RINEX DORIS data processing at INASAN: successes and problems

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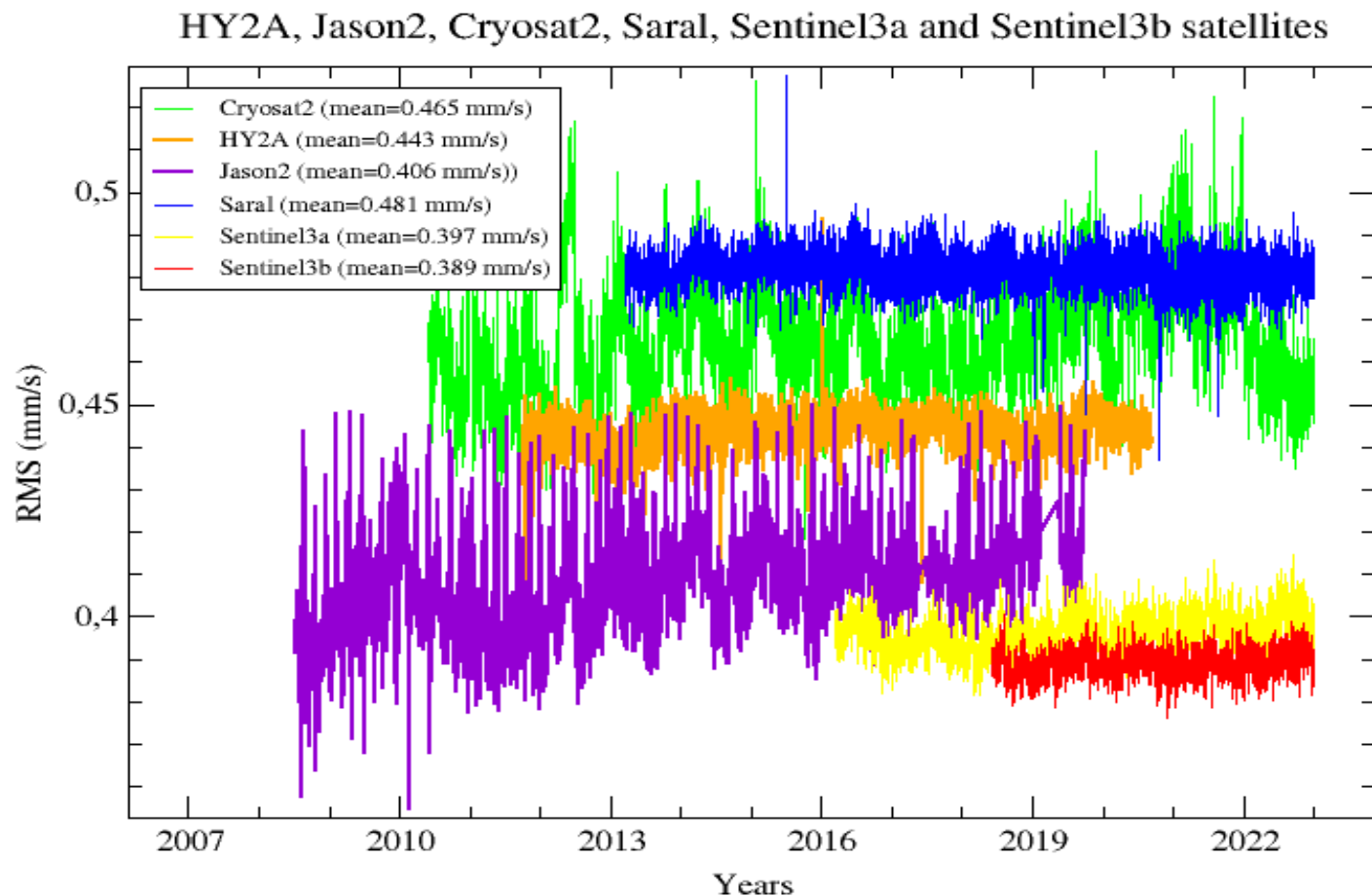
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This year we have made the following improvements in DORIS data processing:

