



European Union



4th SENTINEL-2

VALIDATION TEAM MEETING

15–17 March 2021 | Virtual Event

Comparison of the Copernicus Sentinel-2 L2A Core Product distributed by ESA and the Sen2Cor Toolbox ‘user-generated’ product



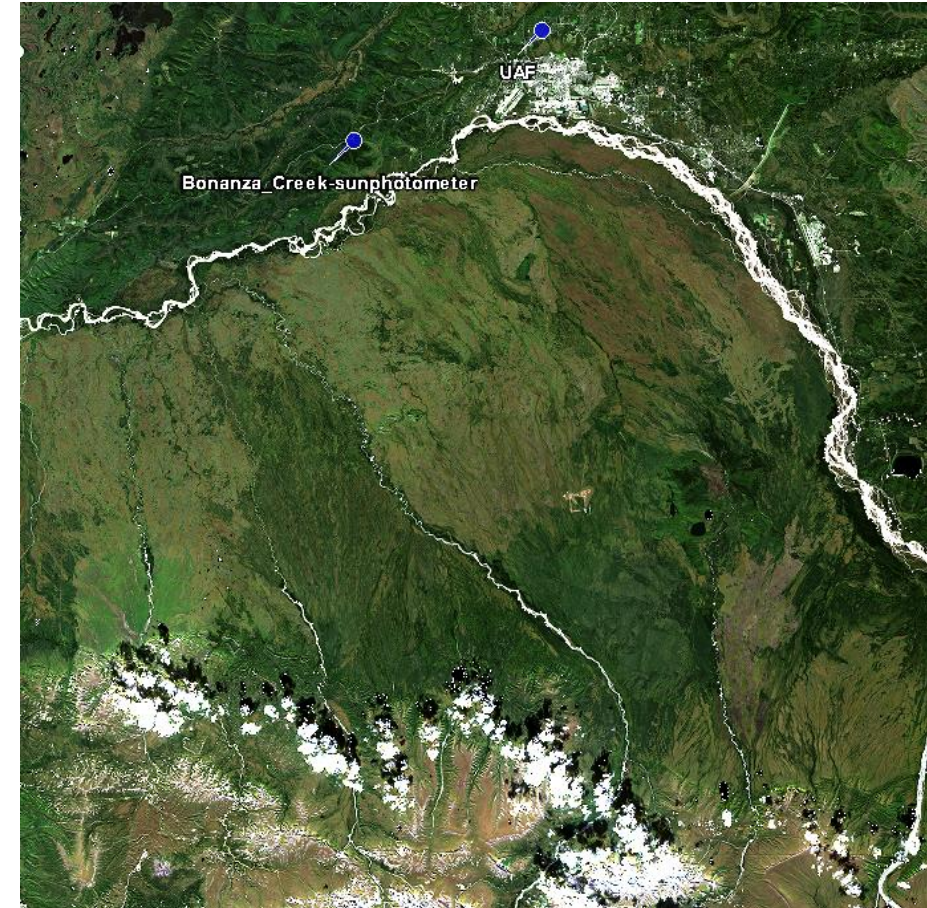
Comparison of the Copernicus Sentinel-2 L2A Core Product distributed by ESA and the Sen2Cor Toolbox 'user-generated' product



