

ITRF2013

Call for participation

Background

Starting with ITRF2005 and continuing with ITRF2008, the International Terrestrial Reference Frame (ITRF) construction used time series of station positions and Earth Orientation Parameters (EOPs): weekly from satellite techniques (SLR, GNSS, DORIS) and session-wise from VLBI. Time series are essential for the ITRF to account not only for station non-linear motions and discontinuities but also to evaluate the stability over time of the physical frame parameters, the origin and the scale, which are critical for Earth science applications. The ITRF rigorous combination provides a self-consistent series of EOPs, including Polar Motion from VLBI and satellite techniques, and Universal Time and Length of Day from VLBI only.

While the ITRF2008 marked considerable progress compared to previous versions of the ITRF, some weaknesses have been identified in the individual technique solutions that were used as well as in their co-locations. New stations have been installed since then, but also large earthquakes have deformed large areas over continental regions. Because of these issues an ITRF2013 becomes necessary that will now benefit from the expected improvement of the reprocessing efforts being undertaken by the Technique Centers (IVS, ILRS, IGS, IDS).

ITRF2013

Since the release of the ITRF2008 the following improvements can be noted:

- Five years of additional observations will become available at the end of 2013;
- New sites have been added to the ITRF network;
- A couple of new co-location sites and new local ties are now available;
- The processing strategies of the individual techniques have improved and self-consistent reprocessed solutions are expected to be available;
- An improved knowledge of the loading effects is available.

In order to take advantage of these new developments, the ITRS Center, together with the ITRF CCs, is planning to generate a new ITRF solution (ITRF2013) and solicits input from the IERS Technique Centers (TCs). The TCs are requested to provide time series that are as long as possible and preferably covering the full history of observations of each technique, such as for instance VLBI and SLR data since the eighties.

It is requested NOT to correct for any geophysical fluid loading effects, except those tidal load and other displacements for which models are given in the IERS Conventions 2010. However, it is envisaged that the individual TC solutions will be corrected for non-tidal atmospheric loading during the ITRF generation, using a unique loading model provided by the IERS Global Geophysical Fluid Center (GGFC). The pertinence of applying model corrections for additional non-tidal loading effects, namely hydrology and ocean circulation will be evaluated.

Long Time Series Contributions

Contributed time series (daily/weekly) solutions to be included in the ITRF2013 should be provided in SINEX format and comply with one of the following constraint categories:

- Solutions with removable constraints;
- Loosely constrained solutions (constraint level: $\sigma > 1$ m);
- Free singular normal equations.

The SINEX files must conform to the SINEX Version 2.01 format standard and should contain for one day — a session in the case of VLBI — or one week (Sunday to Saturday), station positions, a set of EOPs for each day (offsets and rates fitted over 24-hr intervals for polar motion, UT1 and LOD, where only VLBI provides UT1). Requested time series are daily solutions from GNSS, session-wise from VLBI, and weekly solutions from DORIS and SLR. IVS is highly encouraged to provide nutation offsets and quasar coordinates for future studies by the combination centers. If the SINEX files contain a variance-covariance matrix, all constraints applied to the solution should be given in the a priori variance-covariance matrix.

All solutions should conform to the IERS Conventions, including updates posted at: <http://tai.bipm.org/iers/convupdt/convupdt.html>.

Whenever departures from the recommendations of the IERS Conventions are used, it is requested that the effects of those deviations be documented, and discussed beforehand with the ITRS Center. Based on past experiences with ITRF2005/ITRF2008 some specific model updates are requested:

- Thermal expansion of the VLBI antennas causes a significant annual frame scale variation if it is not modeled. IVS is encouraged to consider modeling that effect, and any other possible gravitational effects, provided that no net artifactual scale offset/drift is introduced;
- Appropriate modeling of SLR station range biases is needed to minimize frame scale effects;
- The most up to date GNSS force models to minimize orbit mismodeling and its impact on station positions;
- Appropriate DORIS analysis strategy to minimize possible scale discrepancies between ACs.

