Deutsches Geodätisches Forschungsinstitut (DGFI-TUM)
Technische Universität München

# Current status of the IDS AAC at DGFI-TUM

Julian Zeitlhöfler[1], Mathis Bloßfeld[1] with contributions of Sergei Rudenko[2]

[1]Deutsches Geodätisches Forschungsinstitut, Technische Universität München (DGFI-TUM), Munich, Germany
[2]Geodetic Institute, Karlsruhe Institute of Technology (KIT), Karlsruhe, Germany

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# Recent developments

Next steps mentioned at IDS AWG meeting 03/2025:

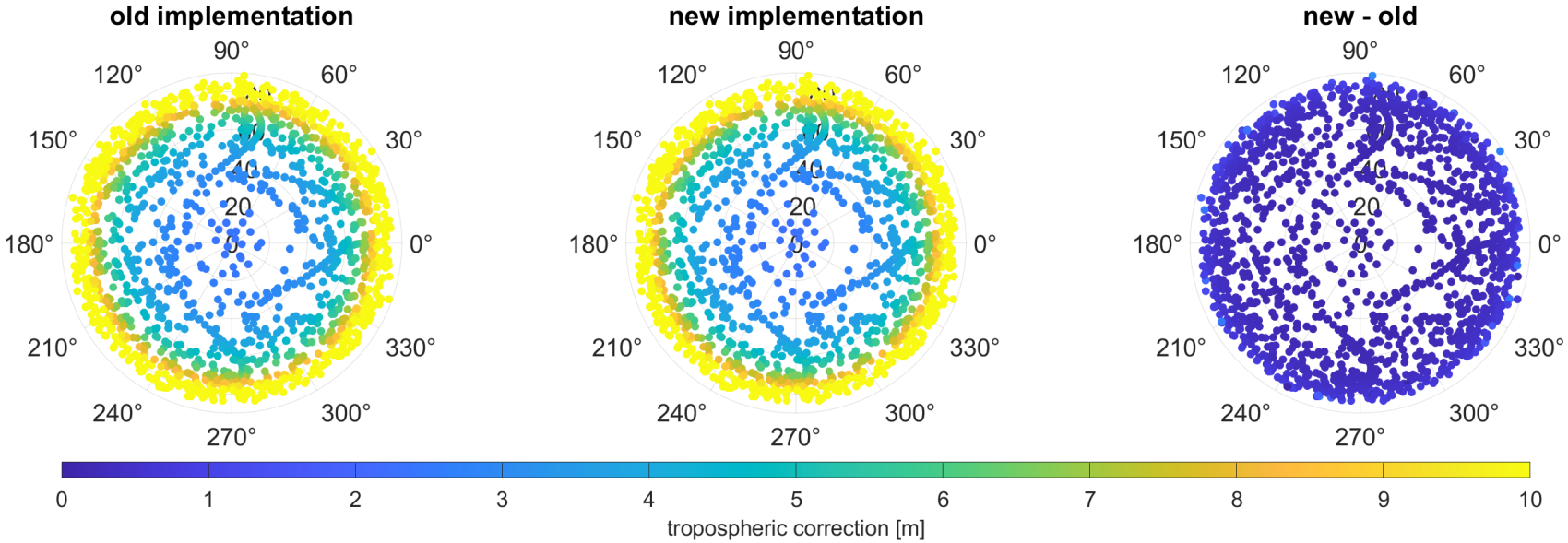
- Finishing the implementation of VMF3
  - ➢ Update mentioned in this talk
- Correlation analysis of POD parameters
  - ➢ Still ongoing
- Refine the parameter setup of DORIS-only and SLR-DORIS combined orbits
  - ➢ Update on this in the talk “First results on combined orbit determination using SLR and DORIS” by Zeitlhöfler et al.
- Comparison between Jason-2 IDS2.2- and RINEX-derived orbits
  - ➢ Still ongoing
- Continue working on Sentinel satellite platforms
  - ➢ Update mentioned in this talk

➢ Comparison of station coordinate time series (based on TRFs)

- ➢ Update on this in the talk “Comparison of time series of DORIS and SLR station coordinates of ITRS 2020 realizations and their updates and their impact on POD of altimetry satellites” by Rudenko et al.

