PROGRAMME OF THE EUROPEAN UNION

co-funded with esa

Presentation of Copernicus Sentinel 2 Global Mosaic Service (S2GM) - Phase 2

Jean-Sébastien Carrière [1]

Christophe Lerebourg [1]

(1) ACRI-ST, Sophia Antipolis and Toulouse, France

SENTINEL - 2 global mosaic

ACRI ST

S2GM – Table of Contents

S2GM - Phase 2

June 2022 | Septembre 2023

June 2018 — **Phase 1** — **Phase 2** — June 2026

The Sentinel-2 Global Mosaic service is funded by European Commission as part of Copernicus Global Land Service

- ➔ Provides regional and temporal composites of surface reflectance derived from the Sentinel-2 MSI sensors.
- ➔ Free of cloud surface reflectance products.
- ➔ On-demand production over specific areas of interest.

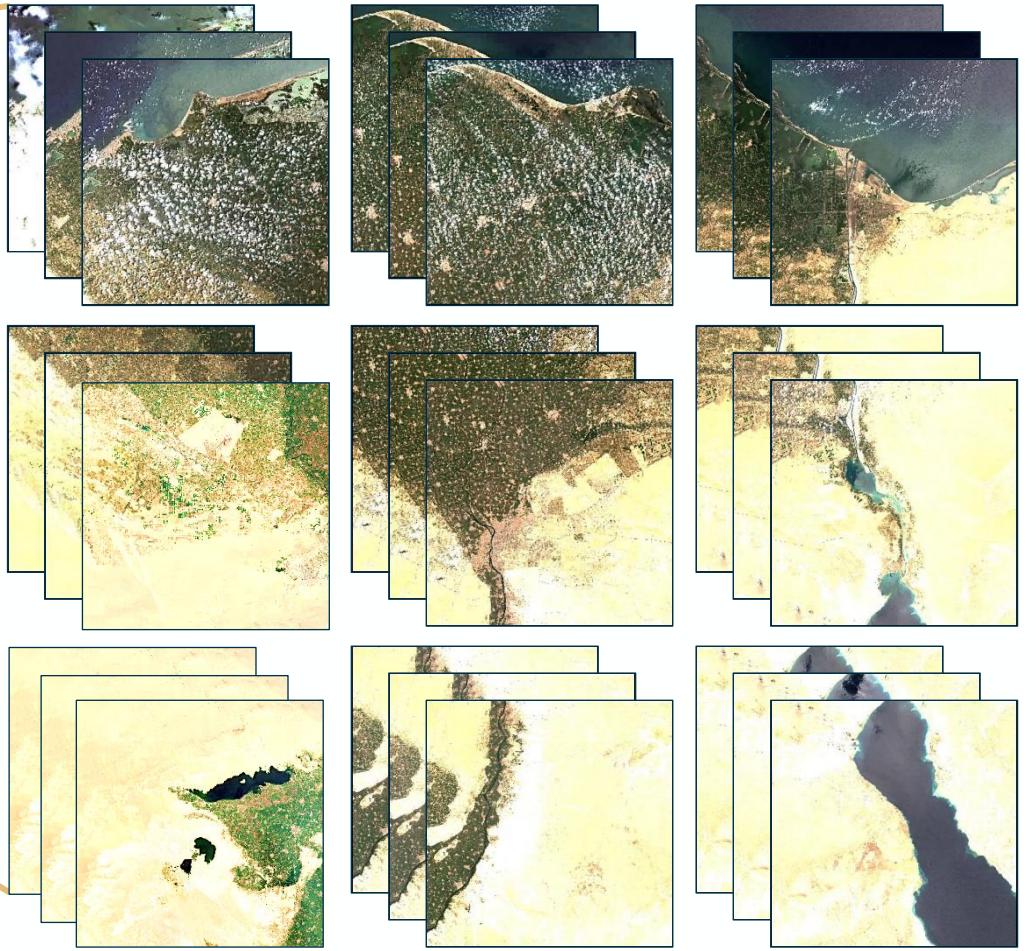
Mosaics include the best representative spectra for each pixel, ensuring consistent spectra & maintaining radiometric quality.

Partners:	ACRI-ST	https://www.acri-st.fr/en/
	AdwaisEO	https://www.adwaiseo.eu/en/home/
	LuxCarta	https://www.luxcarta.com/

