Copernicus POD Service COPERNICUS SENTINEL-6 POD

Sentinel-6 Validation Team 2022 11 July 2022



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Agenda

- **1.** Sentinel-6A @ Copernicus POD Service
- 2. Calibration and characterization activities
- 3. Conclusions from CPOD QWG 11 (June 2022)

S-6A @ CPOD SERVICE

Operational products

- Restituted orbits in near-real time (GPS only):
 - <u>Timeliness</u> (Req. / mean Q1 2022): 10 / 5.8 min
 - <u>Accuracy</u> (radial; vs. COMB; Req. / mean Q1 2022): 30 / 9.5 mm

Non-operational products

- NRT orbits (GAL only). Accuracy (radial; vs. CNES POE; Q1 2022)
 - GPS only: 10.0 mm
 - GAL only: **9.5 mm**
- STC orbits (GPS+GAL): 5.6 mm (mean of radial RMS; mean Q1 2022)

– NTC orbits (GAL only): **3.8 mm** (mean of radial RMS; mean Q1 2022)



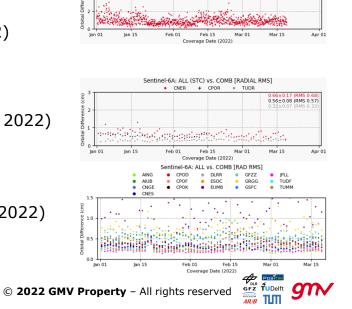
Feb 15

Sentinel-6: ROE_AX vs. COMB [RADIAL RMS] Sentinel-6A

Mar 01

Mar 15

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Copernicus Sentinel-6 POD (S6VT-22)

Configuration:

- POD SW:
- Observations:
- GNSS products:
- Determination arc: ٠
- COST-G 2112 Gravity field model:
- Ambiguity fixed solutions
- Estimated orbital parameters (**step #1**)
 - State-vector, CD, CR
- Estimated orbital parameters (**step #2**) ٠
 - State-vector
 - \succ CD = 1.0 fixed (almost no drag!)
 - \succ CR = fixed to different values depending on configuration

Solution	Current	Update	Upd1	Upd2	CNES
CR	1.0	0.89	0.901	0.967	0.98

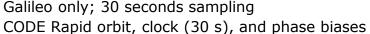
NAPEOS

24 hours

> CPR (constant per revolution): 6 empirical parameter sets consisting of:

CAL/VAL ACTIVITIES @ CPOD SERVICE

- Along-track constant, sine and cosine
- Cross-track constant, sine and cosine



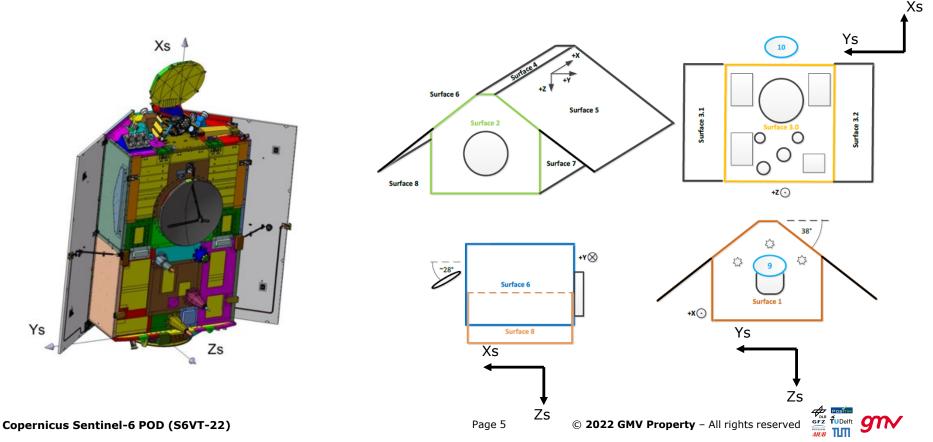








CAL/VAL ACTIVITIES @ CPOD SERVICE MACRO-MODEL CONFIGURATION



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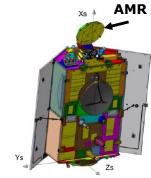
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MACRO-MODEL CONFIGURATION

