



1-5
June
2026



Comparison of GPS-only and Galileo-only ambiguity-fixed PPP solutions: insights from the SPOTGINS analysis center

M. Gravelle, A. Santamaria-Gomez, S. Loyer, the SPOTGINS team

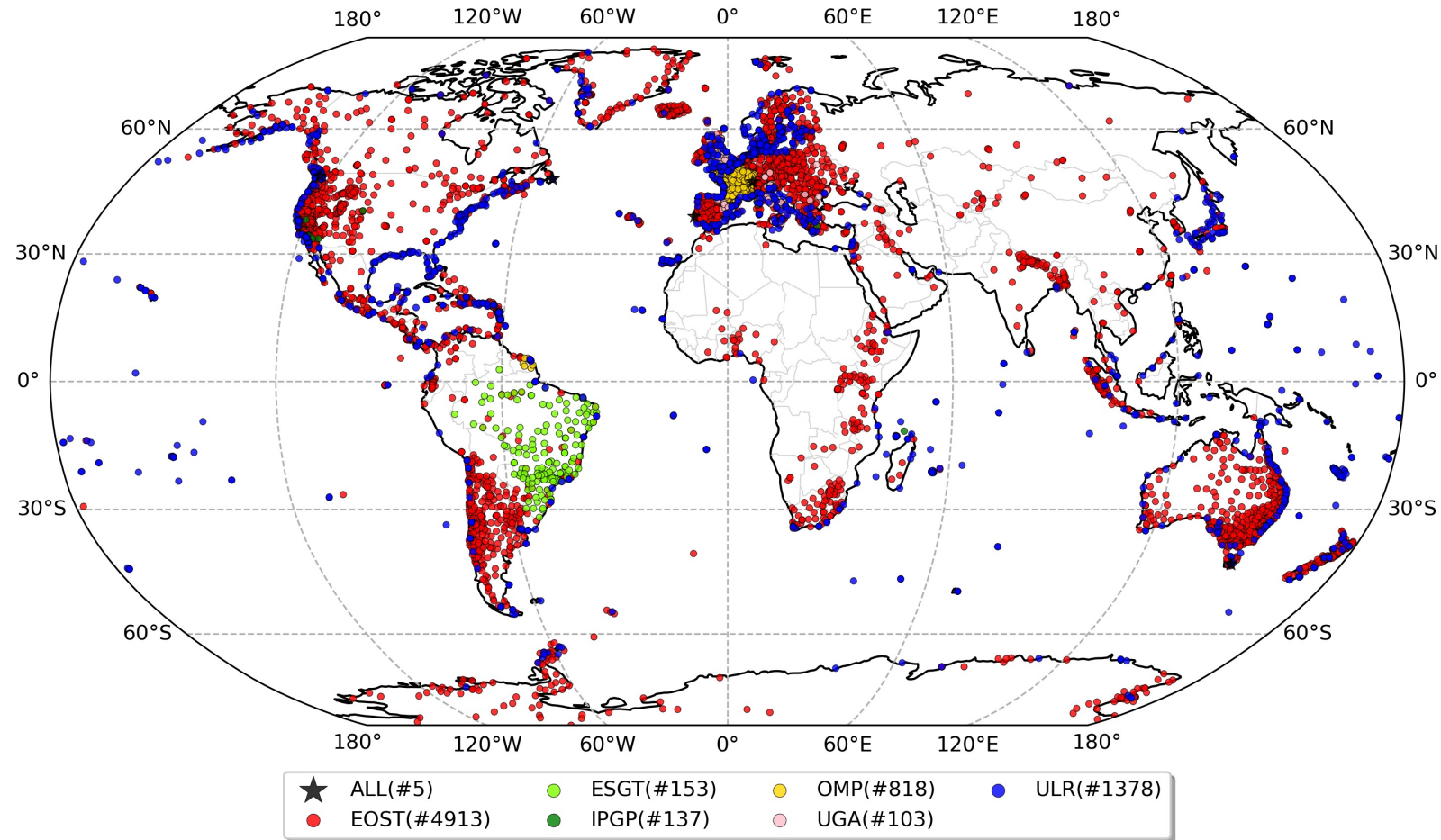
ORGANIZING INSTITUTIONS



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www.igs-workshop-2026.com

The SPOTGINS analysis center



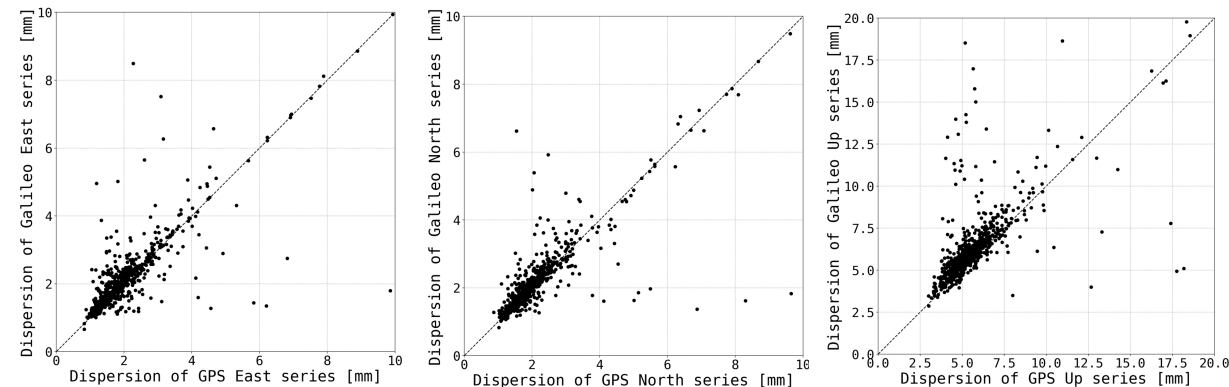
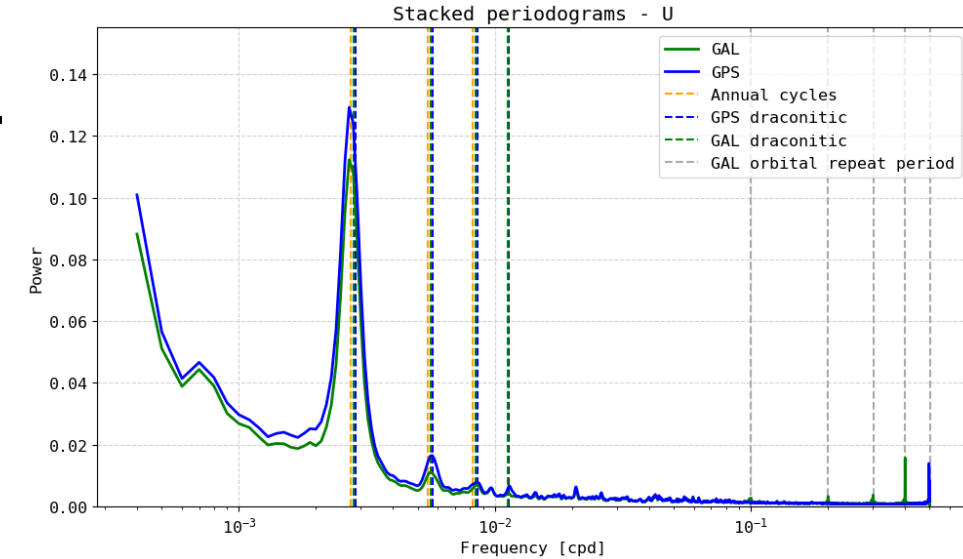
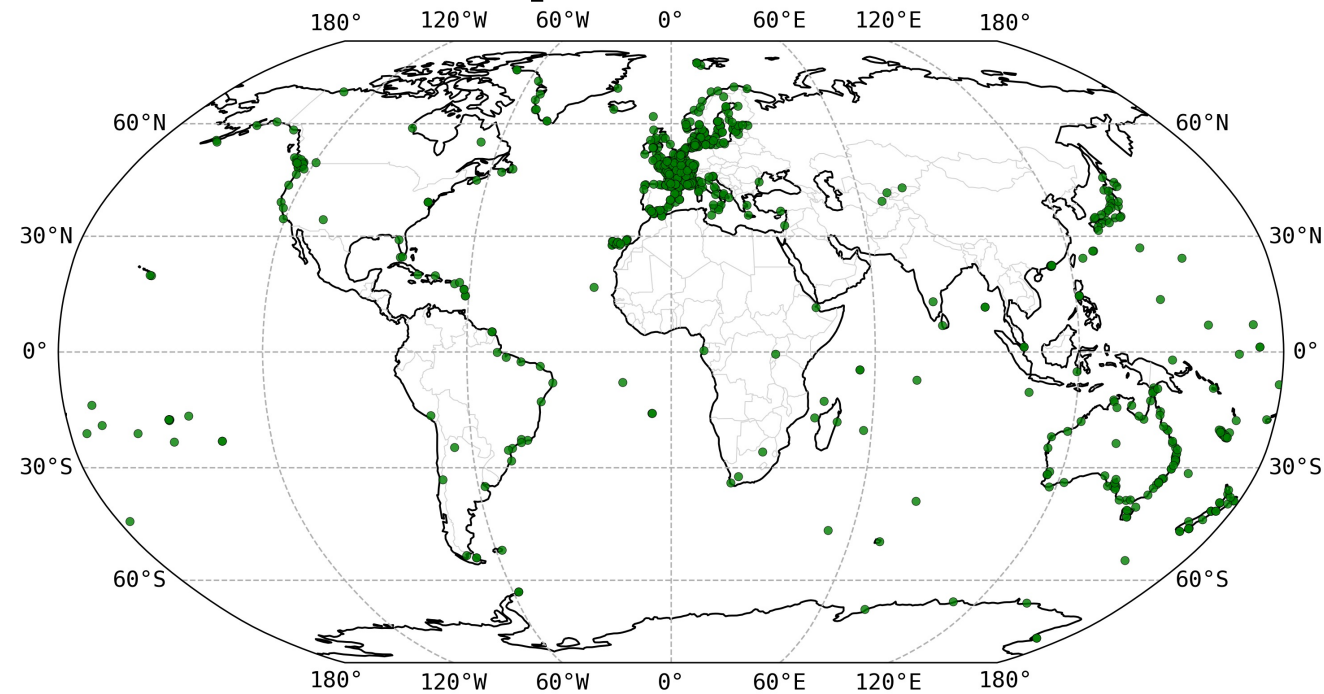
- **Cooperative** project of GNSS IPPP processing
- software:  
- **common strategy: G+E** using products from **CNES/CLS IGS AC** (see P2 07 poster from S. Loyer)