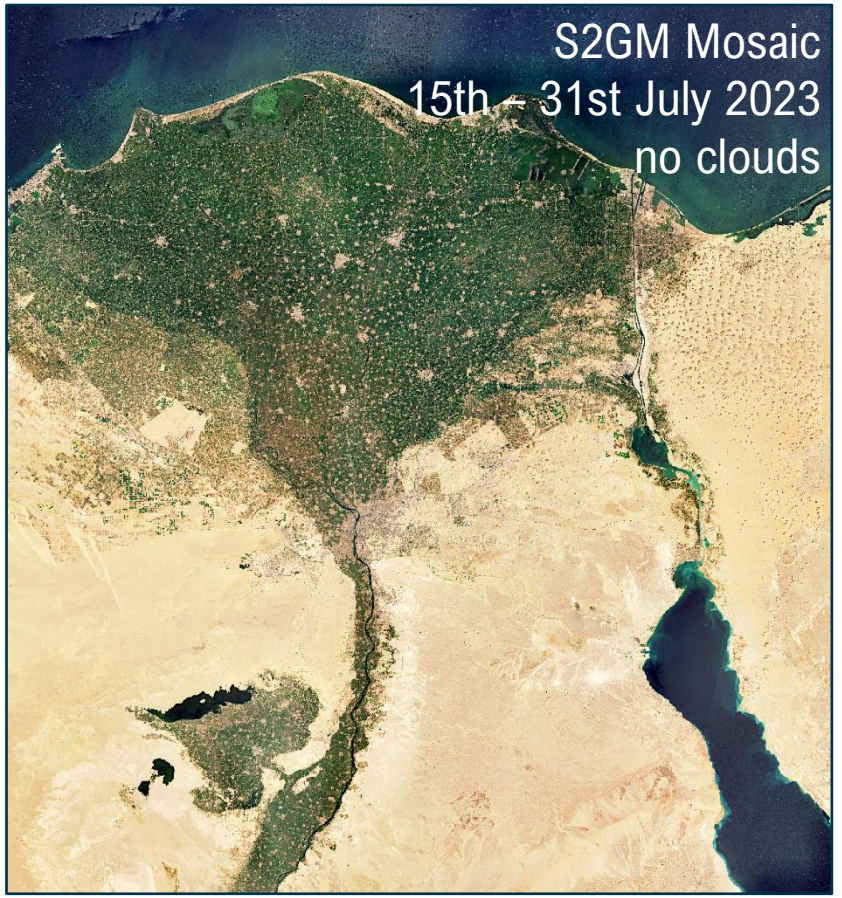
S2GM - Mosaicking

3 x 3 (lon & lat)
x 3 (request period) = 27 S2 tiles

Cairo (Egypt) 3°x3°
15th – 31st July 2023

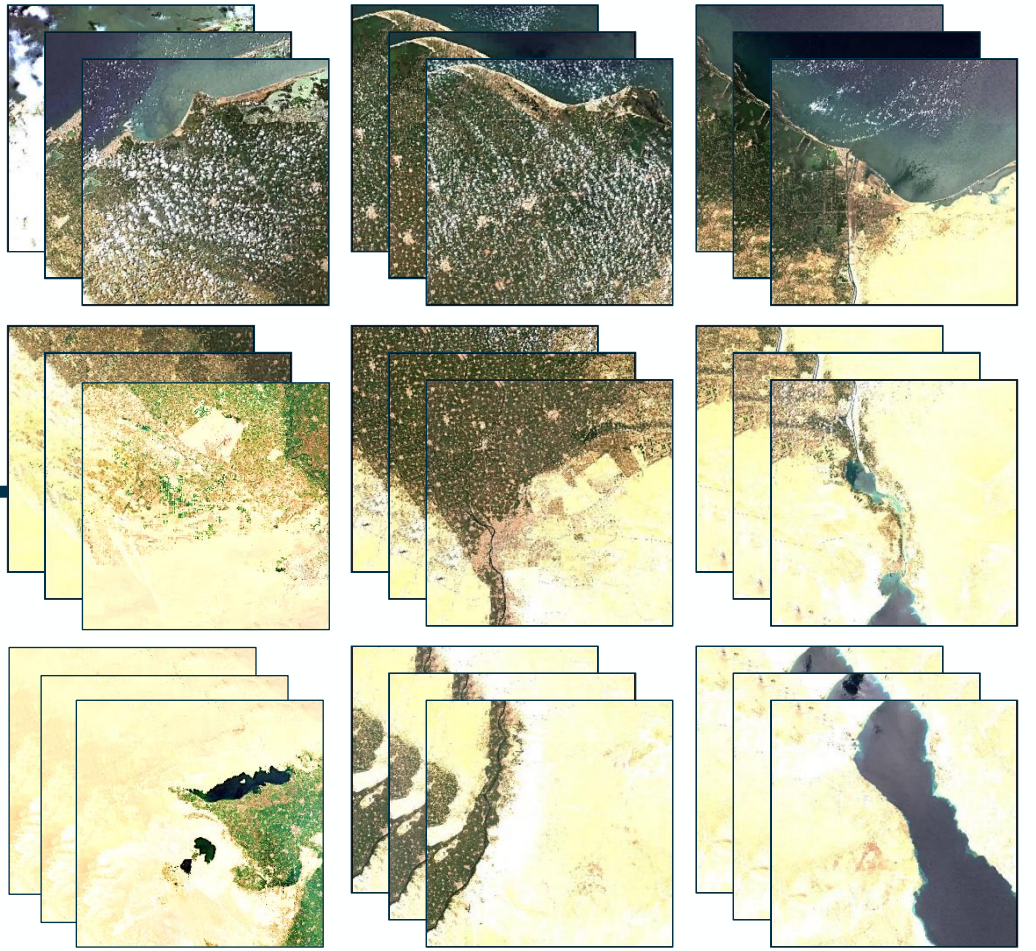


S2GM - Mosaicking

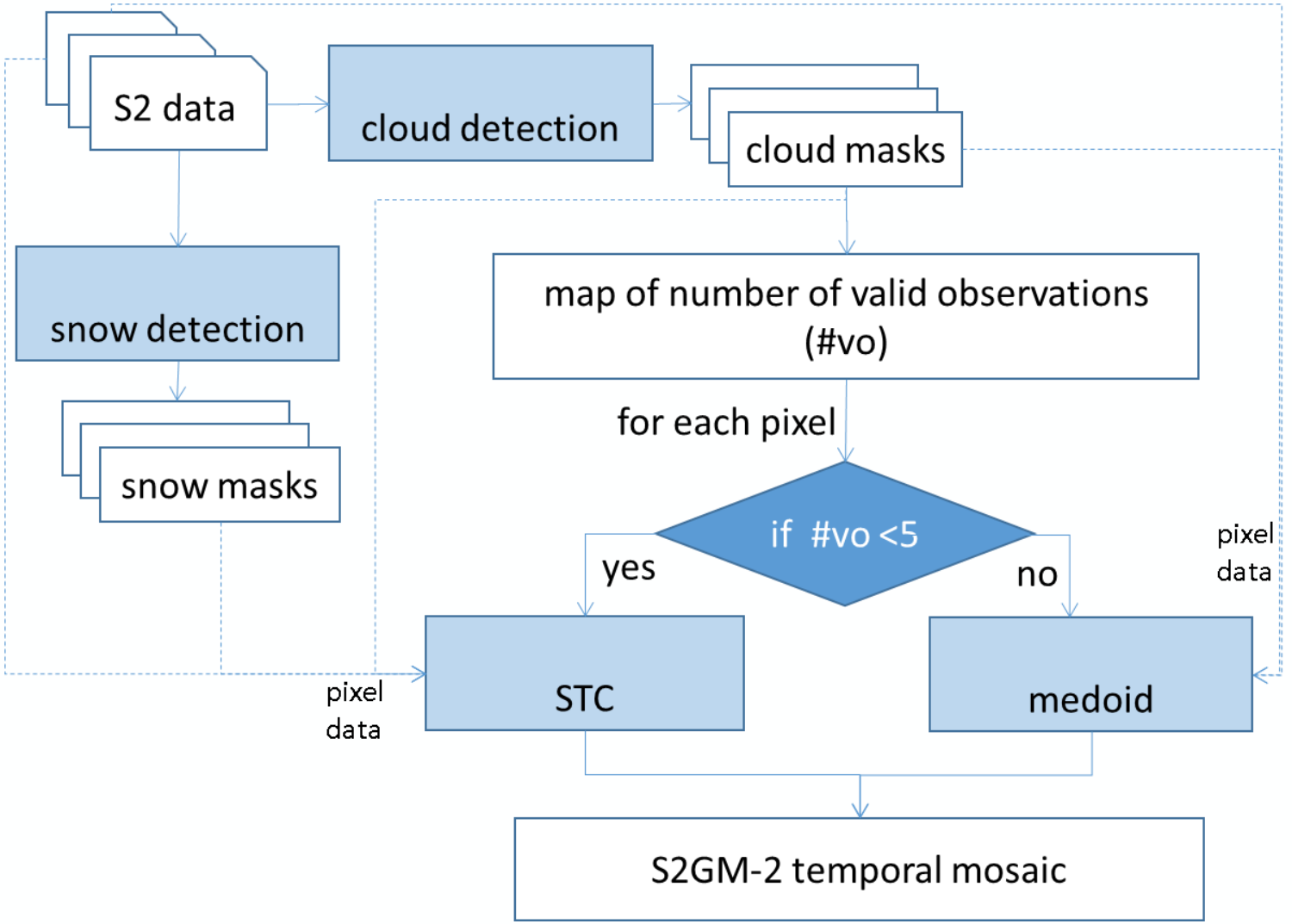


S2GM
Mosaic pipeline

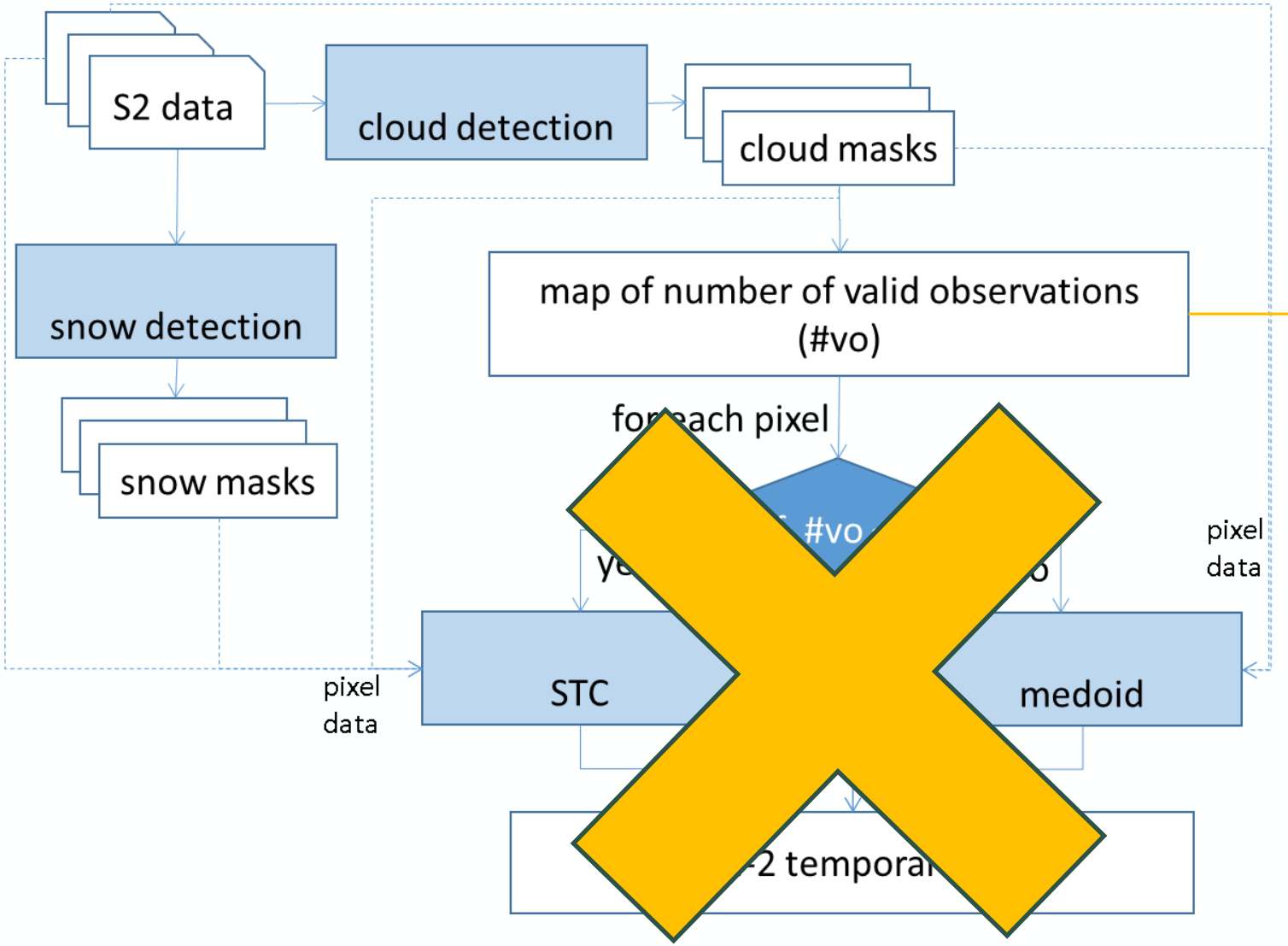
3 x 3 (lon & lat)
x 3 (request period) = 27 S2 tiles



