

Monitoring mangroves using Earth observation data: introduction to the MangMap platform and perspectives in Cambodia

J-F. Faure, T. Catry, E. Delaitre, E. Blanchard, A. Esparon, P. Sonko, H. Durand, P. Mouquet



MangMap - Mangrove monitoring with satellite data

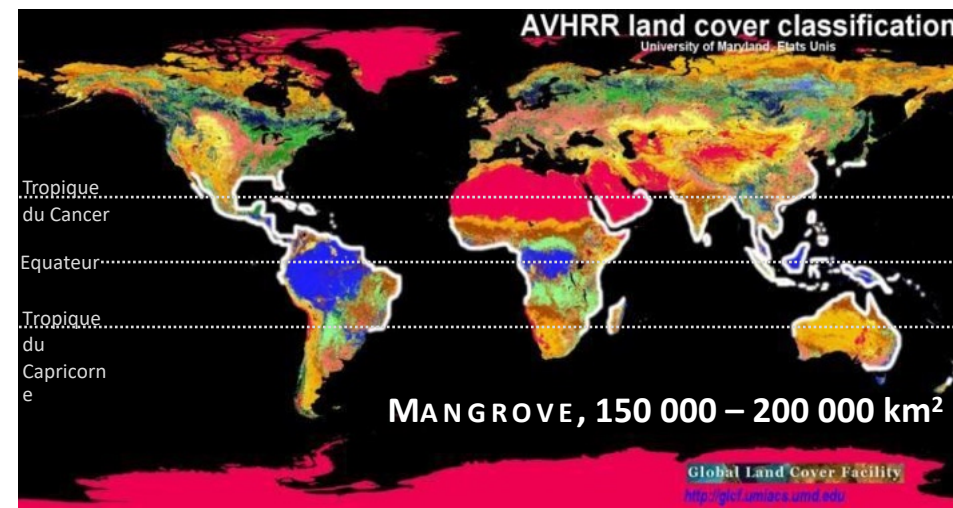
1. Introduction to MangMap
2. MangMap Portal and Platform
3. Illustration: Madagascar use case
4. Perspectives in Cambodia

➤ $\frac{3}{4}$ of all coastal intertropical areas

➤ Intertidal forest ecotone

➤ Root systems adapted to marine immersion
and extreme salinity

Mangrove forests

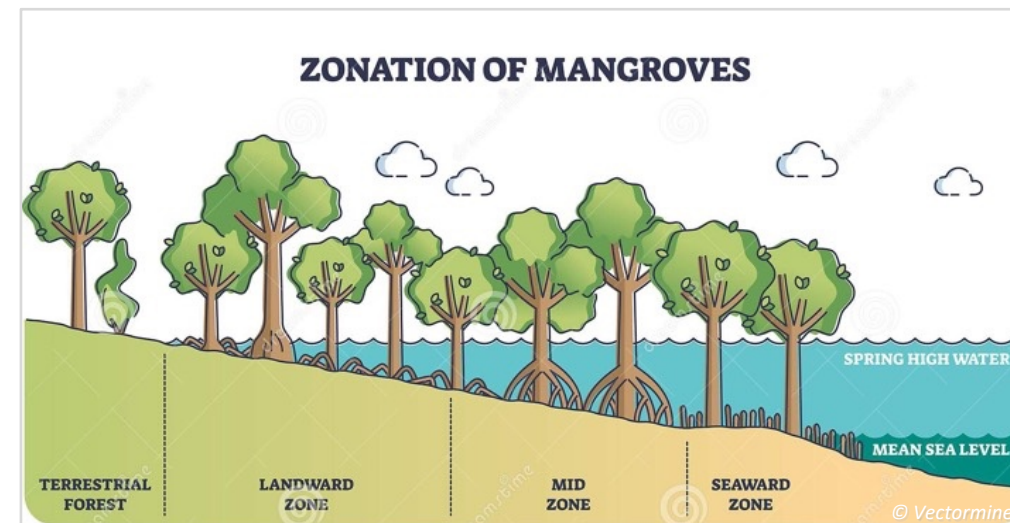


Mangrove ecosystems

➤ $\frac{3}{4}$ of all coastal intertropical areas

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and extreme salinity



Mangrove ecosystems

➤ $\frac{3}{4}$ of all coastal intertropical areas

➤ Intertidal forest ecotone

➤ Root systems adapted to marine immersion and extreme salinity

Rhizophora



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Avicennia

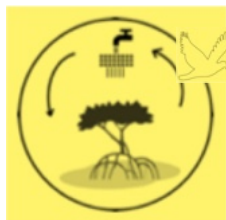


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➔ Numerous ecosystem services



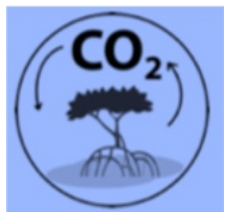
Coastal
protection



Biodiversity



Natural
resources



Carbon
Sequestration
"Blue Carbon"

➔ Well-being and livelihoods of populations increasingly concentrated along the coasts

Importance of mangroves



Mangroves have decreased by **30 to 50%** over the last 50 years (Duke et al. 2007 ; Polidoro et al. 2010)

Introduction to
MangMap

MangMap Portal

The Platform

Illustration
in Madagascar

Perspectives
in Cambodia

➤ Human pressure & destruction



Basse-Casamance – Rice cultivation

➤ Natural / Climate change impacts



French Guiana, coastal erosion

1. Document and contribute to the understanding of mangroves using Earth Observation data

Provide reliable information on their distribution, their evolution over time, and their overall health.

- Science as a vector for development

2. Provide an online tool with data and services accessible to everyone

Develop and maintain a platform with open-access satellite data, standardized products, ready-to-use services useful to Endusers

- Researchers and professors
- Engineers and technicians
- Geomatics specialists: public institutions, national agencies, NGOs...
- Students or professionals in Geomatics...

3. Build and promote networking activities

Agregate Partners and organizations involved in the management and monitoring of mangroves using satellite data, to share experiences and know-hows, to enhance MangMap's features and services:

- **Focal Partners:** invited to share reference data useful to MangMap, to participate to the Platform's development
- **Relay Partners:** invited to co-organize awareness-raising activities and training sessions (webinars, workshops)
- **End-users:** invited to training sessions, to express feedbacks and recommendations (webinars)

Website

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MangMap Portal

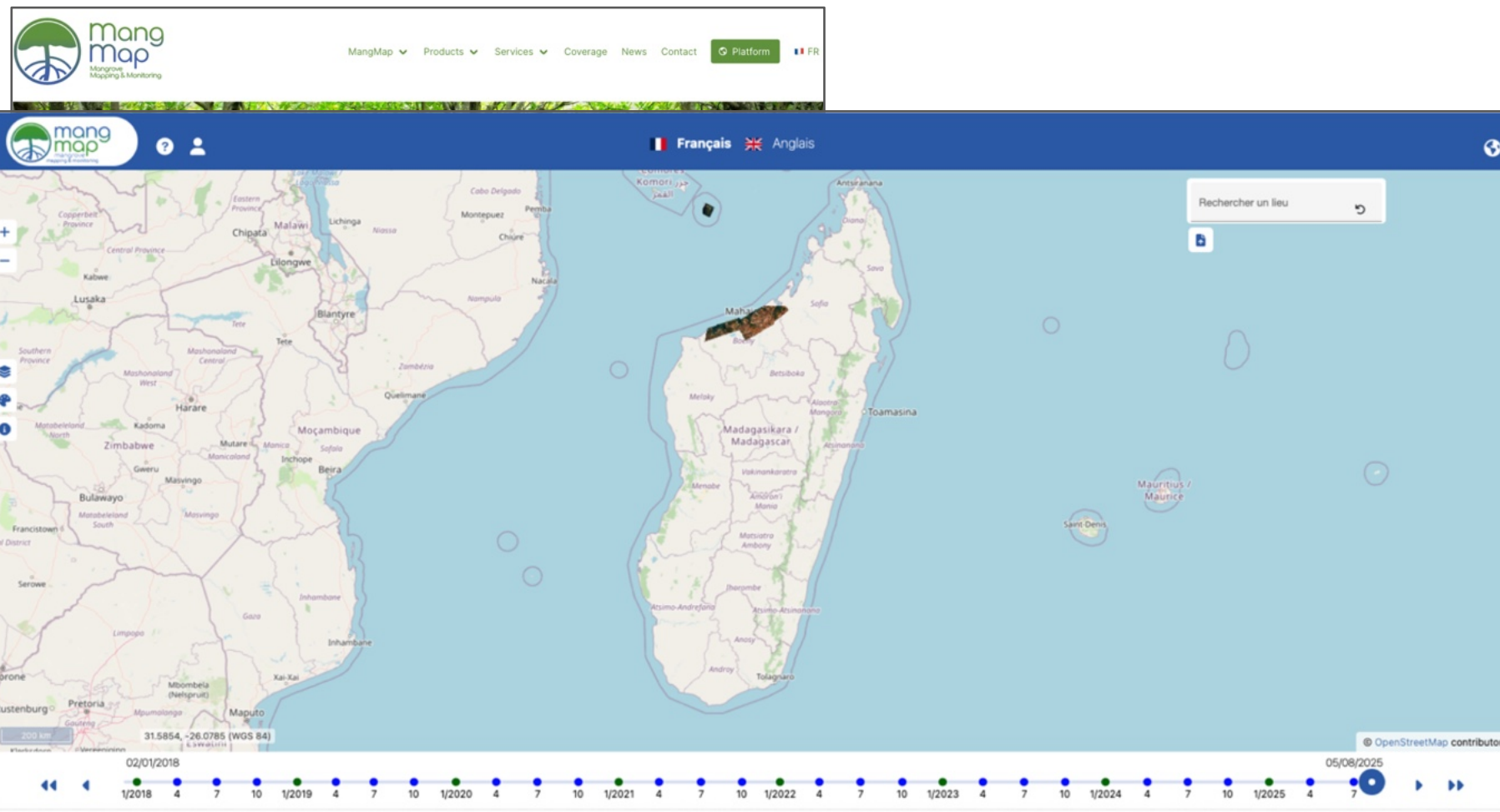
The Platform

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Website



Technical Platform

Introduction to MangMap

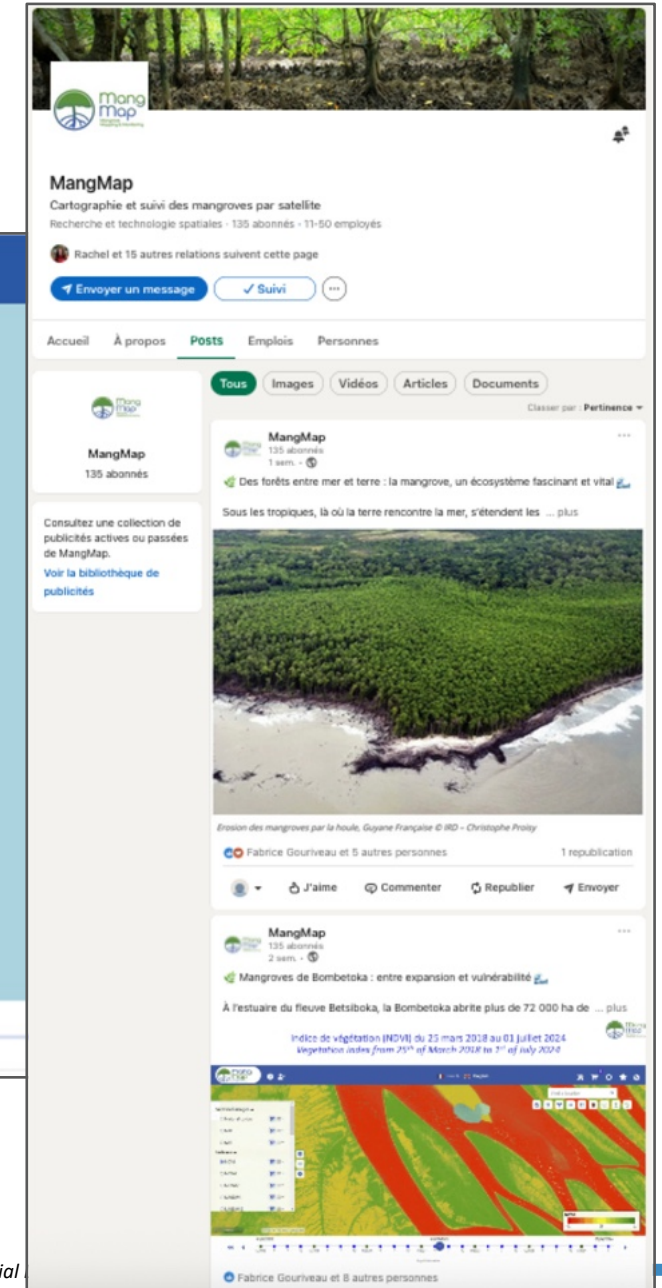
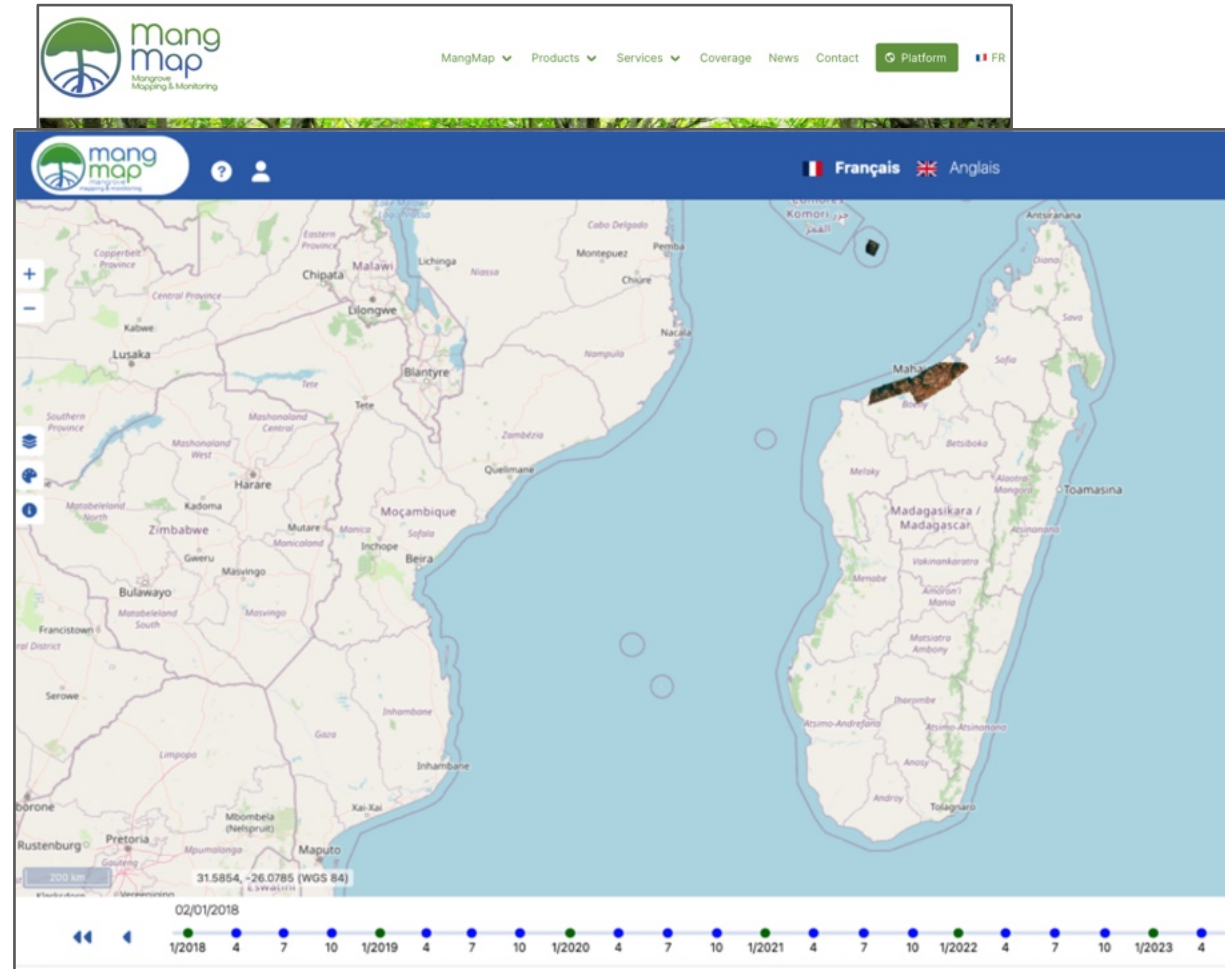
MangMap Portal

