



## GRG AC status

Hugues Capdeville (CLS),  
Jean-Michel Lemoine (CNES),  
Adrien Mezerette (CLS)

CNES/CLS AC (GRG)

IDS AWG  
June 04, 2024



# Status of CNES/CLS IDS Analysis Center

## ❑ Status of the routine DORIS data processing

We processed DORIS data until Dec. 2023 (Serie GRG54) and provided to IDS Combination Center.

SAA mitigation strategy on Sentinel-6A and HY-2C

we use cnes\_grgs\_rl05 gravity model

we use DPOD2020 as apriori

the solutions HY-2C & 2D do not contribute to the scale determination of multi-satellite solution

We also provided Sentinel3-A&B and Sentinel-6A orbits to CPOD QWG until April 2024.

## ❑ AC studies

### *In progress:*

Finalize the introduction of the SWOT satellite in our processing chain

Develop a strategy to mitigate the impact of increased solar activity on POD

(test recent atmospheric density models, adjust more drag coefficient (from 1/4H to 1/1H))

Determination of quaternions (BUS+solar panel) files for HY-2C and HY-2D satellites in ORBEX format

Implementation of the second order ionospheric correction for DORIS measurement

...

# Introduction of SWOT in GRG processing chain

- **Latest additions:**

Macromodel available at: <https://ids-doris.org/documents/BC/satellites/DORISSatelliteModels.pdf>

Attitude:

- Quaternions

- Nominal attitude now implemented

We have estimated the Radiation pressure scale coefficient: 0,98.

- **First results:**

We processed SWOT DORIS data from January 2023 to April 2024.

POD results

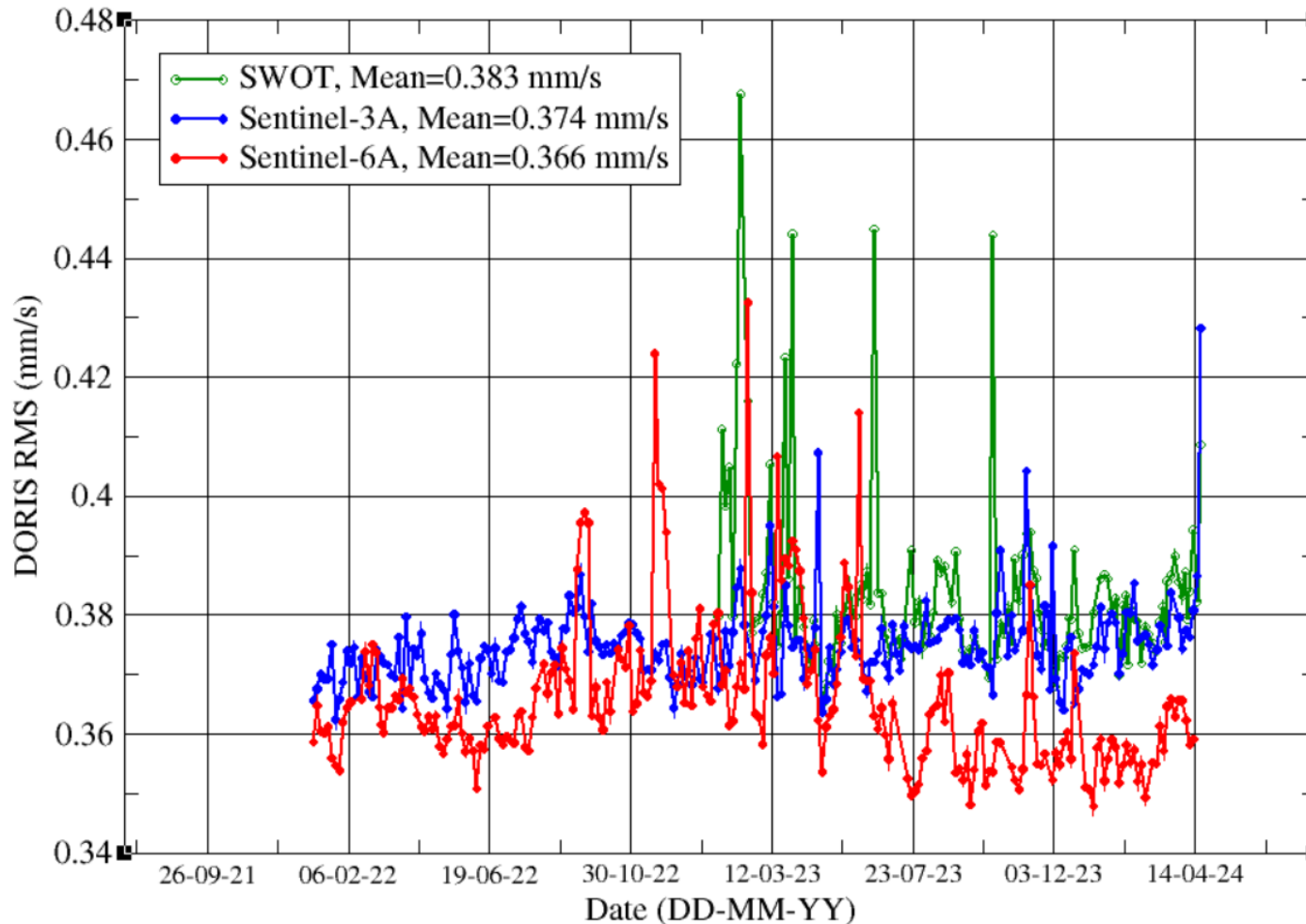
- orbit residuals and OPR empirical acceleration amplitudes