- **5789** time series available on the **GeodesyPlotter** portal (<https://www.poleterresolide.fr/geodesy-plotter>)

More details in Santamaría-Gómez, A. et al., Monitoring the Earth's deformation with the SPOTGINS series, *Earth Syst. Sci. Data*, 17, 5833–5840, <https://doi.org/10.5194/essd-17-5833-2025>, 2025.

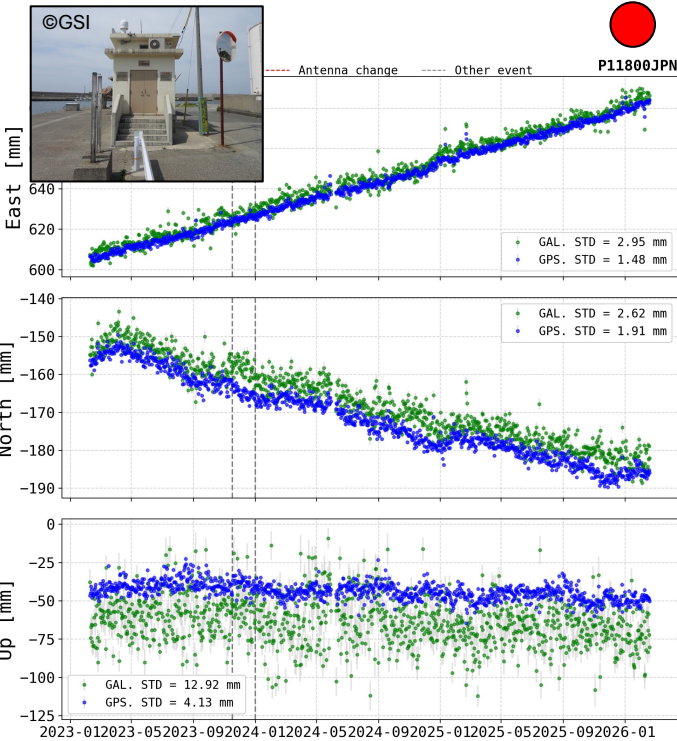
GPS & Galileo processing

Objective: evaluate the contribution of both constellations on the **G+E** SPOTGINS products

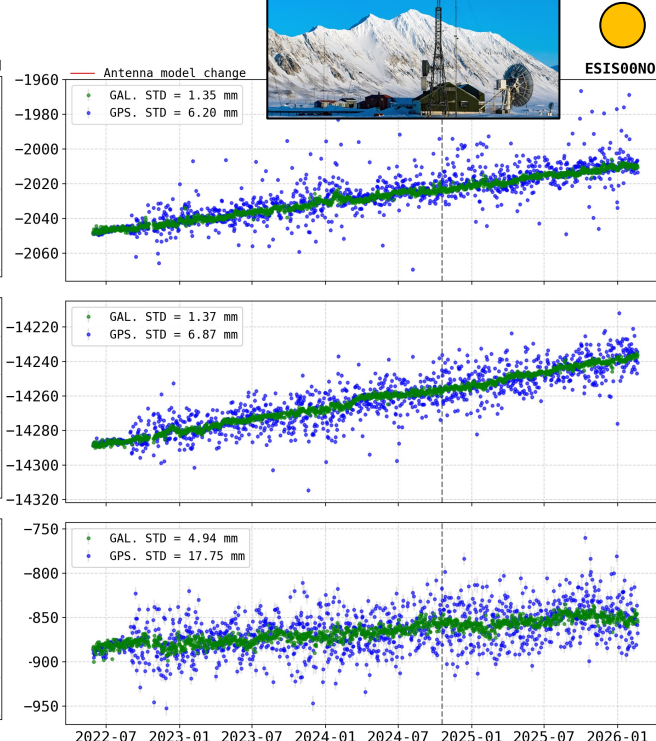
➔ **Processing and comparison of GPS-only and Gal-only time series for #796 stations over [2018-oct:2026-feb]**



