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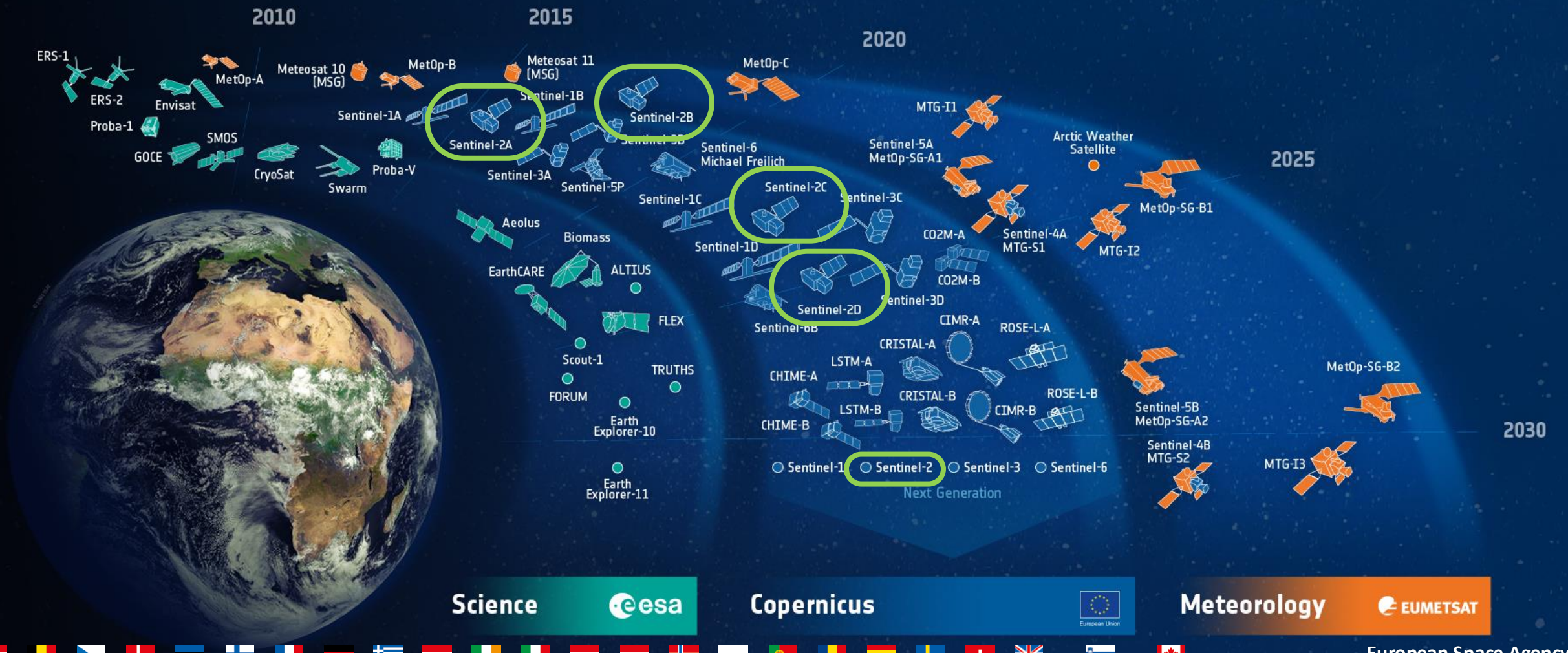
Statut et Perspectives de la Mission Sentinel-2

Ferran Gascon
Sentinel-2 Mission Manager
20 May 2025

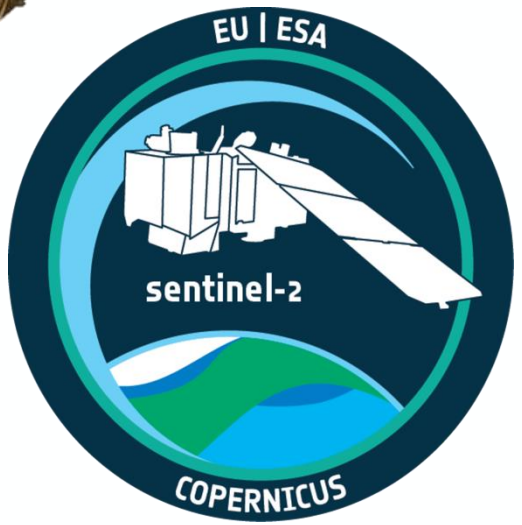
ESA-DEVELOPED EARTH OBSERVATION MISSIONS



Science | Copernicus | Meteorology

European Space Agency

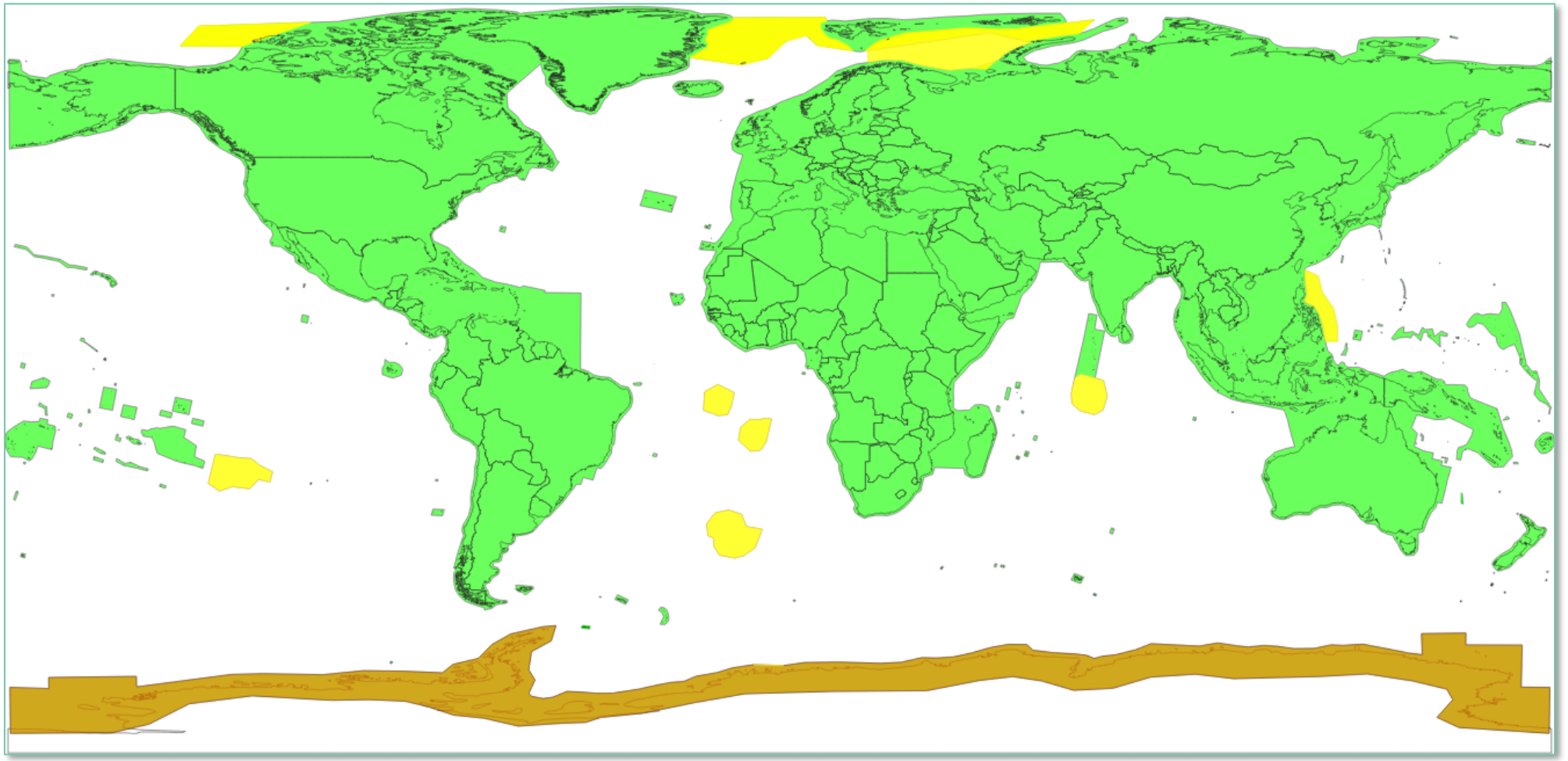
Sentinel-2 Mission Key Features



Optical multi-spectral sensor for monitoring land & coastal areas

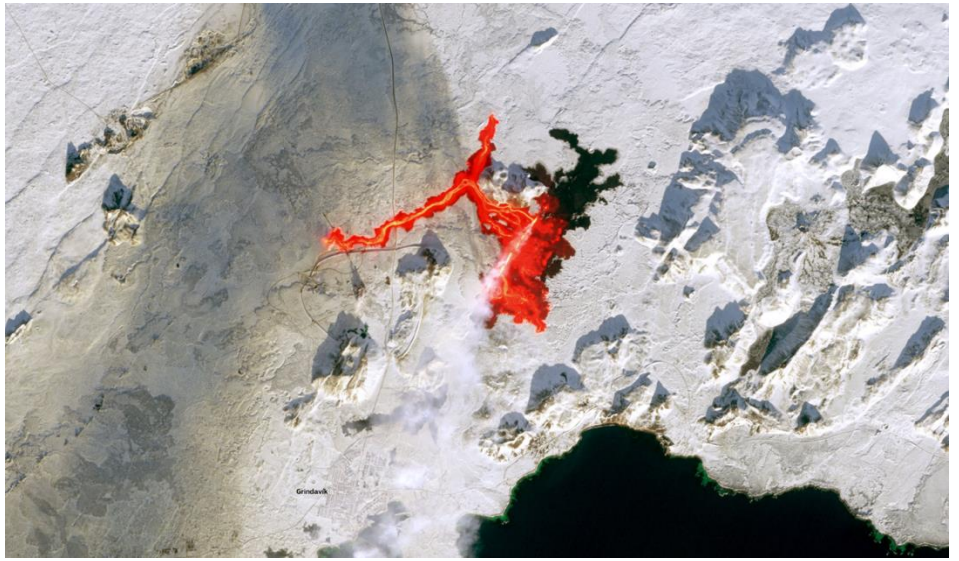
- Geometrical revisit: 5 days (at the Equator) with 2 satellites
- Spectral Bands: 13 spectral bands in the VNIR and SWIR
- Spatial Resolution: 10 m, 20 m, 60 m
- Nominal swath: 294 km, at 786 km altitude
- Acquisition system: Pushbroom scanner
- Local Time: 10:30 a.m. descending node
- Data Access: Free & open for a large range of applications

Sentinel-2 Observation Scenario



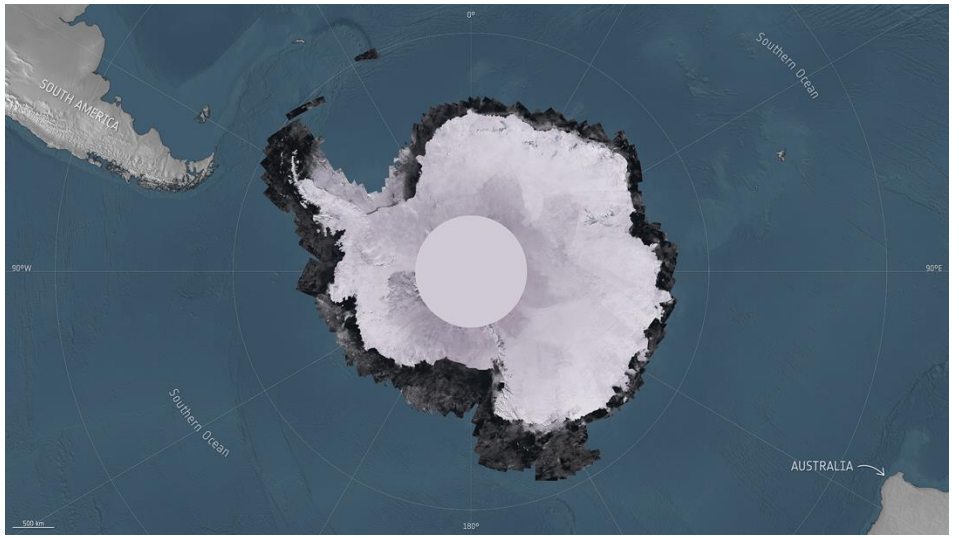
Ad-hoc Acquisition Campaigns

- ✓ Ad-hoc acquisition campaign over Iceland in low-illumination conditions (Sun Zentith Angle < 90 degree).



