



International Global Navigation Satellite Systems Service

IGS
Multi-GNSS Experiment

IGS M-GEX

Call for Participation
www.igs.org

Document prepared by: Experiment Organizing Committee

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1. RATIONALE and SCHEDULE

The IGS was formed through a Call for Participation that was circulated in 1991 by the International Association of Geodesy (IAG). In 1993, a pilot scientific service based on the US Global Positioning System (GPS) led to the official establishment of the International GPS Service in 1994. The IGS has been operating ever since.

In 1998, the IGS circulated a Call for Participation in the International GLONASS Experiment – IGEX. This successful experiment led to the establishment of the International GLONASS

Service Pilot Project within the IGS. By 2003, GLONASS was fully incorporated into the IGS. This led to the IGS becoming a truly GNSS service, GPS plus GLONASS and hence, in 2005, the IGS was renamed to the International GNSS Service.

This Call for Participation for the IGS Multi-GNSS Experiment – IGS M-GEX – recognizes the availability of new additional GNSS signals and new constellations on the horizon. The IGS is preparing for this next phase in the evolution of the IGS to eventually generate products for all GNSS available.

The IGS is a component of the *Global Geodetic Observing System* (GGOS), which is a key integrating activity of the IAG. There is an additional Call for Participation being circulated by GGOS soliciting proposals for a core network of multi-technique geodetic sites to define and improve the Terrestrial Reference Frame and provide essential data for other space geodesy requirements. Please access this companion CfP at <http://www.ggos.org>

1.1 Background

The IGS is deeply involved in GNSS tracking, data management, analysis and production of products for applications requiring the utmost accuracy. The primary products are precise orbits of the satellites and ground station network positions over time, which contribute significantly to the International Terrestrial Reference Frame (ITRF). Precise satellite and ground clock products are also generated. Additional products supporting special projects are produced, relating to the ionosphere, troposphere and real-time data streams, as well as others. Up to now, IGS operations have focused solely on signals provided by the GPS and GLONASS systems. In the future, the IGS should take advantage of and support further navigation satellite systems. To facilitate this, a test experiment is planned in order to a) expand tracking capabilities, b) support in-depth analysis of new signals and equipment, and c) improve GNSS data analysis capabilities. It is expected that this experiment process will be similar to the successful IGEX, but include multiple constellations and new signals.

Current modernization programs for the existing GNSS, GPS and GLONASS, have already launched, and will continue to launch, new generations of satellites. These satellites provide additional signals in order to deliver better accuracy, reliability and availability of positioning, navigation and timing services. The upcoming Galileo system is currently represented by its GIOVE test satellites but will be expanded by the scheduled launch of up to four in-orbit validation (IOV) satellites planned in 2011/12. Furthermore, China is building up its own GNSS, known as Compass/BeiDou, which consists both of GEO and MEO satellites providing global as well as regional services. Japan's Quasi-Zenith Satellite System (QZSS) offers overlay services for the Asian-Oceania region, but with special focus on users in urban and highly masked areas.

Existing or upcoming initiatives to track a variety of the new systems or signals (e.g., tracking GIOVE, QZSS, Compass, Galileo) shall be encouraged to cooperate with this IGS effort. Specifically, a strong link will be established to the recently issued Call of JAXA for hosting sites for a Multi-GNSS Monitoring Network (http://www.satnavi.jaxa.jp/e/news/qz-110601_e.html).

1.2 The IGS Involvement

According to the IGS Terms of Reference, the Service provides the highest quality GNSS data and products in support of the terrestrial reference frame, Earth rotation, Earth observation and research, positioning, navigation and timing and other applications that benefit society. To fulfil this goal new systems and technologies have to be integrated and incorporated as soon as possible. As IGS operations are currently limited to GPS and GLONASS, this experiment will facilitate the collection of global tracking data that would allow a rigorous test of the capabilities of the IGS components to incorporate new systems and signals. For example, the experiment will encourage data analysts to investigate the quality of the measurements made using the new signals and the potential of processing multiple GNSS data sets. The IGS M-GEX should also be viewed as a means of fostering increased participation and cooperation with international space agencies, research organizations, national mapping organizations (NMOs), universities and other organizations interested in high precision GNSS.