Sol ID	POD Context	# Panels
Current	1.4	 10 panels, but two of them are set to zero ± Y areas: 1.03 m² (shaded by solar panels) + Z area: a plate covering the entire bottom of the satellite from one solar panel to the other => empty space below the solar panels is ignored AMR: set to zero
Update	2.0	 12 panels, inner sides of solar panels are added ± Y areas: 1.03 m² (shaded by solar panels) + Z: much smaller, because empty space is <u>not</u> ignored -> 2 additional panels
Upd1 2.0 AMR: direction to Earth set to zero (shadowed from satellite body)		AMR: direction to Earth set to zero (shadowed from satellite body)
Upd2	2.0	 AMR: direction to Earth set to zero (shadowed from satellite body) + Z: deactivation of inner solar panels for SRP; Earth albedo and IR still considered
CNES 2.0 6 panels Updated properties for VI/IR		

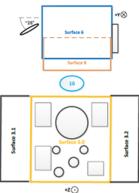




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COPERNICUS **CAL/VAL ACTIVITIES @ CPOD SERVICE STEP 1 – CD, CR, CP RES**



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CD

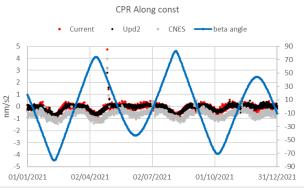
CR

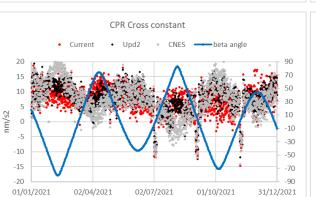
Phase residuals 1.15 12 20 current current update 2 update 2 18 10 1.1 atmosphere drag scale factor radiation pressure coefficient update 3 update 3 carrier phase RMS (mm) 8 1.05 CNES 16 6 0.95 4 0.9 2 0.85 0 6 update 2 -2 0.8 update 3 4 CNES 0.75 -4 50 350 300 350 200 250 350 Ω 200 250 300 0 200 250 Ω 50 150 300 Day of Year 2021 Day of Year 2021 Day of Year 2021

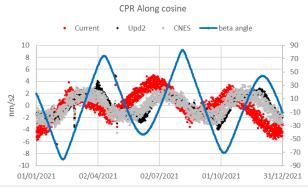
Step#1: Estimate CD, CR without empiricals, to derive the mean of CR (days 113-194):

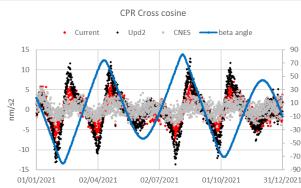
Solution	Current	Update	Upd1	Upd2	CNES
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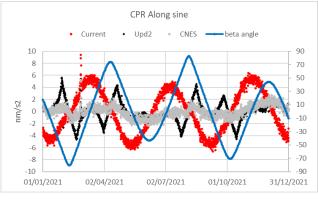
COPERNICUS **CAL/VAL ACTIVITIES @ CPOD SERVICE** opernici STEP 2 – CPRs New

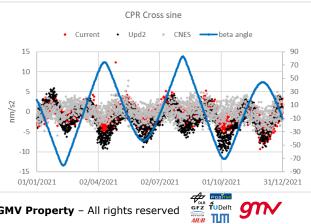






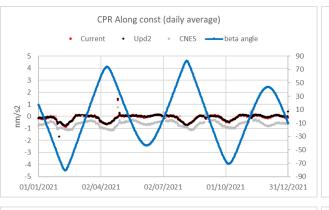


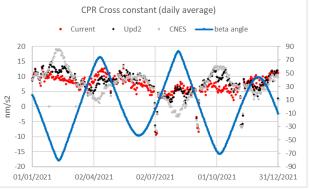


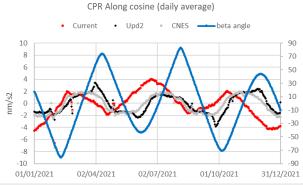


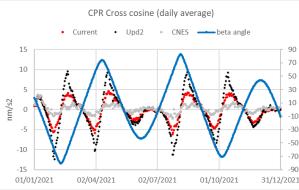
Copernicus Sentinel-6 POD (S6VT-22)

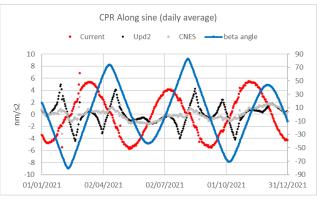
CAL/VAL ACTIVITIES @ CPOD SERVICE COPERNICUS STEP 2 – CPRs (daily averages)



