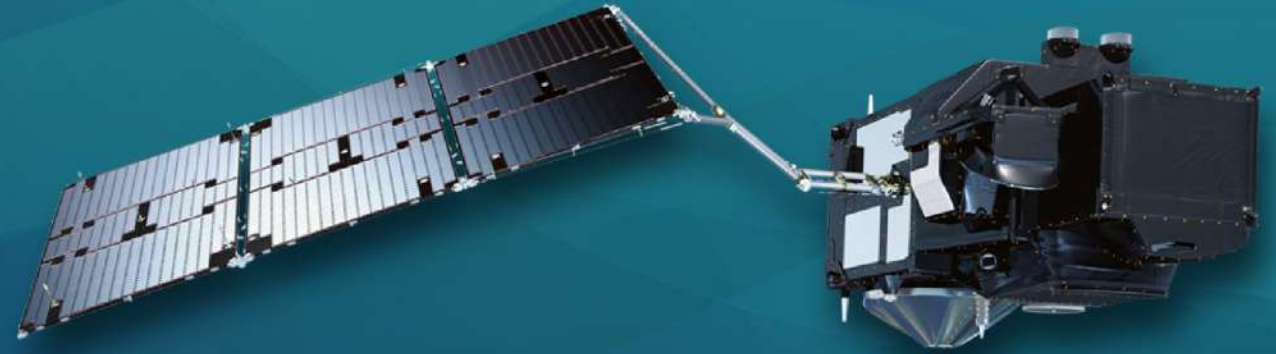




PROGRAMME OF THE
EUROPEAN UNION



co-funded with



9th Sentinel-3 Validation Team meeting 2026

30 March–01 April 2026 | ESA–ESRIN | Frascati (Rome), Italy

Extending the SPOT/VEGETATION and PROBA-V archives with Sentinel-3 SYN VGT

Challenges, achievements and consistency evaluation

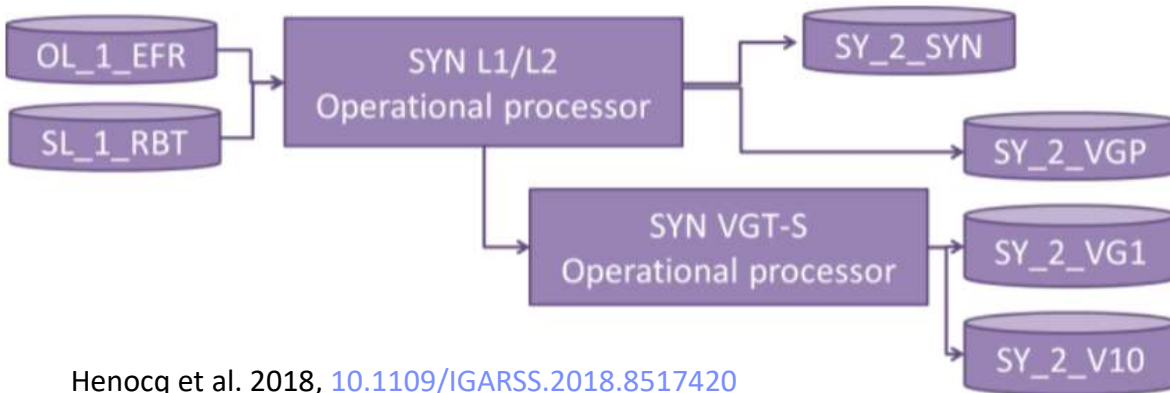
Carolien Toté¹, Else Swinnen¹, Claire Henocq², Steffen Dransfeld³

¹ VITO, ² ACRI-ST, ³ ESA



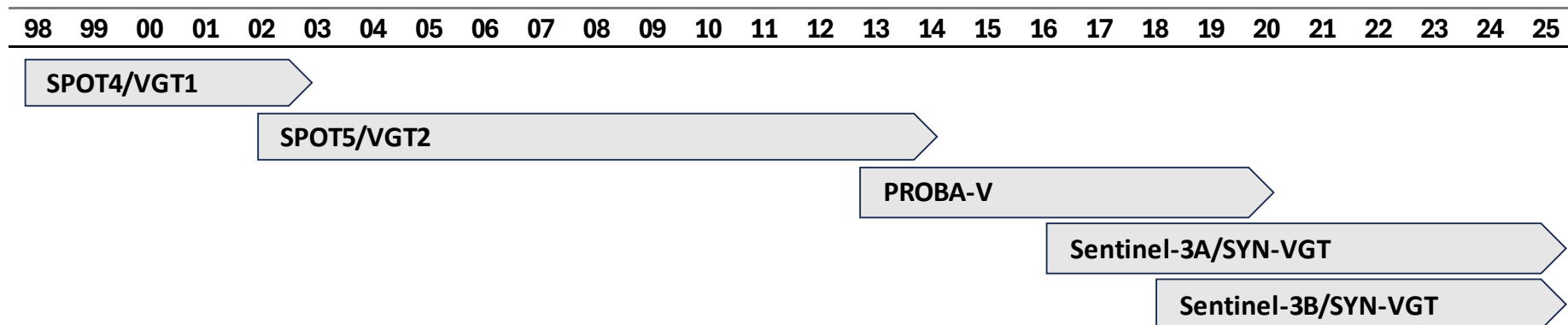
Sentinel-3 SYN Level 2 VGT-like products

Providing continuity to the SPOT/VEGETATION missions based on Sentinel-3 OLCI+SLSTR



- VGP : Top-of-Atmosphere reflectance for BLUE, RED, NIR, SWIR
- VG1: 1-day synthesis of surface reflectance and NDVI
- V10: 10-day synthesis of surface reflectance and NDVI

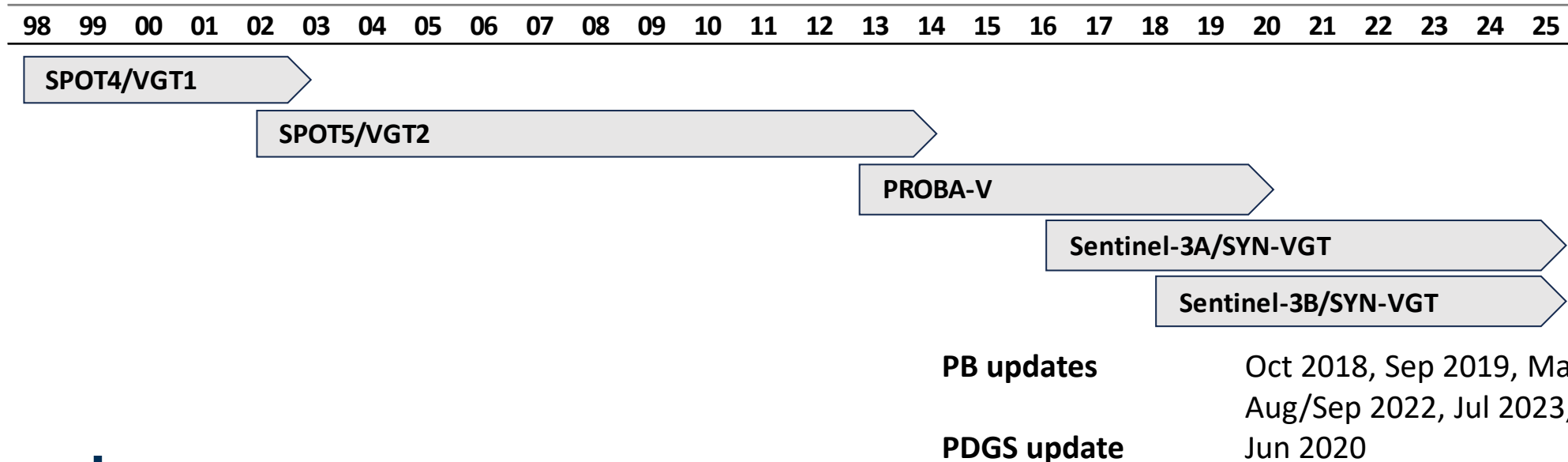
Henocq et al. 2018, [10.1109/IGARSS.2018.8517420](https://doi.org/10.1109/IGARSS.2018.8517420)



Quality Assessment of Sentinel-3 SYN VGT products

OPT-MPC

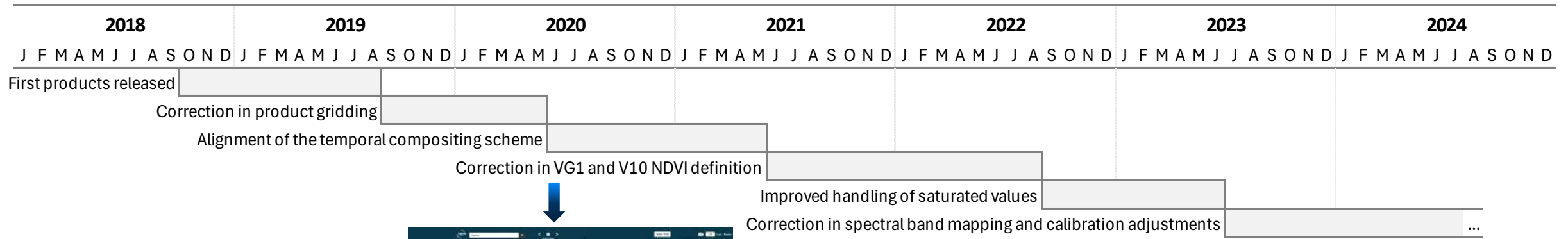
- Consistency with SPOT/Vegetation and Proba-V archives?
- Verification of SYN VGT processor updates
- Indication of possible product improvements



Sentinel-3 SYN VGT – Processor updates

Most important PB updates in SYN VGT time series

- Sep 2019: Correction in product gridding
- Jun 2020: Alignment of the temporal compositing scheme (S1 and S10)
- Jun 2021: Correction in definition of VG1 and V10 NDVI (TOC vs TOA)
- Aug/Sep 2022: Improved handling of saturated values
- Jul 2023: Correction in spectral band mapping, SLSTR calibration factors, OLCI-A calibration adjustment



Toté et al. 2024, [10.3390/rs16203822](https://doi.org/10.3390/rs16203822)



Visual checks



Products available on CDSE browser

The image displays the Opennicus Browser interface for visualizing satellite data. The main map shows a Sentinel-3 SYNERGY L2 VG1 product over Europe, rendered in a false-color composite. The interface includes the following components:

- Header:** Opennicus BROWSER logo, language (EN), and user profile (Carolien Toté).
- Navigation:** VISUALISE button, SEARCH bar, SH DASHBOARD, and WORKSPACE links.
- Date Selection:** DATE: SINGLE, date picker (2026-03-23), and a 30% cloud cover indicator.
- Configuration:** Default configuration dropdown.
- Layers:** Sentinel-3 SYNERGY L2 VG1 layer selected, with options for Add to Compare, Add to Pins, and Add to Timelapse.
- Layer Configuration:** Composite, Index, and Custom tabs. A drag-and-drop interface for bands (B0, B2, B3, MIR) and a color scale (R: B3_V, G: B2_V, B: B0_V).
- Footer:** Show effects and advanced options, Hide layer, and Share buttons.

