IPGP-IGN/JPL AC status AWG IDS meeting 2026

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Outline

- 2025 processing update
- SWOT evaluation
- Tropospheric parameters : quality check
- Future development

Processing

2025 main evolutions :

- Error detection :

IGN v22 vs IGN v23 :

Multi-satellite based vs mono-satellite daily filtering.

Test for the last 3 months from IDS : No clear differences

=> We will keep IGN v22 approach.

Processing

2025 main evolutions :

- SWOT addition :

First satellite for which we use box and solar panel quaternions.
Compared to the previous AWG : Issue with database solved !

SWOT evaluation

Test from march 2023 to december 2024 :

Residuals :
0.385 mm.s^{-1}, with an IQR of 0.06 mm.s^{-1}

Orbit evaluation :

- Internal validation : comparison of daily overlap
  3h before and after for each day => 6h overlap between D and D+1

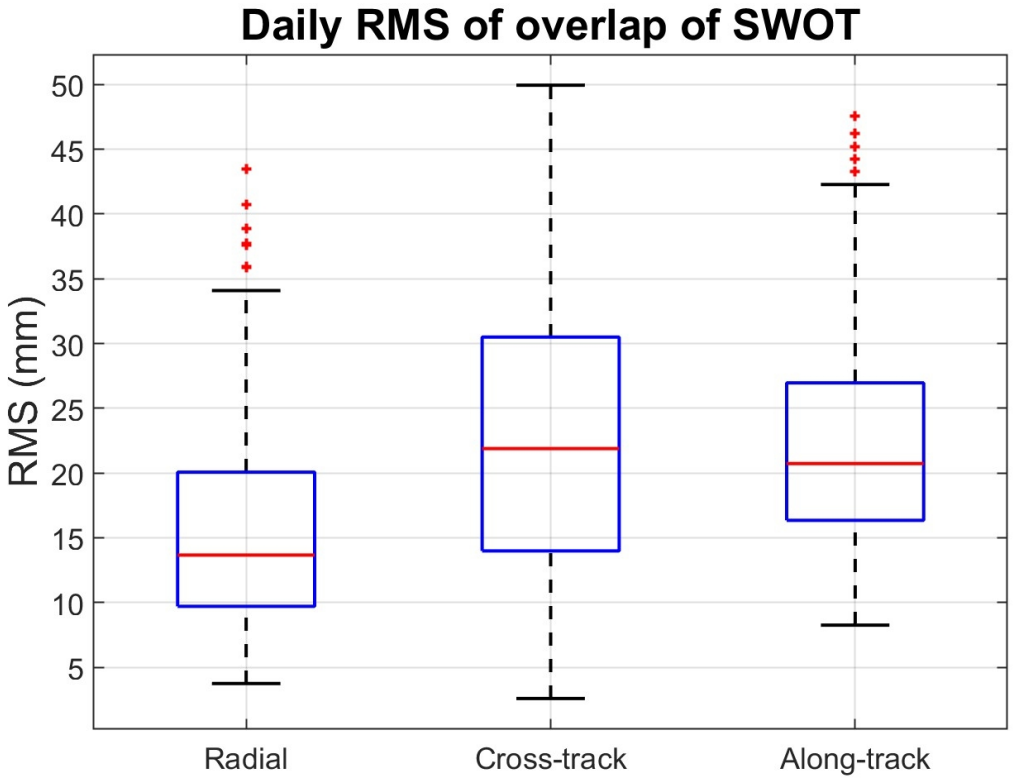
- External validation : comparison with SSALTO orbits

SWOT evaluation

Test from march 2023 to december 2024 :

Internal evaluation :

