU with ROSCOSMOS for closer cooperation with GGOS and ILRS; stuck with Covid-19;
- Not much opportunity for representatives from the Services and the Standing Committees to meet and share progress and plans;
- Talks and posters at AGU, EGU, GGOS Days, JpGU- AGU, etc
- Monitored network status; projected network evolution for the reference frame based on input from current and expected future participants, estimate performance capability 5 and 10 years ahead; need to include better estimates of performance and new station availability;
- Updating Site Requirements Document;
- Letters/documentation to support stations, current/ new missions, and analysis centers;
- Standing Committee on Performance Simulations & Architectural Trade-Offs (PLATO)
 - continued examining trade-off options for station deployment and closure, technology upgrades, impact of site ties, etc. and project future network capability; using projected network configuration in new system implementation;
 - conducting simulation studies to assess impact on reference frame products of: co-location in space, space ties, available satellites (e.g., tracking priorities for LAGEOS and Etalon);
- Standing Committee on Data and Information is working on Meta Data implementation for Space Geodesy applications:
 - Nick Brown (Geoscience Australia) leads a study on the development of a Geodesy Markup Language (GeodesyML), for the GNSS community; potential for expansion to the other space geodesy techniques and GGOS. The current study is identifying metadata standards and requirements, assessing critical gaps and the how these might be filled, what changes are needed in the current standards, and who are the key people who should work on it (more comprehensive scheme);

Global Geodetic Observing System

GGOS Days 2020 - Report



- CDDIS continues efforts to complete collection level metadata in EOSDIS Common Metadata Repository; in addition, the CDDIS will begin a re-ingest activity later this year which will reload GNSS granule level metadata linked to these new collection level records (data products); Carey Noll, the lead in this activity will retire at the end of 2020;
- Standing Committee on Missions
 - List of satellite contributions to fulfill the GGOS 2020 goals (1 mm / 0.1 mm/yr.) and inventory of the GGOS satellite infrastructure has been prepared and posted on the GGOS website;
 - Attention has been focused on the encouraging and supporting gravity field missions;
 - Exchange with PLATO has been initiated by identifying joint interests and possible collaborations;
- IERS Working Group on Site Ties and Co-locations
 - Focusing on gravity deformation of VLBI antennas;
 - Examining new technologies and procedures for ground surveys at space geodesy stations;
 - Encouraging more frequent site surveys and new survey groups to support the stations.

For more detail see the GGOS website under the Bureau of Networks and Observations.

Planned Actions and Milestones

Planned activities for next year.

- Continue advocating for the expansion and upgrade of the space geodesy network for the maintenance and improvement of the reference frame and other GGOS priorities; encourage partnerships to build and upgrade ground stations; Meet and talk
- Continue recruiting stations for the GGOS Affiliated Network; continue effort to close on the MOU with ROSCOSMOS stations;
- Continue monitored network status; projected network evolution for the reference frame based on input from current and expected future participants, estimate performance capability 5 and 10 years ahead; look for better to project station performance and new station availability;
- Complete the next update of the GGOS Site Guidelines Document (was GGOS Site Requirements Document);
- Scope the network for the Reference Frame;
- Continue the work of the Standing Committees;
- Letters/documentation to support stations, current/ new missions, and analysis centers, etc.
- Provide the opportunity for representatives from the Services and the Standing Committees to meet and share progress and plans; discuss issues of common interest; meetings at EGU, AGU, GGOS Days, etc.;
- Talks and posters on the Bureau at EGU, AGU, JPGU-AGU, AOGS meetings, etc.;

7.2 GGOS Bureau of Products and Standards

D. Angermann (1), T. Gruber (2), M. Gerstl (1), R. Heinkelmann (3), U. Hugentobler (2),
L. Sánchez (1), P. Steigenberger (4)

(1) Deutsches Geodätisches Forschungsinstitut, Technische Universität München (DGFI-TUM), Germany

(2) Institut für Astronomische und Physikalische Geodäsie (IAPG), Technische Universität München, Germany

(3) Helmholtz Centre Potsdam, German Research Centre for Geosciences (GFZ), Germany

(4) Deutsches Zentrum für Luft- und Raumfahrt (DLR), Germany

Present Status and Progress

This report summarizes the present status and progress of the GGOS Bureau of Products and Standards (BPS) in 2020. Associated with the BPS are the following GGOS components (reports for each of these components are attached):

- Committee “Contributions to Earth System Modeling” (Chair: Maik Thomas)
- Committee “Essential Geodetic Variables (EGVs)” (Chair: Richard Gross)
- Working Group “Towards a consistent set of parameters for the definition of a new GRS” (Chair: Urs Marti).