The map shows a false-color composite of Sentinel-3 SYNERGY L2 VG1 data over Europe. The color scale is set to R: B3_V, G: B2_V, B: B0_V. The map displays various geographical features, including the Mediterranean Sea, the Gulf of Venice, and the Gulf of Lion. Major cities and regions are labeled, such as Milan, Rome, and Paris. The interface also includes a search bar, a date selector (2026-03-23), and a layer configuration panel.

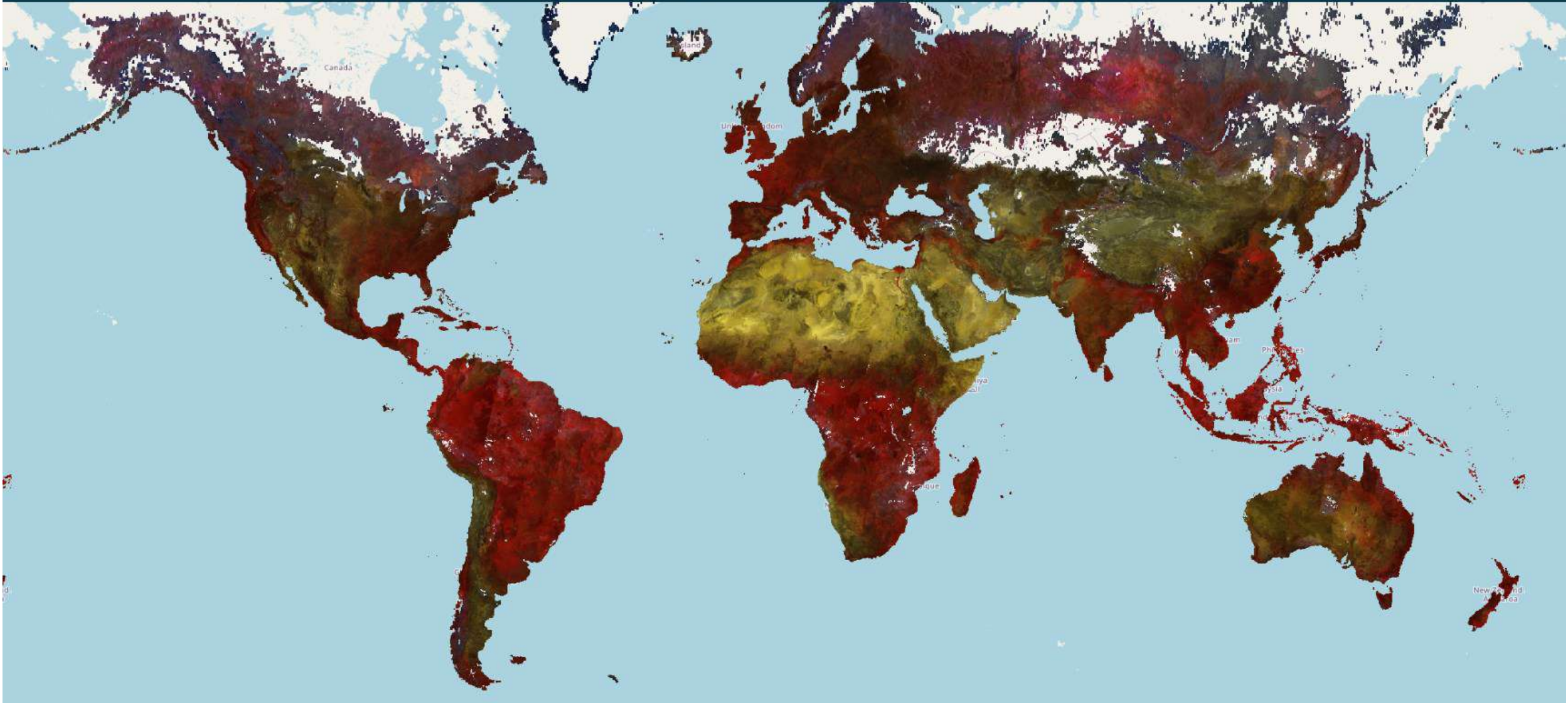
Products availability on Terrascope

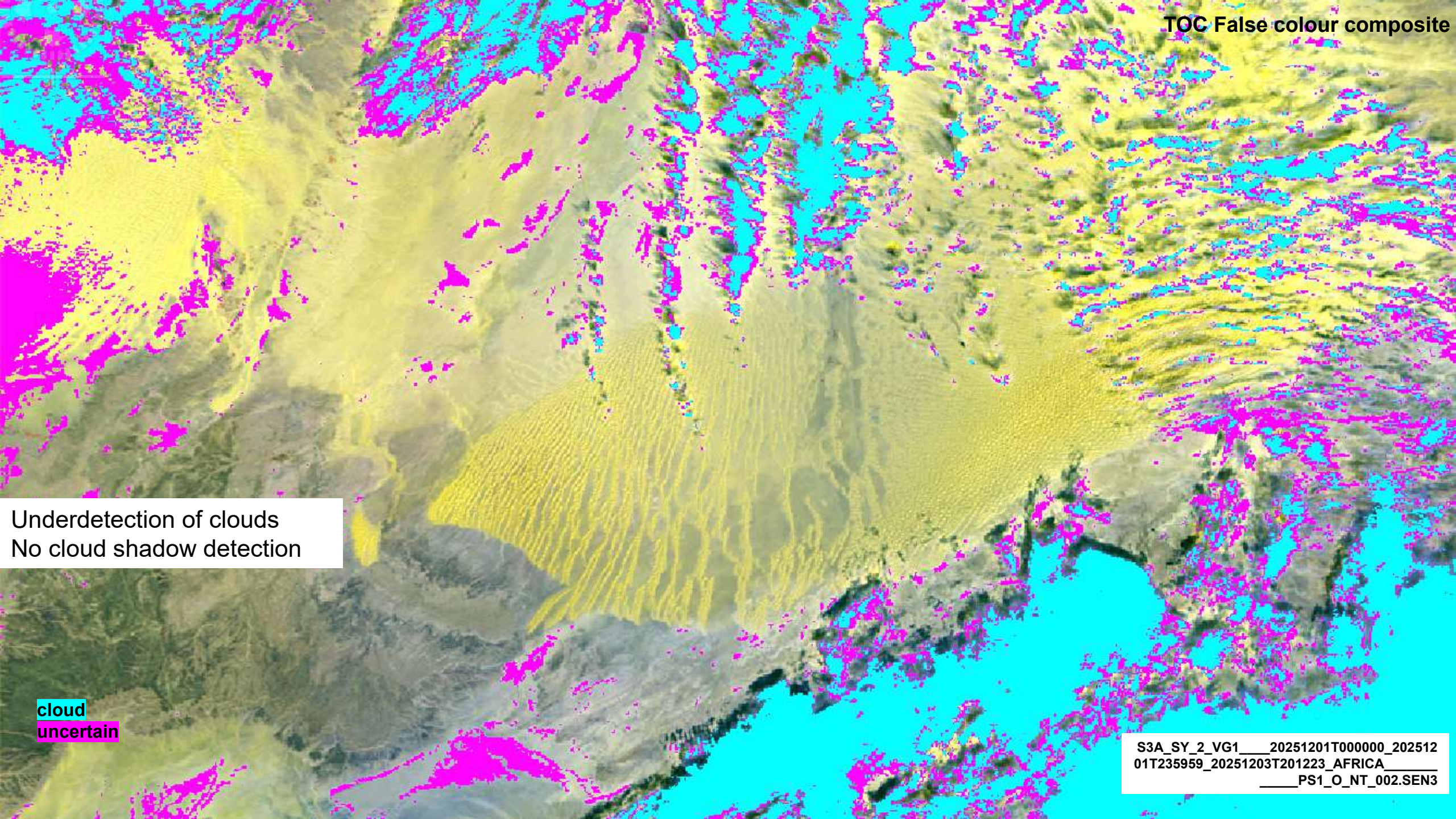
Belgian Earth Observation Data Space

- Automated query & download of NTC S3 SYN VGT products from [Copernicus Data Space Ecosystem](#)
- SYN VGT products on Terrascope
 - User documentation (consistency, limitations)
 - Conversion to COG
 - VG1 and V10 on <http://viewer.terrascope.be/>
- Issues with Sentinel-3B SYN VGT products since Jan/2025 (missing/incomplete/duplicate/erroneous) – Resolved since Q4/2025