# Implementation of Vienna Mapping Function 3 (VMF3)

- “Old” troposphere modelling:
  - Zenith delay according to averaged global mean model by Collins (1999)
  - Mapping functions (dry, wet) by Niell (1996)
- “New“ troposphere modelling:
  - A priori zenith wet delay (dry) according to Saastamoinen, (dry, wet) VMF3-based mapping functions
  - A priori gradients in North-South and East-West directions equal to zero, (dry, wet) mapping functions based on Chen-Herring (1997)
  - Tropospheric corrections are estimable; iterative improvement of parameters
- Example: Jason-3 arc, tropospheric corrections of DORIS beacon Toulouse (TLSB)

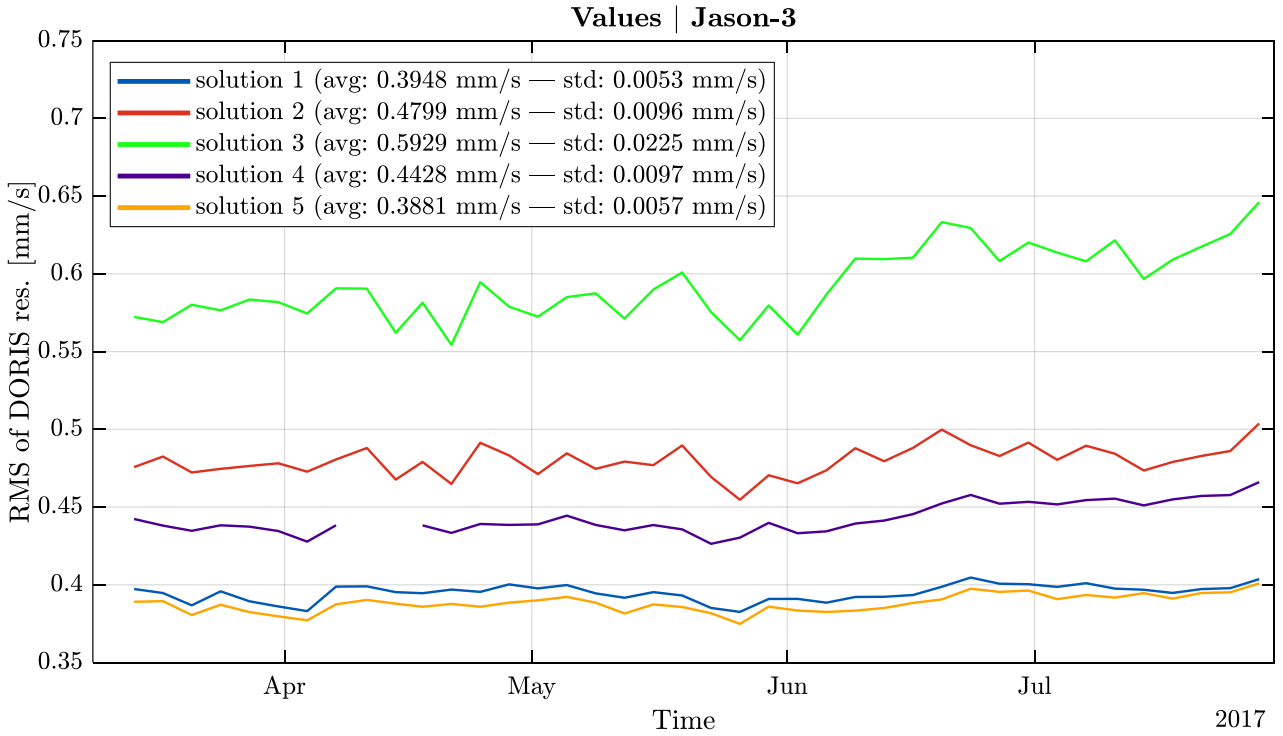


# Implementation of VMF3

- "Old" modelling (with estimation of a scale factor of tropospheric refraction) [solution 1]