S2GM – Temporal mosaic pipeline



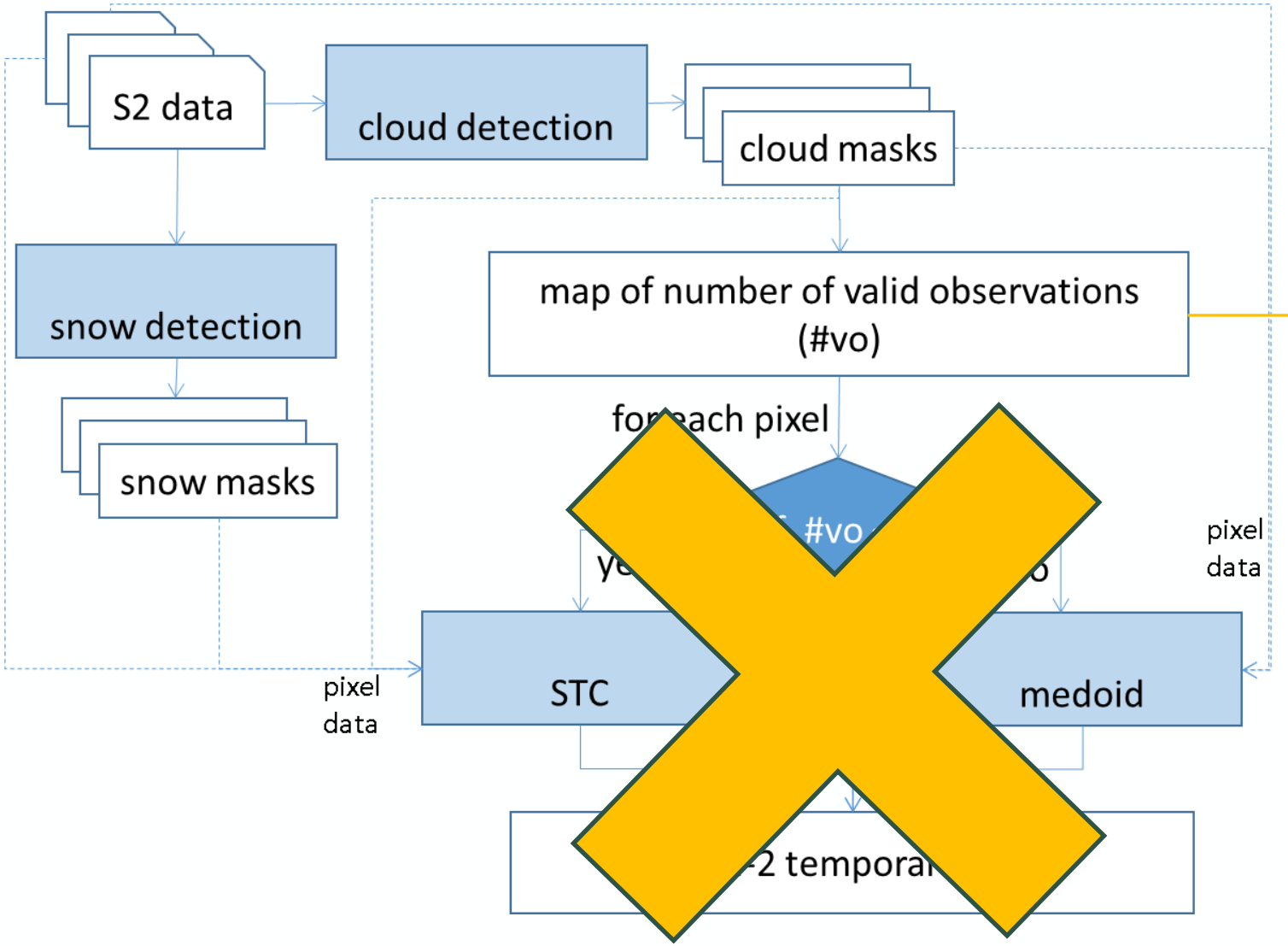
S2GM – Point Time Series (PTS) pipeline



If AOI is 1x1 or 3x3 pixels: keep all the valid observations

BRF time series over the requested time period

S2GM – BrightEarth mosaic pipeline



Only keep the least cloudy pixel

S2GM-2 BrightEarth mosaic

➔ Faster & only for RGB bands

S2GM – User Interface (UI)

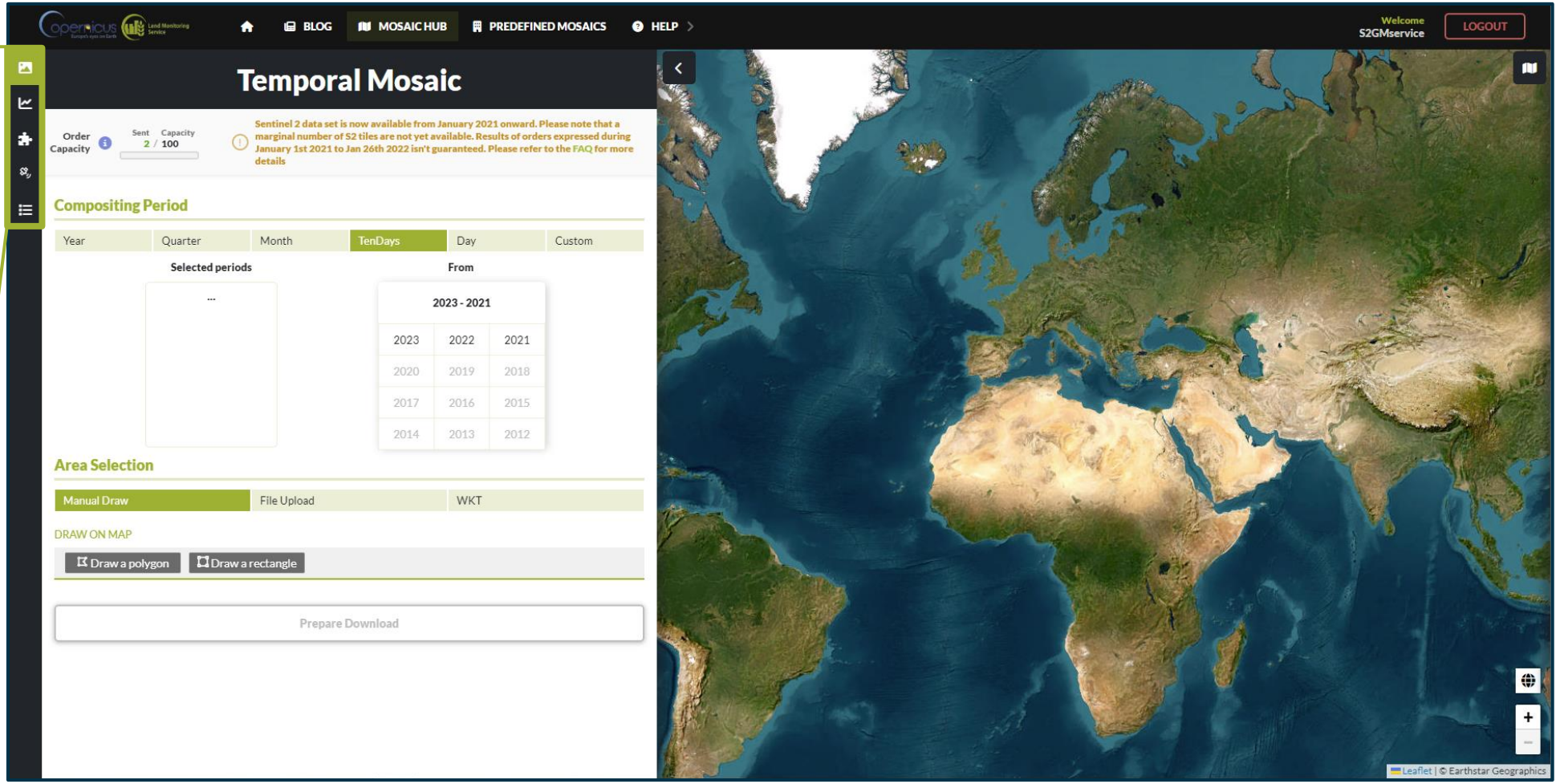
Temporal Mosaic

Time Series

BrightEarth

Predefined Mosaic

User Area



S2GM – User Interface (UI)

Everything is available through API

Time Series (PTS)

Resolution
- *10m*
- *20m*
- *30m*

Pixel selection
- *1x1*
- *3x3*

BrightEarth Mosaic

Only B02, B03 and B04
S2 bands

Temporal Mosaic

All S2 bands
Bit Depth: 8 & 16-bit
Multiple quality bands: *AOT*
Cloud & Snow confidences
View & Sun angles
Scene classifications
Medoid Quality & Source index
Number of valid observations