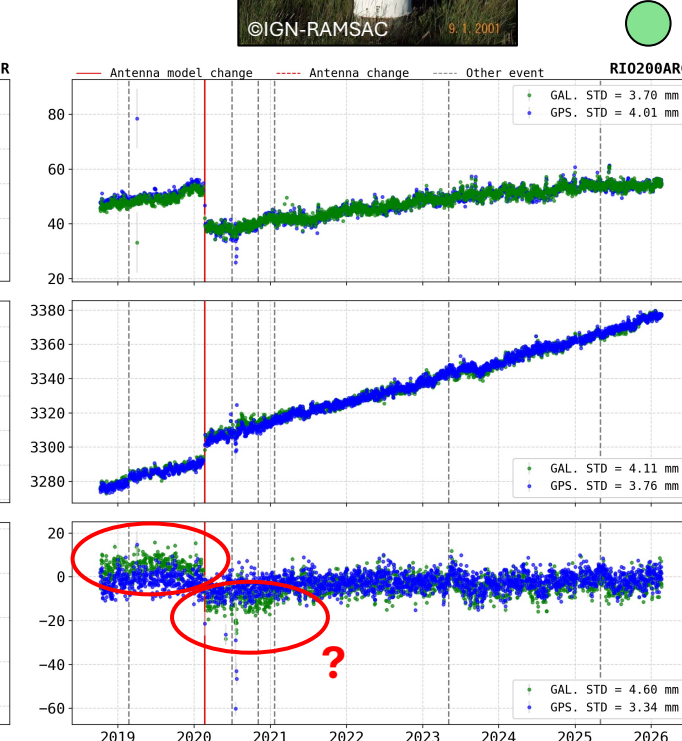
GPS vs Galileo



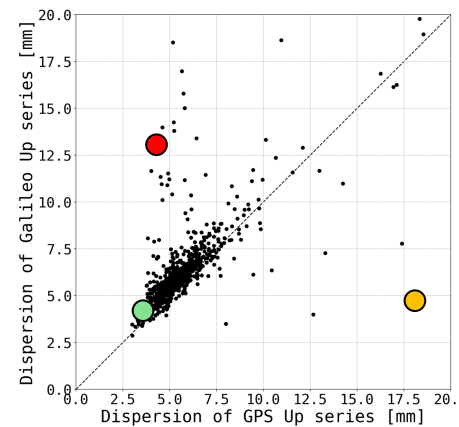
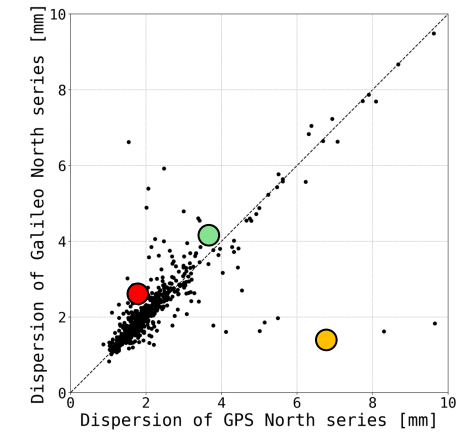
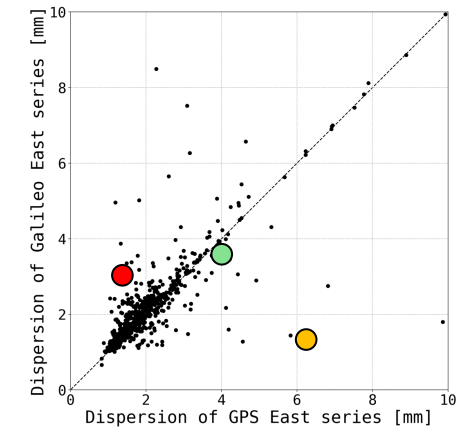
$$\text{GPS}_{\text{disp}} < \text{GAL}_{\text{disp}}$$



$$\text{GPS}_{\text{disp}} > \text{GAL}_{\text{disp}}$$



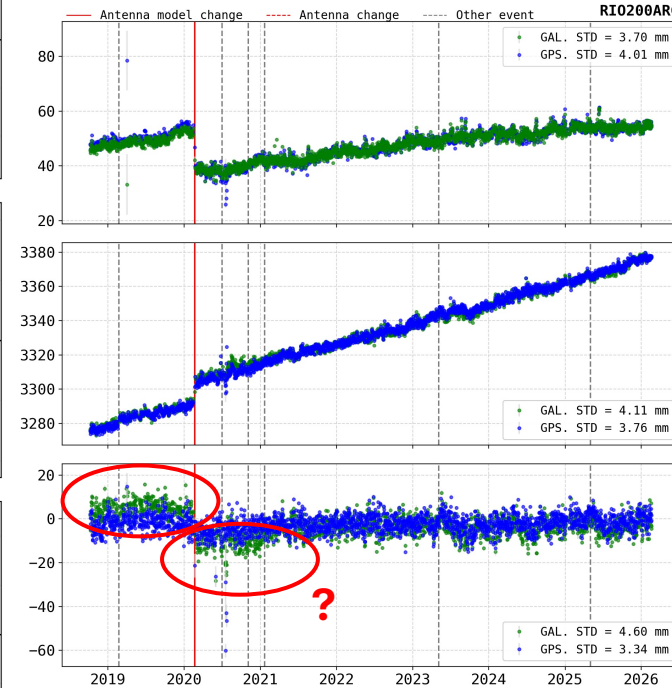
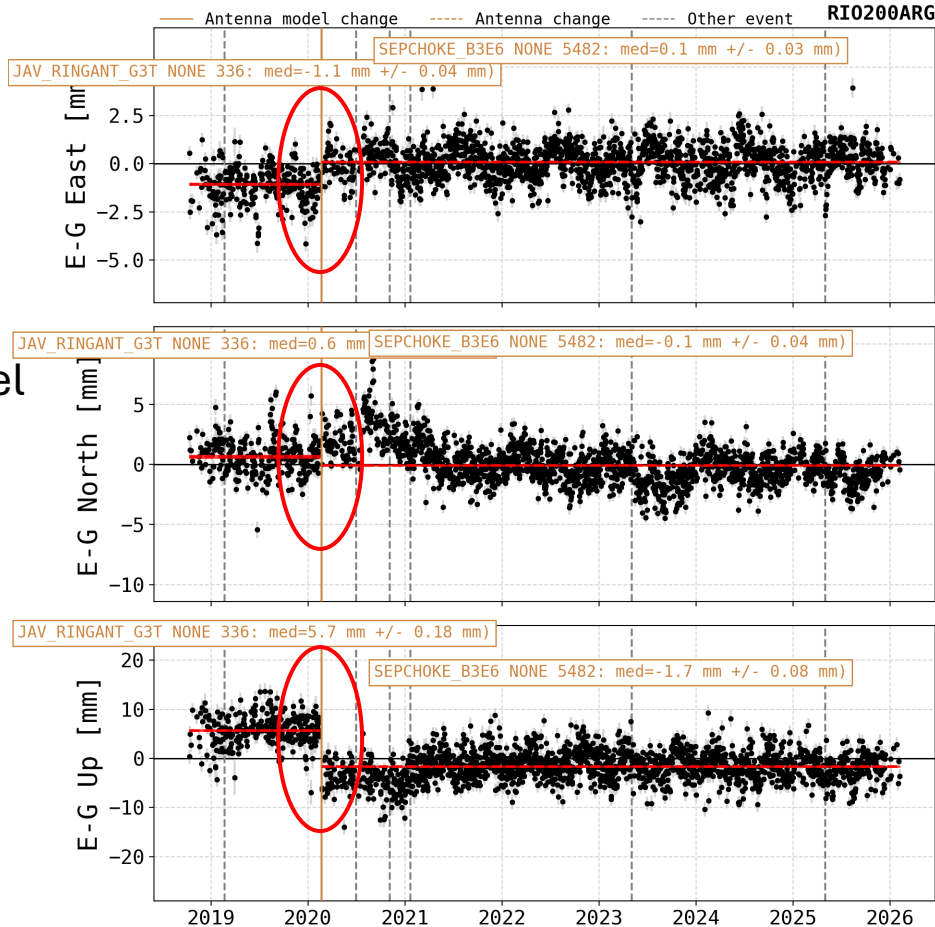
$$\text{GPS}_{\text{disp}} \approx \text{GAL}_{\text{disp}}$$



