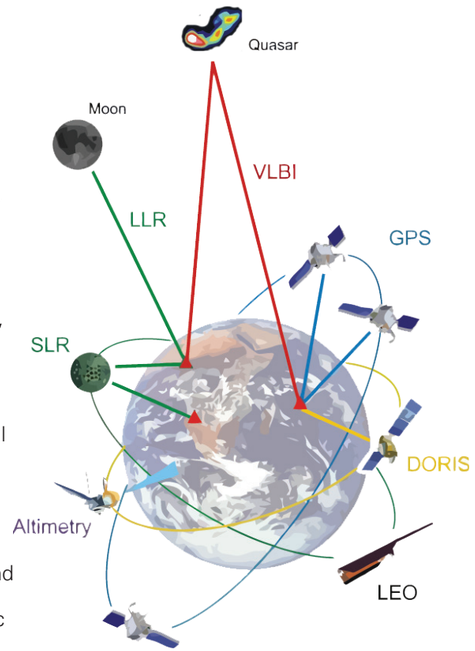
The International GNSS Service provides the highest quality GNSS data, products, and services in support of the terrestrial reference frame; Earth observations and research; Positioning, Navigation, and Timing (PNT); and other applications that benefit the scientific community and society.

Products

The IGS, a component of the Global Geodetic Observing System, operates a global network of GNSS ground stations, data centers, and data analysis centers to provide data and derived data products that are essential for Earth science research; multi-disciplinary positioning, navigation, and timing (PNT) applications; and education. The IGS Reference Frame Coordinator determines tracking site coordinates and velocities in the International Terrestrial Reference Frame (ITRF), and organizes the IGS contribution to ITRF.

IGS products include:

- GNSS satellite ephemerides
- Earth rotation parameters
- Global tracking station coordinates and velocities
- Satellite and tracking station clock information
- Zenith tropospheric path delay estimates
- Global ionospheric maps



These products support Earth science analyses and other efforts, such as

- Improving and extending the International Terrestrial Reference Frame (ITRF) maintained by the International Earth Rotation and Reference Systems Service (IERS),
- Monitoring deformation of the Earth,
- Monitoring Earth rotation,
- Monitoring the troposphere and ionosphere,
- Determining orbits of scientific satellites,
- and other diverse applications.

Organizational Values

Fundamental to the IGS are key values that are shared across the organization, these are:

- Advocacy of an open data policy, with data and products readily available,
- Welcome contributions from and participation with all organizations,
- Effective reliability through redundancy of IGS components,
- Technical evolution through "friendly competition",
- Dedicated engagement with policy entities to raise mutual awareness of IGS

The IGS...

...is a federation of over 200 agencies, universities, and research institutions in more than 90 countries

...is a provider of GPS satellite orbits to the highest precision in the world, 3 cm

...ensures precise positions (5 mm) for over 400 worldwide reference stations

...produces products that support realization of the International Terrestrial Reference Frame