- comparisons to the CNES POD team orbit POE-F

Evaluation of SWOT single satellite solution by comparison to DPOD2020

# Introduction of SWOT in GRG processing chain

## □ DORIS RMS of fit

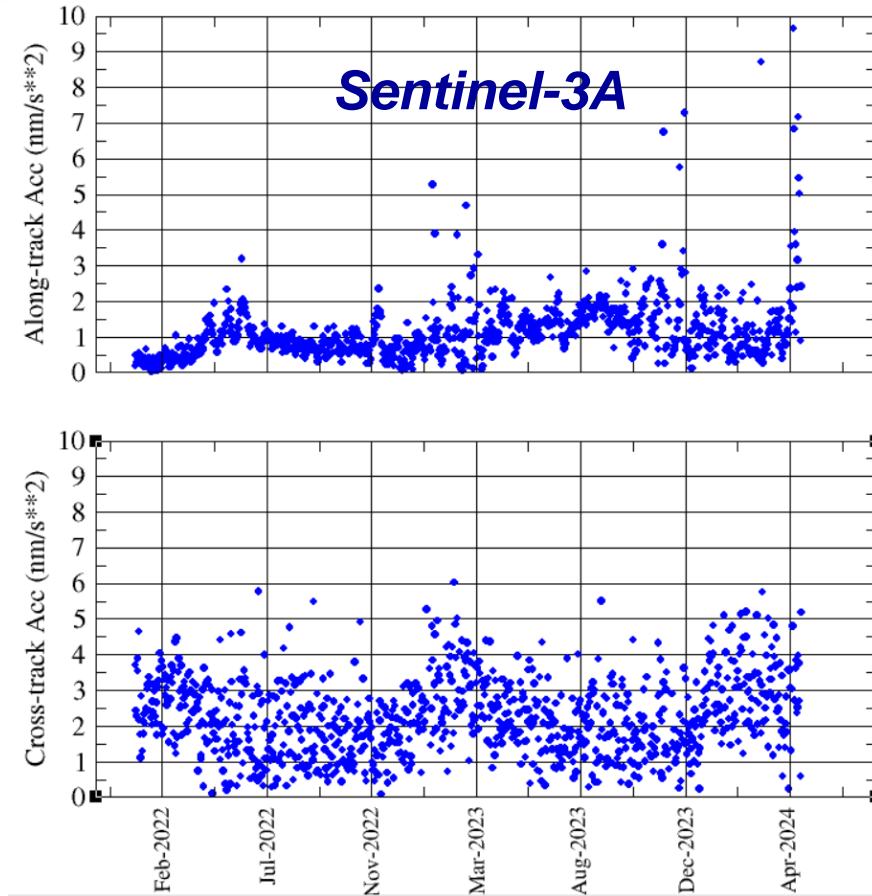
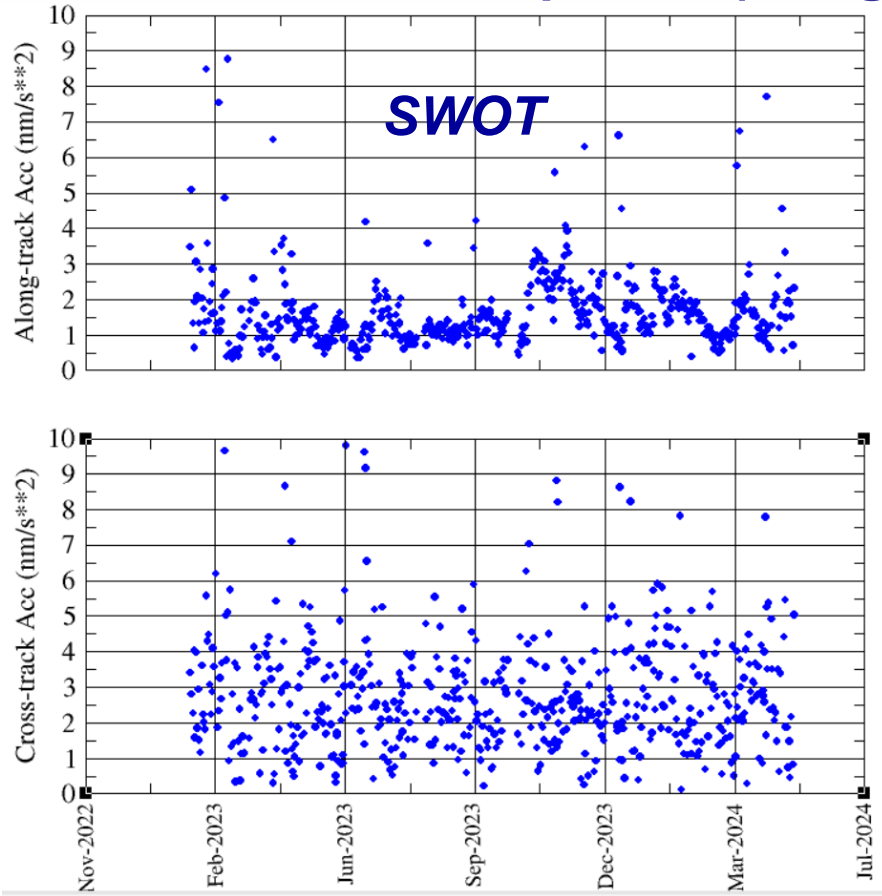