Lava flow from the eruption of the Fagradalsfjall volcano near Grindavík (Iceland) on 09 Feb. 2024.

- ✓ Mosaic of Sentinel-2 acquisitions during 2022-2023 austral summer.



Sentinel-2 Products

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User Products

Level-1B

Top-of-atmosphere radiances in sensor geometry

Level-1C

Top-of-atmosphere reflectances in cartographic geometry

Level-2A

Surface reflectances in cartographic geometry

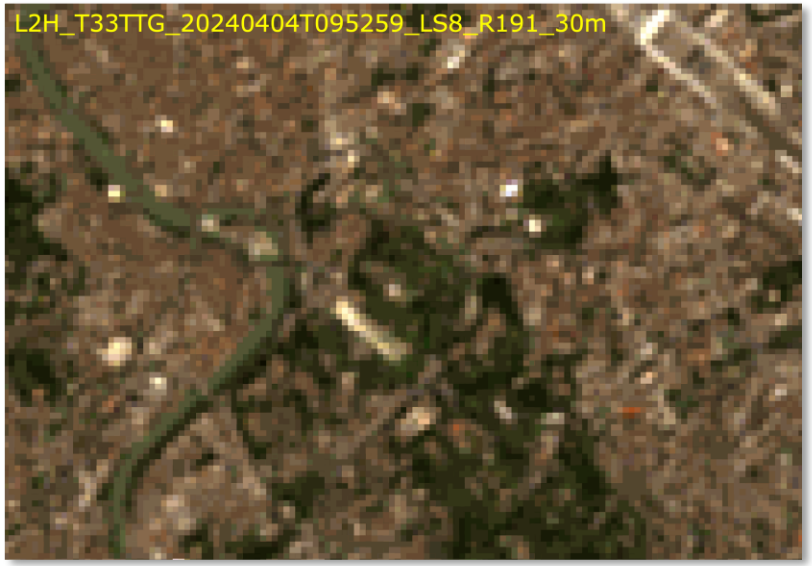
Pilot Products

Level-2H

Harmonised Sentinel-2 + Landsat-8/9 surface reflectances in cartographic geometry

Level-2F

Fused Sentinel-2 + Landsat-8/9 surface reflectances in cartographic geometry



Level-2F Product Integrating Landsat

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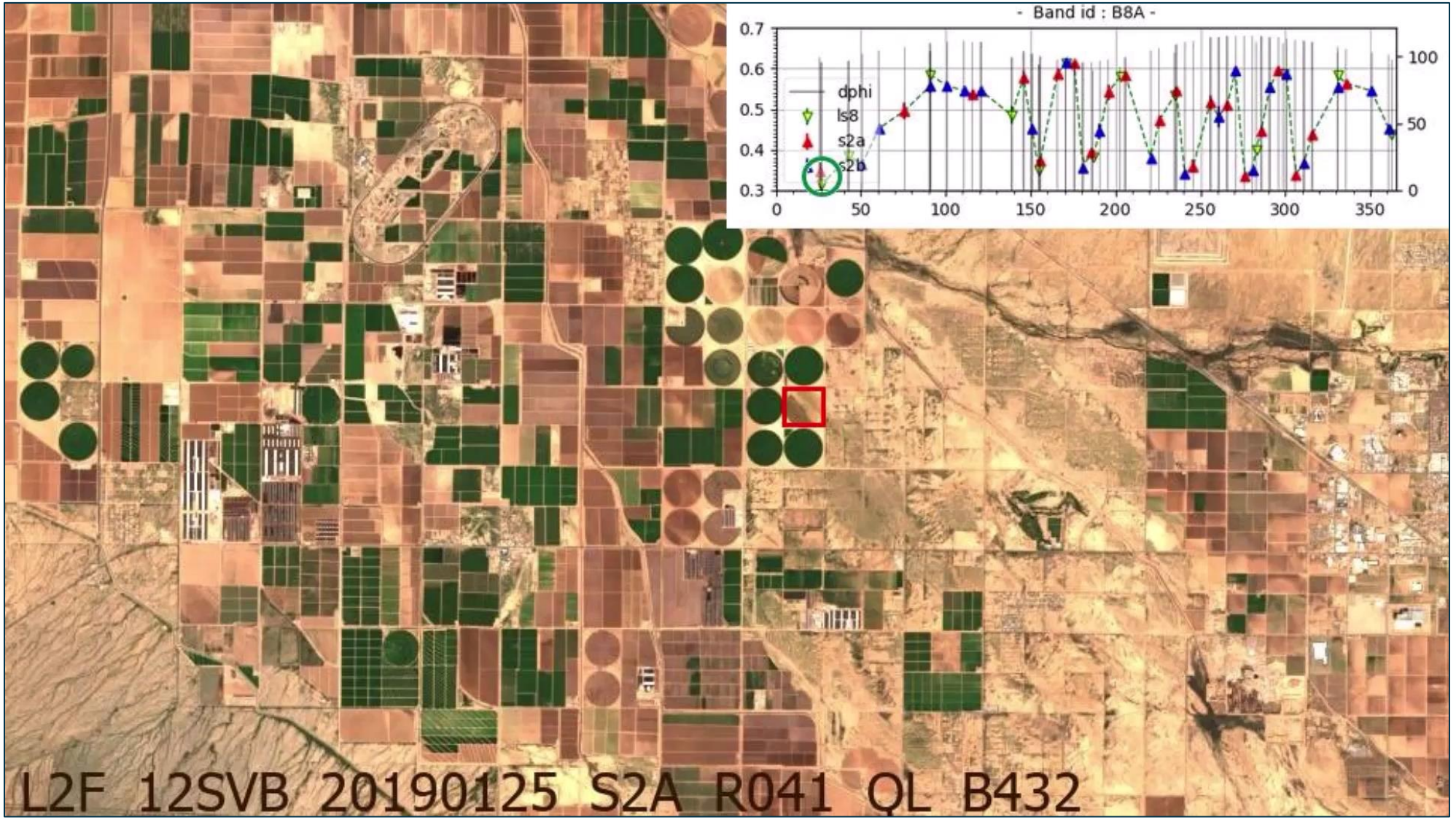

dataspace.copernicus.eu

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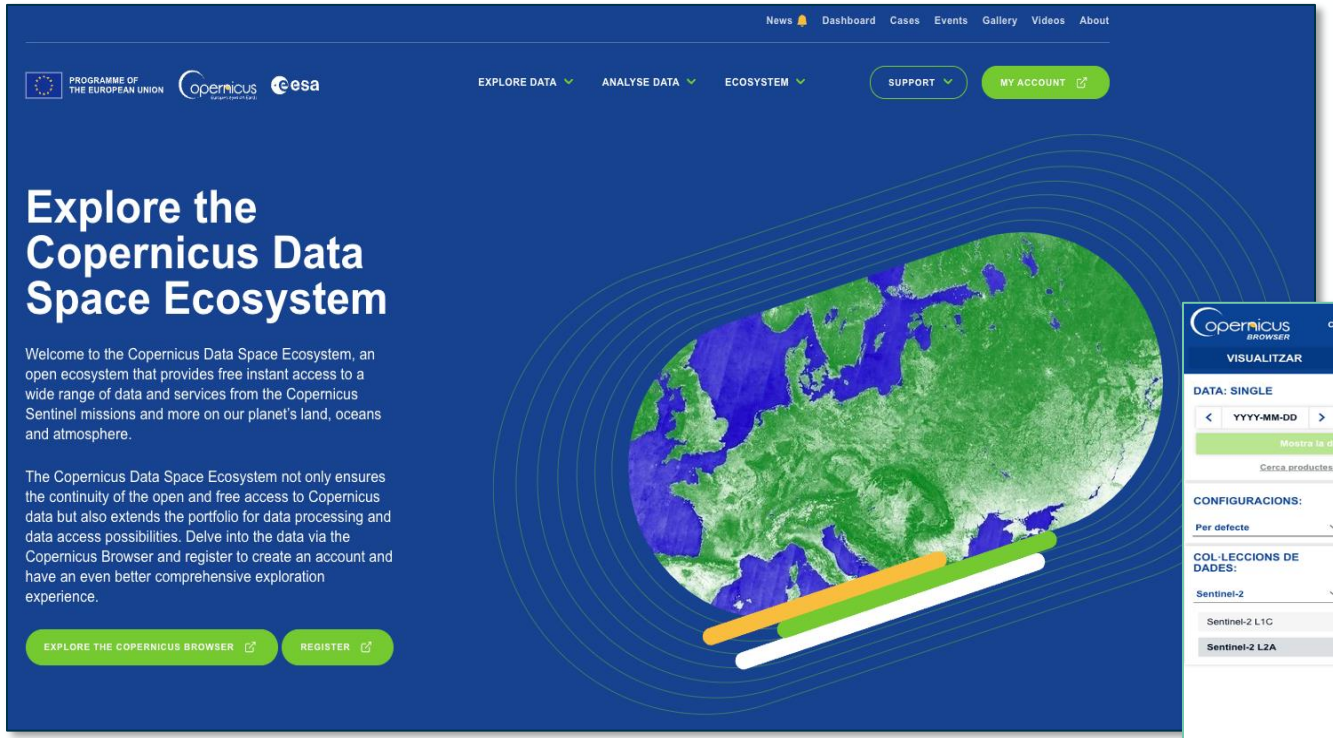