1.3 Objectives

The main purpose of IGS M-GEX is to conduct a global multi-GNSS signals tracking experiment in parallel to the regular IGS operations, to focus on tracking the newly available GNSS signals. This includes all signals from the modernized satellites of the GPS and GLONASS systems, as well as for the first time in IGS operations, all available or applicable signals of the Compass/BeiDou, Galileo and QZSS systems and any space-based augmentation system (SBAS) of interest. In the first instance the experiment is focused on collecting and making publicly available observation data suitable for post-processing and engineering analysis. However, Real-Time (RT) data flow from participating individual sites or organizations contributing via tracking data exchange with this experiment is also very welcome, and will be coordinated by the IGS Real-Time Working Group.

This call will be followed by a more definitive plan focussing on the analysis of the unique set of observations collected in the course of this call. Analysis Centers are encouraged, on a best effort basis, to use the IGS M-GEX data to determine inter-system calibration biases, to compare equipment performance and to test and further develop processing software capable of handling multiple GNSS observation data. Finally, the development of multi-GNSS IGS products will be stimulated, eventually leading to a Multi-GNSS Pilot Project.

1.4 IGS M-GEX Schedule

- August 2011: Distribution of Call for Participation
- October 30th: Proposals due (entities may propose and join at any time)
- December 15th: Evaluation of proposals by Organizing Committee
- February 1st 2012: Experiment begins

- July 23th – 27th 2012 Evaluation of first results during IGS Workshop in Olsztyn, Poland
- August 31th 2012: Experiment ends

1.5 Organizational Aspects

The IGS M-GEX is coordinated by an Experiment Organizing Committee. This Committee is appointed by the IGS GB for the duration of the experiment and will then be dissolved. Further activities will be coordinated by the IGS GNSS Working Group. The Organizing Committee consists of the Chairs of the IGS Pilot Projects and Working Groups and of the Members of the IGS GNSS Working Group.

The Organizing Committee, with assistance from the Central Bureau, prepares and sends out the Call for Participation, and then evaluates and answers the proposals received.

Additional information may be found below and at the following web site:

IGS website: <http://igs.org>

2. CALL for PARTICIPATION

The Organizing Committee is seeking participation in the IGS M-GEX through the following components

- Multi-GNSS Observing Sites
- Multi-GNSS Data Centers
- Multi-GNSS Experiment Analysis Centers and/or Engineering Analysis Centers
- Multi-GNSS Collaborating Organizations and Networks

2.1 Observing Sites

2.1.1 Receivers

Only geodetic-type receivers (capable of collecting pseudorange and carrier phase observations) may be used. Receivers should be able to track GPS or GPS+GLONASS signals and in parallel signals of further systems such as Galileo (GIOVE/IOV), Compass/BeiDou and, if possible, QZSS on at least two frequencies.

Receivers should be, if possible, co-located with or tied to sites that have well-determined ITRF coordinates. Already established IGS sites are preferred. In cases where there are no suitable ITRF coordinates available at a site, the installed multi-GNSS receiver should be able to track dual-frequency geodetic-quality GPS data to collect sufficient GPS data during the experiment

to compute ITRF coordinates for the site with the required accuracy. If the station(s) are part of a cooperating network, please note that in the proposal.

A Site Log must be available at the IGS M-GEX Data Center and the IGS Central Bureau prior to the observation experiment (format identical to IGS site documentation form, available at the IGS website, <ftp://igs.org/pub/station/general/blank.log>). Please note that site photos are requested for each site and details will be at the IGS website.

A 4-character acronym for each receiver operated during the experiment should be proposed to and approved by the IGS Central Bureau (igs cb at igs cb.jpl.nasa.gov).

2.1.2 Operational considerations

RINEX observation data shall be provided either in daily (30 sec sampling rate) or hourly (30 sec) or 15 min files (1 sec). The maximum latency for all file types shall be 24 hours.

Receiver, antenna and monument configuration should be kept stable throughout the experiment.

The data may be forwarded to an IGS M-GEX Data Center on an hourly basis if possible. In any case, the data must be forwarded not later than 48 hours from the end of the UT day on which it was collected.

The exchange file format is the RINEX V3.01 format (or upgraded RINEX version as available prior to experiment). Site operators shall perform a data quality control before sending the data to a Data Center. Detailed guidelines for the data handling will be provided as soon as possible.

Real-time data transmission – in addition to provision of tracking data in RINEX format - is welcome, too. Activities related to real-time data streaming will be coordinated by the IGS Real Time WG. Detailed information will be provided as soon as practical, see <http://www.rtigs.net/>

It is essential to note that the IGS M-GEX experiment is in conjunction with ongoing IGS operations and shall not disturb stable IGS stations, especially IGS reference frame stations. Any planned activities related to equipment changes of IGS sites must be coordinated with the IGS Infrastructure Committee.