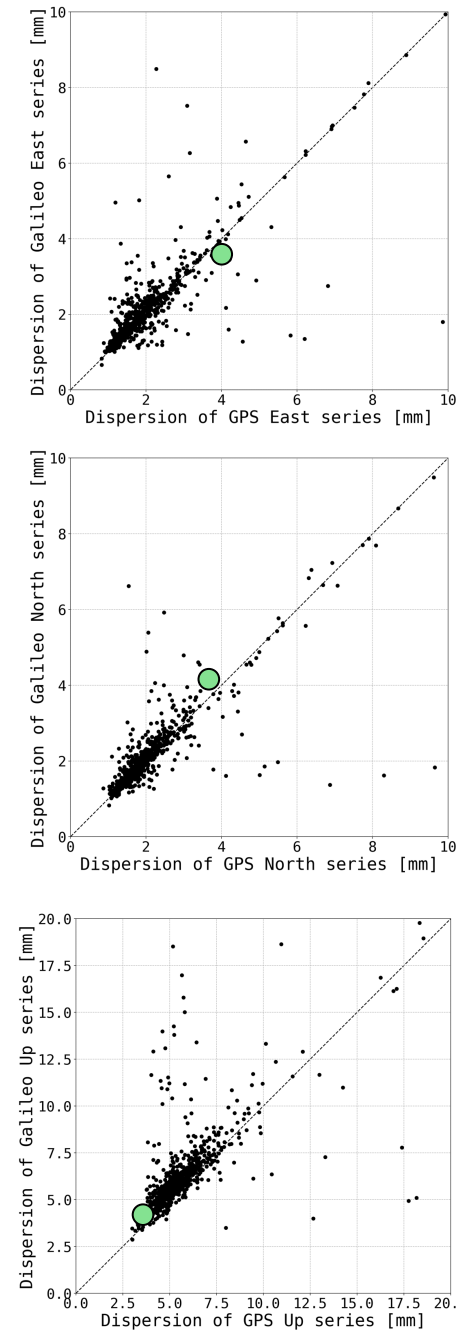
- Lack of Galileo observations
- Same for other stations in Japan
- Unable to fix GPS ambiguities
- Needs to be investigated

GPS vs Galileo

- Offset in the time series of **differences** after the antenna model change
- Impact of the calibration model?



