Copernicus LAC Chile

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Coastal Monitoring Service

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Ocean remote sensing specialists

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Global Gateway

Co-funded by the European Union

UNIVERSIDAD DE CHILE

fcfm FACULTAD DE CIENCIAS FÍSICAS Y MATEMÁTICAS UNIVERSIDAD DE CHILE

CMM Center for Mathematical Modeling

Who are we?

Experience on coastal environments, littoral processes, and risk assessment, integrating marine sciences, coastal management, and territorial planning to support the analysis of coastal systems.

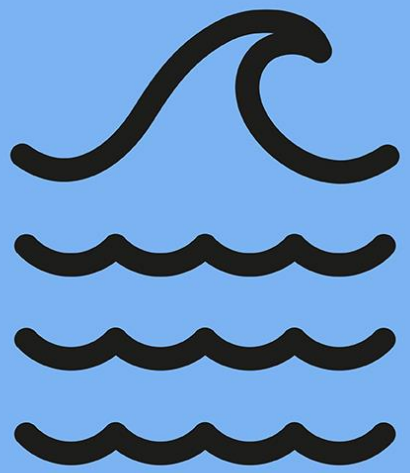
PhD (c) in Geography at the Pontifical Catholic University of Chile, with a **Master's degree in Coastal and Estuarine Management** from the Polytechnic University of Catalonia and a **Bachelor's degree in Marine Sciences** from the University of Cádiz.

Who are we?

Experience in the application of geomatics sciences to the development of operational solutions in private sector since 2018, applied in solar energy, desalination and agriculture.

Working at CopernicusLAC Chile since 2025. **Master in Business Management and Administration** from the University of Chile and a **Renewable Natural Resources Engineer** from the same institution.

Belize, first image Sentinel 2-C



Coastal Monitoring

Coastal Monitoring for Latin America and the Caribbean

Its purpose is to provide consistent, up-to-date, and traceable scientific information to support analysis, planning, coastal management, and decision-making processes for public institutions, the private sector, and academia.

Coastal Monitoring

What are we going to do?

This workshop introduces the CopernicusLAC Chile Coastal Monitoring Service, its satellite-derived ocean products, and their application for assessing environmental conditions.

Using these products, participants will develop a practical analysis focused on oceanographic indices to interpret ecological processes and support decision-making in coastal management.

Coastal Monitoring

What are we going to do?

Workshop structure:

- **Block 1 –** Introduction and context | 60 min
- **Block 2 –** Data access and exploration | 30 min
- **Block 3 –** Indices construction and spatial analysis | 120 min
- **Block 4 –** Workshop wrap-up and closing discussion | 30 min

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Block 1

Introduction and context

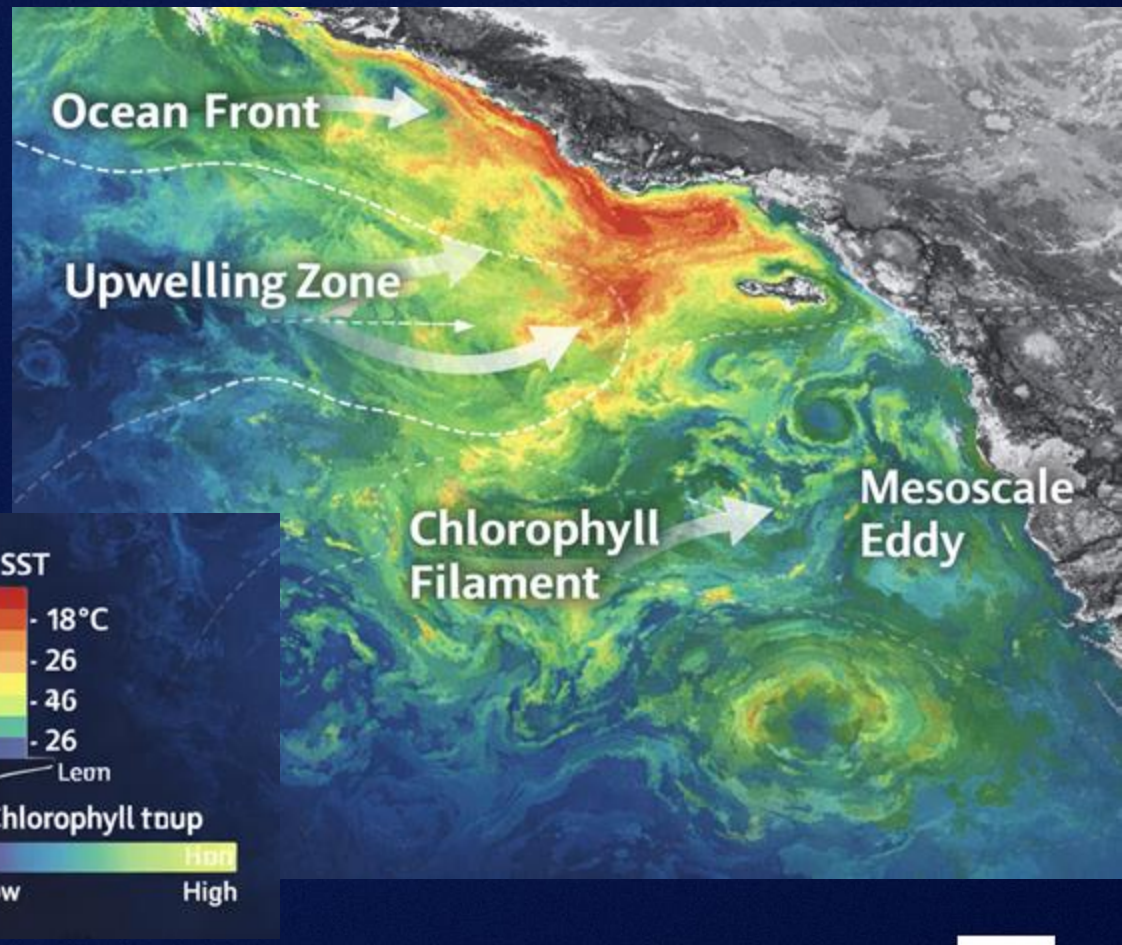
Coastal Monitoring

Coastal Variability and the need for Synoptic Observation

Coastal ocean processes vary across different temporal scales:

- Short-term variability Atmospheric events such as storms and strong winds.
- Seasonal variability changes in solar radiation and ocean circulation patterns.
- Long-term variability Climate-driven trends and ocean warming.

Traditional *in situ* observations provide highly accurate measurements, but their spatial coverage is limited.



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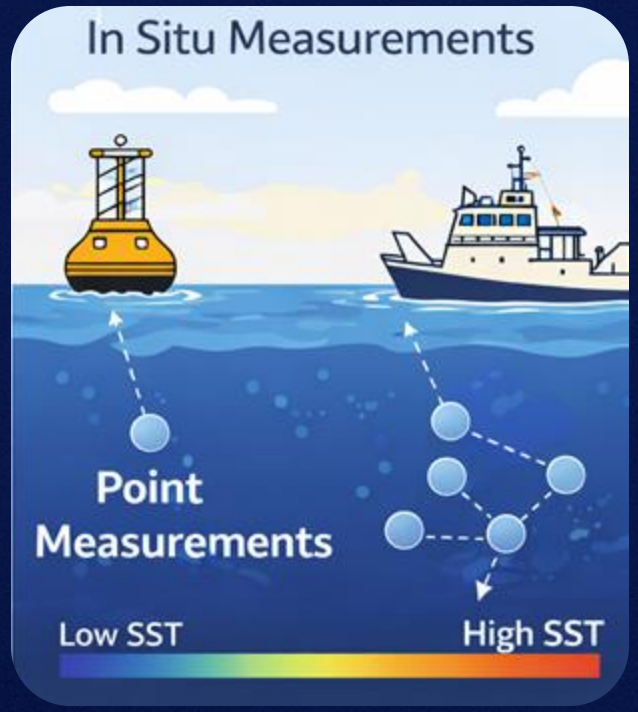
Coastal Variability and the need for Synoptic Observation

To properly understand coastal systems we require synoptic observations, meaning observations with:

Broad spatial coverage



Repeated measurements through time

How are you monitoring the ocean and coast?

Why?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Chile
EN BEAUCHEF
SOMOS
COMUNIDAD

Coastal Monitoring

Copernicus LAC Chile

CopernicusLAC Chile

We strengthen regional capacities to access, process, and use Earth Observation (EO) data through the implementation of advanced technological infrastructure, an in-situ data management strategy, and the development of high-value public services for Latin America and the Caribbean (LAC).

Data Center

In Situ **Data strategy**

High-value public services

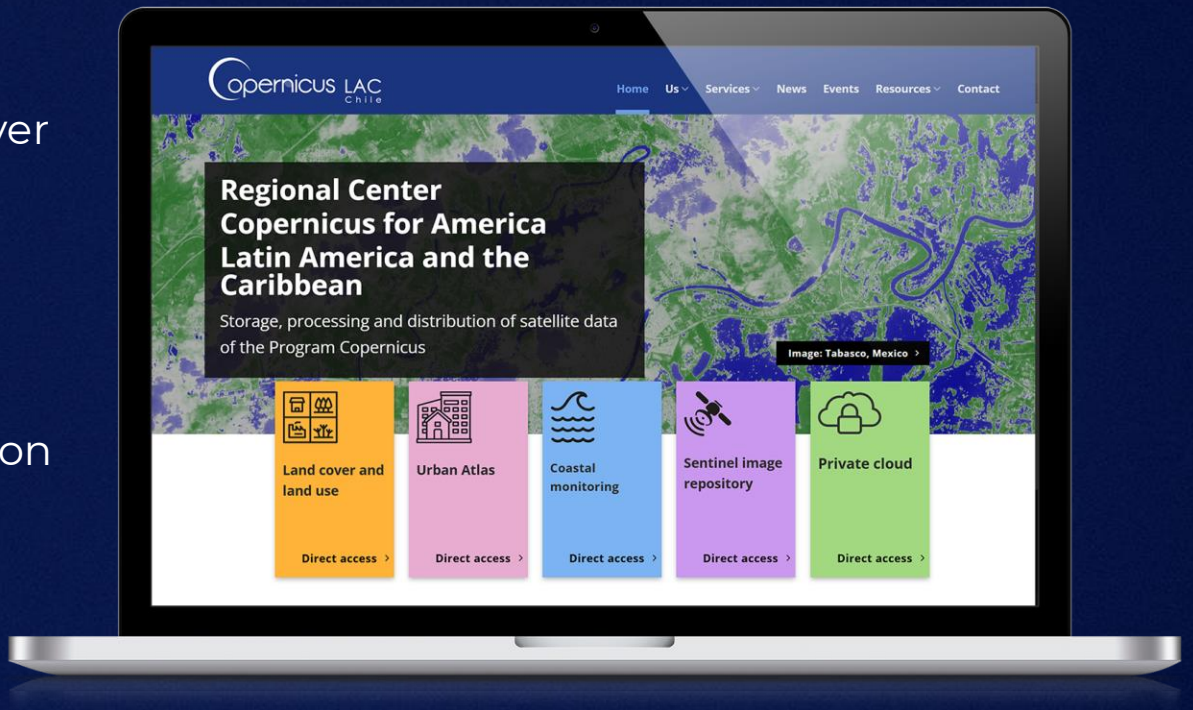
Coastal Monitoring

Value-added Services

- **Land Cover and Land Use:** Pan-regional product that provides harmonised information on different land cover types, generated using artificial intelligence applied to satellite data and local information from LAC.