The Platform

Illustration in Madagascar

Perspectives in Cambodia

Website



Introduction to MangMap

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Technical Platform



Social media

Cambodia Geospatial

Interactive dashboard for viewing and analyzing time series of satellite imagery

- Based on tools and services that complement existing platforms, fully open access, at local scales and sub-annual time steps;
- Enabling online viewing, downloading, or production of new information in ZOIs and at frequencies of interest to users;
- In support to mangroves monitoring: spatial distribution, status of environmental parameters, changes and assessments of spatial and temporal dynamics.

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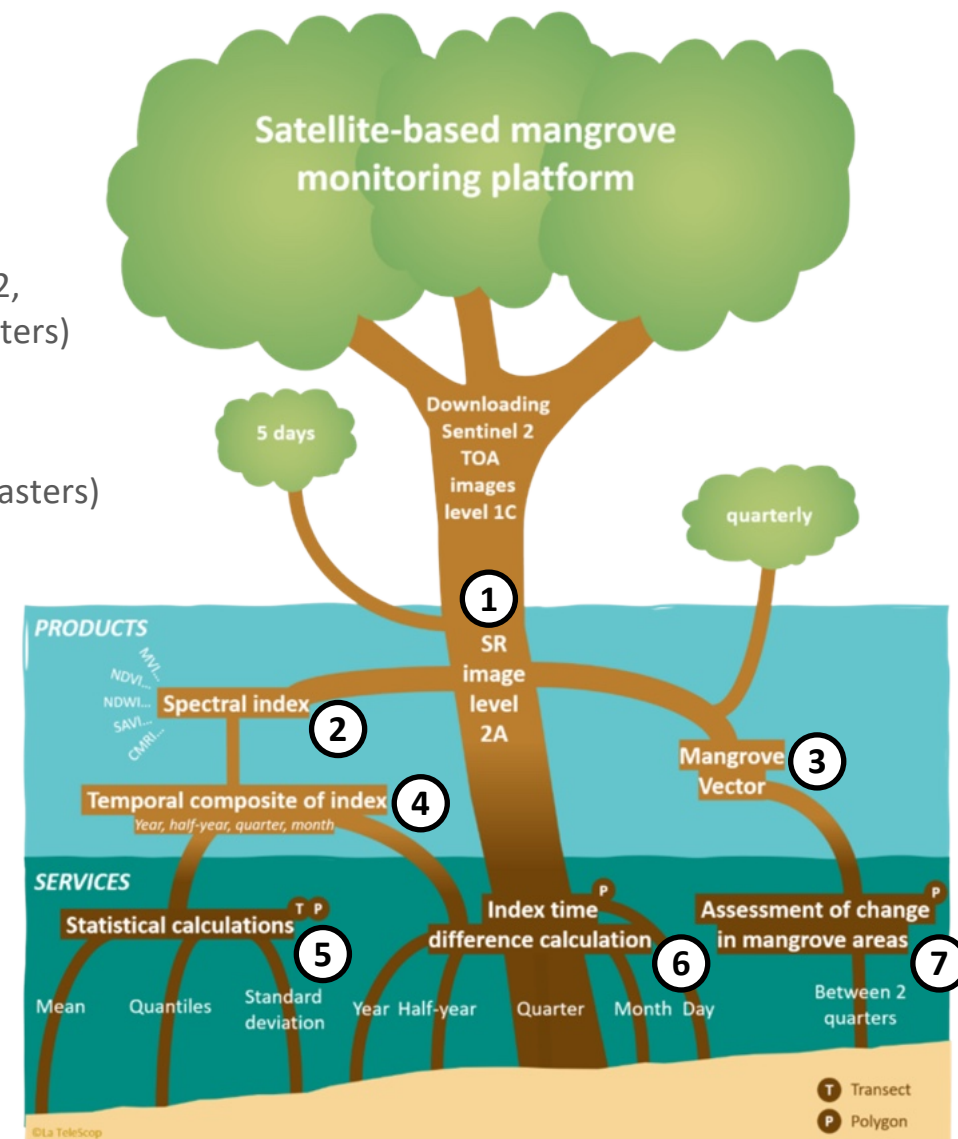
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Data, Image Processing, Coastal Zone Products

- ① Reflectance Sentinel 2 (level 2A) every 5 days
(outputs : rasters)
- ② 11 spectral indexes informing on mangroves habitat: NDVI, NDWI, NDWI2, MNDWI, MNDWI2, NDRE, BIGR, CMRI, IRECI, MVI, SAVI, every 5 days (rasters)
- ③ Quarterly Mangrove extension (vectors)
- ④ Temporal composites (all indexes) : monthly, quarterly, semester, year (rasters)

MangMap Data & Methods



TOA: Top Of Atmosphere, SR: Surface Reflectance



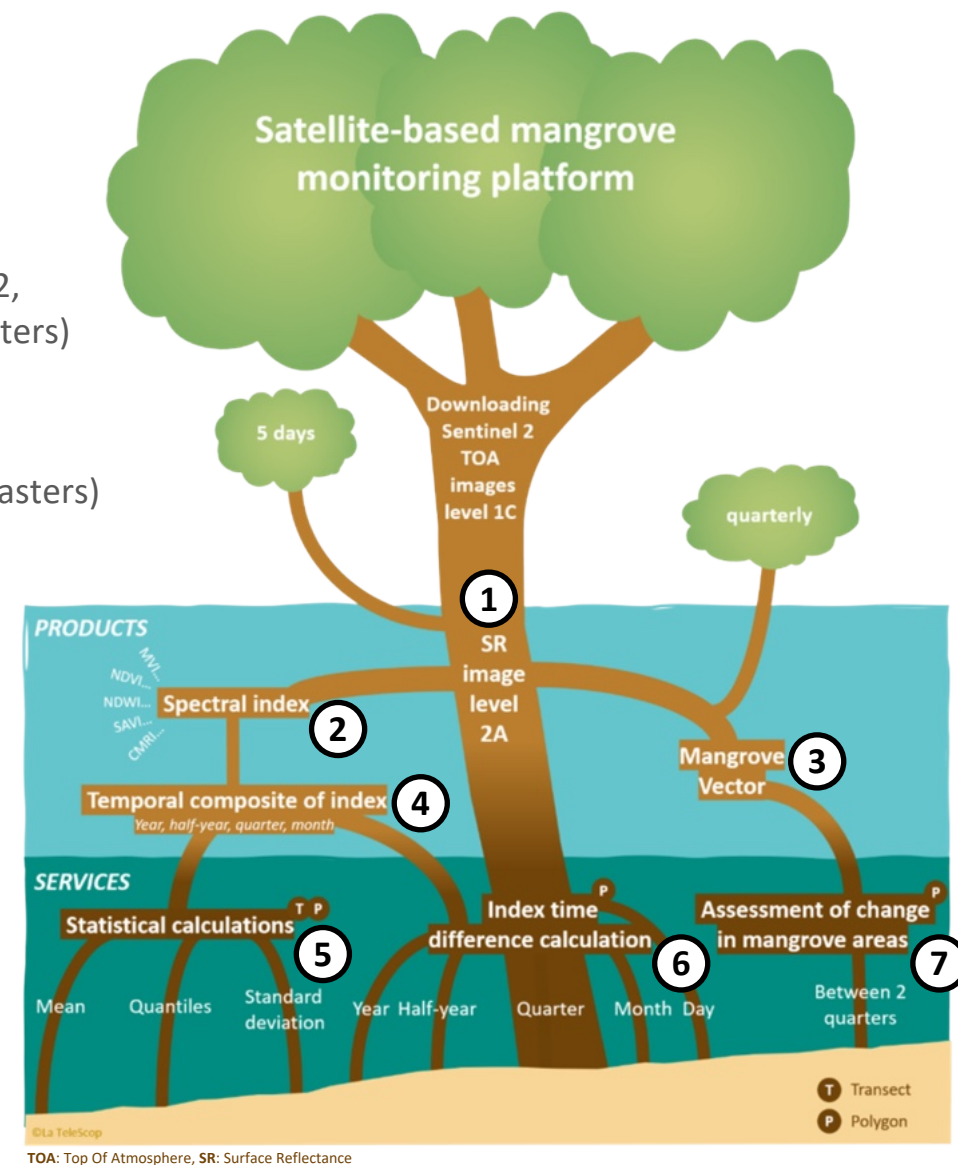
MangMap Data & Methods

Data, Image Processing, Coastal Zone Products

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On-demand Services

- ⑤ Statistical reports: changes over time in temporal composites within ZOIs, transects, or user points (outputs: graphs, tables)
- ⑥ Date-to-date differences in temporal composites of indexes within user ZOIs (outputs: rasters)
- ⑦ Estimation of the spatial evolution of mangroves within user ZOIs



TOA: Top Of Atmosphere, SR: Surface Reflectance



MangMap Data & Methods

Data, Image Processing, Coastal Zone Products

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- ④ Temporal composite of mangrove extension every year (rasters)

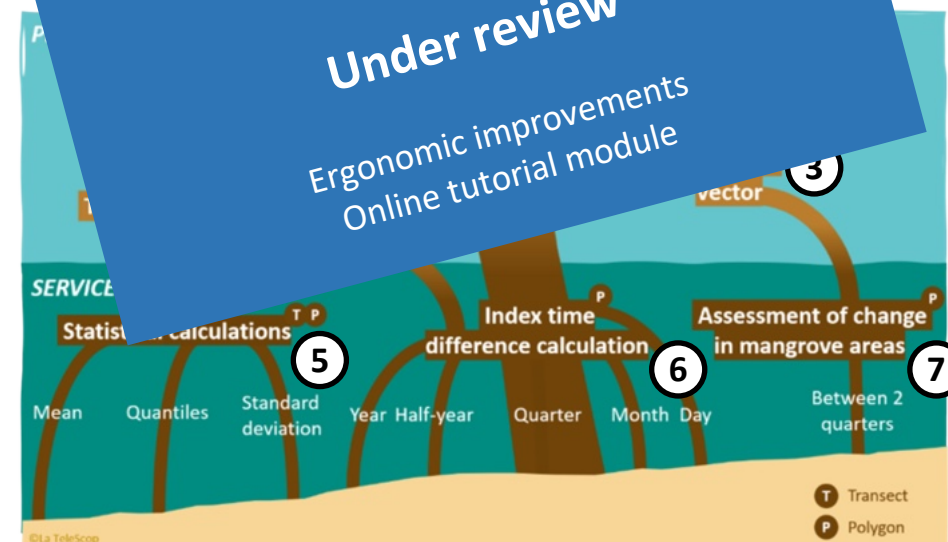
Demo Mode: corrections and continuous development

- ⑤ Statistical reports: changes over time in temporal composites within ZOIs, transects, or user points (outputs: graphs, tables)
- ⑥ Date-to-date differences in temporal composites of indexes within user ZOIs (outputs: rasters)
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In prep.
Deforestation or forest cover degradation alert service

Under review
Ergonomic improvements
Online tutorial module



TOA: Top Of Atmosphere, SR: Surface Reflectance



Opened in Demo mode in 6 locations (2024)

- Bombetoka Bay, **Madagascar**
- Obock Region, **Djibouti**
- South Coast, **Senegal**
- North Province, **New Caledonia**
- Central Coast, **French Guiana**
- Mayotte, **France**

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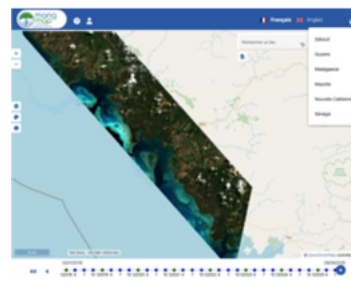
Perspectives
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Madagascar
Bombetoka Bay



