

EUREF 2023 Symposium 23-26 May Gothenburg (Sweden)

Combining normal equations based on IGS20 or IGb14 standards and models: impact on the cumulative time series





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Outline

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- 2. Other frame transitions: the IGb14 case
- 3. IGS20: new frame, new standards
- 4. IGb14+IGS20 and IGS20 examples
- 5. Conclusions/future work





Introduction

The ITRF regularly improves the global reference frame. Some examples are ITRF2008, ITRF2014 and ITRF2020.



After the publication of each ITRFxxxx, a new IGSxx (GNSS only) realization follows.

The new IGS realizations include a set of positions and velocities at a certain epoch, as well as a ITRFxx CONSISTENT antenna offset and phase center variation file in standard ANTEX format (IGSxx.ATX).

Some recent ITRF and their counterpart IGS realization examples are:

- ITRF2008 and IGS08 (from 2011/04/17 to 2017/01/28); IGb08 from 2012/10/07
- ITRF2014 and IGS14 (from 2017/01/29 to 2022/11/26); IGb14 from 2020/05/17
- ITRF2020 and IGS20 (from 2022/11/27)

Each time a new frame is introduced, discontinuities may have to be included.



Other frame transitions: the IGb14 case

When IGS14 was introduced, the IGS provided latitude-dependent models allowing to compute the position offsets due to the switch from igs08.atx to igs14.atx: IGSMAIL 7399: https://lists.igs.org/pipermail/igsmail/2016/001233.html

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Some antenna models (model+residuals):





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Other frame transitions: the IGb14 case

After the antenna model corrections were applied, the time series looked very smooth and no further data manipulation was necessary. No need for new discontinuities:







IGS20: new frame, new standards

When the IGS20 is introduced, no latitude-dependent model is provided to allow to compute the position offsets due to the switch from igs14.atx to igs20.atx. This, on its own, can cause discontiuities at certain sites.

The most remarkable changes wrt the IGS14 are:

- New antenna PCV file: igs20.atx
- Long filenames for IGS products

Besides the antenna model switch, at the EPN level some new processing standards are recommended to better align the EPN regional solutions to the IGS:

- Do not use absolute individual antenna calibration files (only the ones maintained by EPNCB)
- No atmospheric loading
- Correct PCVs of antennas that are misaligned from North
 Some of the models are updated:
- A priori troposphere: from VMF1 to VMF3,
- New/improved models: DESAI2016 (subdaily ERP),....

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IGS20: new frame, new standards

This means that when IGS20 is introduced, we are not only facing a datum/antenna switch, but also a change in the processing standards. The impact of the new IGS20 solutions in the cumulative time series (IGb14-compliant) is clear (source: EPNCB):

POTS, IND. CAL.: JAVRINGANT_G5T/NONE

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GOPE, NO IND. CAL.: TPSCR.G3/TPSH

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IGS20: new frame, new standards

For EPN: a repro3 campaign is being designed (see C. Voelksen's talk), so EPN will be IGS20compliant.



At the EPND level, all the solutions must be combined and harmonized normal equations are a requirement: we must align our solutions to the EPN, so the solutions must be fully compatible by using the same (or very similar) processing standards.

Most Acs (all?) have upgraded the software (to Bernese 5.4), capable to use the new IGS20 standards and long filenames.





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IGb14+IGS20 and IGS20 EPND examples:



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IGb14+IGS20 and IGS20 EPND examples:



JACA: LEIAR25.R3 LEIT with Ind. Cal. values: DNEU = 1.68; 0.01; -6.07 mm ZFRA: LEIAR25.R3 LEIT with Ind. Cal. values: DNEU = 2.50; 2.22; -6.72 mm

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Conclusions/future work

- The impact of the IGS20 frame (+igs20.atx file) is not negligle for many ground antennas.
- Antennas with absolute individual calibration values are also affected by the new processing standards: this did not happen in previous frame transistions (e.g. IGb08 to IGS14), so new discontinuities must be included in the affected stations.
- Combining IGb14+IGS20 normal equations imply introducing discontinuities (starting 2022-11-27). This implies inconsistent discontinuities and SNs related to the EPN/IGS solutions and to other EPND solutions.

Future:

- Is reprocessing a feasible task for all the EPND ACs?
- If not, other options should be consider to minimize the impact of combined IGb14+IGS20. For example, create an offsets file for each antenna and apply them to the SINEX files.

In any case, we now have the opportunity to reprocess all the EPND solutions in a harmonized way that will lead to consistent solutions for all the ACs and further analises (IGS, EPOS,...). EPND will very very much improved!







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