- **Urban Atlas:** This product documents urban areas in capital cities, providing detailed and comparable data on land use and its evolution over time.

- **Coastal Monitoring:** Coastal and ocean product at a regional scale that integrates essential ocean variables, including sea surface temperature and chlorophyll-a concentration, and progressively incorporates physical and biogeochemical variables such as sea surface salinity and ocean colour variables.



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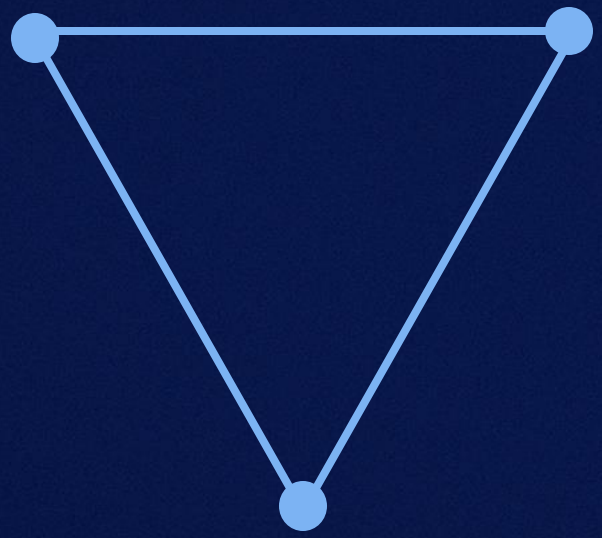
Our reach

Local needs

Local capacity



Network

Coastal Monitoring

Block 1

What this service is in detail

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Regional Center Copernicus for America Latin America and the Caribbean

Storage, processing and distribution of satellite data of the Program Copernicus

Image: Tabasco, Mexico ›

Land cover and land use

Direct access ›

Urban Atlas

Direct access ›

Coastal monitoring

Direct access ›

Sentinel image repository

Direct access ›

Private cloud

Direct access ›

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Coastal Monitoring

Coastal Monitoring for Latin America and the Caribbean

Copernicus LAC Chile

Variables of the Coastal Monitoring Service for Latin America and the Caribbean

Sea Surface Temperature (SST)
Monthly reference field, free from diurnal cycle effects.

Chlorophyll (Chl-a)
Indicator of phytoplankton biomass and primary productivity.

→

Coastal Monitoring

What makes us different from global products?

- Geographic focus
- Spatial resolution
- Variables selection
- Regional adaptation
- Decision-support value

Coastal Monitoring

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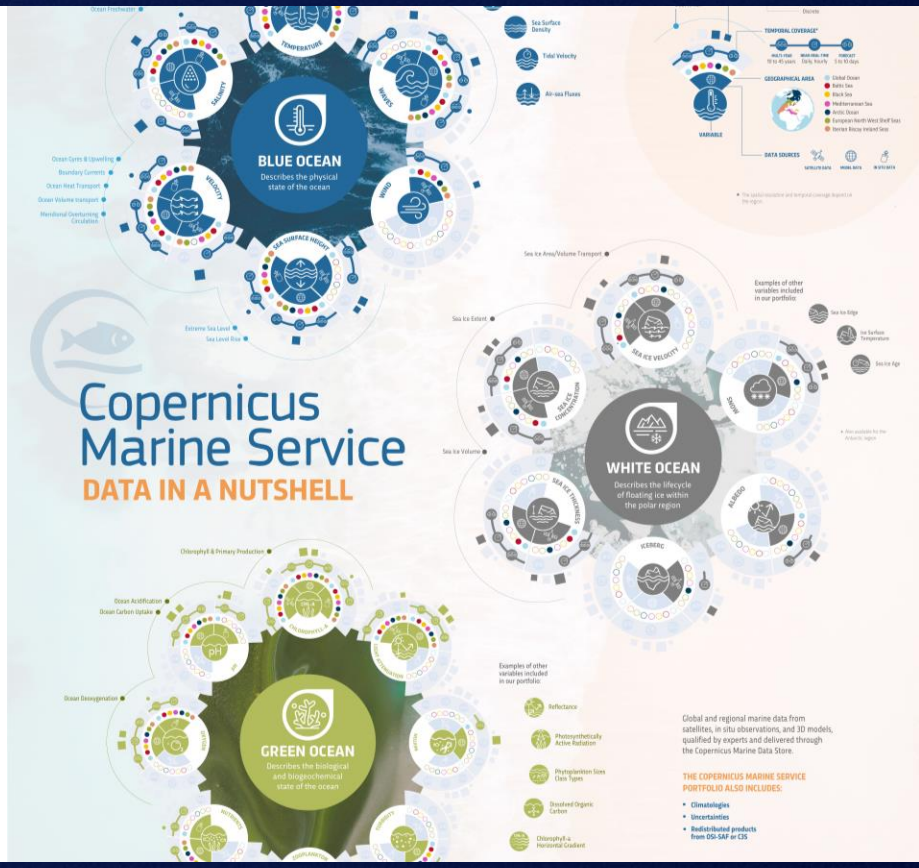
Why these two?



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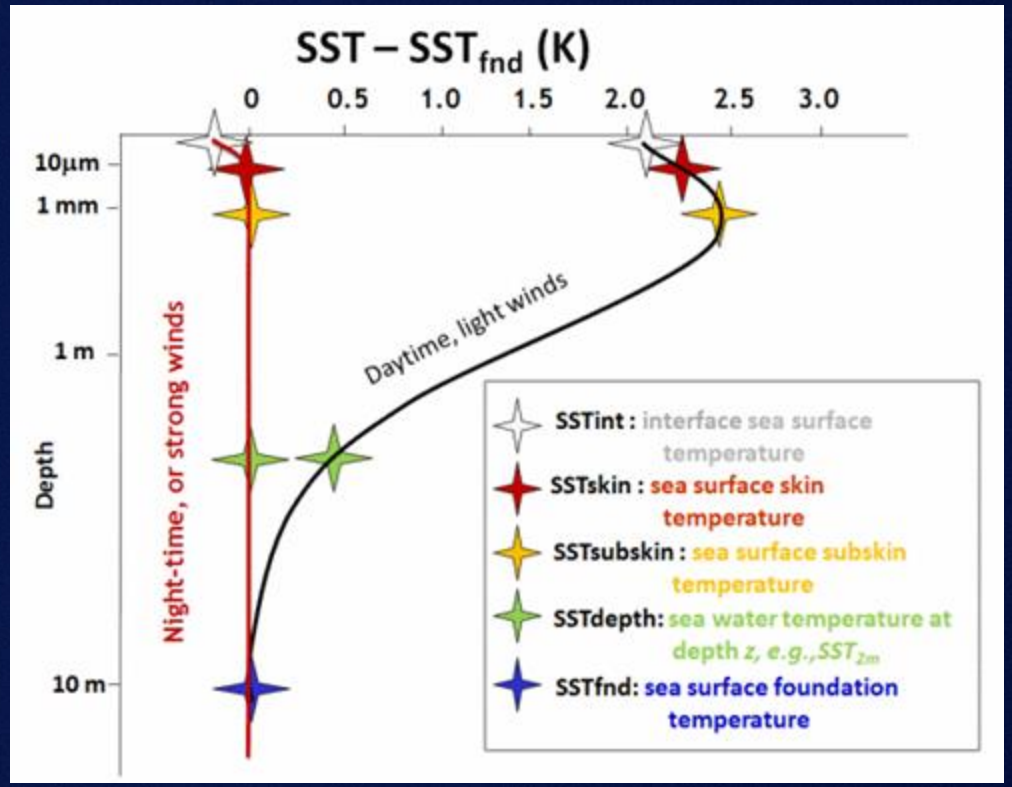
Sea Surface Temperature

Sea Surface Temperature (SST) is a component of the Earth's climate system. It has a major influence on the exchange of heat, energy, and gasses between the ocean and the atmosphere.

SST fields reveal the structure of several key ocean processes, including:

- oceanic fronts
- mesoscale eddies
- coastal upwelling systems
- exchanges between coastal and open-ocean environments



GHRSST diagram

→

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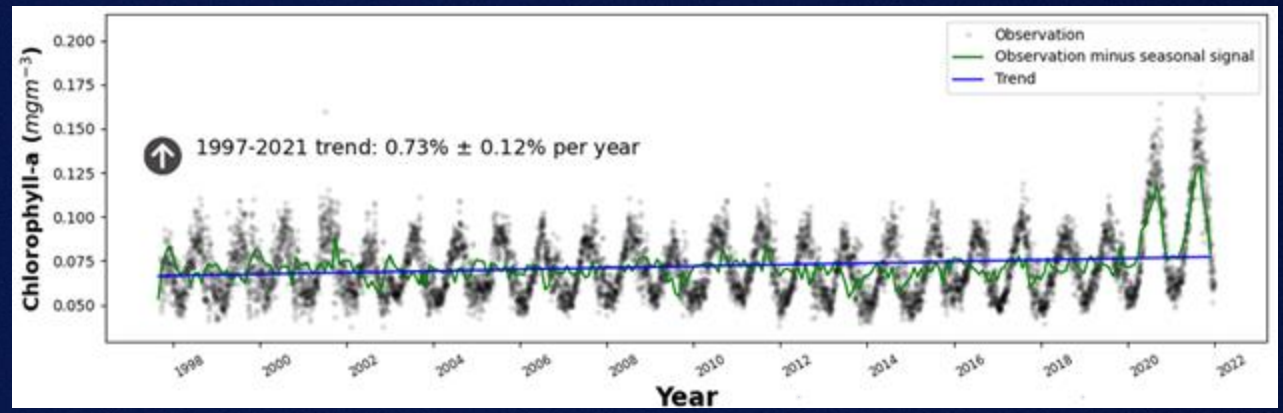
Chlorophyll

Surface chlorophyll concentration represents the phytoplankton biomass in the ocean

This is due to its fundamental function in:

- marine primary productivity
- ocean biogeochemical cycles
- marine trophic networks

Chlorophyll observations allow the identification of relevant biogeochemical processes, and support the analysis of ecological variability and ecosystem responses to climatic and anthropogenic drivers.