- "New" modelling (zenith delay (wet), gradients North-South (wet, hyd.), gradients East-West (wet, hyd.))
  - 5-parameter set per arc [solution 2]
  - 5-parameter set per pass [solution 3] => mostly diverging solutions
  - 5-parameter set continuous piece-wise linear (every 12h) [solution 4]
  - 5-parameter set discontinuous piece-wise linear (every 12h) [solution 5]

Example arc: 53 stations, 1178 passes

| Sol. | Number of troposphere parameters | |
|---|---|---|
| 1 | 1178 | 1x(per station, per pass) |
| 2 | 265 | 5x(per station, per arc) |
| 3 | 5890 | 5x(per station, per pass) |
| 4 | 2120 | 5x(per station, every 12 h in 3.5 days) |
| 5 | 4240 | 5x(per station, every 12 h in 3.5 days)x2 |



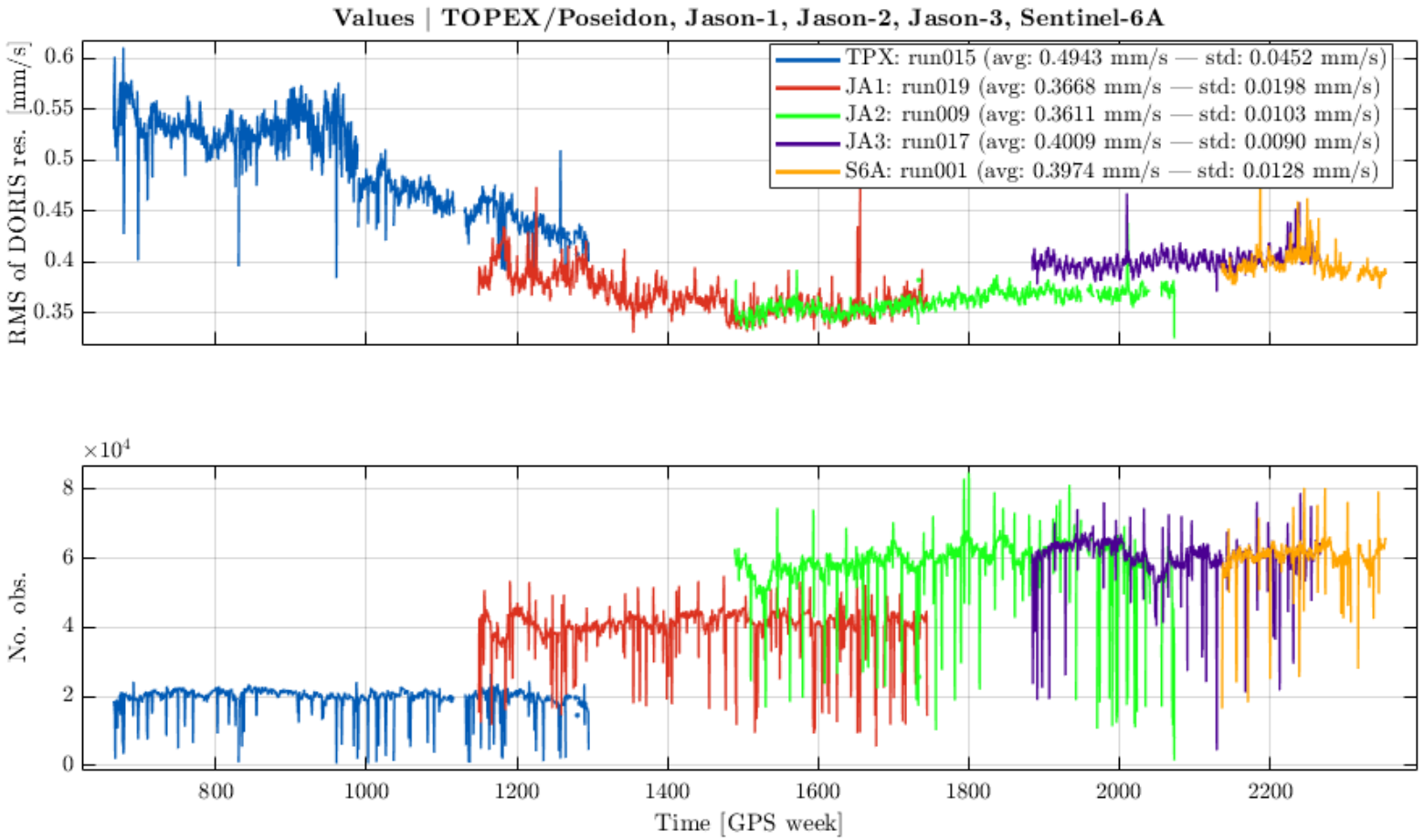
# DORIS residual RMS of currently processed altimetry missions