The BPS comprises the staff members, the chairs of the associated GGOS components (see above), as well as about 20 representatives of the IAG Services and other entities involved in standards and conventions.

In 2020, the BPS has finalized the 2nd version of the BPS inventory of standards and conventions used for the generation of IAG products. The document has been evaluated by reviewers designated by IAG. The revised version has been submitted to the IAG Bureau in August 2020 for publication in *The Geodesists Handbook 2020*. The 2nd version of the BPS inventory will also be published online on the GGOS website.

In the framework of the re-writing of the IERS Conventions, the director of the BPS serves as Chapter Expert for the “General Definitions and Numerical Standards”. The director of the BPS has been nominated to act as IAG representative to ISO/TC 211 and the UN GGIM “GGRF” Subcommittee on Geodesy (SCoG), mainly to the Working Group “Data sharing and development of geodetic standards”. Within GGOS, the BPS contributes to the activities of the Committee on Essential Geodetic Variables (EGVs) and the Working Groups on “DOIs for geodetic data” and “Towards a consistent set of parameters for the definition of a new GRS”.

Ongoing activities and planned actions

- The BPS presents its activities at scientific conferences (e.g., AGU, EGU, IAG/IUGG), contributes to the organization of GGOS sessions and holds Bureau meetings twice per year. Internal meetings of the BPS staff members take place every 2-3 months.
- The BPS inventory of standards and conventions will be regularly updated as a “living document” to keep track of adopted geodetic standards and conventions across all IAG components, and initiate steps to close gaps and deficiencies.
- The BPS will further contribute to the UN GGRF WG “Data Sharing and Development of Geodetic

Global Geodetic Observing System

GGOS Days 2020 - Report



Standards”, to GGOS entities mentioned above, to the re-writing of the IERS Conventions, and interact with external stakeholders such as IAU, BIPM and ISO in the field of standards and conventions.

- The BPS supports the development of new products derived from a combination of geometric and gravimetric observations. Towards this aim the BPS interacts with IAG Components and the GGOS Focus Areas “Unified Height System” and “Geodetic Space Weather Research”.
- The BPS contributes to the development of a new GGOS Website and to other GGOS outreach activities (publications, popular articles, brochures, etc.).
- Finally, the BPS is compiling a new Implementation Plan for the period 2020-2022.

7.3 GGOS Focus Area Unified Height System (FA-UHS)

Laura Sánchez

Deutsches Geodätisches Forschungsinstitut, Technische Universität München (DGFI-TUM)

Present Status and Progress

The main current objective of the FA-UHS is the implementation of the International Height Reference System (IHR) defined by the IAG 2015 Resolution No. 1 (see page 981 in Drewes, H., et al., 2016, *J Geod* 90(10): 1091, doi:10.1007/s00190-016-0948-z); especially, the establishment of the International Height Reference Frame (IHRF). In the term 2015 – 2019, our activities concentrated on investigating appropriate strategies for the realisation of the IHR. In addition to define a preliminary station selection for the IHRF reference network, a key activity was the evaluation of different strategies for the determination of potential values as IHR/IHRF reference coordinates within the so-called Colorado experiment. This experiment aimed at computing geoid, quasi-geoid and potential values using the same input data and the own methodologies of colleagues involved in the gravity field modelling. About 40 colleagues grouped in fourteen international computation groups contributed to this initiative. The Colorado experiment started at the IAG/IASPEI Scientific Assembly (Aug 2017, Kobe). First results were discussed at the GGOS2018 Symposium (Sep 2018, Copenhagen). A second computation was ready for the EGU2019 (Apr 2019, Vienna) and some refinements (third computation) were delivered in Jun 2019. The results were extensively discussed at the IUGG2019, Symposium G02: Static Gravity Field and Height Systems (July 2019, Montreal). At present, we are preparing a special issue on Reference Systems in Physical Geodesy to be published in the *Journal of Geodesy*. This special issue will include the scientific description of the individual solutions contributing to the Colorado experiment as well as key contributions for the establishment of the IHR/IHRF and the IGRS/IGRF (International Gravity Reference System and Frame). Paper submission started in October 2019 and was closed in May 2020. We received 23 manuscripts; four of them are already published, one was rejected, and the others are still under review. Since the GGOS Days 2019 in the last November, most of our activities concentrated on preparing the manuscripts for this special issue and performing the editorial management (as guest editors).