- **SWOT** (from Jan. 2023 to Apr. 2024)
- **Sentinel-3A & 6A** (from Jan. 2022 to April. 2024)

- *The DORIS RMS residuals for SWOT and Sentinel-3A are at the same level.*
- *There are more peaks (maneuvers).*

# Introduction of SWOT in GRG processing chain

## □ OPR Acceleration Amplitude (along-track)

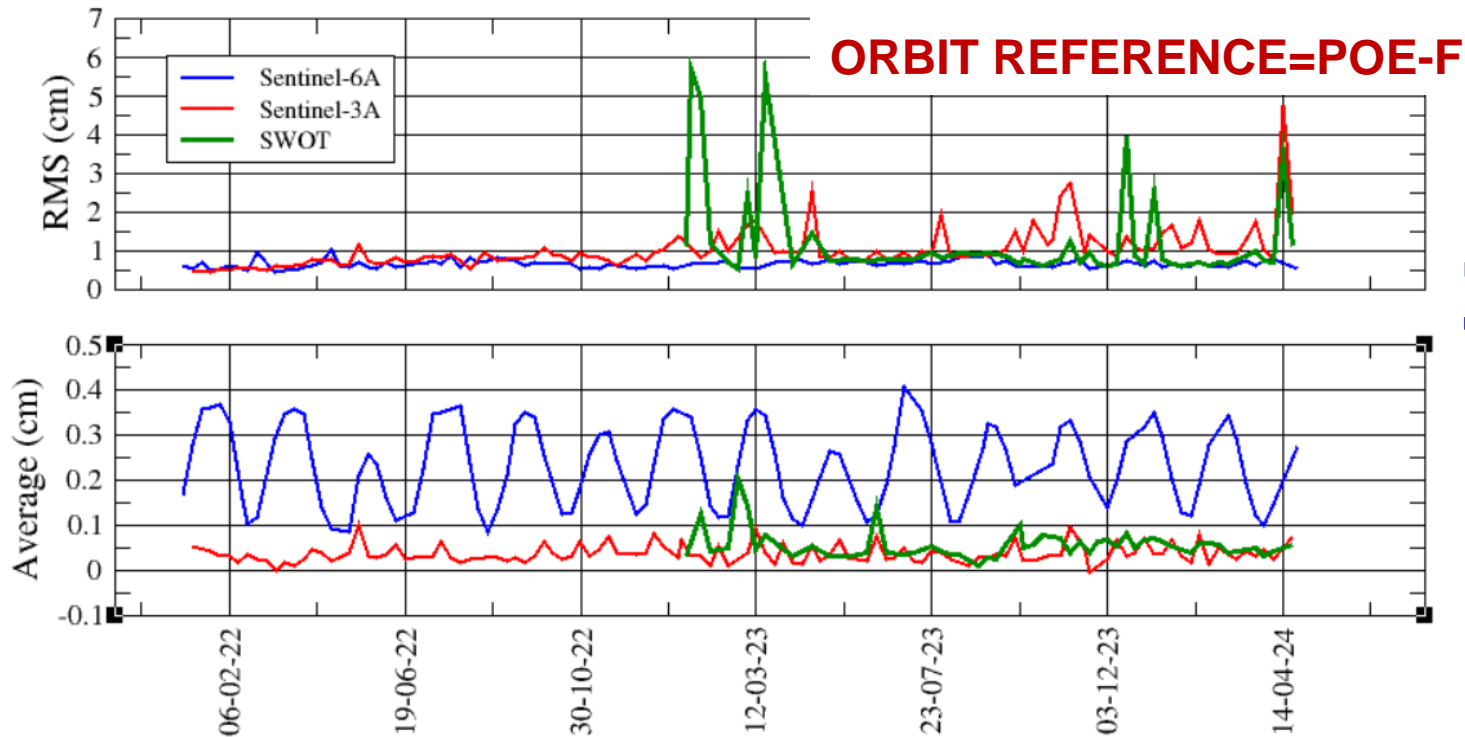


- As for Sentinel-3A, for SWOT, the level of the OPR amplitude is correct for the two directions, Along-track and Cross-track.
- For Sentinel-3A, there is a degradation in the along-track amplitude from early 2023 (as the solar flux increases).

# Introduction of SWOT in GRG processing chain

## Comparison to external orbit POE-F

### Weekly Average and RMS orbit differences (in cm)



- **SWOT** (from Jan. 2023 to Apr. 2024)
- **Sentinel-3A & 6A** (from Jan. 2022 to April. 2024)