South Atlantic Gyre Chlorophyll-a

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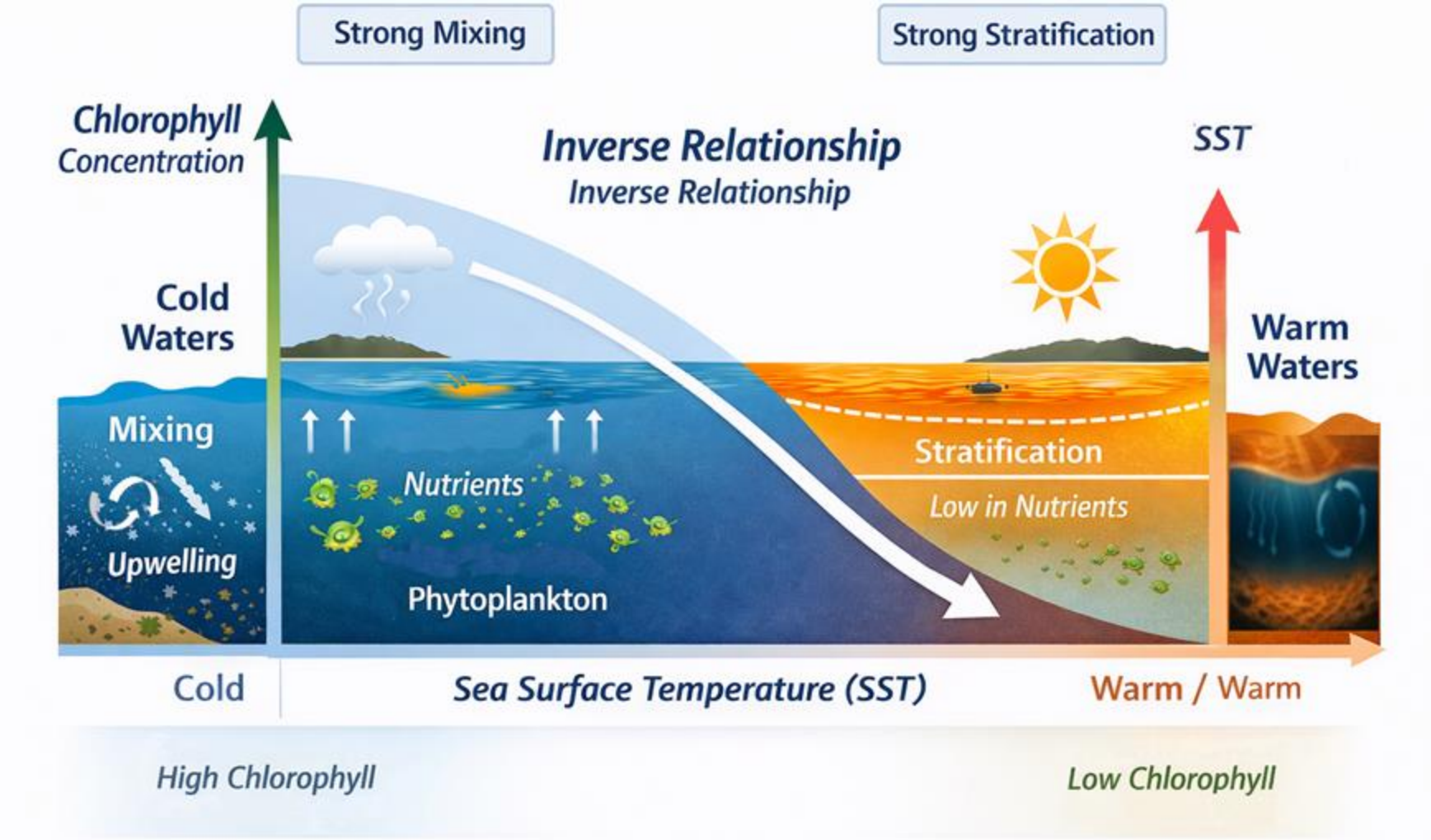
How are these variables related?



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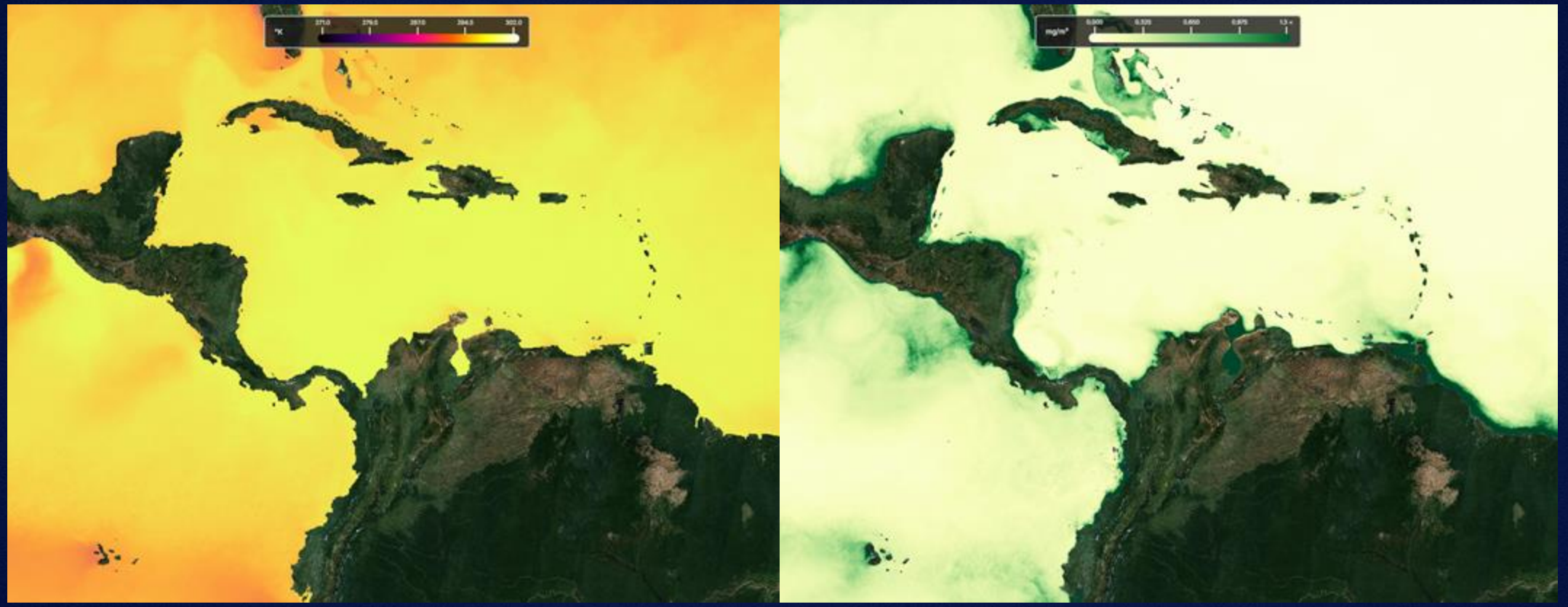
SST–Chlorophyll Interaction Mechanisms



Higher SST → stronger stratification → lower nutrient availability → lower chlorophyll

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Block 1

Our products workflows

Coastal Monitoring

SST product

As a parameter, SST represents the upper layer of the ocean (up to approximately 10 meters depth) and can be estimated through the integration of remote sensing and in situ observations.

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SST product

All methodological steps follow the GHRSST GDS 2.1 standard, ensuring:

- physical traceability
- interoperability
- comparability with the main global ocean monitoring systems.

SST and its horizontal gradients are used to obtain:

- accurate climate predictions
- seasonal and subseasonal forecasts

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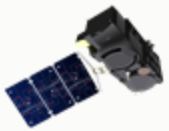
SST product

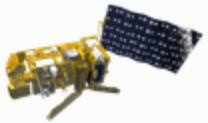
Production workflow

GHRSST GDS 2.1 Compliant



SLSTR

VIIRS



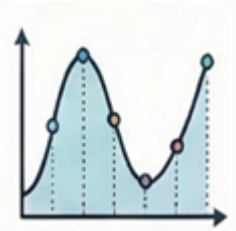
AVHRR

L2P

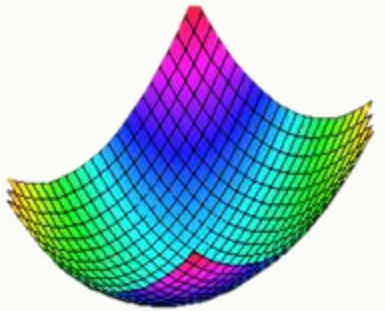
L3U

L3C

L3S



L4



Continuos result
Gap-Free at 2km

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SST product

Production workflow

Physic-Radiometric quality control

- Cloud filtering
- Night observations
- <6 m/s winds

Regional regrilled 2km

- Resolution standardization

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SST product

Production workflow

Regional regrilled 2km

- Resolution standardization

Daily composite & armonization

- SLSTR as reference

Multisensor fusion

- Ponderated means by uncertantability
- Coverage increase

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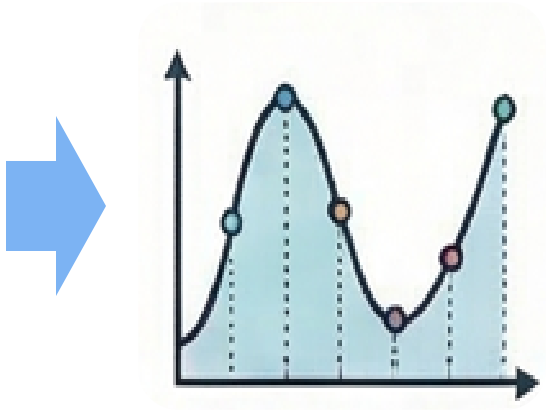
SST product

Production workflow



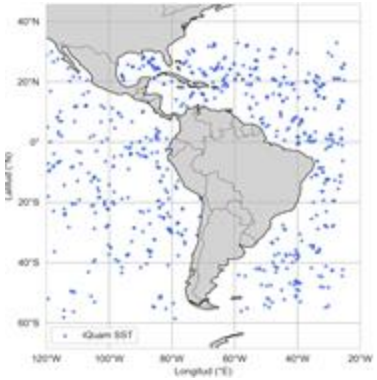
Multisensor fusion

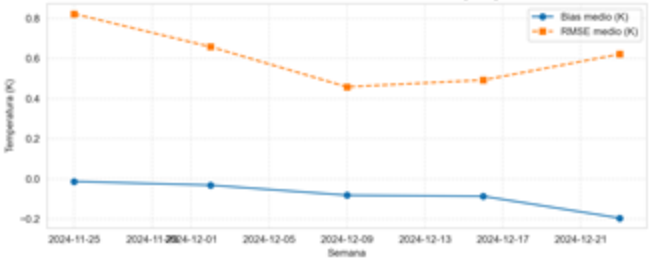
- Ponderated means by uncertantability
- Coverage increase

