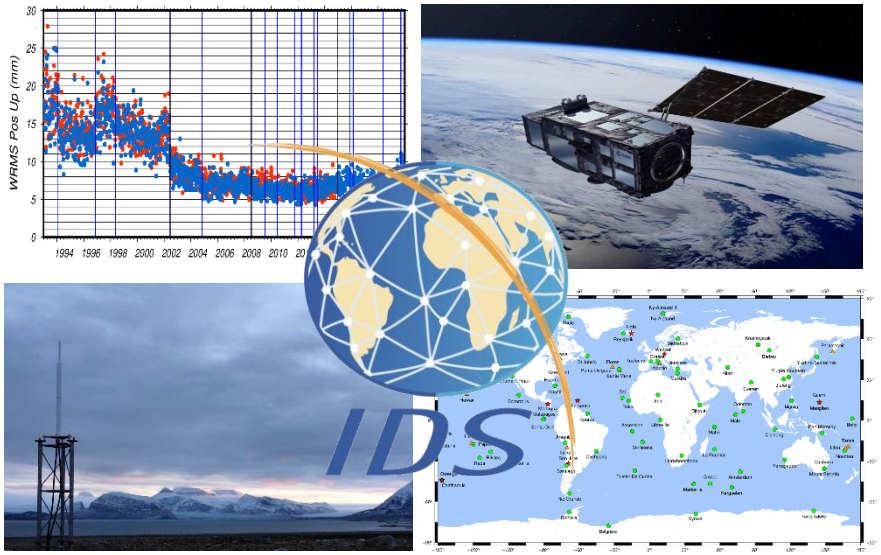
Evaluation of GOP 69, GRG 56, GSC 60 and IGN 22 Single Satellite Solutions

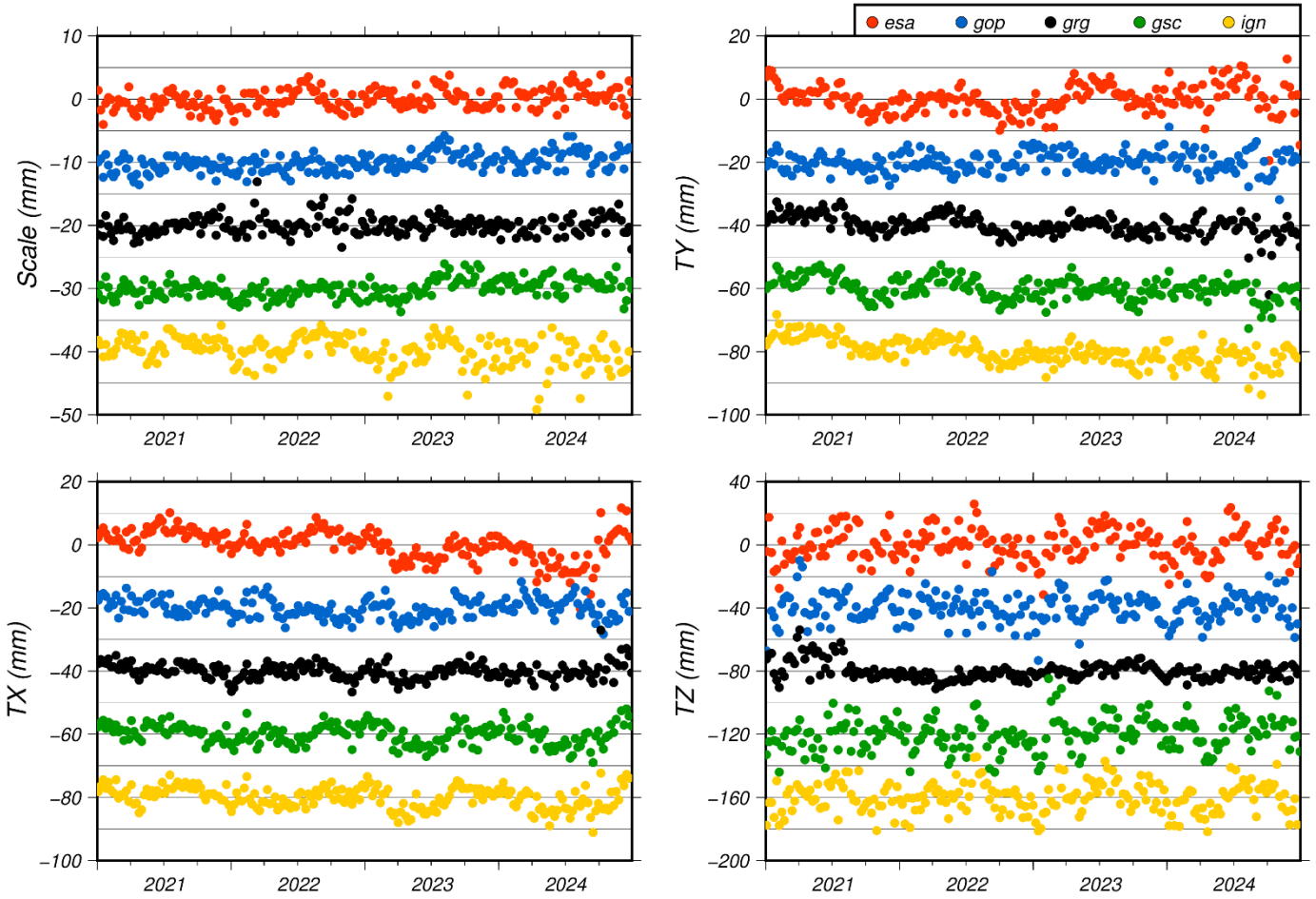


Guilhem Moreaux
Collecte Localisation Satellites

IDS AWG 2025 – Athens (Greece) – 2025/11/06

Objective

Better understanding of the IDS AC multi-satellite solution features which contributed to the second yearly update of the ITRF2020.