1) applied de-aliasing model AOD1B RL06 by GFZ
2) obtained multi-satellite solutions (for 8 satellites). Unfortunately multi-satellite solutions are unstable in sense of variance factor. We spent a lot of time to find and fix the problem but couldn't do it completely.
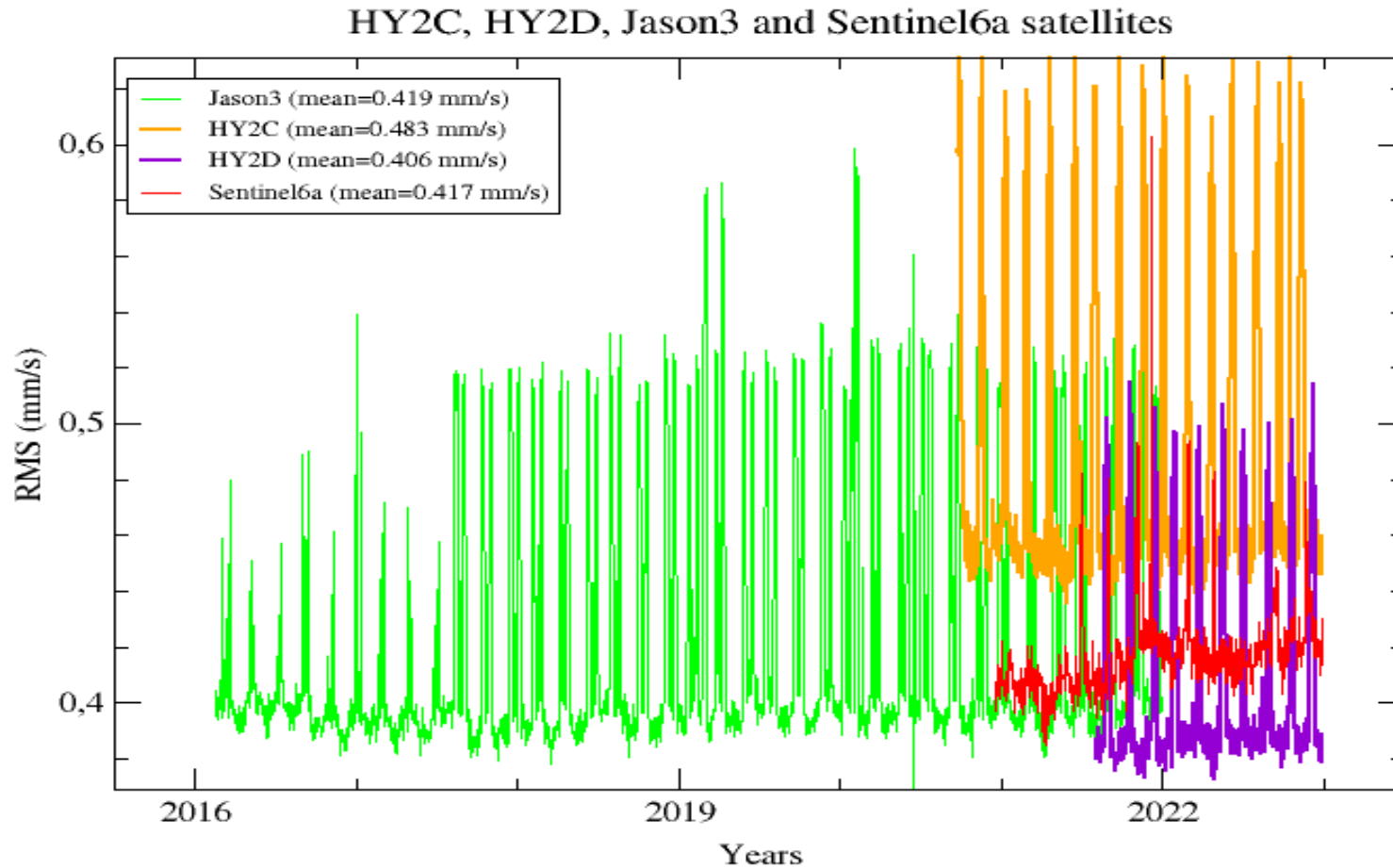3) evaluated the impact of using the AOD1B model and the application of quaternions on the accuracy of the solution

4) Currently we are looking for the best strategy for the multi-satellite solutions

Daily single-satellite solutions.
Post fit residuals

HY2A, Jason2, Cryosat2, Saral, Sentinel3a and Sentinel3b satellites

Legend:
- Cryosat2 (mean=0.465 mm/s)
- HY2A (mean=0.443 mm/s)
- Jason2 (mean=0.406 mm/s))
- Saral (mean=0.481 mm/s)
- Sentinel3a (mean=0.397 mm/s)
- Sentinel3b (mean=0.389 mm/s)