Underdetection of clouds
No cloud shadow detection

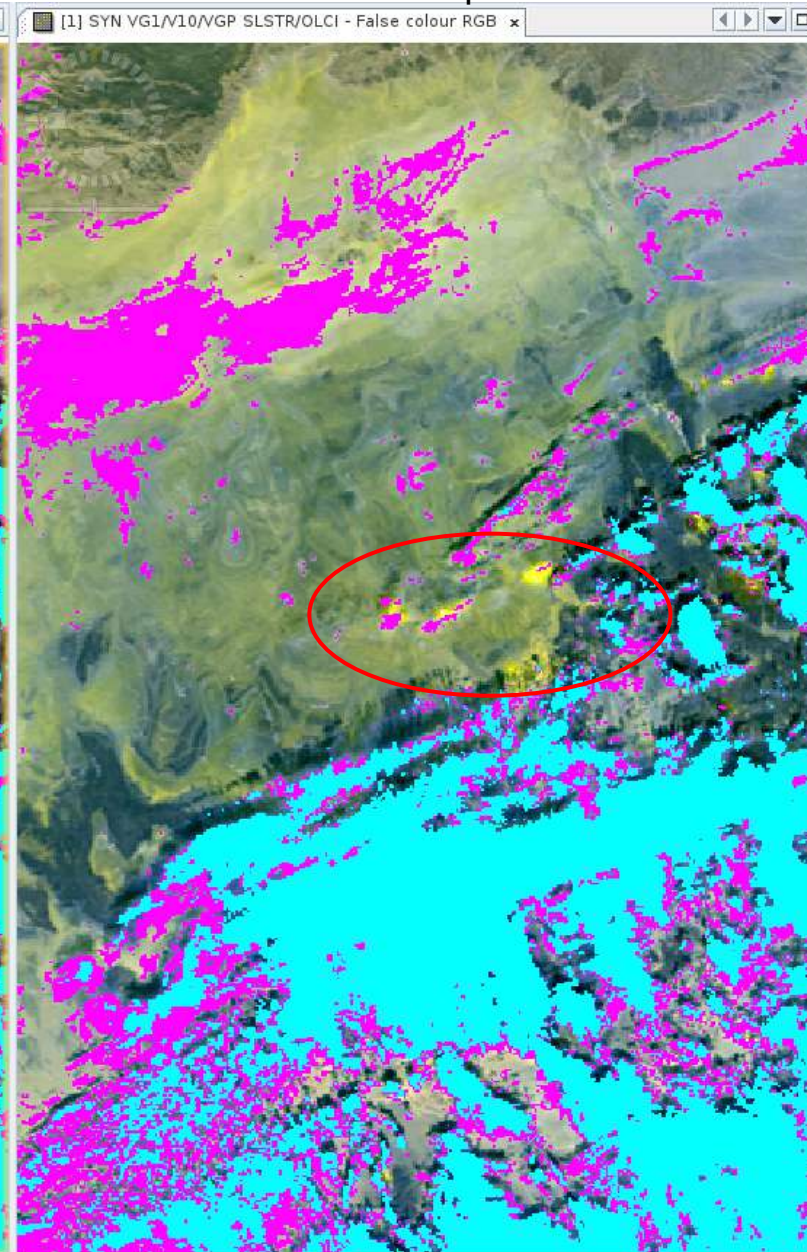
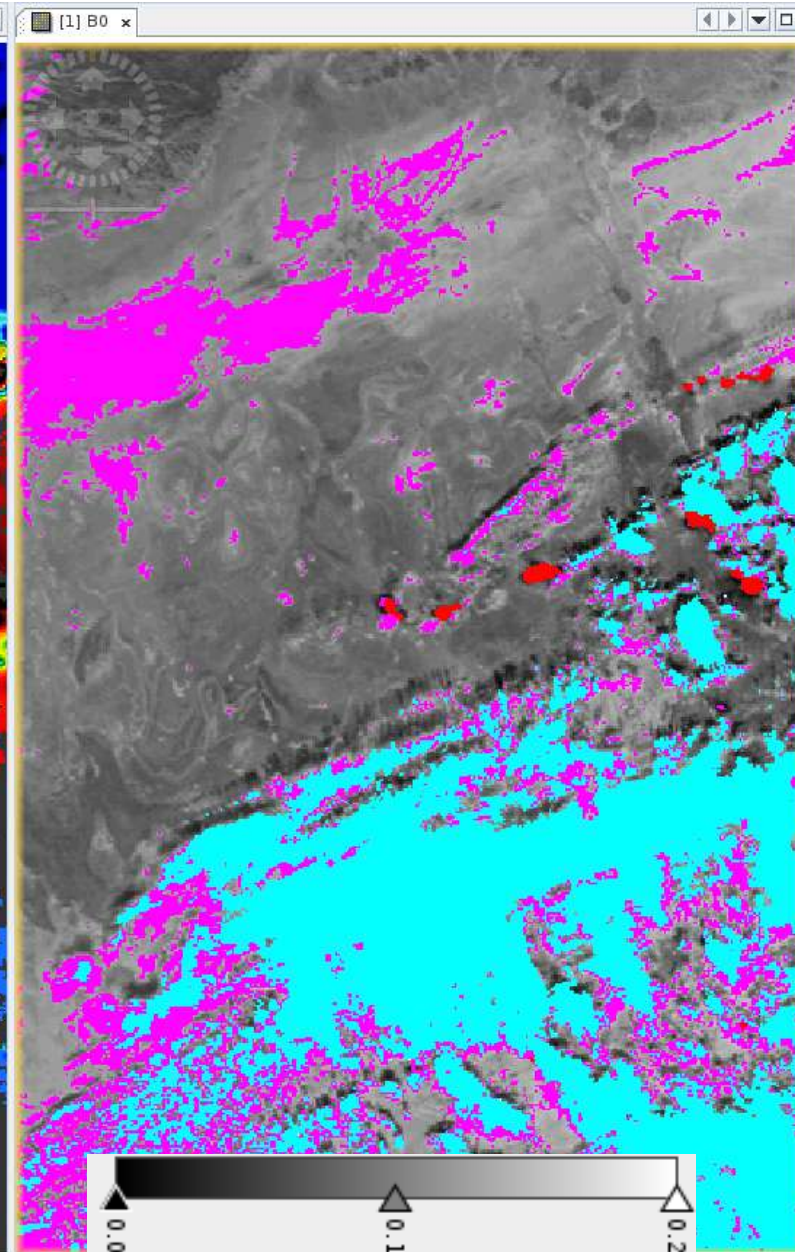
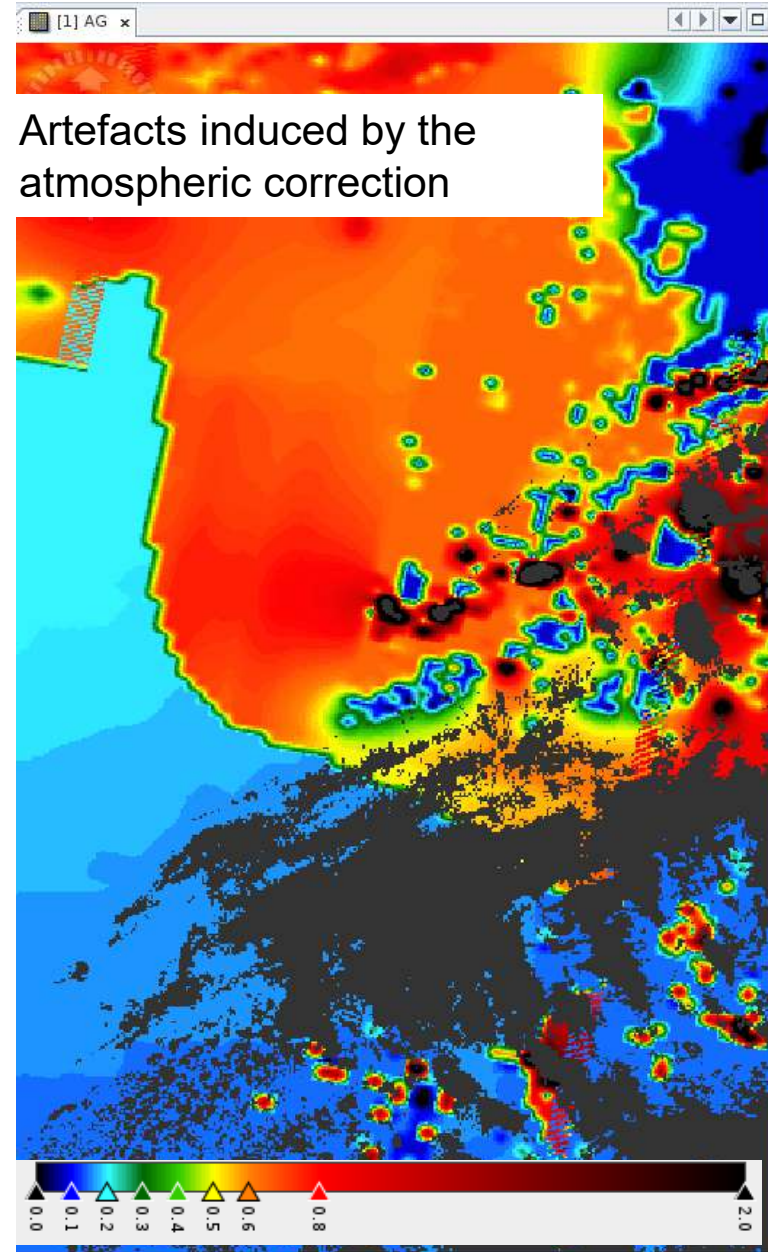
cloud
uncertain