$$\text{GPS}_{\text{disp}} \approx \text{GAL}_{\text{disp}}$$

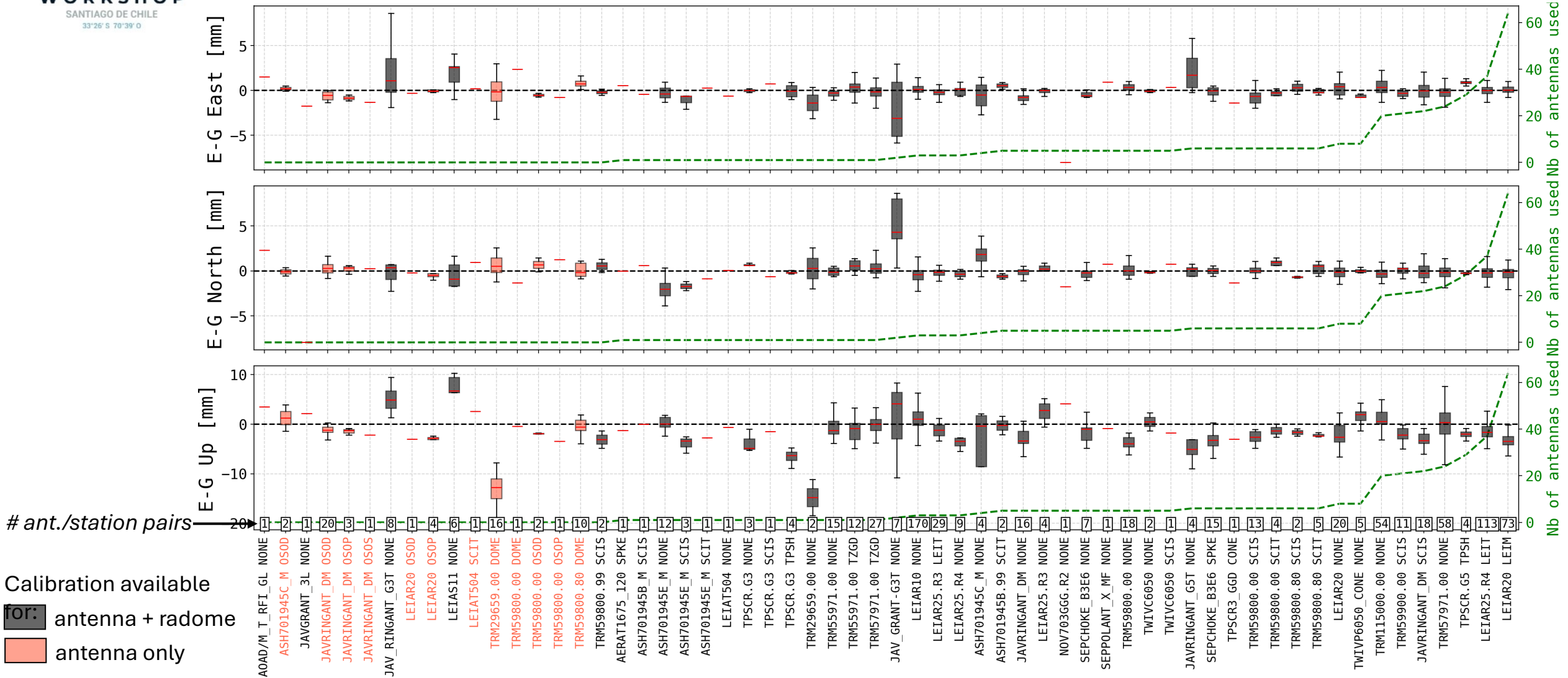


➡ Process of mean biases for each antenna+radome pairs per stations

Antennas mean biases

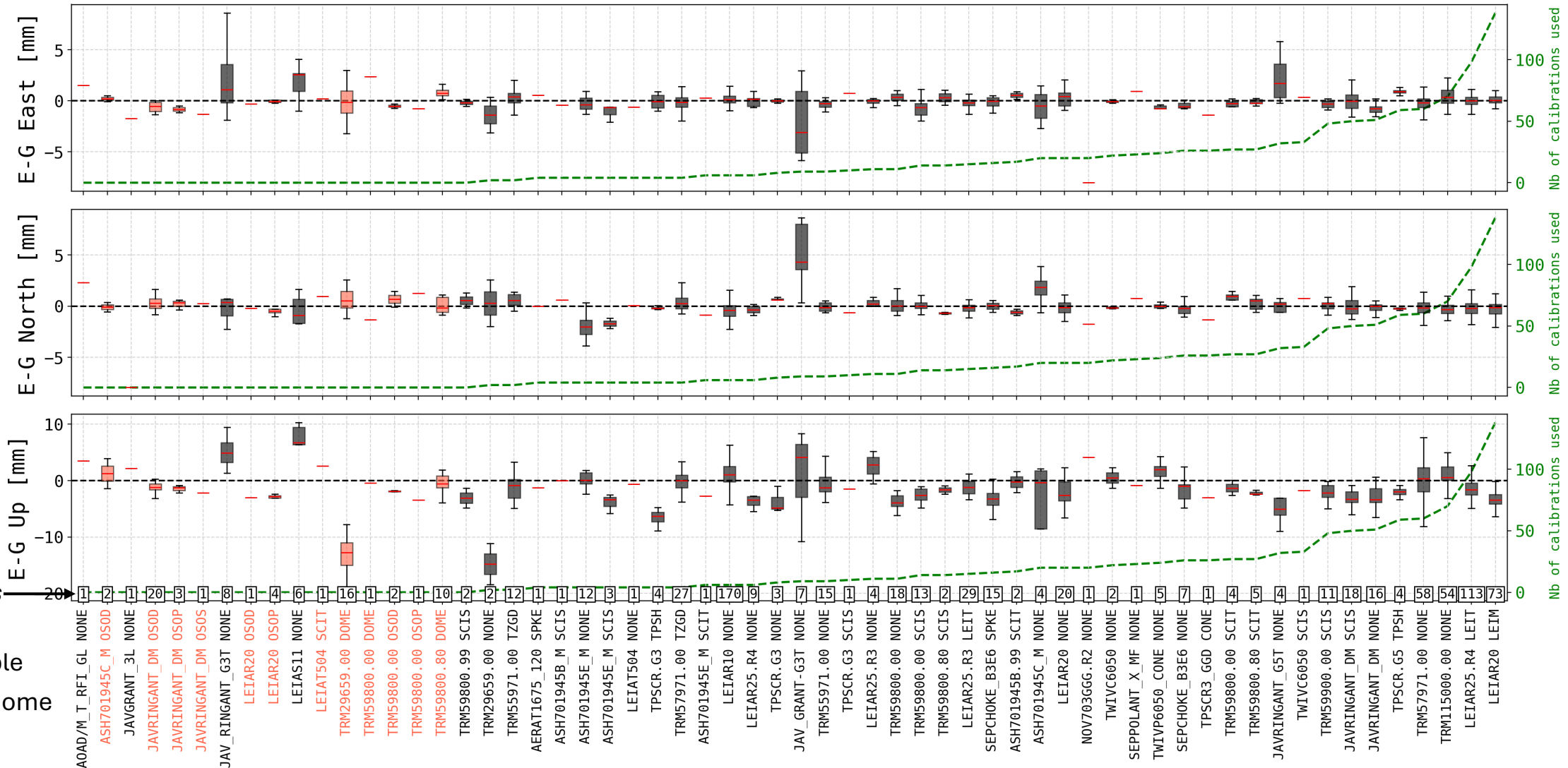
sorted by # individual antennas calibrated