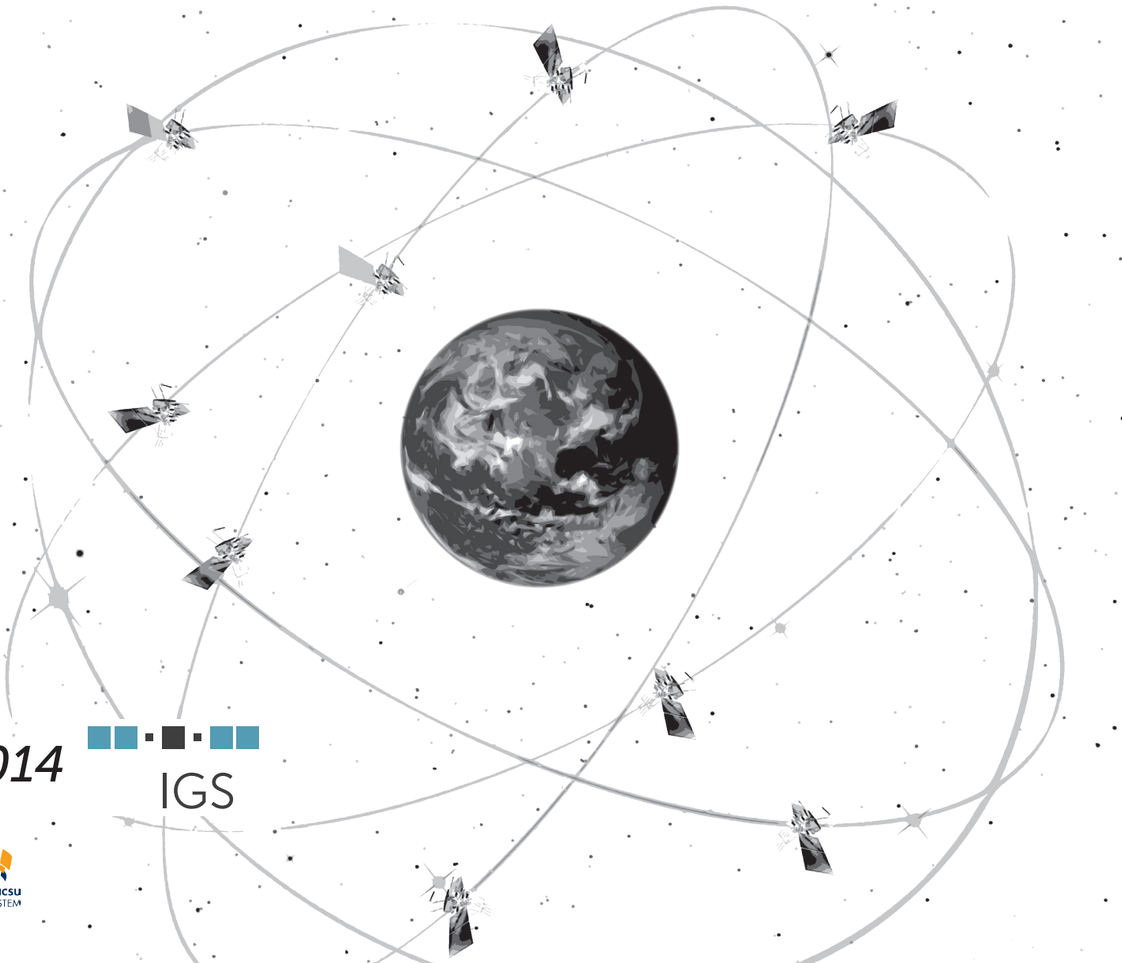
...works for the continuous development of new applications and products through Working Groups and Pilot Projects

... functions as a component of the Global Geodetic Observing System (GGOS)

IGS

IGS Central Bureau
Jet Propulsion Laboratory
MS 238-540
Pasadena, CA 91109 USA
Phone: (818) 354-2077
Fax: (818) 354-8545
http://www.igs.org
cb@igs.org

IGS INTERNATIONAL GNSS SERVICE



IGS *Celebrating* **1994** *20 Years* **2014** *of Service*

IAG 150 years · GGOS · NASA · ICSU WORLD DATA SYSTEM

IGS

The foundation of the International GNSS (Global Navigation Satellite System) Service (IGS) is a global network of over 400 permanent, continuously operating, geodetic quality stations tracking GPS, GLONASS, Galileo, BeiDou, QZSS, and SBAS.

Station data is archived at four IGS Global Data Centers and multiple Regional Data Centers. Analysis Centers regularly process the data and contribute products to the Analysis Center Coordinator, who produces the official IGS combined products. The Central Bureau is responsible for day-to-day management of the IGS, following policies set by the IGS International Governing Board.

Service Mission and Benefits

The International GNSS Service (IGS) has ensured open access, high-quality GNSS data products since 1994. These products enable access to the definitive global reference frame for scientific, educational, and commercial applications – a tremendous benefit to the public.

Through the Real-time Service (RTS), the IGS extends its capability to support applications requiring real-time access to IGS data and products.

Products, Working Groups, and Pilot Projects

The IGS classic product set — satellite orbits, clocks, Earth rotation parameters, and station positions — is augmented by newer products born from IGS Working Groups (WG) and Pilot Projects (PP):

- Antenna WG
- Bias and Calibration WG
- Clock Products WG
- Data Center WG
- Multi-GNSS WG
- Ionosphere WG
- Real-Time WG and PP
- Reference Frame WG
- RINEX WG
- Space Vehicle Orbit Dynamics WG
- Tide Gauge (TIGA) PP
- Troposphere WG

IGS MGEX

MGEX - The Multi-GNSS Experiment

The Multi-GNSS Experiment (MGEX) has been set-up by the IGS to track, collate and analyze all available GNSS signals. This includes signals from the BeiDou, Galileo and QZSS systems, as well as from modernized GPS and GLONASS satellites and any space-based augmentation system (SBAS) of interest.