Recently, to support the initiative promoted by the GGOS Coordinating Office to modernise the GGOS website, new texts and graphics were prepared to describe the activities, achievements, and challenges of the FA-UHS. The new structure includes: a short presentation directed to non-geodesists; objectives; activities; working groups (not only the active ones, but also previous working groups since the establishment of the FA-UHS) and further reading (including, scientific papers, IAG resolutions motivated by the FA-UHS, presentations, reports, and terms of reference).

Planned Actions and Milestones

The planned activities of the FA-UHS may be summarised as follows:

- (1) Based on the Colorado experiment outcomes, to elaborate a document with detailed standards and conventions for the realisation and maintenance of the IHR.

- (2) With the support of the IAG Commission 2, the International Gravity Field Service (IGFS) and the Inter-Commission Committee on Theory (ICCT) to promote the study of
- quality assessment in the determination of potential values;
 - determination of potential changes with time;
 - realisation of the IHRS in marine areas.

With this purpose, following working/study groups are established for the term 2019-2023:

- IAG Commission 2 working group *Error assessment of the 1-cm geoid experiment*, chaired by M Willberg (Germany) and T Jiang (China).
 - IAG ICCT study group *Geoid/quasi-geoid modelling for realisation of the geopotential height datum*, chaired by J Huang (Canada).
 - GGOS-FA-UHS and IGFS working group *Implementation of the International Height Reference Frame (IHRF)*, chaired by L Sánchez (Germany) and R Barzaghi (Italy).
- (3) In agreement with the IGFS and the IAG Commission 2, to design a strategy to install an operational infrastructure within the IGFS to ensure the maintenance and availability of the IHRF in a long-term basis. Aspects to be considered are:
- Updates of the IHRS definition and realisation according to future improvements in geodetic theory and observations.
 - Regular updates of the IHRF (e.g. IHRFyyyy) according to new stations, coordinate changes with time, improvements in the estimation of reference coordinates and modelling of the Earth's gravity field, etc.
 - Support in the realisation and utilisation of the IHRS/IHRF at regional and national level.
 - To guarantee an organisational and operational infrastructure to ensure the sustainability of the IHRF.

Global Geodetic Observing System

GGOS Days 2020 - Report



7.4 GGOS Focus Area Geohazards

John LaBrecque, Chair

Present Status and Progress

The Geohazards Focus Area is working to support the [IUGG 2015 Resolution #4](#) as discussed and reported upon by the [GTEWS 2017 workshop](#). The GTEWS 2017 Workshop Report is the peer reviewed version of the initial report by [the APRU](#). The Focus Area activities implement the [GGOS 2020 recommendation 5.8](#) to “promote the development of GNSS seismology particularly for early warning and disaster assessment”.

The Focus Area fully supports the GATEW Working Group that is aligned to these same goals via a call for participation. The [GATEW Working Group](#) was formed in response to this [call for participation](#) issued by the GGOS Chair (Dr. Kutterer). The GATEW WG currently numbers 18 exceptional institutions from 12 countries. The GATEW WG was central to the success of the GTEWS 2017 workshop.

The current pandemic crisis has impacted the Geohazards Focus Area. This Focus Area had announced the GTEWS 2020 meeting as a sequel to GTEWS 2017. GTEWS 2020 was a collaboration with the IUGG, APEC, Tohoku University, UCDAVIS. The meeting is now postponed until a later date due to the challenges of travel during the pandemic.

In the interim, we determined that it is best to move forward with the first recommendation of the [GTEWS 2017 workshop](#) i.e., the establishment of a Consortium to oversee the development and operation of a GNSS enhancement to Tsunami Early Warning for the Indo-Pacific and Caribbean Basins. Starter funds have been identified in support of a meeting of principals to develop a [GTEWS Consortium](#) to encourage the shared use of real time multi-GNSS data and processing software within cloud computing environment. It is believed that rapid progress can be made with minor investment.

The concept of a meeting of principals to discuss the GTEWS Consortium is endorsed by the GGOS Coordinating Committee, the IAG President, the IUGG Commission on Geophysical Risk and Sustainability.

The GEO workplan for 2020-2022 establishes the Geodesy4Sendai Community Activity. Geodesy4 Sendai is the optimal forum for the GTEWS Consortium. I am working with Allison Craddock to recommend that GEO include the GTEWS_Consortium as a community activity within the Geodesy4Sendai initiative. The IUGG has offered about \$20,000 in support of this meeting. These funds will serve as starter funds in planning the meeting of principals to include a broadened support community of agencies and institutions.