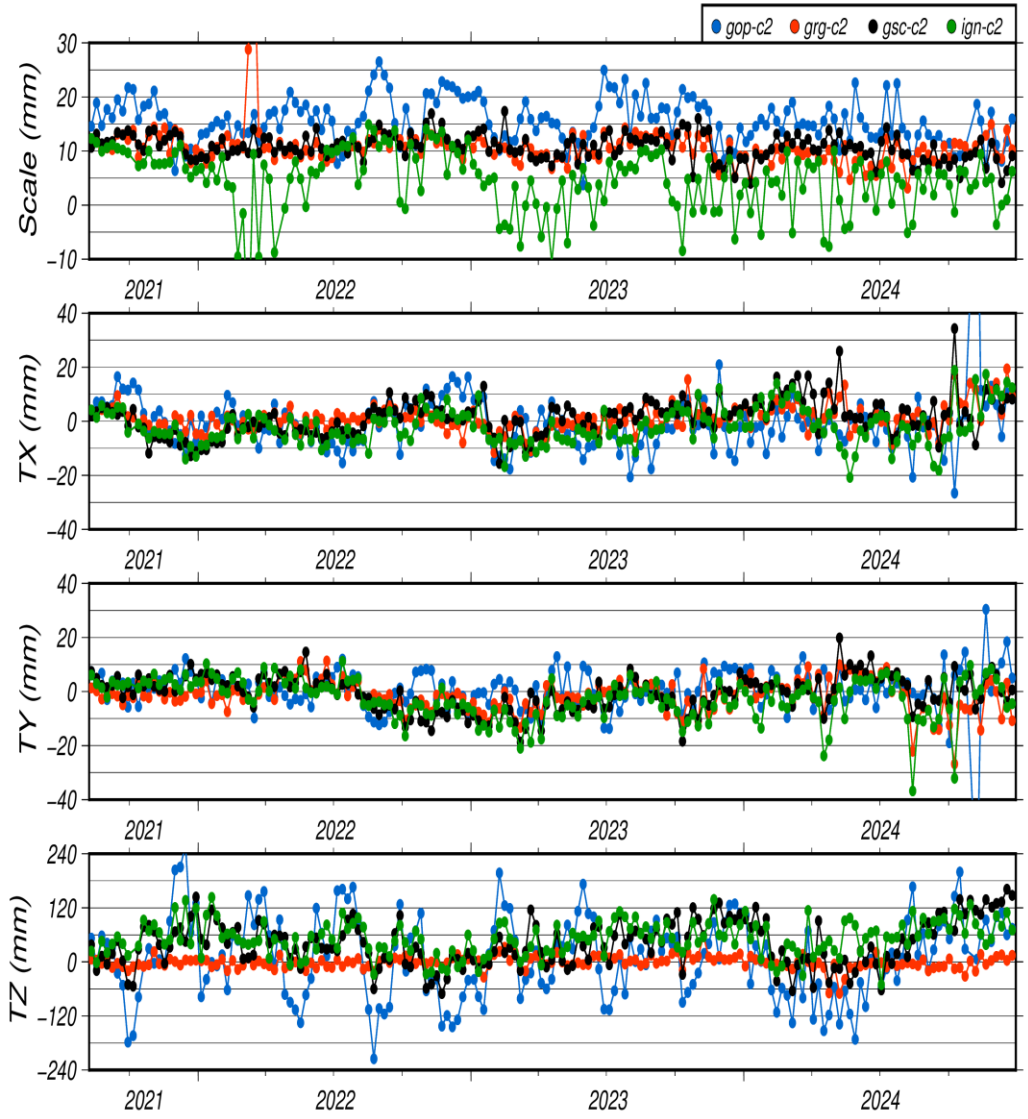


Single Satellite Solutions

	GOP 69	GRG 56	GSC 60	IGN 22
Cryosat-2	Y	Y	Y	Y
Saral	Y	Y	Y	Y
Jason-3	Y	Y	Y	Y
Sentinel-3A	Y	Y	Y	Y
Sentinel-3B	Y	Y	Y	Y
Sentinel-6A	Y	Y	Y	Y
HY-2C	Y	Y	N	N
HY-2D	Y	Y	N	N

Time period: 2021.0-2025.0

Cryosat-2 – Helmert Parameters



Helmert parameters wrt DPOD2020 v4.0

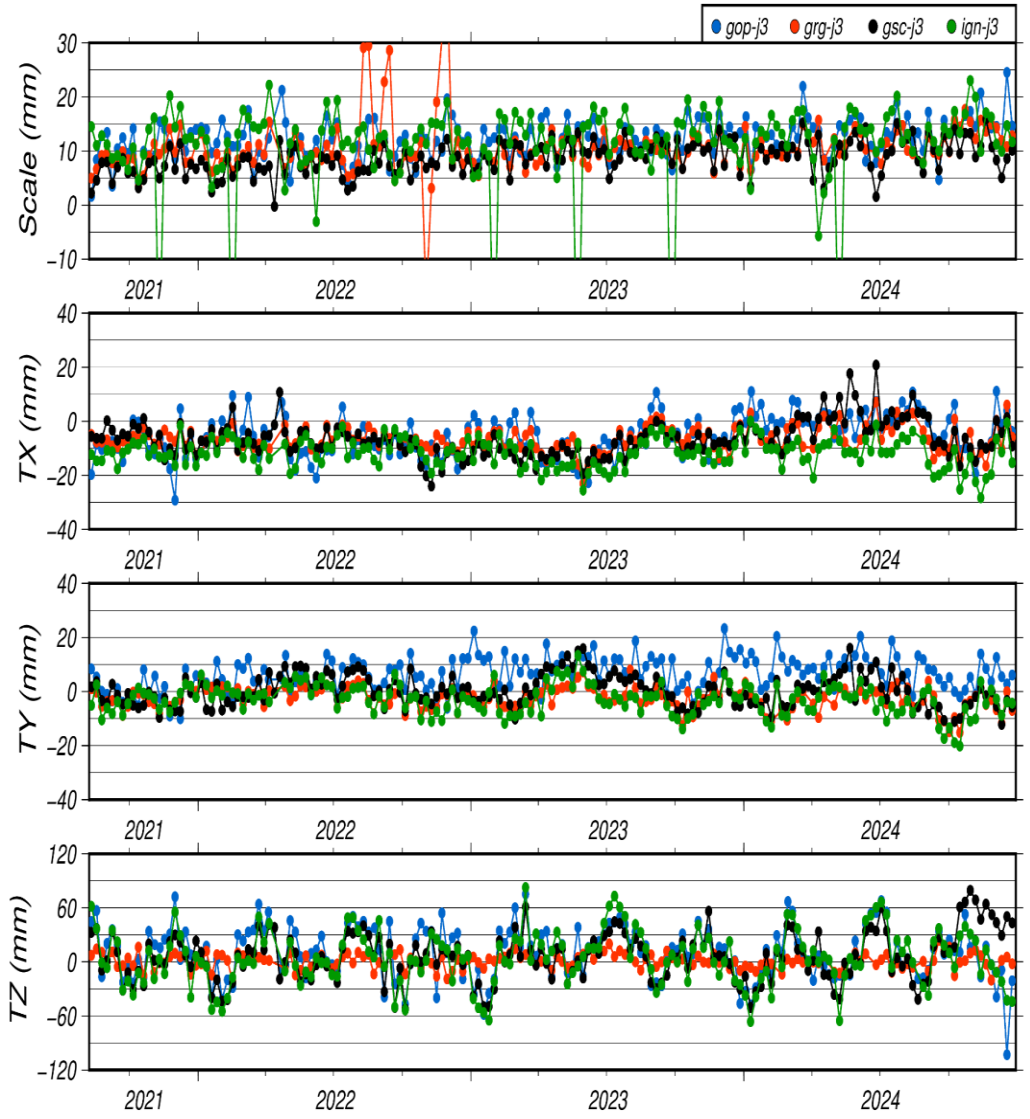
Scale:

- **IGN: annual signal, mainly before 2023.0 with amplitude of about 3 mm.**

Z-translation:

- **GOP: 480-day signal with amplitude of about 43 mm and mean bias of nearly 15 mm.**
- **GSC: 480-day signal with amplitude of about 35 mm and mean bias of nearly 45 mm.**
- **IGN: 480-day signal with amplitude of about 16 mm and mean bias of nearly 50 mm.**

Jason-3 – Helmert Parameters



Helmert parameters wrt DPOD2020 v4.0

Scale: trend of about 1 mm/yr for all the ACs.

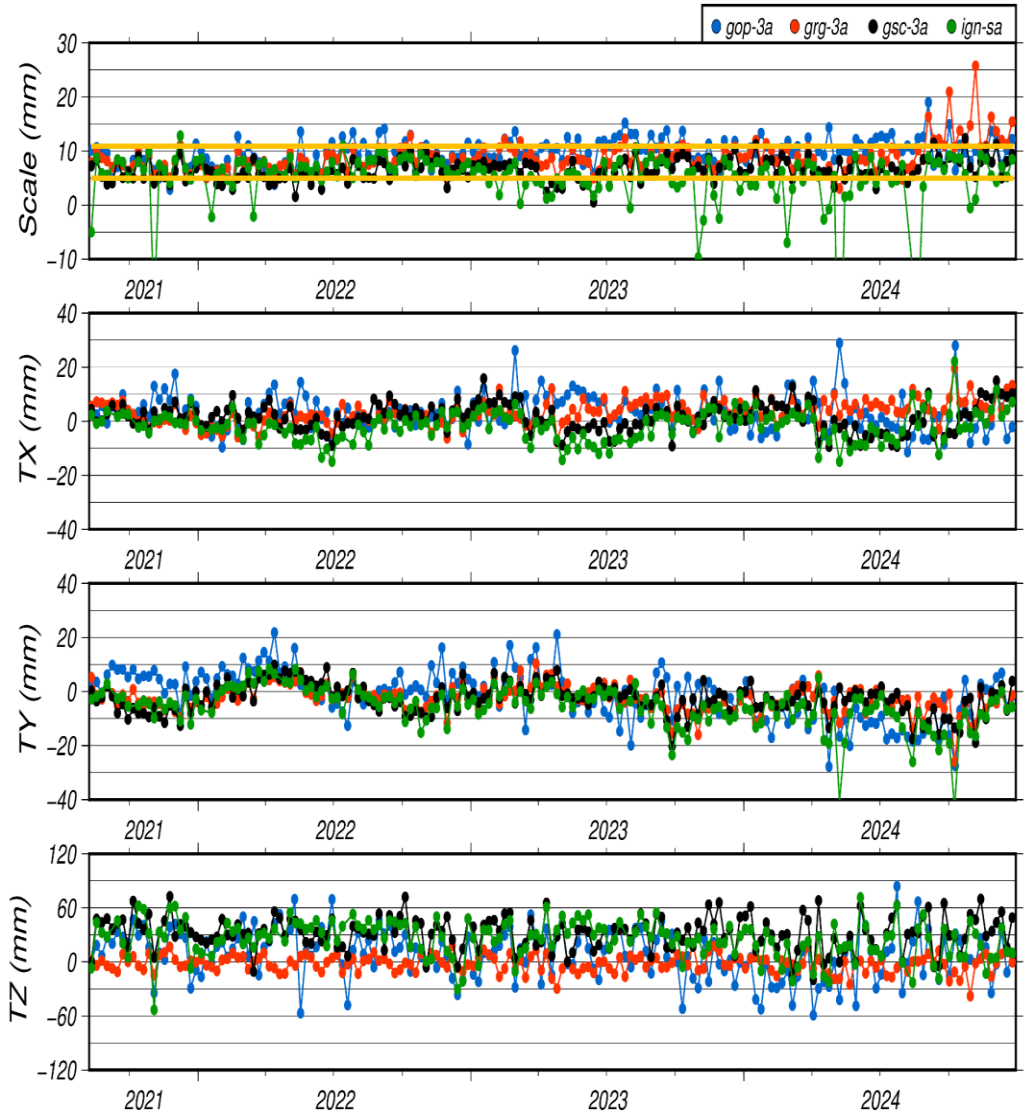
Y-translation:

- **GSC: clear annual signal up to 2023.0 (amplitude of about 5 mm).**

Z-translation:

- **GOP: 118-day signal with amplitude of about 26 mm.**
- **GRG: clear reduction of the 118-day signal (21 vs 2 mm) with estimation of a daily normal bias.**
- **GSC: 118-day signal with amplitude of about 21 mm.**
- **IGN: 118-day signal with amplitude of about 22 mm.**

Sentinel-3A – Helmert Parameters



Helmert parameters wrt DPOD2020 v4.0

Scale: very good agreement between the ACs up to 2023.0.