Satellite	Inclination (degree)	Altitude (km)
Cryosat2	92	717
HY2A	99.4	963
Jason2	66	1336
Saral	98.65	800
Sentinel3a	98.65	814
Sentinel3b	98.65	814

Daily single-satellite solutions.
Post fit residuals

HY2C, HY2D, Jason3 and Sentinel6a satellites

Legend:
- Jason3 (mean=0.419 mm/s)
- HY2C (mean=0.483 mm/s)
- HY2D (mean=0.406 mm/s)
- Sentinel6a (mean=0.417 mm/s)

| Satellite	Inclination (degree)	Altitude (km)
Jason3	66.04	1336
HY2C	66	957
HY2D	66	957
Sentinel6a	66.04	1336

Single-satellite processing results

Satellite	Processing period	Mean post fit RMS (mm/s)	Mean number of daily deleted points, %
Cryosat2	2010.4-2023.0	0.465	1-2
HY2A	2011.8– 2020.7	0.443	6-10
HY2C	2020.7– 2023.0	0.483	3-8
HY2D	2021.6– 2023.0	0.406	3-10
Jason2	2008.5– 2019.8	0.406	1-2
Jason3	2016.0– 2023.0	0.419	2-5
Saral	2013.2– 2023.0	0.481	10-12
Sentinel3a	2016.0– 2023.0	0.397	3-5
Sentinel3b	2018.4– 2023.0	0.389	4-6
Sentinel6a	2020.9– 2023.0	0.417	2-4