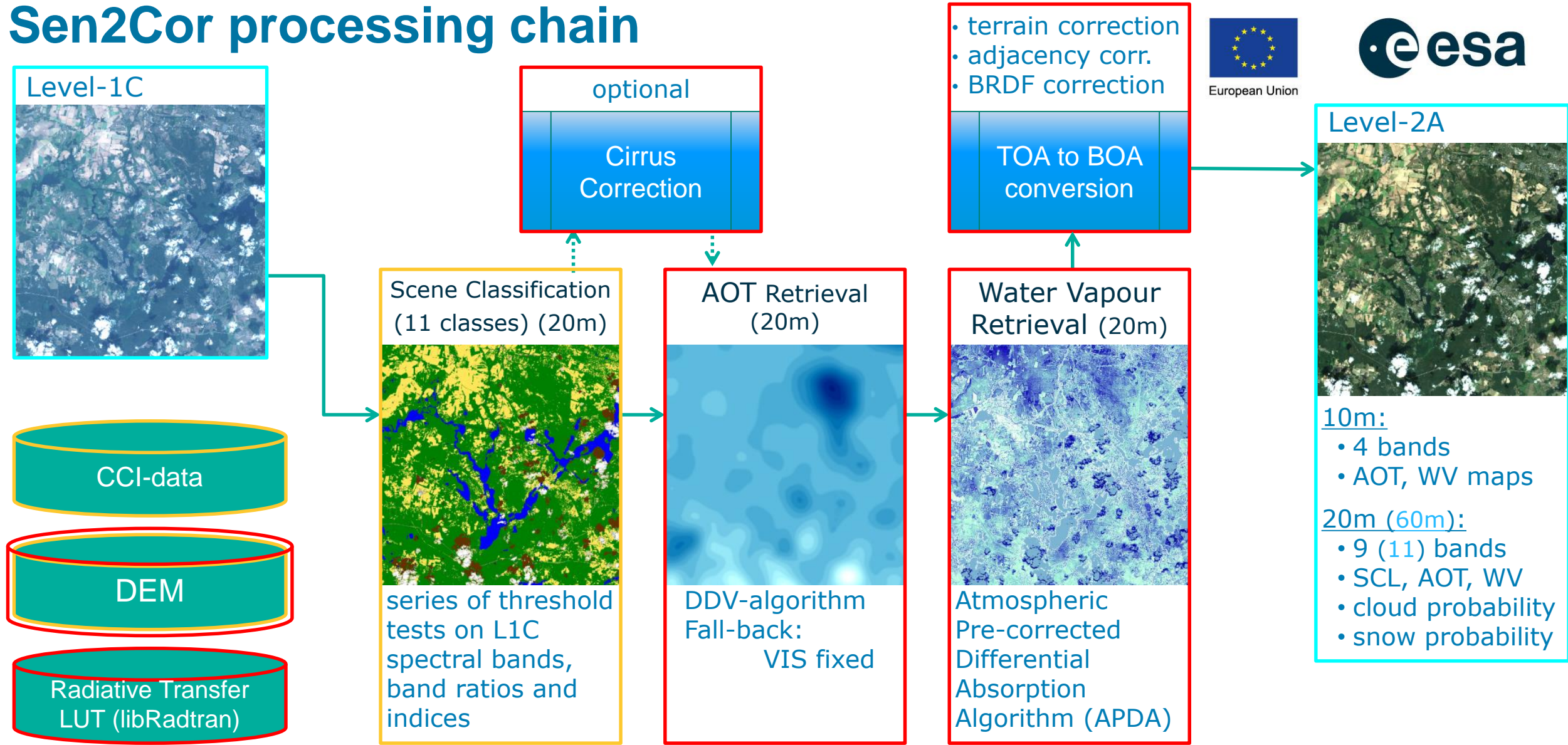
1. Sen2Cor processing chain
2. Core-product versus 'user-generated'-product
3. Sen2Cor version history
4. When rely on 'user' processing ?
5. Recommendations

External links and references:

- L2A core products available on OpenHub:
 - <https://scihub.copernicus.eu/dhus/>
- Sen2Cor for 'user' processing available at:
 - <http://step.esa.int/main/third-party-plugins-2/sen2cor/>
- Monthly Sentinel-2 L2A Data Quality Report available at:
 - <https://sentinels.copernicus.eu/documents/247904/685211/Sentinel-2-L2A-Data-Quality-Report/>