Image Format
- *GeoTiff*
- *JPEG200*
- *COG*
- *NetCDF*

Resolution
- *10m*
- *20m*
- *30m*

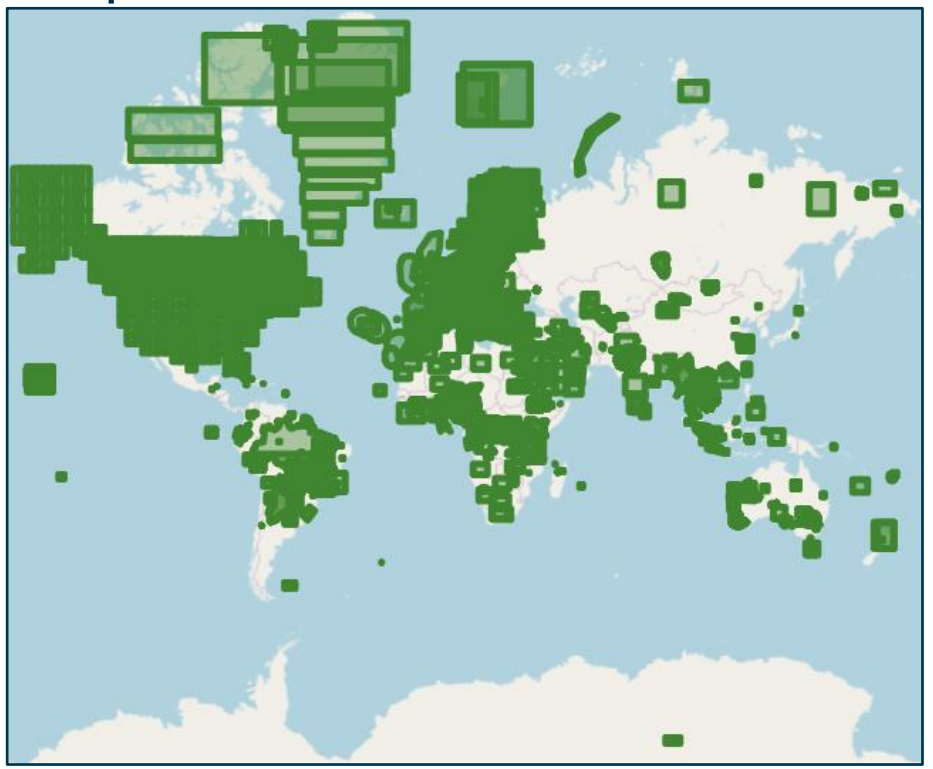
Coordinate System
- *WGS84*
- *UTM*

Cloud mask
- *ESA cloud mask*
- *BrightEarth cloud mask*

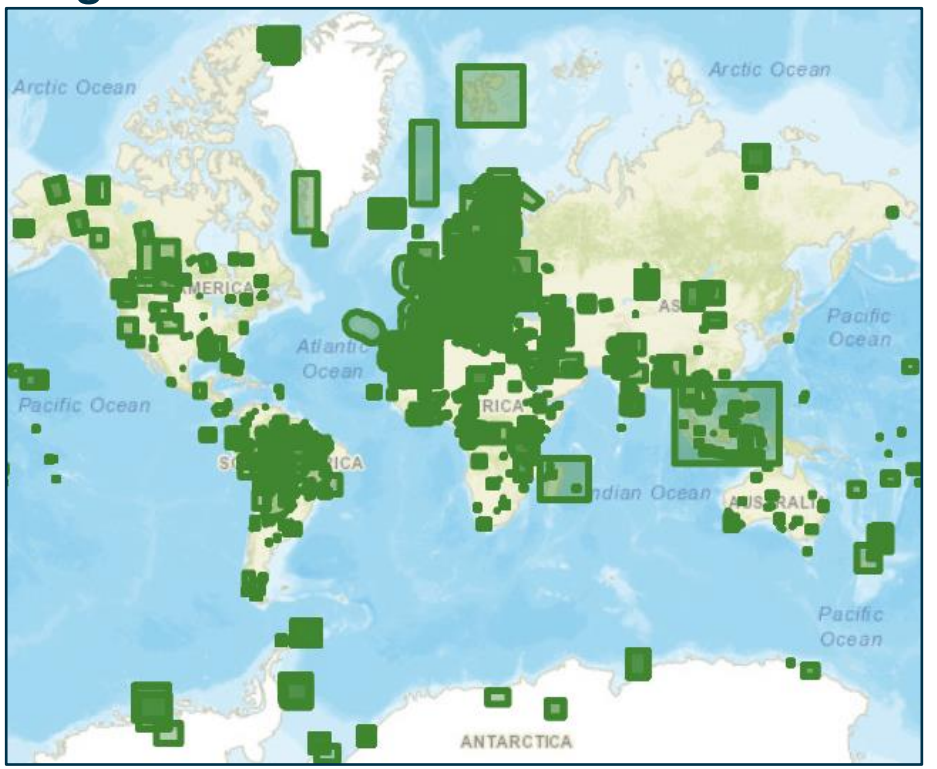
Production – Since June 2022

PROGRAMME OF THE EUROPEAN UNION
opernicus Europe's eyes on Earth
co-funded with esa