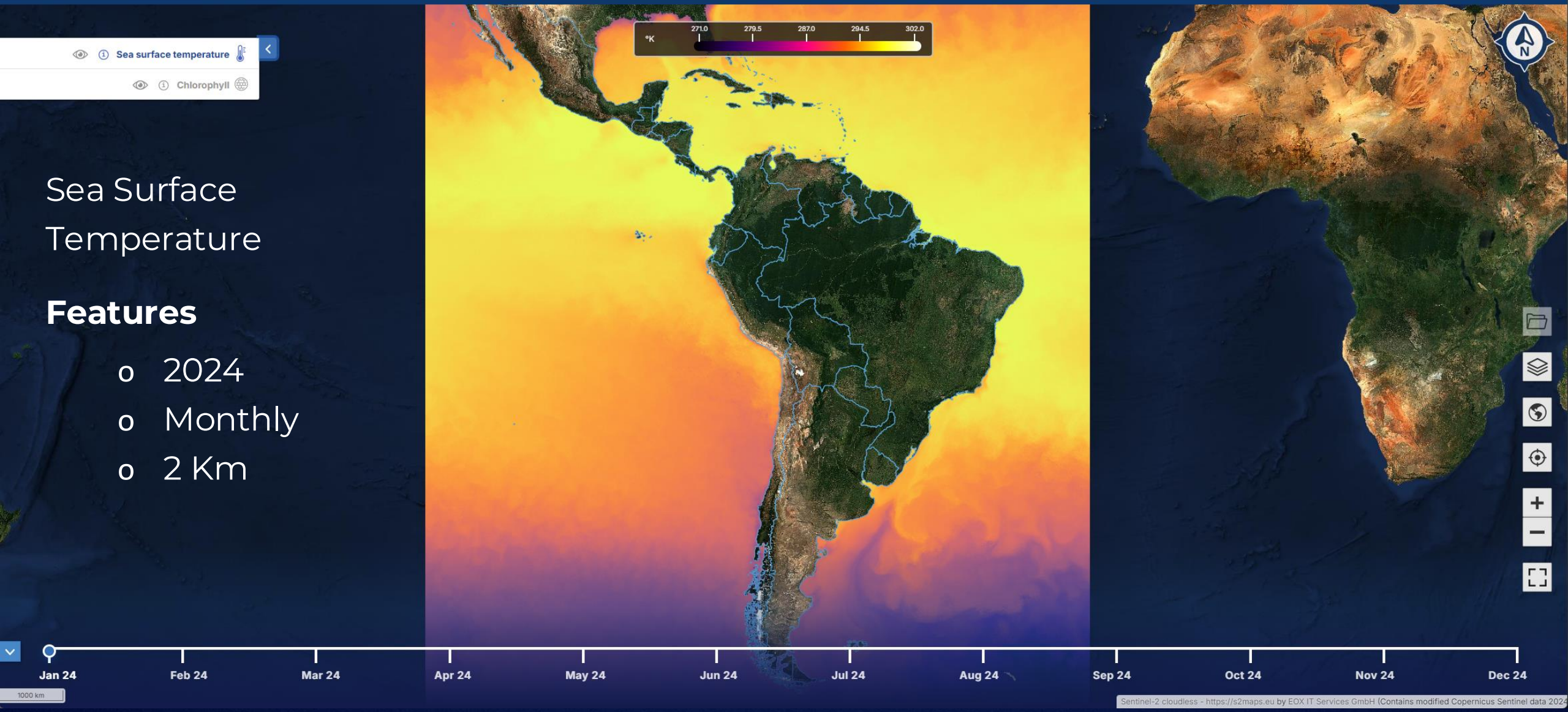
Gap-free reconstruction

- Optimal interpolation Deep Learning (U-Net)

Validation with *in situ* data







Sea Surface Temperature

Features

- 2024
- Monthly
- 2 Km

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Chl-a product

Surface chlorophyll is a indicator of the biological state of the ocean, due to its fundamental role in primary productivity and marine trophic networks.

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Chl-a product

Chlorophyll-a enables the identification of relevant oceanographic and biogeochemical processes, as well as the evaluation of the ecological variability of the ocean and its response to climate and anthropogenic pressures.

In coastal environments, it is also used for:

- water quality monitoring
- detection of algal bloom events
- assessment of ecological conditions affecting fisheries and aquaculture

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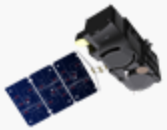
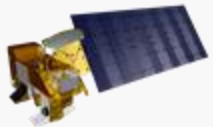
Chl-a product

Production workflow



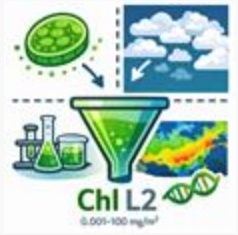
OLCI

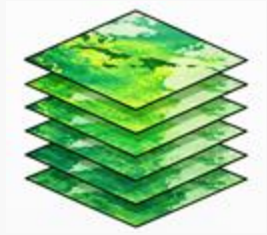
VIIRS

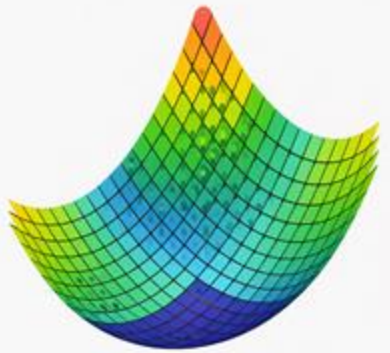


M-Aqua

IOCCG Report Series







L2 | **L3U** | **L3C** | **L3S** | **L4**

Continuous result Gap-Free at 1km

Coastal Monitoring

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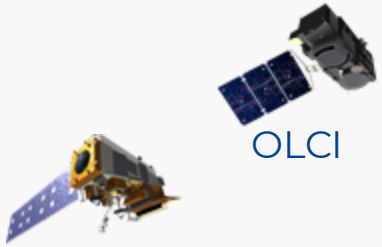
Chl-a product

Production workflow



OLCI

VIIRS

M-Aqua

Physic-Radiometric quality control

- Cloud filtering
- Physical interval correction (0.001-100 mg/m3)

Regional regrilled 1km

- Resolution standardization

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Chl-a product

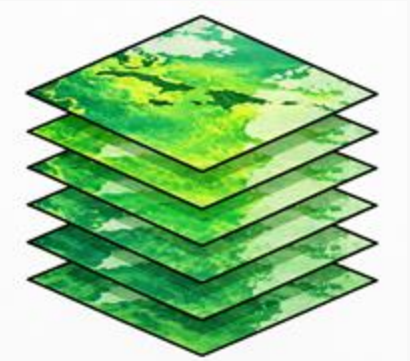
Production workflow

Regional regrilled 1km

- Resolution standardization

Daily composite & armonization

- OLCI as reference
- logarithmic domain



Multisensor fusion

- Integration using logarithmic average
- Coverage increase

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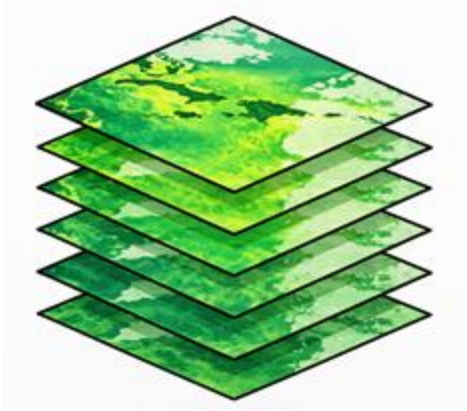
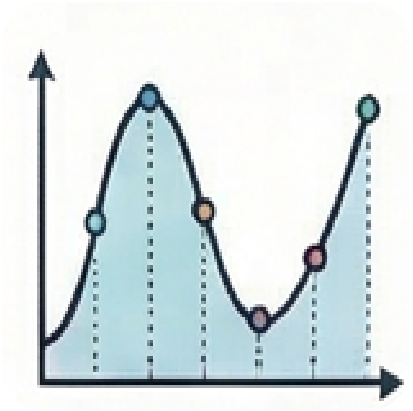
Chl-a product

Production workflow



Multisensor fusion

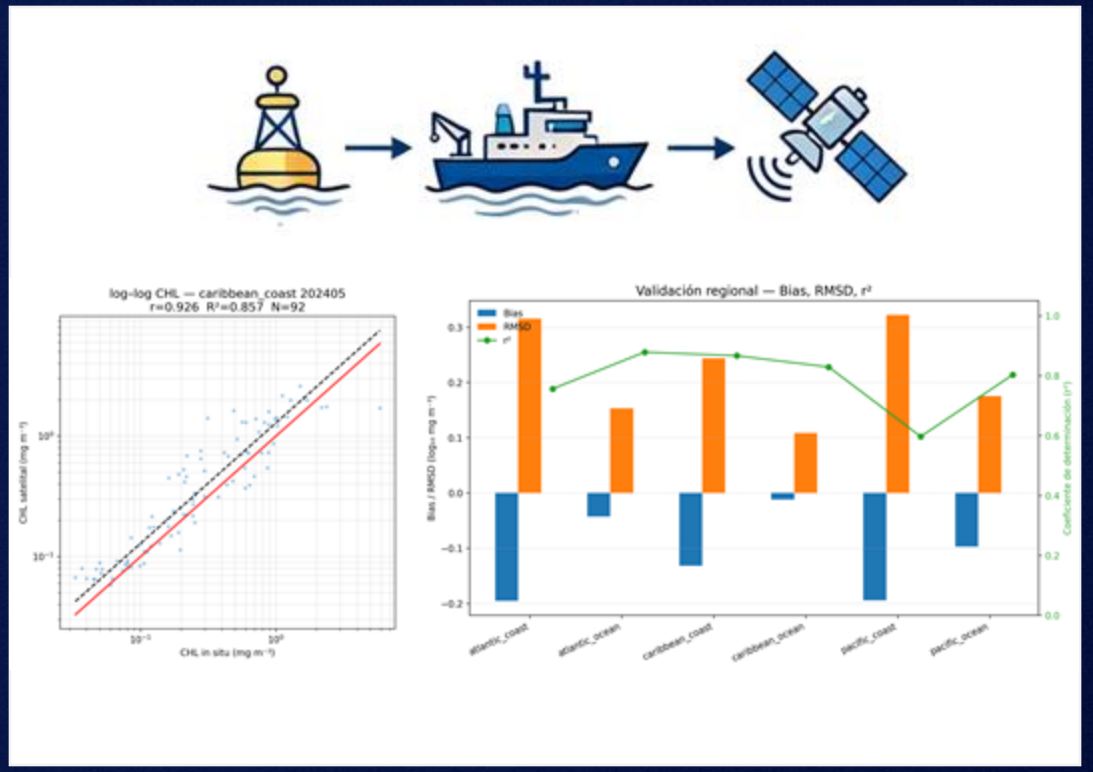
- Integration using logarithmic average
  Coverage increase