Sen2Cor processing chain



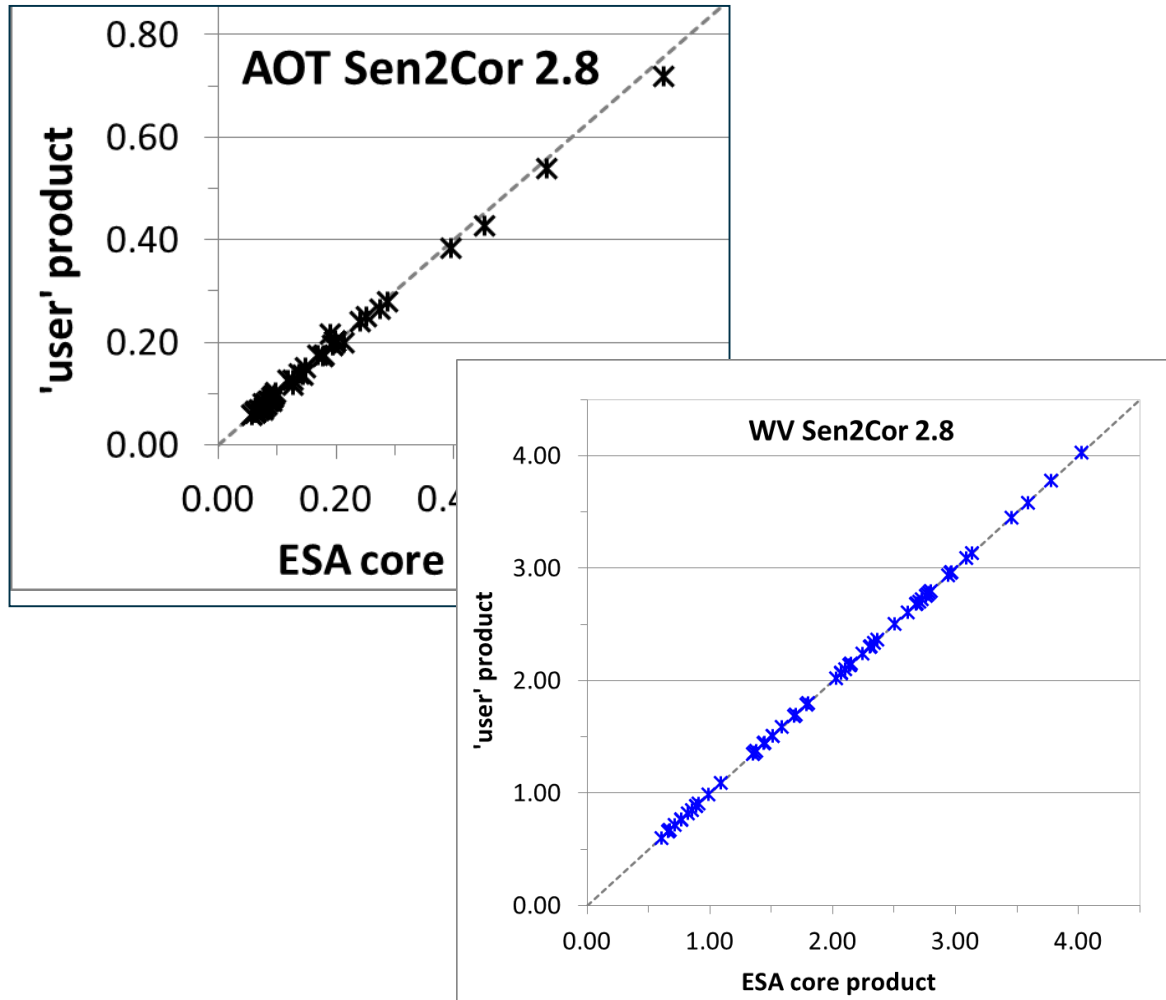
core-product versus `user-generated`-product

- http://step.esa.int/main/snap-supported-plugins/sen2cor/sen2cor_v2-8/



Category	Difference	Core products	`user-generated`-products
Processor version		New versions / updates not at the same time	
	Patches	More frequent	With new version release
Radiometry at pixel level			
	Digital Elevation Model Copernicus DEM	Planet DEM Copernicus DEM 30m/90m	SRTM resp. user DEM Copernicus DEM 90m
	JPEG2000 encoding library	Kakadu	OpenJPEG
Product Format	HTML Folder Manifest generation	Yes	No
		Same Set of Items but arranged in different order	
		by L2A packager	by Sen2Cor
Product Quality Metadata		Generated by online Quality Check (OLQC)	only copied from L1C, no specific L2A OLQC