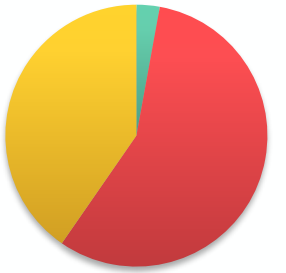
Temporal Mosaic



BrightEarth Mosaic since October 2022



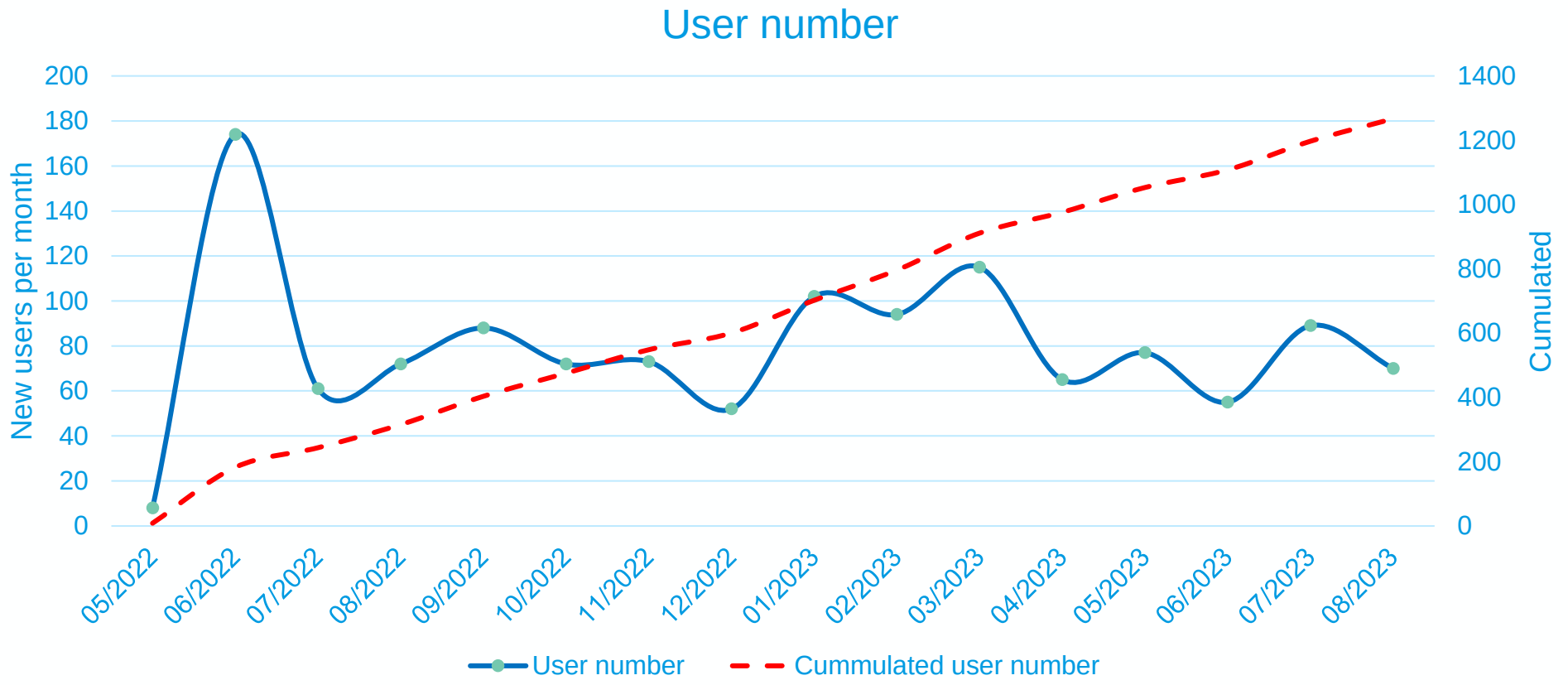
Product Type



Temporal Period

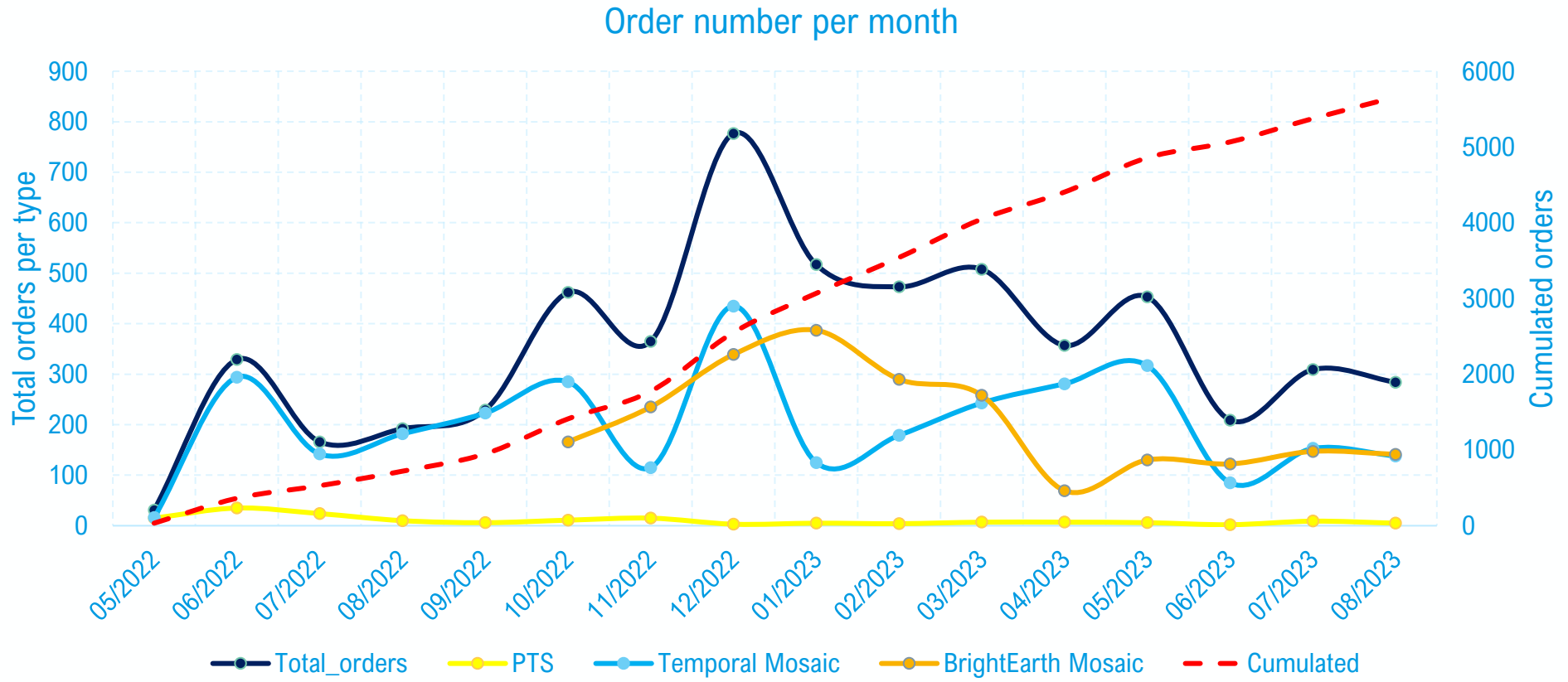
Number of users: 1279

60 to 80 new users per month



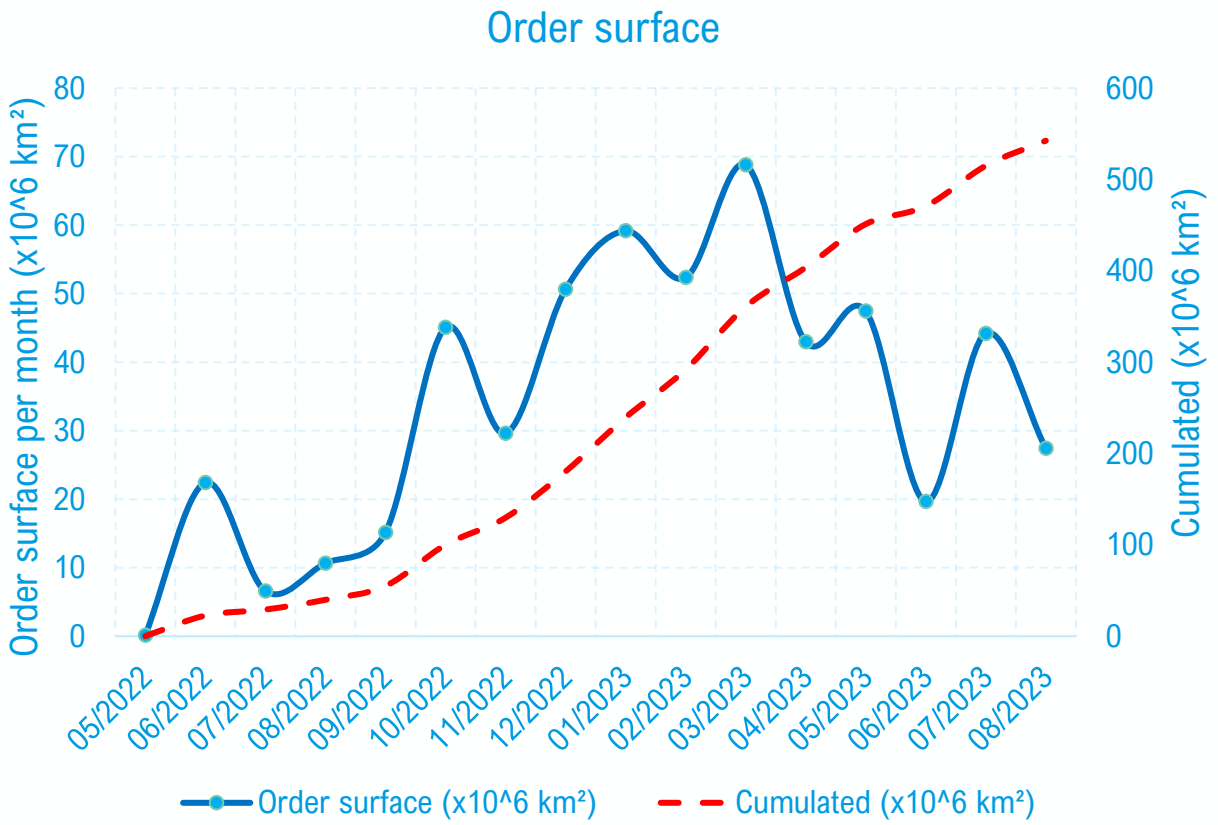
Number of orders: 5684

300 to 500 orders per month

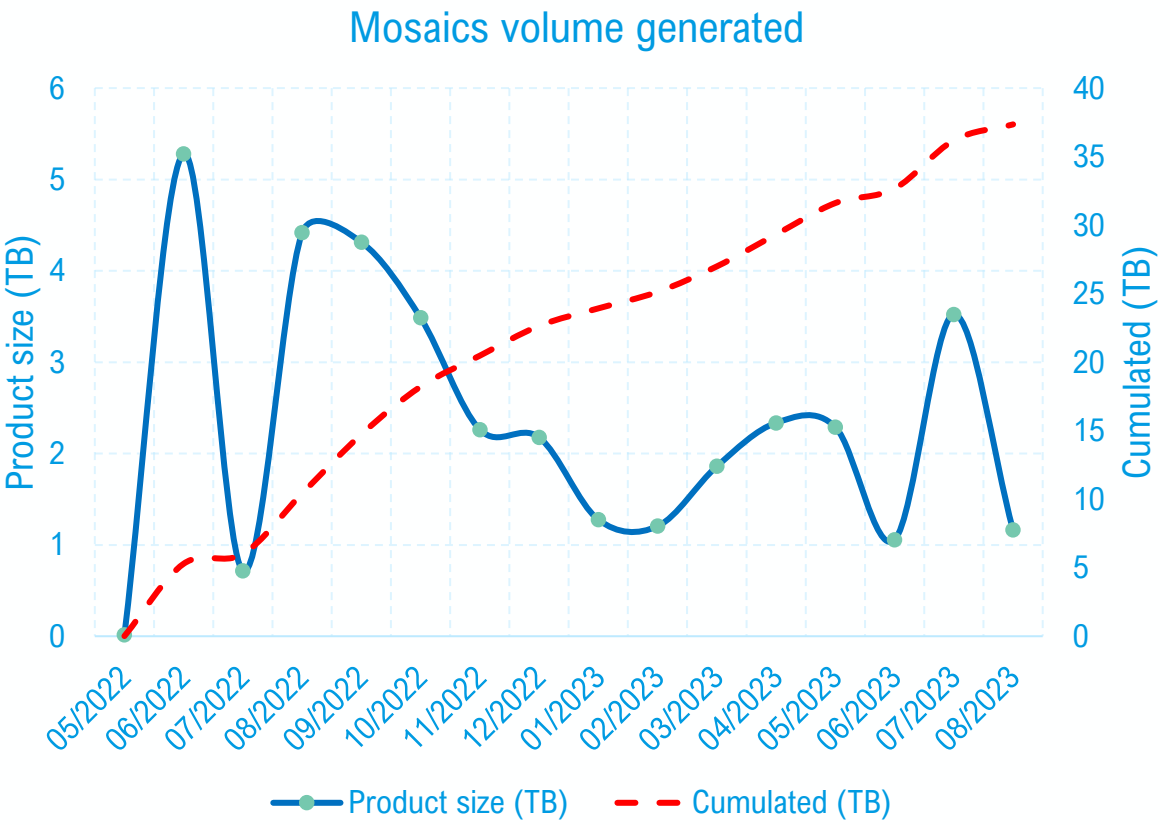


Production – Since June 2022

About 550 millions km² > Total Earth surface



Now about 2Tb per month



Sentinel-2 Mosaic over Finland

Imagery / Base Maps / Earth Cover

2017 | Finland | The Finnish Meteorological Institute

The Finnish Meteorological Institute is using Sentinel-2 Global Mosaic Service to produce dekad mosaics shortly after the last day has been imaged. The mosaics are meant as general purpose information and are for example being used in a **pilot service for forest damage assessment after storms**.