Solicited solutions to be considered in the ITRF2013 combination are official single-technique combined time series from the Technique Centers.

Solutions that result from a combination of various techniques *at the observation level* may be submitted. These solutions will be analyzed and evaluated against ITRF2013 after its release. It is important that these solutions should comply with the guidelines of this call, the IERS Conventions are strictly followed, common parameters between techniques other than EOPs (e.g. troposphere parameters, orbit parameters of multi-technique satellites) are combined, the full history of technique observations of common time-span are used and no terrestrial local ties should be introduced.

A summary file describing the strategy adopted to generate the time series (a priori models but also combination strategy) should be submitted together with the SINEX files, as well as a recommended station position discontinuity file.

Local Surveys at Co-location Sites

The local ties available at the ITRS Center for a certain number of co-location sites are now old by 10 to 20 years. The owners of co-location sites are solicited and highly encouraged to consider conducting new local tie surveys using the most up to date survey methods. The results of least squares adjustments of the survey observations should be provided to the

ITRS Center in the form of SINEX format, with full variance-covariance information. It is further recommended NOT to remove the IGS GPS/GNSS antenna during the survey, in order to avoid undesirable possible discontinuity in the position time series when the antenna is restored back to its original marker. The position of the GNSS antenna reference point should then be determined by indirect methods. It is desirable to receive new local tie SINEX files as early as possible, but before the start of the analysis of ITRF2013 input data in February 2014. It is also advised to contact the ITRS Center (itrf@ign.fr) before beginning the survey in order to discuss specific details of individual sites.

ITRF2013 Analyses and Results

The general analysis strategy planned by the ITRF CCs will follow the procedure used for ITRF2008 and will consist of the following steps:

- Remove original constraints (if any);
- Apply non-tidal atmospheric (and possibly other loading) effects corrections;
- Perform per-technique combinations (TRF + EOP) of each individual time series: stacking/accumulating the weekly/daily time series. The outputs of this step will be full SINEX file per technique, containing station positions, velocities and daily EOPs;
- Identify and reject outliers and properly handle discontinuities, using break-wise approach;
- Combine the per-technique combinations adding local ties in co-location sites. During this step, a proper weighting will be applied, by rescaling the individual variance-covariance matrices. This global combination will constitute the ITRF2013 solution.

The main results expected include:

- Positions and velocities for a global network of tracking stations and related markers of the four techniques (VLBI, SLR, GNSS, DORIS), with full variance-covariance information provided in SINEX format;
- Fully consistent EOPs: daily polar motion and their rates, UT1 and LOD;
- Per-technique solutions of station positions and velocities and daily EOPs, with full variance/covariance information provided in SINEX format;
- Output discontinuity files for each technique;
- Residual time series as result from the per-technique time series combinations;
- Geocenter offset time series from satellite solutions (SLR, GNSS, DORIS).

Instructions

The Technique Centers and individual Analysis Centers that intend to contribute their long time series of SINEX files should submit these series by February 10, 2014 at the latest. Earlier submissions are most welcome and are very much encouraged.

To submit a time series of SINEX files please send an e-mail to:

ITRS Center itrf@ign.fr

and

IERS Central Bureau central_bureau@iers.org

The e-mail should contain the detailed instructions on where the solutions can be downloaded, their present naming convention, etc. The submitted SINEX files will be archived by the ITRS Center and in the IERS information and database system.

Schedule:

March 27, 2013	Dissemination of the Call for Participation
February 10, 2014	Deadline for solution submissions by Technique Centers. Earlier submissions are welcome.
April 2014	First results and discussions at EGU General Assembly
Until end of May, 2014	Inter comparisons of the ITRF CCs solutions
June, 2014	Preliminary ITRF2013 solution available for evaluation by the Technique/Analysis Centers
July-August, 2014	Final ITRF2013 solution released by the ITRS Center.