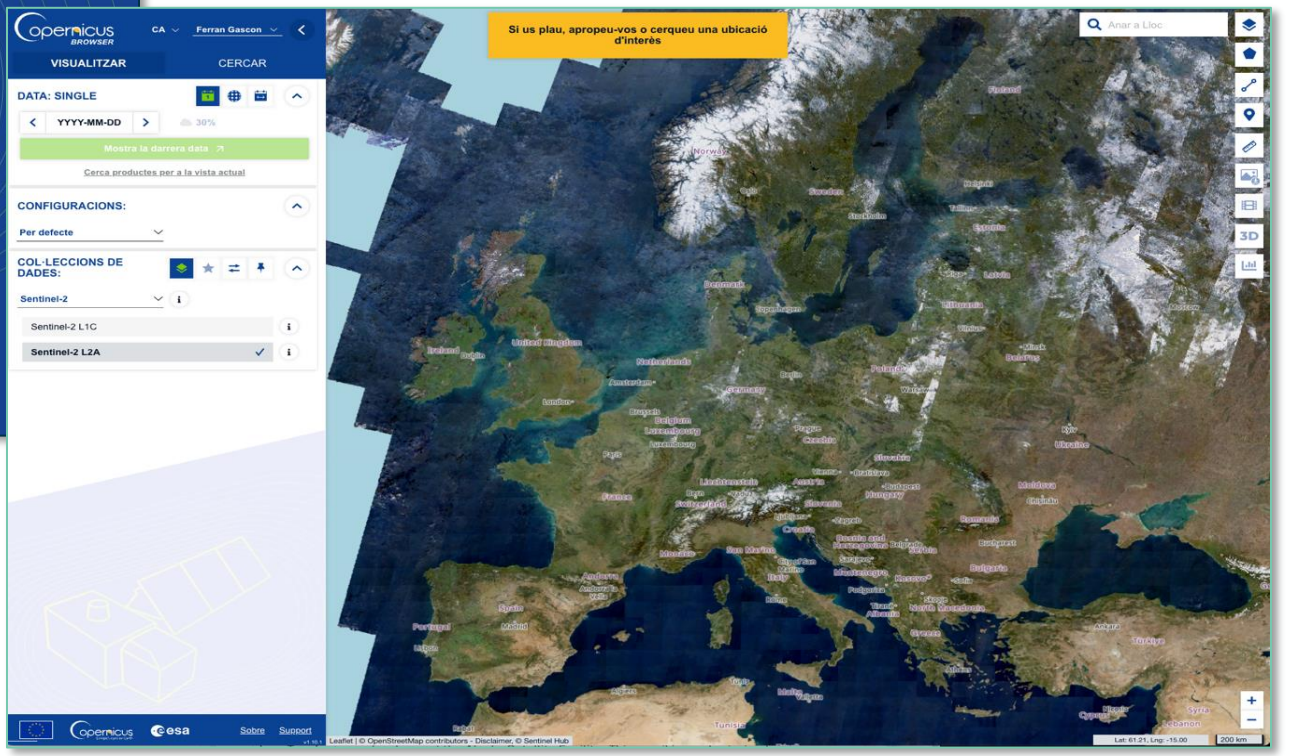

→ THE EUROPEAN SPACE AGENCY

CDSE APIs and Apps

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APIs

Catalog APIs

OData
OData is an SO/IEC approved, OASIS standard , which is based on https RESTful Application Programming Interfaces. It enables resources, which are identified by URLs and…

OpenSearch Catalog web service
The OpenSearch catalogue allows you to search through Copernicus data using a standardized web service. The OpenSearch specification can be consulted for technical details…

STAC product catalogue
STAC (SpatioTemporal Asset Catalog) is a relatively new web service specification for catalogs that is increasingly used and supported. STAC data have become a de-facto…

Streamlined data access

Sentinel Hub
Sentinel Hub is a multi-spectral and multi-temporal big data satellite imagery service capable of fully automated archiving, real-time processing and distribution of remote…

openEO
openEO represents an innovative community standard that revolutionizes geospatial data processing and analysis. This groundbreaking framework provides a novel approach to…

Additionally

Access to EO data via S3
S3 API is one of the main access methods for EO data. It is suitable for Third Party applications that require high-performance parallel access and scalability. Moreover…

On-Demand Production API
On-demand processing capability for CARD-BS and CARD-COH6/12 is available in the Copernicus Data Space Ecosystem. This service is offered via a limited pool of resources…

Traceability Service
Traceability Service allows the user to track a data product's lifecycle. It acts as a historian of the product's lifecycle, collecting the traces of all related events.…

Applications

Filter

openEO Algorithm Plaza
The openEO Algorithm Plaza is a marketplace to discover and share various EO algorithms expressed as openEO process graphs. These can be addressed via user interfaces or via…

About the Browser
The Copernicus Data Space Ecosystem Browser serves as a central hub for accessing, exploring and utilizing the wealth of Earth observation and environmental data provided by…

Copernicus Data Space Ecosystem Dashboard
The Copernicus Data Space Ecosystem Dashboard (hereinafter the Dashboard) is your go-to tool for checking out the Copernicus Data Space Ecosystem in action. It's a free…

About Data Workspace
The Data Workspace is a valuable tool for managing and reviewing Earth observation-related products. This platform enables you to aggregate and review products, which can…

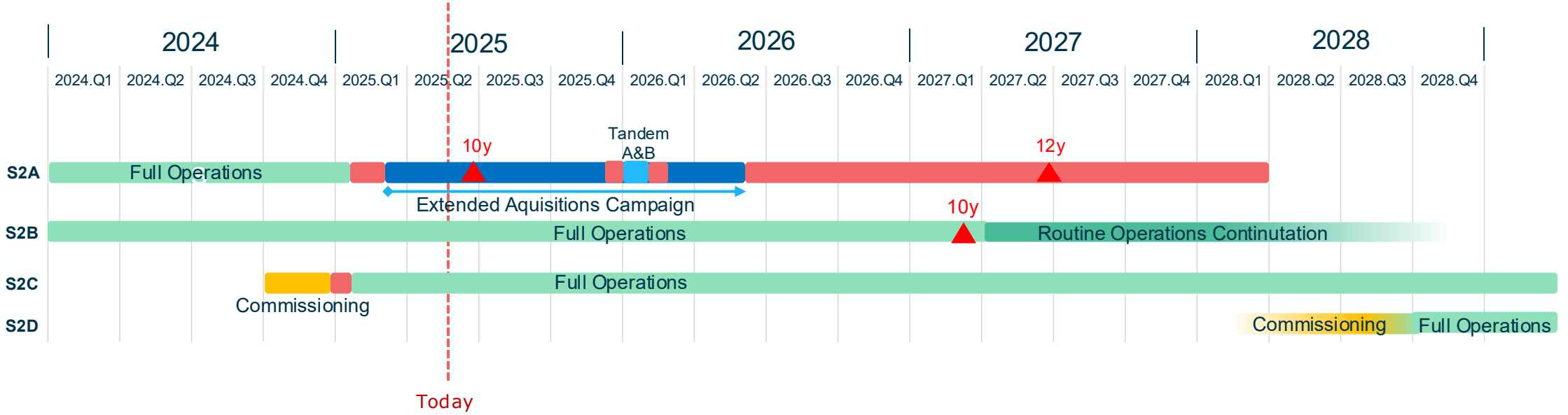
JupyterLab
JupyterLab is an advanced interactive development environment (IDE) that offers a flexible and feature-rich interface for working with notebooks, code, and data. It allows…

Sentinel Hub QGIS Plugin
The Sentinel Hub QGIS Plugin allows you to view satellite image data from the Copernicus Data Space Ecosystem or from Sentinel Hub directly within a QGIS workspace. All…

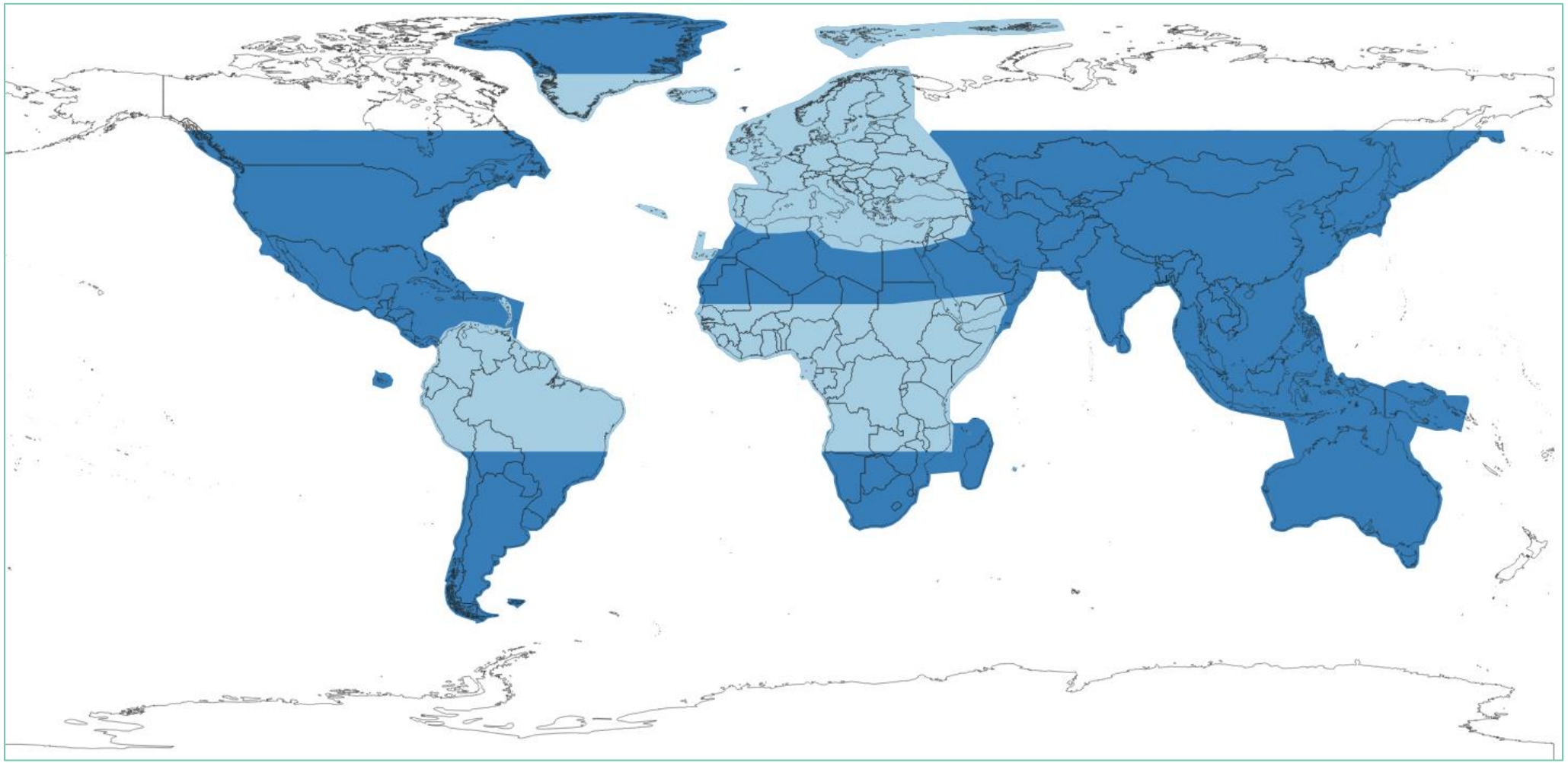
openEO Web Editor
The openEO Web Editor is a web-based graphical user interface (GUI) that allows users to interact with the openEO API and perform various tasks related to Earth observation…

Sentinel-2A Extension Campaign

- Implemented Sentinel-2A ‘extended acquisitions campaign’ for a 1-year period.
- Implemented scenario:
  - Sentinel-2B & Sentinel-2C continue with full baseline observation scenario.
  - Sentinel-2A complements other satellites acquiring additional data.
- Sentinel-2A limited observation scenario allows to preserve the satellite health.