2.2 Data Centers

Support is requested from organizations and data centers with the capability to expand their archives to include data and products from participants in this tracking campaign. Data centers interested in handling IGS M-GEX data and products must operate according to agreed upon IGS data format standards and follow accepted file and directory naming conventions, etc. as outlined on the IGS website. Interested parties should refer to the IGS Data Center Charter (<http://igs.org/organization/dccharter.html>) for a list of requirements. Existing IGS data centers proposing to support IGS M-GEX should ensure that the data and products related to the

experiment are archived separately from the IGS operational data set and do not affect routine operations. The proposal should describe the maximum number of stations from which data can be received, stored and made available for anonymous ftp access.

Data upload from the stations to the Data Center should also be performed through ftp (anonymous or by user account/password). However, it will be the responsibility of the IGS M-GEX Data Center(s) to coordinate the data upload with the observing sites.

The data should be available online within hours after reception from the observing organizations and for at least 3 months after the experiment. Offline availability upon request should be maintained for at least 2 years.

Data centers are expected to provide open access to IGS data and products provided through this experiment.

2.3 Experiment Analysis Centers and/or Engineering Analysis Centers

The experiment is focussed on collecting and making publicly available observations of new systems and signals suitable for post-processing and engineering analysis. The IGS seeks groups interested in using the tracking data for engineering and experimental analysis. The primary goal is to obtain a detailed understanding of the signal performance and equipment properties for high precision applications. Analysis results shall be made available to the IGS through the GNSS WG and may be presented during the IGS Workshop taking place on 23–27 July 2012 in Olsztyn, Poland.

2.4 Collaborating Organizations and Networks

The IGS is interested in fostering cooperation with international organizations that already operate, or are planning to operate a multi-GNSS tracking network in the near future. In this context, IGS M-GEX is interested in data exchange to fill gaps in site distribution and signal coverage and to realize synergies between organizations in the exploitation of the new GNSS signals and systems.

The level of collaboration can be specified in detail via the appended application forms.

3 Instructions for Submitting a Proposal

Proposals submitted in response to this Call for Participation should contain:

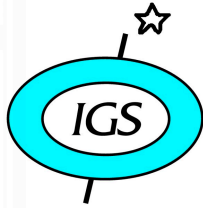
- A cover letter signed by an official representative of the organization
- The attached cover sheet “*Response to the Call for Participation*”
- A detailed plan describing the activities proposed by the organization, and
- Completion of the appropriate attached forms which will be available as web forms – see the ‘What’s New’ box at <http://igs.org>

It should be clear in the proposal which organizations are cooperating or assumed to contribute, and whether the organization(s) would further consider continuing their activities after the end of the observation experiment in August 2012.

Please send proposals to:

Ruth Neilan
IGS Central Bureau
c/o Jet Propulsion Laboratory/Caltech
Mail Stop 238-540
4800 Oak Grove Drive
PASADENA, CA 91109 USA

Please e-mail: mgex@jpl.nasa.gov
with copy to Robert Weber (Robert.weber@tuwien.ac.at)



Response to the Call for Participation

International Global Navigation Satellite Systems Service

IGS
Multi-GNSS Experiment

IGS M-GEX

Organization:	
Name of Point of Contact(s):	
Address:	
E-mail address:	
Website:	
Phone:	
Fax:	

Form 1: Organization information

Organization

Organization	
Address	
Name of Representative	
Department/Division	
Phone	
Fax	
E-mail address	

Form 2. Site information

Site Name		Four letter ID	
Location	Country:	City/Town:	
Site Information	<input type="checkbox"/> new site		<input type="checkbox"/> IGS site
	<input type="checkbox"/> Co-location with other geodetic reference		
	If yes, describe what reference is co-located here:		
Proposed antenna location	Longitude		
	Latitude		
	Height		
Monumentation			
Receiver installation			
External Frequency Standard	If yes, please describe		
Internet access			
Other information			

Receiver Type / Antenna Type / Tracked Signals

Receiver Type	
Antenna Type	
Radome	
Antenna Absolute Calibration (robot or chamber calibration) available for tracked frequencies?	<input type="checkbox"/> yes <input type="checkbox"/> no <input type="checkbox"/> Chamber <input type="checkbox"/> Robot
If no, specify uncalibrated frequencies	
If no, do you intend to perform a calibration in the near future?	<input type="checkbox"/> yes <input type="checkbox"/> no
Antenna Calibration freely/publicly available?	<input type="checkbox"/> yes <input type="checkbox"/> no
Tracked Signals	Please indicate below
GPS	
GLONASS	
GIOVE/Galileo	
Compass/Beidou	
QZSS	
SBAS	