AOT₅₅₀ and WV comparison



AOT statistics Sen2Cor2.8	core	user
MA (Median Accuracy value)	-0.00 ₁	0.00 ₀
MP (Median Precision value)	0.12 ₁	0.12 ₄
U (Uncertainty)	0.12 ₂	0.12 ₅

WV statistics Sen2Cor2.8	core	user
MA (Median Accuracy value) [cm]	-0.12 ₃	-0.12 ₃
MP (Median Precision value) [cm]	0.15 ₂	0.15 ₂
U (Uncertainty) [cm]	0.19 ₈	0.19 ₈

→ not exactly the same numbers

→ differences between core-product and 'user'-product not significant

Surface Reflectance comparison: Example Payerne

(Switzerland)



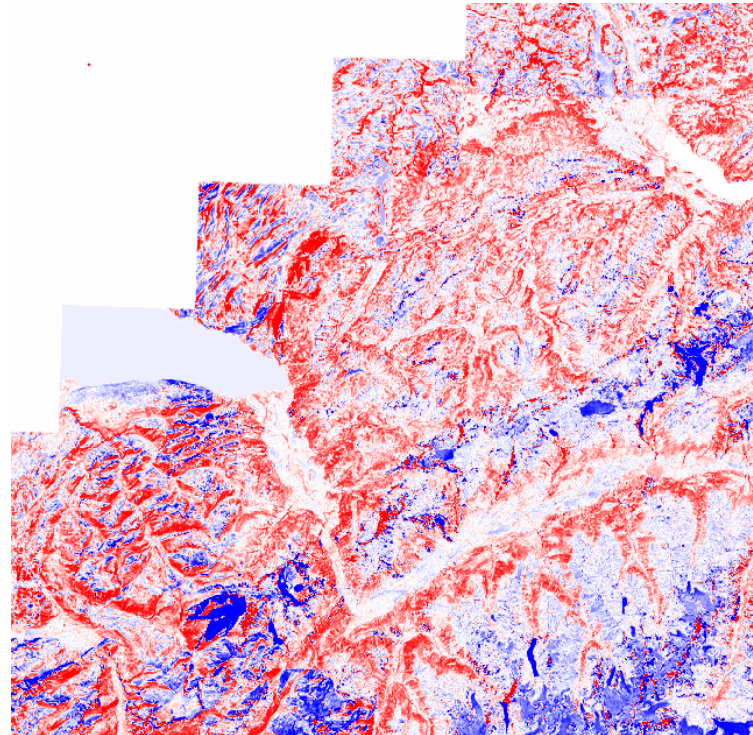
S2A

20200504

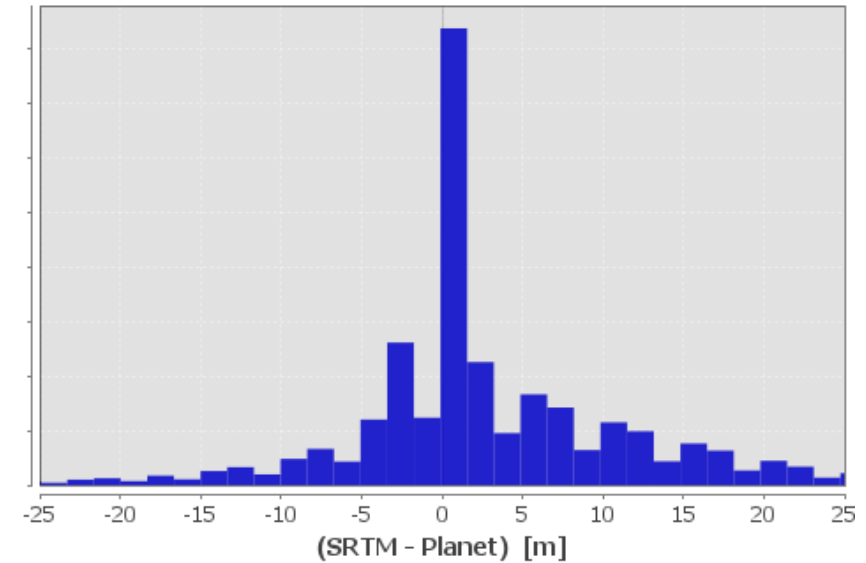
Granule: T32TLS

Elevation [365;4449] m ; variation 4084 m

SRTM – Planet DEM 90



Payerne (T32TLS)



Mean difference: $(2 \pm 16)\text{m}$

Min: -439m

Max: +409 m

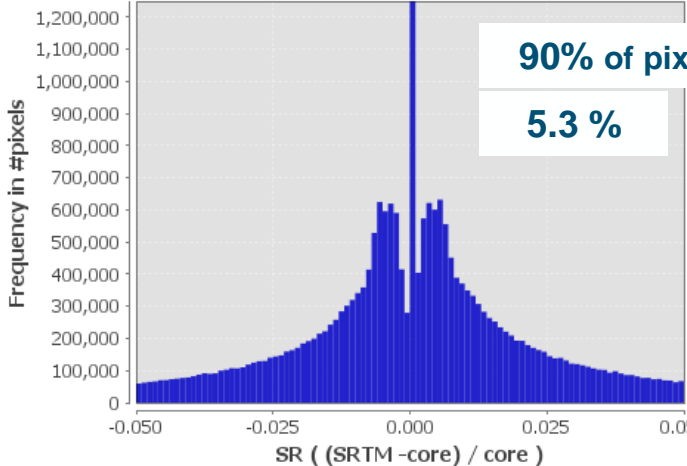
Surface Reflectance comparison: Example Payerne

(all bands at 20m spatial resolution)

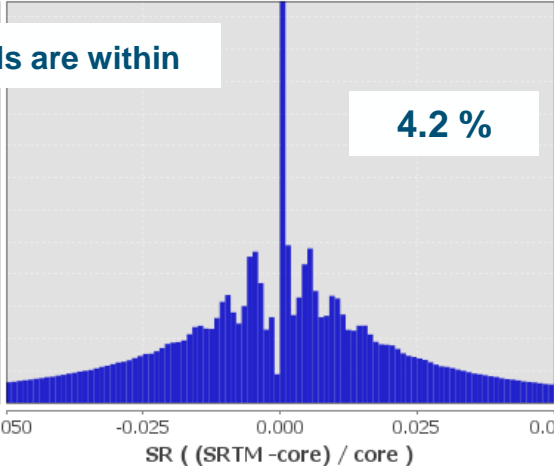
(Switzerland)



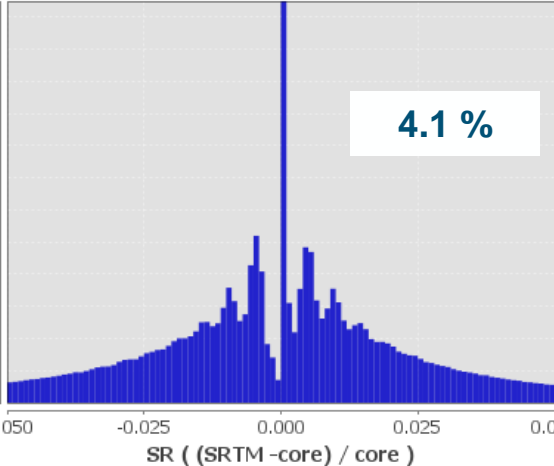
B01 with SRTM-DEM (T32TLS)