Planned Actions and Milestones

During the coming months, the GATEW Working Group will conduct virtual meetings with small subgroups to discuss support for GTEWS Consortium its goals, strategies, timelines and membership composition including those government agencies responsible for disaster risk management.

7.5 Focus Area: Geodetic Space Weather Research

Michael Schmidt (1), Ehsan Forootan (2)

(1) Deutsches Geodätisches Forschungsinstitut der Technischen Universität München (DGFI-TUM), Germany, mg.schmidt@tum.de

(2) Geodesy and Earth Observation Group, Aalborg University, Denmark, efo@plan.aau.dk

Present Status and Progress

The following items will be mentioned here:

- Following the decision made at the splinter meeting of the FA-GSWR at the IUGG 2019 General Assembly in Montreal, the scientific content of the FA-GSWR was officially extended by the magnetosphere and their coupling processes such that the FA deals with the Magnetosphere – Ionosphere – Thermosphere (MIT) system and the mutual couplings.
- Ehsan Forootan, now affiliated with the Geodesy and Earth Observation Group at the Aalborg University in Denmark, was appointed as the new Vice-Chair of the FA-GSWR
- An oral presentation about the FA-GSWR was given at the AGU Fall Meeting 2019 at December 9, 2019 in San Francisco, USA in the GGOS Session. The title of the presentation was: GGOS Focus Area on Geodetic Space Weather Research – Observation Techniques and Modeling Approaches
- One single GGOS Joint Study Group (JSG), associated with the Inter-Commission Committee on Theory (ICCT) of the IAG and denoted as ICCT-JSG T 0.27, and three Joint Working Groups (JWG), directly associated with the FA-GSWR, have finally been established, namely as:

JSG 1 (ICCT-JSG 0.27): Coupling processes between magnetosphere thermosphere and ionosphere electron density modelling; Chair: Andres Calabia Aibar (China), Vice-Chair: Munawar Shah (Pakistan), 11 group members

Current activity: opening a Website-Forum with information and updates concerning the coupled processes within the MIT, available bibliography and models, instructions and examples how to use the models, etc.

JWG 1: Electron density modelling; Chair: Fabricio dos Santos Prol (Germany), Vice-Chair: Alberto Garcia-Rigo (Spain), 18 group members

Current activities: (1) definition of instruments and measurements to be used in the evaluations, (2) data gathering and processing for the generation of a first campaign (four weeks with relevant geomagnetic storms).

JWG 2: Improvement of thermosphere models; Chair: Christian Siemes (The Netherlands), Vice-Chair: Kristin Vielberg (Germany), 9 group members

Current activity: planning of a virtual group meeting in October 2020

JWG 3: Improved understanding of space weather events and their monitoring by satellite missions; Chair: Alberto Garcia-Rigo (Greece), Vice-Chair: Benedikt Soja (Switzerland), 11 group members

Current activity: (1) identification of solar weather data sources publicly available, (2) determination of key parameters and products affected by selected space weather events

- Update of the FA-GSWR part of the GGOS website including research description, structure, objectives, activities, etc.

Planned Actions and Milestones

- Performing a virtual meeting with the chairs and vice-chairs of the four study and working groups in November 2020 on the status and the future steps of the FA-GSWR
- Continuation of the work on the definition and selection of the essential geodetic variables (EGV) in the framework of the scientific work within FA-GSWR
- The main topics of the FA-GSWR are again included in the description of the PICO Session G5.1: Ionosphere, thermosphere and space weather: monitoring and modelling of the Geodesy Division of the European Geosciences Union (EGU) General Assembly (GA) 2021. The main convener of this session will be Ehsan Forootan, co-conveners of the Session G5.1 are Benedikt Soja and Michael Schmidt. Deadline for submitting abstracts will be January 13, 2021; the EGU GA 2021 will take place from April 25 to 30, 2021 in Vienna, Austria
- Planning of a splinter meeting of the FA-GSWR during the EGU GA 2021 in Vienna
- The 2nd International Symposium of IAG Commission 4 “Positioning and Applications” was originally planned for September 7 – 11, 2020 with a special conference part dedicated and organized by the FA-GSWR; due to the Corona pandemic the symposium was postponed to September 2022
- The special issue "Observing and Modelling Ionosphere and Thermosphere using in situ and Remote Sensing Techniques" of the journal "Remote Sensing" was initiated. Guest editors are Ehsan Forootan, Michael Schmidt and Benedikt Soja; the deadline for manuscript submissions is December 31, 2020