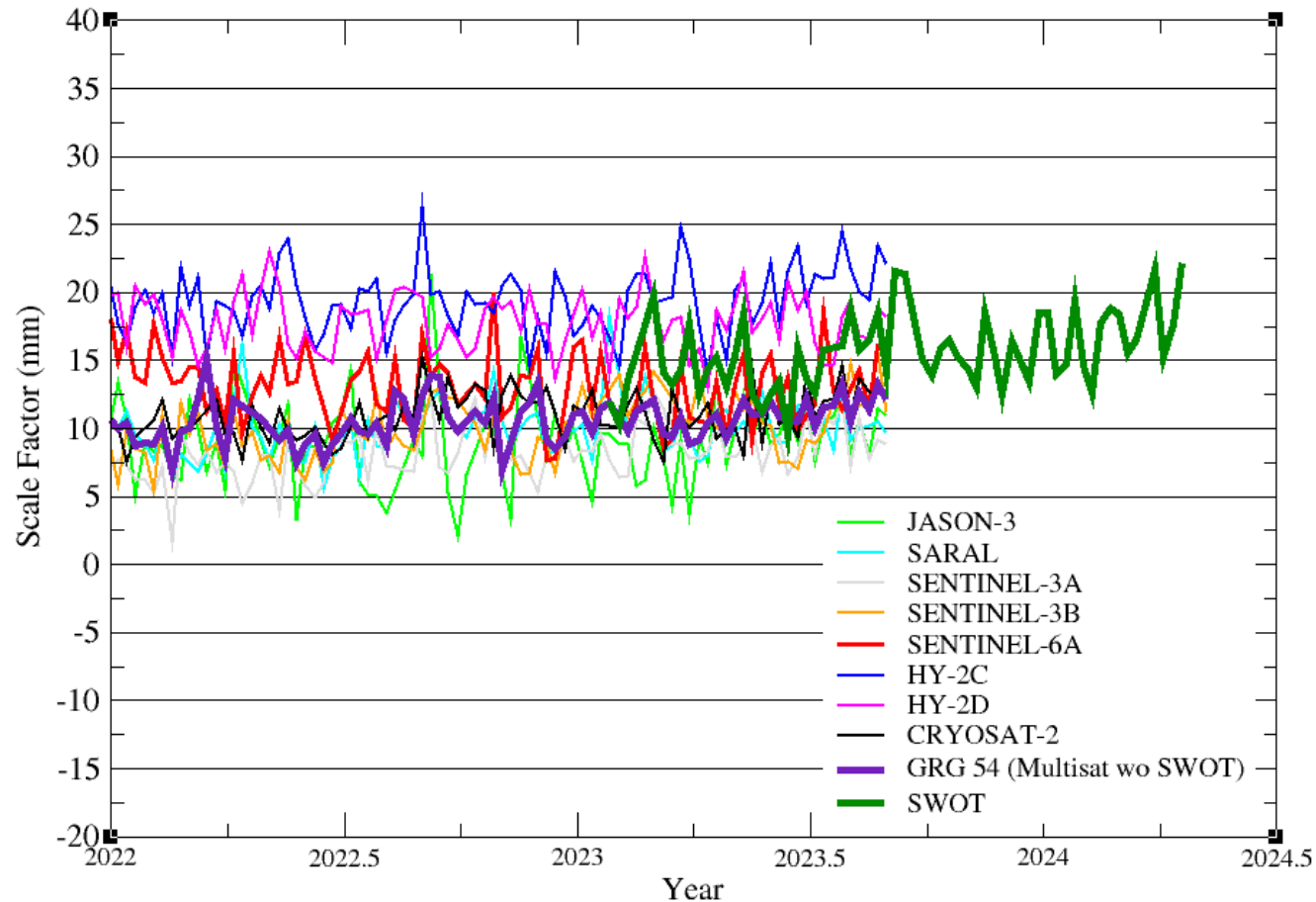
- For SWOT, there is a good agreement between GRG orbit and CNES orbit ( $< 1\text{cm}$  RMS), except for a few weeks.
- For Sentinel-6, there is a 59 days periodic signal in the radial component with POE-F orbit. Probably due to the use of a different solar radiation pressure model (direct solar).

# Introduction of SWOT in GRG processing chain

## Comparison of each solution to DPOD2020 (computed by CATREF)

SATELLITE	Inclination (degree)	Altitude (km)
Cryosat-2	92	717
Saral	98.65	750
Jason-3	66.04	1336
Sentinel-3A	98.65	814
Sentinel-3B	98.65	814
Sentinel-6	66.04	1336
HY-2C	66	971
HY-2D	66	971
SWOT	77	891

### Scale Factor from single satellite solutions



- *In purple: Multi-satellite solution wo SWOT in which HY-2C and HY-2D solutions do not contribute to the scale.*
- *In dark green: the SWOT scale is slightly highest than the others except HY satellites.*