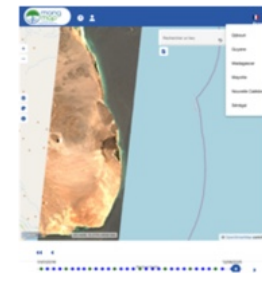
French Guiana
Cayenne - Kourou



Nelle Caledonia
North Province



Mayotte



Djibouti
Obock Region



Sénégal
South Coast

Access to the Plateform: from the website

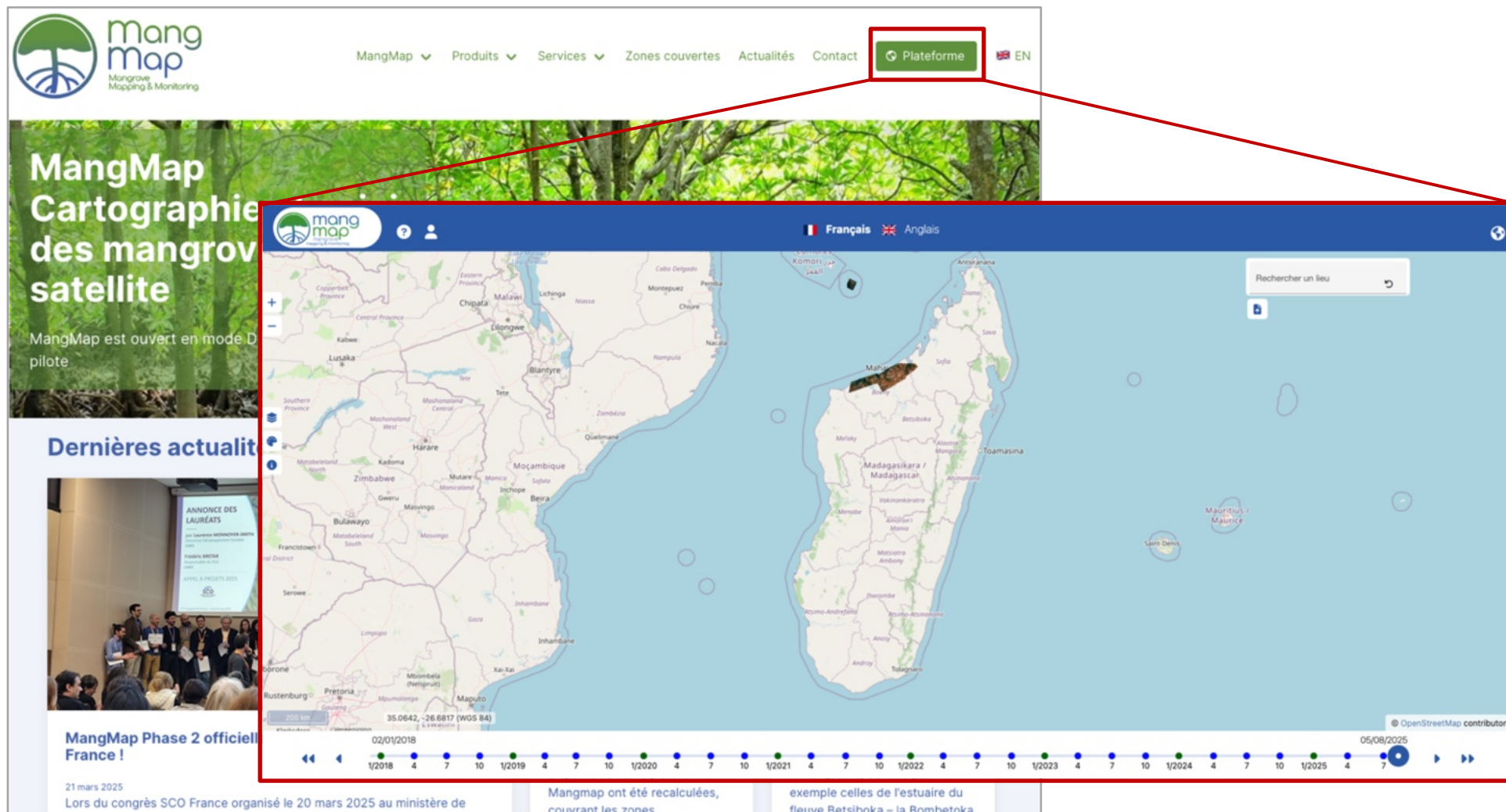
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The screenshot shows the MangMap website interface. At the top, the 'Plateforme' button is highlighted with a red box. Below the header, the main content area features a large banner for 'MangMap Cartographie des mangroves satellite' and a section for 'Dernières actualités' (Latest news). The central part of the interface is a map of Madagascar, showing various regions and mangrove zones. A search bar is located in the top right corner. At the bottom, there is a timeline of updates from 2018 to 2025, with a red circle highlighting the date 05/08/2025. The timeline includes the text 'MangMap Phase 2 officielle France !' and 'Mangmap ont été recalculées, couvrant les zones exemple celles de l'estuaire du fleuve Betsiboka – la Bombetoka'.

Log in to access all services

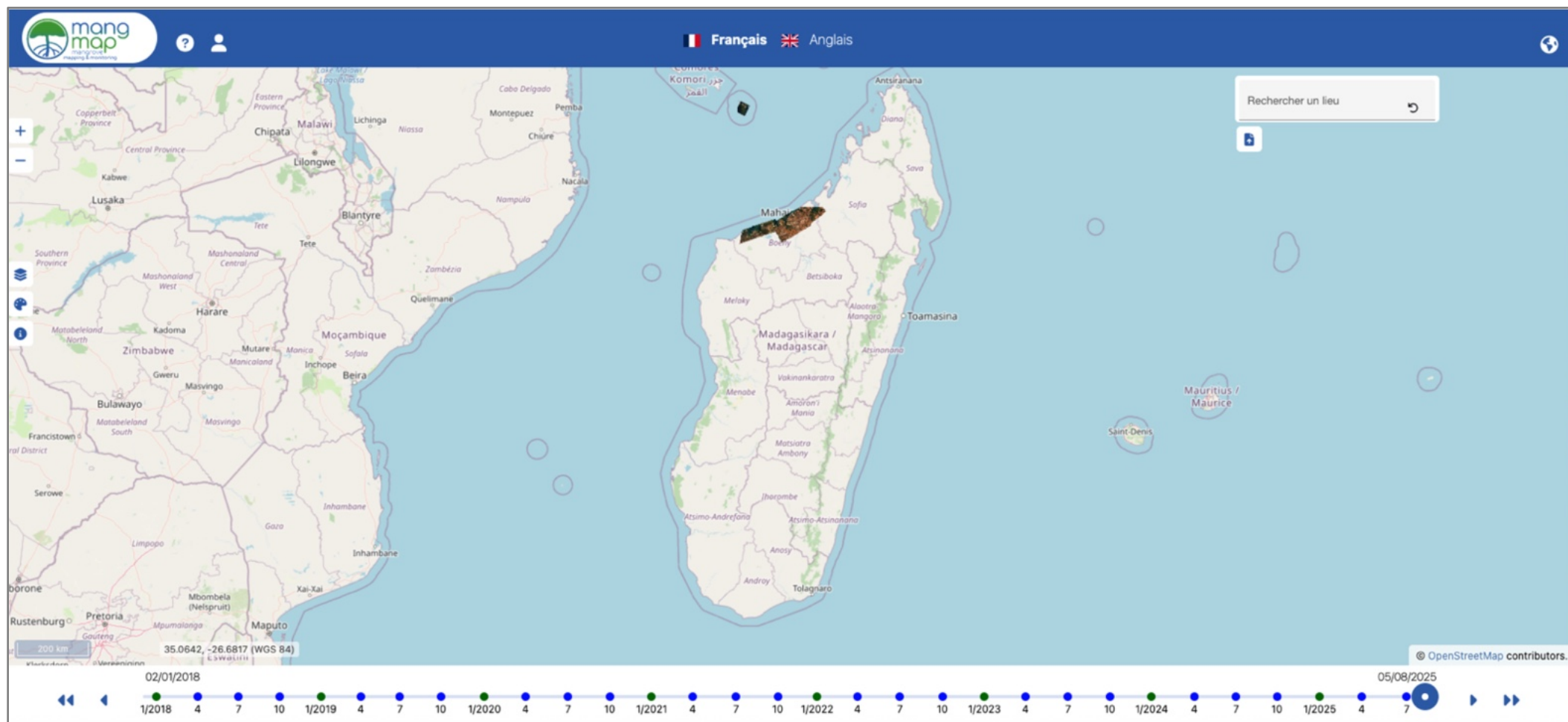
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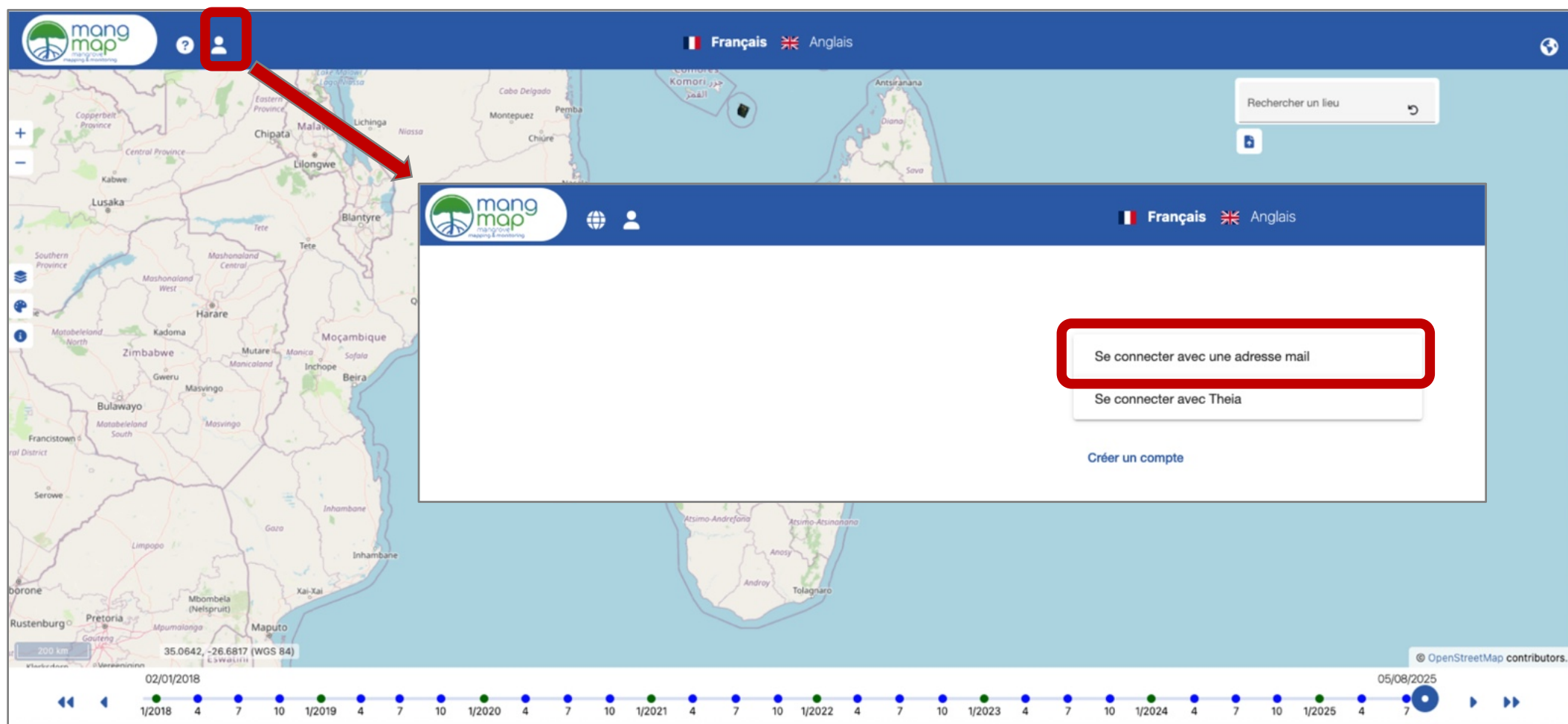
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Log in to access all services



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Key features

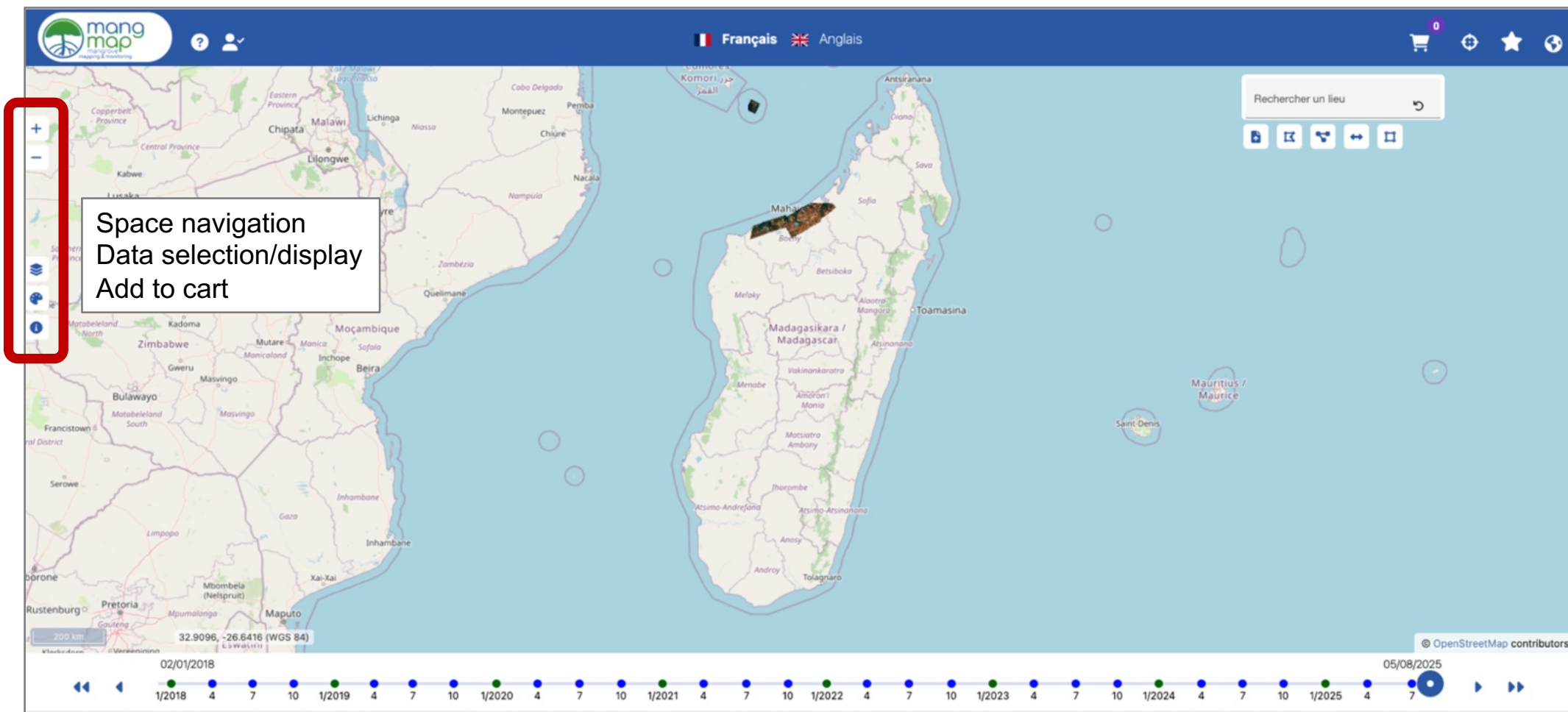
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Key features

