The current status and future plans of GOP AC

Petr Štěpánek, Vratislav Filler

Research Institute of Geodesy, Topography and Cartography, Zdiby, Czech republic

Department of Geodetic Observatory Pecný

Online, April 18th, 2023

Current status

- Weekly SINEX files delivered until 3Q/2022
- 4Q/2022 processed and SINEX files are ready for delivery
- Sentinel-6 quaternions applied (previous experiments with nominal attitude)
- Hy-2C and Hy-2D macromodels and nominal attitude models implemented
- 4Q/2022 – solutions of various satellite constellation and single satellite solutions – analyzing the effect of Sentinel-6 and Hy-2C,2D
- Alias for SAA stations – Jason-3, Sentinel-6 and Hy-2C

Coming soon

- Sentinel-6, Hy-2C,2D satellites processing evaluation – longer series
- Some modification in GOP Sinex (elimination of “alias” stations)
- Inspection of the GOP Tx.Ty.Tz series (Ty bias reported by Guilhem)
  - Check if the effect is satellite specific or not)
  - Understand why I do not observe it in my analysis as significant as Guilhem (different transformation key station selection criterions etc.)
- Single satellite solutions as a standard output together with operational series
- DORIS-only SP3 orbits

Future prospects

Sentinel project with TUM Munich (prof. Urs Hugentobler)

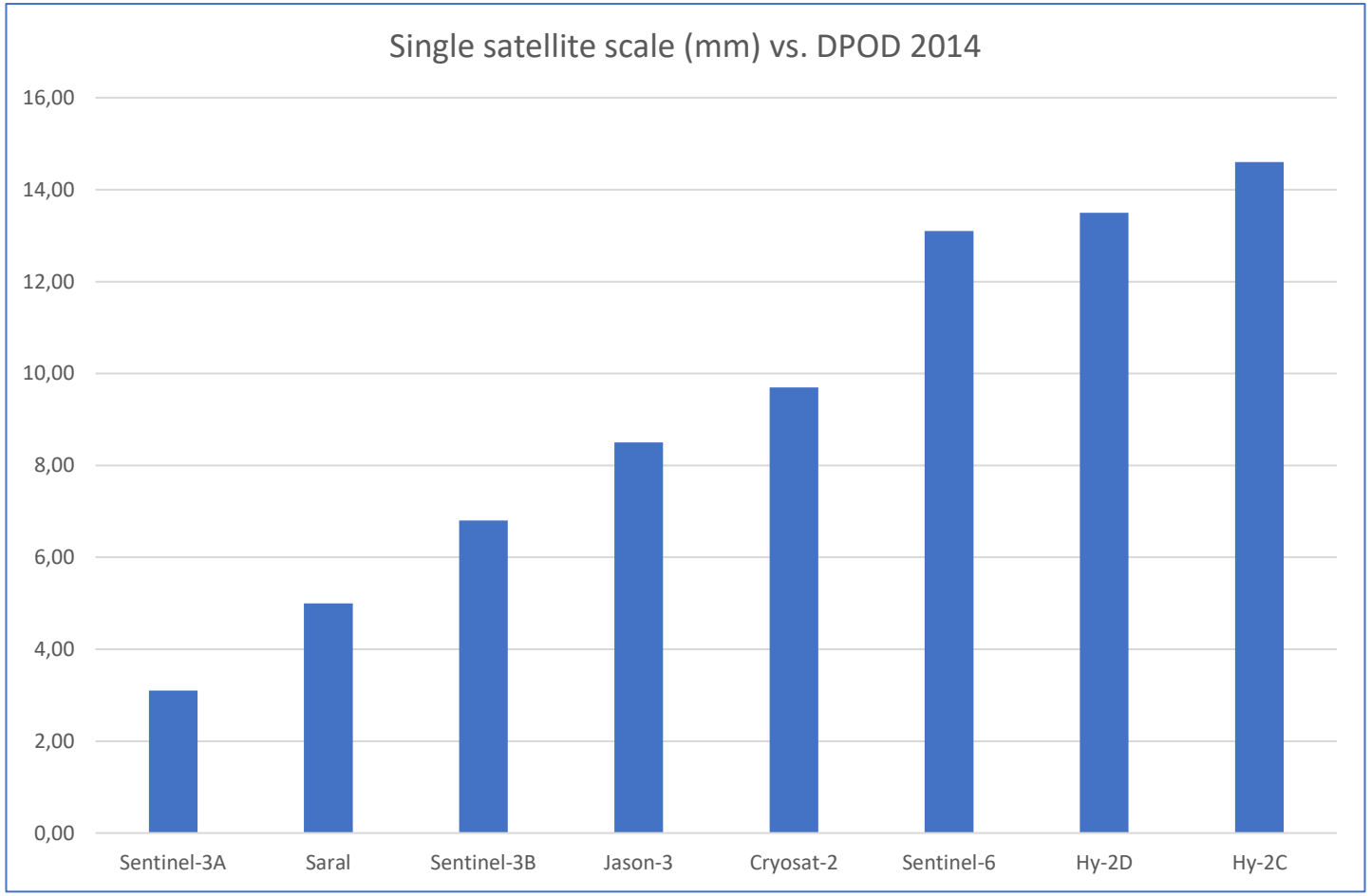
- Proposal in preparation
- 2024-2026
- DORIS USO observation by GNSS (continue previous work)
- Stochastic USO model
- DORIS phase processing experiment
- Sentinel-3 tandem phase
- Simulation of DORIS system with all clocks linked to GNSS