S3A_SY_2_VG1_____20251201T000000_202512
01T235959_20251203T201223_AFRICA_____
_____PS1_O_NT_002.SEN3

AOD

TOC BLUE

TOC False colour composite



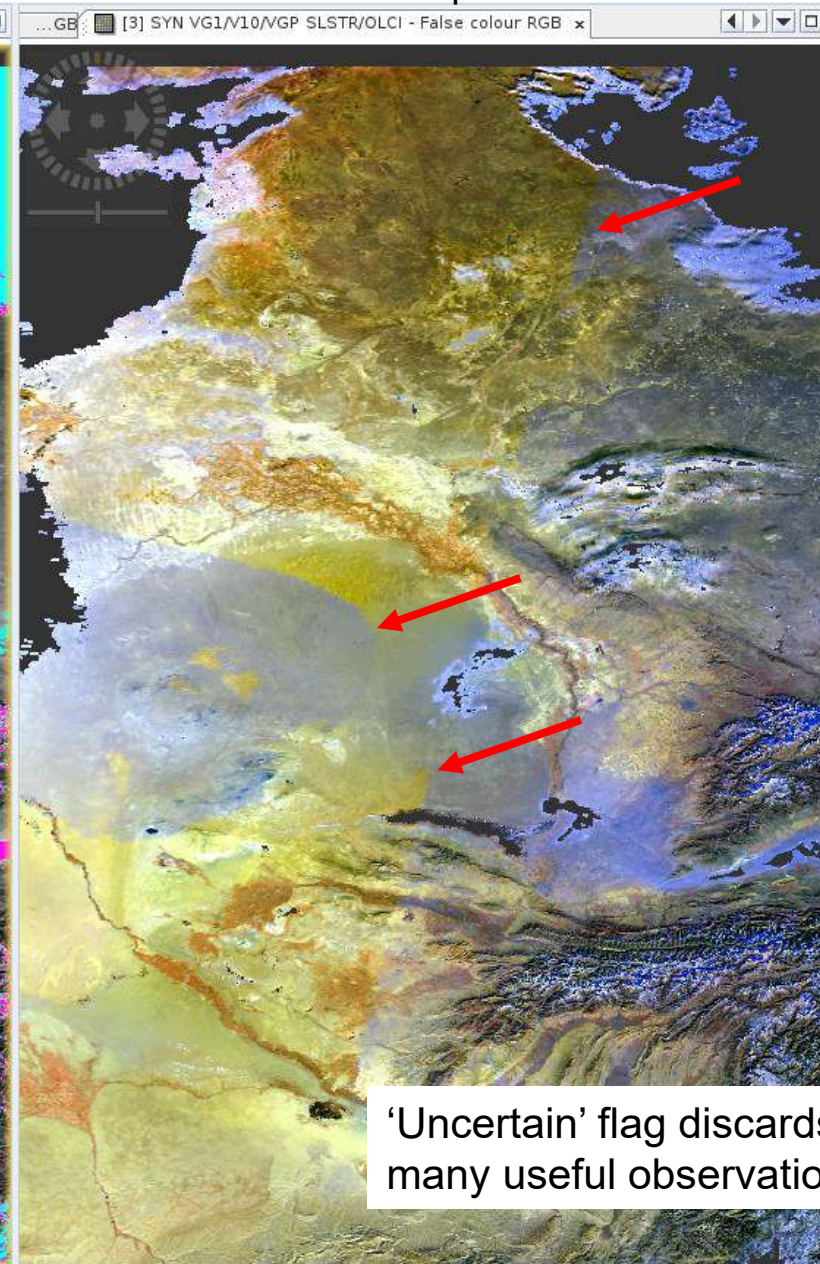
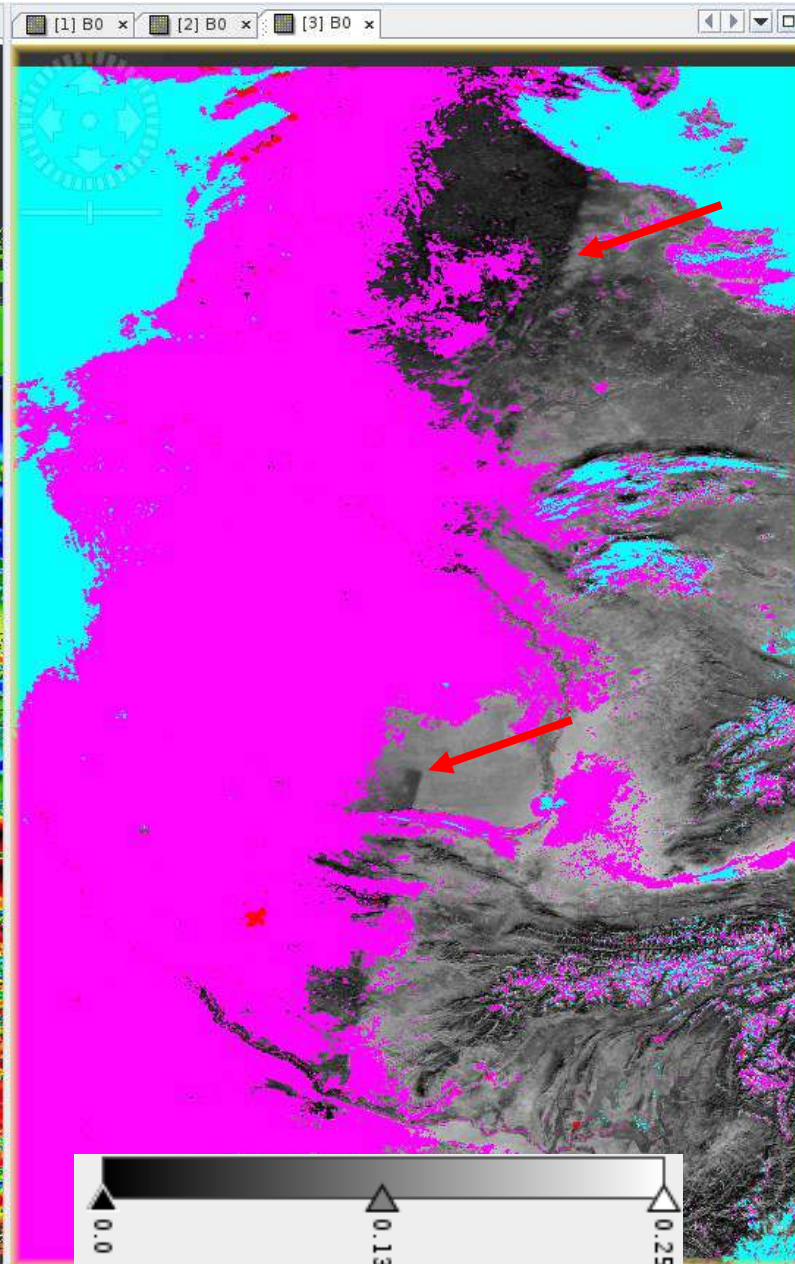
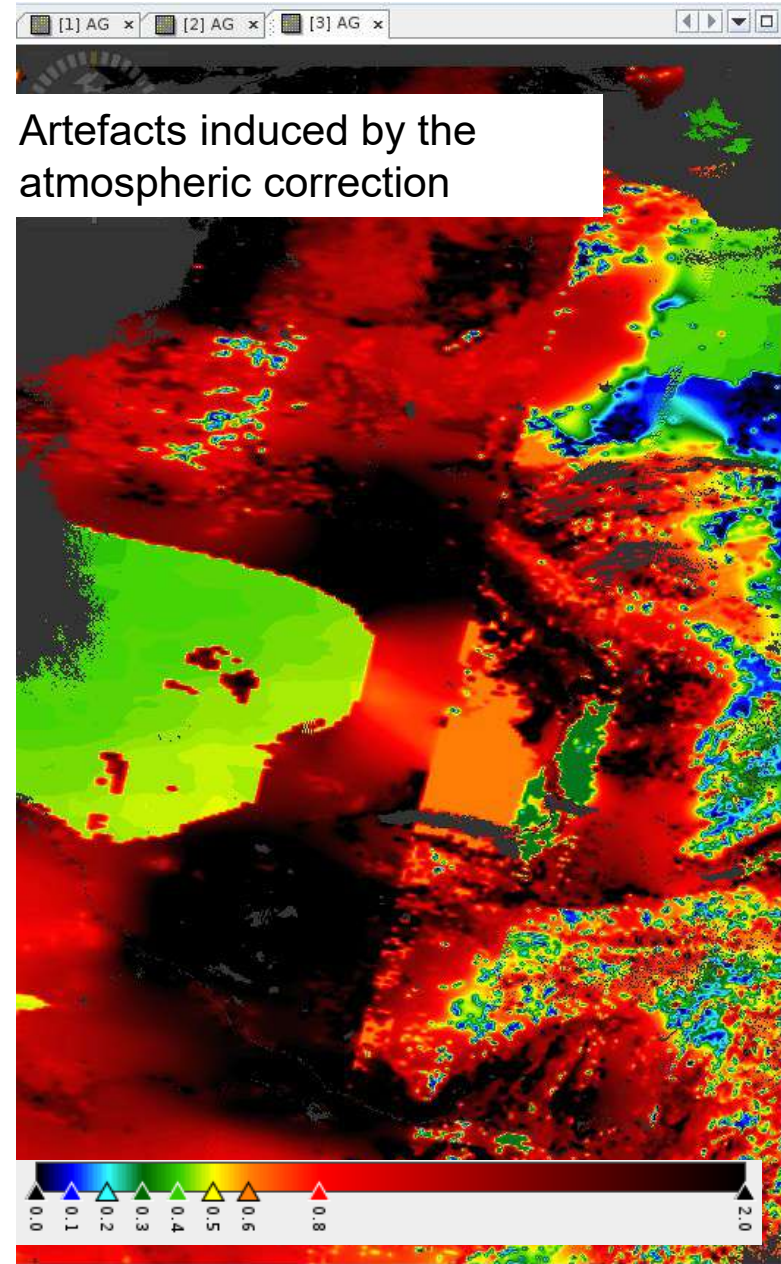
cloud
 uncertain
 saturated AOD (AOD > 1.016)

S3A_SY_2_VG1____20251201T000000_202512
 01T235959_20251203T201223_AFRICA____
 ____PS1_O_NT_002.SEN3

AOD

TOC BLUE

TOC False colour composite



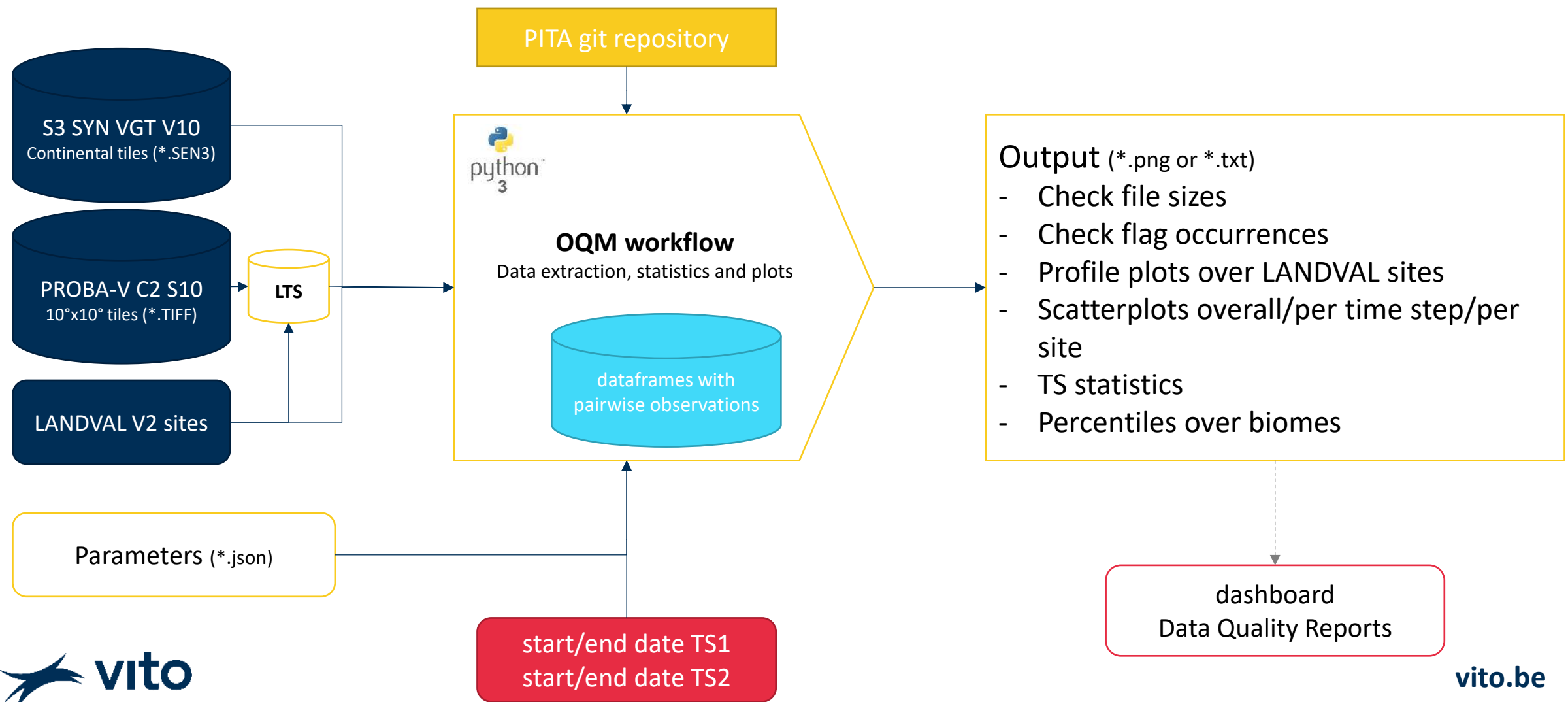
cloud
uncertain
saturated AOD (AOD > 1.016)