PROGRAMME OF THE EUROPEAN UNION
opernicus Europe's eyes on Earth
co-funded with esa

Sentinel-2 Mosaic over Bordeaux

Imagery / Base Maps / Earth Cover

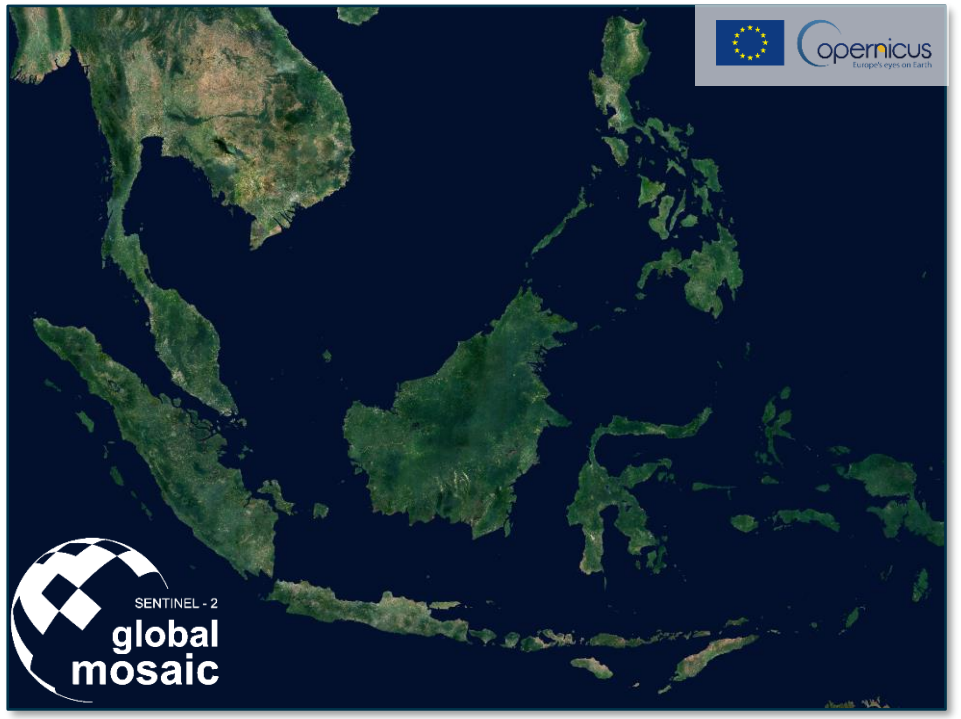
2022 | South West France | U-Space

U-Space is responsible for the feasibility study of certain Earth observation missions, as well as system engineering for satellite missions.

In this context, we are testing various data processing algorithms, whether on the ground or on board, and we want to **evaluate** these **algorithms using simulations of images that our instruments would capture**.

For this reason, we are using Earth images with a ground spatial resolution of around 10 meters as input data, exceeding the capabilities of our current instruments.

Sentinel-2 Mosaic over South-East Asia



Imagery / Base Maps / Earth Cover

2023 | Australia | Geoscience Australia

The media team of Geoscience Australia was in search of a high-quality satellite image showcasing Southeast Asia, which they intended to use for publicity reasons.

Range ➔ latitude : 42°
➔ longitude : 32°

Sentinel-2 Mosaic over Canada

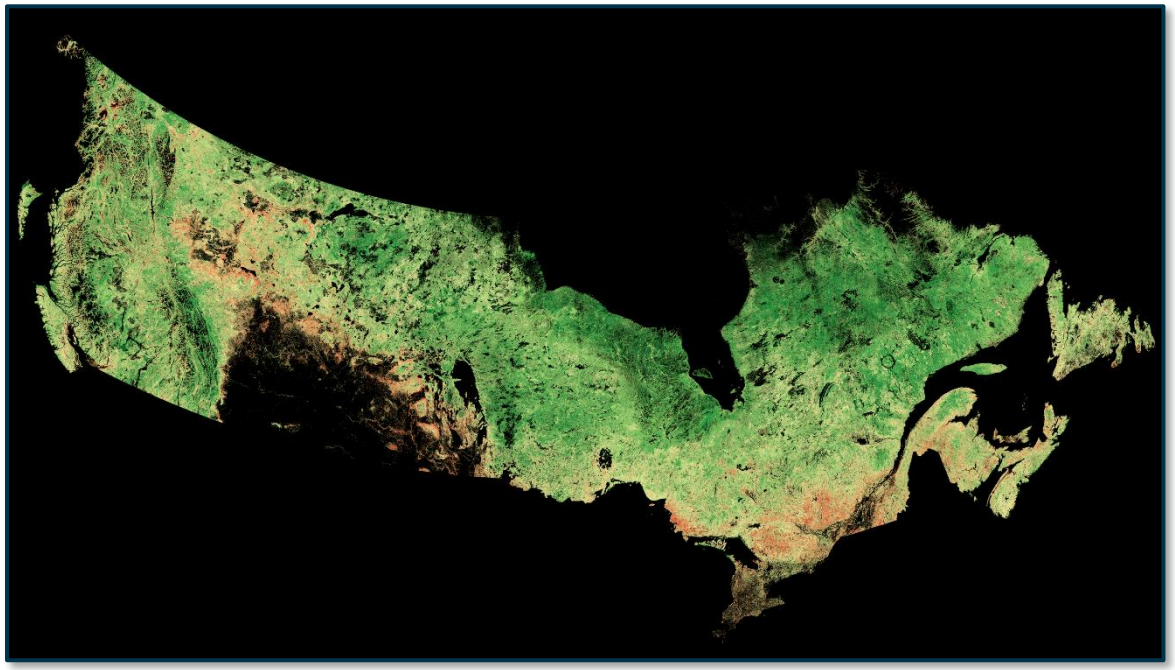
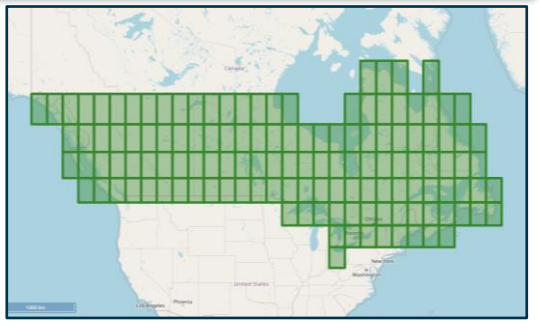


Image by FRMG Inc., Canada.



Imagery / Base Maps / Earth Cover

2022 | Canada | First Ressources Management Group (FRMG) Inc.

FRMG specializes in the production of cost-effective, accurate, near real-time forest information using satellite images, lidar and other geospatial data.

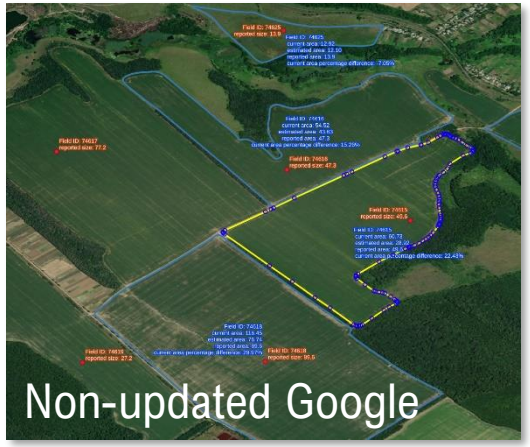
We succeeded in mapping **the percentage of coniferous trees across Canada at a 20 m resolution** using S2GM temporal mosaic images. Our algorithm was trained to estimate the percentage of conifer trees using more than 40 000 field plots and their corresponding S2GM values.