S2A Observation Scenario



S2A coverage every 10 days
S2A coverage every 20 days

S2 Extended Scenario

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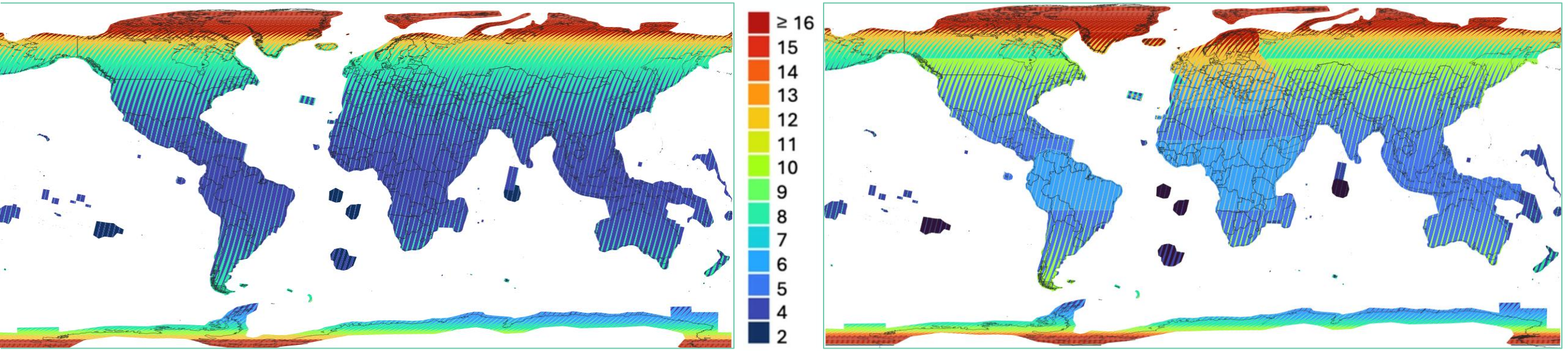
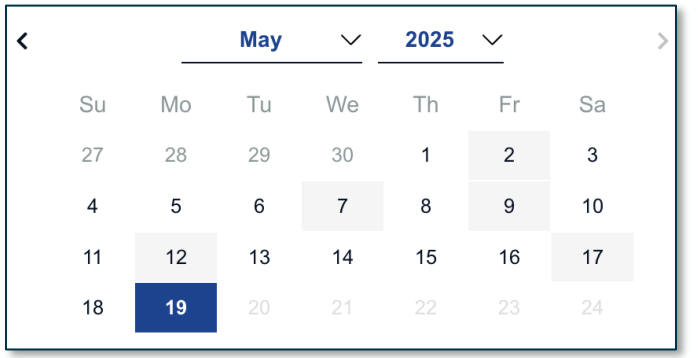
Baseline Scenario (S2B + S2C)

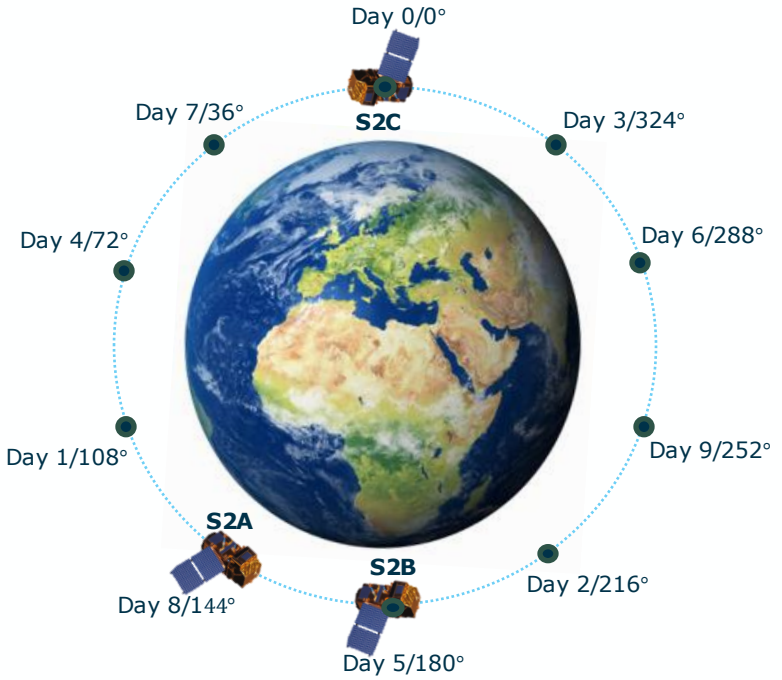
Extended Scenario (S2B + S2C + S2A)

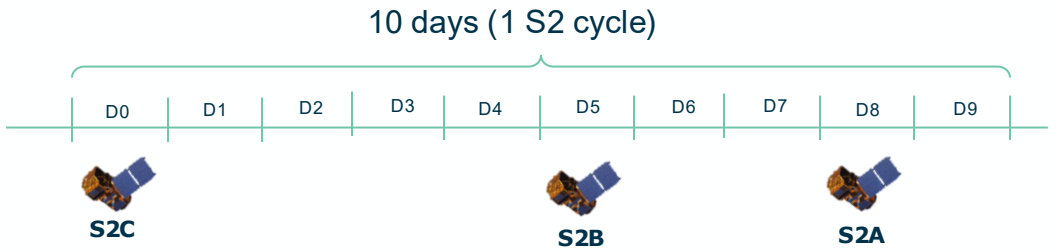
Number of acquisitions over 20 days



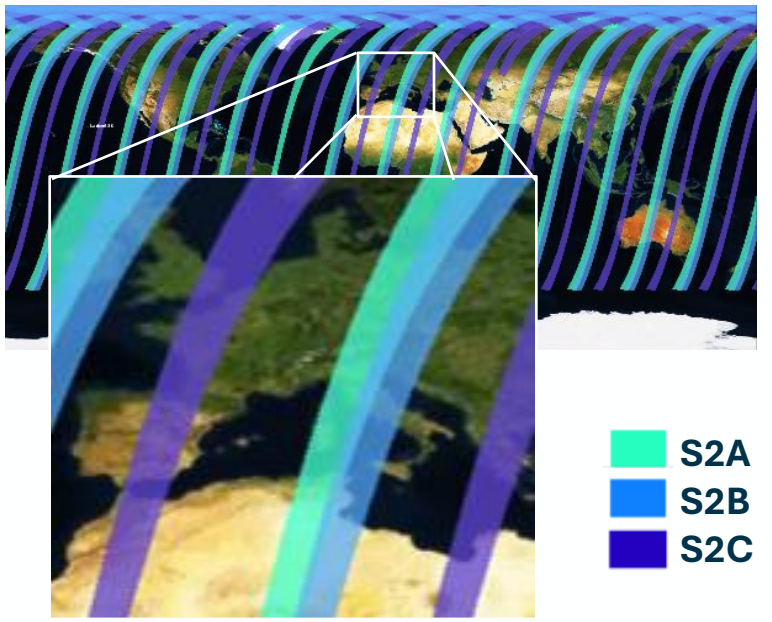


S2A Extended Scenario





1-day coverage



Generated ‘extended’ pseudo-swath acquisition (A and B, with a 10 min. acquisition separation).

Broad Range of Applications

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CLMS
Copernicus Land Monitoring Service – Global and Pan-European Components

- Hot Spot Monitoring for EU field projects and international policies
- Global Mosaics
- Inland waters Turbidity
- Inland waters Total Suspended Matter
- Biophysical products
- Land cover products

CMEMS
Copernicus Marine Environment Monitoring Service

- Sea-ice charting
- Coastal waters Turbidity
- Coastal waters Total Suspended Matter

CEMS
Copernicus Emergency Management Service

- Emergency response to rapid mapping (burnt area, flood, landslides, volcanoes)
- Risk recovery (e.g. crop change, floods)
- Validation (e.g. fires, floods, landslides)
- EFFIS/GWIS (Burned area mapping, fire severity and vegetation recovery

CSS
Copernicus Security Service/ Copernicus Maritime Surveillance Service/ European Maritime Safety Agency/ CleanSeaNet/ Support to External Action

- Oil spill detection and polluter identification (CleanSeaNet)
- Maritime surveillance (e.g. ship detection, search and rescue, anti-piracy)
- Up-to-date background information
- Integration with very high-resolution imagery
- Feature of interest extraction

C3S
Copernicus Climate Change Service

- Glaciers mapping
- Glaciers flow velocities

Tropical Forests and their Traits

nature

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nature > articles > article

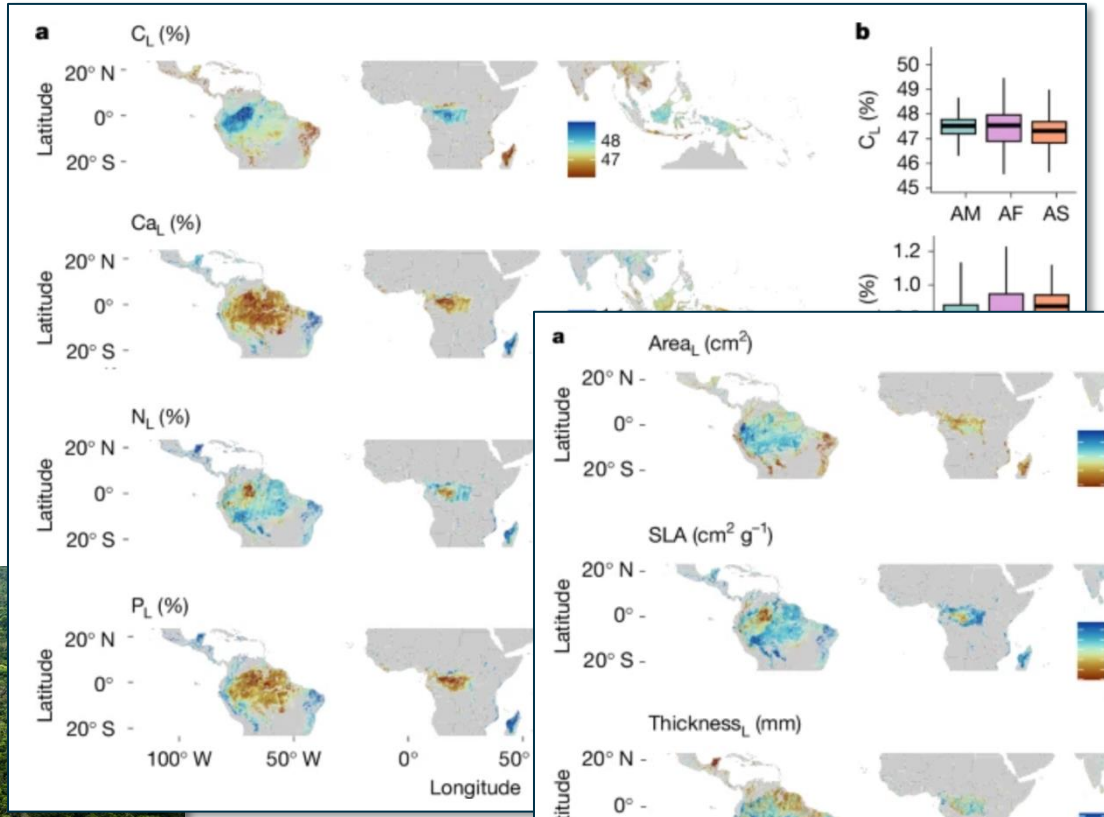
Article | Open access | Published: 05 March 2025