Analysis centers will attempt to estimate inter-system calibration biases, compare equipment performance and further develop processing software capable of handling multiple GNSS observation data.

For more information about MGEX, including news, constellation status, network and station information, data holdings, real-time data, and products, please visit: *http://igs.org/mgex*

Thule Air Base station (THU2), Greenland.

IGS PRESENTS

IGS Presents - Learn from the Best

The key element that ensures the success of the IGS is its people. The IGS maintains a library of video recorded presentations by leaders of the geodesy community, available online at: *http://igs.org/presents.*

IGS RTS

Introducing the IGS Real-time Service (RTS)

The International GNSS Service (IGS) Real-time Service is a GNSS orbit and clock correction service that enables Precise Point Positioning (PPP) at worldwide scales. The RTS products enable applications such as scientific testing, geophysical monitoring, hazard detection and warning, weather forecasting, time synchronization, GNSS constellation monitoring, imagery control and many other public-benefit applications.

RTS Products

The RTS Products consist of GNSS satellite orbit and clock corrections to the broadcast ephemeris, as well as data streams from a global network of high-quality GNSS receivers.

The RTS products are distributed as RTCM SSR correction streams broadcast over the Internet using the NTRIP protocol. The corrections are expressed within the International Terrestrial Reference Frame 2008 (ITRF08). The initially offered products include GPS-only correction streams, as well as an experimental GPS+GLONASS correction stream that is anticipated to be fully integrated within the RTS in the near future.

RTS Infrastructure

RTS is based on the IGS global infrastructure of network stations, data centers and analysis centers that provide the "world's standard" high-precision GNSS data products. Operational responsibility for the generation of the official RTS combination products lies with the IGS Real Time Analysis Center Coordinator (RTACC), currently the European Space Agency's Space Operations Centre in Darmstadt, Germany (ESA/ESOC).

The RTS product streams are combination solutions generated by processing individual solutions from participating Real-time Analysis Centers (RTAC). The effect of combining the different RTAC results is a more reliable and stable performance than that of any single AC's product.

IGS Quality of Service

The IGS continuously monitors the accuracy of its products through intercomparison of results between Analysis Centers. IGS strives to deliver its products on a highly available basis as shown below. Due to the volunteer nature of IGS, availability of products cannot be not guaranteed.

Information for Users

The RTS is supported by the IGS as an openly available service with access to all users, as far as dissemination resources allow. RTS is initially offered as beta service for the development and testing of applications. The RTS is expected to be fully operational by the end of 2013. As NTRIP is an RTCM open standard, no special licensing is associated with its use. Commercial entities interested in integrating RTS into their equipment should contact the IGS Central Bureau for additional information and support.

The RTS product streams are available through designated product distribution centers around the world. Users may register online through the IGS Real-time Service website.

Content Description of the RTS Product Streams

The RTS products are disseminated in the form of RTCM SSR streams. The technical content of the RTS products is described in the table below. The products, designated at IGS01/ICG01 and IGS02, contain corrections only for the GPS satellites. The experimental product, designated at IGS03, contains corrections for GPS and GLONASS. The RTCM v3 streams listed below may be used to support development and testing of real-time Precise Point Positioning (PPP) and related applications.

For more information, please visit the RTS website: *http://rts.igs.org.*

Stream Name	Description	Ref Point	RTCM Messages	Provider / Solution ID	Bandwidth (kbits)	Software
IGS01	Orbit/Clock Correction, Singe-Epoch Combination	APC	1059 (5),1060 (5)	258 / 1	1.8/sec	ESA/ESOC
IGC01	Orbit/Clock Correction, Singe-Epoch Combination	CoM	1059 (5),1060 (5)	258 / 9	1.8/sec	ESA/ESOC
IGS02	Orbit/Clock Correction, Kalman Filter Combination	APC	1057 (60), 1058 (10), 1059 (10)	258 / 2	0.6/sec	BKG
IGS03	Orbit/Clock Correction, Kalman Filter Combination	APC	1057(60), 1058(10), 1059(10), 1063(60), 1064(10), 1065(10)	258 / 3	0.8/sec	BKG
RTCM3EPH	Broadcast Ephemeris		1019(5), 1020(5), 1045(5)		6.0/sec	BKG/BNC

APC: Antenna Phase Center CoM: Center of Mass, (not compliant with current RTCM-SSR standard). The figures in brackets next to each RTCM message ID denote the message sample interval in seconds.