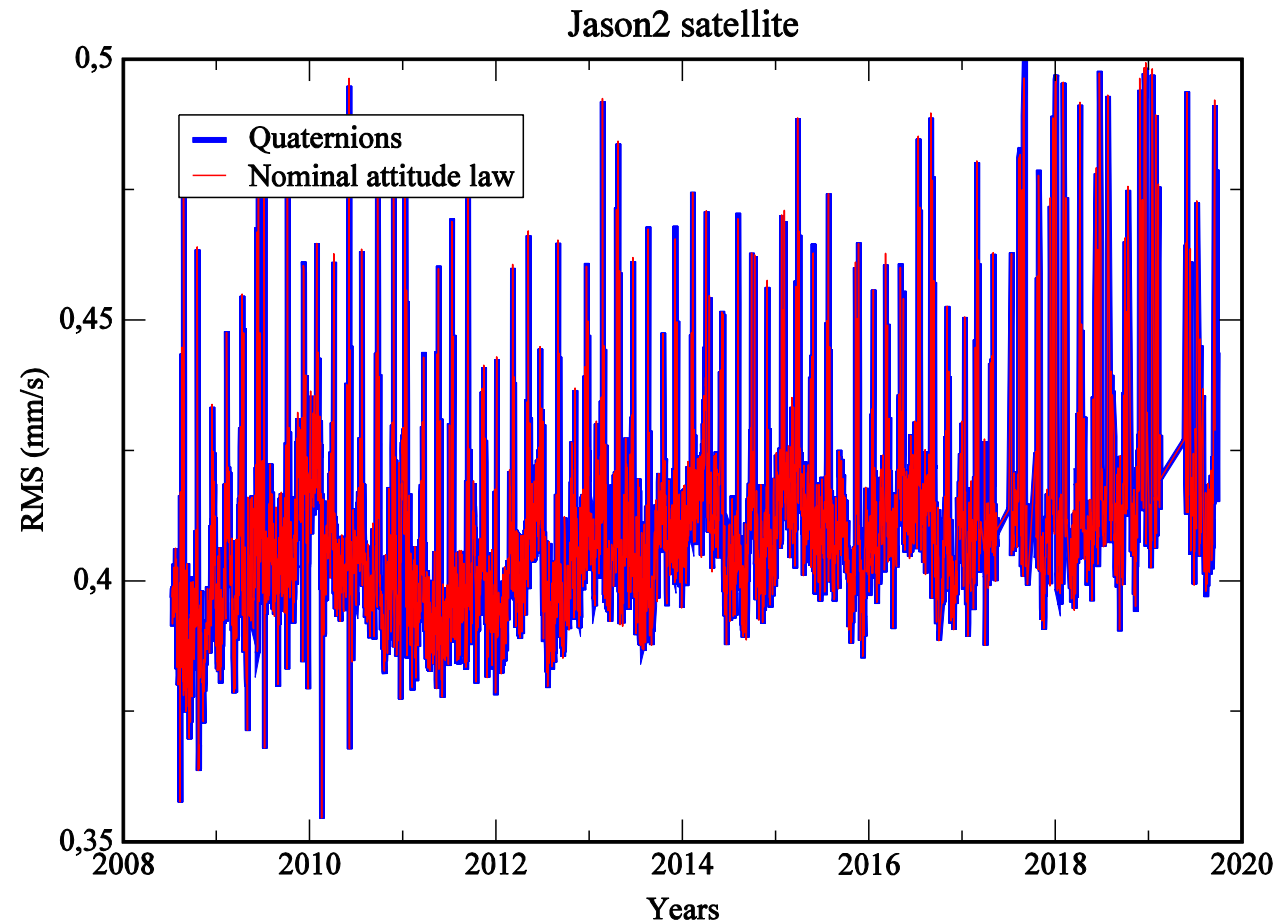# Multi-satellite solution wrt DPOD2020 v1.3 (picture by G. Moreaux)