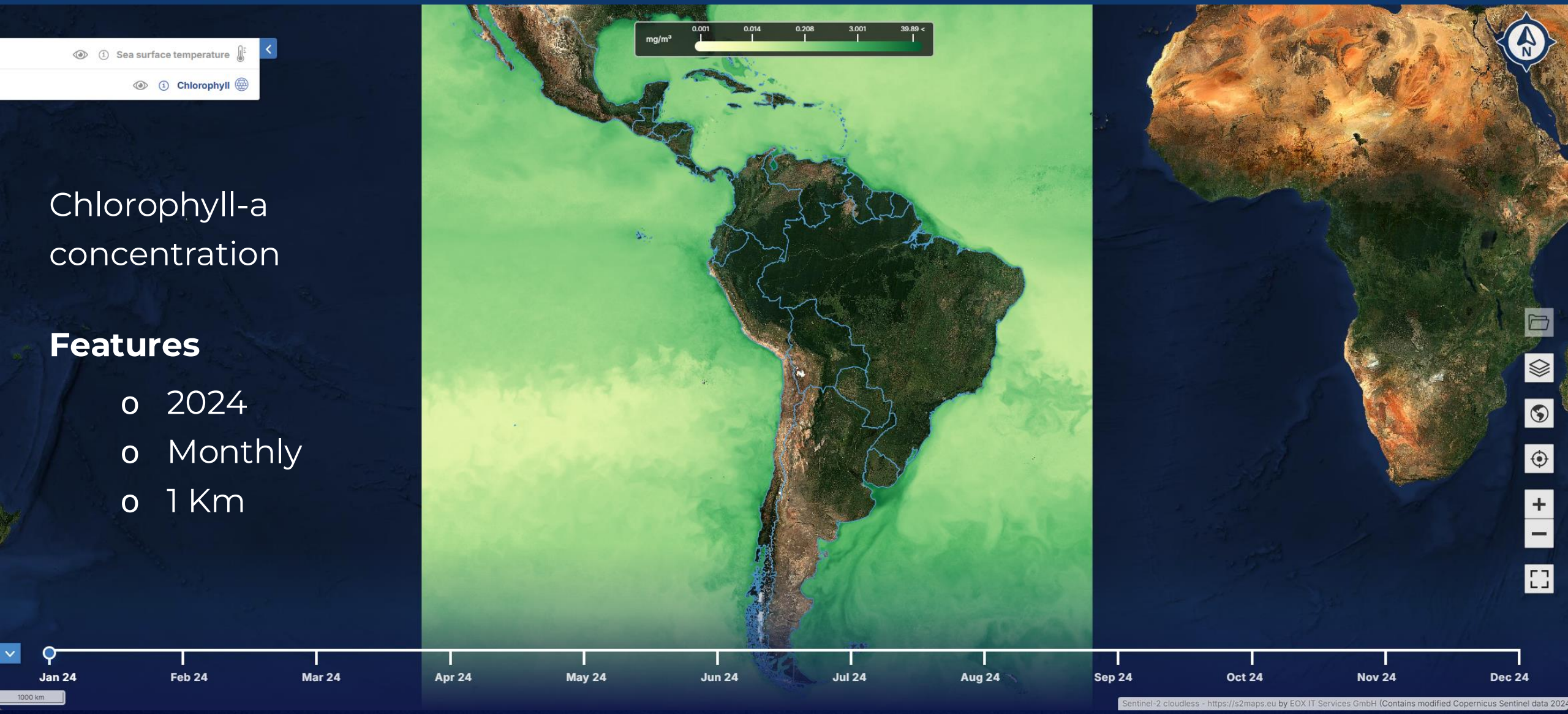


Gap-free reconstruction

- Optimal interpolation
  Deep Learning (U-Net)

Validation with *in situ* data & satellite data model





Chlorophyll-a concentration

Features

- 2024
- Monthly
- 1 Km

Coastal Monitoring

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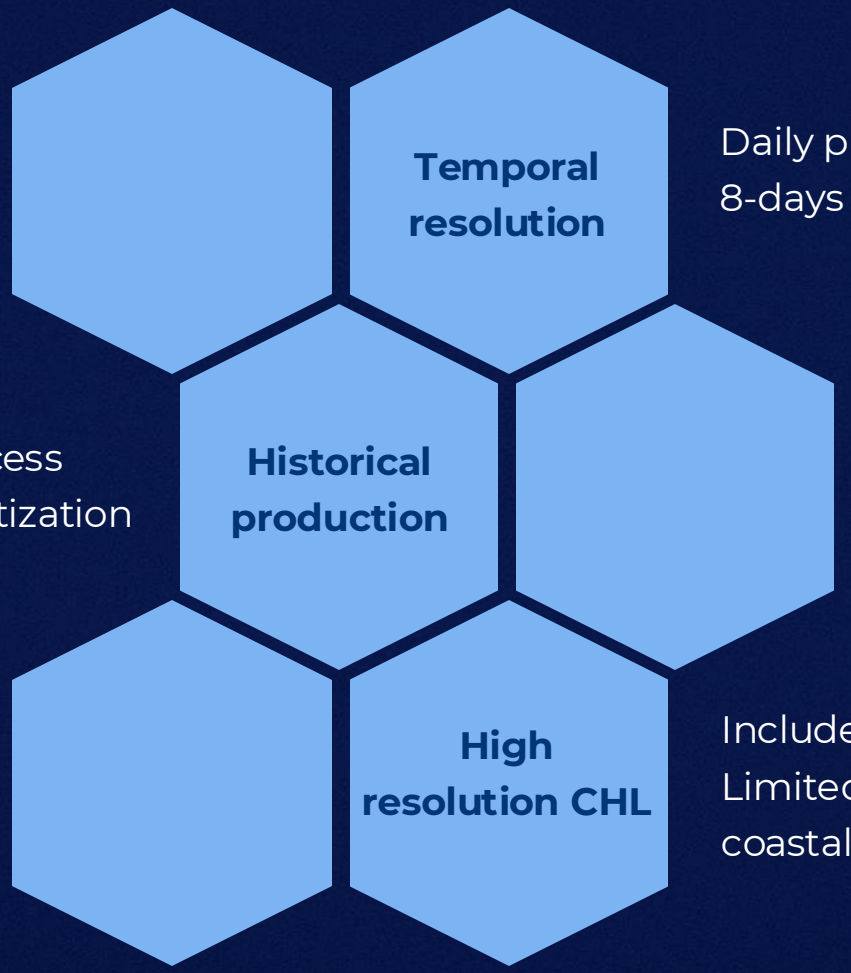
Updates & Improvements

Process automatization



Daily products & 8-days composite

Include S2 Limited to the coastal area

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New ocean products

Ocean Colour

- Key variable in LAC coastal area due to rivers, estuaries and suspended sediments.
- Directly related to water quality, Primary Production, anthropogenic impact & extreme events.
- **An GOOS Essential Ocean Variable**
- Operational extent of Chlorophyll
- Include: turbidity, Particulate Matter, CDOM, Rrs, ZSD.

Sea Surface Salinity (SSS)

- Key variable in Climate change monitoring.
- Relevant for ocean circulation and water cicle.
- **An GOOS Essential Ocean Variable**.

Sea Surface Height (SSH)

- Key variable in Climate change monitoring.
- **An GOOS Essential Ocean Variable**.

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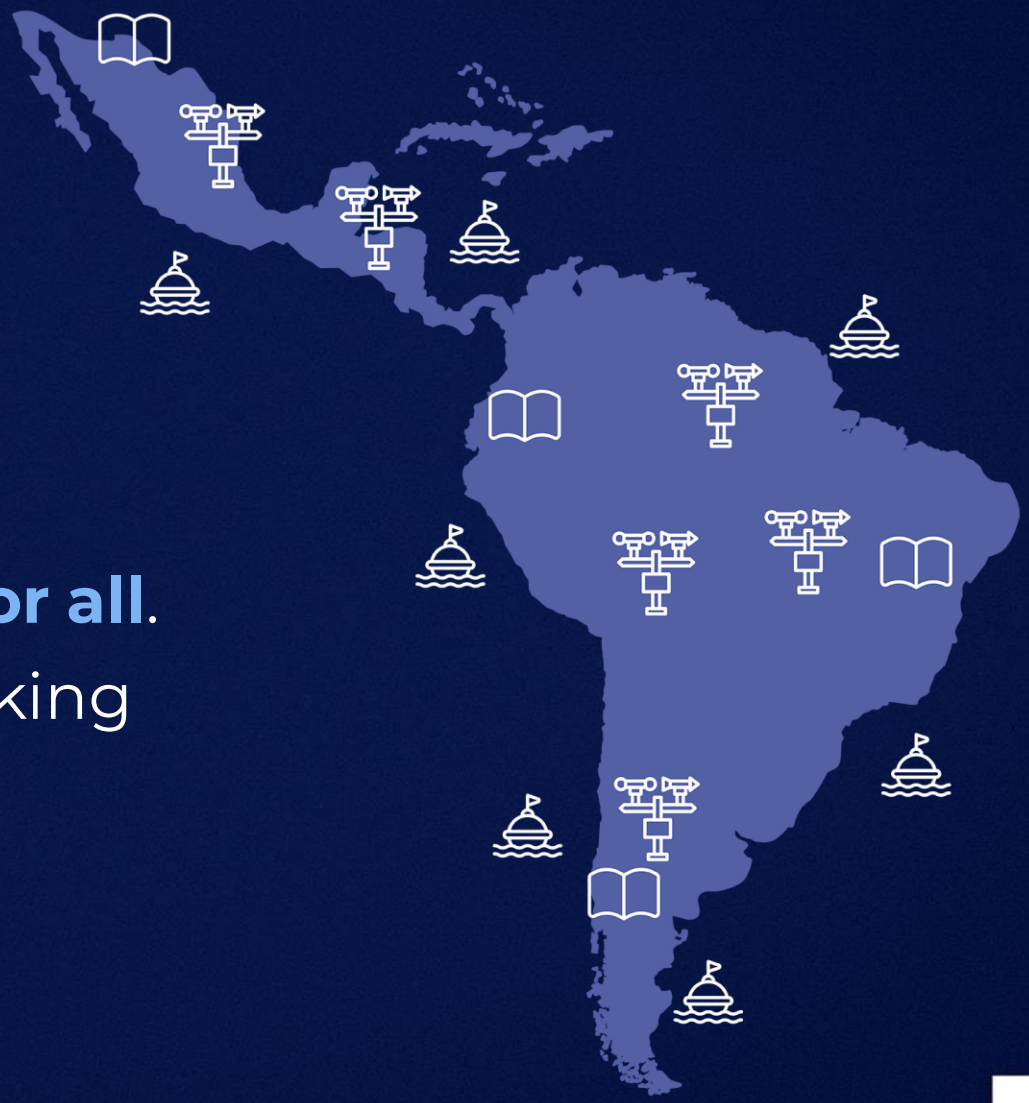
In Situ Data: Share to grow

- **On the ground data** to certify and validate satellite products.
- Crucial to **train AI Algorithms**.
- Sharing Data **improves products for all**.
- CopernicusLAC Chile is actively seeking **In Situ Data access agreements**.