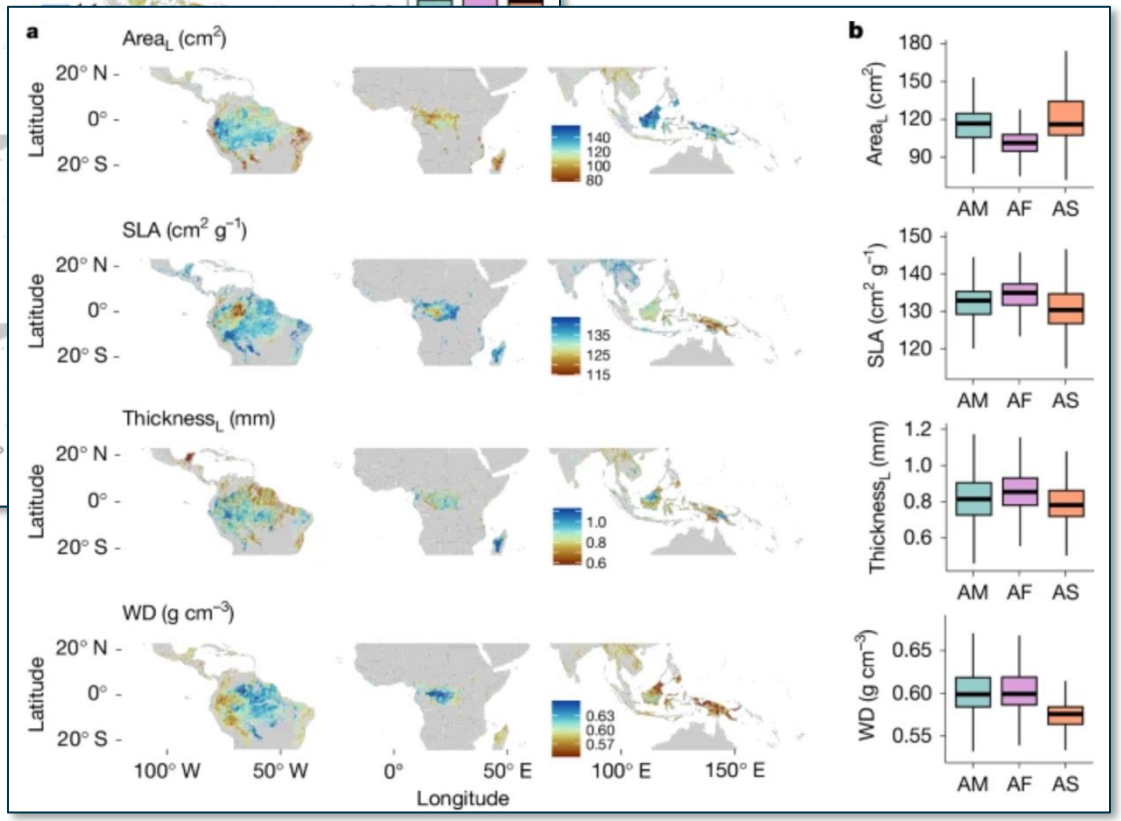
Canopy functional trait variation across Earth's tropical forests

Jesús Aguirre-Gutiérrez ✉, Sami W. Rifai, Xiongjie Deng, Hans ter Steege, Eleanor Thomson, Jose Javier Corral-Rivas, Aretha Franklin Guimaraes, Sandra Muller, Joice Klipel, Sophie Fauset, Angelica F. Resende, Göran Wallin, Carlos A. Joly, Katharine Abernethy, Stephen Adu-Bredu, Celice Alexandre Silva, Edmar Almeida de Oliveira, Danilo R. A. Almeida, Esteban Alvarez-Davila, Gregory P. Asner, Timothy R. Baker, Maíra Benchimol, Lisa Patrick Bentley, Erika Berenguer, ... Yadvinder Malhi + Show authors

Nature **641**, 129–136 (2025) | Cite this article

https://www.nature.com/articles/s41586-025-08663-2





Accurate Mapping of Burnt Areas

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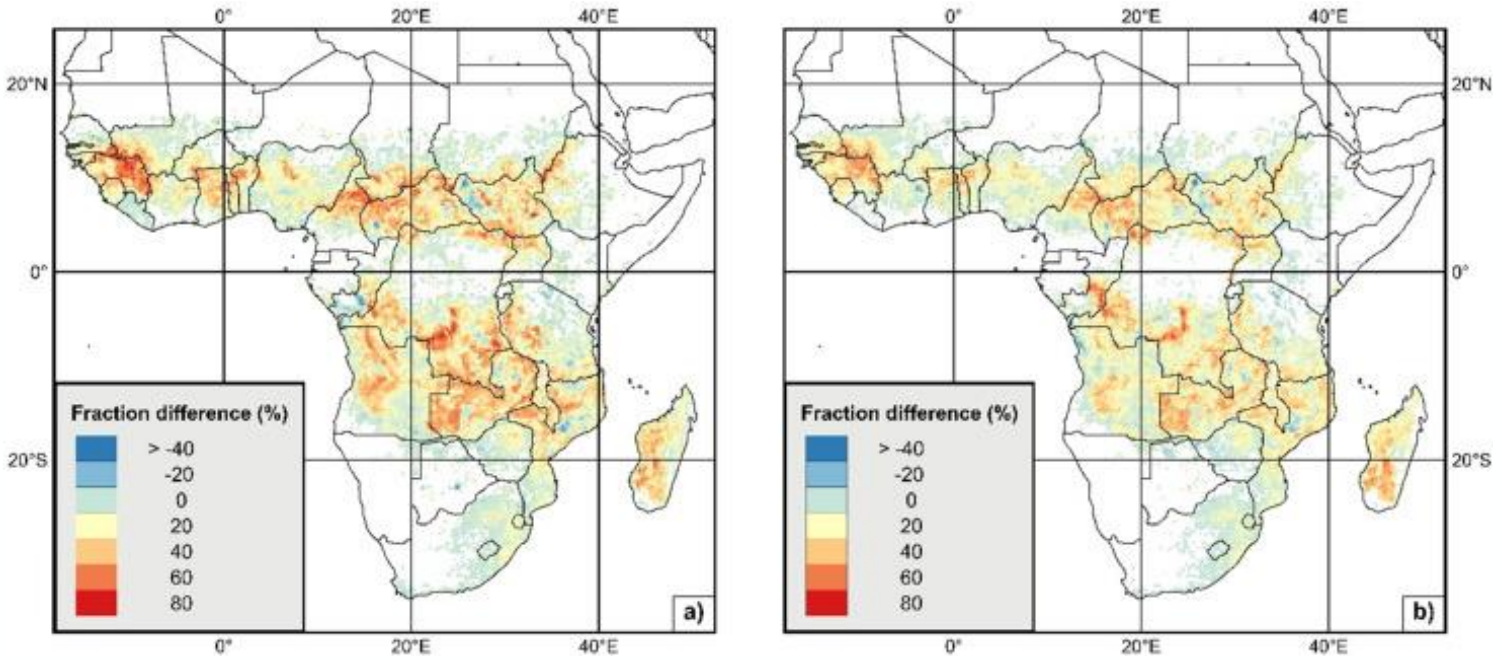
- The monitoring of Burnt Areas (BA) is crucial for climate change and carbon cycle study.
- Coarse resolution sensors (e.g MODIS) are not very sensitive at detecting small fire patches, making current estimations of global BA very conservative.
- Estimations using Sentinel-2 implied significant improvements over the global, coarser spatial resolution BA products in areas where fires tend to be small and frequent



Difference of Burnt Area estimates between Sentinel-2 based method and two state-of-the art MODIS-based methods.

ELSEVIER

Science of The Total Environment

Volume 845, 1 November 2022, 157139

Building a small fire database for Sub-Saharan Africa from Sentinel-2 high-resolution images

Emilio Chuvieco [a], Ekhi Roteta [b], Matteo Sali [c], Daniela Stroppiana [c], Martin Boettcher [d], Grit Kirches [d], Thomas Storm [d], Amin Khairoun [a], M. Lucrecia Pettinari [a], Magí Franquesa [a], Clément Albergel [e]

www.nature.com/scientificreports

scientific reports

Check for updates

OPEN **Mapping burned areas in Thailand using Sentinel-2 imagery and OBIA techniques**

Chanida Suwanprasit[1✉] & Shahnawaz[2]

Sentinel-2 bathymetry

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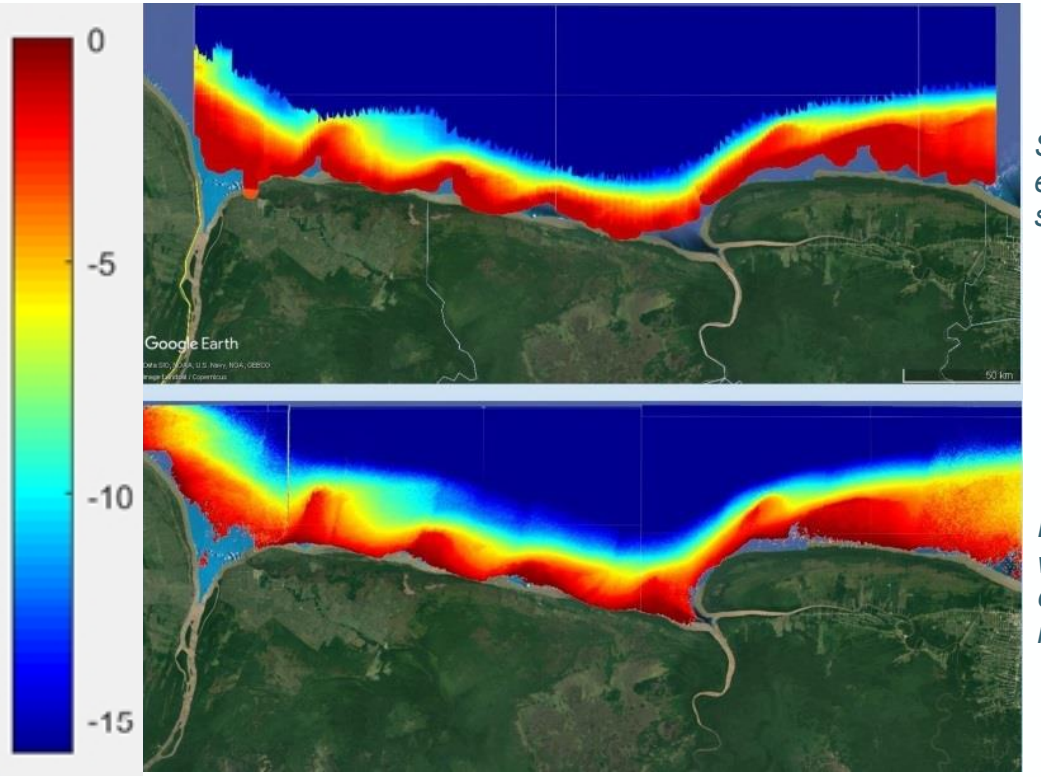
Mapping dynamic ocean depth is useful for marine geology researchers, tide modelling and prediction, coastal management and navigation

Sediment discharge of the Amazon River congregates into mud banks captured by Sentinel-2. Sediments are migrated by forces of waves and currents westward along the northeast South America coastline.
Copyright: Contains modified Copernicus Sentinel data (2023), processed by ESA.