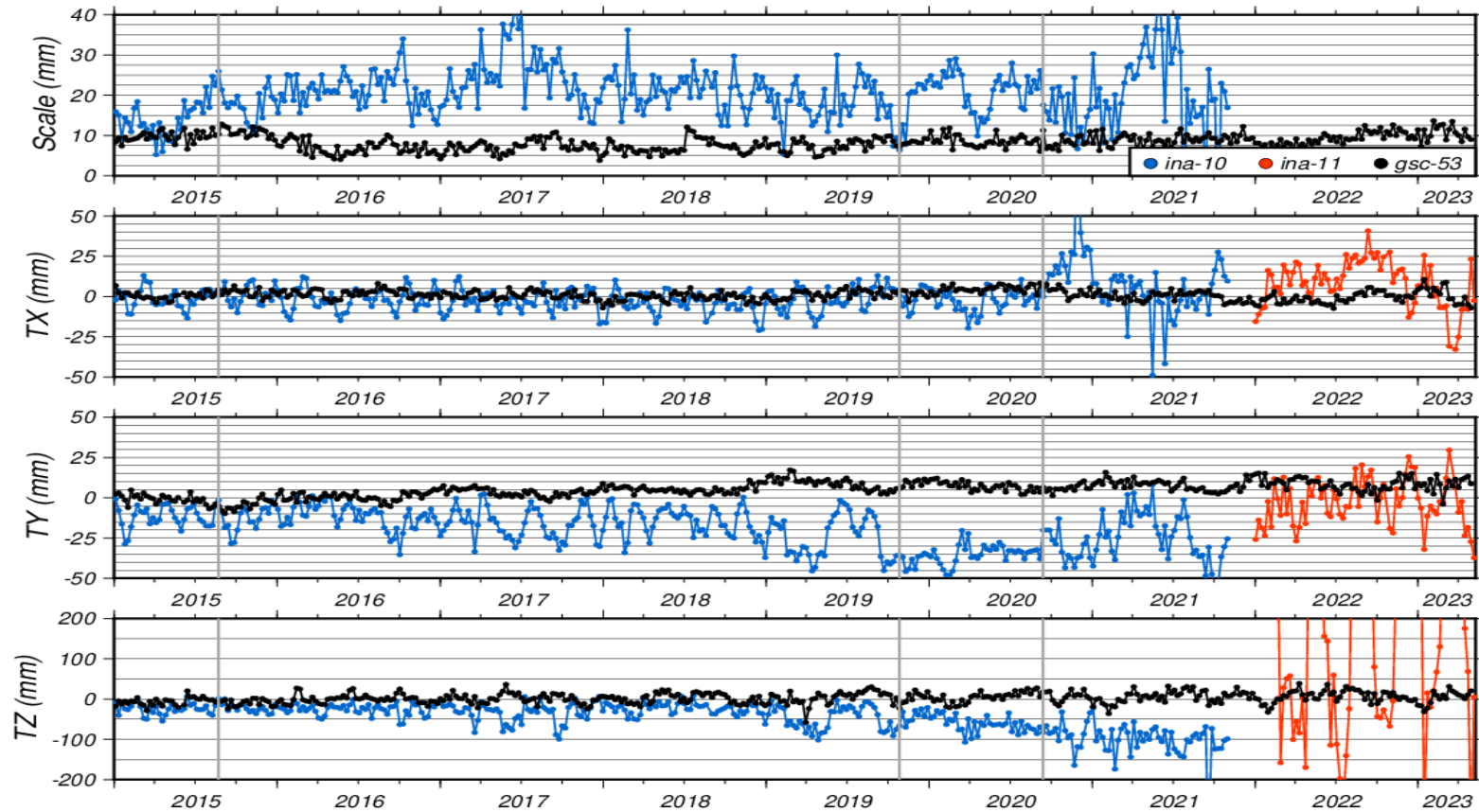
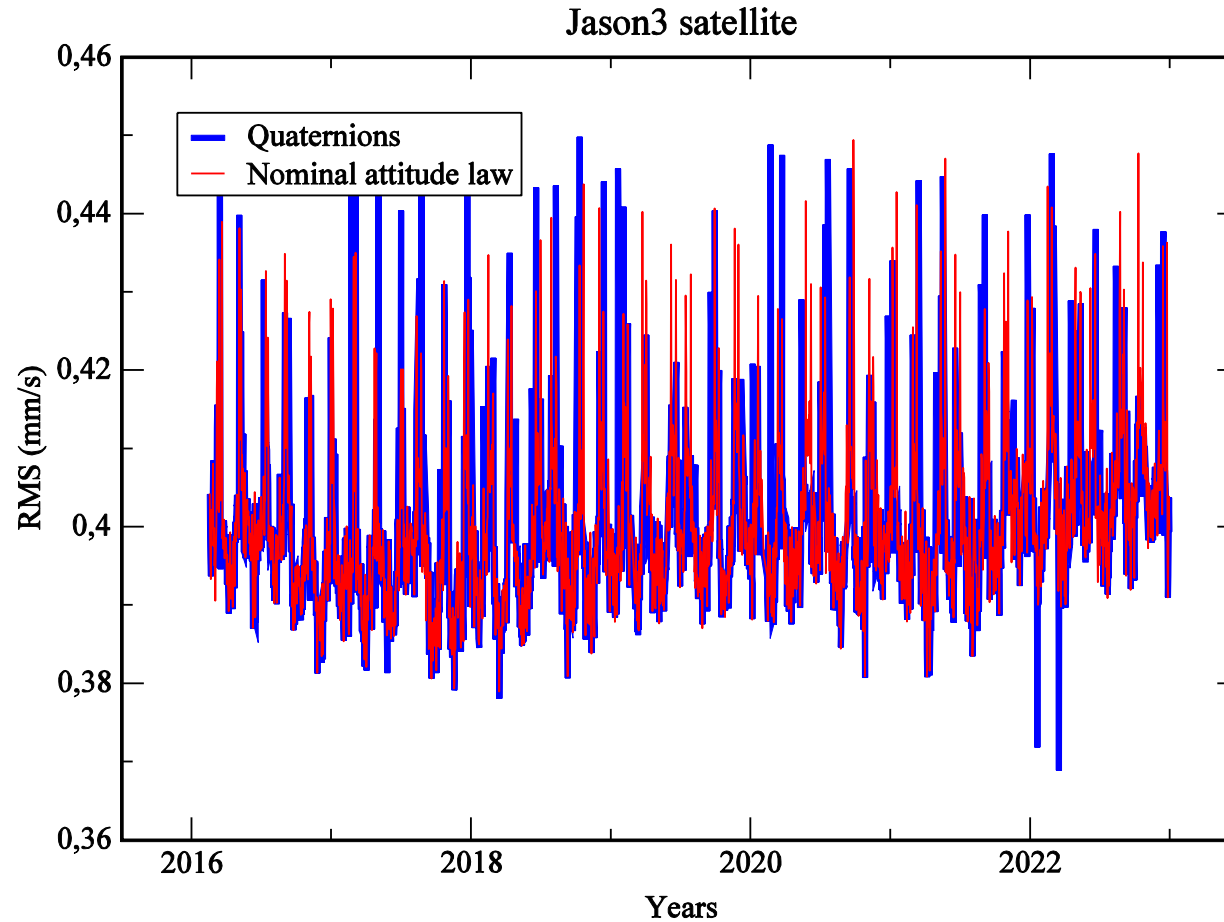# Multi-satellite solution wrt