Parametrisation:

- SRP SF per arc
- ERP SF per arc
- ATM SF every 12 h
- EAC periodic per arc TN, every 12 h N
- Biases: FO per pass, FD per arc, TR per arc
- Station coord. estimated
- EOP estimated
- DPOD2020_v31 incl. dPSD and PER
- GRGS_RL05 Earth's gravity field model

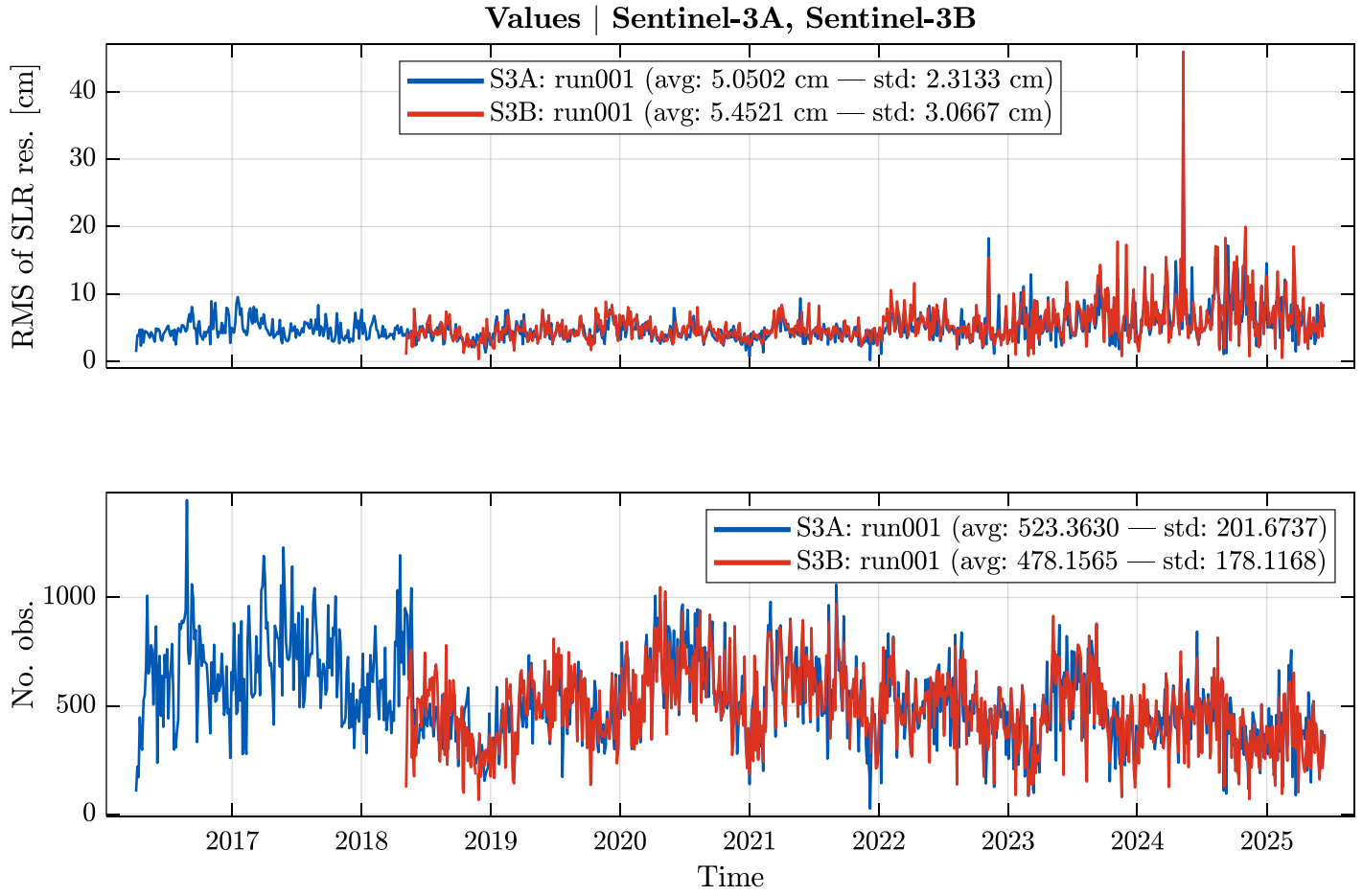
Differences in the parametrisations:

- TPX and JA1: use of tropospheric correction provided in IDS2.2 files
- S6A: no station coord. estimated



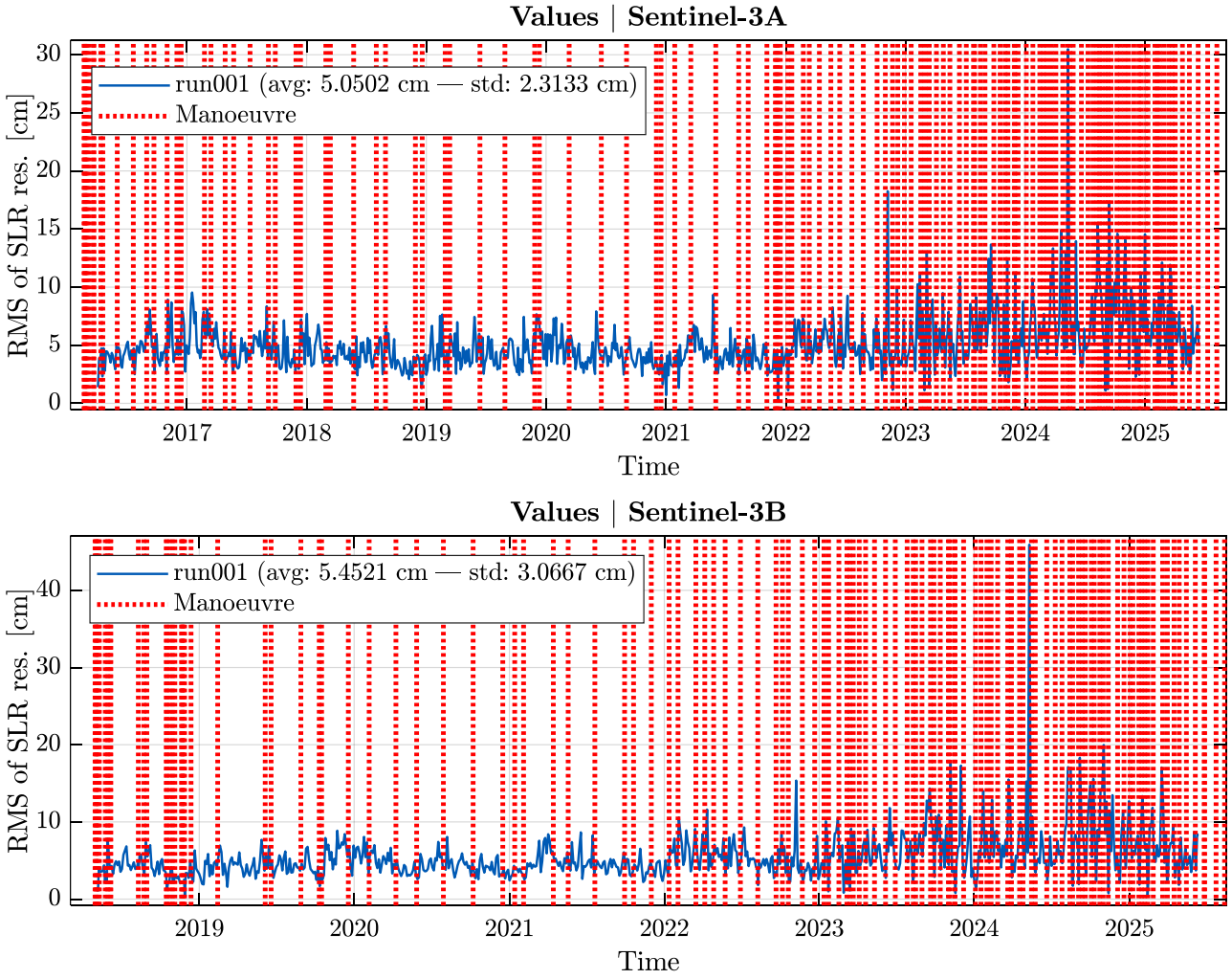
# Implementation of Sentinel-3A and 3B

- First run (with very constrained orbit parametrisation)



# Implementation of Sentinel-3A and 3B

- Missions contain a lot of manoeuvres → many arcs to adjust in processing the first run