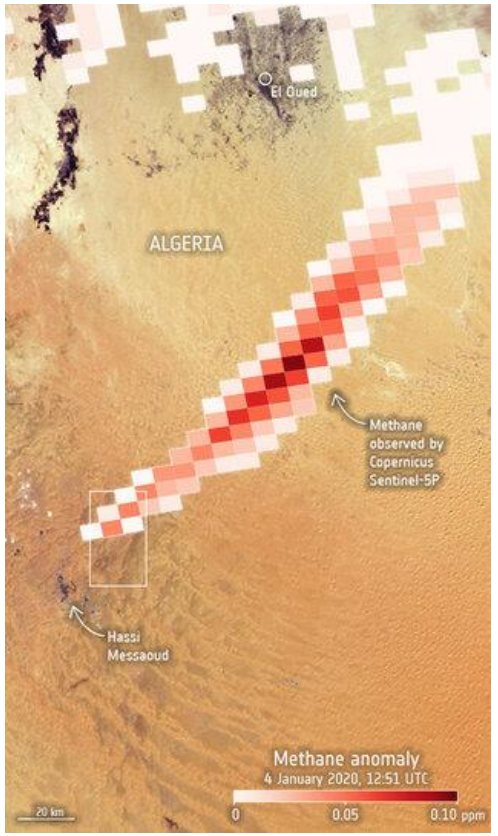
Single-beam echo sounding survey

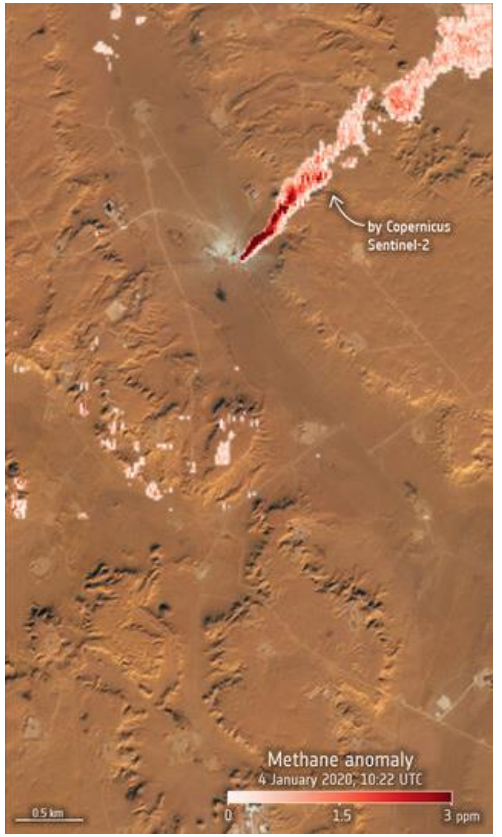
Bathymetry derived with Sentinel 2, composite of all images 2017-2022

Copyright: Contains modified Copernicus Sentinel data (2017-22), processed by R.Abileah (jOmegak Consulting).

https://sentinels.copernicus.eu/web/success-stories/-/copernicus-sentinel-2-bathymetry-to-map-south-americas-coastline

Methane Emissions Monitoring





nature communications

Article

https://doi.org/10.1038/s41467-023-40671-6

National quantifications of methane emissions from fuel exploitation using high resolution inversions of satellite observations

Received: 7 August 2022

Accepted: 7 August 2023

Lu Shen[1], Daniel J. Jacob[2], Ritesh Gautam[3], Mark Omara[3], Tia R. Scarpelli[4], Alba Lorente[2], Daniel Zavala-Araiza[3,5], Xiao Lu[6], Zichong Chen[2] & Jintai Lin[1]

nature communications

Article

https://doi.org/10.1038/s41467-024-47754-y

Automatic detection of methane emissions in multispectral satellite imagery using a vision transformer

Received: 23 August 2023

Accepted: 10 April 2024

Bertrand Rouet-Leduc[1,2,3] & Claudia Hulbert[2,3]

Atmos. Meas. Tech., 14, 2771–2785, 2021
https://doi.org/10.5194/amt-14-2771-2021

Atmospheric Measurement Techniques
EGU

High-frequency monitoring of anomalous methane point sources with multispectral Sentinel-2 satellite observations

Daniel J. Varon[1,2], Dylan Jervis[2], Jason McKeever[2], Ian Spence[2], David Gains[2], and Daniel J. Jacob[1]
[1]School of Engineering and Applied Science, Harvard University, Cambridge, 02138, USA
[2]GHGSat, Inc., Montréal, H2W 1Y5, Canada

communications earth & environment

ARTICLE

https://doi.org/10.1038/s43247-023-01190-w OPEN

Assessment of methane emissions from oil, gas and coal sectors across inventories and atmospheric inversions

Kushal Tibrewal[1,8], Philippe Ciais[1,2], Marielle Saunois[1], Adrien Martinez[1], Xin Lin[1], Joel Thanwerdas[1,14], Zhu Deng[3], Frederic Chevallier[1], Clément Giron[4], Clément Albergel[5], Katsumasa Tanaka[1,6], Prabir Patra[7,8], Aki Tsuruta[9], Bo Zheng[10,11], Dmitry Belikov[8], Yosuke Niwa[6,12], Rajesh Janardanan[6], Shamil Maksyutov[6], Arjo Segers[13], Zitely A. Tzompa-Sosa[1,15], Philppe Bousquet[1] & Jean Sciare[2]

Methane Emissions Monitoring

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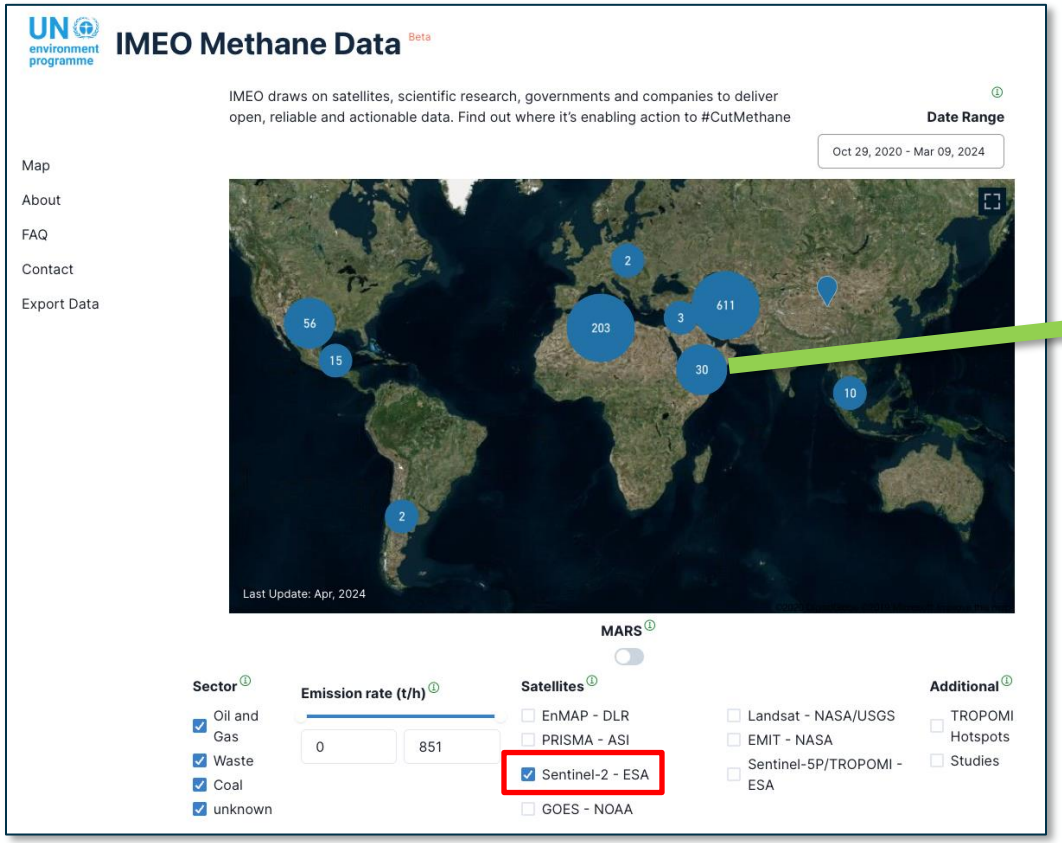
Sentinel-2 is a major workshorse for the International Methane Emissions Observatory (IMEO)

Sentinel-2 is the top satellite data provider feeding IMEO, becoming a key asset for UN global methane monitoring.



UN environment programme

On 10 April 2024, the EU Parliament adopted a provisional political agreement with EU countries on a new law to reduce methane emissions from the energy sector.