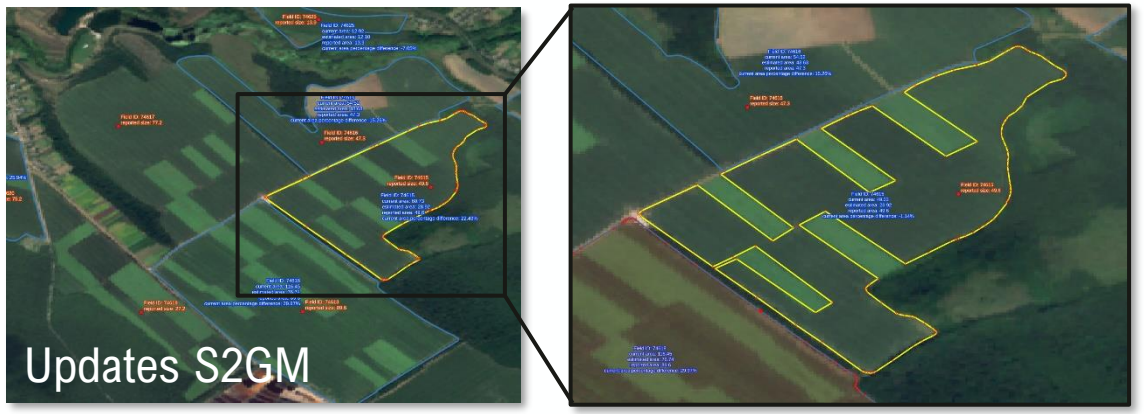
The quality of the bottom of atmosphere reflectance values of S2GM greatly facilitated the calibration of such a large model.

The resulting map can be used in a large array of applications, ranging from forest management and planning to wildfire risk modeling.

PROGRAMME OF THE EUROPEAN UNION
opernicus Europe's eyes on Earth
co-funded with esa

Sentinel-2 Mosaic over Croplands





Imagery / Base Maps / Earth Cover

2023 | Copenhagen | Agreena

Agreena uses **updated** RGB mosaics for specific AOIs from S2GM to **improve cropland field boundary delineation** for Agreena MRV products.

Farmer cropland field boundaries are a key product for Agreena's farmer plateform and for training Agreena's machine learning models based on satellite imagery.

Automatically created field boundaries need sometimes a visual quality assessment to finetune the boundary delineation and align with the field area size reported by the farmer.

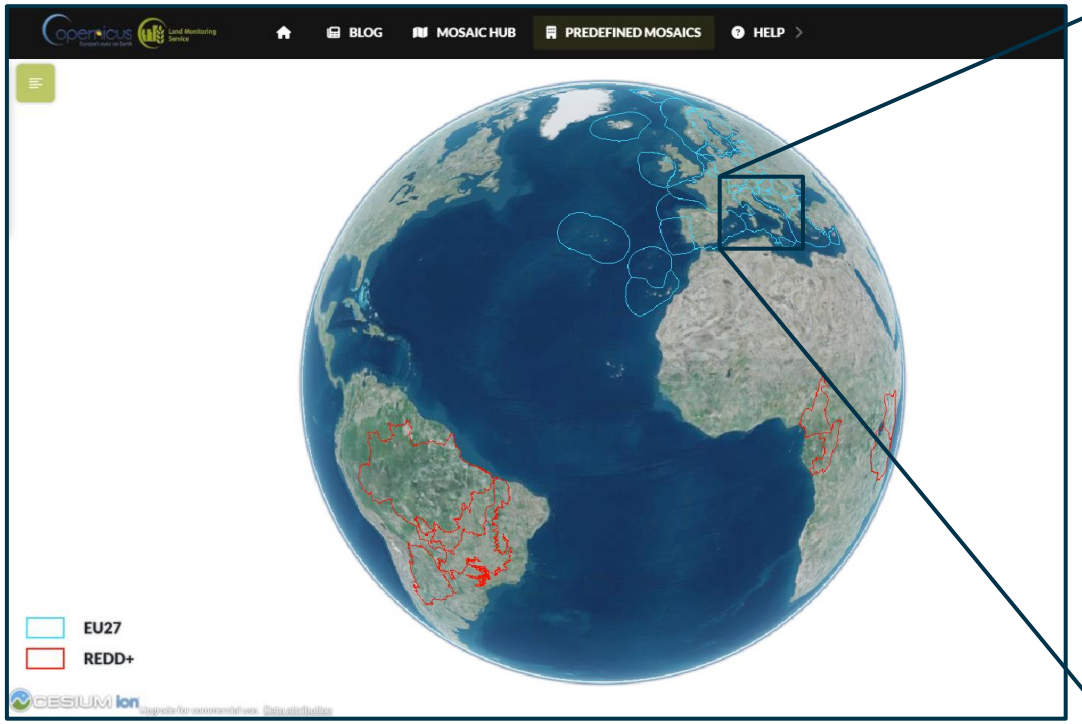
High resolution base maps like Google Maps or Bing Maps can be outdated and are not always suitable to correct field boundaries.

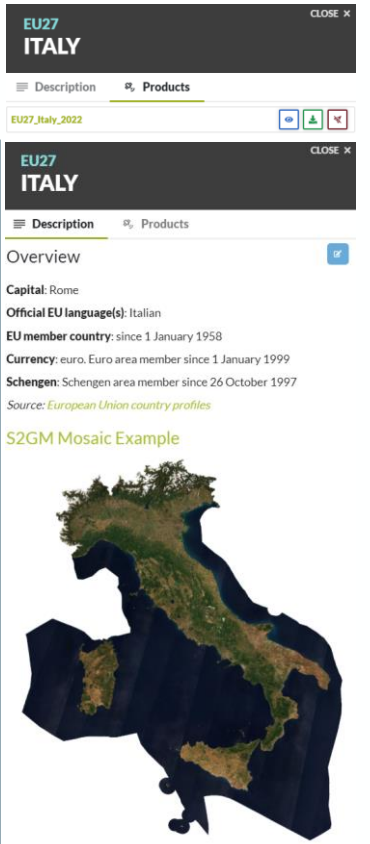
S2GM provides a **flexible and customizable** environment to create for you AOI and for your desired imaging period **updated**, cloud free RGB mosaics derived from Sentinel 2 with **good color calibration and optimized pixel selection**.

S2GM – Predefined Mosaic

Predefined mosaics are already released for REDD+ and EU27 countries

Reducing Emissions from Deforestation and Forest Degradation (REDD+) is a United Nations initiative which aims to mitigate climate change by enhancing forest management in developing nations.
The '+' represents the additional aspects of forest landscape restoration and the promotion of sustainable forest management.





S2GM – Available in October 2023

Mosaics from an alternative level2 processor as test products.

UCLC
Consulting with Experts

Sensor Independent Atmospheric correction (SIAC)

➔ BRF + **per pixel uncertainties**

➔ **NBAR + per pixel uncertainties**

➔ SIAC cloud mask

https://github.com/MarcYin/SIAC

Yin, F., Lewis, P. E., and Gómez-Dans, J. L.: Bayesian atmospheric correction over land: Sentinel-2/MSI and Landsat 8/OLI, Geosci. Model Dev., 15, 7933–7976, https://doi.org/10.5194/gmd-15-7933-2022, 2022.

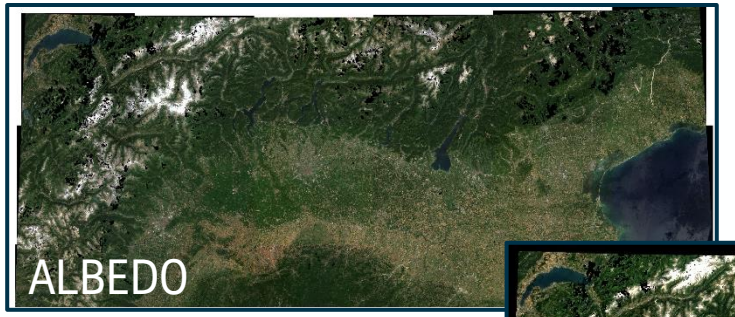
Albedo product + uncertainties using HR Albedo procedure

https://github.com/RS-UCL/hr-albedo/

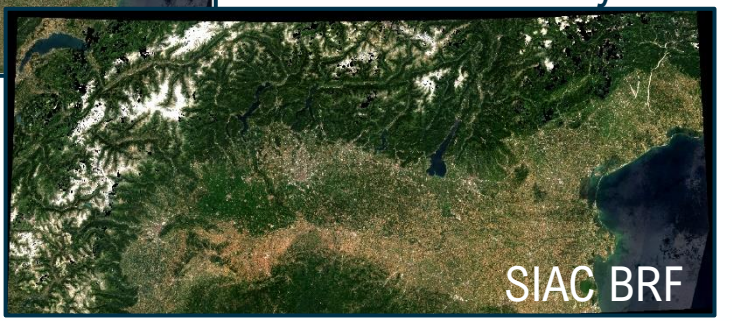
http://www.hr-albedo.org/

iLab Follow on will be **LAI+unc** and **FAPAR+unc** (Q4 2024).