~1.5 cm Radial
~2.2 cm in both along-track and cross-track directions



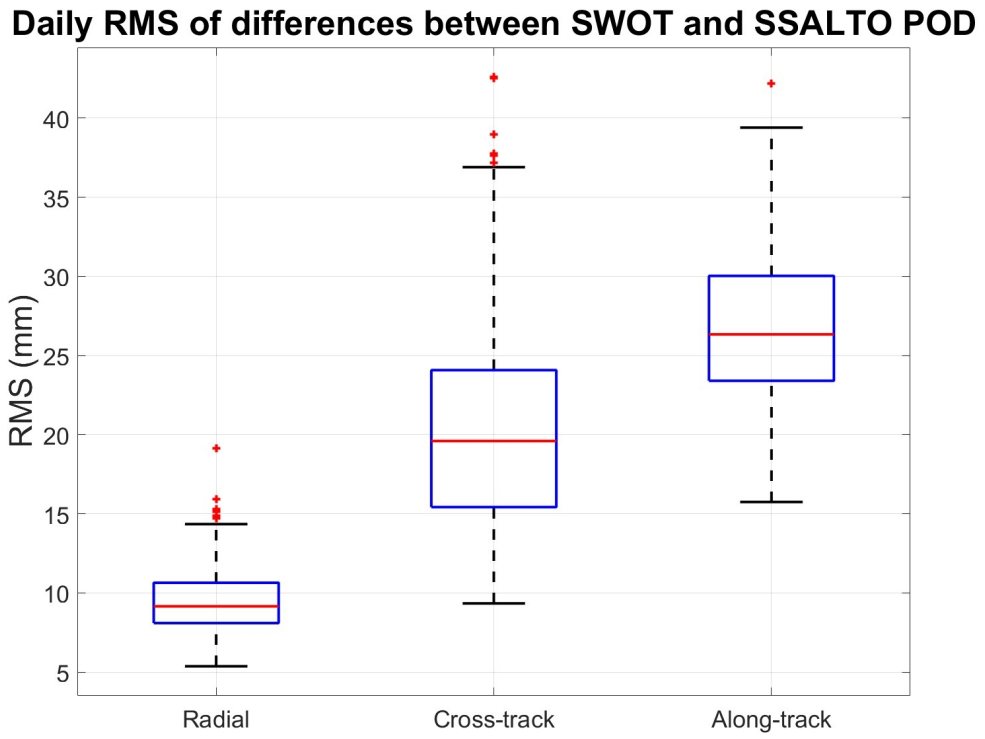
SWOT evaluation

Test from march 2023 to december 2024 :

External evaluation :

~9.2 mm Radial
~2 cm cross-track
~2.7 cm along-track

Along track issue ?



SWOT evaluation

Test from march 2023 to december 2024 :

Impact in the AC solutions :

- 3 solutions have been computed :
* CS2, JA3, S3A, S3B, S6A, and SRL , without SWO : WO-SWO
* CS2, JA3, S3A, S3B, S6A, and SWO , without SRL : WO-SRL
* CS2, JA3, S3A, S3B, S6A, SRL, and SWO : ALL

SWOT evaluation

Test from march 2023 to december 2024 :

Impact in the IGN solutions :

- 3 solutions have been computed :
* CS2, JA3, S3A, S3B, S6A, and SRL , without SWO : WO-SWO
* CS2, JA3, S3A, S3B, S6A, and SWO , without SRL : WO-SRL
* CS2, JA3, S3A, S3B, S6A, SRL, and SWO : ALL

- Impact on :
* WRMS wrt. DPOD2020
* Translation & Scale wrt. DPOD2020
* EOPs wrt. EOPC04