DPOD2020 v1.3 (picture by G. Moreaux)
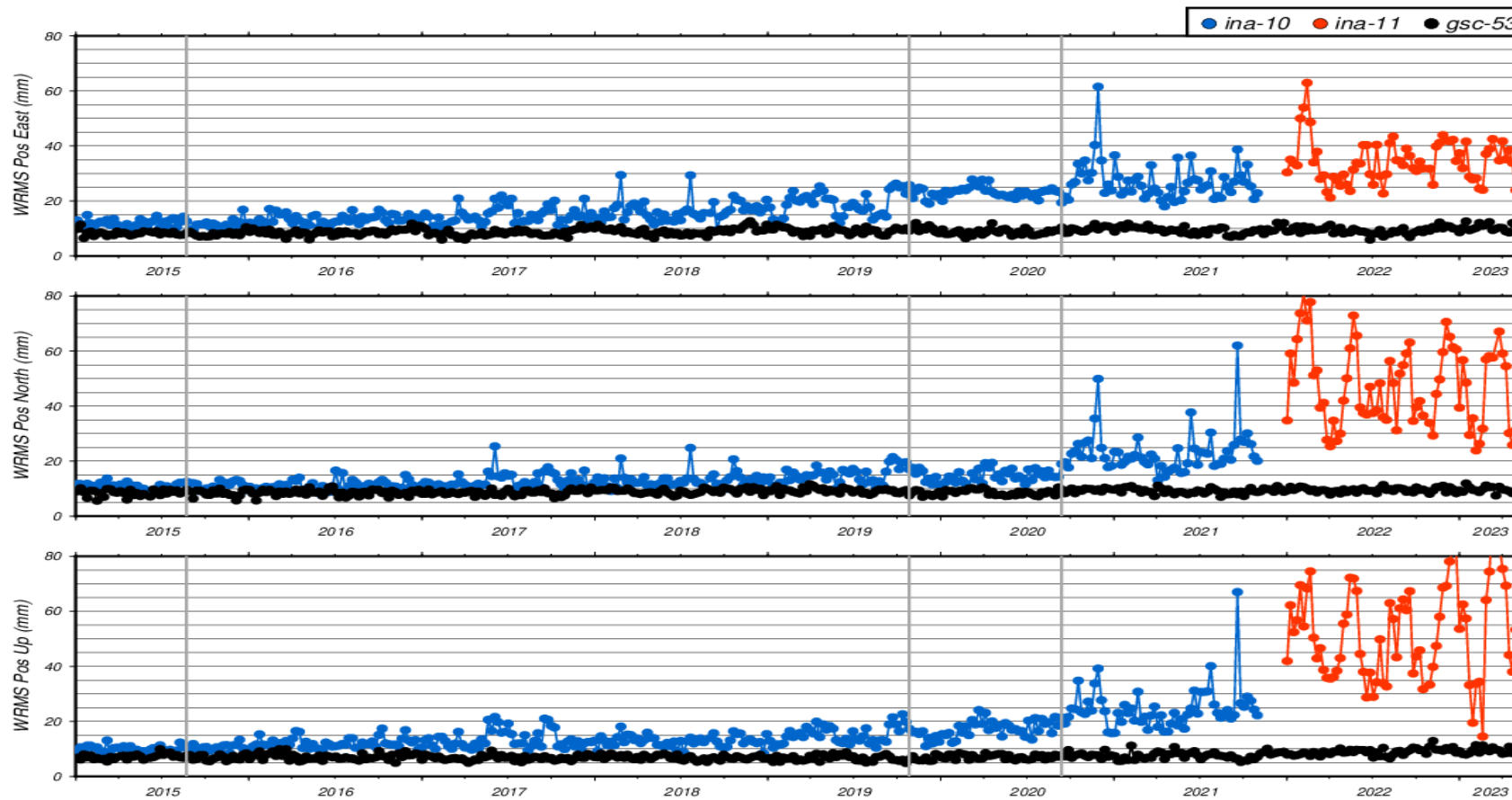
Quaternions study for Jason2