→ no visible impact



Antennas mean biases *sorted by total calibration runs*

→ *no visible impact*

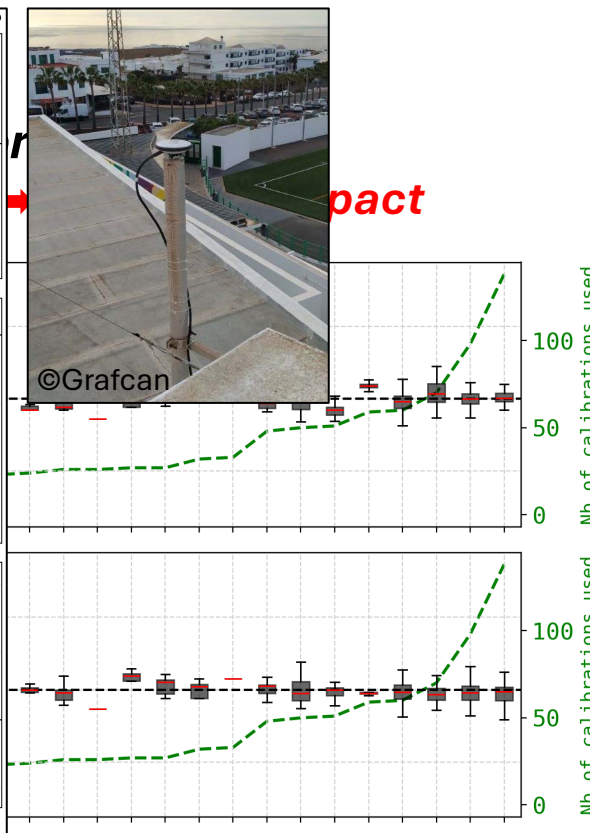
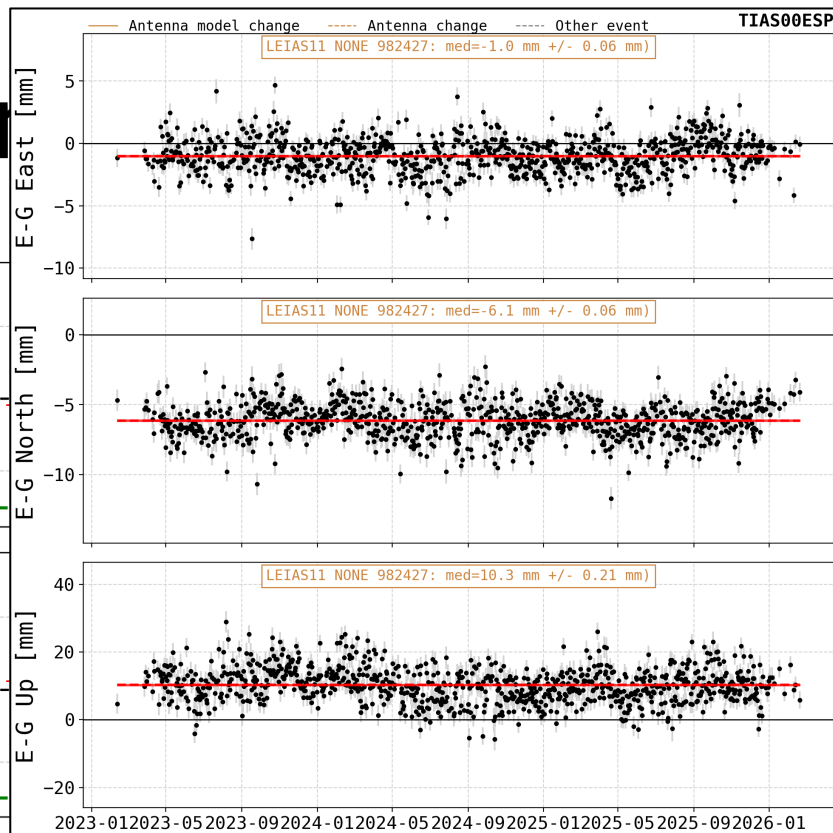
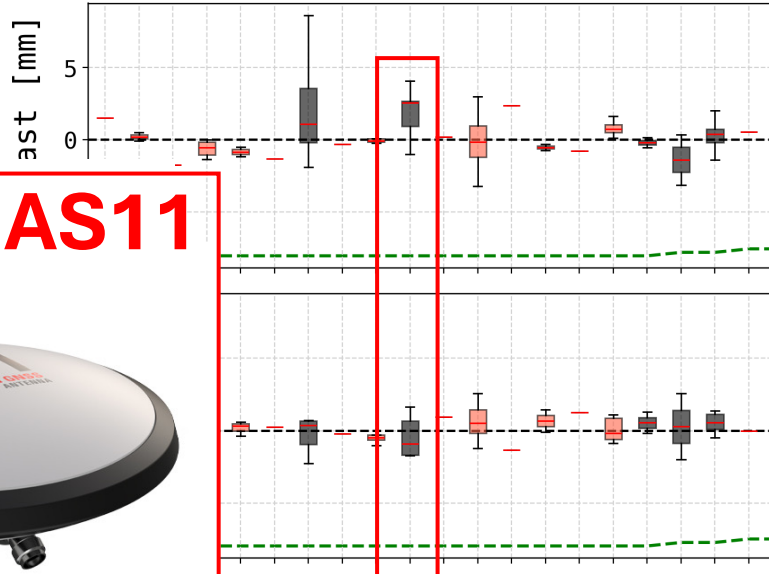


Antennas mean

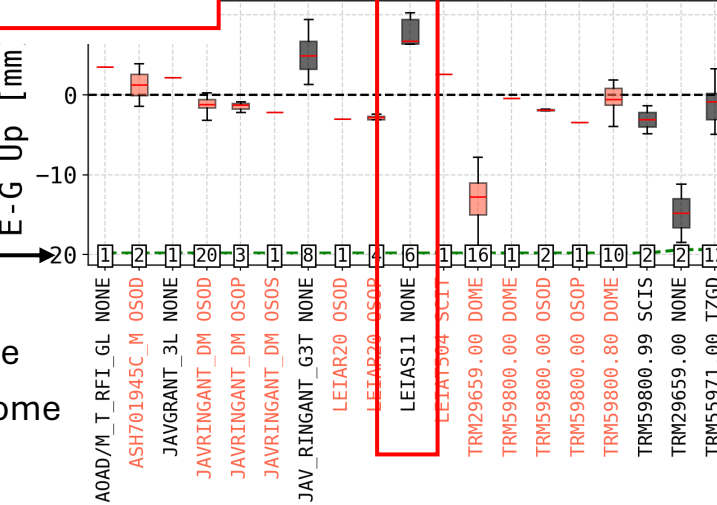
LEICA AS11



©Leica



ant./station pairs → 20

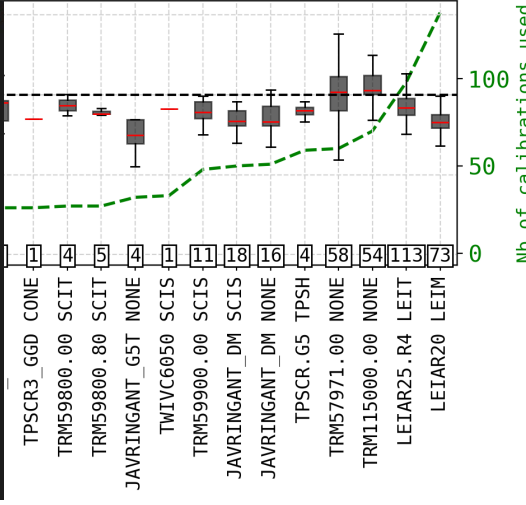


ROBOT 5.0 0.0 90.0 5.0 21 IGS20_2417

COPIED FROM LEICGA100 NONE

ATTENTION! COPIED WITHOUT VERIFICATION BY CALIBRATION!