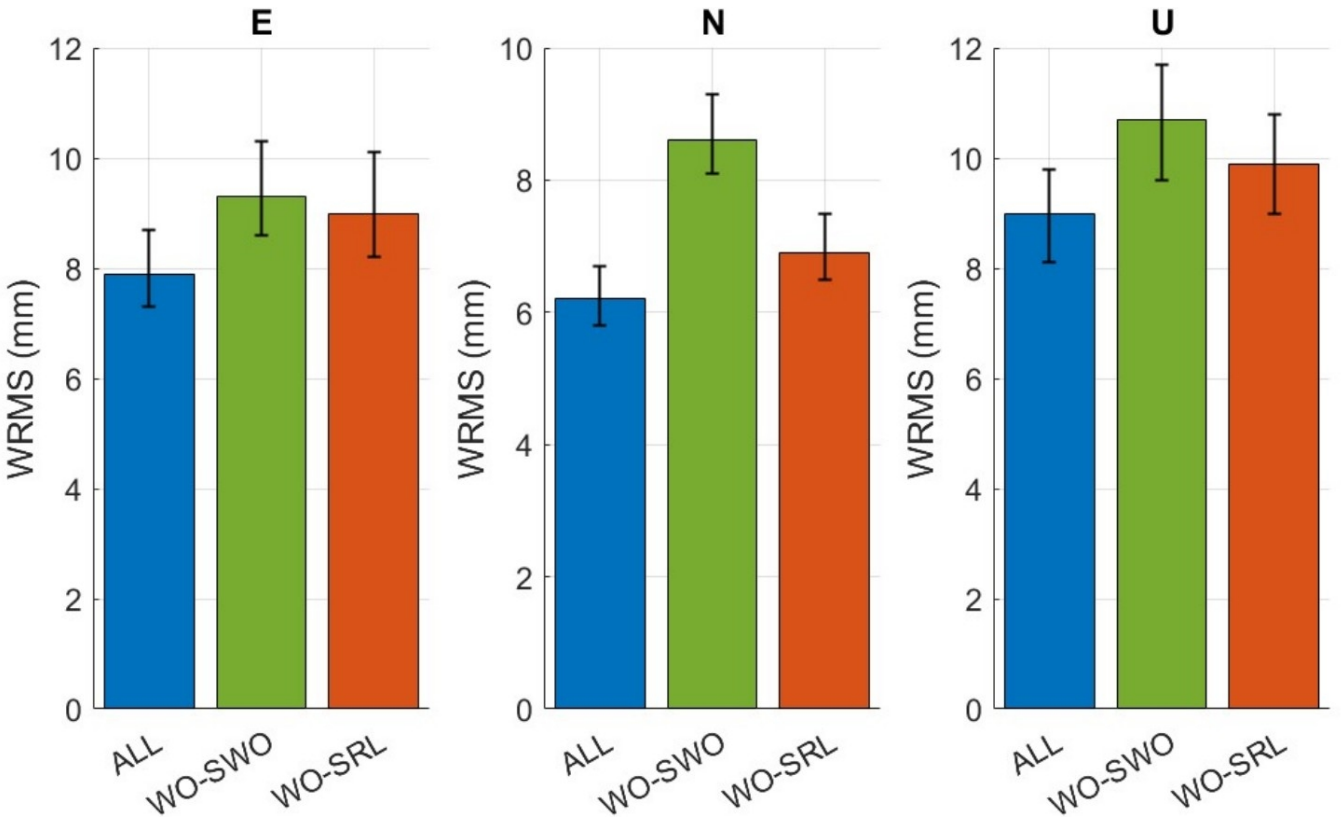
SWOT evaluation

Test from march 2023 to december 2024 :

Station positions :