Quality of Service

GPS Satellite Ephemerides / Satellite and Station Clocks		Sample Interval	Accuracy	Latency	Continuity	Availability
Broadcast (for comparison)	Orbits	1s	~100 cm	real time	Continuous	99.99%
	Sat. Clocks		~5 ns RMS; ~2.5 ns Sdev			
Ultra-Rapid (predicted half)	Orbits	15 min	~5 cm	predicted	4x daily, at 03, 09, 15, 21 UTC	95%
	Sat. Clocks		~3 ns RMS; ~1.5 Sdev			
Ultra-Rapid (observed half)	Orbits	15 min	~3 cm	3-9 hours	4x daily, at 03, 09, 15, 21 UTC	95%
	Sat. Clocks		~150 ps RMS; ~50 ps Sdev			
Rapid	Orbits	15 min	~2.5 cm	17-41 hours	daily, at 17 UTC	95%
	Sat. & Stn. Clocks	5 min	~75 ps RMS; ~25 ps Sdev			
Final	Orbits	15 min	~2 cm	12-18 days	weekly, every Thursday	99%
	Sat. & Stn. Clocks	Sat: 30 s; Stn.: 5 min	75 ps RMS; 20 ps Sdev			
Real-time	Orbits	5-60 s	~5 cm	25 seconds	Continuous	95%
	Sat. Clocks	5 s	300 ps RMS; 120 ps Sdev			

Note 1: *Orbit accuracies are 1D mean RMS values over the three XYZ geocentric components. IGS accuracy limits, except for predicted orbits, are based on comparisons with independent laser ranging results and discontinuities between consecutive days. The precision is better.*

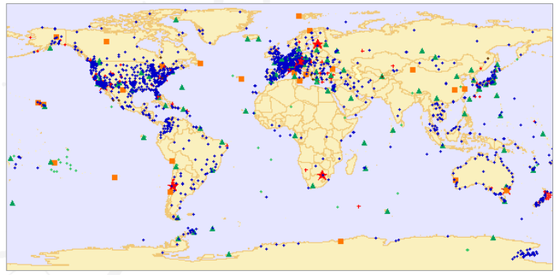
Note 2: *The accuracy (neglecting any contributions from internal instrumental delays, which must be calibrated separately) of all clocks is expressed relative to the IGS timescale, which is linearly aligned to GPS time in one-day segments. The standard deviation (SDev) values are computed by removing a separate bias for each satellite and*

Note 3: *Availability :percentage of time that accuracy and continuity of service meet stated specification.*

Contributions to The International Terrestrial Reference Frame (ITRF)

The IGS contributes to, extends, and densifies the International Terrestrial Reference Frame (ITRF). The ITRF provides an accurate and consistent frame, or datum, for referencing positions at different times and in different locations around the world. The IGS realization of ITRF, which extends the number of stations significantly, makes the reference frame easily accessible.

These requirements are stringent in order to ensure reliable measurements around the world for projects such as sea-level change, which occurs at the millimeter level. Limitations in a reference frame negatively impact the accuracy of numerous scientific and positioning applications, especially in the region immediately surrounding the station.



Reference Frame Stations contribute to the ITRF, and are the highest-quality GNSS stations in the world. This quality directly impacts the level of accuracy that can be achieved by using the ITRF. Requirements for stations include: a high-quality monument on stable crustal bedrock with excellent sky visibility; a long observing history; high-quality, consistent, continuous, and complete raw data; minimal changes to equipment and its surroundings; and a commitment to keep the station operating for as long as possible.

Full requirements are detailed in the IGS Site Guidelines: *http://bit.ly/ITRFguide.*

There are numerous advantages for an organization or station operator to support the ITRF, including: increased accuracy of the reference frame in the organization's region of interest; enhanced ease and accuracy of connections to the reference frame; increased accuracy of global positioning products, such as satellite orbits and clock products; and more accurate determination of transformations between realizations of the reference frame in that region and the national datums.