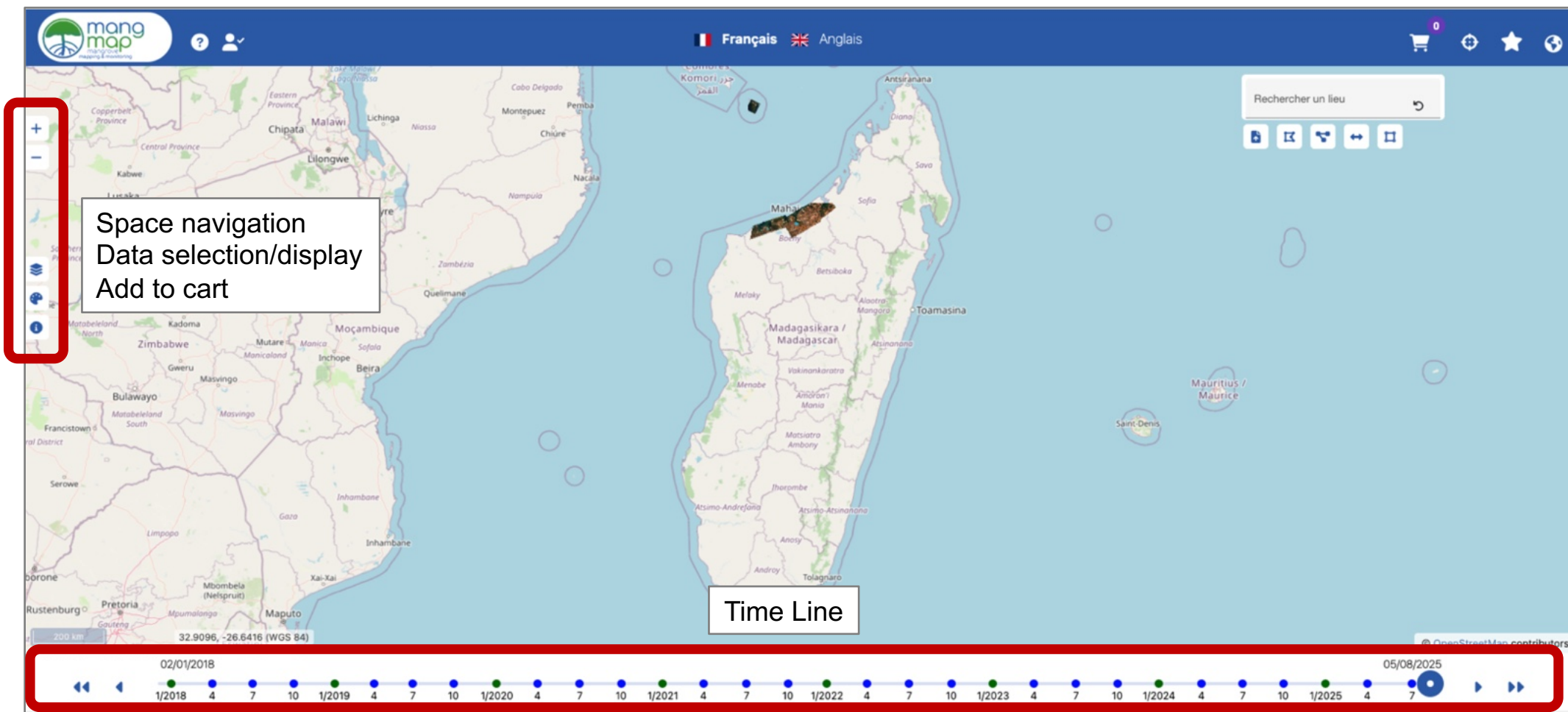
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Key features

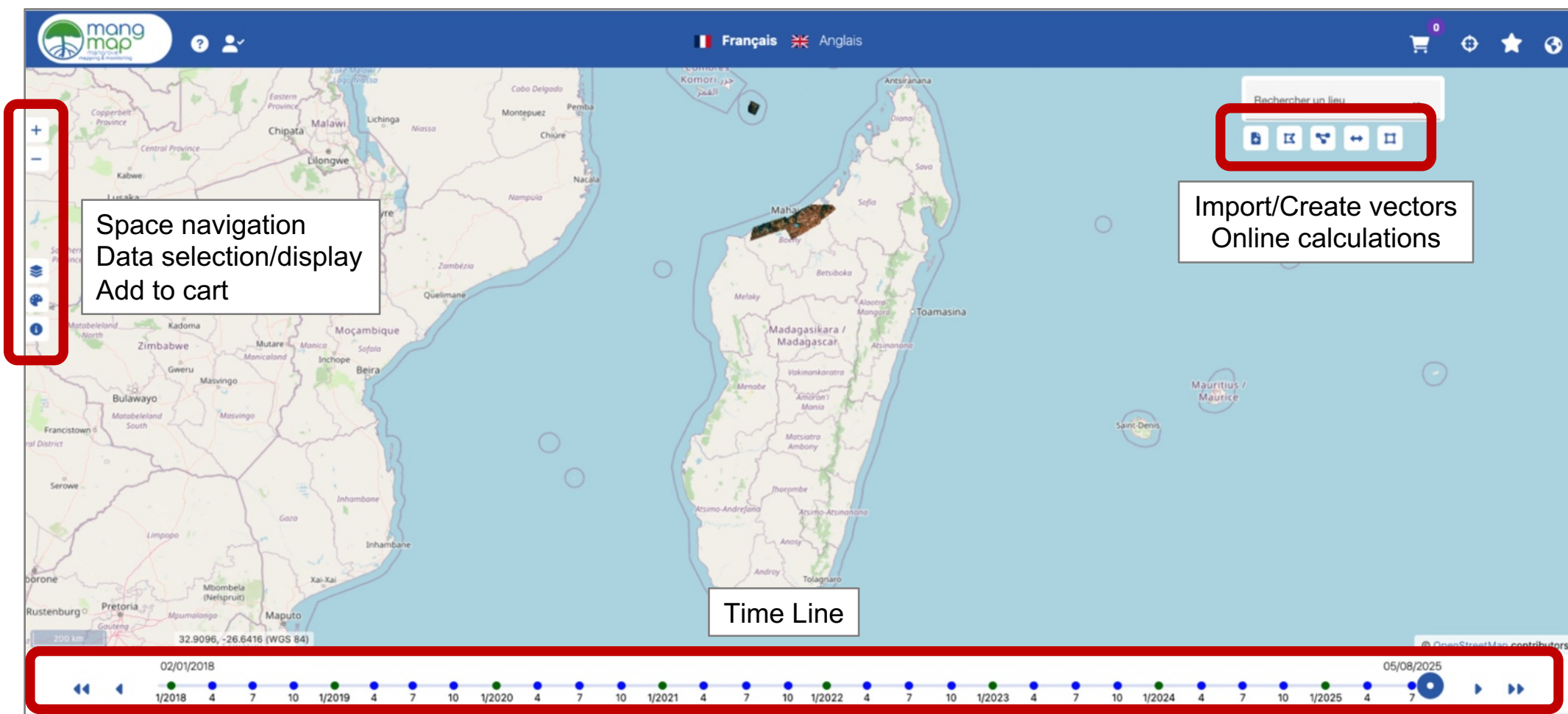
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Key features

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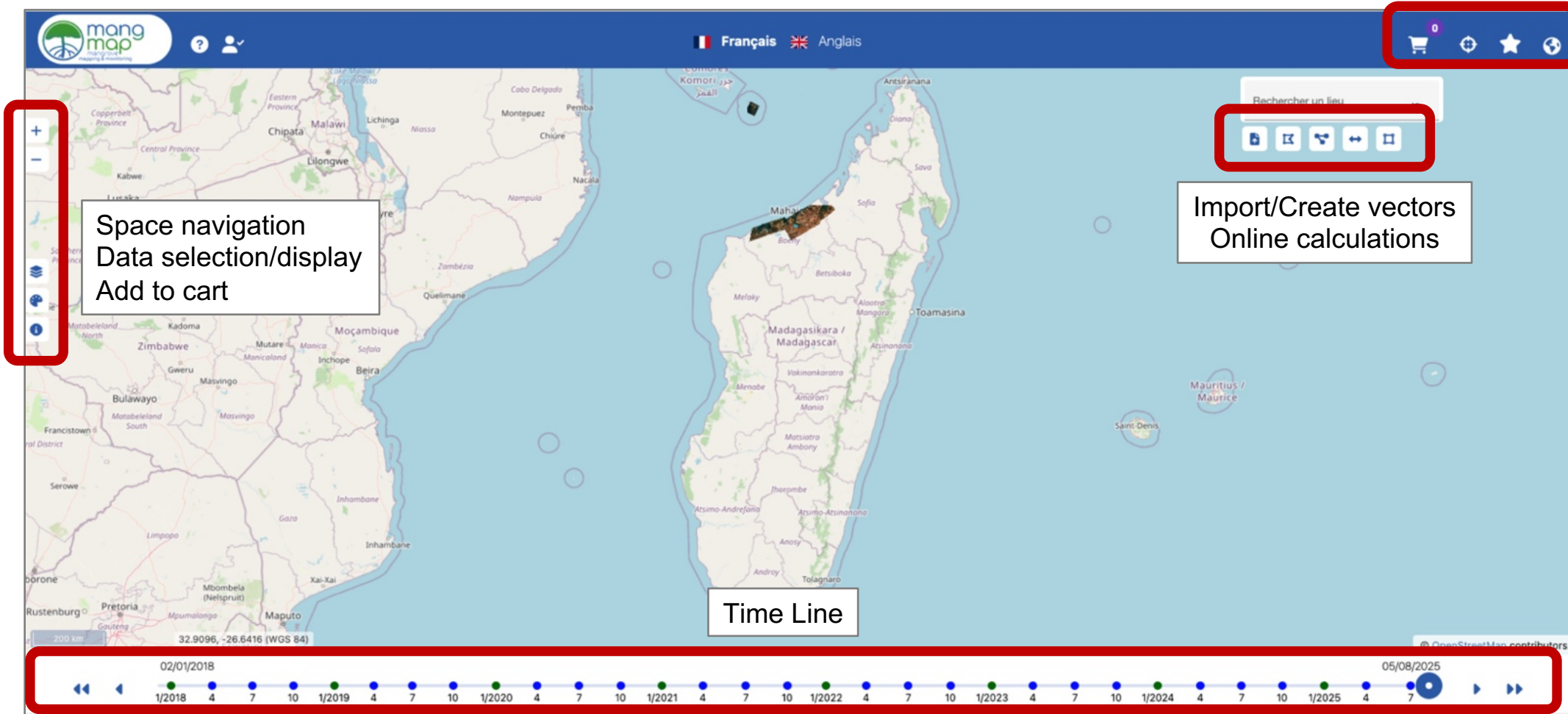
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Cart, shortcuts



Viewing, downloading imagery or indexes, temporal composites of indexes

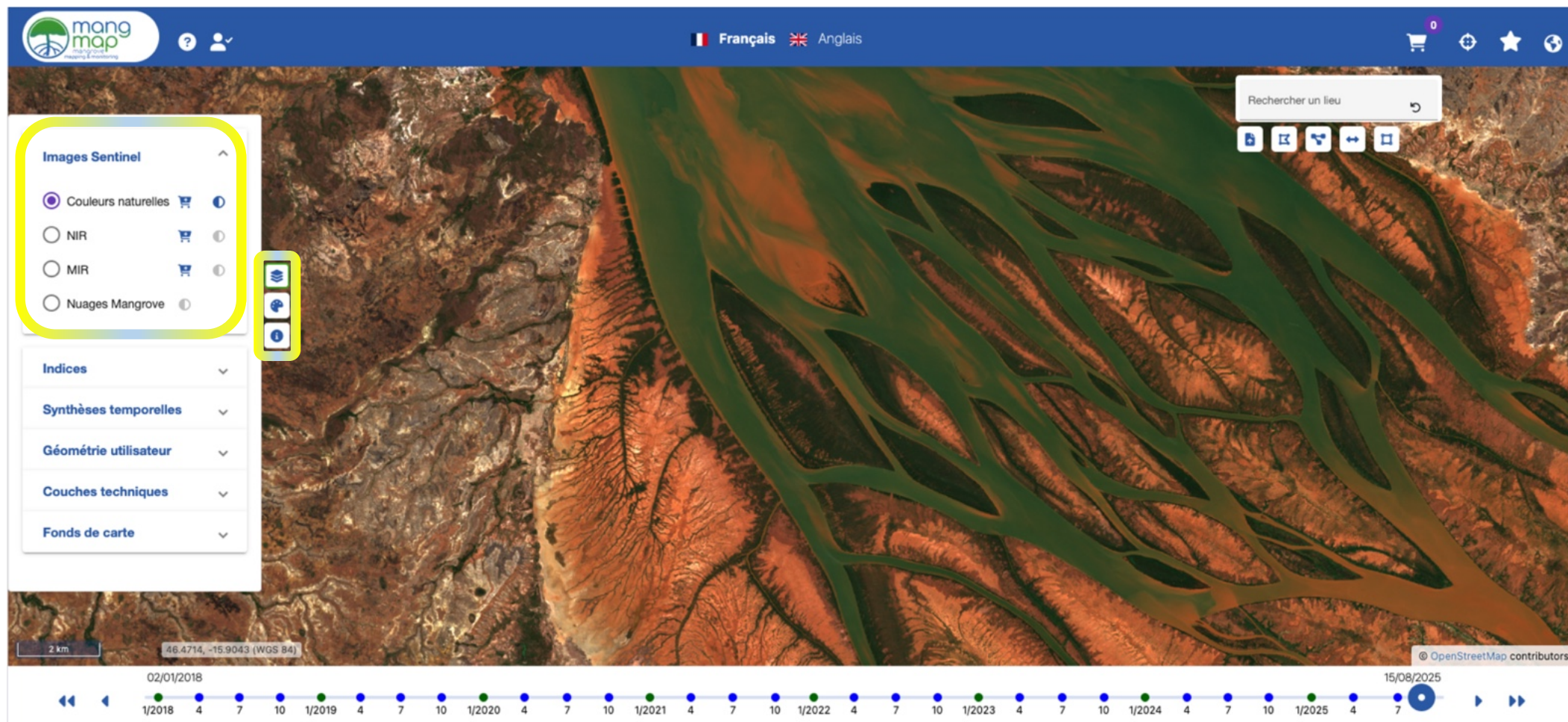
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Viewing, downloading imagery or indexes, temporal composites of indexes