ALL :
~15 % reduction E,U
~25 % reduction N

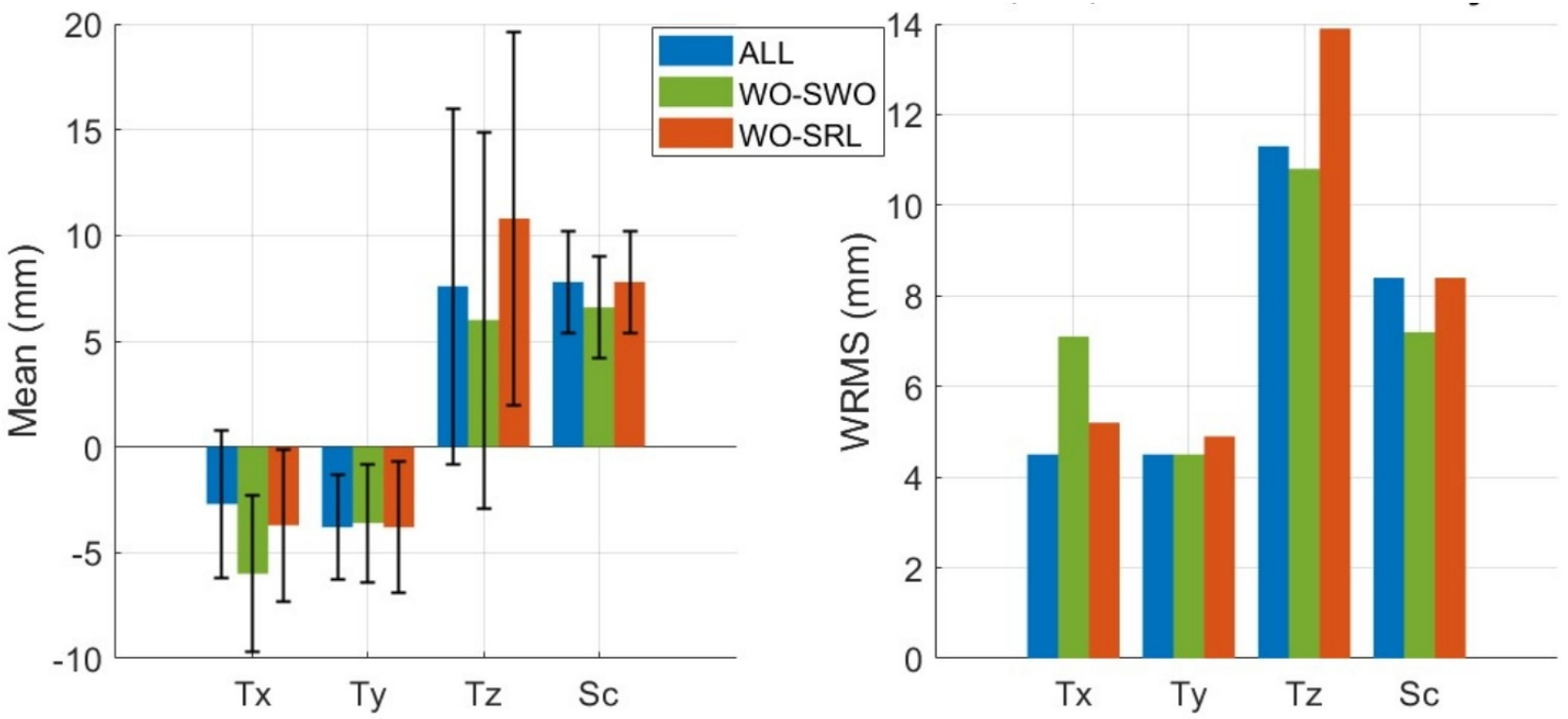
SWOT has a greater impact than SARAL



SWOT evaluation

Test from march 2023 to december 2024 :

TRF :