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Block 1

From satellite data to environmental indices

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Environmental Index as Decision-Support Tools

- The integration of multiple environmental variables improves the interpretation of marine ecosystem dynamics and environmental conditions.

- An index can be defined as a synthetic variable that integrates information from one or several environmental variables in order to represent a complex process in a simplified and interpretable form.

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Ocean Variables

SST

Chl-a

Derived Indicators

Productivity Index

Eutrophication Index

Vulnerability Index

Ecological Interpretation

Marine Monitoring

Nutrient Limitation

Climate Sensitivity

Decision Support

Marine Monitoring

Coastal Management

Policy & Planning

Coastal Monitoring

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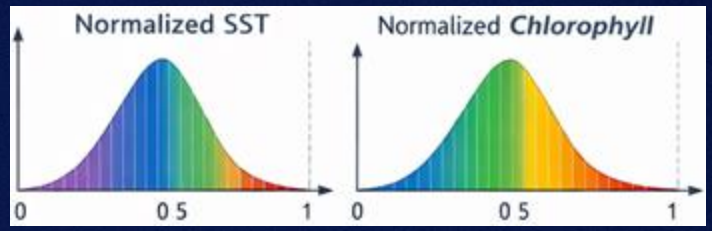
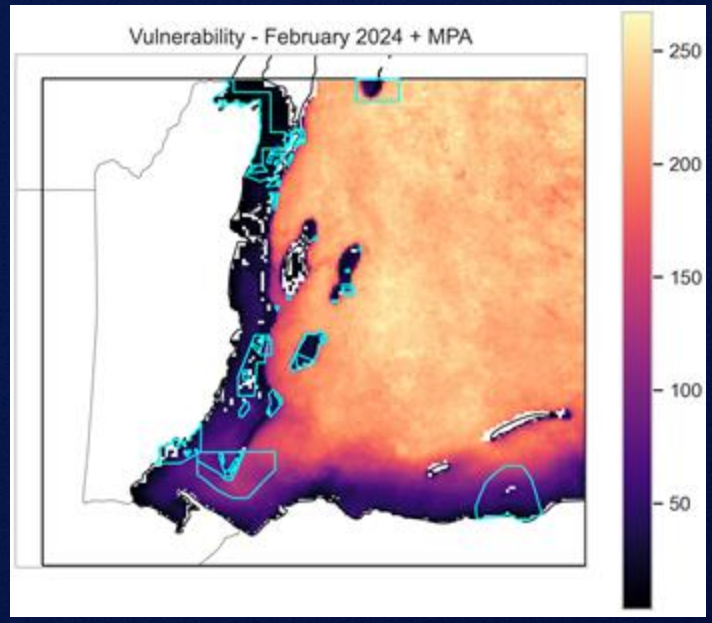
Analytical steps:

Variable Normalization
Standardizing data to make different variables comparable



Multivariable Integration
Combining Environmental Data



Synthetic Index
Ecological Index

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Block 1

Assessing marine ecosystem conditions through bio-oceanographic indices

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Ocean Conditions through Oceanographic Index

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Indices used in the exercise

1. Potential Primary Productivity: Proxy of biological production capacity.
2. Coastal Eutrophication Index: Indicator of nutrient enrichment and trophic conditions.
3. Ecosystem Vulnerability Index: Indicator of ecosystem sensitivity to climate variability.

→

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Potential Primary Productivity

Ocean primary productivity represents the base of marine trophic networks, regulating the availability of energy for higher trophic levels.

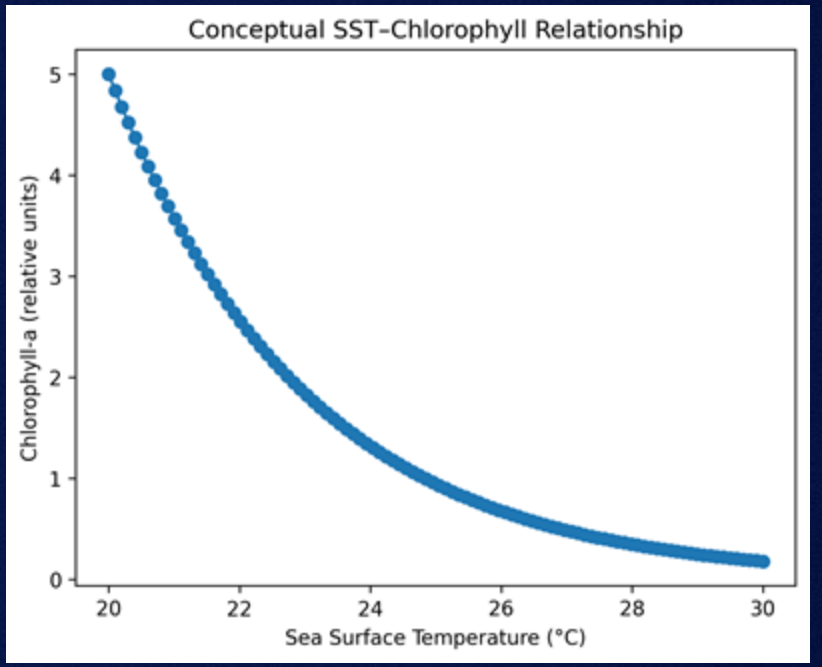
Primary productivity is strongly related to:

- phytoplankton biomass (chlorophyll-a)
- thermal conditions influencing metabolic rates

Areas with high chlorophyll concentrations under favorable thermal conditions tend to exhibit higher biological productivity.

Applications

- Identification of productive regions relevant for fisheries
- Detection of ecological productivity hotspots
- Large-scale ecosystem monitoring



NPP ≈ CHL × exp(0.063 × SST)

(Eppley, R.W., 1972)

→

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Coastal Eutrophication Index

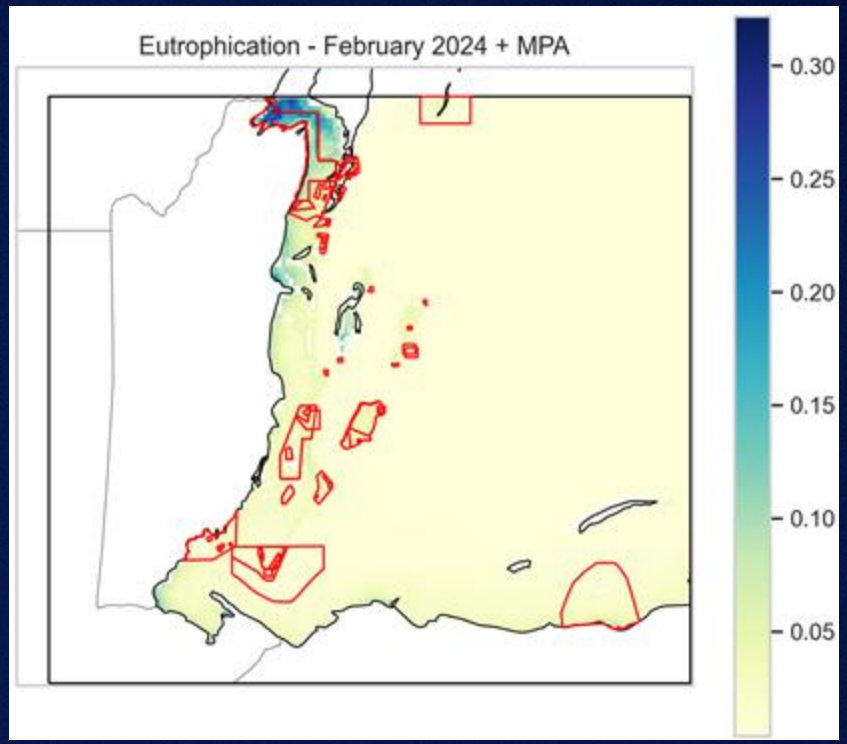
Eutrophication refers to the increase of nutrients concentrations in aquatic systems, which stimulates phytoplankton growth and generates an uncontrolled increase in biomass that depletes oxygen in the water, causing ecosystem colapse and biodiversity loss.

In coastal environments, elevated chlorophyll levels may be associated with:

- river discharge
- coastal urbanization
- anthropogenic nutrient inputs

Eutrophication = CHL / SST

Higher values may indicate nutrient enrichment and elevated trophic conditions.