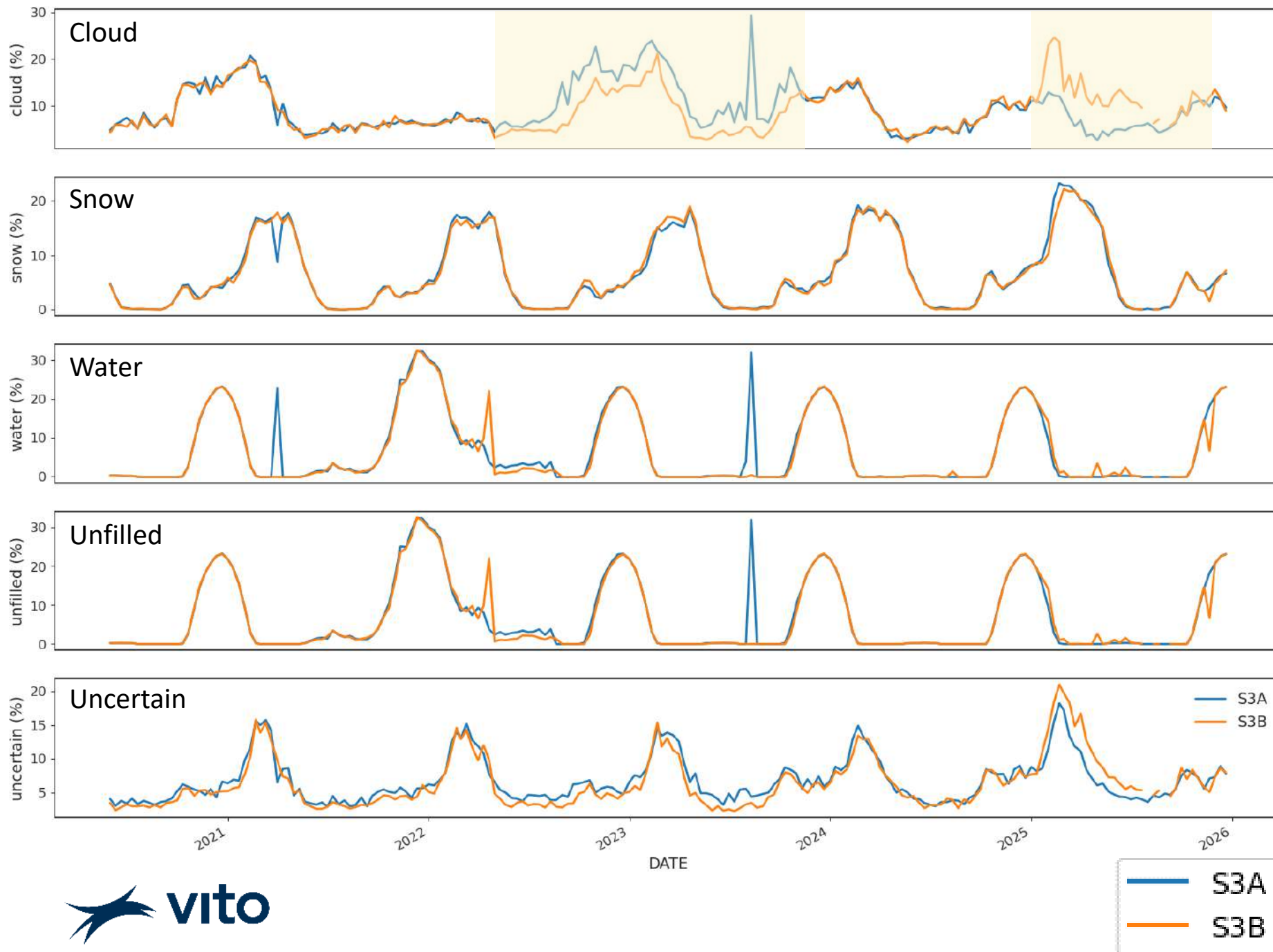
Operational Quality Monitoring

Product completeness, statistical consistency, temporal consistency



Operational quality monitoring





[Apr/2022 – Nov/23]

7-days default product retention policy on S3A production service
→ S3A V10 products based on 7-days time window (instead of 10)

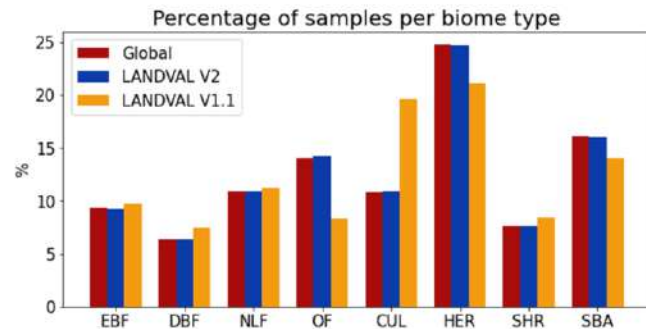
[Jan/2025 – Nov/25]

Missing or incomplete, products in S3B

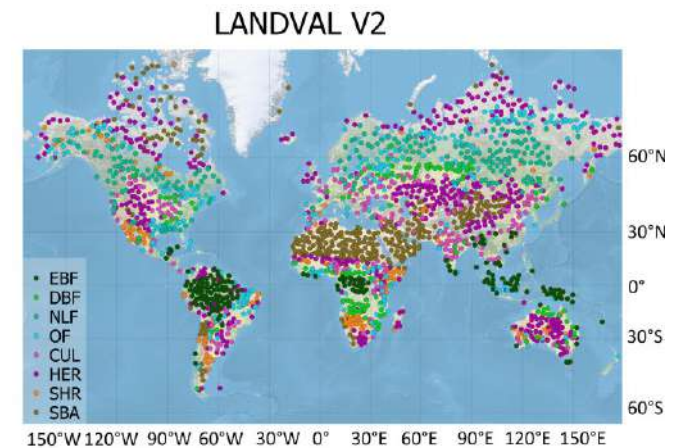
Statistical consistency with PROBA-V

Methodology

- SYN VGT July/2020 – Dec/2025 vs. PROBA-V C2 Long Term Statistics (LTS) 2014–2018
- 2000 LANDVAL v2 sites [Martínez-Sánchez, 2024]



EBF – Evergreen Broadleaf Forest
DBF – Deciduous Broadleaf Forest
NLF – Needle-leaf Forest
OF – Other Forest
CUL – Cultivated
HER – Herbaceous
SHR – Shrublands
SBA – Sparse and Bare Areas



- Pairwise intercomparison, with good quality in both datasets
 - S3A_SY_V10 <> PV_S10 LTS
 - S3B_SY_V10 <> PV_S10 LTS
 - S3A_SY_V10 <> S3B_SY_V10

Statistical consistency with PROBA-V

Metrics

- Accuracy (A) = average bias

$$A = \frac{1}{n} \sum_{i=1}^n (X_i - Y_i) = \bar{X} - \bar{Y}$$

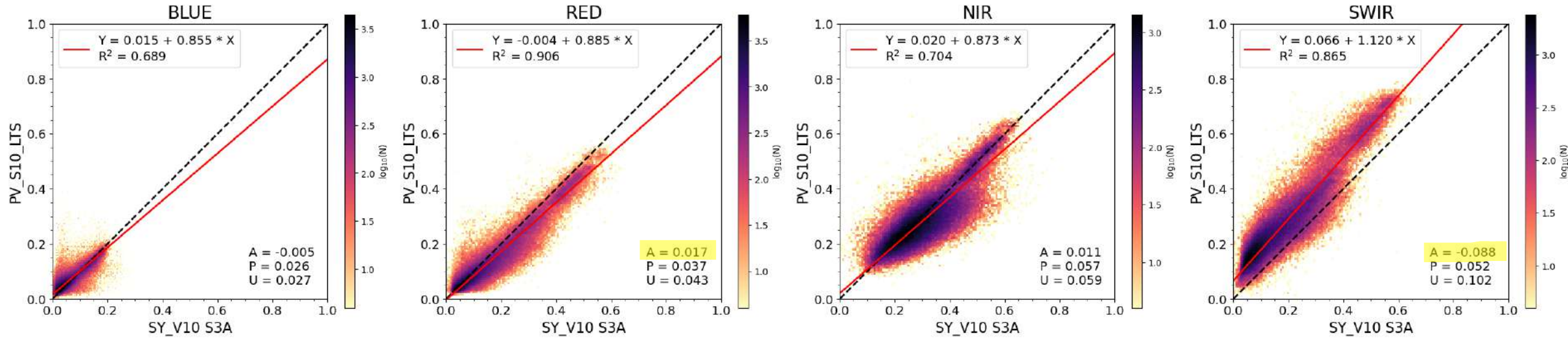
- Precision (P) = repeatability, or standard deviation of the bias