Jason2 satellite

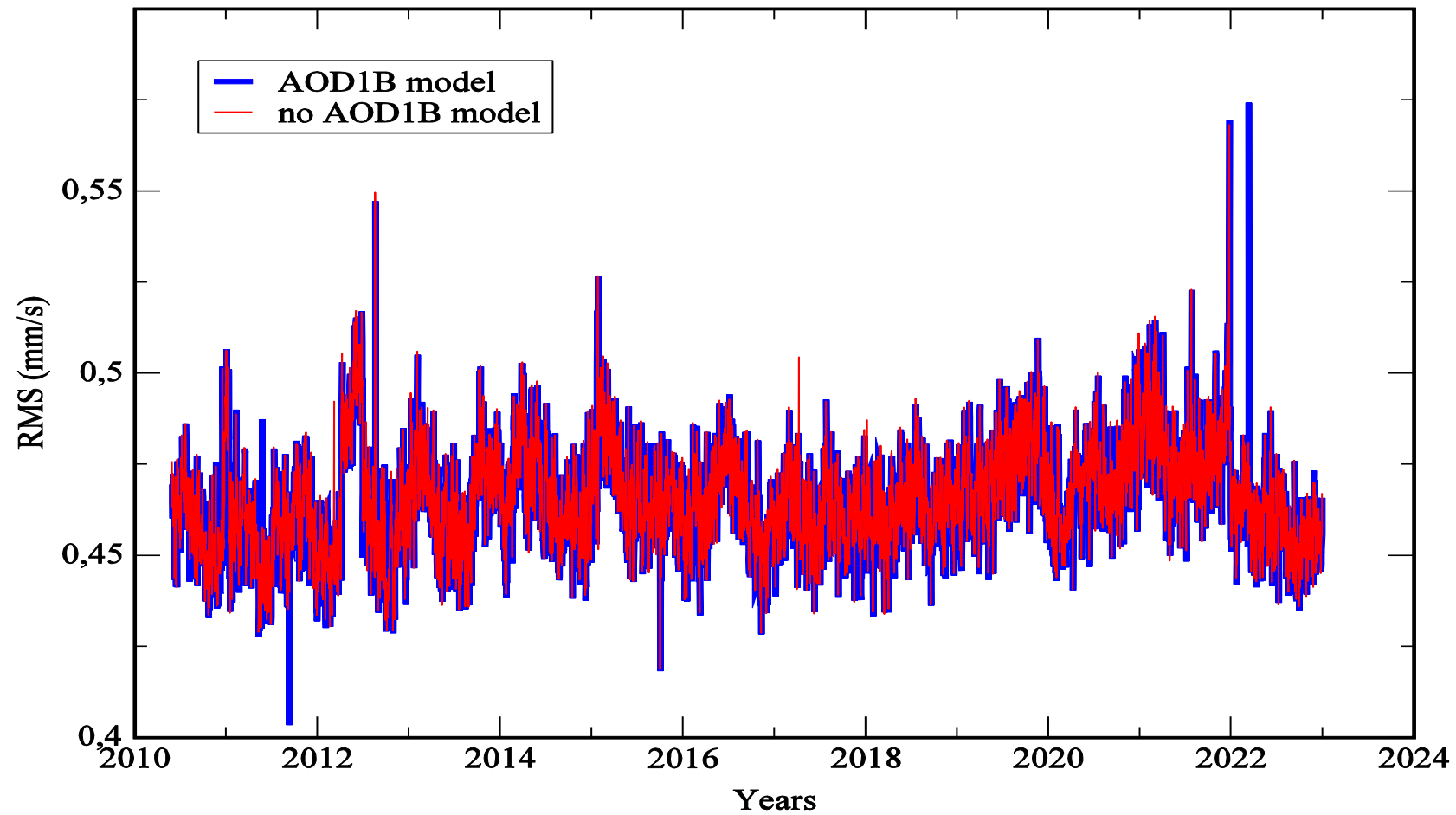# Quaternions study for Jason3

Jason3 satellite

Results applying quaternions

Satellite	Time period	Mean post fit RMS (mm/s)	
		Quaternions	Attitude files
Jason2	2008.5 – 2019.8	0.408500	0.408597
Jason3	2016.0 – 2023.0	0.398219	0.400276