Cooperation with University Bern (Rolf Dach)

- TRF evaluation using DORIS, GNSS, SLR
- Merge DORIS version of Bernese and official version
  - after 8 years of independent evolution
  - About 1500 files of modified source code

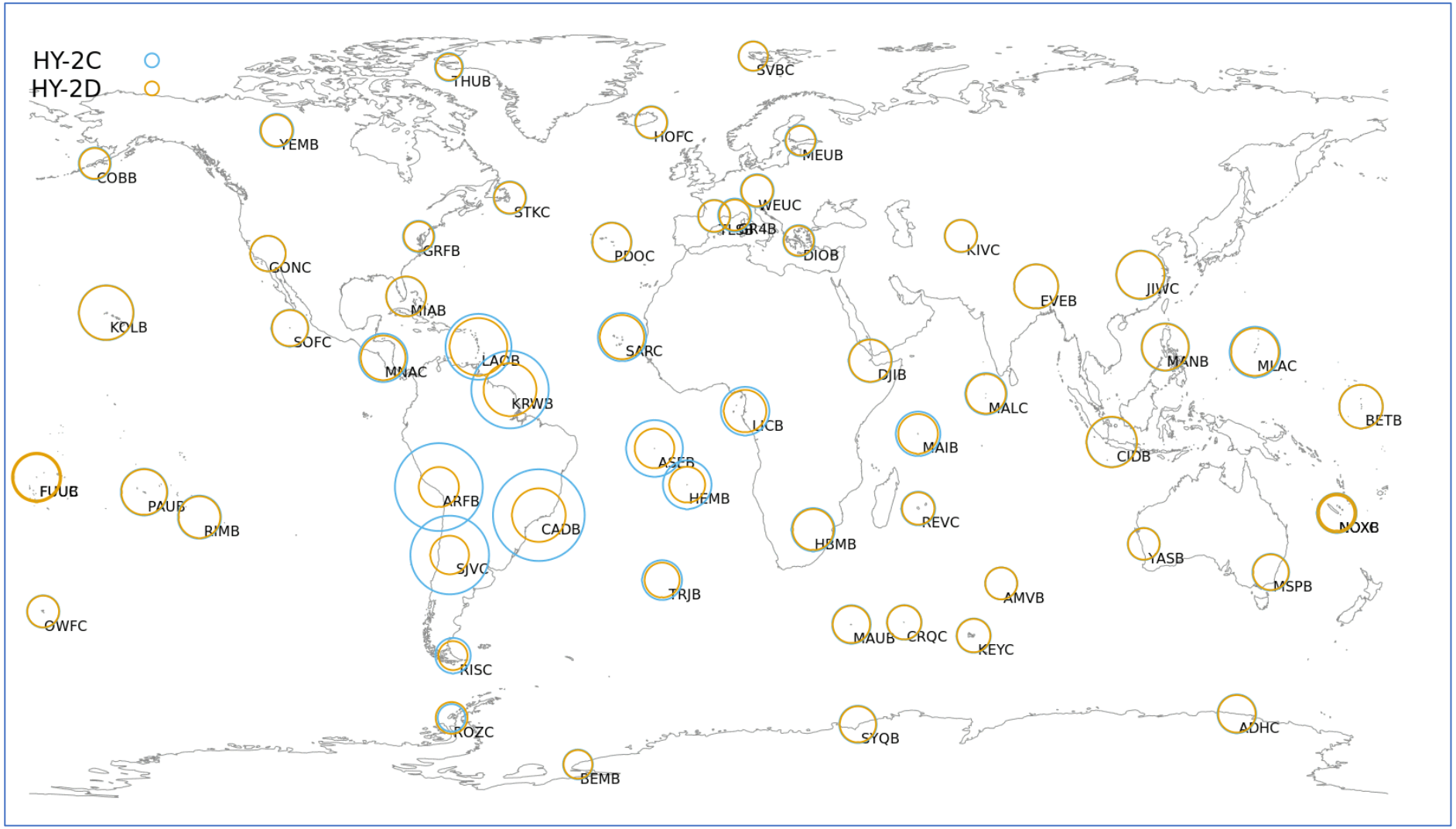
Single satellite solution scale vs. ITRF2014