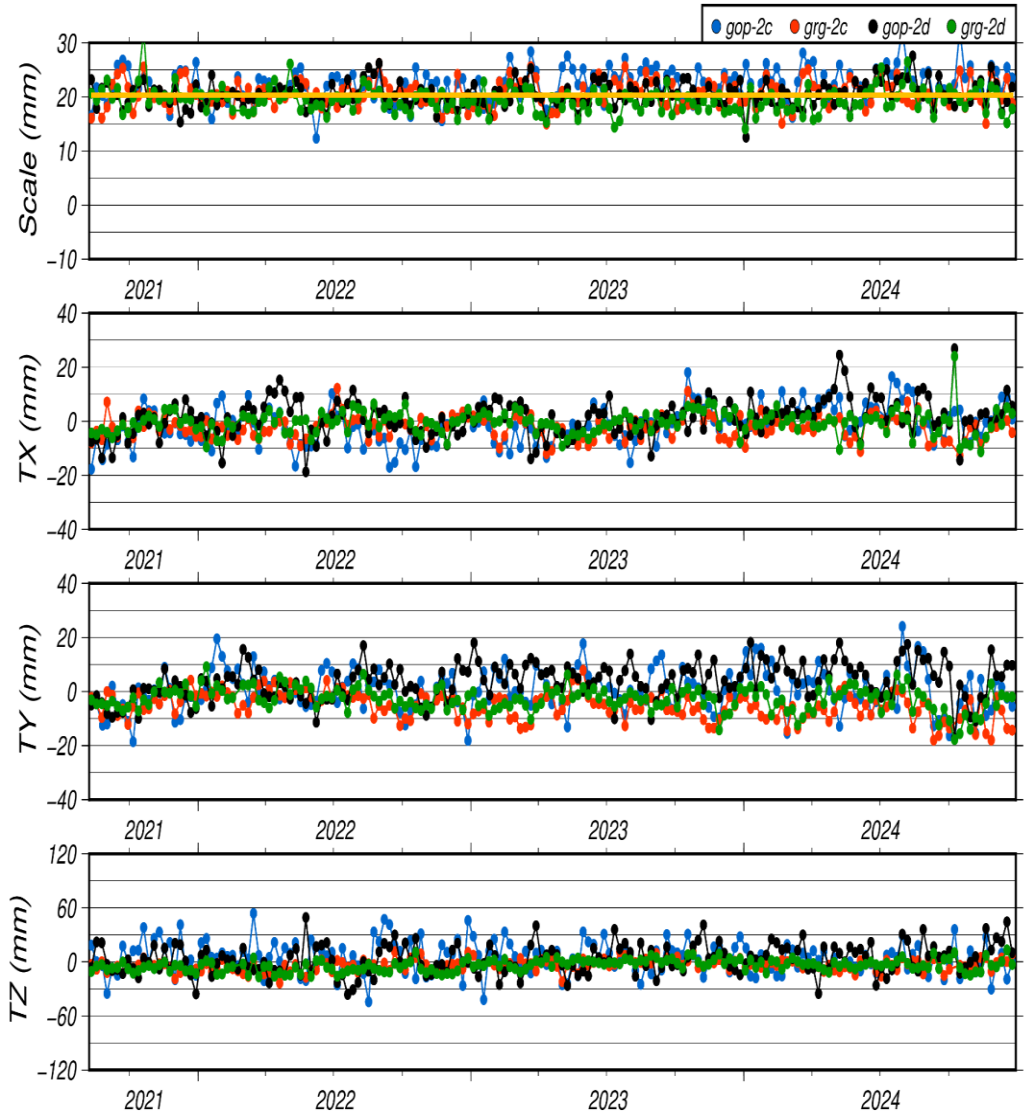
Y-translation:

- **GRG, GSC, IGN: clear annual signal up to 2023.0 (amplitude of about 6 mm).**

Z-translation:

- **GOP: Annual signal with amplitude of about 11 mm.**
- **GRG: Reduction of annual and semi-annual signals with estimation of a daily normal bias.**
- **GSC: Mean offset of about 32 mm.**
- **IGN: Mean offset of about 26 mm.**

HY-2C/2D – Helmert Parameters



Helmert parameters wrt DPOD2020 v4.0

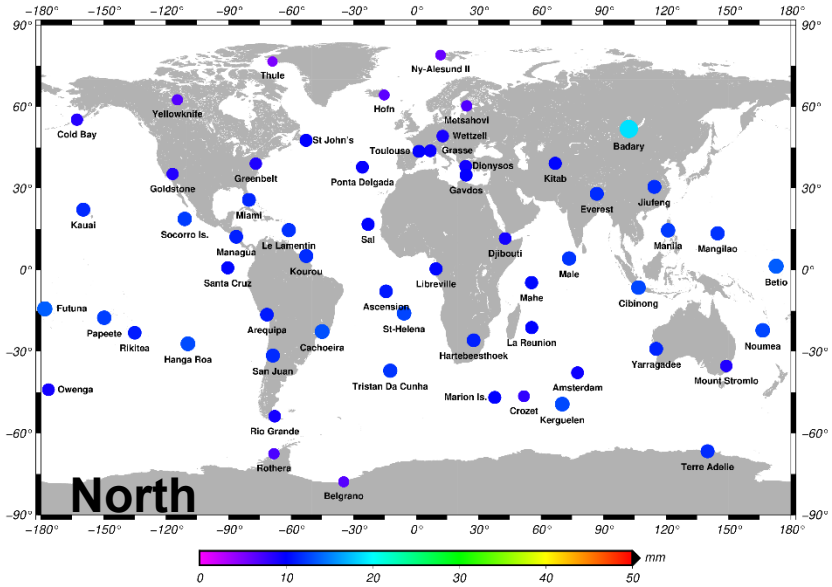
Scale:

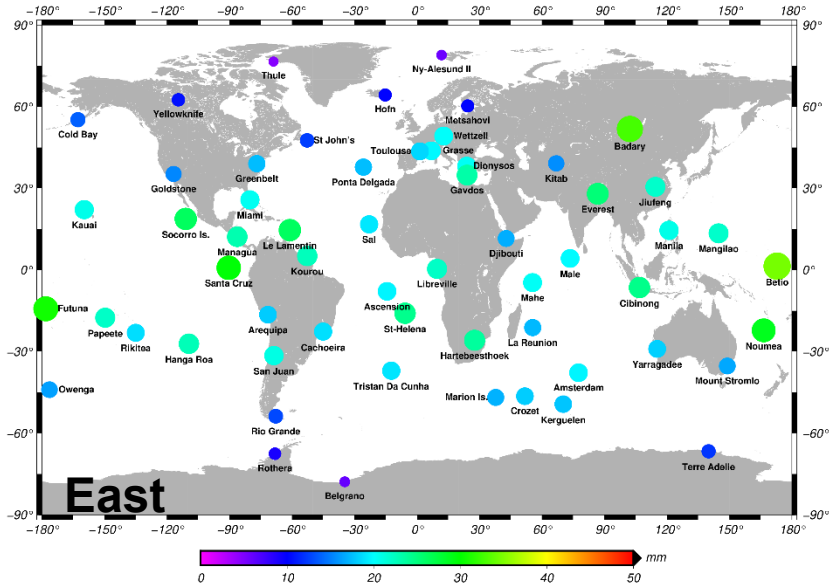
- **Largest mean scale offsets – Almost 5-10 mm mean offset wrt other missions**