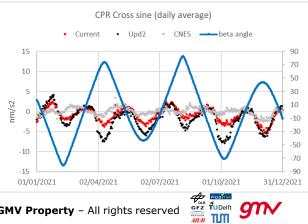




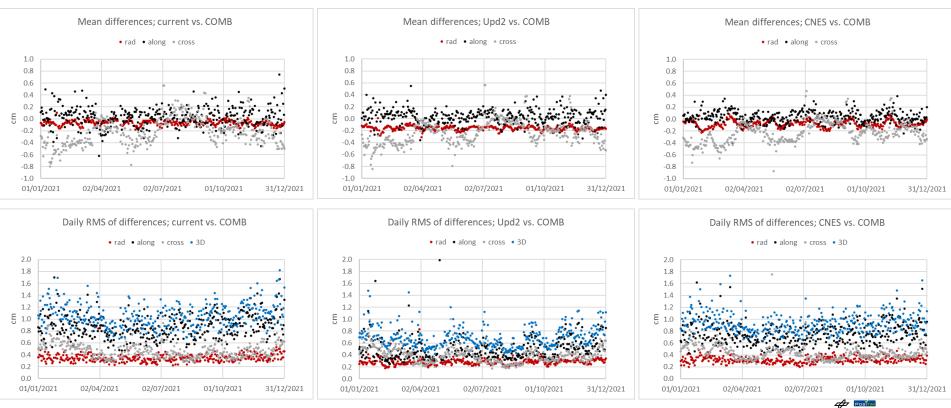




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Copernicus Sentinel-6 POD (S6VT-22)



Copernicus Sentinel-6 POD (S6VT-22)

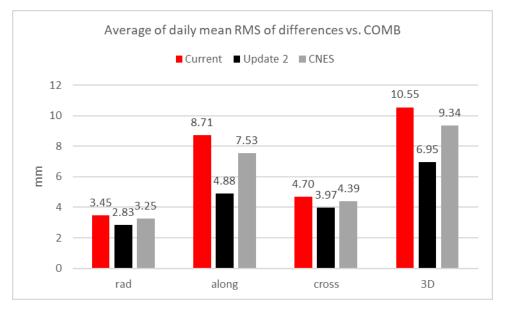
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GFZ TUDelft

COMPARISONS VS. RSR#23

mm	Rad	along	cross	3D
Current	3.45	8.71	4.70	10.55
Update 2	2.83	4.88	3.97	6.95
CNES	3.25	7.53	4.39	9.34



Copernicus Sentinel-6 POD (S6VT-22)

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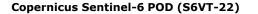
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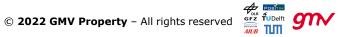
	Mean (mm)	RMS (mm)	
Current	2.0	8.9	
Update2	1.2	8.8	
CNES	ТВС	TBC	

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- 12 selected stations, no range biases or station coordinate corrections estimated
- SLR validation gives preference to **Update2** solution because of the lower mean



- Update of S-6 satellite macro model shows improvements but also deteriorations in the POD(-related) results.
- Shadowing effects have to be considered.
- Fine-tuning of the macro model is on-going.
- No final conclusion which macro model should be used for the further processing.



CONCLUSIONS FROM CPOD QWG #11



- From DLR analysis (ref. 12_QWG11_DLR_Sentinel-6A TRIG-PODRIX Cross Calibration):
 - There is a difference of 14 mm between the TRIG and PODRIX, in the Y-direction. Most probably due to a wrongly calibrated location of the antennas
 - Get TRIG antenna calibration; Better characterization the satellite before launch.
 - There is a difference of 9 mm between the TRIG and PORDIX in the X-direction. Most probably it is due to a time-tag error in one, or both systems. SLR analysis suggest it is dominated by TRIG
 - Verify TRIG-PODRIX timing discrepancy in signal simulator.
- From CNES analysis (ref. 19_QWG11_CNES_Sentinel-6 Solar radiation pressure model)
 - New macro-model behaves better than the pre-flight model
 - Still, improvements are needed for:
 - better modelling of the solar array energy exchanges (external panels)
 - how to handle the +-y cavities in a simple model



Thank you

Copernicus POD Service

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