$$P = \sqrt{\frac{1}{n-1} \sum_{i=1}^n (X_i - Y_i - A)^2}$$

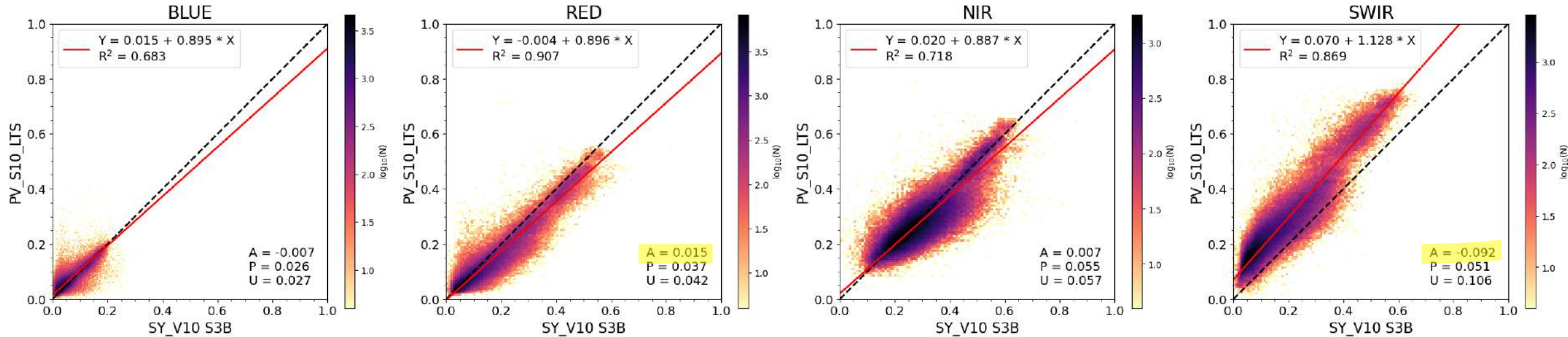
- Uncertainty (U) = root mean squared difference

$$U = \text{RMSE} = \sqrt{\frac{1}{n} \sum_{i=1}^n (X_i - Y_i)^2}$$

S3A

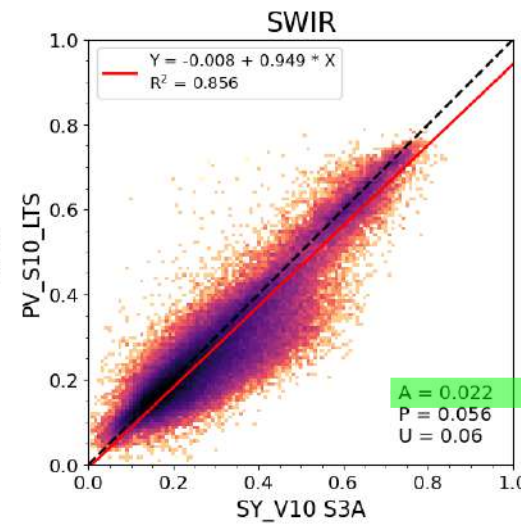
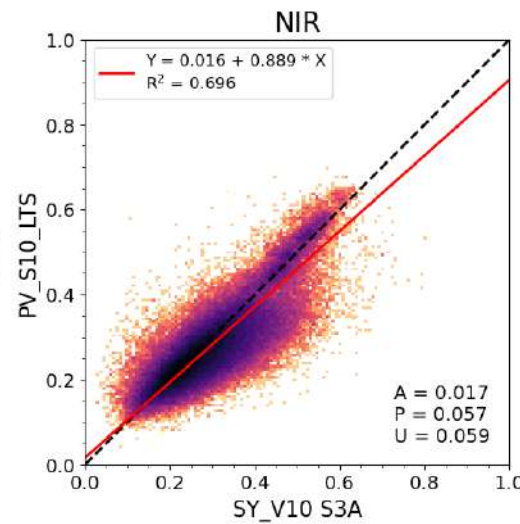
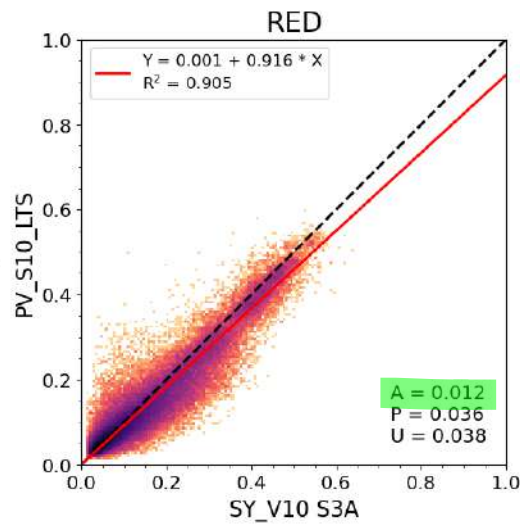
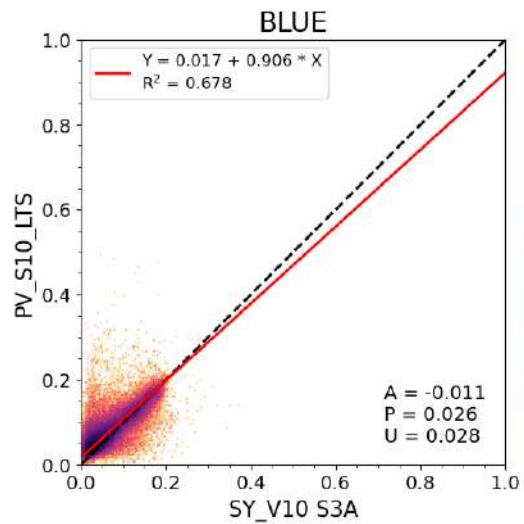


S3B

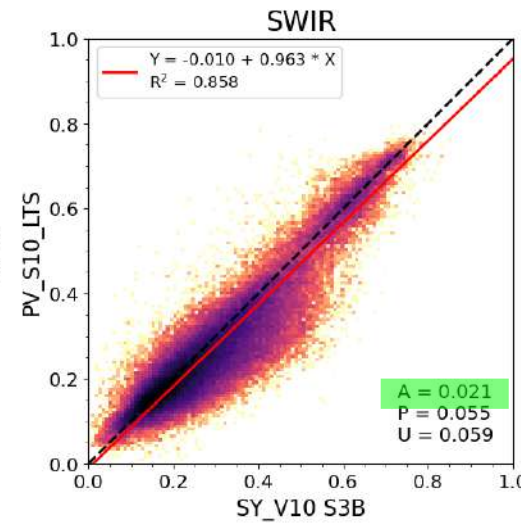
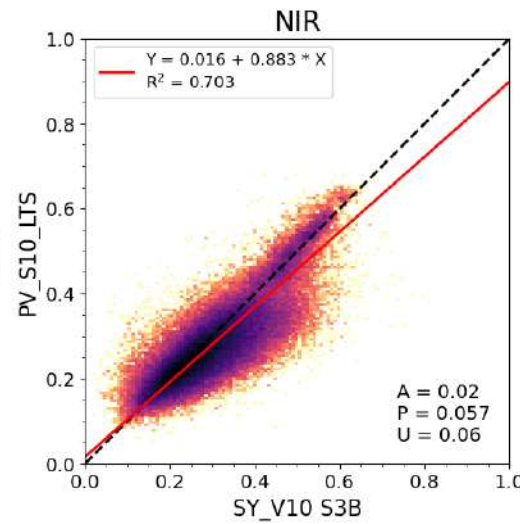
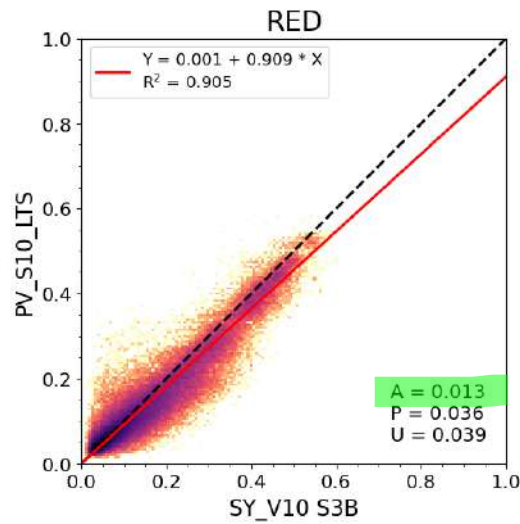
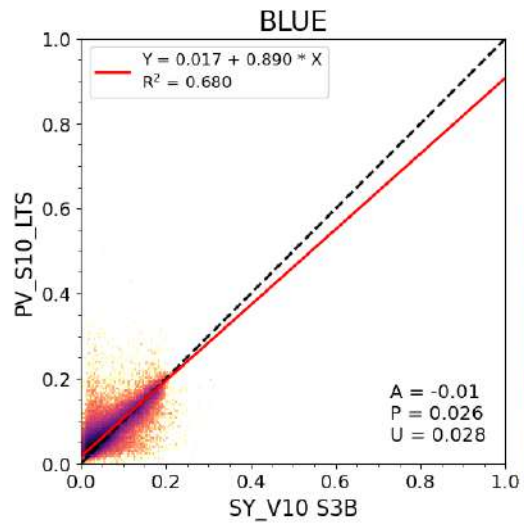


Pairwise comparison over LANDVAL2 sites (good quality pixels only). S-3 SYN V10 [Jul 2020 – Jun 2023] vs. Proba-V S10 TOC LTS [2014-2018]