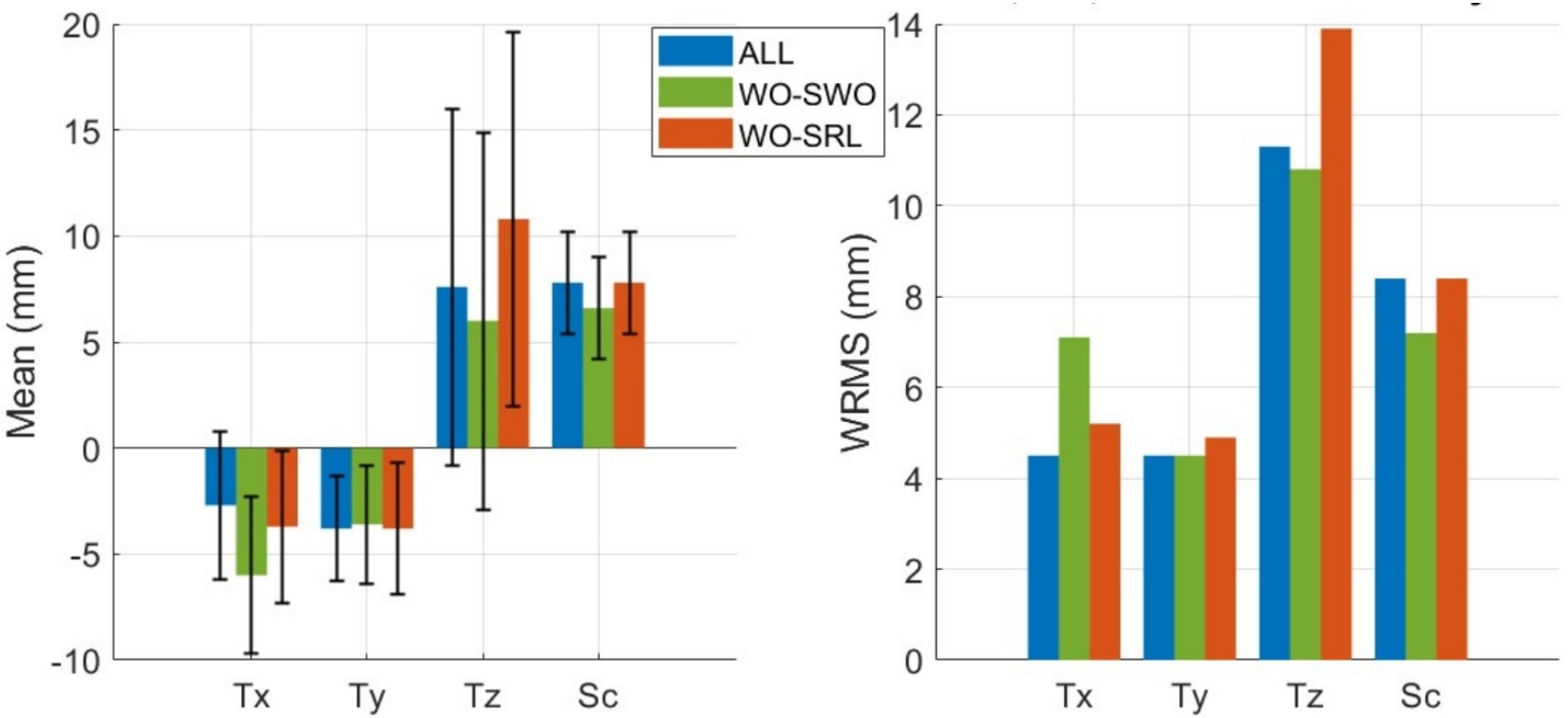
SWOT evaluation

Test from march 2023 to december 2024 :

TRF :

- Tx :
improvment
- Ty :
no impact
- Tz :
Slight increase
- Sc :
Bias increase
(0.2 ppb)

=> PCO /
Shadow ?



SWOT evaluation

Test from march 2023 to december 2024 :

TRF :

Periodic signals in the time series :

ALL present less periodic signal with amplitude > 1mm :

- **Annual signal for Tx** (ampl. < 3mm), **Ty** (ampl. < 2mm), **Tz** (ampl ~5.5 mm) **ampl. < ampl. WO-SWO & WO-SRL** (< ~0.2mm)
- Signal aound 116d (**JA3 & S6A draconitic signal**) in **Ty** (~1 mm) and **Tz** (~4mm)

WO-SWO & WO-SRL presents periodic signals difficult to interpret:

For **Ty** : 1mm signal around **190d** ????

For **Tz** : 3 mm signal around **72d** WO-SWO (resp. 2.4 mm WO-SRL) ???

For **Tx** : More draconitic signals

WO-SWO : ~1.2 mm **JA3 & S6A draconitic period** & ~1.4 mm **52d** (1/7 year?)

