The IGS, the IAG, and the ICG

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Content

- The IAG, the IGS, the GGOS, the GIAC, and the ICG
- The UN GGRF Working Group and the UN resolution on reference frames, February 26, 2015.
- IGS: present and future
IAG, the International Association of Geodesy is a scientific organization in the field of geodesy promoting scientific cooperation and research [...] on a global scale [...].

GGOS, IAG’s Global Geodetic Observing System, working with the other IAG components to provide the geodetic infrastructure necessary for monitoring the Earth system and for global change research.

GIAC is the GGOS Inter-Agency Committee (GIAC).

IGS, the International GNSS Service, is a scientific service of the IAG, enabling highest-accuracy applications, including scientific applications.

IERS is the International Earth Rotation and Reference System Service (of IUGG and IAU) using the IGS products to generate technique-overarching geodetic & astronomical products.

The IGS is an associate member of the ICG, the International Committee on Global Navigation Satellite Systems.
UN-GGRF & resolution of reference frames

UN-GGRF (UN-Global Geodetic Reference Frames) is a working group of the UN Committee of Experts on Global Geospatial Information Management (UN GGIM).

GGRF members are in part members of the aforementioned IAG entities.

On February 26, 2015, the first UN resolution about global geodetic reference frames was adopted.

→ The resolution is an astonishing example of the science-driven community and decision makers from politics, in particular from the UN working together to the benefit of society.
The IGS: present

Today, the IGS archives

- archives all globally relevant GNSS observations since 1991,

generates and provides

- ephemerides (accurate to 2-4 cm) for ~32 GPS satellites and for ~24 GLONASS satellites (accurate to 5-8 cm), and other GNSS being deployed,
- satellite and receiver clock corrections (sub-ns accuracy)
- polar motion (PM) and length of day (LOD) (cm accuracy)
- coordinates and velocities for 200+ sites (cm / mm/y accuracy)
- atmosphere information, in particular Global Ionosphere Models (GIMs).
- Satellite clock corrections & corresponding orbits are also provided in „real time“ based on the IGS Real Time Network of 150+ sites.

IGS products are accurate, reliable and validated.

- Combined products are formed by Coordinators and made publicly available in a timely manner.
IGS Workshop 2014: 20th Anniversary

http://kb.igs.org/hc/en-us/articles/204895687-Compendium. The IGS is regularly questioning and improving its performance and products.
Future in GNSS: the science perspective

Until about 2007/08 GNSS was synonymous to GPS + minor contributions from other systems.

Today, we have two fully operational systems, namely GPS and GLONASS, which are both capable of generating geodetic products.

A combined analysis may result in better products for science and the wider user community.

>2018 there will be 3+ fully operational systems.

The future has already begun in the IGS with the MGEX (Multi-GNSS Experiment)
MGEX: Why Multi-GNSS?

More Satellites
- Improved PPP convergence
- More pierce points for atmospheric sounding
- De-correlation of height, clock, troposphere

Improved Signals
- Less multipath
- Increased robustness (scintillation, weak signal

Stable clocks
- Improved Real-time PPP
- Orbit improvement / prediction

Diversity
- Different orbital periods and commensurabilities
- Decorrelation of estimated parameters (orbits, Earth rotation)
IGS-MGEX Products

**Post-processed**
- Precise orbits and clocks
- Broadcast ephemerides
- Differential code biases

**Real-time**
- Broadcast ephemerides
- Orbit and clock corrections (Galileo)
MGEX: Today’s „System of Systems”

<table>
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<th>System</th>
<th>Blocks</th>
<th>Signals</th>
<th>Sats*)</th>
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<td>L1 C/A, L1/L2 P(Y)</td>
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<td>IIF</td>
<td>+L5</td>
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<td>GLONASS</td>
<td>M</td>
<td>L1/L2 C/A+P</td>
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<td>M+</td>
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<td></td>
<td>MEO</td>
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<td>L1 C/A, L1C, SAIF</td>
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<td>L5, S</td>
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*) Status June 2015; brackets indicate satellites not declared healthy/operational
Modeling GNSS Orbits

- Lageos (LAser GEodetic Satellite); spherical, diameter 60cm, mass 405kg
- GNSS satellite: Body 2 x 2 x 2 m³, “wings” 20 x 2 m², mass 500-1000kg
Ferraris are built to minimize non-gravitational forces, trucks not really (only “to some extent”).

From the p.o.v. of orbitography the Lageos is a Ferrari, the GNSS satellite is a truck.
Wishes ...

All GNSS satellites equipped with Laser Reflectors

Information needed: The IGS is only capable of generating integrated and highest quality GNSS products, provided the information on

- satellite properties (mass, surface, reflectivities),
- Attitude,
- Satellite clock properties,

is available from system providers. ICG is the ideal platform for that purpose.

IGS acknowledged by PNT, ICG as provider for highest accuracy GNSS products.

IGS-internal:
Include LEO GNSS receivers for product generation.
Acknowledgement

The slides on MGEX stem from Oliver Montenbruck’s presentation on the occasion of the 15th PNT Advisory Board Meeting.