(Mozafari, Z. et al., 2023)

Applications:

- Water quality monitoring
- Detection of anthropogenic pressure on coastal ecosystems

Coastal Monitoring

Ecosystem Vulnerability Index

In warm ocean regions, increased sea surface temperature can intensify water column stratification. Under these conditions:

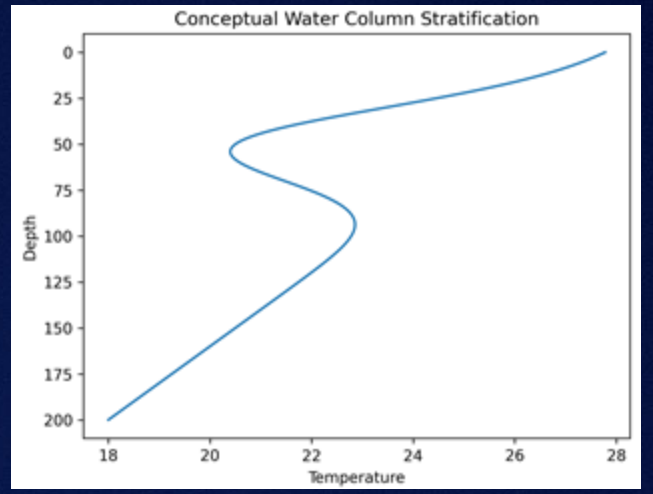
- vertical mixing is reduced
- nutrient supply to the area exposed to sunlight decreases
- biological productivity becomes limited

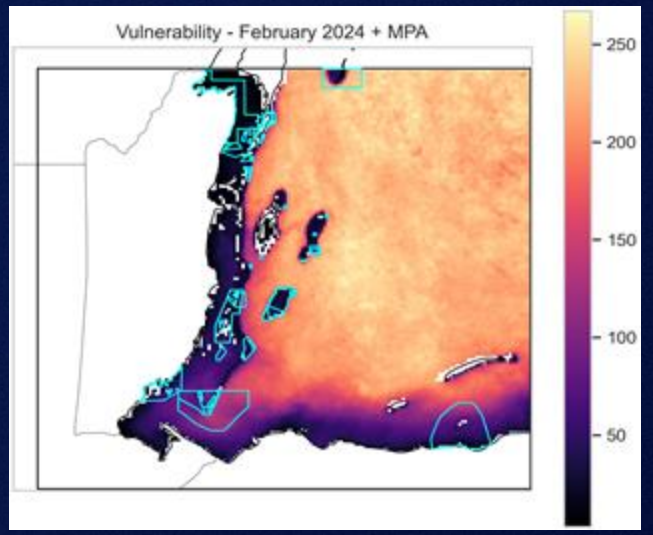
High temperature + low chlorophyll → potential ecosystem stress conditions → vulnerable ecosystem

Vulnerability = SST / CHL

Applications

- Climate impact assessment
- Identification of ecosystems requiring monitoring or conservation
- Prioritization of monitoring and conservation actions





Putra, D. P. et al. 2025

Coastal Monitoring

Block 1

Spatial analysis and marine protected areas

Coastal Monitoring

Spatial framework in Latin America and the Caribbean

Copernicus LAC Chile

Five major oceanographic systems are considered:

- Caribbean region
- South Pacific
- Southern Cone
- Amazon–Atlantic region
- Central America and Mexico Pacific region

These regions present contrasting physical and biogeochemical regimes, leading to distinct spatial patterns.

Map of LAC with the five oceanographic regions

→

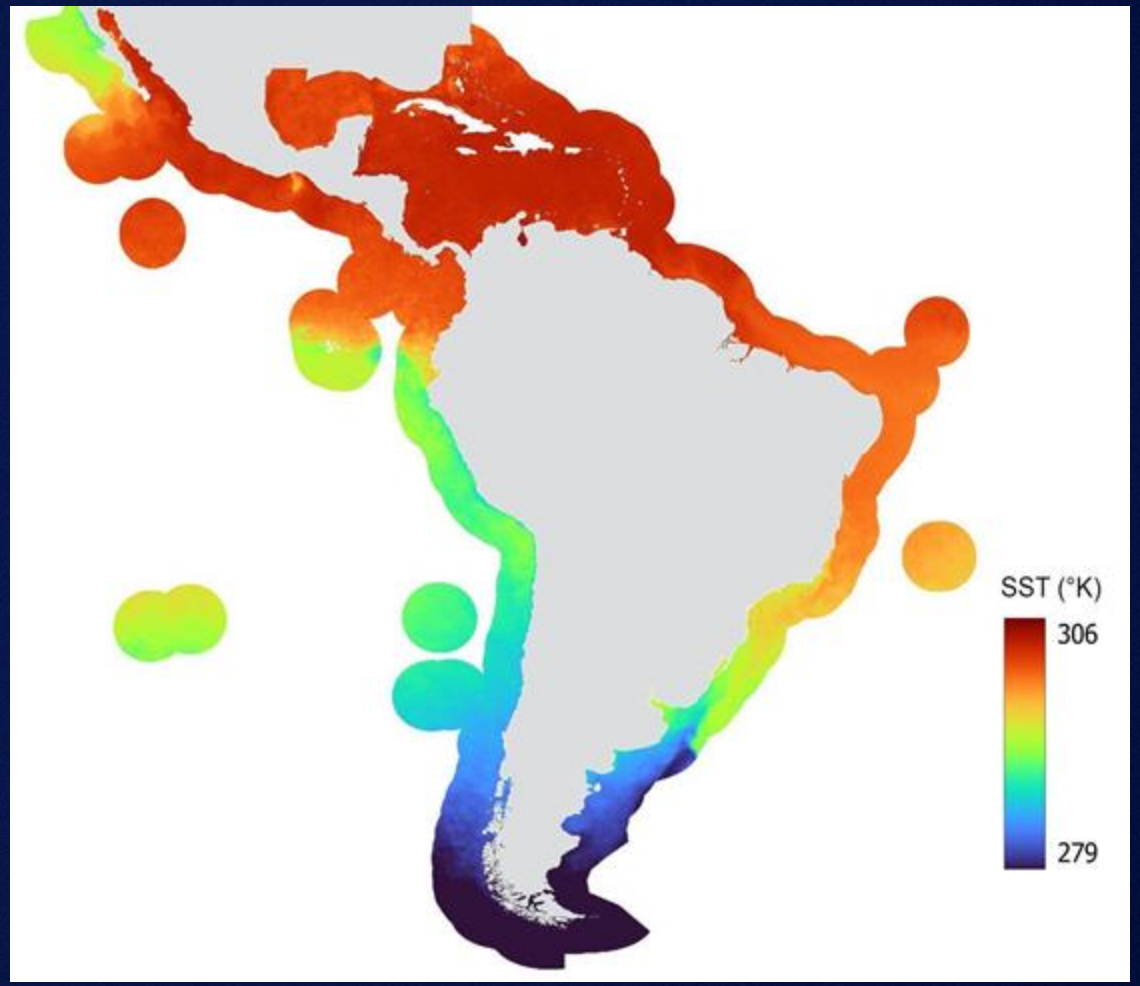
Coastal Monitoring

Regional oceanographic patterns in LAC

Copernicus LAC Chile

Conceptual framework

Region	SST	Chlorophyll	Ecosystem regime
Caribbean	High	Low	Oligotrophic
South Pacific	Low	High	Highly productive
Southern Cone	Variable	Moderate	Frontal systems
Amazon–Atlantic	High	Moderate–High	River-influenced
Central America & Mexico	High	Low–Moderate	Mesotrophic



Coastal Monitoring

Regional oceanographic patterns in LAC

Caribbean region

Ocean conditions

- Warm stratified waters (27–30 °C)

Chlorophyll distribution

- Low chlorophyll concentrations (<0.15–0.25 mg m^{-3})
- Oligotrophic system
- Local increases near coasts and river plumes

Ecosystem interpretation

- Low nutrient availability
- Low primary productivity
- High ecosystem vulnerability to ocean warming

Caribbean Chl map

Coastal Monitoring

Regional oceanographic patterns in LAC

Central America and Mexico Pacific region

Ocean conditions

- Diverse coastal ecosystems (coral reefs, mangroves, shallow platforms)
- SST typically between 26–30 °C

Chlorophyll distribution

- Low to moderate chlorophyll concentrations (0.2–0.5 mg m^{-3} offshore)
- Higher values in coastal waters influenced by runoff

Ecosystem interpretation

- Mesotrophic conditions
- Moderate productivity
- Strong spatial variability linked to coastal processes and climate variability

CA & Mexico Chl map

Coastal Monitoring

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Marine Protected Areas (MPAs)

A clearly defined geographical space, recognized, dedicated and managed through legal or other effective means, to achieve the long-term conservation of nature, together with its associated ecosystem services and cultural values.

(UICN, 2008)

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Marine Protected Areas (MPAs)

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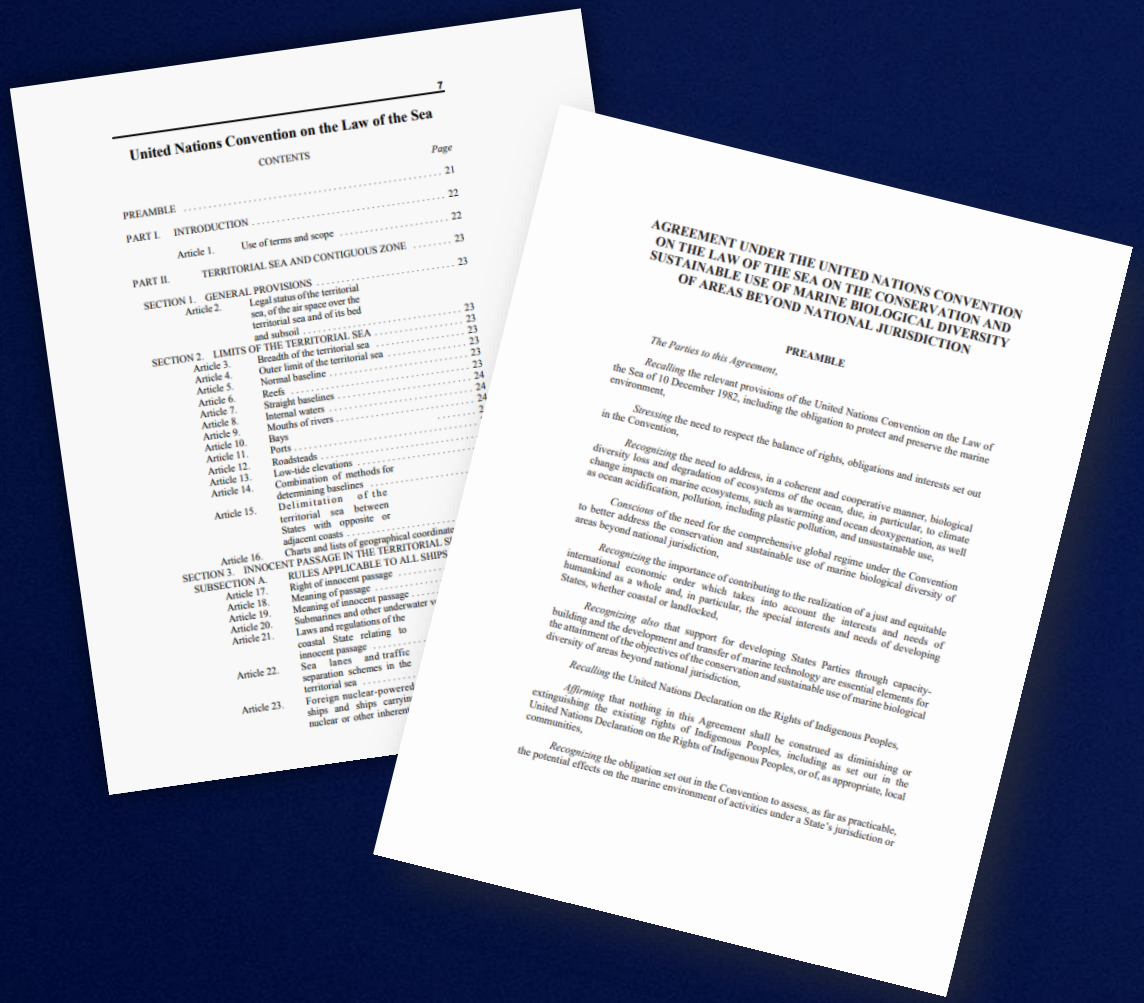