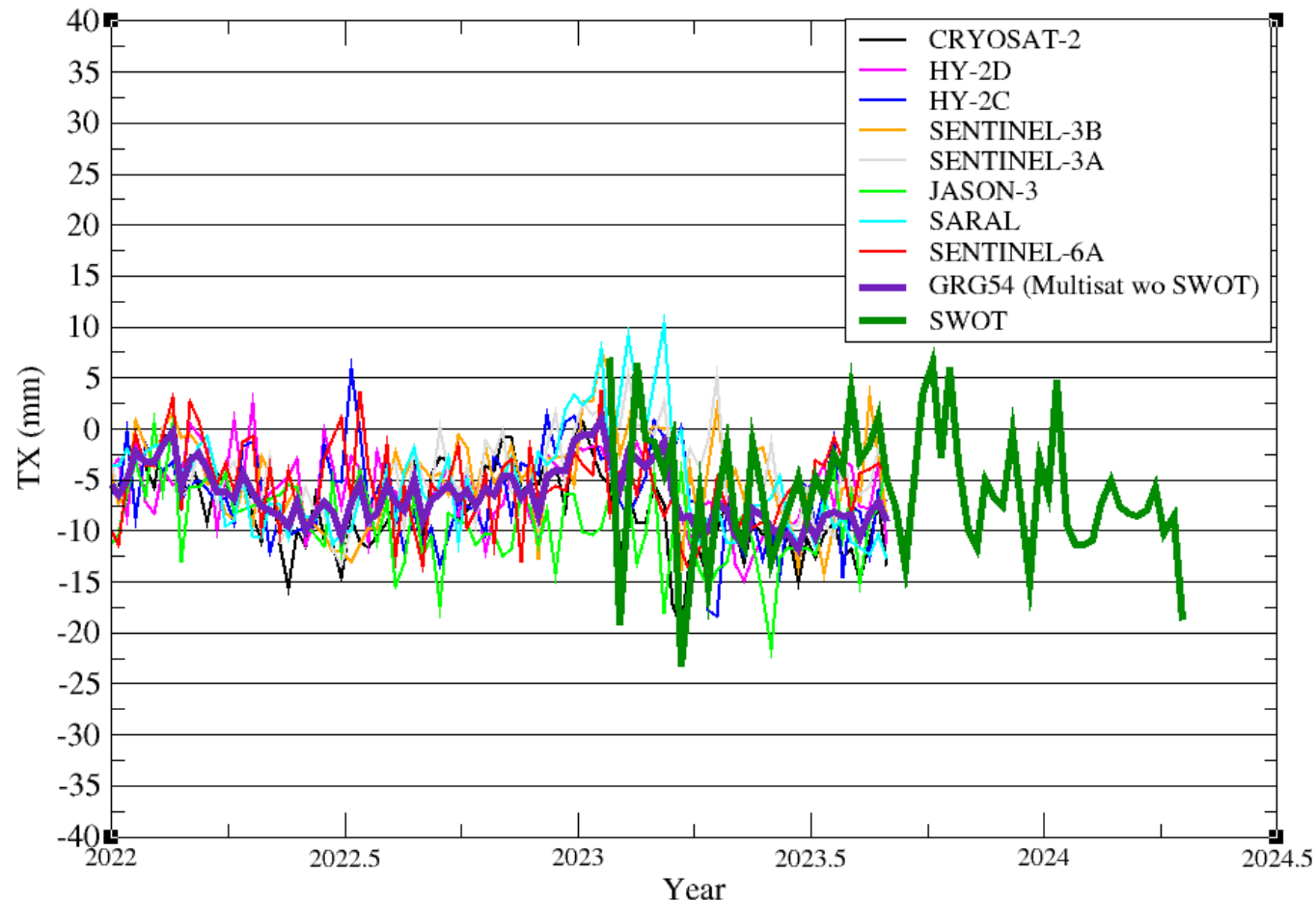


# Origin and scale from single satellite solutions

## Comparison of each solution to DPOD2020 (computed by CATREF)

SATELLITE	Inclination (degree)	Altitude (km)
Cryosat-2	92	717
Saral	98.65	750
Jason-3	66.04	1336
Sentinel-3A	98.65	814
Sentinel-3B	98.65	814
Sentinel-6	66.04	1336
HY-2C	66	971
HY-2D	66	971
SWOT	77	891

Tx from single satellite solutions



- There is a good agreement between the single satellite solutions.
- The TX for SWOT in dark green is at the same level as the others but the discrepancy is higher.