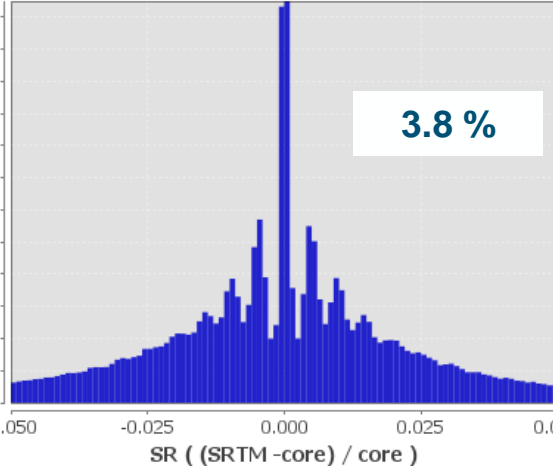
B03 with SRTM-DEM (T32TLS)



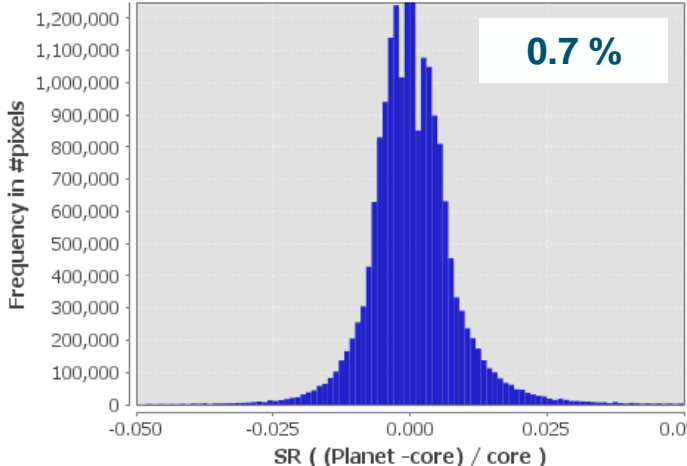
B04 with SRTM-DEM (T32TLS)



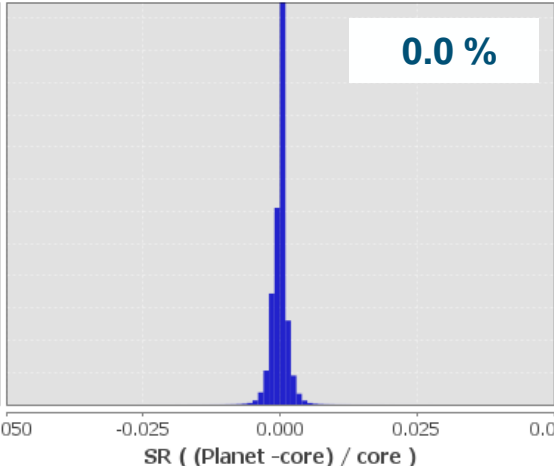
B08 with SRTM-DEM (T32TLS)



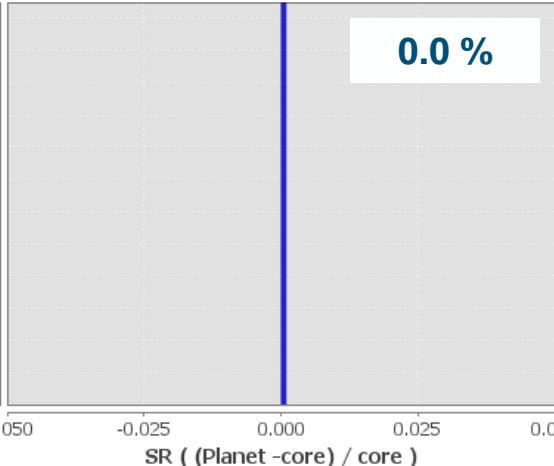
B01 with Planet_DEM90 (T32TLS)