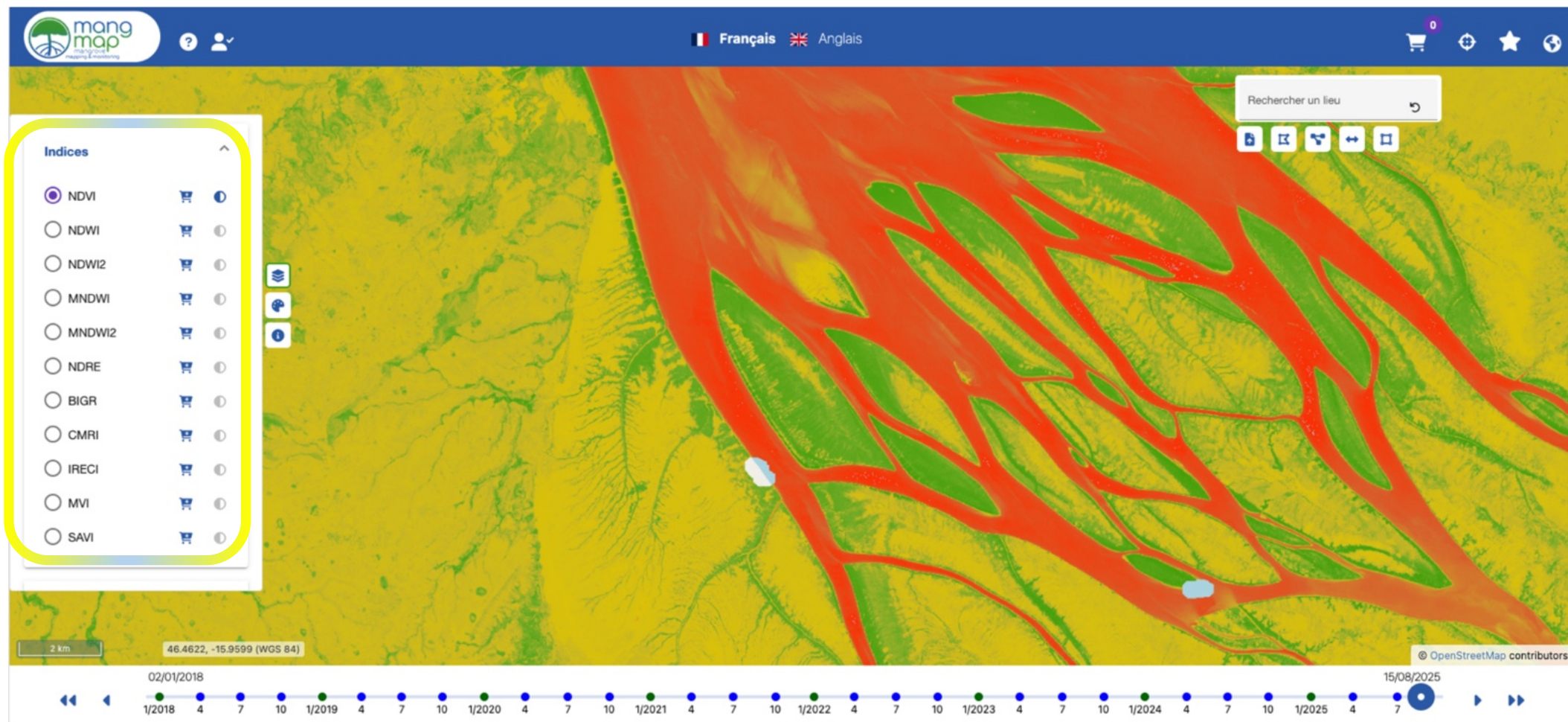
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Viewing, downloading imagery or indexes, temporal composites of indexes

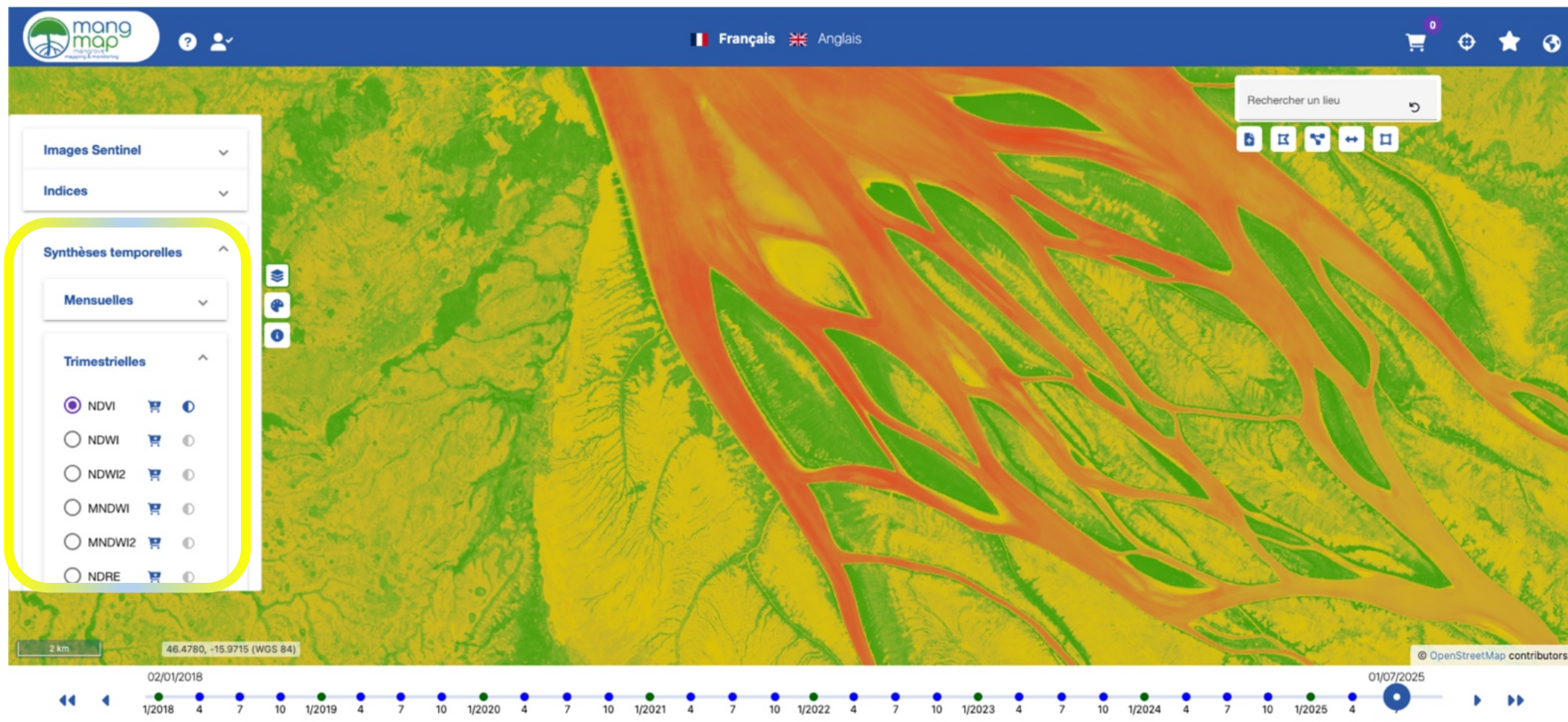
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Viewing, downloading imagery or indexes, temporal composites of indexes

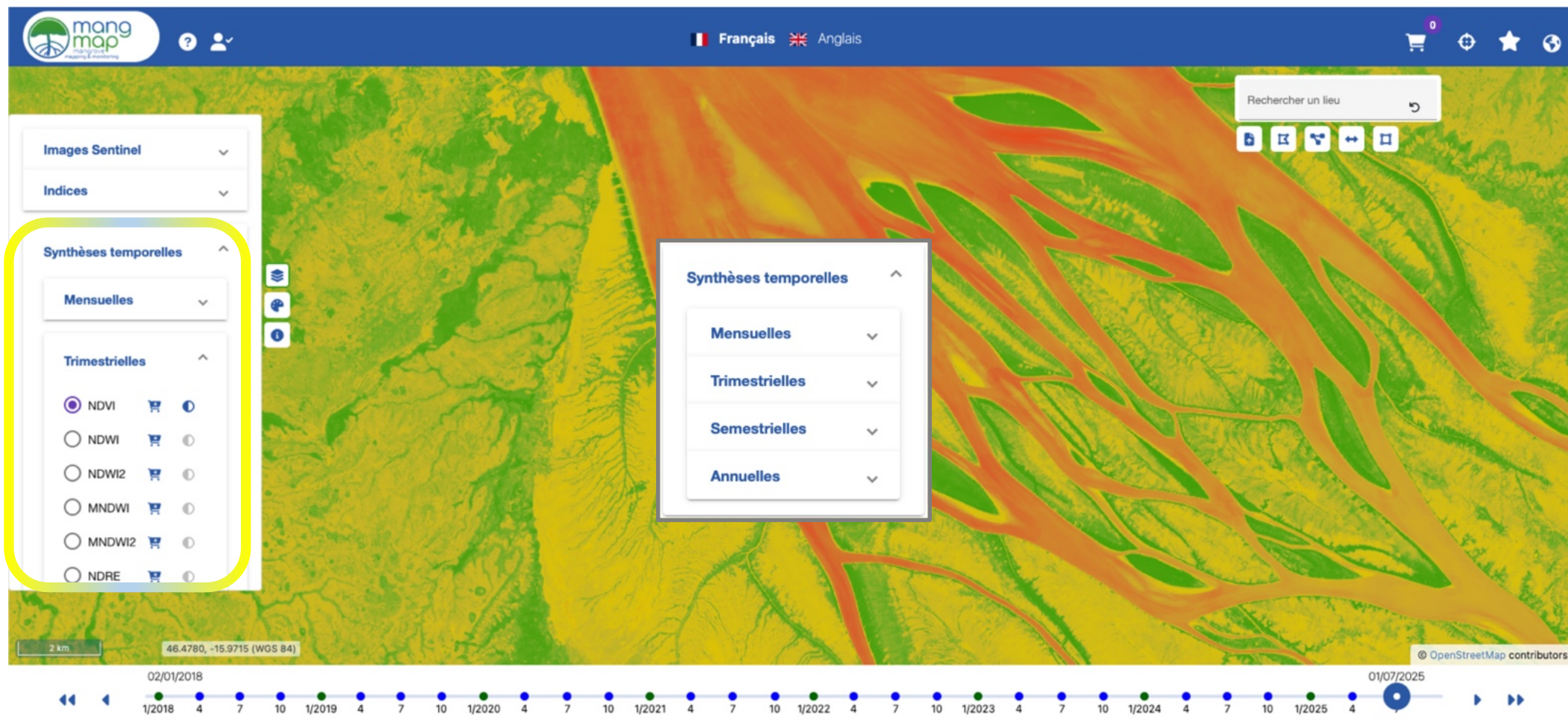
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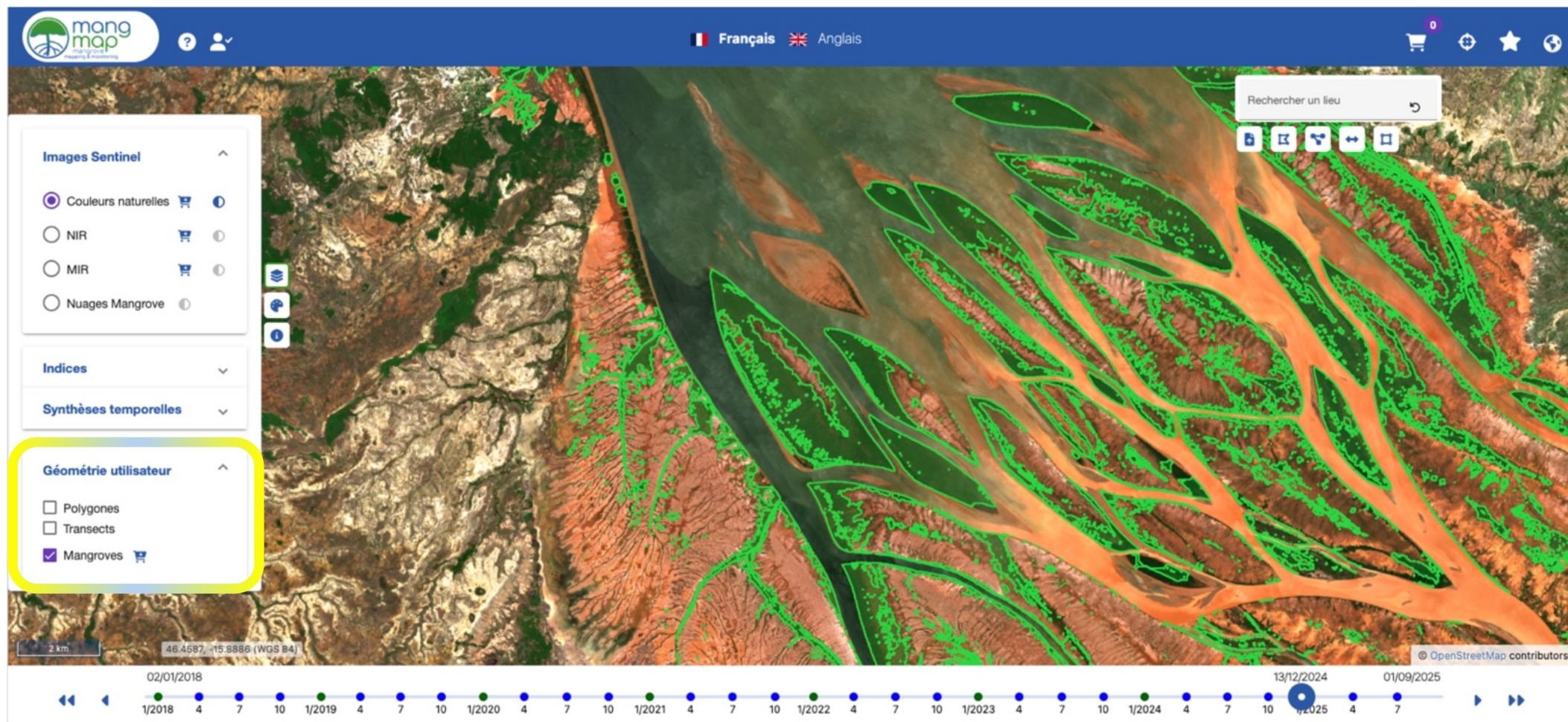
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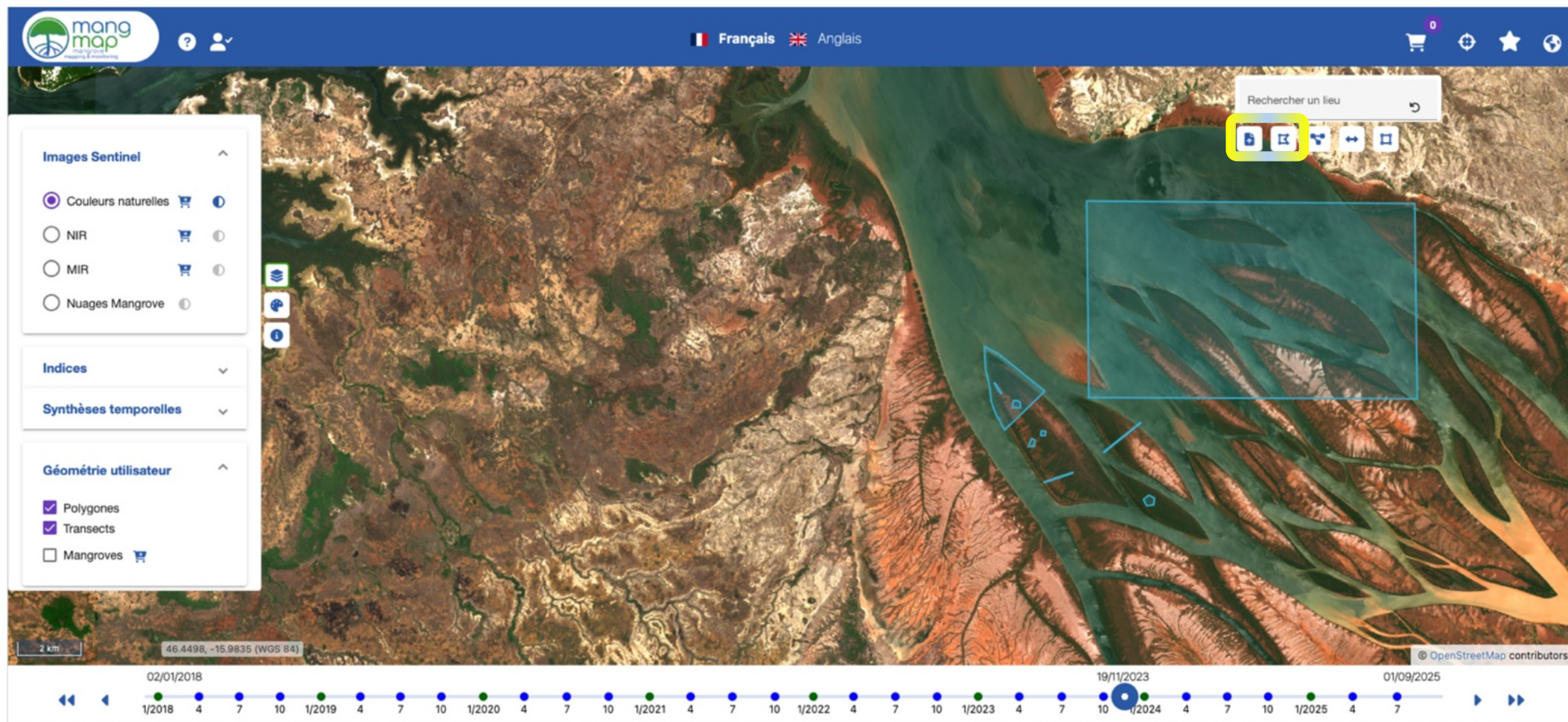
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Importing or entering polygons or transects of interest...