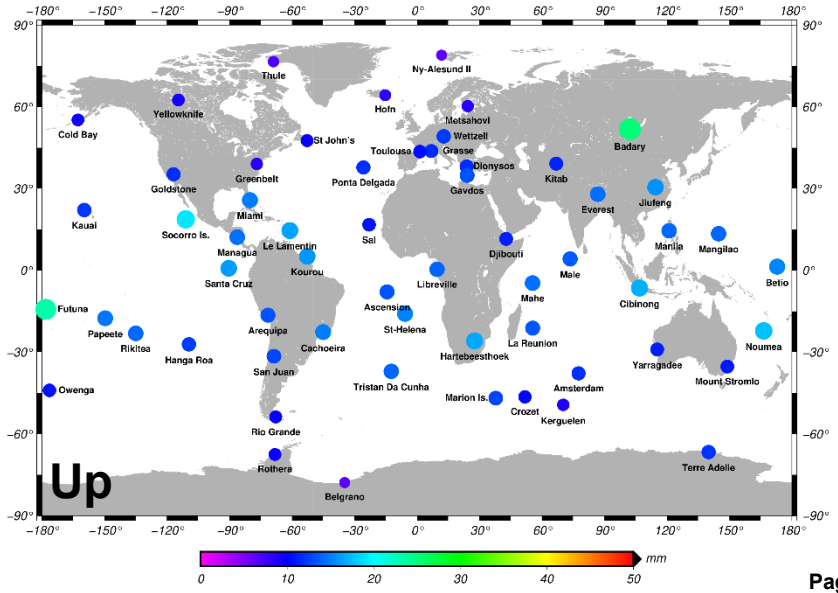
🡐 wrong value of the CoM-CoP (like with HY-2A at the early dates)?

- **Do not contribute to the scales of the GOP and GRG multi-satellite solutions.**

Saral – GOP – Station Position Residuals

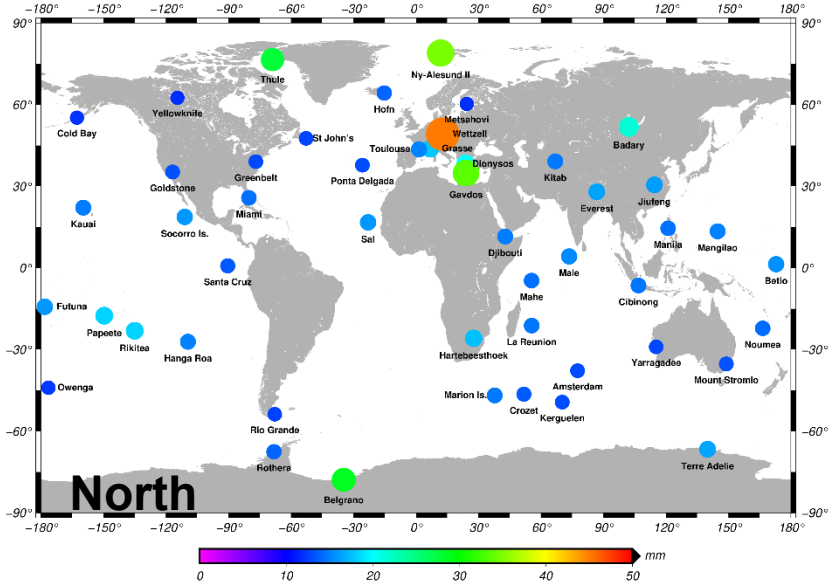


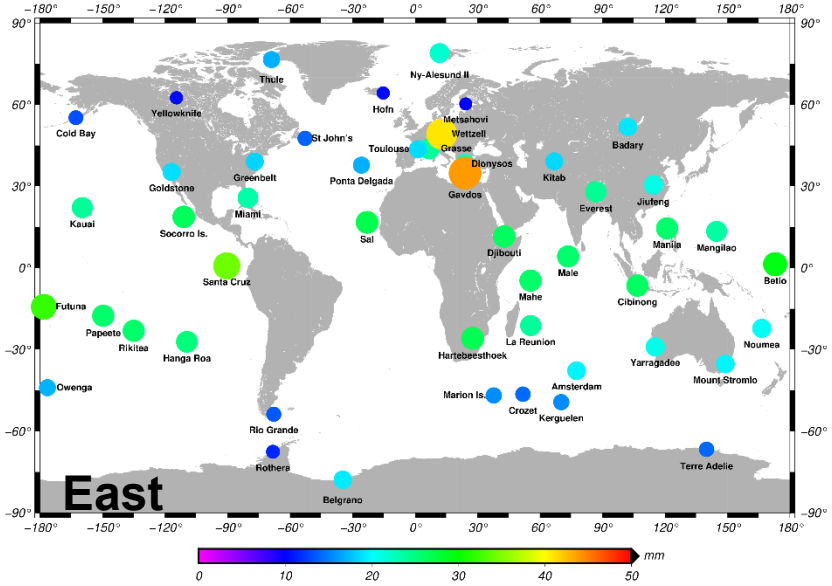


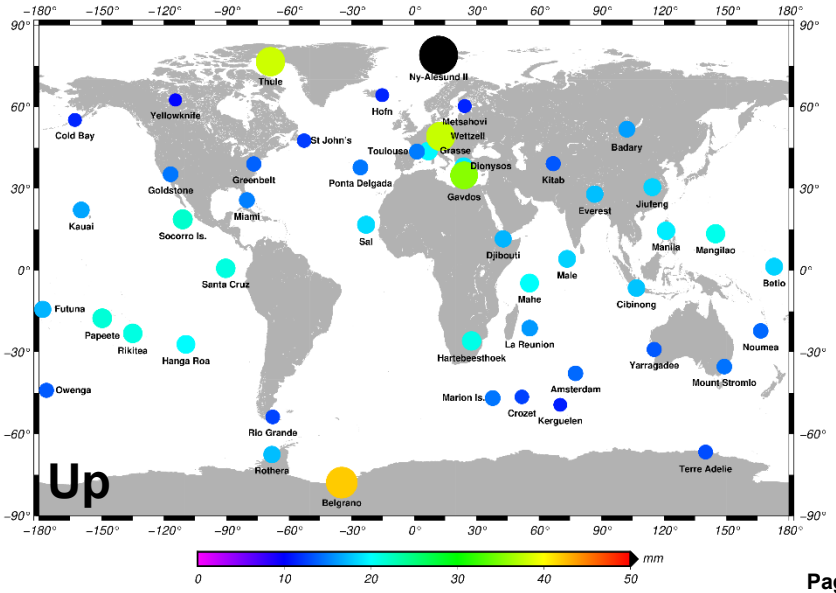


Latitude effect on the East residuals: larger values between -30 and +30 degrees in latitude.