The new regulation is the first piece of EU legislation aimed at cutting methane emissions and covers direct methane emissions from the oil, fossil gas and coal sectors, and from biomethane once it is injected into the gas network.

https://methanedata.unep.org

NO_2 Emissions Monitoring

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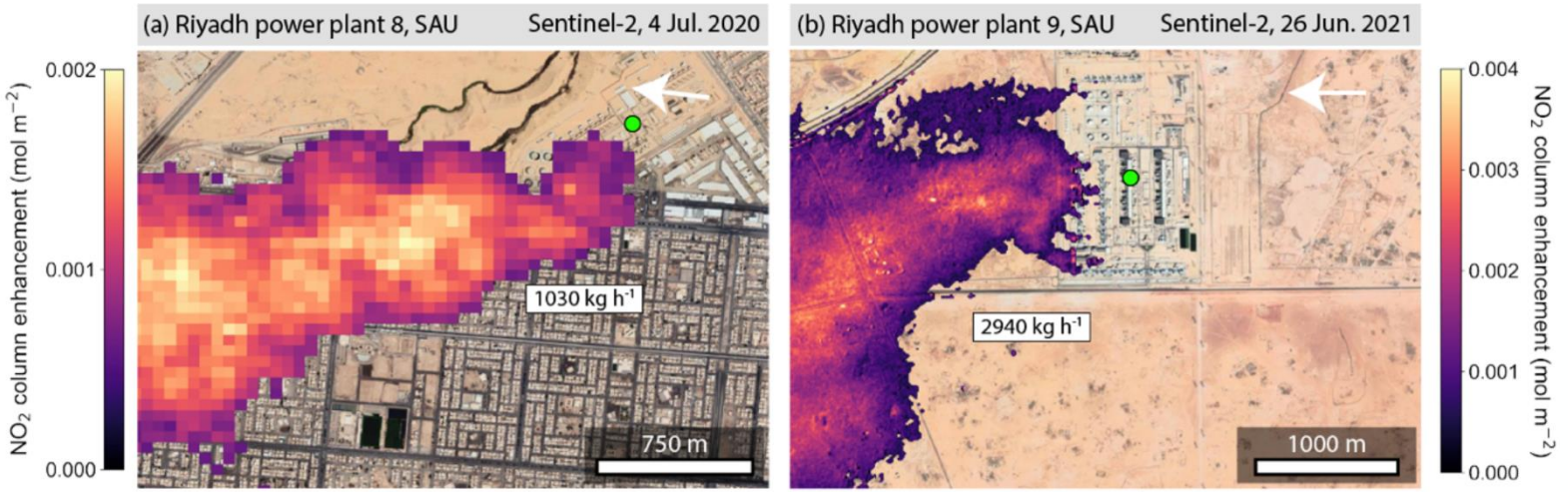
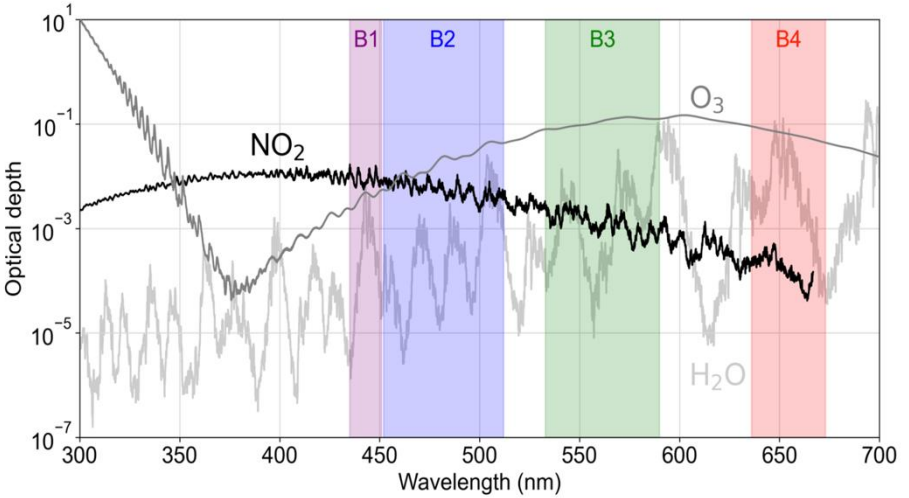
- Atmospheric nitrogen oxides (NOx) are air pollutants with important implications for air quality, climate, and the biosphere.
- Satellites have mapped atmospheric NO_2 concentrations since the 1990s, but with spatial resolution generally too coarse to resolve individual point sources such as power plants.
- Sentinel-2 satellites can monitor NO_2 plumes from large point sources (>500 $kg.h^{-1}$) using their blue and ultra-blue bands.
- The fine pixel resolutions of Sentinel-2 enable separation of individual point sources and stacks, including in urban background, and archive records enable examination of emission trends.



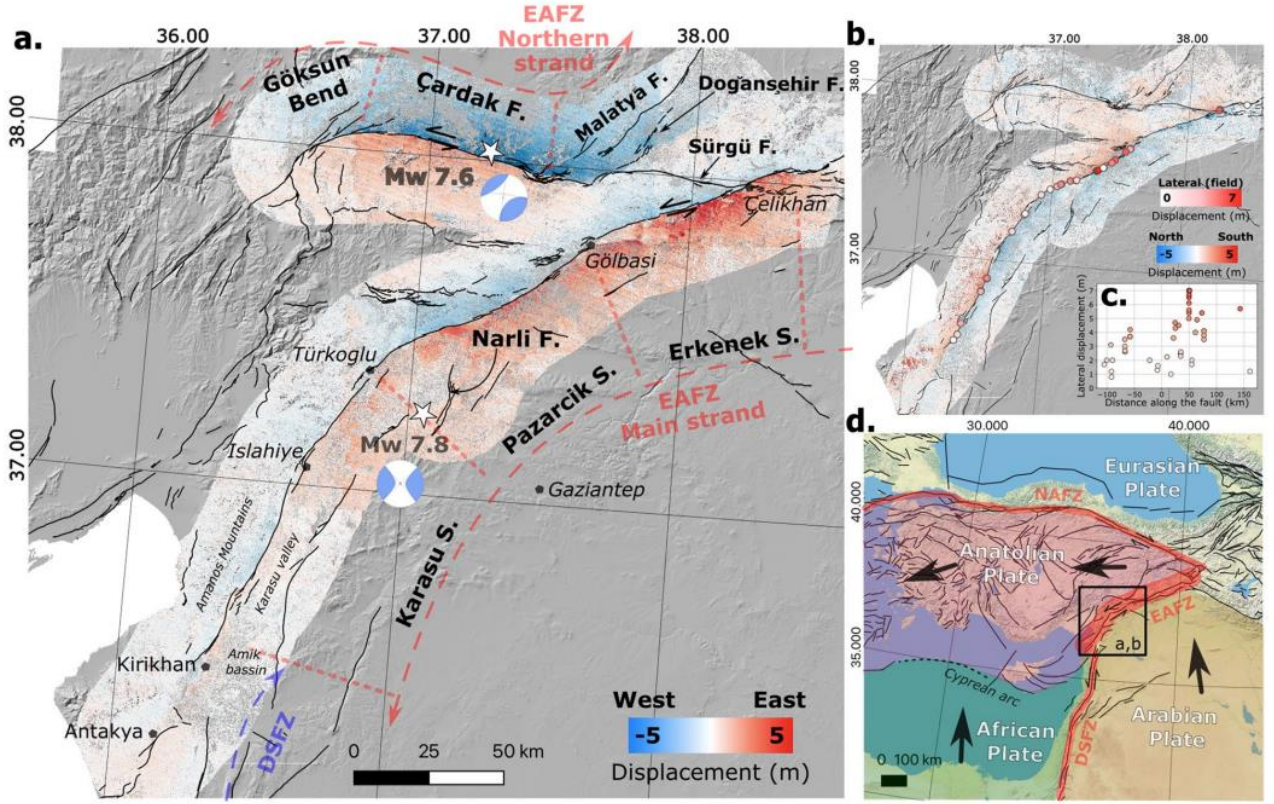
Sample Sentinel-2 and Landsat 8 retrievals of NO2 plume column enhancements from five power plants in Saudi Arabia.



https://www.varon.org/research

Ground Motion Monitoring by Sentinel-2

- Sentinel-2 optical data enables the high-resolution mapping of the entire co-seismic surface rupture and an estimate of the rupture width, total and on-fault offset, and diffuse deformation.
- The mapping is derived from image correlation of Sentinel-2 optical satellite measuring the North-South and East-West displacements.
- The use of optical image correlation complements Sentinel-1 providing new insights into seismic hazard.



www.nature.com/scientificreports

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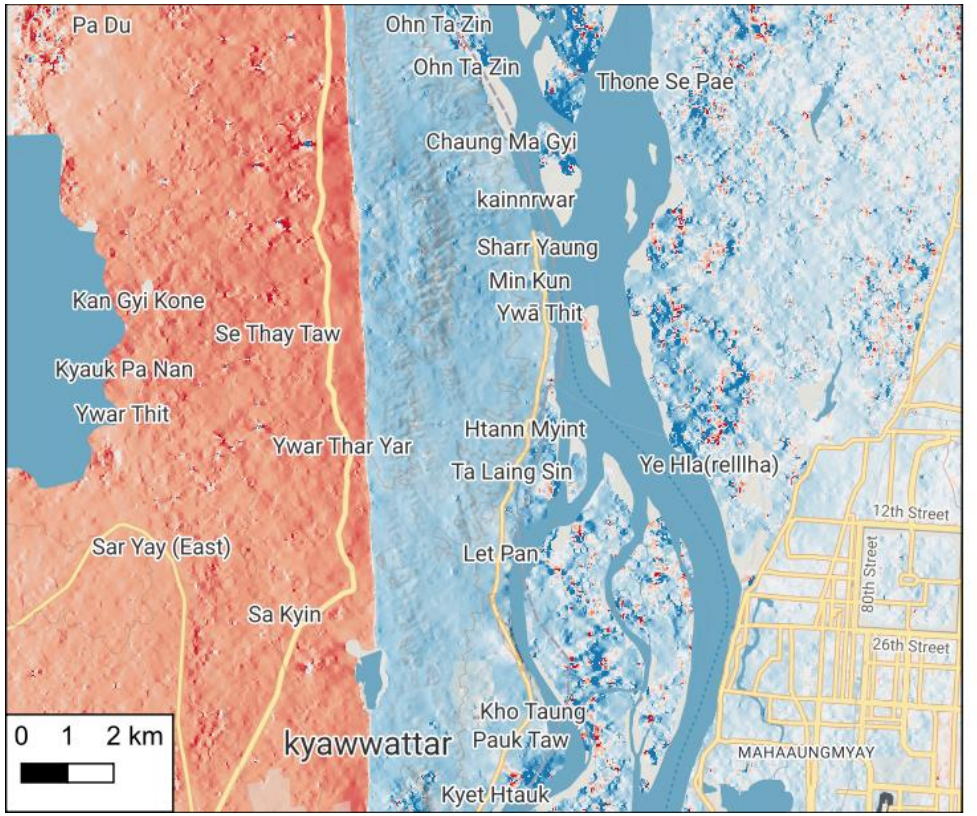
OPEN

High-resolution co-seismic fault offsets of the 2023 Türkiye earthquake ruptures using satellite imagery

Floriane Provost[1,2✉], Volkan Karabacak[3], Jean-Philippe Malet[1,2], Jérôme Van der Woerd[1,2], Mustapha Meghraoui[1,2], Frédéric Masson[1,2], Matthieu Ferry[4], David Michéa[1] & Elisabeth Pointal[5]

Myanmar Earthquake Ground Motion

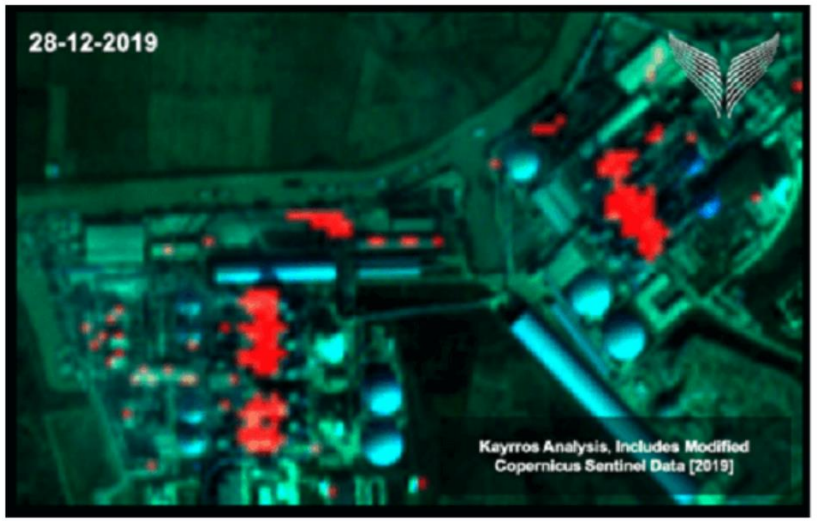


North-South displacement
2025-03-20 vs 2025-03-30
meter
5
-5

https://www.cesbio.cnrs.fr/multitemp/sentinel-2-reveals-the-surface-deformation-after-the-2025-myanmar-earthquake/