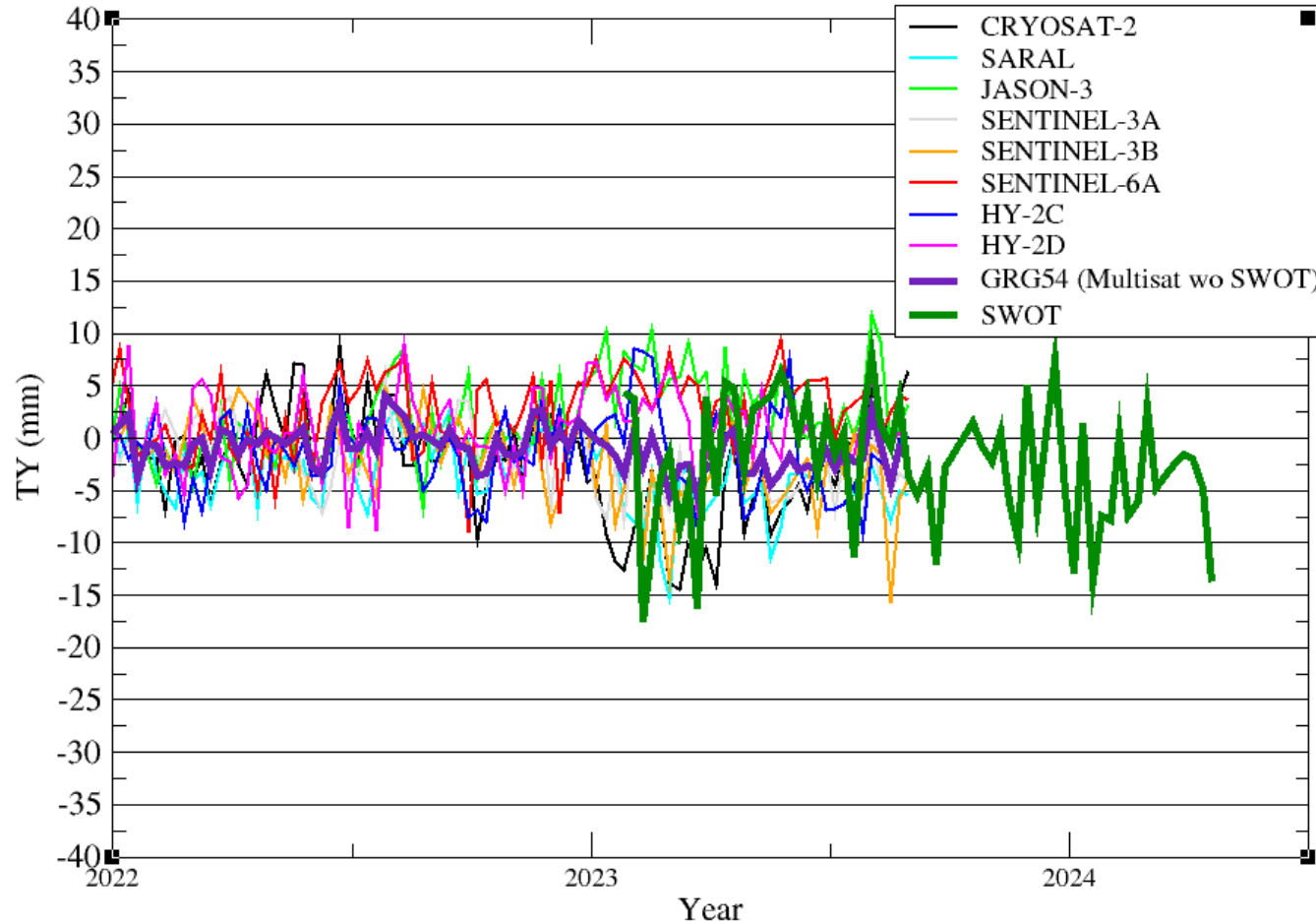


# Introduction of SWOT in GRG processing chain

❑ Comparison of each solution to DPOD2020 (computed by CATREF)

SATELLITE	Inclination (degree)	Altitude (km)
Cryosat-2	92	717
Saral	98.65	750
Jason-3	66.04	1336
Sentinel-3A	98.65	814
Sentinel-3B	98.65	814
Sentinel-6	66.04	1336
HY-2C	66	971
HY-2D	66	971
SWOT	77	891