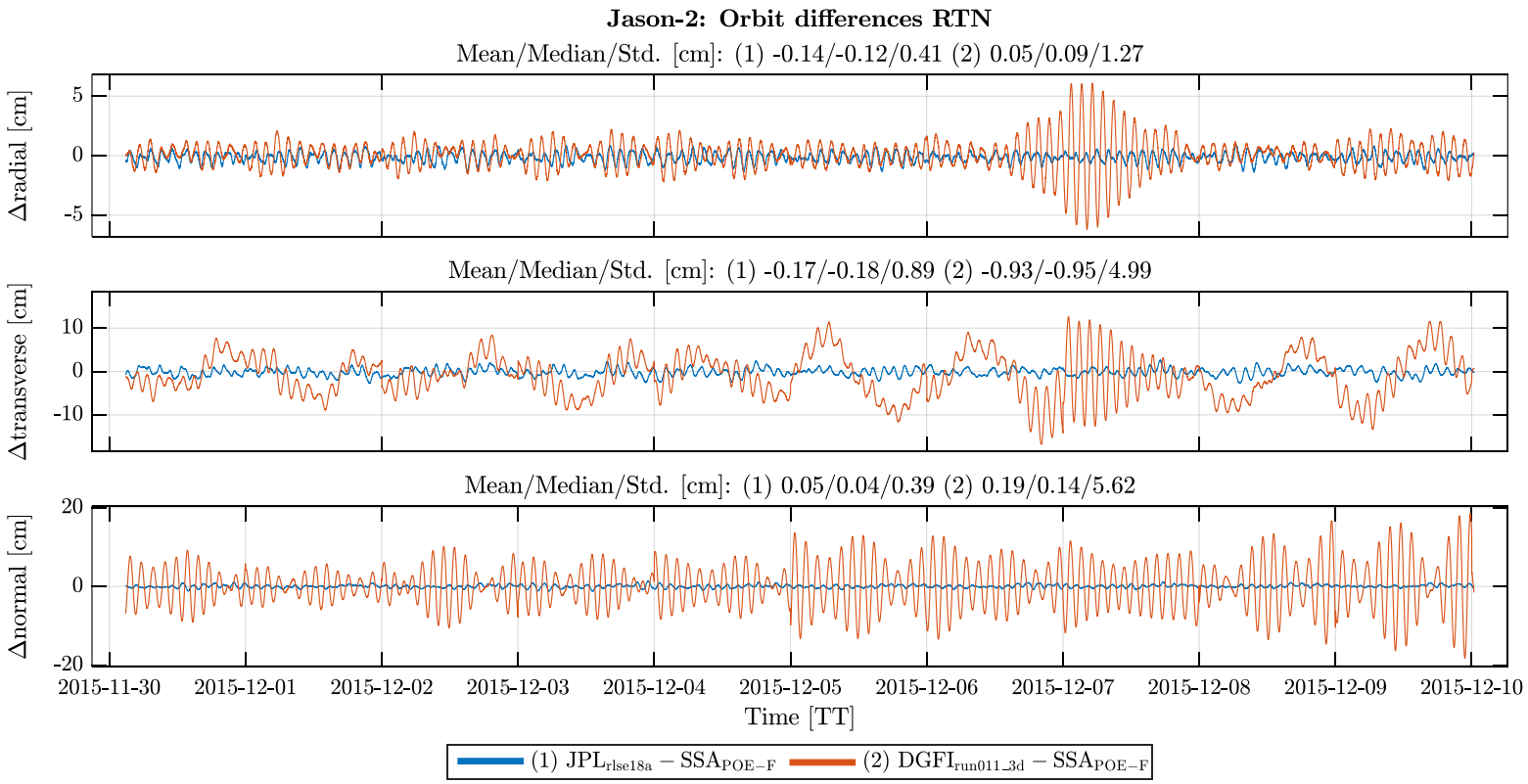


# Comparison with external orbit (1) – Orbit differences

- Satellite: Jason-2
- Reference solution: CNES SSA POE-F
- Compared solutions:
  - JPL rlse18a solution
  - DGF-TUM run011_3d solution (loosely constrained, 3-day orbit with extraction of middle day)
- Time interval: cycle 273

Results:

- Average orbit at similar level as both external solutions in all three components
- Scattering (especially in T and N) significantly larger