- Largest scale for new satellites
- The same effect observed by GRG for Hy-2C and Hy-2D



Observation residuals for stations, Hy-2C and Hy-2D

- Strong SAA effect for Hy-2C (as also reported by Hugues Capdeville/GRG AC at IDS Workshop 2022)



POD, comparison with CNES/SSALTO multi-technique orbits

- Along track offset for Sentinel-6

Sat	Mean radial (cm)	Mean along (cm)	Mean cross (cm)	RMS r adial (cm)	RMS along (cm)	RMS cross (cm)
Sentinel-6	-0.1	-2.9	0.0	0.9	2.8	4.0
Hy-2C	0.0	-0.1	0.2	1.0	3.0	4.2
Hy-2D	0.0	-0.2	0.1	1.0	2.8	2.7

Estimated SRP coefficient

- Higher for Hy -2C/2D. Attitude mismodeling?

Sat	SRP
Sentinel-6	0.999
Hy-2C	1.061
Hy-2D	1.049

Transformation parameters vs. DPOD2014

- About 2.7 mm increment of the scale when including Sentinel-6 and Hy-2C/2D
- Reduction of Tz variations
- Increment of Tx variations (but too short series to analyze annual and semiannual effects)

Sat combination	TX (mm)	Ty (mm)	Tz (mm)	Scale (mm)
Cryosat-2,Saral, Sentinel -3A,3B, Jason-3 (= 5 sats)	4.6±2.0	-3.5±3.9	7.0±14.1	5.9±1.4
5sats + Sentinel-6	2.1±2.6	-1.8±3.8	5.1±11.2	7.1±1.7
5sats + Hy-2D	3.5±2.6	-2.4±4.3	8.5±8.4	7.1±1.4
5sats + Sentinel-6 + Hy-2D	2.3±2.1	-2.8±4.3	9.2±9.1	8.2±1.4
5sats + Sentinel-6 + Hy-2D, 2C	0.9±2.5	-1.5±4.1	7.7±8.4	8.6±1.5

Pole vs. IERS C04 model

- Slight improvement including Sentinel-6 and Hy-2C/2D

Sat combination	Xp Mean(mas)	Yp Mean(mas)	Xp RMS(mas)	Yp RMS(mas)
Cryosat-2,Saral, Sentinel -3A,3B, Jason-3 (= 5 sats)	0.19	-0.08	0.38	0.38
5sats + Sentinel-6	0.15	-0.02	0.38	0.38
5sats + Hy-2D	0.21	-0.10	0.39	0.39
5sats + Sentinel-6 + Hy-2D	0.16	-0.05	0.34	0.38
5sats + Sentinel-6 + Hy-2D, 2C	0.14	0.00	0.34	0.36

Station weekly repeatability WRMS

- Improvement when including Hy-2C/2D and Sentinel-6A

Sat combination	Lat (mm)	Lon (mm)	H (mm)
Cryosat-2,Saral, Sentinel -3A,3B, Jason-3 (= 5 sats)	6.55	8.98	7.65
5sats + Sentinel-6	6.55	8.97	7.49
5sats + Hy-2D	6.29	8.40	7.24
5sats + Sentinel-6 + Hy-2D	6.22	8.04	7.00
5sats + Sentinel-6 + Hy-2D, 2C	6.25	7.86	6.90

Thanks for your attention !