Provided Data Format (required update rates specified in CfP document)

Format	version
RINEX	<input type="checkbox"/> 3.01 <input type="checkbox"/> Other, please specify
RTCM	<input type="checkbox"/> 3.1 <input type="checkbox"/> 3.0 <input type="checkbox"/> other, please specify
Real-Time data stream?	<input type="checkbox"/> yes <input type="checkbox"/> no

Do you plan to continue data delivery after scheduled end of IGS M-GEX	<input type="checkbox"/> yes <input type="checkbox"/> no <input type="checkbox"/> maybe/uncertain
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Form 3: Data Centers

Organization

Organization	
Address	
Name of Representative	
Department/Division	
Phone	
Fax	
E-mail address	

Data Center Particulars:

User access	<input type="checkbox"/> Anonymous ftp <input type="checkbox"/> Web
Number of stations data center can support	
Available data resolution	<input type="checkbox"/> Daily <input type="checkbox"/> Hourly <input type="checkbox"/> High-Rate <input type="checkbox"/> Real-Time
Accepted data formats	<input type="checkbox"/> RINEX 3.01 <input type="checkbox"/> Other, please specify
Accepted data upload strategy (e.g., get/push from data source)	<input type="checkbox"/> Get (retrieve from data source) <input type="checkbox"/> Push (accept from data source) Comments:
Directory structure for IGS M-GEX data*	
Directory structure for IGS M-GEX products*	
Latency of online availability of delivered data	
How long after scheduled end of IGS M-GEX does the data centers guarantee online data access?	
Does the data center plan to continue hosting experiment data submitted after the	<input type="checkbox"/> yes <input type="checkbox"/> no <input type="checkbox"/> maybe/uncertain

scheduled end of IGS M-GEX?	
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* IGS M-GEX GNSS data and products should be archived separately from the IGS operational data set, preferably by the name of the experiment (e.g., /igsmgex/daily/YYYY/DDD..., /products/igsmgex/...).

Form 4: IGS M-GEX Analysis Efforts

Organization

Organization	
Address	
Name of Representative	
Department/Division	
E-mail address	
Phone	
Fax	
Describe your anticipated efforts for analysis interests	

Form 5: Collaborating Organizations and Networks

Organization

Organization	
Address	
Name of Representative	
Department/Division	
E-mail address	
Phone	
Fax	
Network	Describe the network operated by your organization: Number of sites : Year of Observation Start: Number of IGS sites in your network: Further information / URL:

Cooperation with IGS M-GEX

Specify level of cooperation with IGS M-GEX	
Specify planned data interface with IGS M-GEX	
Do you plan to continue data delivery after the scheduled end of IGS M-GEX?	<input type="checkbox"/> yes <input type="checkbox"/> no <input type="checkbox"/> maybe/uncertain

Specify site information for all stations you intend to provide tracking data to IGS M-GEX (please copy tables as necessary)

Site information (Same as Form 2 above)

Site Name		Four letter ID	
Location	Country:	City/Town:	
Site Information	<input type="checkbox"/> new site		<input type="checkbox"/> IGS site
	<input type="checkbox"/> Co-location with other geodetic reference		
	If yes, describe what reference is co-located here:		
Proposed antenna location	Longitude		
	Latitude		
	Height		
Monumentation			
Receiver installation			
External Frequency Standard	If yes, please describe		
Internet access			
Other information			

Receiver Type / Antenna Type / Tracked Signals

Receiver Type			
Antenna Type			
Radome			
Antenna Absolute Calibration (robot or chamber calibration) available for tracked frequencies?	<input type="checkbox"/> yes	<input type="checkbox"/> no	
	<input type="checkbox"/> Chamber	<input type="checkbox"/> Robot	
If no, specify uncalibrated frequencies			
If no, do you intend to perform a calibration	<input type="checkbox"/> yes	<input type="checkbox"/> no	

in the near future?	
Antenna Calibration freely/publicly available?	<input type="checkbox"/> yes <input type="checkbox"/> no
Tracked Signals	Please indicate below
GPS	
GLONASS	
GIOVE/Galileo	
Compass/Beidou	
QZSS	
SBAS	

Provided Data Format (required update rates specified in CfP document)

Format	version
RINEX	<input type="checkbox"/> 3.01 <input type="checkbox"/> Other, please specify
RTCM	<input type="checkbox"/> 3.1 <input type="checkbox"/> 3.0 <input type="checkbox"/> other, please specify
Real-Time data stream?	<input type="checkbox"/> yes <input type="checkbox"/> no