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... and launch online calculations on a selected object

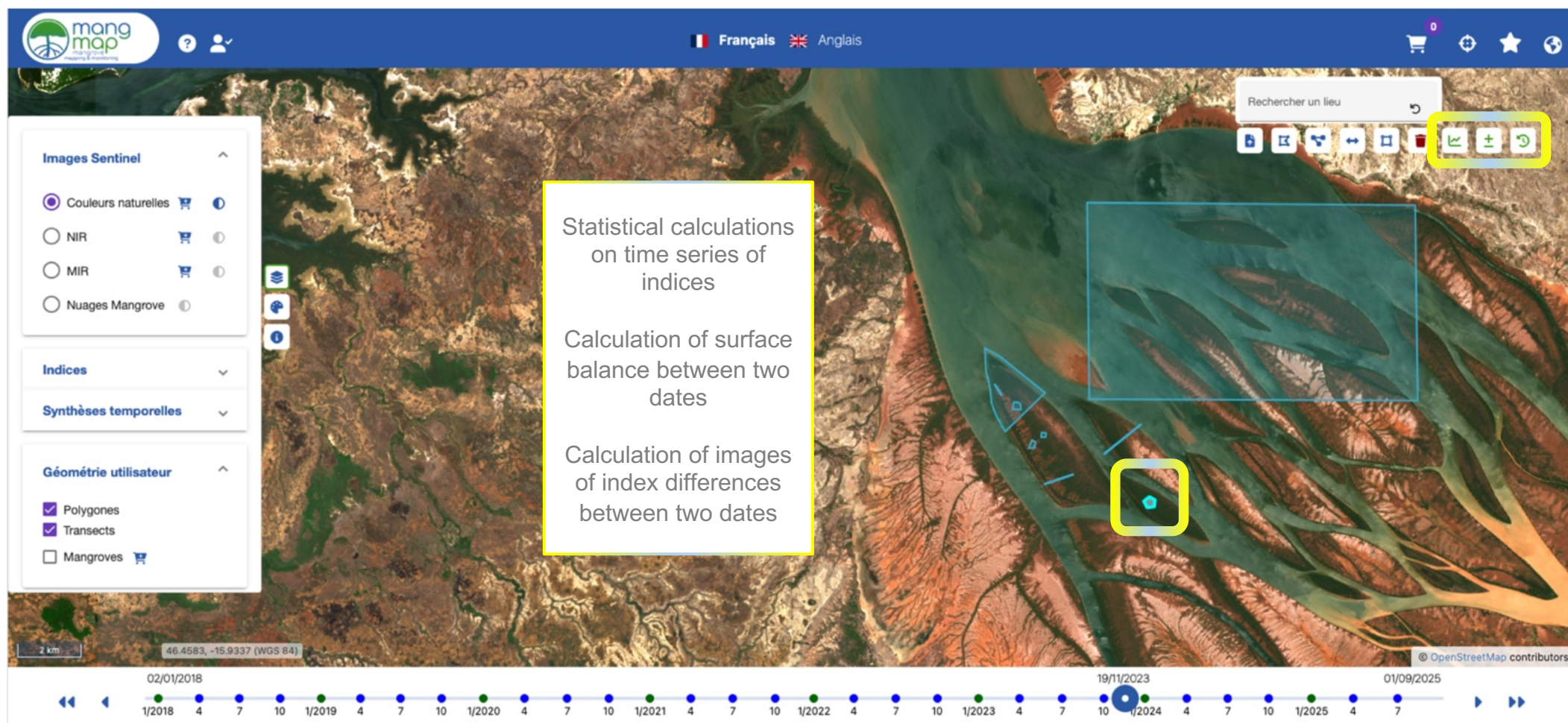
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In a polygon: statistics calculated on time series of index composites

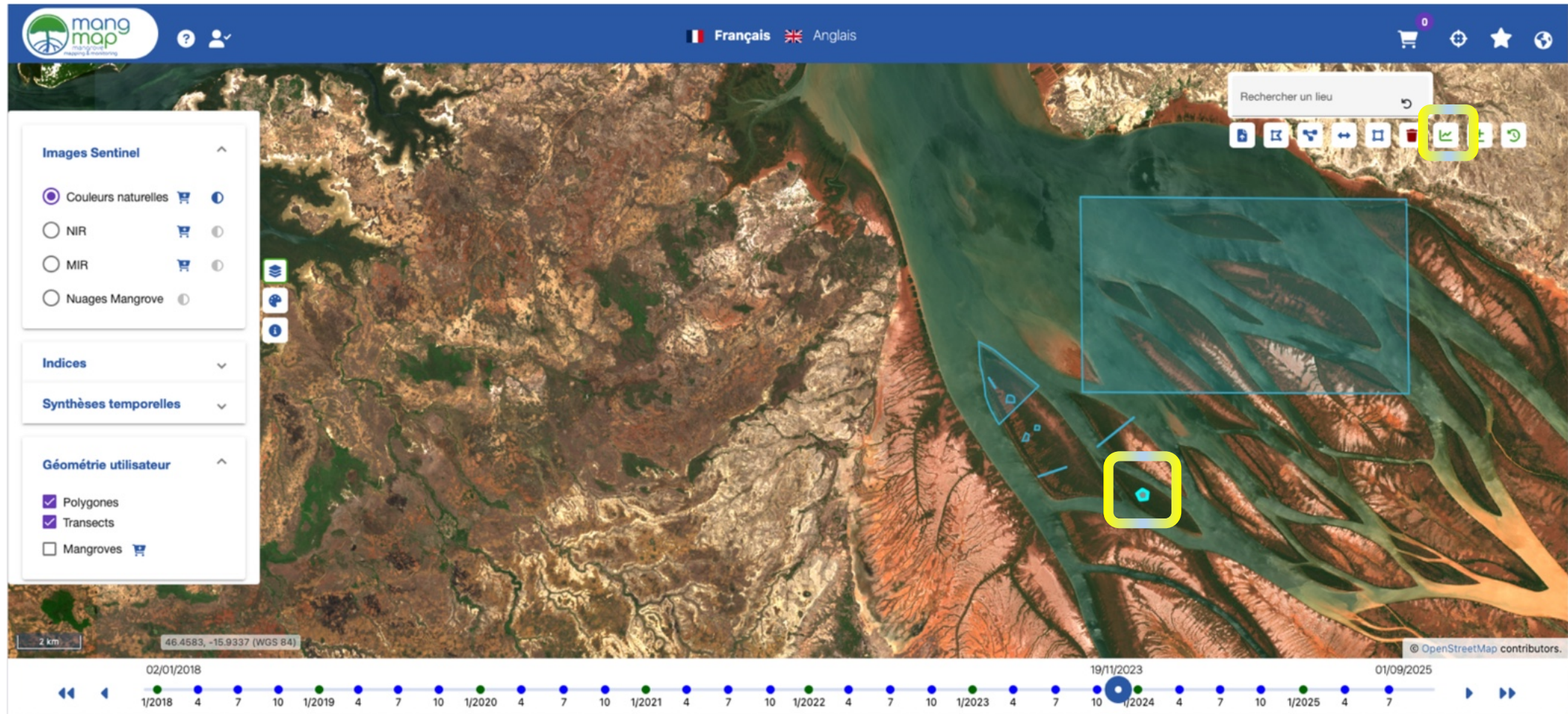
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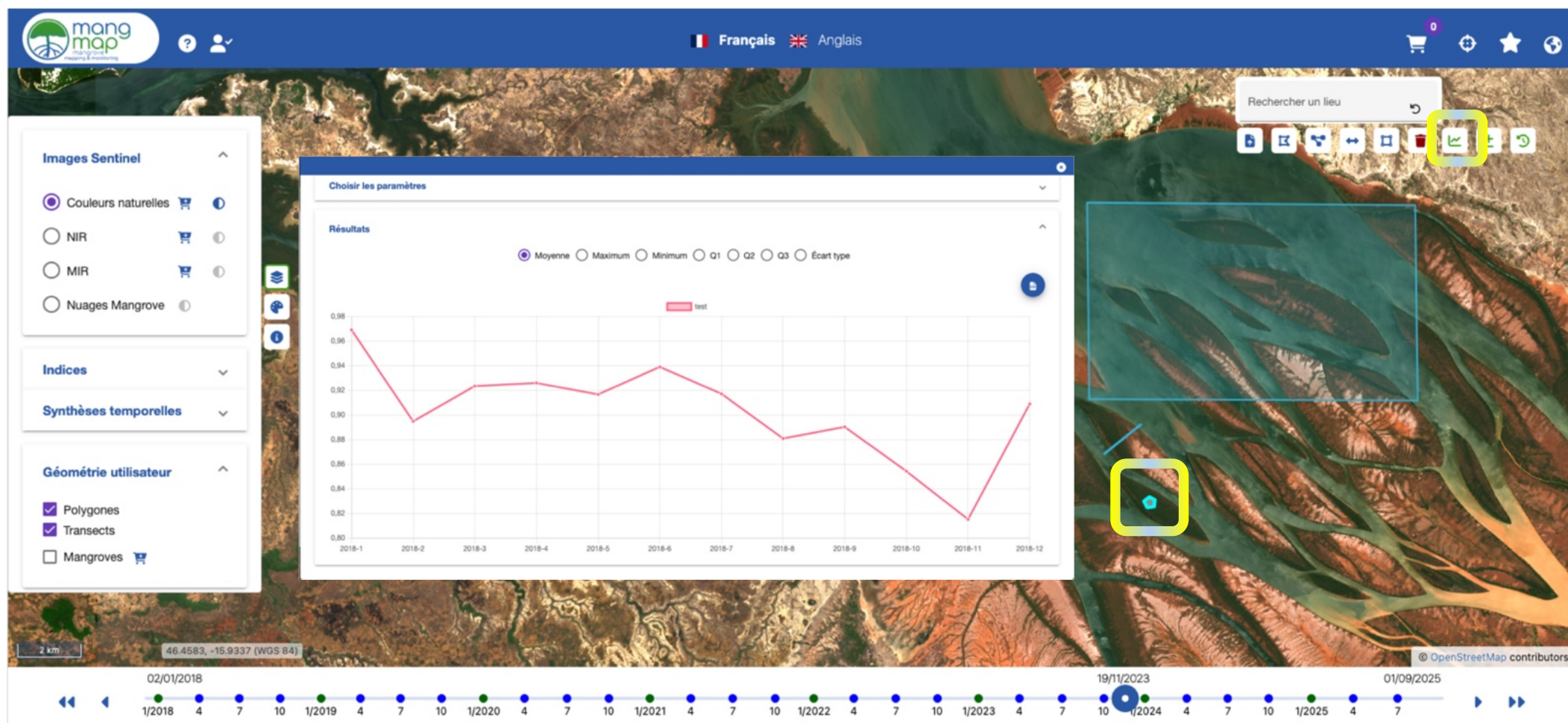
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In a polygon: Area assessment of mangroves between two dates