Jason-3 – GOP – Station Position Residuals



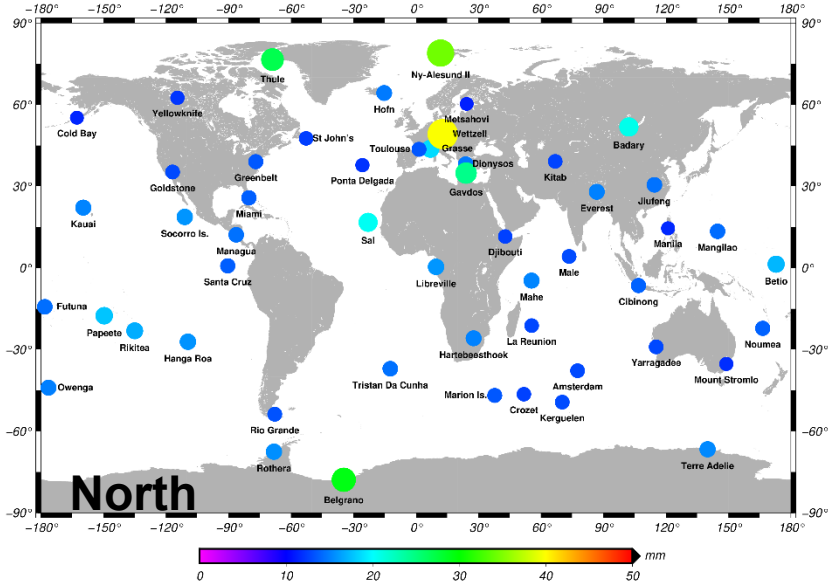


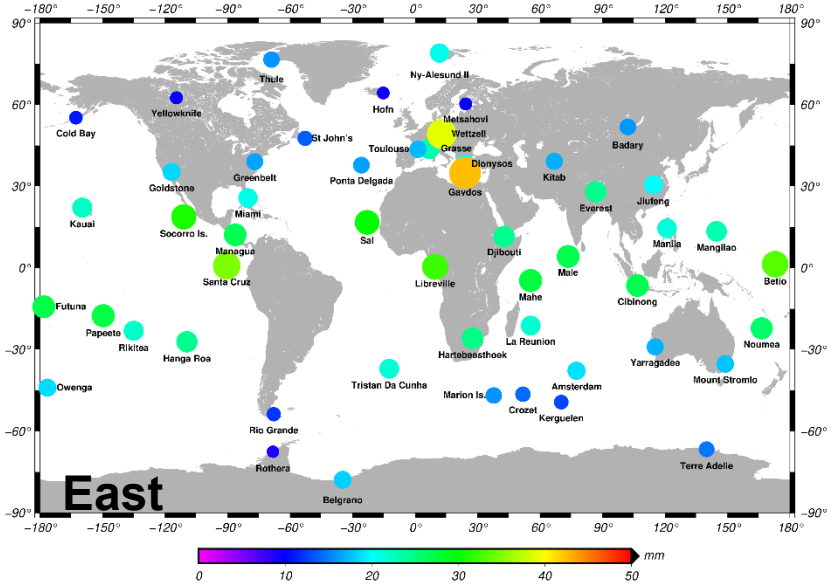


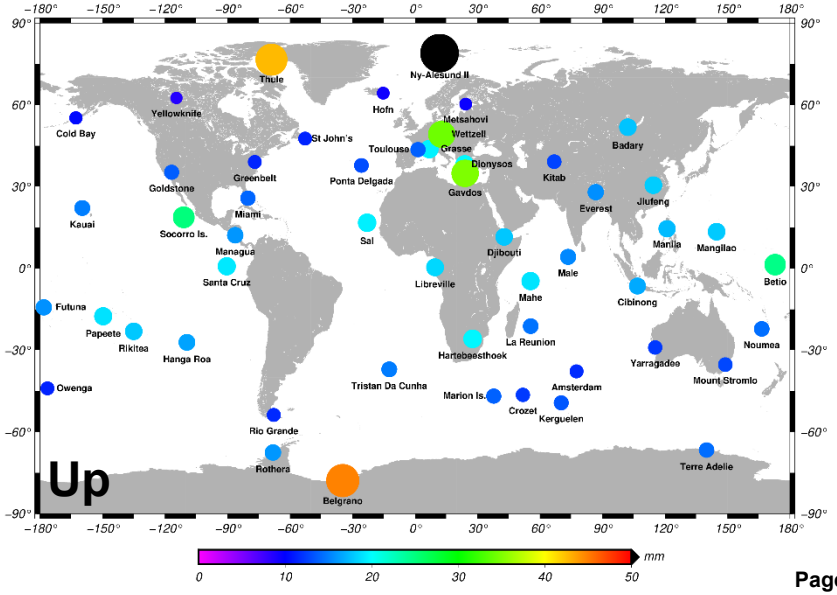
Larger WRMS for sites with high latitudes (ex: Ny-Alesund, Thule, Antarctica) are expected. Larger residuals in the East direction for sites between -30 and +30 degrees of latitude.

We see large residuals for Gavdos, Wettzell in almost the three directions. These two stations have a frequency shift (as well as Grasse).

Sentinel-6A – GOP – Station Position Residuals







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Gavdos, Grasse and Wettzell

Why all the AC show larger residuals for Gavdos and Wettzel?

