

3.7.4 Working Group on Site Coordinate Time Series Format

This Working Group is a unified one, both an IERS WG (<<http://iers.org/WGSCTSF>>) and IAG WG 1.1.1 (<<http://iag.uni.lu/index.php?id=175>>) of Sub-Commission 1.1 (Coordination of Space Techniques). The following report summarizes its activities in 2015. For more details on the goals and on previous work see the reports for 2012 to 2014 and the web sites.

Goals and objectives

- Define a common exchange format for coordinate time series for the geodetic techniques (DORIS, GNSS, SLR, VLBI). The format should provide a user-friendly presentation of coordinate time-series results for a potentially broader community of users.
- Ensure that the format contains the necessary information (data and metadata) to be easily used or converted for the web tools of the IAG Services (GGOS, IERS, IDS, IGS, ILRS, IVS)
- The format must allow the comparisons of time series between GNSS, SLR, VLBI and DORIS, but also with other techniques such as tide gauges records. Some of the issues that should also be addressed are, e.g., reference system, time unit, content description ...

WG Members

In order to have the best possible interaction with the groups working with station coordinate time series, the working group is composed of time series providers and users:

- Thomas Herring (MIT), IERS Analysis Coordinator (ex officio)
- Daniela Thaller, Director of the IERS Central Bureau (ex officio)
- Bernd Richter (BKG), GGOS portal manager
- Xavier Collilieux (IGN), ITRS Combination Center
- Manuela Seitz (DGFI), ITRS Combination Center
- Laurent Soudarin (CLS), IDS representative
- Paul Rebischung (IGN), IGS representative
- Erricos Pavlis (Univ. of Maryland, Baltimore County), ILRS representative
- John Gipson (NASA), IVS representative
- Médéric Gravelle (Univ. La Rochelle), user (SONEL)
- Yehuda Bock (Scripps Institution of Oceanography), user (SOPAC GPS webservice)
- Simon Williams (Proudman Oceanographic Laboratory), user (CATS software)
- Xiaoping Wu (JPL), user

Timeline of activities

- April 2012 WG established by IERS DB (IAG WG 1.1.1 since 2013)
- Dec. 2012 1st WG meeting in San Francisco
- April 2013 2nd WG meeting in Vienna
- May 2013 Presentation of the WG activity at the IERS Retreat in Paris
- July 2014 Draft document submitted to the WG
- Apr. 2015 3rd WG meeting in Vienna

WG activity in 2015

A meeting of the WG took place in Vienna, on April 15th, 2015, during the EGU General Assembly week. Based on a non exhaustive list of existing formats at IAG services and GPS time series providers, metadata and data have been examined.

Summary of previous discussions

File structure and format

- Metadata and data should be in the same file.
- Easy identification of data block and metadata block should be possible.
- Header should be easy and quickly to read, to get the required information easily.
- Avoid stripping out the data and putting it into user's own format, that might lead to errors.
- To lighten the format, use default values (units ...) and optional fields.

Data

Epoch, time scales, time tags:

- Time should be as specific as possible.
- It should be easily understood by users (eg. YYYY MM DD HH MM SS.sss), easy to lot (MJD), precise enough for high frequency sampled series.
- Two time scales are probably needed.
- Decimal year is not recommended as it can cause problems because of leap years.
- A certain flexibility of the format is necessary. For daily and weekly sampling, hours, minutes and seconds could be ignored.
- The sampling frequency could be indicated in the metadata.
- Time tag: middle of the span.

Coordinate system:

- XYZ needed to convert to any geographic system
(We want to plot NEU variations in mm, but XYZ is the basic data)

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Accuracy of the series (vs magnitude):

- A precision of 10 to 3 mm may be required.
However, such a precision is not required for fast event such as glacier (several m/year).

Metadata

- Metadata descriptors
 - To be unified
 - To be used by plotting tools
 - Need for a list of descriptor type? (Unified Content Descriptor? Cf. metadata search engine of the GGOS Portal)
- Transformation applied by provider must be indicated (6, 7, ... parameters).

Open issues

- How many stations per file? More than one raises issues (e.g. ties between stations) and consequences on the format (e.g. block of metadata for each station, station code in data).
- Position and velocity discontinuities (soln in SINEX): desired but a lot of issues.
- Need of correlations between components?
- Exchange format: in text or elaborate language (JSON, XML, YAML ...)?
- Substitution character when values non available: «N/A», other? Separation with coma?

Existing formats at IAG services and GPS time series providers

IDS Station Coordinates Difference format (STCD)

<http://ids-doris.org/documents/report/CB_STCD_format_v1.0.pdf>

UNAVCO Plate Boundary Observatory (PBO) GPS time series format

<http://www.unavco.org/projects/major-projects/pbo/lib/docs/gps_timeseries_format.pdf>

<<http://pbo.unavco.org/doc/NOTICE%20TO%20UNAVCO%20DATA%20PRODUCT%20USERS%2020130315.pdf>>

Nevada Geodetic Laboratory (NGL) GPS time series formats

<http://geodesy.unr.edu/gps_timeseries/README_txyz2.txt>

<http://geodesy.unr.edu/gps_timeseries/README_tenv.txt>

<http://geodesy.unr.edu/gps_timeseries/README_tenv3.txt>

University of La Rochelle (ULR) GPS time series format

No description

JPL GPS Time Series and Residual Format

<http://sideshow.jpl.nasa.gov/post/tables/GPS_Time_Series.pdf>

Others formats:

Scripps Orbit and Permanent Array Center (SOPAC) XML for Geodesy

<http://sopac.ucsd.edu/xmlGeodesy.shtml>

Virtual Observatory (VO) VOTable Format Definition

[<http://www.ivoa.net/documents/VOTable/>](http://www.ivoa.net/documents/VOTable/)

The content of these formats have been listed and compared, regarding the metadata and the data. The examination allows identifying three types of metadata (file information, site information, and product information) as well as a list of variables forming the data block.

Future activities

The next step is to define the necessary elements for the time series exchange format (metadata content, data table, mandatory and optional inputs) as well as the units, the coordinate system, the date and time system. Starting from these elements, a draft of format can be proposed.

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