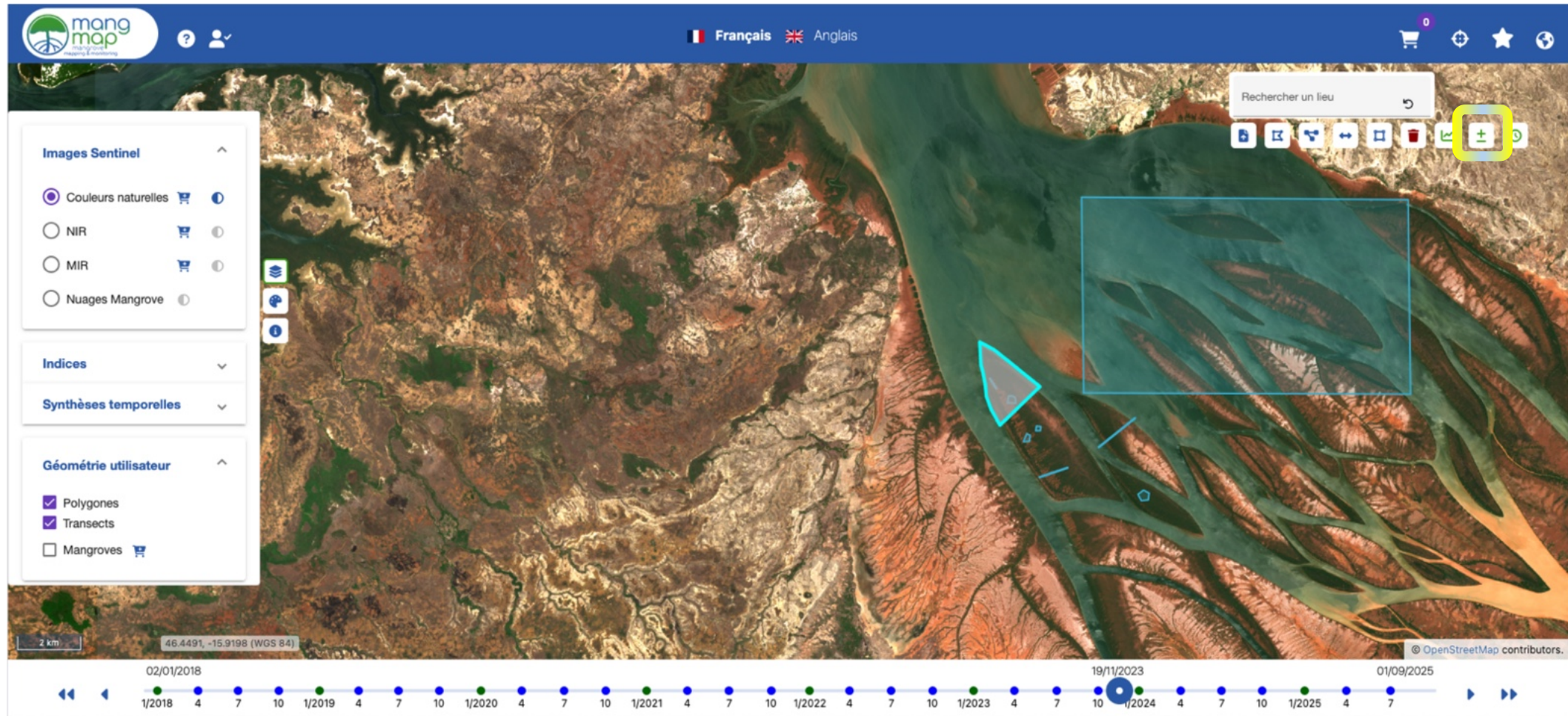
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In a polygon: Area assessment of mangroves between two dates

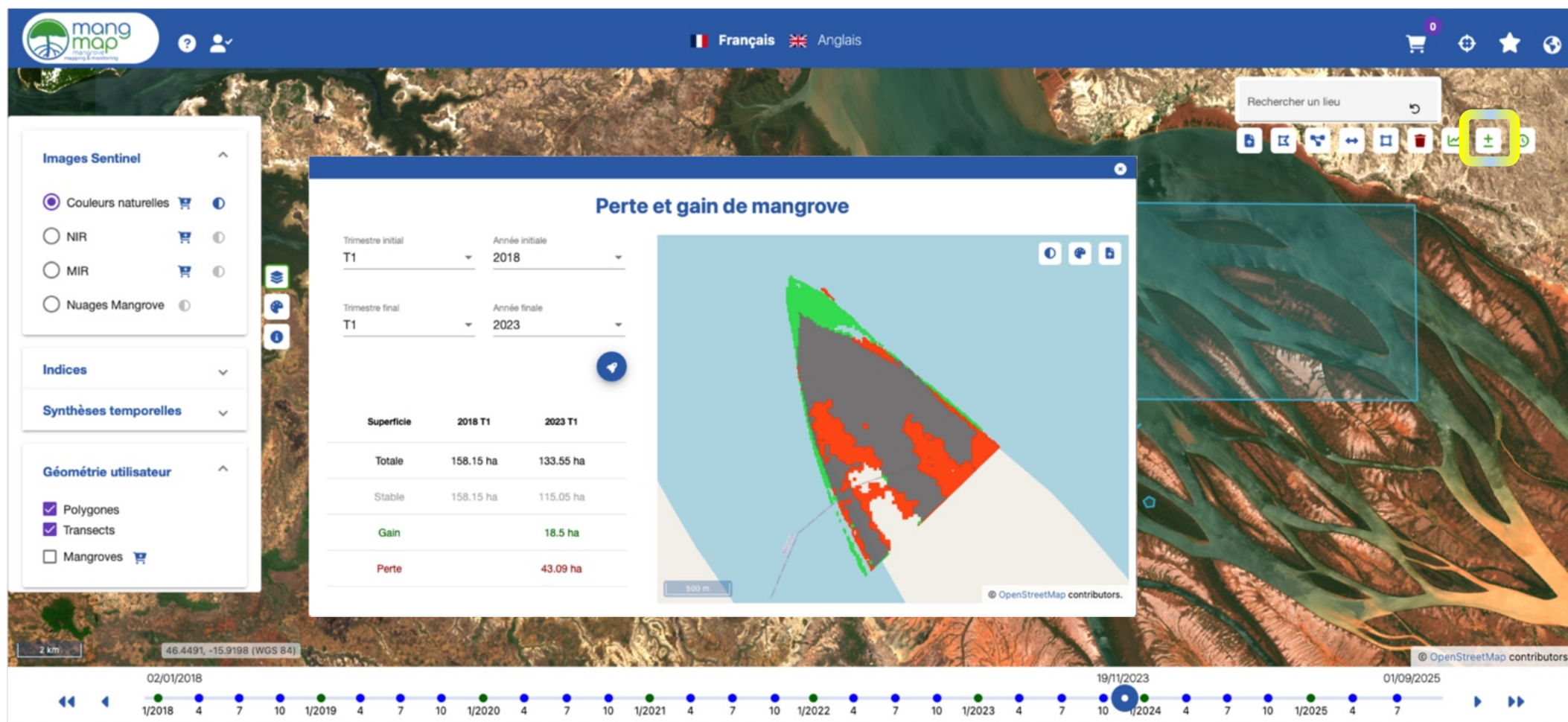
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In a polygon: difference between two date-to-date time composites

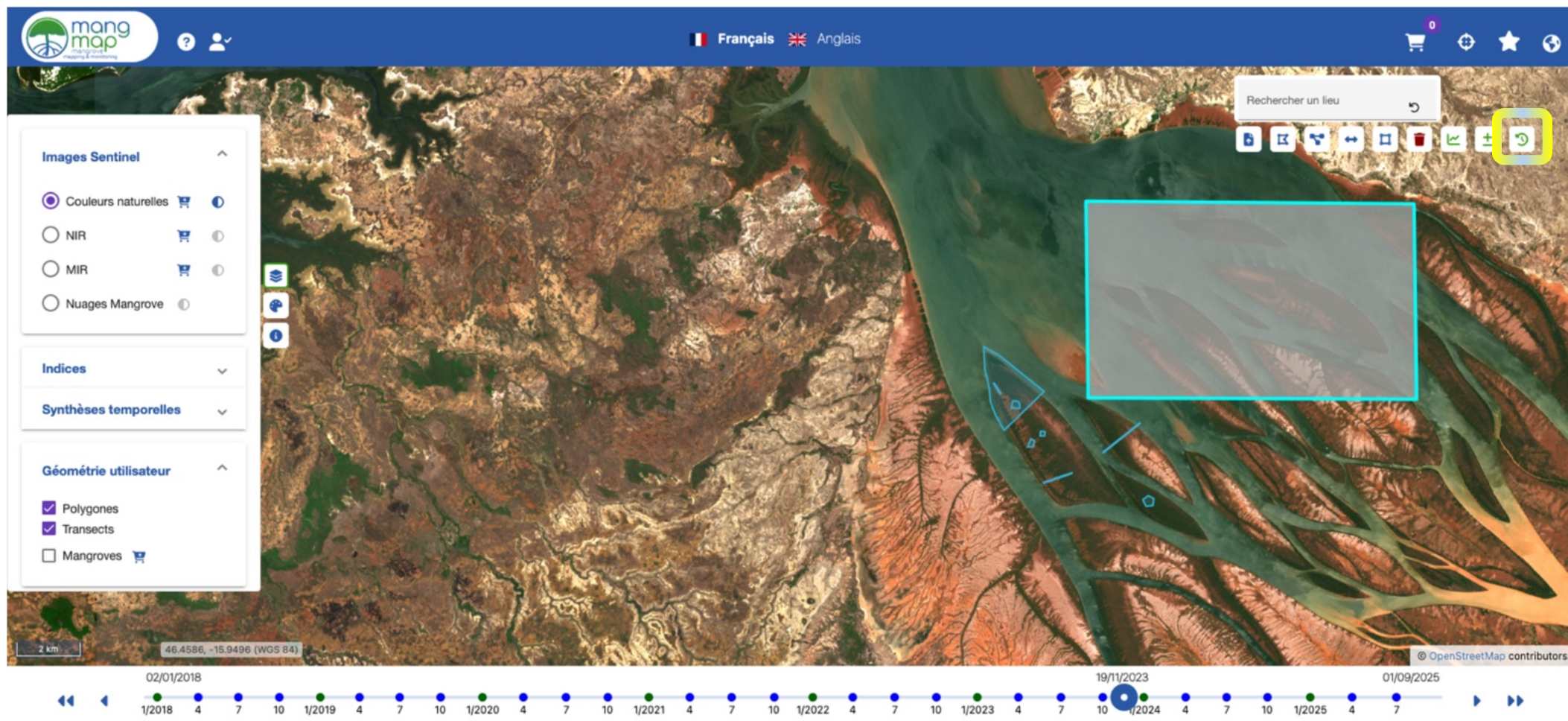
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In a polygon: difference between two date-to-date time composites

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Along a transect: statistics calculated on time series of index composites

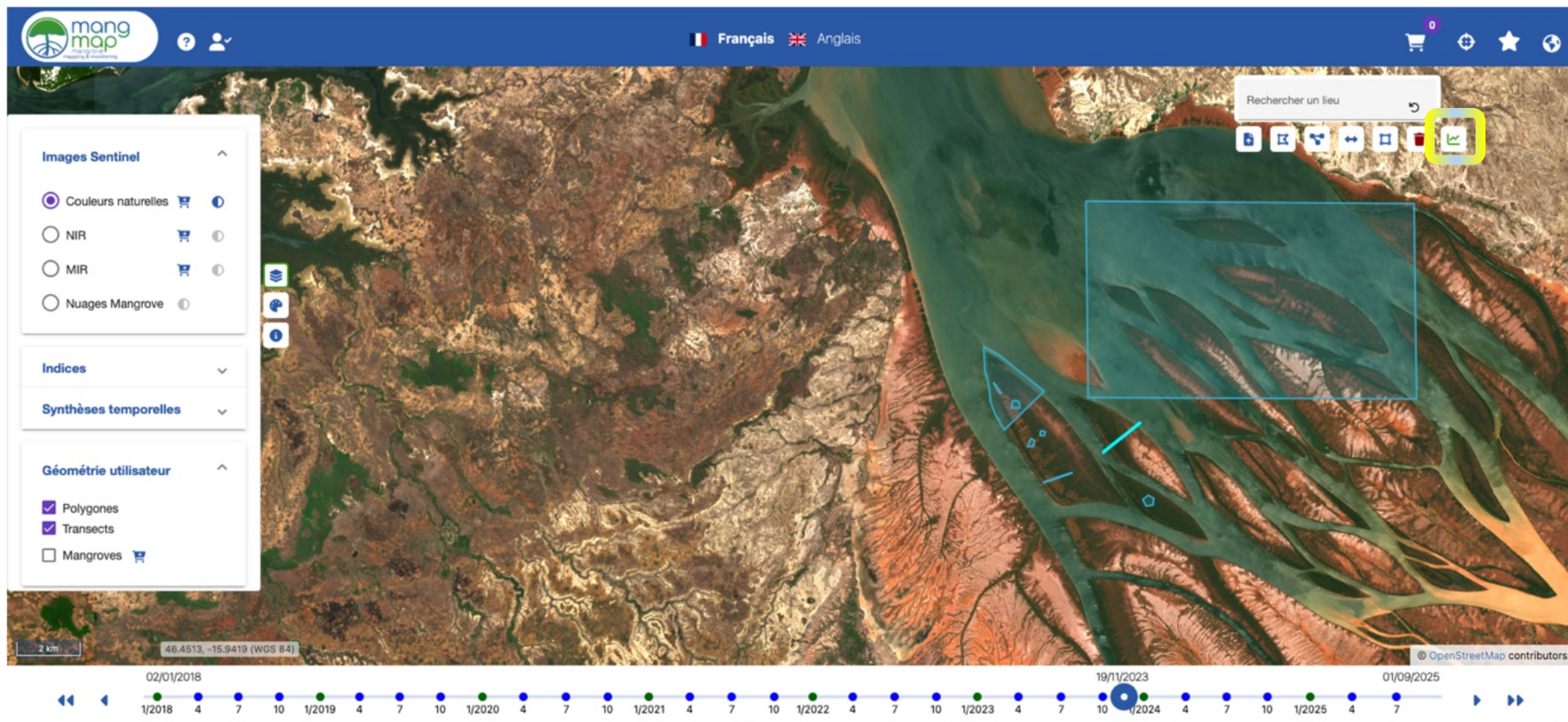
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Along a transect: statistics calculated on time series of index composites