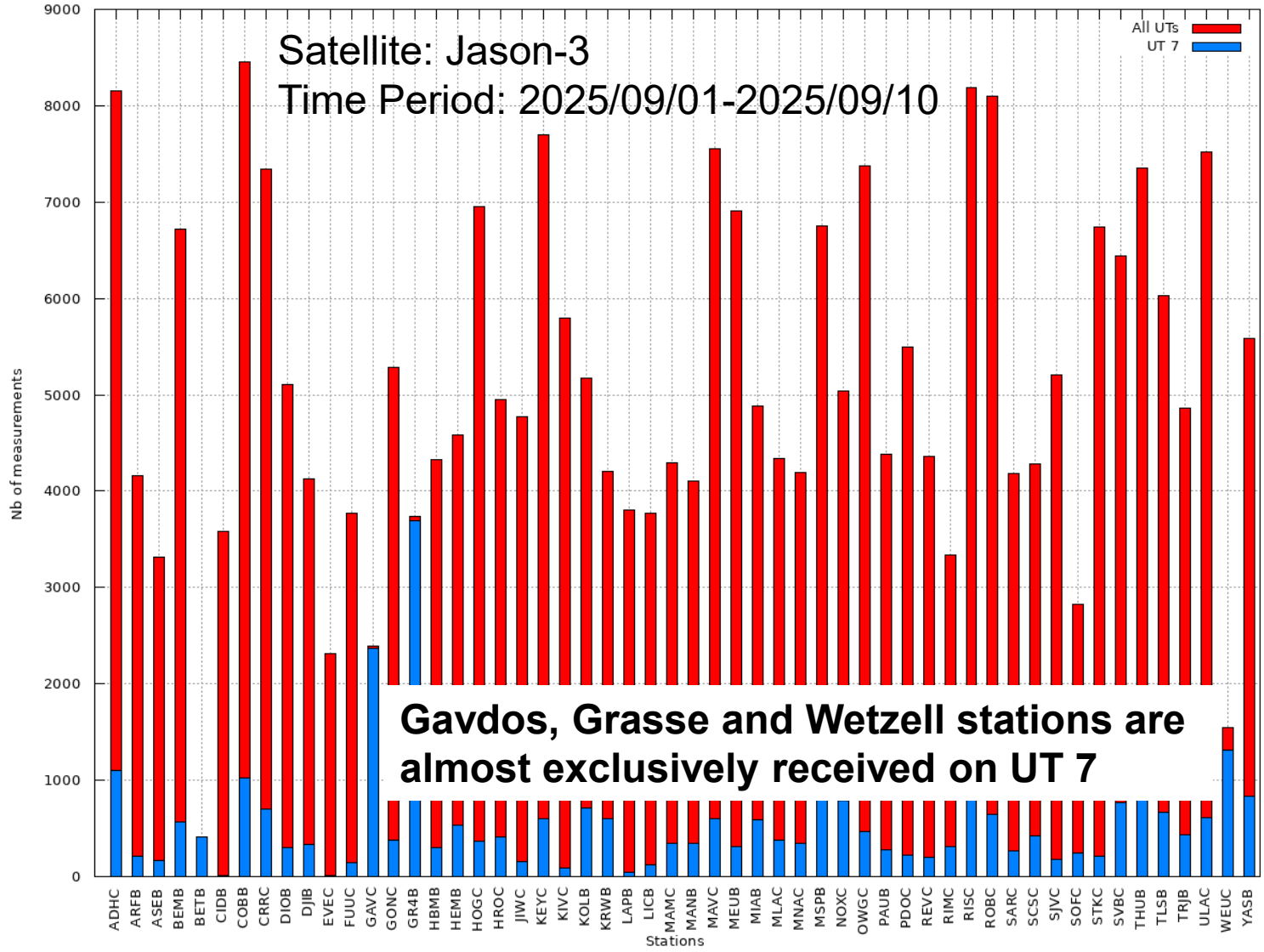
Gavdos, Grasse and Wettzell

- Have a frequency shift.
- Are localized in the European area with a dense network
  ➔ may be affected by a Doppler collision.
- Have the same receiving priority.
- Unlike the other stations, they are not automatically received onboard. They are mostly acquired on the DAS chanels.
- Wettzell is often turned off during VLBI sessions.

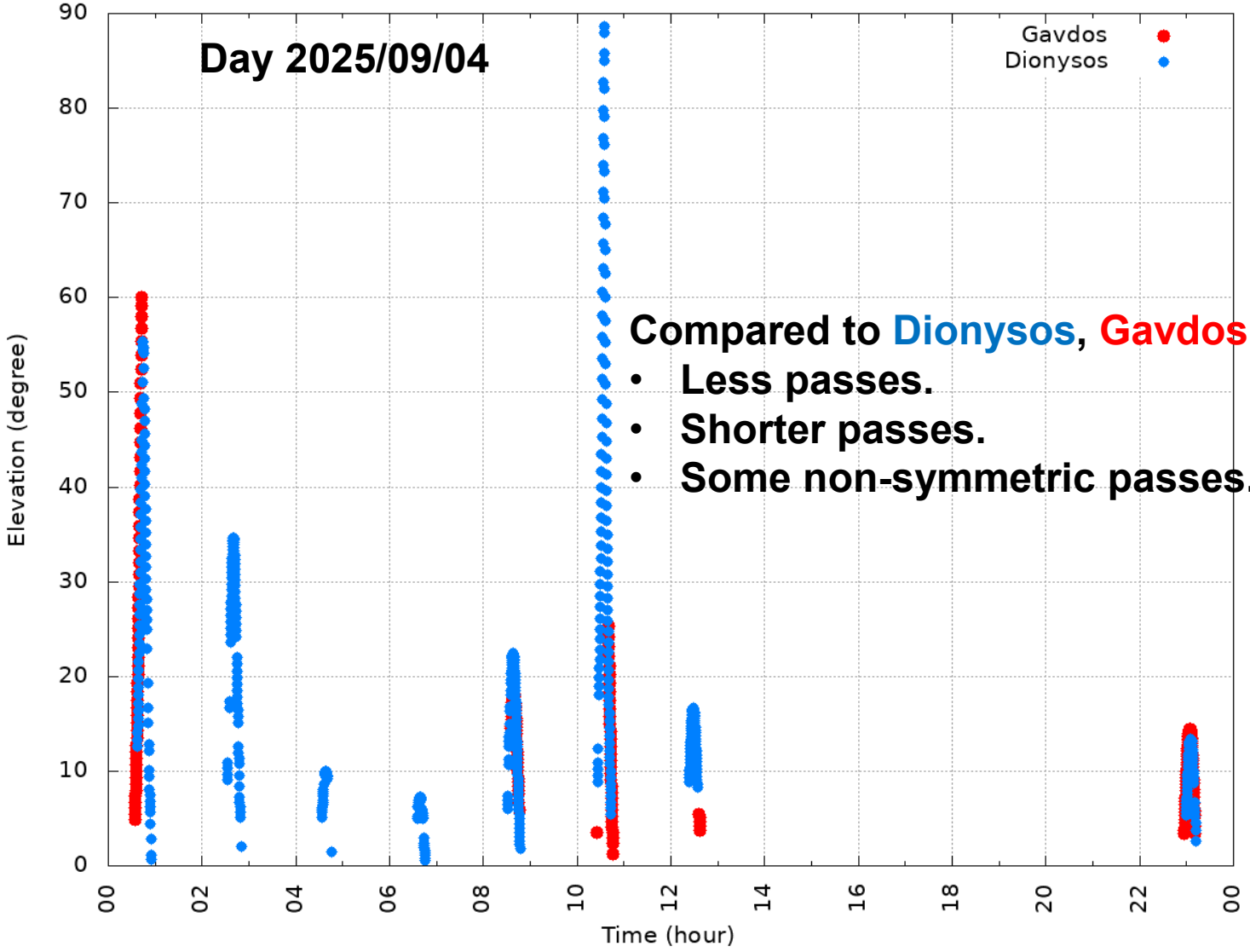
DAS (Spectral Analysis Designation) mode