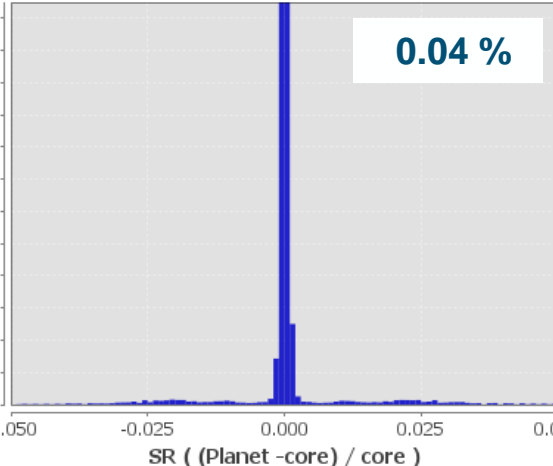
B03 with Planet_DEM90 (T32TLS)



B04 with Planet_DEM90 (T32TLS)



B08 with Planet_DEM90 (T32TLS)



CONCLUSION



ESA-L2A core product gives results equivalent to
'user-generated' product

if processed with same configuration and auxiliary data.

Always?

- There are publications in the literature reporting significant larger differences!!!

Sen2Cor version history

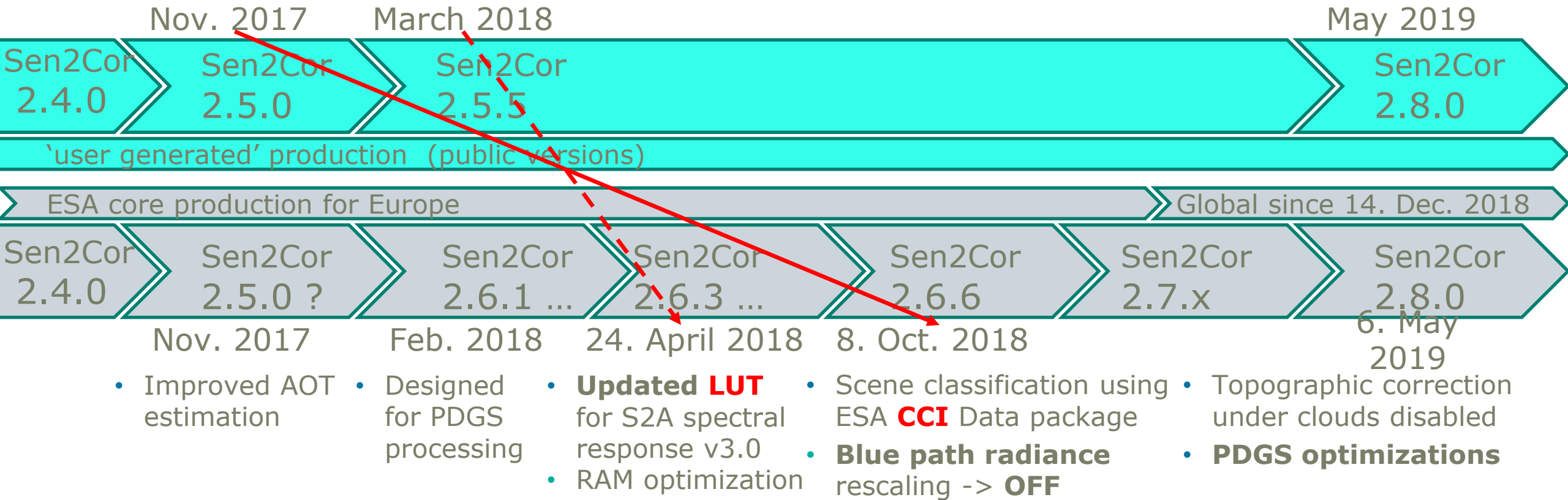
- S2-PDGS-MPC-L2A-SRN-V2.8.pdf
- Sentinel-2-L2A-Data-Quality-Report.pdf



European Union

- Merge with evolutions of core production
- Option to disable terrain correction using a DEM

- Scene classification using ESA **CCI** Data package
- Improved AOT estimation
- **Updated LUT** for S2A spectral response v3.0