SIAC BRF on T31TFJ (South France)



7° x 2.5° North Italy



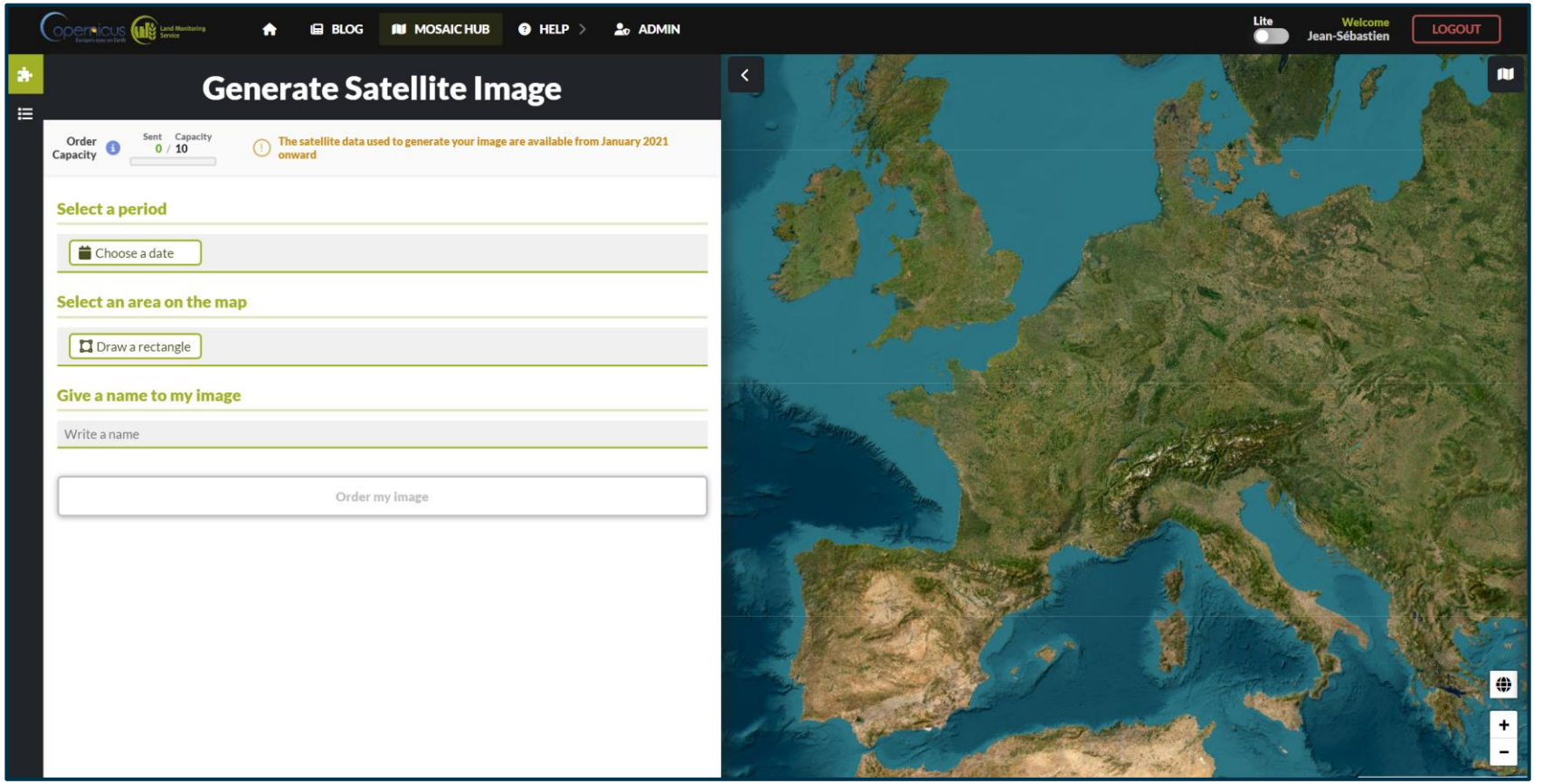
S2GM – Available in October 2023

PROGRAMME OF THE EUROPEAN UNION

co-funded with

Basic mode (versus Advanced)

- Limited options (month and AOI)
- Only provide a Quicklook
- No need for downloader installation
- ➔ **Reach non-expert users**



Thank you!

PROGRAMME OF THE EUROPEAN UNION

opernicus Europe's eyes on Earth

co-funded with esa

STAY CONNECTED

EVENTS, ONLINE, and MAP VIEWERS

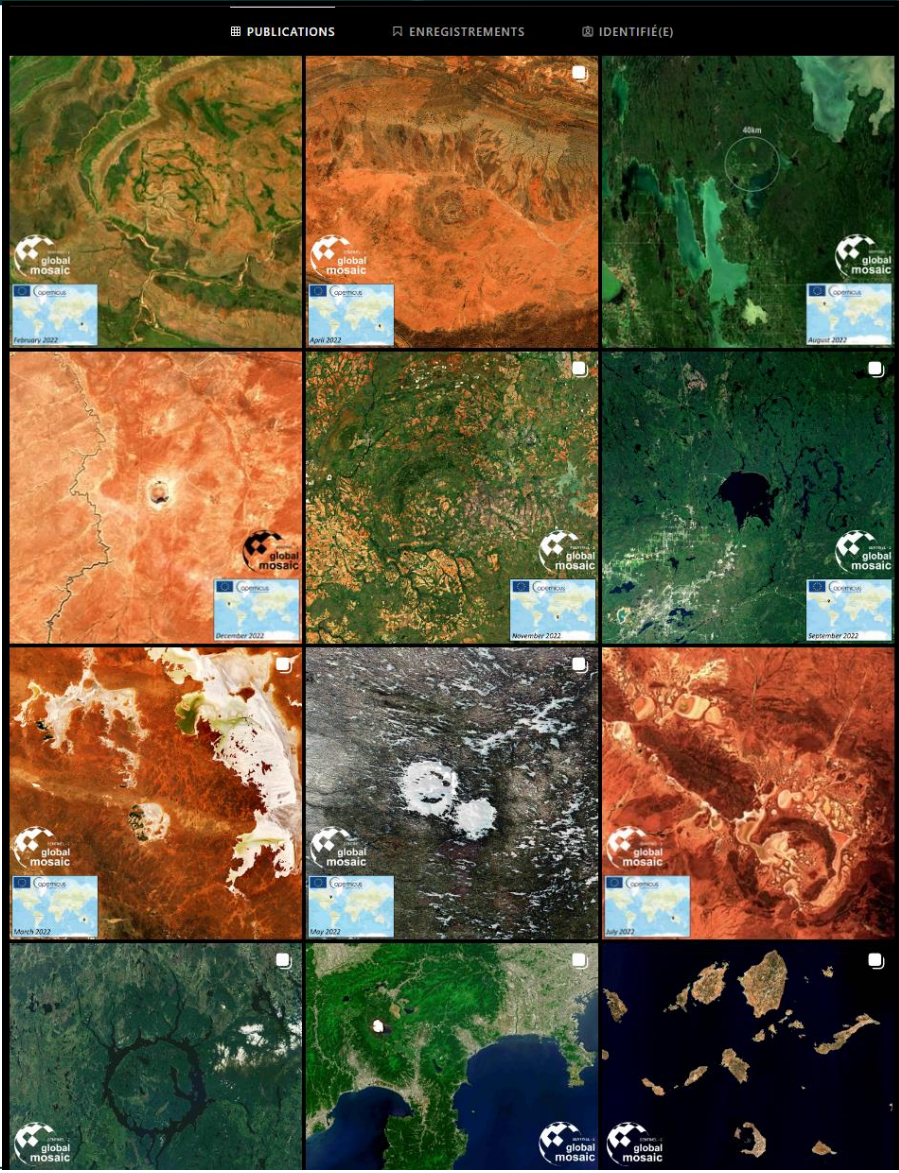
@CopernicusLAND

land.copernicus.eu/global

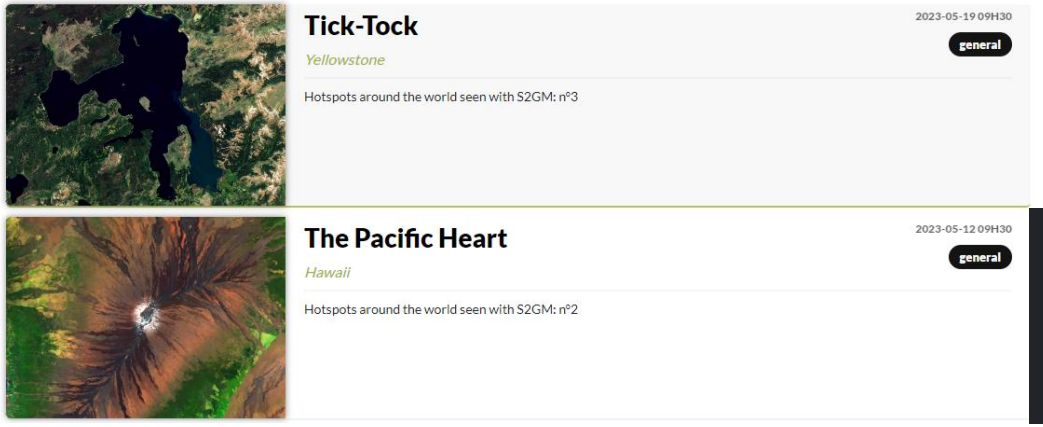
land.copernicus.eu/global/viewing

S2GM Image of the week

Since November 2022
Fridays 9:30 AM CEST



https://s2gm.land.copernicus.eu/blog



SOCIAL NETWORKS

S2GM – Annexes

EU27 countries