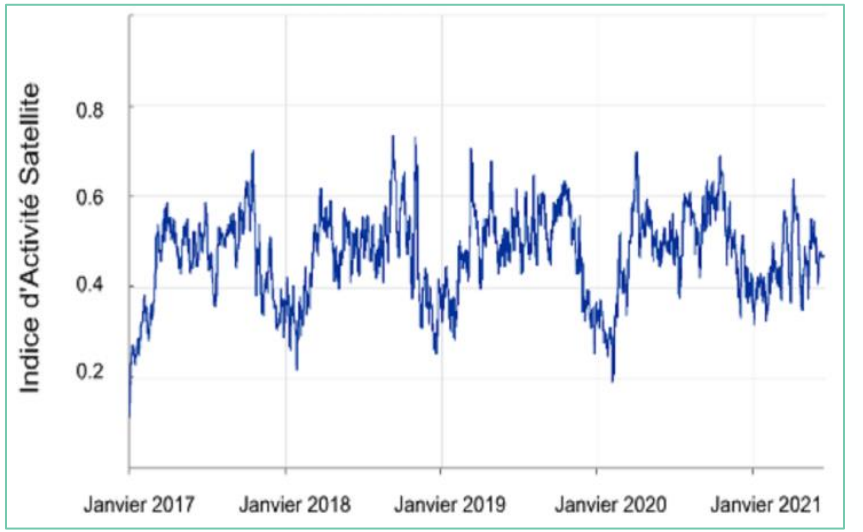
Cement plant activity index

- To monitor the global economy in real-time, satellite detection of heat emitted by active cement plants enables a production indicator.
- This indicator, used in a neural network model to predict construction activity, shows excellent performance compared to reference models and other indicators.



KAYRROS

Sentinel-2 image of a cement factory in China (Before/During Covid-19). Pixels colored red are those for which the algorithm detects the heat of cement kilns.



Cement plant activity index for China generated using Sentinel-2 data. The index represents the utilization rate of a country's production capacity, equal to the average utilization rate of each cement plant, weighted by its capacity.

Peer-Reviewed Publications

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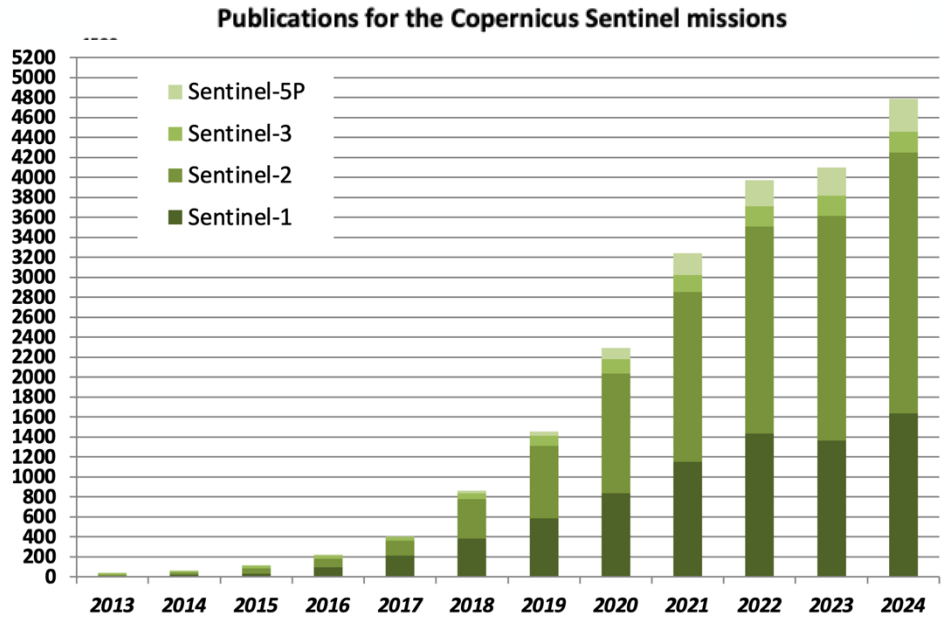
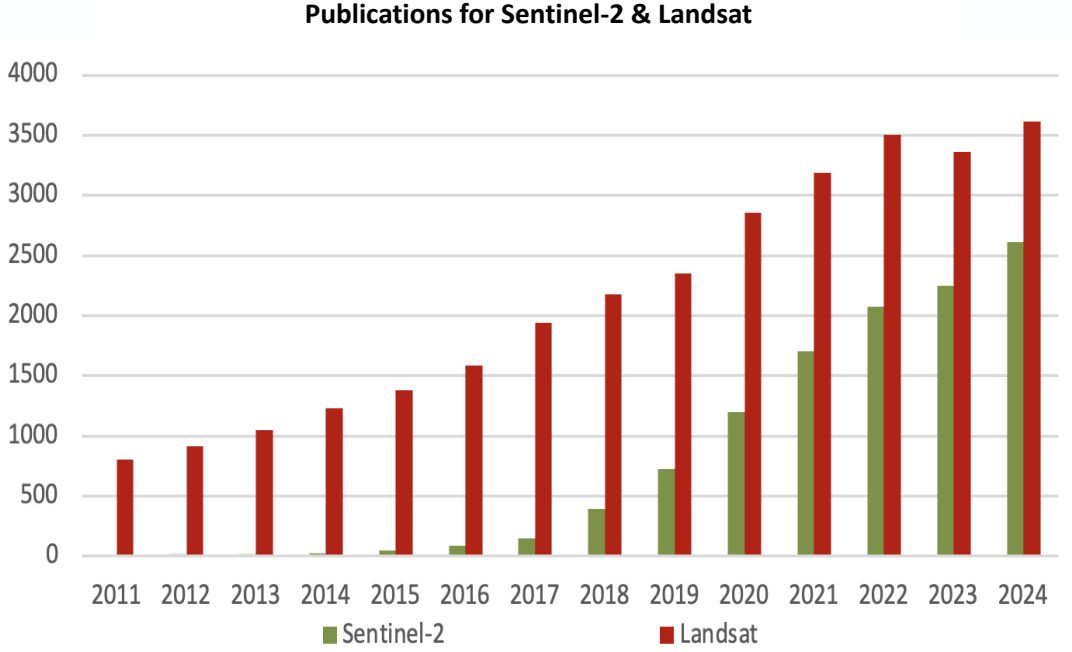
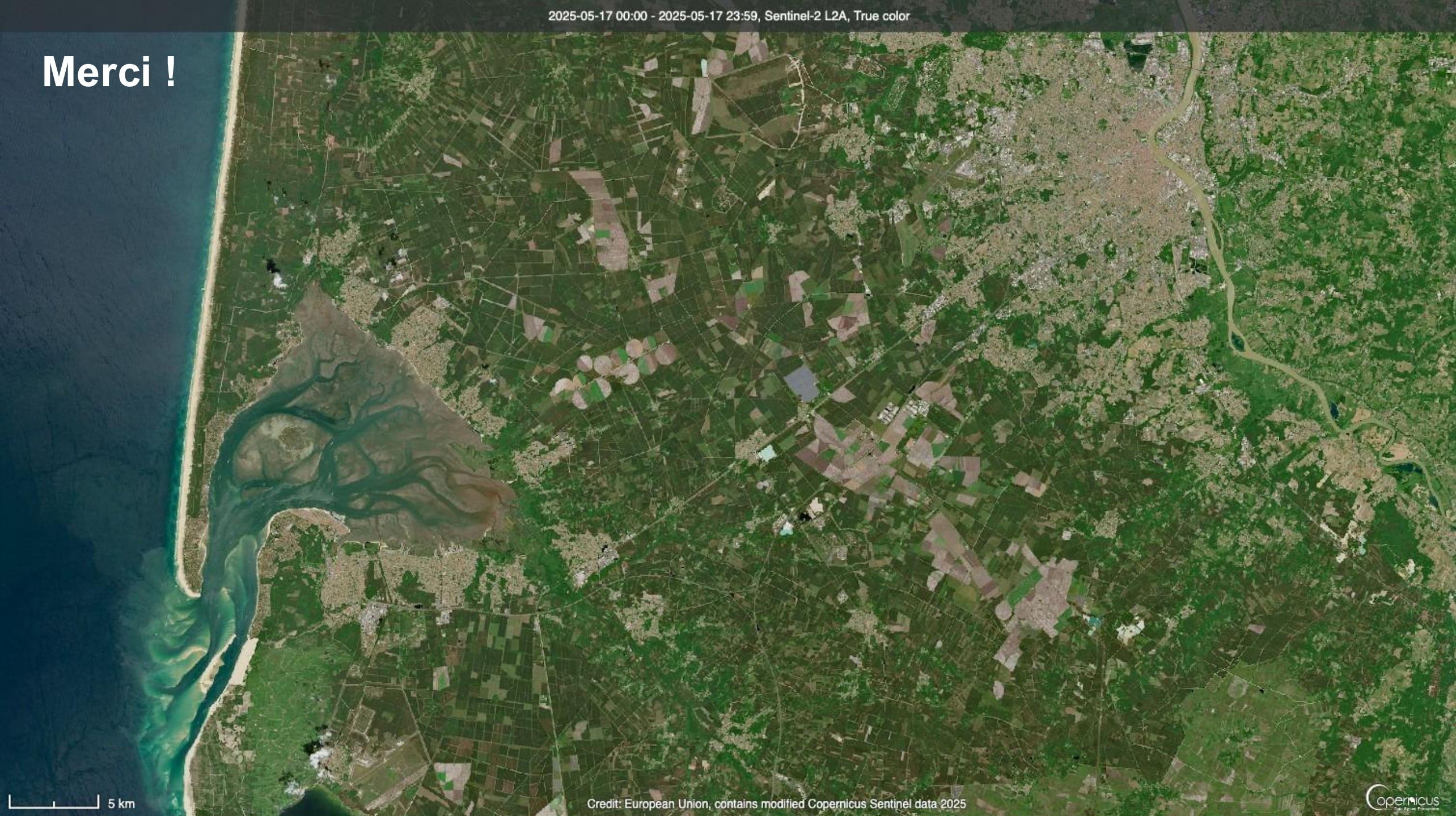


2614 publications in 2024



Metrics based on Elsevier Scopus database: Number of peer reviewed publications searching for mission/instrument name within papers title, abstract and keywords, and excluding conference papers.

Merci !


2025-05-17 00:00 - 2025-05-17 23:59, Sentinel-2 L2A, True color
5 km
Credit: European Union, contains modified Copernicus Sentinel data 2025