Freq.[MHz]	Freq. Codes
1602.000	R01 R04
1575.420	G01 E01 J01 S01 C01
1561.098	C02
1278.750	E06 J06
1268.520	C06
1246.000	R02 R06
1227.600	G02 J02
1207.140	E07 C07
1202.025	R03
1191.795	E08 C08
1176.450	G05 E05 J05 C05 S05 I05



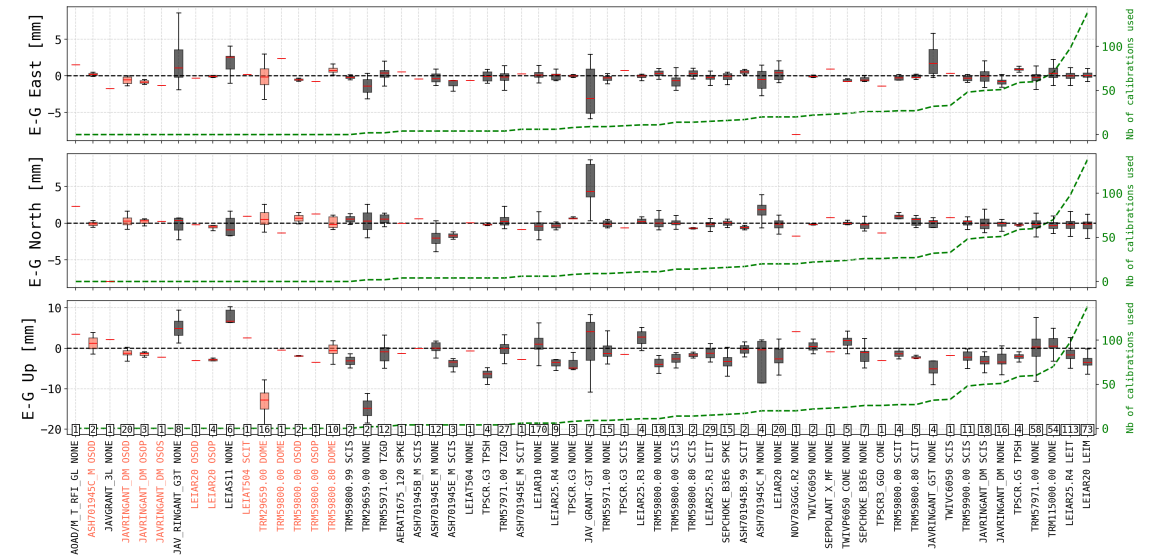
Calibration available for:

- antenna + radome
- antenna only



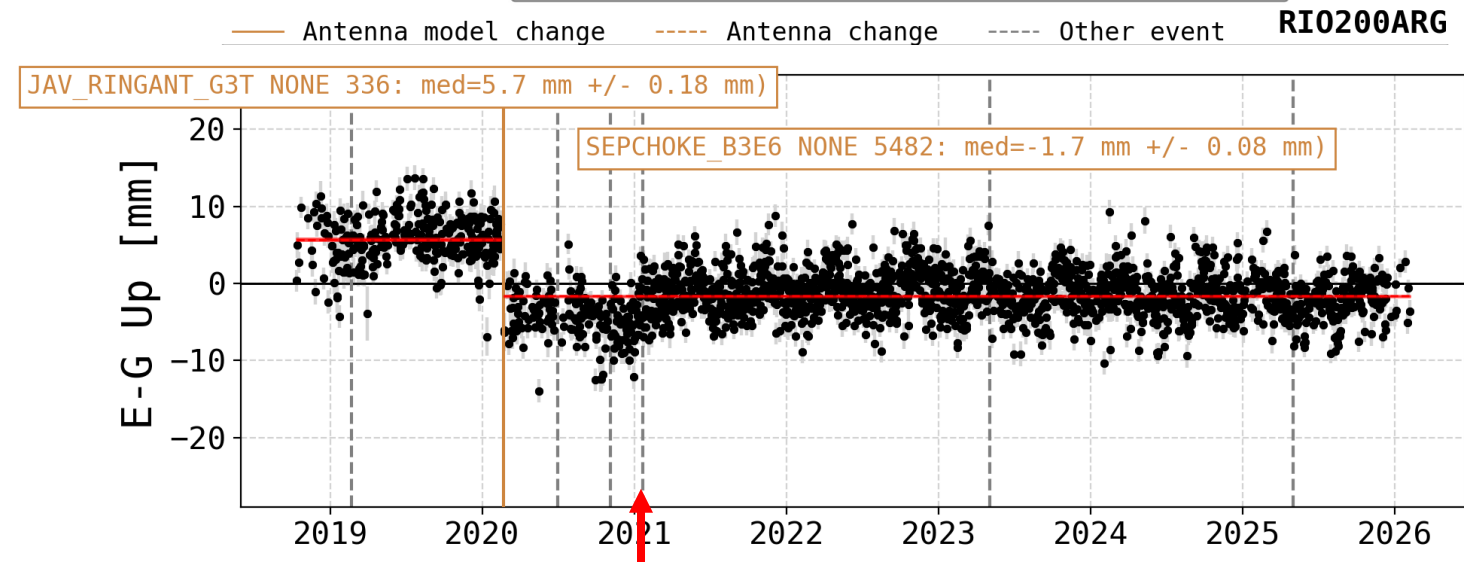
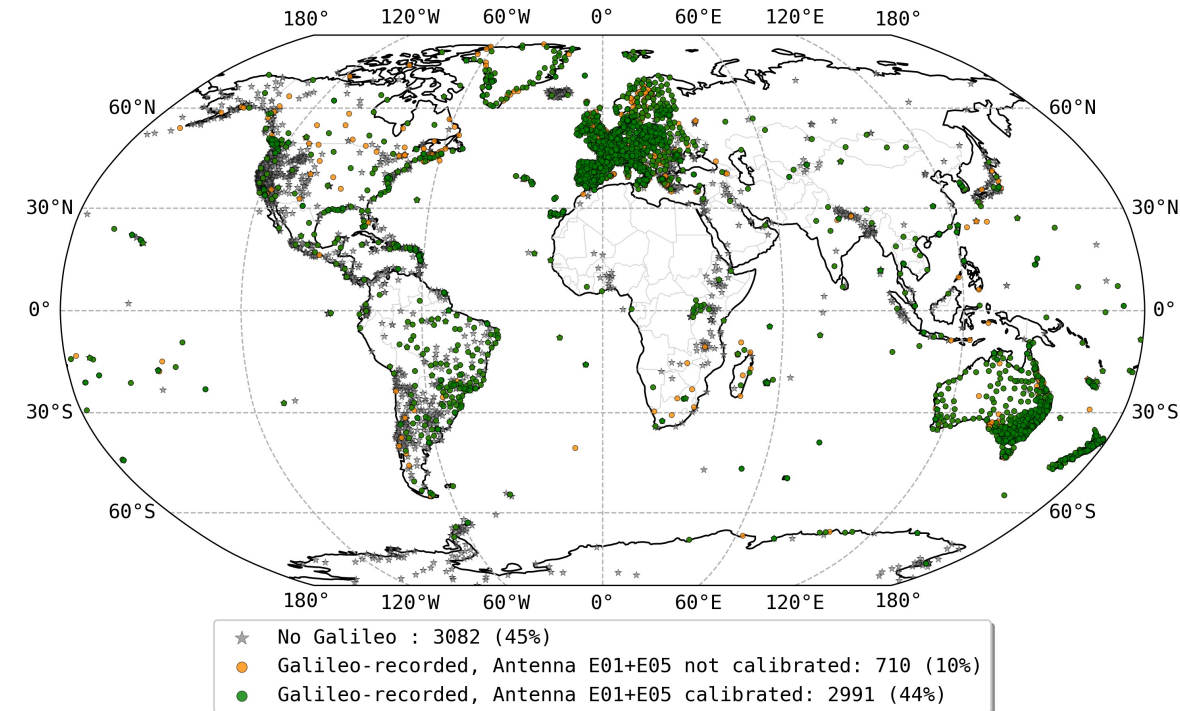
Calibration available
for:  antenna + radome
 antenna only

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Perspectives

- Need to densify the analysis using the potential of the SPOTGINS network: **up to 3000 Galileo-only time series**
- Evaluate the impact of receiver model and firmware?