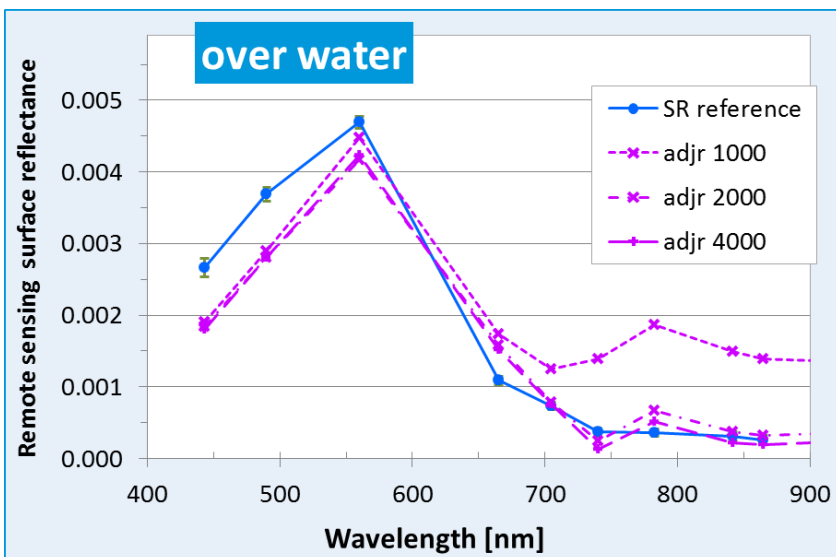


When rely on `user` processing ?

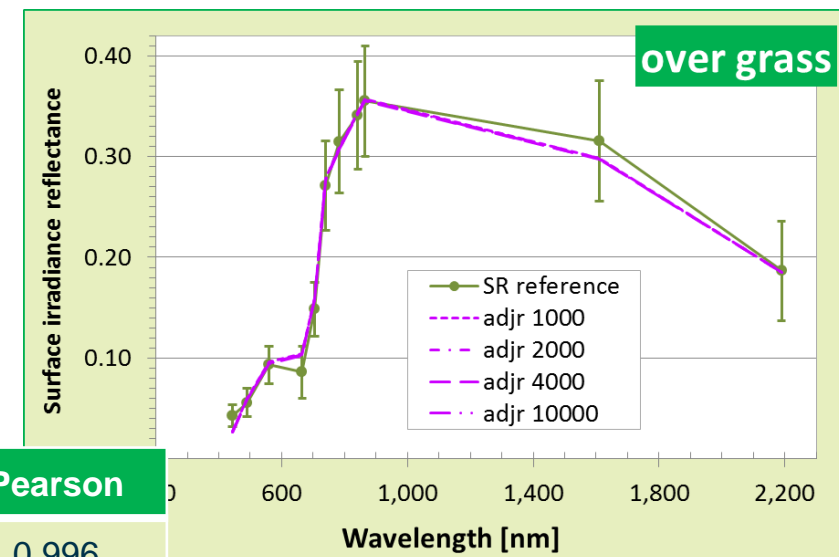


- Need of homogeneous time series
- Need of Non-default configuration (example of 'Adjacency range' [adjr] (relative to measured SR reference))

(configure in L2A_GIPP.xml)



adjr	RMSD	Pearson
1 km	0.0009	0.905
2 km	0.005	0.973
4 km	0.005	0.974
10 km	0.007	0.967



adjr	RMSD	Pearson
1 km	0.010	0.996
2 km	0.010	0.996
4 km	0.010	0.996

Recommendations



- ESA-L2A core product is equivalent to 'user-generated' product
 - core product is based on default configuration
 - 'user-generated' product gives opportunity to process with non-default configuration
 - Rely on 'user-generated' product if no sufficient homogenous time series is available in ESA archive for the time range you need.

Thanks you for your attention !



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and the Sen2Cor Toolbox 'user-generated' product



Bringfried Pflug

Bringfried.pflug@dlr.de

Jérôme Louis
Vincent Debaecker

Uwe Müller-Wilm

Carine Quang

Rosario Quirino Iannone
Ferran Gascon
Valentina Boccia