Ty from single satellite solutions



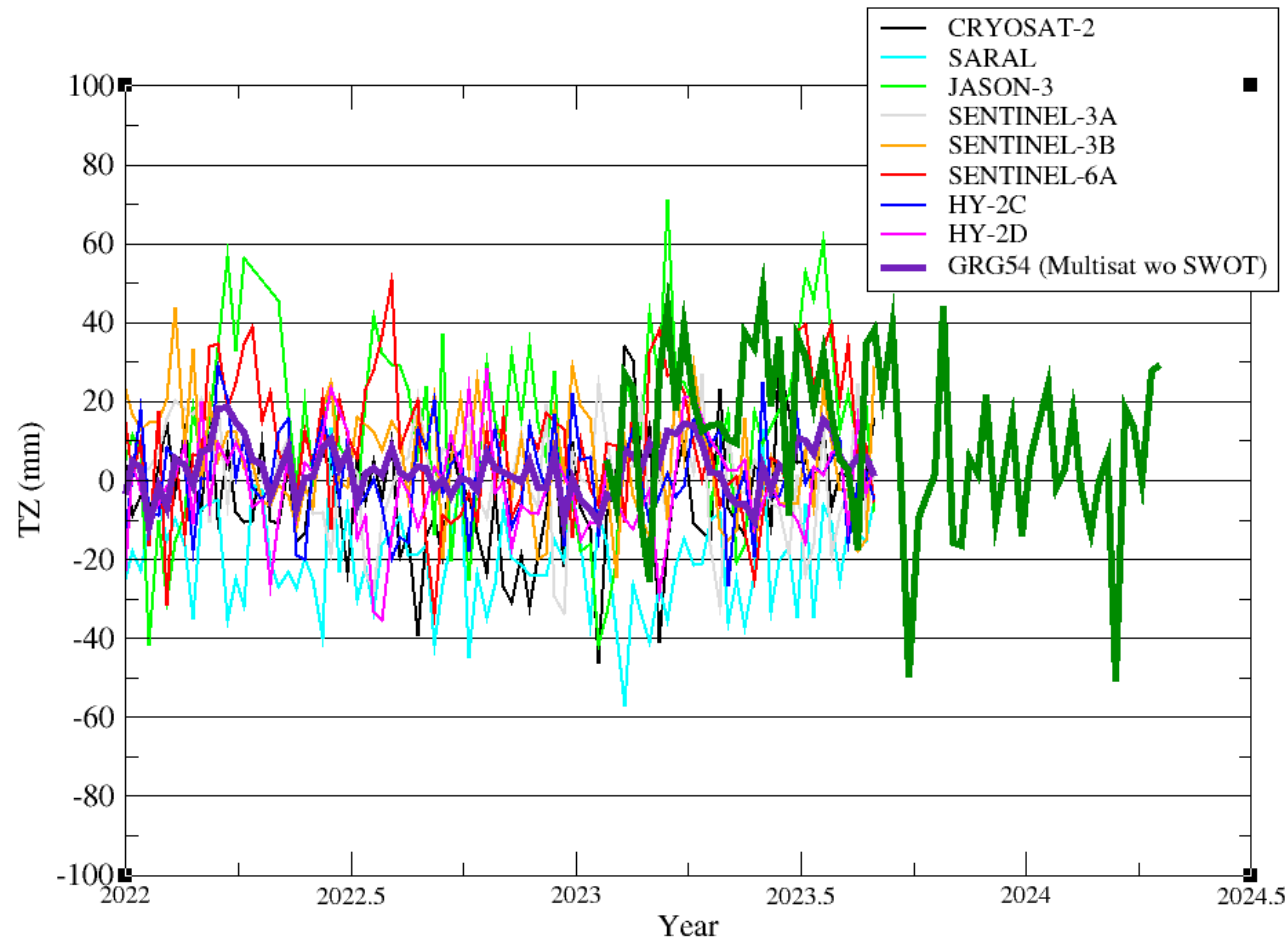
- *The multi-satellite TY is stable.*
- *There is a good agreement between the single satellite solutions.*
- *The TY for SWOT in dark green is at the same level as the others but the discrepancy is higher.*

# Introduction of SWOT in GRG processing chain

❑ Comparison of each solution to DPOD2020 (computed by CATREF)

SATELLITE	Inclination (degree)	Altitude (km)
Cryosat-2	92	717
Saral	98.65	750
Jason-3	66.04	1336
Sentinel-3A	98.65	814
Sentinel-3B	98.65	814
Sentinel-6	66.04	1336
HY-2C	66	971
HY-2D	66	971
SWOT	77	891

Tz from single satellite solutions



▪ The TZ for SWOT in dark green is at the same level as the others but the discrepancy is higher.

# Future work

- *Evaluation of DPOD2020 version 3 with annual and semi-annual terms*
- *Continue to analyze Origin and Scale factor from single satellite solutions*
- *We plan to continue the evaluation of GRG orbits:*
  - by comparisons to internal orbits with GNSS*
  - by comparison to external orbits*
  - by Independent SLR RMS of fit*
  - by Altimeter crossover Cycles*
- *Develop a strategy to mitigate the impact of the increased solar activity*
- *Finalize the introduction of SWOT in our processing chain*
- *Contribution to the IDS Working Group:*
  - Determination of geocenter motion from DORIS measurements*
  - Sentinel clock corrections*
- *Finalize the implementation of the second order ionospheric correction for DORIS measurement.*
- ...