



Antenna Working Group

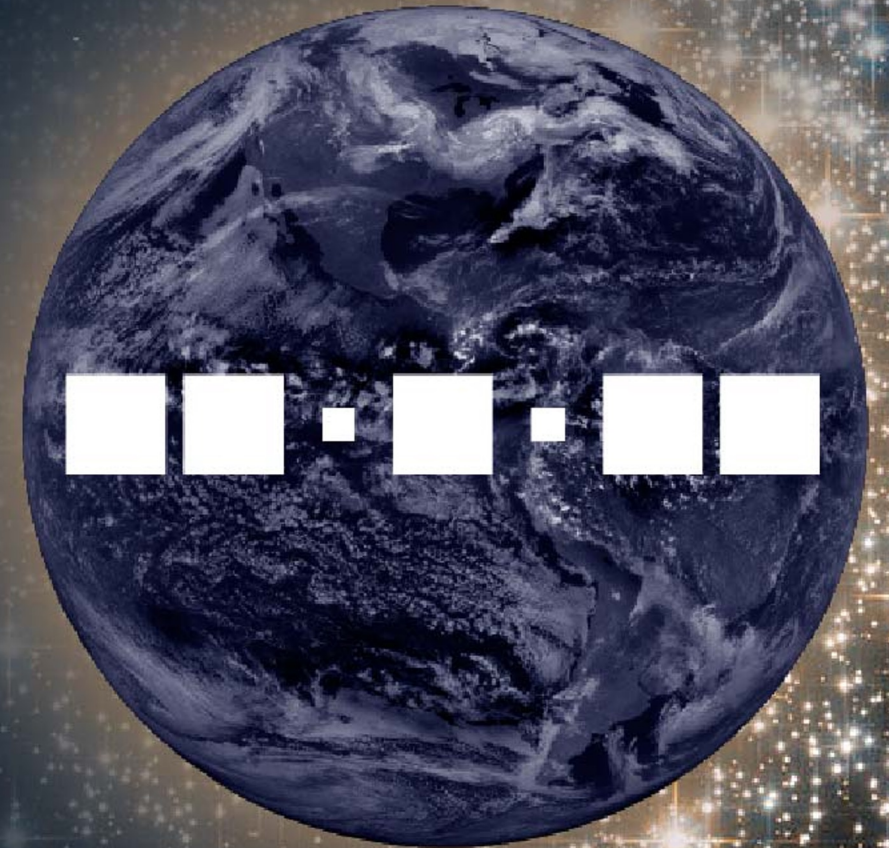
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IGS INTERNATIONAL
GNSS SERVICE

IGS 5th Open Associate Member
And Working Group Meeting



Achievements in 2022

- Transition from the IGS Repro3 ANTEX to the IGS20 ANTEX
Switch from igs14.atx to igs20.atx (starting with GPS week 2038)
- Update of the igs14.atx and igs20.atx file in 2022
- Project “ring antenna calibration”
 - change of lead early 2022
 - Progress (see next slides)
- Challenges for 2023

Transition from IGS14 to IGS20

- Starting from GPS week 2238 the IGS switched from IGS14 to IGS20
 - -> igs20.atx is now the current IGS ANTEX file
- The IGS provides currently two ANTEX files:
 - igs14.atx (<https://files.igs.org/pub/station/general/igs14.atx>)
 - igs20.atx (<https://files.igs.org/pub/station/general/igs20.atx>)
- Modification concerning satellite constellations are communicated through the IGS Mailing list. Note that only notifications for IGS20 ANTEX updates is given
- Receiver antenna updates only are communicated through the IGS Equipment mailing list
- The igs14.atx is currently still updated (end of life not yet decided)

Transition from IGS14 to IGS20

- IGS20 ANTEX file:
 - Galileo based satellite z-PCOs
 - Multi-GNSS robot and chamber receiver antenna calibrations
 - Include:
 - Satellite antenna pattern: GPS, GLONASS and Galileo
 - Receiver antenna pattern: multi-GNSS (including BeiDou and QZSS)

Transition from IGS14 to IGS20

- Adapting IGS14 satellite PCOs (in cooperation with IGS RF):
 - estimation of satellite-wise GPS and GLONASS PCOs
 - Estimation of one common offset for GPS BLOCK IIIA satellite (using updated disclosed pattern from Lockheed Martin)
- Update of multi-GNSS receiver antenna calibrations

Status antenna calibration patterns

| | IGS14 ITRF 2014 scale | IGSR3 Galileo scale | IGS20 ITRF 2020 scale |
|------------------|--------------------------|------------------------|--------------------------|
| Receiver | GPS/GLONASS L1/L2 | multi-GNSS | updated multi-GNSS |
| GPS BLOCK I & II | estimated | estimated | estimated |
| GPS BLOCK IIIA | estimated | estimated | scale adjusted |
| GLONASS | estimated | estimated | estimated |
| GALILEO | N/A | chamber | scale adjusted |

scale adjusted: Adjustment of the z-component of the phase center offset to be aligned to the ITRF2020:

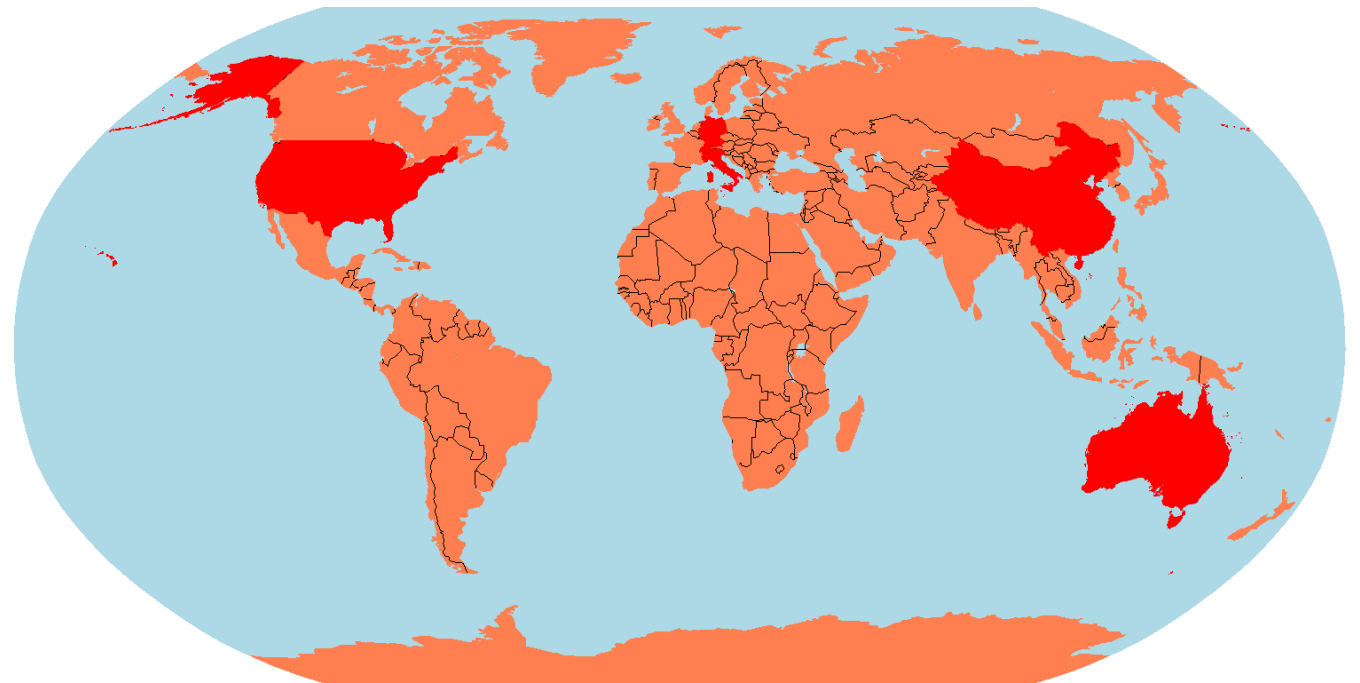
- one common offset for all Galileo satellites (except of E102)
- one common offset for all GPS BLOCK IIIA satellites

Project and Goal of the project “RINGANT”

- Project lead transferred early 2022 to Andria B
- ilich (NGS), Igor Sutyagin (Topcon), and Tobias Kersten (IfE)
- Using digital platform for monitoring and exchange of the data
- Goal:
 - Finding causes and assessing differences among the calibration methods (PCC realisations)
 - Improve the stability and reliability of PCCs
 - Consideration of further parameters in calibration processes (receiver for comparability) and definition of uncertainty values of PCCs

Current status

- The start of the antenna calibration campaign started in September 2022
- Eight participants from six countries
- Systems and approaches:
 - 2 chambers
 - 7 field robots
- 4 choke ring antennas (different manufacturer)
- 1 geodetic and on rover antenna



Outlook for 2023 and beyond

- Continuation of the ringcalibration project
- Update of the igs20 ANTEX file (and igs14)
- Extension of L5 for GPS (igs20.atx)
- Study of multi-GNSS calibrations (all frequencies!)
- Inclusion of Beidou and QZSS for next ITRF
- **Study origin of scale inconsistency between Galileo and ITRF!**

Recommendations

- The IGS20 ANTEX file shall be extended with BeiDou, IRNSS, and QZSS using, if available, chamber calibrated satellite antenna pattern provided by the system provider.
- The nadir dependent phase variations shall be extended from 14 to 17 degree to support LEO POD.
For satellites without PV information zero patterns will be added.

Recommendations

- The listing of receiver and antenna names and ANTEX entries shall be restricted: 1) only geodetic antennas and receivers if the corresponding antenna pattern is provided 2) for coordination purpose of antenna and receiver naming for antenna calibration facilities and regional networks connected to the IGS (e.g., EUREF, SIRGAS, ...)
- The IGS AWG acknowledges shortcomings in the current ANTEX format, and the need for a new antenna calibration interchange format. A new format shall be developed, either as a major update to or replacement of the current ANTEX 1.4 format.
- The IGS AWG project "Ring-Ant" is a crucial part of for the antenna calibration comparison / validation activities. Within this project a selection of different antennas shall be exchanged among the participating antenna calibration facilities allowing to compare the resulting antenna calibration patterns.