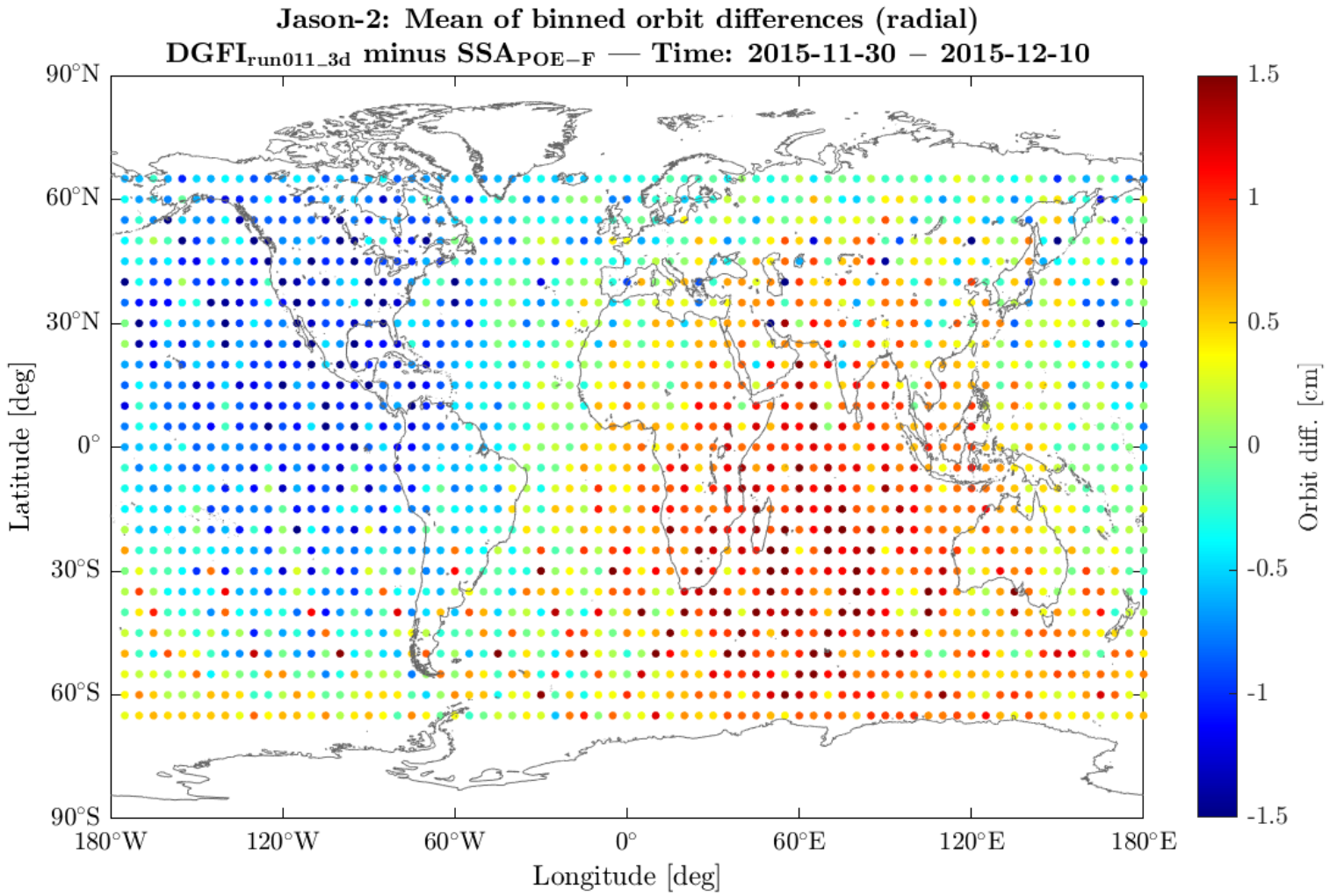


# Comparison with external orbit (2) – Geographical analysis

- Satellite: Jason-2
- Reference solution: CNES SSA POE-F
- Compared solutions:
  - JPL rlse18a solution
  - DGF-TUM run011_3d solution (loosely constrained, 3-day orbit with extraction of middle day)
- Time interval: cycle 273

Results:

- Obvious geographical pattern in the DGFI-TUM – SSA orbit differences



# Conclusions and outlook

- Steady extension of the pool of non-spherical satellites observed by DORIS
- Continuous enhancement of the background models used in DOGS-OC

Ideas for further improvement:
- Apply NTL corrections for stations (e.g. ESMGFZ products) and satellite perturbation (e.g., GFZ AOD products)?
- Anything else to consider?

Outlook:
- Further debugging of the new troposphere implementation
- Analyses for appropriate parameter setups related to the new troposphere implementation
- Compute DORIS-only orbit of Sentinel-3A/B
- Implementation of SARAL and Cryosat-2 into DOGS-OC
- Comparison of orbit parameters (drag, SRP, ERP, empiricals, etc.) with IDS ACs and AACs in case of general interest

Thank you very much for your attention!

# References and recent publications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- Collins J (1999) Assessment and Development of a Tropospheric Delay Model for Aircraft Users of the Global Positioning System. M.Sc.E. thesis, Department of Geodesy and Geomatics Engineering Technical Report No. 203, University of New Brunswick, Fredericton, New Brunswick, Canada
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