

IGS Reference Frame Working Group Charter (IGSRF)

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BACKGROUND

The collective effort of the working group participants is to generate the official IGS station coordinates and velocities, Earth Rotation Parameters (ERPs), geocenter estimates and other frame-related parameters along with the appropriate covariance information. The estimated parameters are aligned to the International Terrestrial Reference Frame (ITRF). The group strives for consistency, reliability, accuracy and timeliness of the above products.

The RFWG also specifies and selects globally distributed sets of GNSS stations from the ITRF solutions to realize the successive IGS Reference Frames (RF). New RF realizations are issued at irregular intervals, usually synchronized to new ITRF releases. The reliability and consistency of individual RF stations must be continuously monitored and occasional updates announced to users.

TASKS

ONGOING ACTIVITIES

The station coordinates and ERP information from the Analysis Centers (AC), the Global Network Associate Analysis Centers (GNAAC), the Regional Network Associate Analysis Centers (RNAAC) and potentially other sources are compared and used to generate and validate the IGS official products. A new solution is computed and made available weekly. At the present time, it contains station coordinates, daily ERPs, a weekly geocenter estimate, and relevant information on the equipment used at each station. The results are then used by the Analysis Center Coordinator to form the IGS combined orbit and clock products in a way that maintains a high level of overall internal consistency.

The station coordinate solutions estimated per epoch are added to a cumulative solution to form a continuously evolving secular GNSS RF with linear station velocities. This cumulative solution contains at least one set of estimated coordinates and velocities at a reference epoch for each station. The AC, GNAAC, RNAAC, epoch-wise, cumulative, ITRF and potentially other solutions are compared and residual files are made available weekly. The weekly or cumulative solutions are submitted as needed to IERS in order to contribute to the definition of ITRF providing the official IGS submission for the ITRF updates.

An accumulated series of daily ERPs is also updated weekly. It includes the pole coordinates, their rates and the excess length of day. While other ERP files are also generated by the ACC from the various IGS orbit combination processes, the weekly final ERPs from the RF combination are the definitive IGS products.

Abnormal station coordinate behaviours are reported. Potential inconsistencies in past and current coordinate solutions are investigated and corrected whenever possible. The performance and long term characteristics of the network based on the station coordinate time series are monitored and reported to the concerned IGS bodies, at least to the Infrastructure Committee (IC) and to the Network Coordinator (NC). A set of coordinate and velocity discontinuities should be continuously documented, updated, and published in SINEX format for general use.

PLANS AND FUTURE DEVELOPMENTS

The IGS Reference Frame Working Group will promote improvements to the products through refinement in the analysis, modeling and algorithms, through collaboration with other groups and scientific organizations.

- In the frame of the adoption of a new IGS realization, a new cumulative solution will be computed and proposed. It will be based on the “repro1” results submitted for the ITRF2008 realization and will include velocity constraints in case of non-earthquake discontinuities for example. The ITRF discontinuity list will be adopted
- The use of the IGS realization of ITRF will be promoted. The products will be suitable for other IGS products as well as various studies such as plate tectonics, regional deformations, temporal variations. In this frame of work, the TRF definition of the weekly combined IGS solution needs to be discussed.

At the moment, the weekly solutions are aligned in origin, scale and orientation to the current RF. But this is unsatisfactory since part of the geophysical signals alias into the transformation parameters, and the « GPS origin information » is no longer available and cannot be used to define the origin of ITRF. One solution would be to generate parallel (not necessarily official) products constrained in orientation only.

- Taking a frozen extract from an ITRF realization as IGS RF has some drawbacks: new discontinuities inevitably make the number of available RF stations decrease. In addition to a close collaboration with the Network Coordinator and the station operators to have a first level of maintenance, the Working Group will have to investigate the feasibility of regular updates of the IGS RF. Regular addition of recent data would indeed improve the quality/accuracy of the IGS RF realization.
- Interaction and communication with the IGS Central Bureau (IGSCB) will be enforced in order to follow the performance and behaviour of the IGS stations over time, and in particular the RF stations that are crucial for the stability of the IGS RF. In coordination with the IGSCB, communication with station operators will be established to inform of possible abnormal station behaviours that could be detected in time series analysis.
- Certain other frame-related parameters are reported in AC SINEX solution files, such as the phase center offsets of the GNSS satellite antennas. The working group will collaborate with the IGS Antenna Working Group in examining and updating estimates of the satellite antenna offsets based on these parameter estimates. In parallel, rigorous week to week combination of the absolute satellite phase center offset parameters will be studied.
- Noting the tremendous progress achieved by the IGS Analysis Centers (ACs) and the successive Analysis Center Coordinators (ACCs) over the past decade, we believe that

there are still areas where progress could be made to improve the consistency and accuracy of the IGS products, in particular toward a fully consistent and rigorous combination system. There are indications that important systematic errors affecting the TRF and ERP are due to some orbit mismodelings, such as the harmonics seen in station position residuals, imprecise geocenter and scale estimates and LOD biases. In addition, the AC constraints imposed on the orbit modeling have most probably an impact on the TRF and ERP estimates.

- As a result of the proposed changes, enhancements to current exchange standards and reports may be proposed.
- To facilitate dissemination and use of the IGS Reference Frame products, a dedicated website will be set up to include all necessary documentation and results and to illustrate the IGS SINEX combination products. In particular, a web service for time series analysis and plots will be developed. Useful information for the users of the IGS SINEX combined products will be posted at the website.

WG Membership:

The working group is composed of one coordinator, the Director of the IGS Central Bureau, one representative from each AC, one from each GNAAC and one from the ITRF/IERS section. Other members may be added as required.

The working group reports to the IGS Governing Board. Modifications to the goals and working plan will be done through consultation among the working group.

Current members (2011):

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A RFWG mailing list including all the Working Group members has been created and is maintained at the IGS CB. Emails can be sent to igs-rfwg@igscb.jpl.nasa.gov. An archive for this list will be available at the IGS CB, but its content is only available to its members.

The IGN IGS RF group can be contacted at igs-rf@ign.fr.