S3A



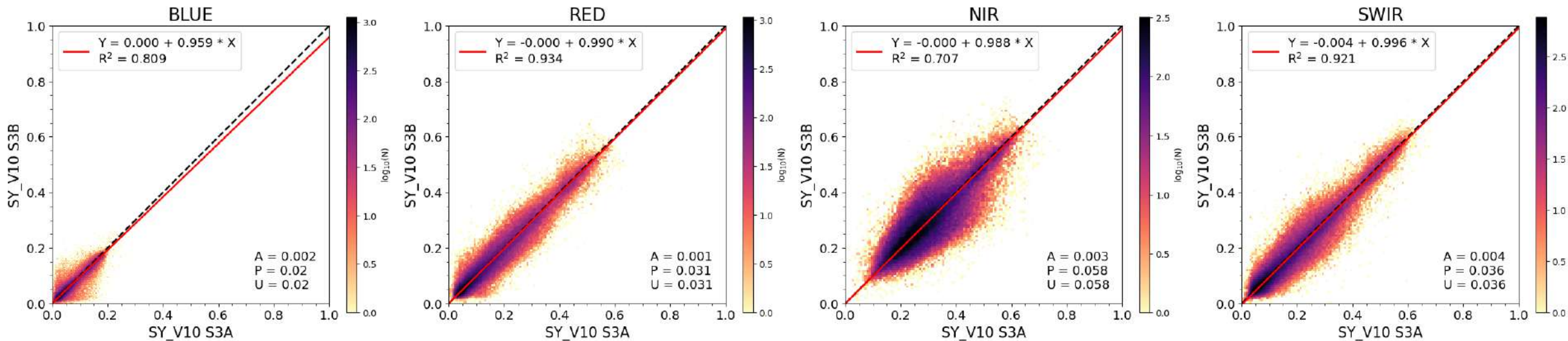
S3B



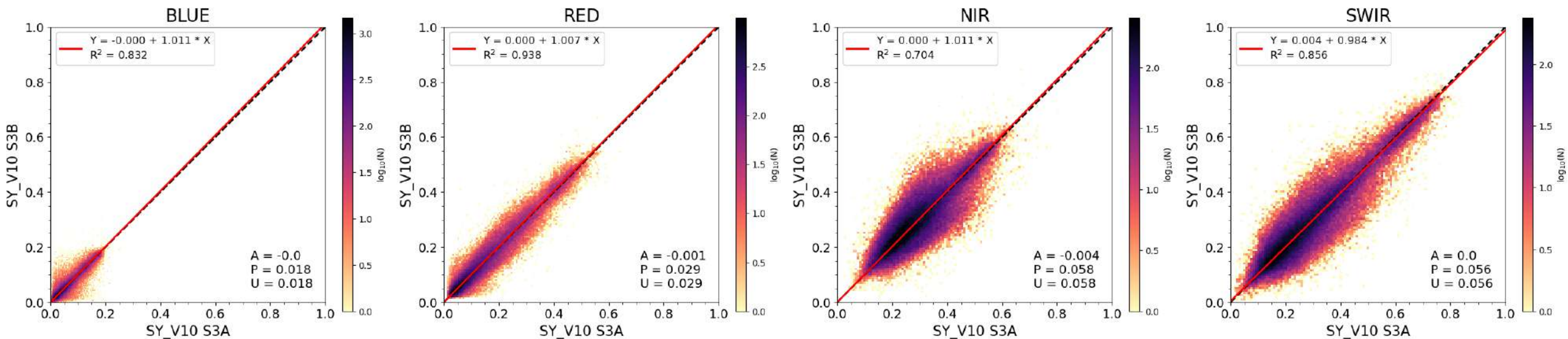
Pairwise comparison over LANDVAL2 sites (good quality pixels only). S-3 SYN V10 [Aug 2023 – Dec 2024] vs. Proba-V S10 TOC LTS [2014-2018]

July 2020 – June 2023 (N ≈ 125 10³)

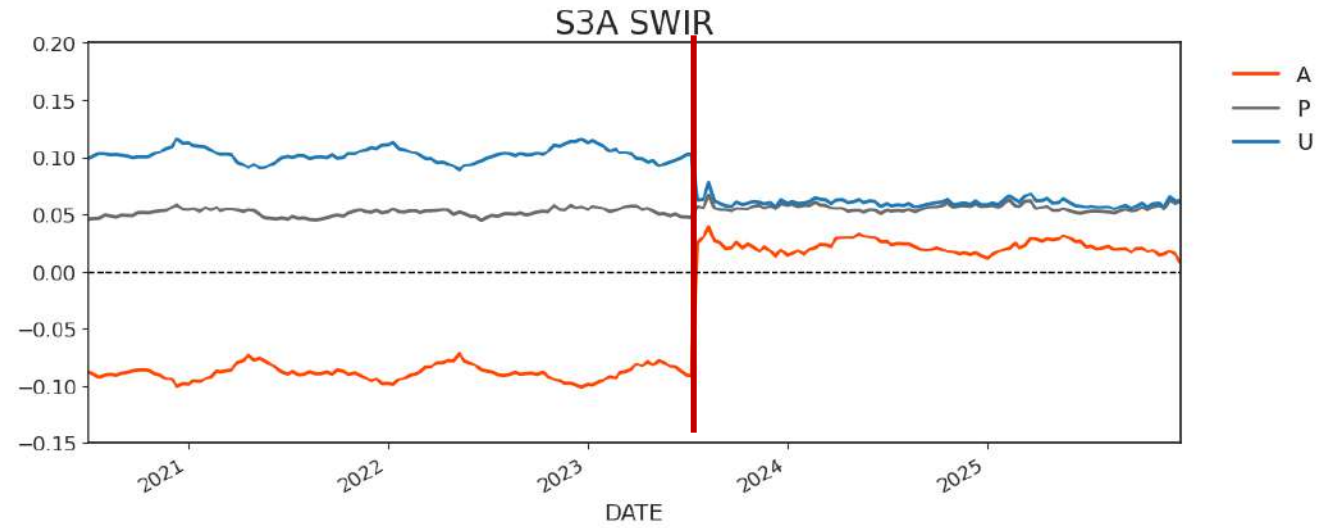
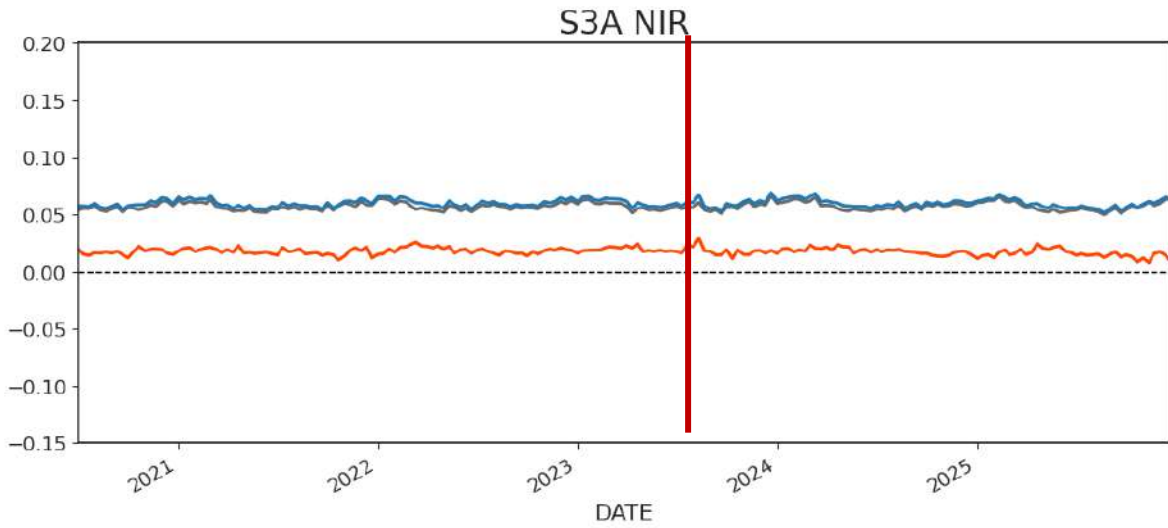
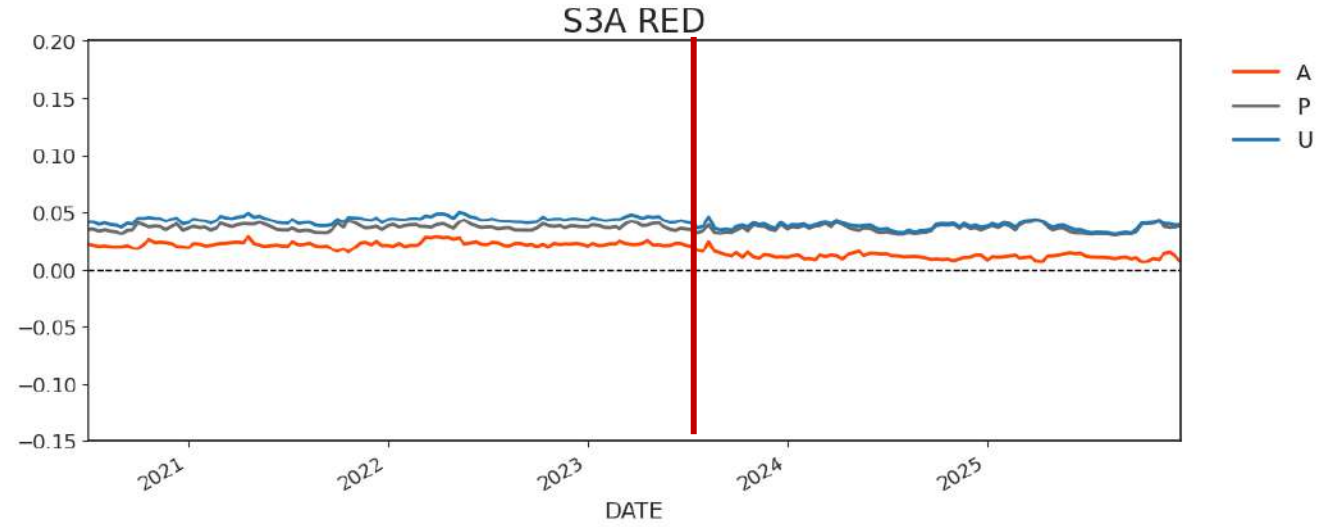
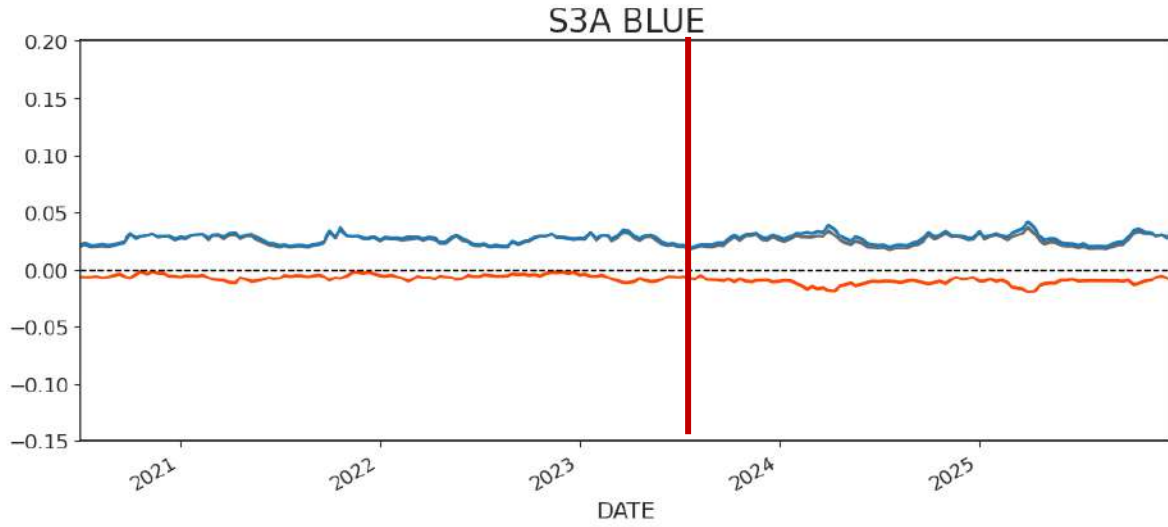
SY_V10 S3A vs S3B