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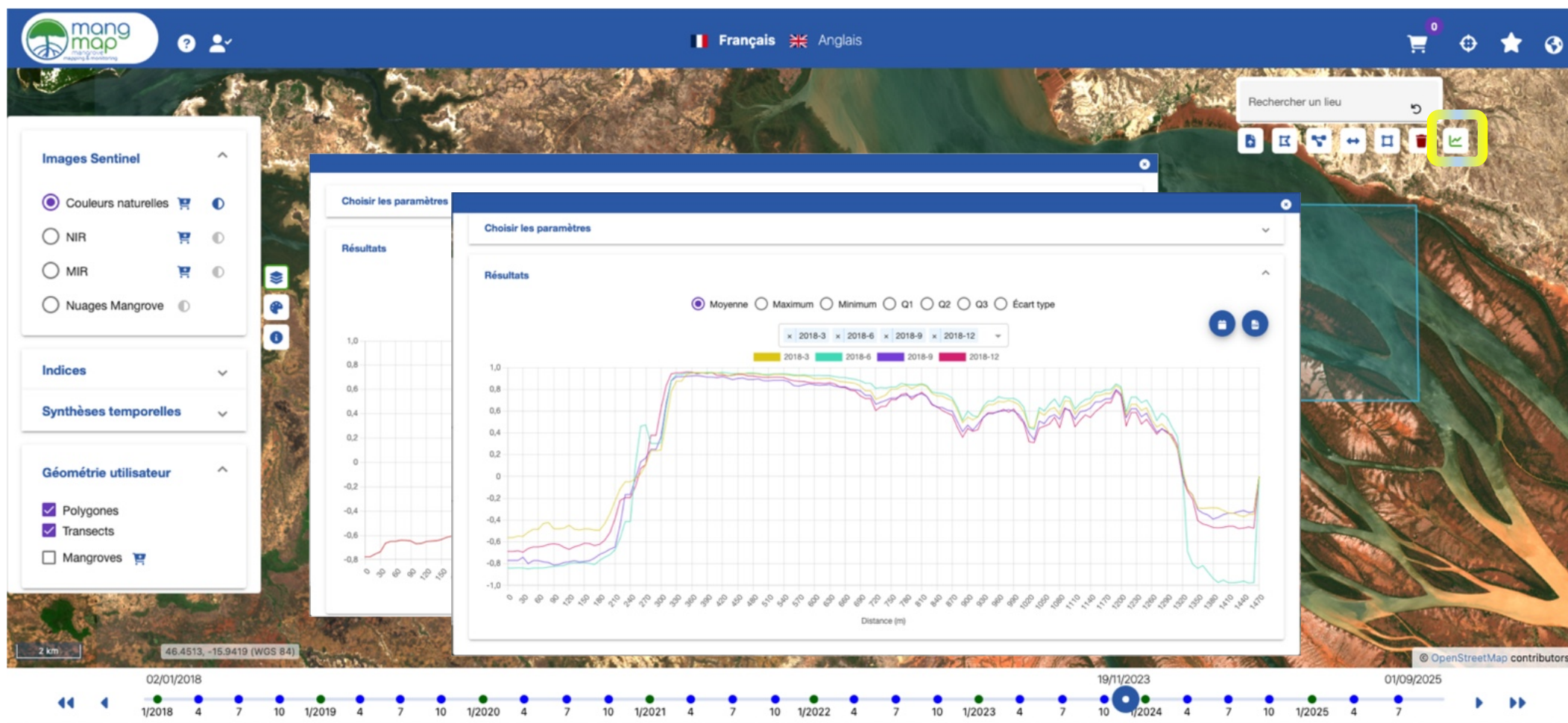
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Along a transect: statistics calculated on time series of index composites



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Example of by-products generated with screenshots

Monthly vegetation index from 03/25/2018 to 06/01/2024

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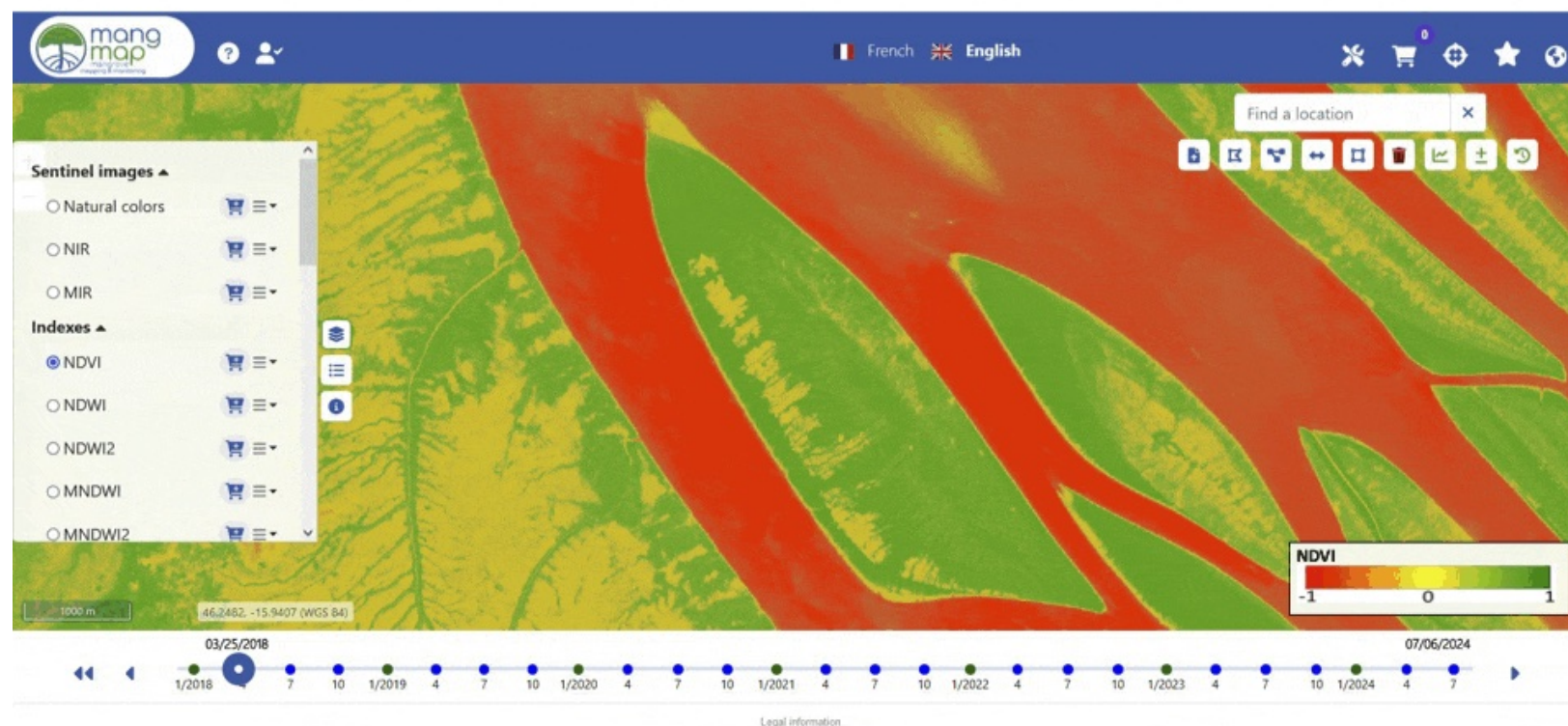
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Indice de végétation (NDVI) du 25 mars 2018 au 01 juillet 2024
Vegetation index from 25th of March 2018 to 1st of July 2024



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MangMap Phase 2 (2026-2028) : 3 Objectives

1. Expansion to new sites
2. Acculturation, training, and facilitation of a MangMap network
3. New features and tools



Lead by  Institut de Recherche
pour le Développement
FRANCE  **Espace DEV**
OBSERVATION SPATIALE, MODÈLES
& SCIENCE APPLIQUÉE

Financed by  **SCO**
SPACE CLIMATE
OBSERVATORY

Training Program submitted to IRD: Partners in Madagascar, **Cambodia**, Brazil

Objective 01 - Expansion to new sites

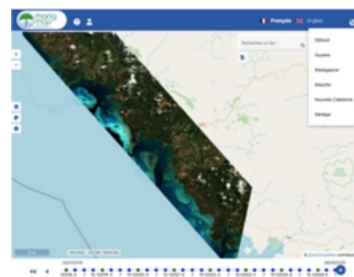
- Current locations



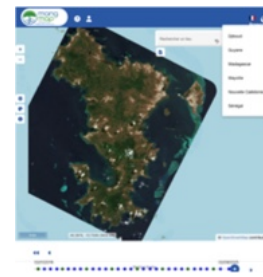
Madagascar
Bombetoka Bay



French Guiana
Cayenne - Kourou



New Caledonia
North Province



Mayotte

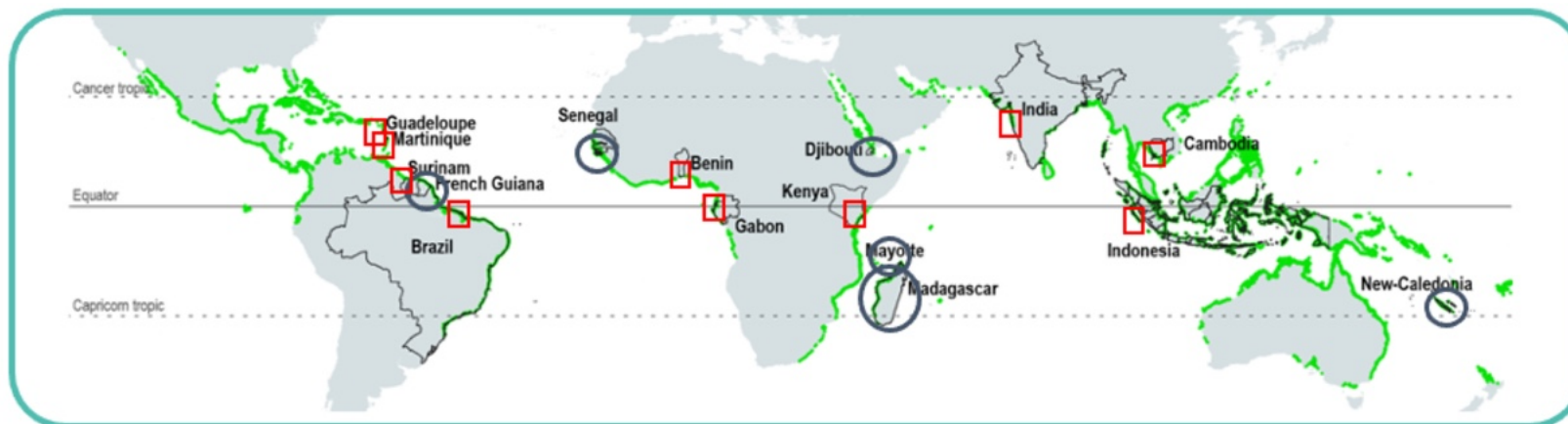


Djibouti
Obock Region



Sénégal
South Coast

- New planned sites



Priorities

- Madagascar
- Cambodia**
- Brazil

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MangMap

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in Madagascar

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Objective 02 - Acculturation, training, and facilitation of a MangMap network

Endusers

- Webinars: raising awareness, information
- Webinars or workshops: training sessions



Majunga University Madagascar
03/2024

Partners, collaborative Organizations

- Participation to the inclusion of new sites within MangMap Platform
- Co-organization of webinars and training sessions held locally
- Involvement in MangMap developments

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Objective 03 – New features and tools

Introduction to
MangMap

Website

- Creation of detailed tutorials
- Development of simple online educational courses (Hands-on MangMap)

MangMap Portal

The Platform

Illustration
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Platform

- Improvement of the interface after collecting initial feedbacks
- Alerts system in areas of interest to users: leaf cover degradation alert, deforestation alert (restoration alerts under consideration)

Perspectives
in Cambodia


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in Madagascar

**Perspectives
in Cambodia**

- **ITC: Partner of Training Program in MangMap Phase 2**
→ Specific project submitter 
- **Cambodian mangroves to be included in MangMap**
→ Objective 1 of MangMap Phase 2

→ **Inclusion of Cambodian mangroves in MangMap**

Steps to consider:

1. **Testing:** select a Sentinel Tile and feed it to the Platform
2. **Ramp-up:** integrate all mangroves of Cambodia
3. **Empowerment:** train partners, enduser community

Step 1 - Testing

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Perspectives
in Cambodia

- Select a Tile of prior interest
- Co-validate a vector shape file of mangroves, co-define Parameter sets
- Run tests and co-validate results

MangMap integrates the Tile in the Plaform:

- **First Cambodian study site in MangMap Platform**



Step 2 – Ramp-up

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in Madagascar

**Perspectives
in Cambodia**

- Elaborate a Development Plan and form a Working Group
- Co-produce vector shape files for all mangrove areas, co-validate Parameter sets, co-validate test results

MangMap integrates all Tiles in the Platform:

- **All Cambodian mangroves in MangMap**



Step 3 - Empowerment of endusers

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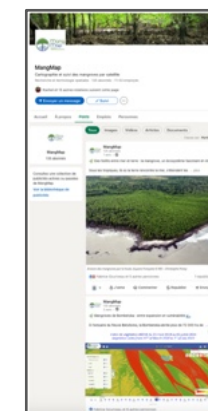
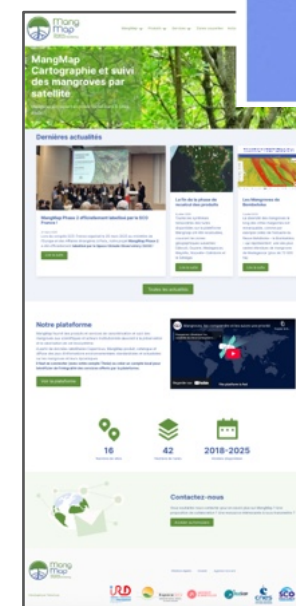
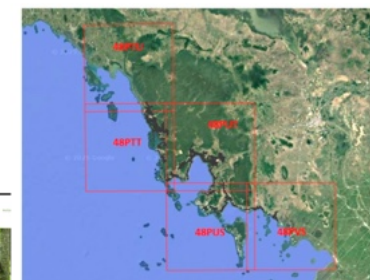
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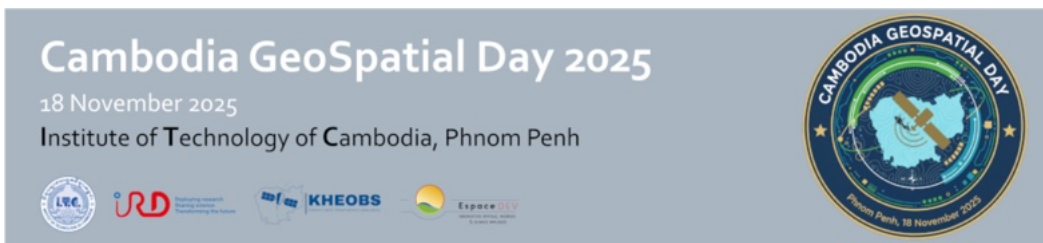
- Elaborate a program to raise awareness
 - ✓ Communication and networking
 - ✓ Webinars
- Elaborate a training program
 - ✓ Training of Endusers (webinars, workshops)
 - ✓ Training of Trainers (workshops)

➤ Programs start simultaneously to the integration of all mangroves in MangMap





MangMap - Mangrove monitoring with satellite data



Thank you for your attention !

Contact

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