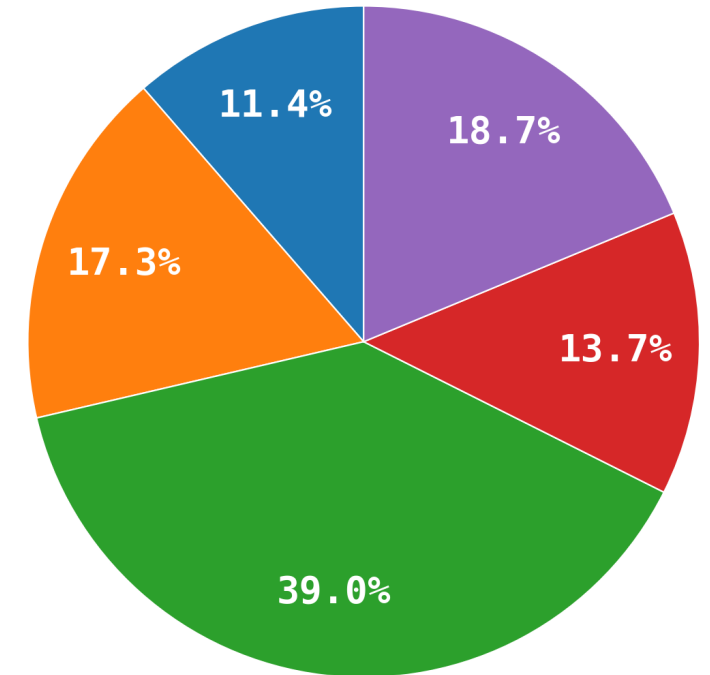


Rcv: SEPT ASTERX4, fw version: 4.8.0 Rcv: SEPT ASTERX4, fw version: 4.8.2

Perspectives

Status of the 533 IGS stations

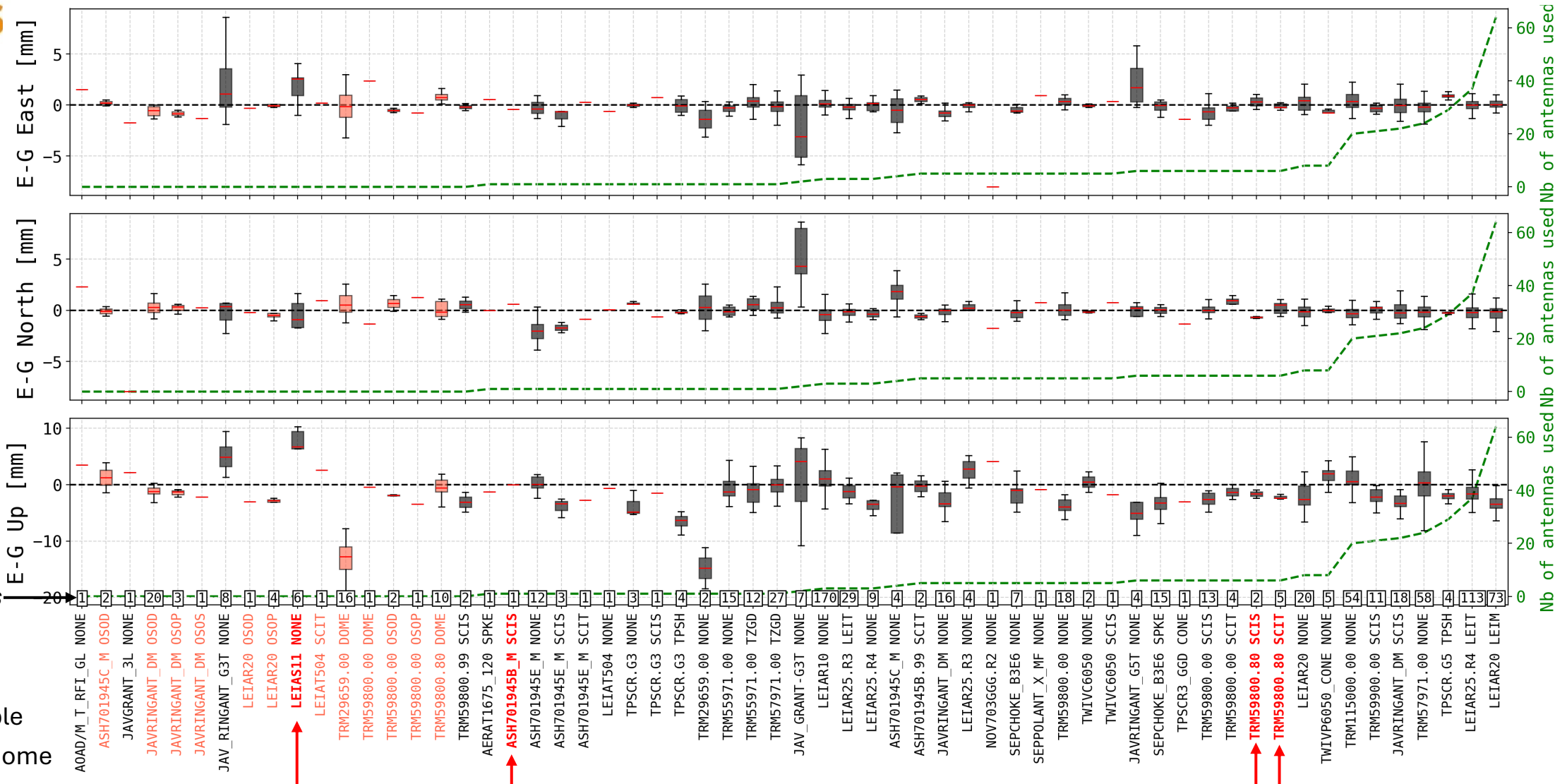
- Need to densify the analysis using the potential of the SPOTGINS network: **up to 3000 Galileo-only time series**
- Evaluate the impact of receiver model and firmware?
- Impact on IGS products
 - Impact when data from new constellations arrive?
 - Impact on velocities when combining Gal and no-Gal solutions?
- **Results are freely available:** open to compare “problematic” time series with other softwares or products



- Galileo not recorded
- Antenna not/not fully Galileo calibrated
- No significant bias
- Significant bias - #16 antennas
- Bias not evaluated

THANK YOU FOR YOUR ATTENTION

Antennas mean biases *sorted by # individual antennas calibrated*



Calibration copied from another antenna without verification by calibration