WO-SRL : ~1.7 mm **JA3 & S6A draconitic period** ; 1mm 230d (~1/2 **CS2 draconitic**) & 1 mm 157d (**SWO draconitic**)

SWOT evaluation

Test from march 2023 to december 2024 :

EOPs :

WRMS	ALL	WO-SWO	WO-SRL
XP (µas)	**235**	254	**256**
YP (µas)	**231**	249	**271**

EOPs less impacted by SWOT than SARAL
WRMS : ~7.5 % reduction with all satellites

SWOT evaluation

Conclusion :

- Good overall performance (WRMS stations & EOPs)

- PCO / Shadowing issue ? (Tz & Sc degradation with SWOT, especially Sc)

Tropospheric parameters : quality check

Evaluation of tropospheric parameters from daily mono-satellite process

- Internal mono-satellite comparison :
Daily arc : 1D ± 3h
=> Overlap (~6h)

- Internal multi-satellite comparison :
Stations with multi-satellite visibility at the same time

- External evaluation :
Stations co-located with GNSS (future work)

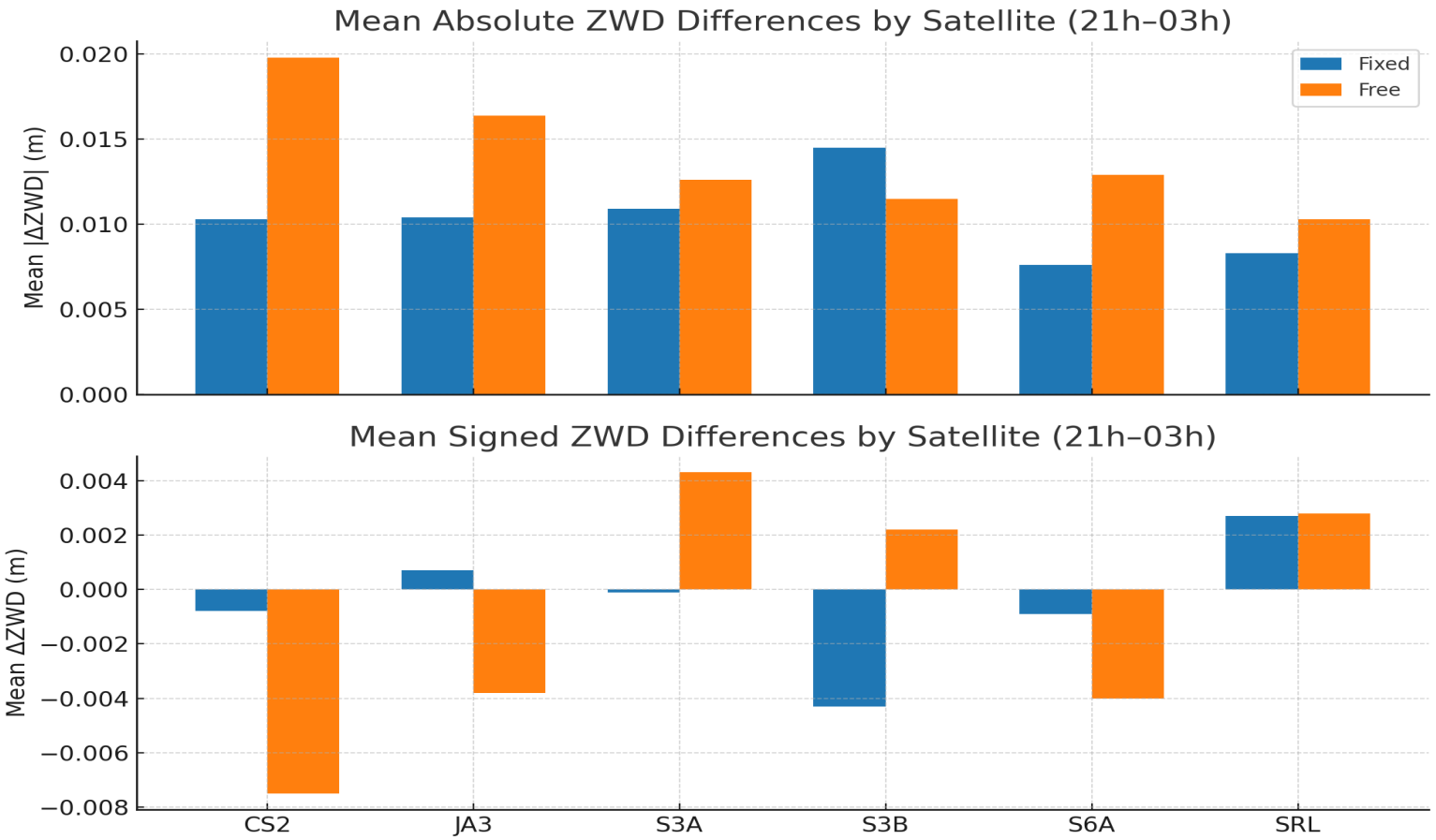
Comparison done with two solutions, one with fixed station coordinates (FIXED) and one with estimation of these parameters, with loose constraints (FREE).