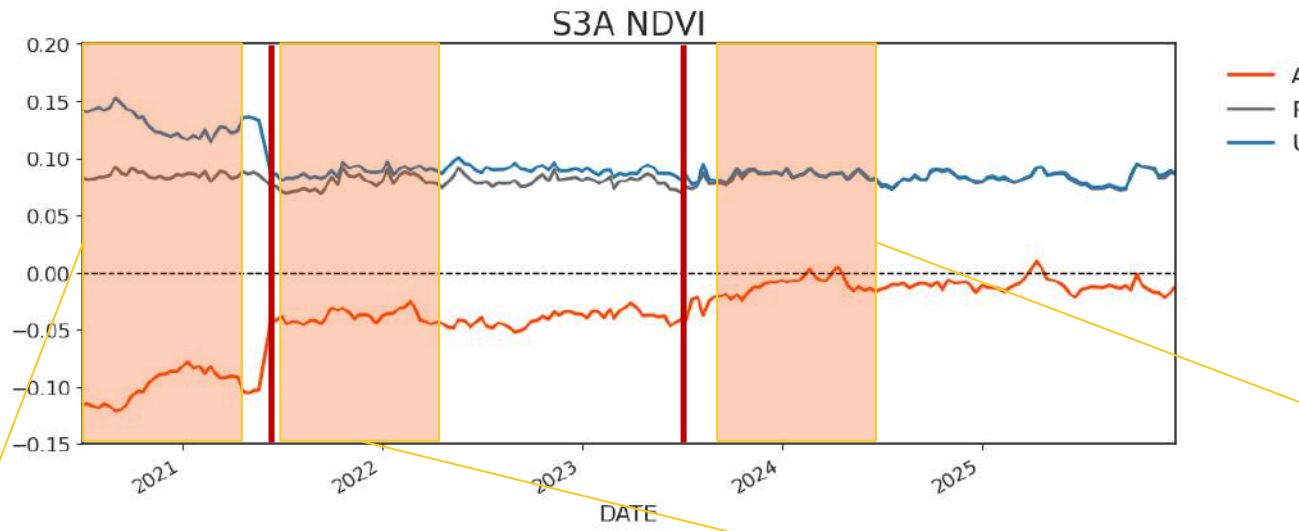
August 2023 – December 2025 (after SRF correction + bug fix + calibration adjustment) (N ≈ 61 10³)



SY_V10 vs PROBA-V S10



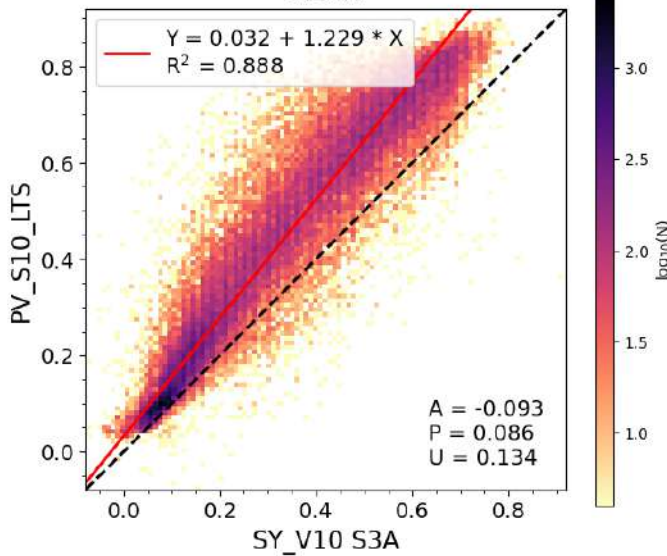
SY_V10 vs PROBA-V S10



— A
— P
— U

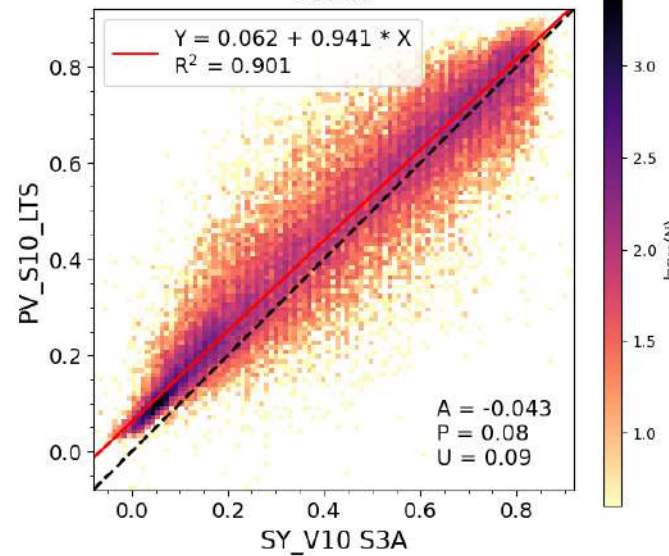
Jun 2020 – May 2021

NDVI



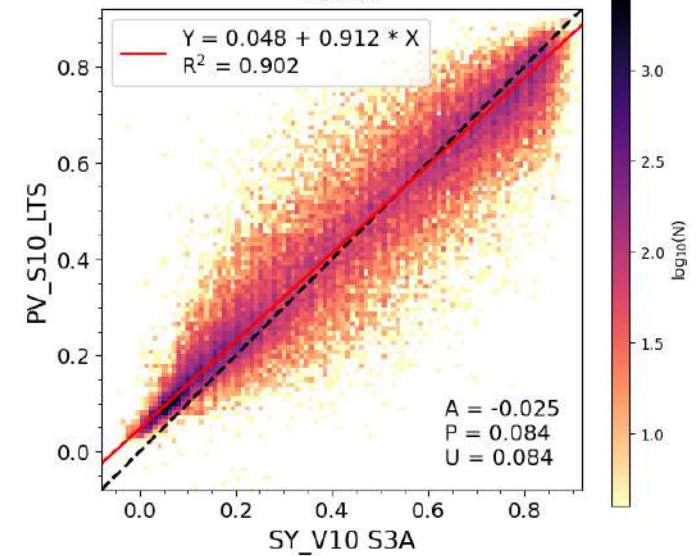
Aug 2021 – Jul 2022

NDVI



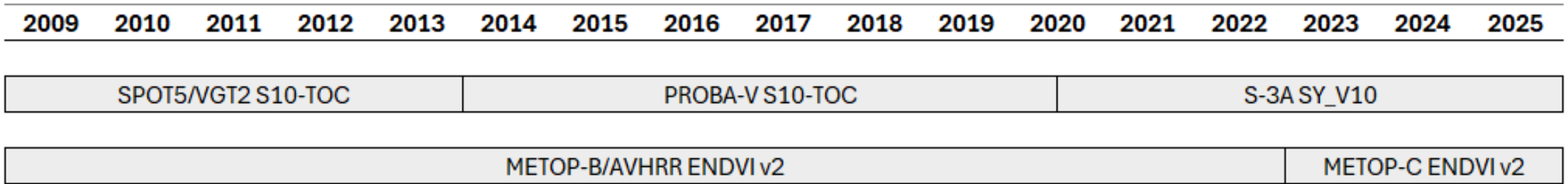
Aug 2023 – Jul 2024

NDVI

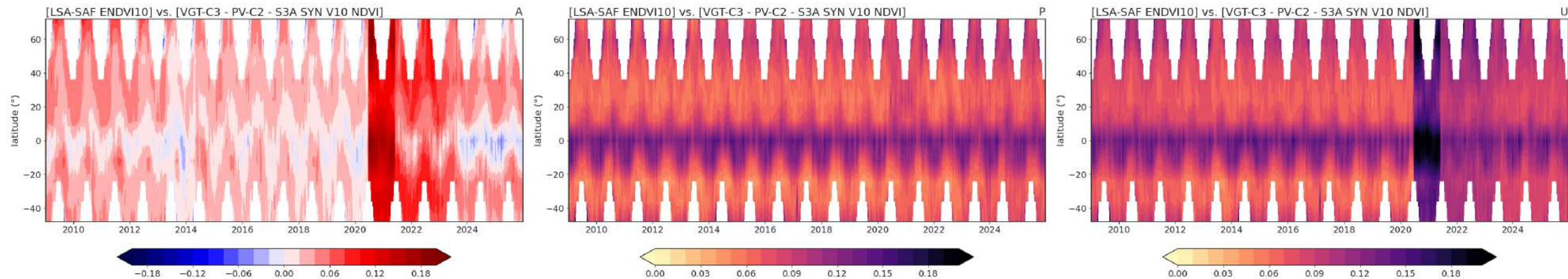


Pairwise comparison over LANDVAL2 sites (good quality pixels only). S-3 SYN V10 vs. Proba-V S10 TOC LTS [2014-2018]

Combined VGT-PV-S3 NDVI series vs external dataset



MetOp/AVHRR vs. combined series VGT2 [2009-2013] – Proba-V [2014-Jun/2020] – S3 SYN VGT [Jul/2020-Dec/2025]



Conclusions



Conclusions

and next steps

- Large improvements in SYN VGT, leading to better consistency with the PROBA-V (and SPOT/VGT) archive(s), but some quality issues remain open
 - Omission of clouds, no cloud shadow detection
 - AOD overestimation and related artefacts in surface reflectance
- Ongoing project “Global improvement of the SYN branches” – Quality assessment of SYN VGT
 - after inclusion of cloud shadow
 - after SYN AOD merge
- Important issues with reduced product completeness and erroneous products for S3B SYN VGT products since Jan/2025, seem to have been resolved
- Continuous and consistent +25 years [SPOT VGT – PROBA-V – SYN VGT] archive requires SYN VGT archive reprocessing

Thank You

+ Stay informed

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remotesensing.vito.be

+ Get in touch

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carolien.tote@vito.be