- Jason-3 and Sentinel-6A: UT 7 only.
- Saral, Sentinel-3A/B, SWOT: UTs 6 and 7.
- Cryosat-2: UTs 5, 6 and 7.

Gavdos, Grasse and Wettzell



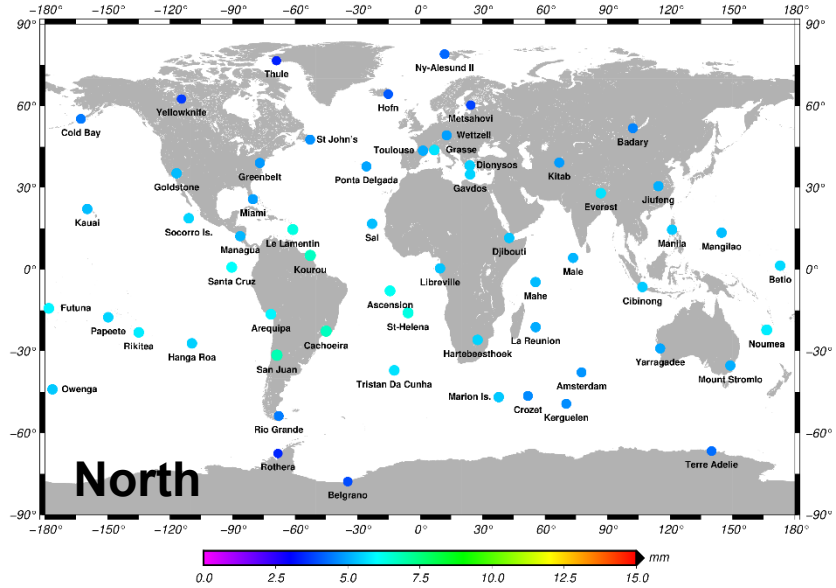
Jason-3 - Gavdos vs Dionysos

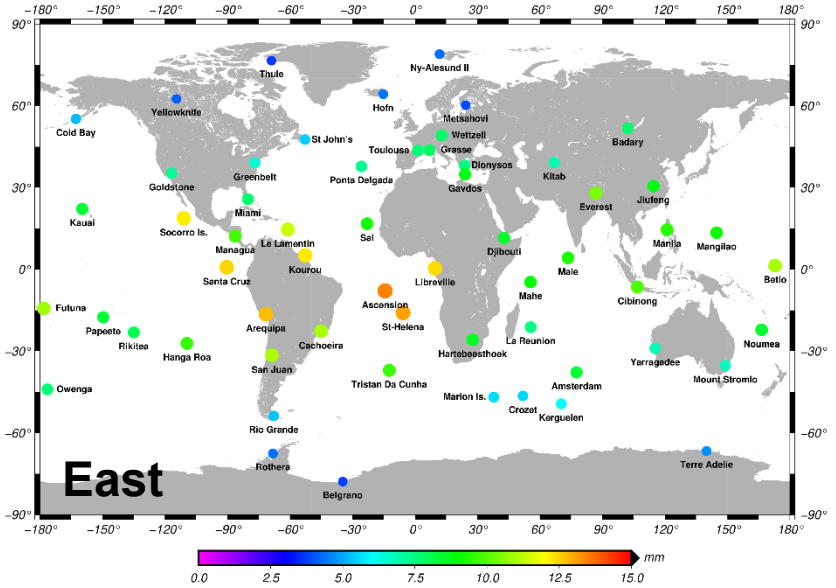


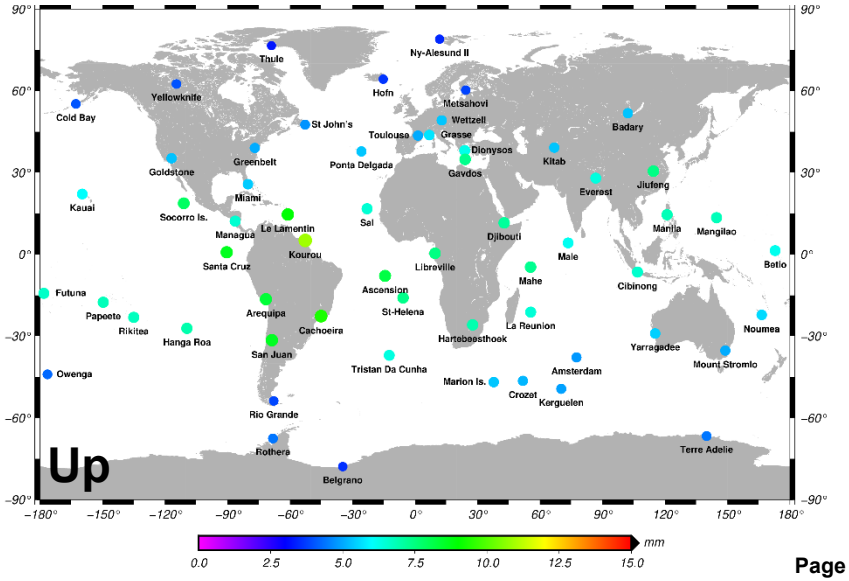
Compared to Dionysos, Gavdos depicts:

- **Less passes.**
- **Shorter passes.**
- **Some non-symmetric passes.**

GOP Multi-satellite Solution
Station Position Residuals







However, the larger Jason-3 and Sentinel-6A residuals for Gavdos, Wettzell seem to not impact the multi-satellite solutions.