ZWD mono-satellite overlaps

	Computation	Median (mm)	Q1 (mm)	Q3 (mm)
|ΔZWD|	FIXED	3.3	1.4	8.5
	FREE	4.9	1.7	12.6
ΔZWD	FIXED	0.2	-3.2	3.8
	FREE	0.2	-5.2	4.6

Mono-satellite inner consistency of around 4-5 mm

ZWD mono-satellite overlaps Satellite comparison

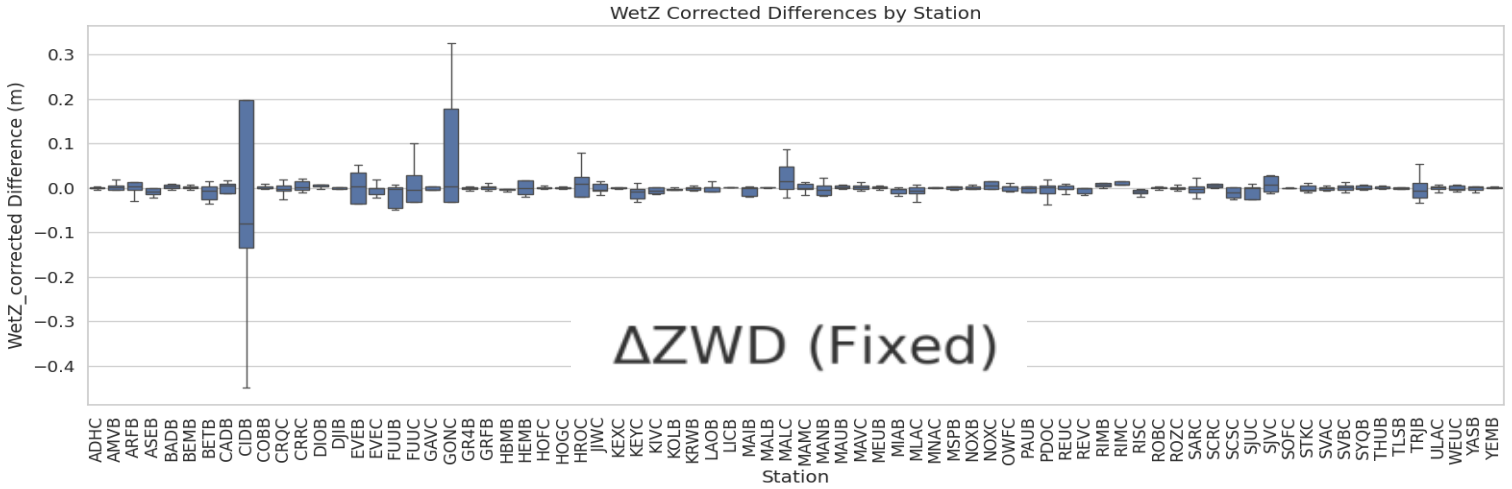


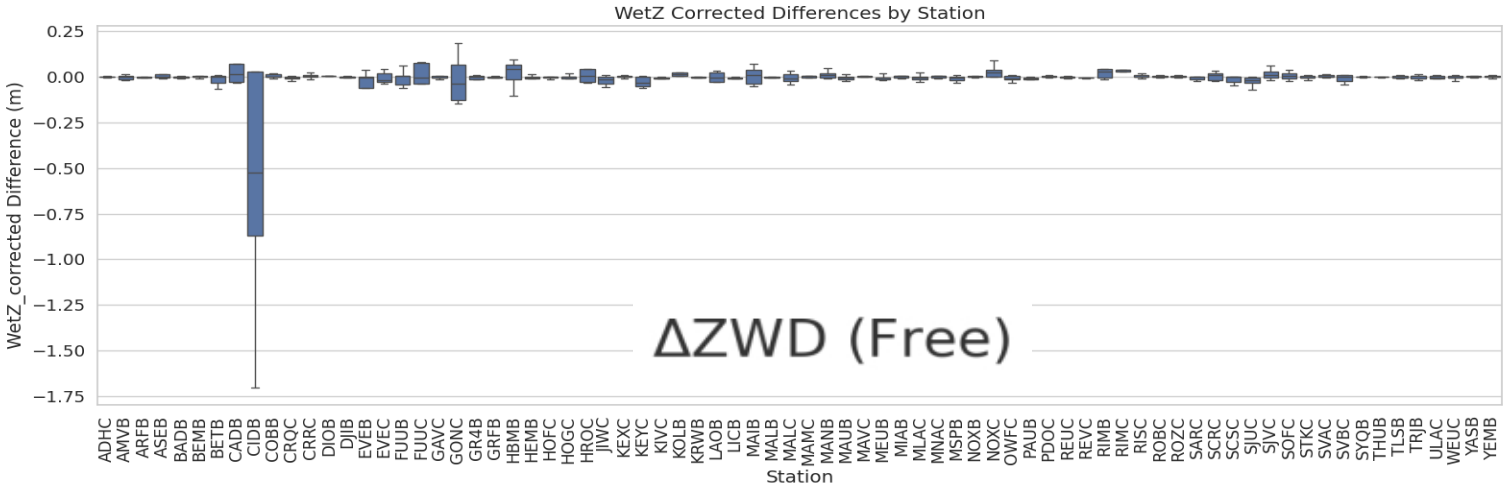
Fixed computation :

S6A & SRL seems to be slightly better

S3B slightly worse

Station comparison





Stations CIDB & GONC need to be investigate in our process

ZWD multi-satellite overlaps

Global statistics on $|\Delta ZWD|$ for 2-satellite overlaps.

Strategy	Count	Mean	Std	Min	Q1	Median	Q3	Max
Fixed	2,242,277	0.0101	0.0179	0.0000	0.0032	0.0069	0.0126	11.4946
Free	2,249,352	0.0115	0.0201	0.0000	0.0036	0.0077	0.0142	5.0196

Global statistics on ΔZWD for 2-satellite overlaps.

Strategy	Mean	Std	Min	Q1	Median	Q3	Max
Fixed	−0.0010	0.0205	−11.4946	−0.0080	−0.0012	0.0056	5.1123
Free	−0.0007	0.0232	−3.6202	−0.0085	−0.0008	0.0069	5.0196

Global statistics for cases with ≥ 3-satellites

Statistic	Std ZWD [m] (fixed)	Max ΔZWD [m] (fixed)	Std ZWD [m] (free)	Max ΔZWD [m] (free)
Count	201487.0	201487.0	202655.0	202655.0
Mean	0.00641	0.01497	0.00718	0.01675
Std. dev	0.00633	0.01443	0.01284	0.02798
Min	1e-05	2e-05	1e-05	2e-05
Q1 (25%)	0.00299	0.00699	0.00326	0.00762
Median (50%)	0.00497	0.01168	0.00543	0.01272
Q3 (75%)	0.00787	0.01845	0.00863	0.02025
Max	0.2653	0.56542	3.96897	8.45263

Future development

Scale bias :

- Ing. Project with Géodata Paris :

Study the Impact of 1 cm PCO error in solutions for each flying satellite processed by IGN
Study the Impact of solar scale para. fixation, Cd frequency estimation and acc. Para. on the scale

Understanding why we observe formal uncertainties larger than those of other AC

Multi-satellite daily solutions :

- Processing all satellites simultaneously :
Goal : separate clocks from satellite and stations
Improve tropospheric estimation by changing tropospheric evolution model from a bias per sat. and sta. pass to estimation per 5 min per station with evolution constraint like GNSS