AOD1B model investigation

Cryosat2 satellite

AOD1B model investigation

Sentinel3a satellite
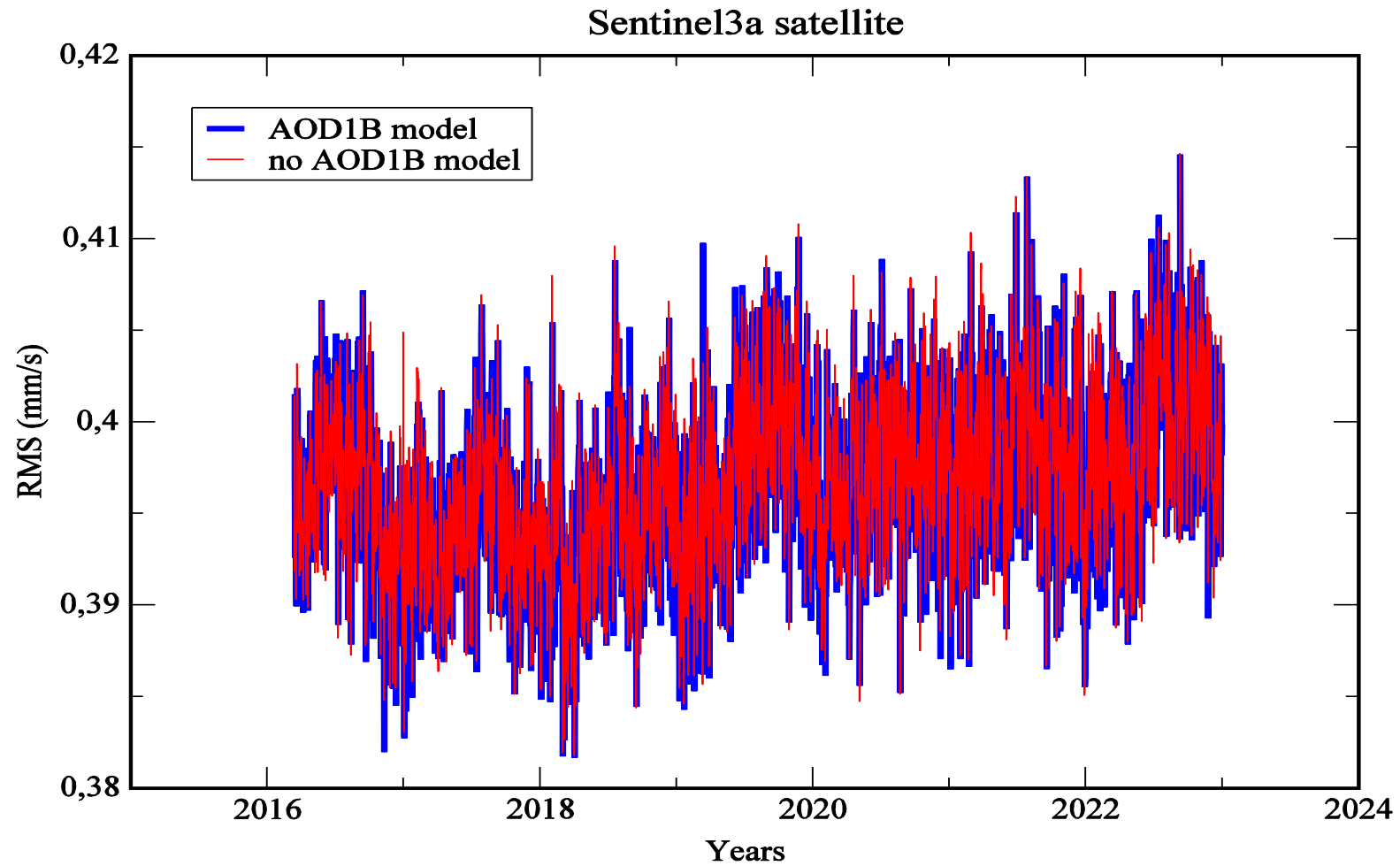
AOD1B model investigation

Satellite	Time period	Mean post fit RMS (mm/s)	
		AOD1B	No AOD1B
Cryosat2	2010.4 – 2023.0	0.465164	0.465685
HY2A	2011.8– 2020.7	0.443554	0.443642
HY2C	2020.7– 2023.0	0,482860	0.482895
HY2D	2021.6– 2023.0	0.405610	0.405667
Jason2	2008.5– 2019.8	0.406865	0.406870
Jason3	2016.0– 2023.0	0.419131	0.419579
Saral	2013.2– 2023.0	0.481804	0.481844
Sentinel3a	2016.0– 2023.0	0.396506	0.396813
Sentinel3b	2018.4– 2023.0	0.389076	0.389333
Sentinel6a	2020.9– 2023.0	0.417302	0.417378

Main problems

- To get reliable multi-satellite solutions
- Periodic jumps (2-month) for some satellites in post fit residuals (Jason3, HY2C, HY2D, Sentinel6a)

Future plans

- To receive robust multi-satellite solution
- To use new gravitational field model
- To use ITRF2020
- Processing SWOT satellite data
- To use Cryosat2, Sentinel3a, Sentinel3b и Sentinel6a quaternions

Conclusion

- Obtained single-satellite solutions for all "RINEX DORIS missions"
- Obtained multi-satellite solutions and sent to IDS for evaluation
- The effect of using quaternions on the accuracy of the solution has been investigated (for Jason2 and Jason3 only). Applying quaternions slightly improves post fit RMS (less than 1 %).
- The effect of using the AOD1B model on the accuracy of the solution has been investigated (for all satellites). Applying AOD1B model slightly improves post fit RMS (less than 1 %).
- The processing problems are identified and plans for further work are outlined