7

United Nations Convention on the Law of the Sea

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AGREEMENT UNDER THE UNITED NATIONS CONVENTION ON THE LAW OF THE SEA ON THE CONSERVATION AND SUSTAINABLE USE OF MARINE BIOLOGICAL DIVERSITY OF AREAS BEYOND NATIONAL JURISDICTION

PREAMBLE

The Parties to this Agreement,

Recalling the relevant provisions of the United Nations Convention on the Law of the Sea of 10 December 1982, including the obligation to protect and preserve the marine environment,

Stressing the need to respect the balance of rights, obligations and interests set out in the Convention,

Recognizing the need to address, in a coherent and cooperative manner, biological diversity loss and degradation of ecosystems of the ocean, due, in particular, to climate change impacts on marine ecosystems, such as warming and ocean deoxygenation, as well as ocean acidification, pollution, including plastic pollution, and unsustainable use,

Conscious of the need for the comprehensive global regime under the Convention to better address the conservation and sustainable use of marine biological diversity of areas beyond national jurisdiction,

Recognizing the importance of contributing to the realization of a just and equitable international economic order which takes into account the interests and needs of humankind as a whole and, in particular, the special interests and needs of developing States, whether coastal or landlocked,

Recognizing also that support for developing States Parties through capacity-building and the development and transfer of marine technology are essential elements for the attainment of the objectives of the conservation and sustainable use of marine biological diversity of areas beyond national jurisdiction,

Recalling the United Nations Declaration on the Rights of Indigenous Peoples,

Affirming that nothing in this Agreement shall be construed as diminishing or extinguishing the existing rights of Indigenous Peoples, including as set out in the United Nations Declaration on the Rights of Indigenous Peoples, or of, as appropriate, local communities,

Recognizing the obligation set out in the Convention to assess, as far as practicable, the potential effects on the marine environment of activities under a State's jurisdiction or

- **CONVEMAR 1982:** the *"Oceans Constitution"* establishes the obligation of States to protect the marine environment.

- **BBNJ (Biodiversity Beyond National Jurisdiction) 2026:** enables the establishment of Marine Protected Areas (MPAs) in areas beyond national jurisdiction, outside the 200 nautical mile Exclusive Economic Zones (EEZs).
  - Global objective: protect 30% of the ocean by 2030 → main instrument supporting the **30x30 target**.
  - **Ratified by:** Brazil, Chile, Cuba, Dominica, Dominican Republic, Saint Vincent and the Grenadines, Uruguay.
  - **Signed by:** Colombia, Costa Rica, Mexico, and Panama.

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Coastal Monitoring

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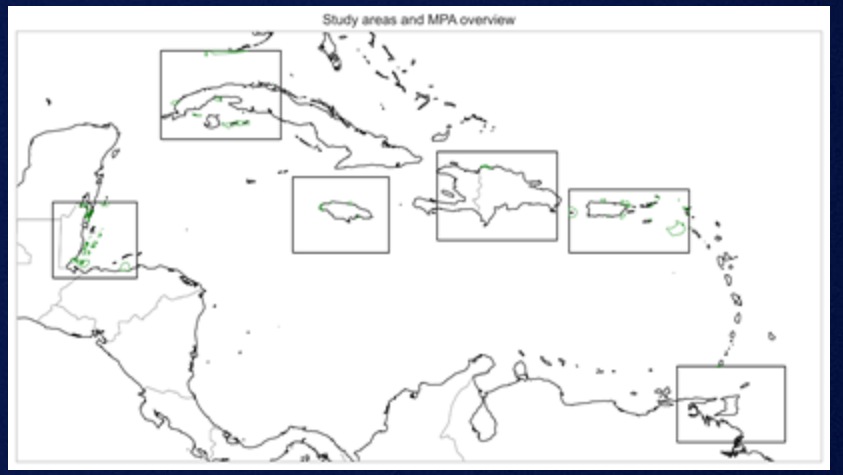
Marine Protected Areas (MPAs)

Map of MPAs in the Caribbean

Caribbean region



UNEP-WCMC (2026): www.protectedplanet.net

Coastal Monitoring

Implications for Marine Spatial Planning

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Marine Protected Areas (MPAs) are key instruments for the spatial management of marine ecosystems and human activities.

Main contributions:

- Ecological zoning
  - protection of critical habitats
- Regulation of ocean uses
  - fisheries
  - tourism
  - shipping
  - energy
- Ecosystem connectivity
  - support migration and larval dispersal
- Climate resilience
  - protected ecosystems show higher stability

→

Coastal Monitoring

Block 1

Sustainable development goals (SDGs) and ocean observation

Coastal Monitoring

Sustainable Development Goals (SDGs)

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Ocean observations provide essential environmental information to support sustainable ocean management and global development policies.

SDGs: A set of global goals (17) adopted by the United Nations in 2015 to promote sustainable development worldwide by 2030.

Key Sustainable Development Goals linked to ocean observation and management are:

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Block 2

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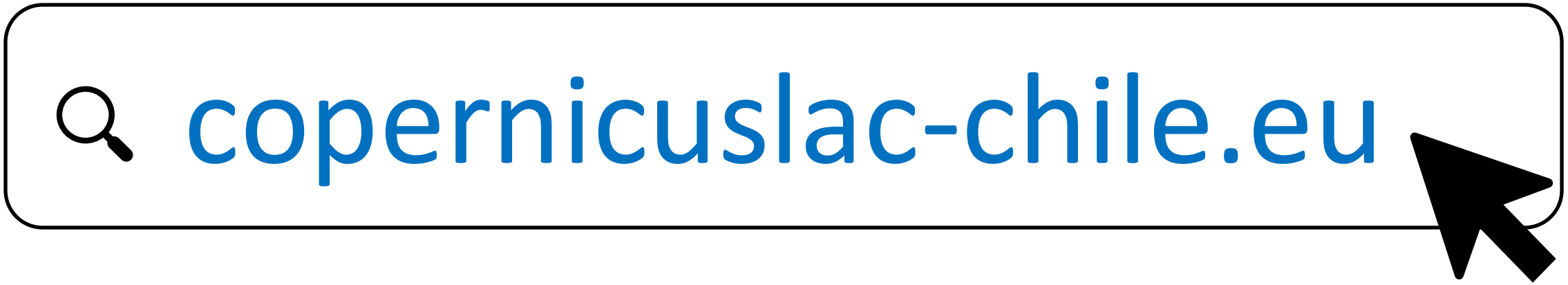
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Regional Center Copernicus for America Latin America and the Caribbean

Storage, processing and distribution of satellite data of the Program Copernicus

Image: Tabasco, Mexico

Land cover and land use
Direct access

Urban Atlas
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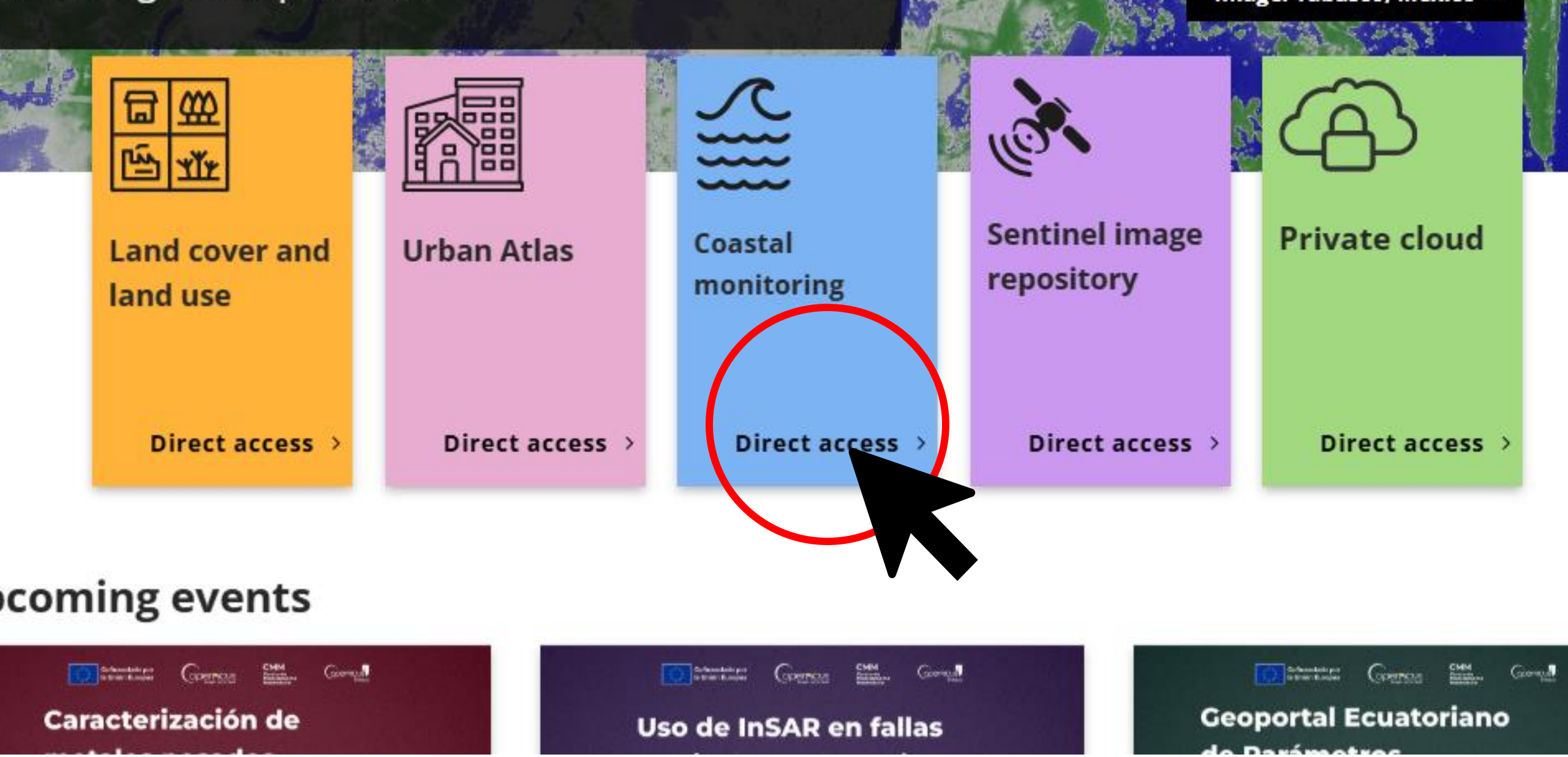
Upcoming events



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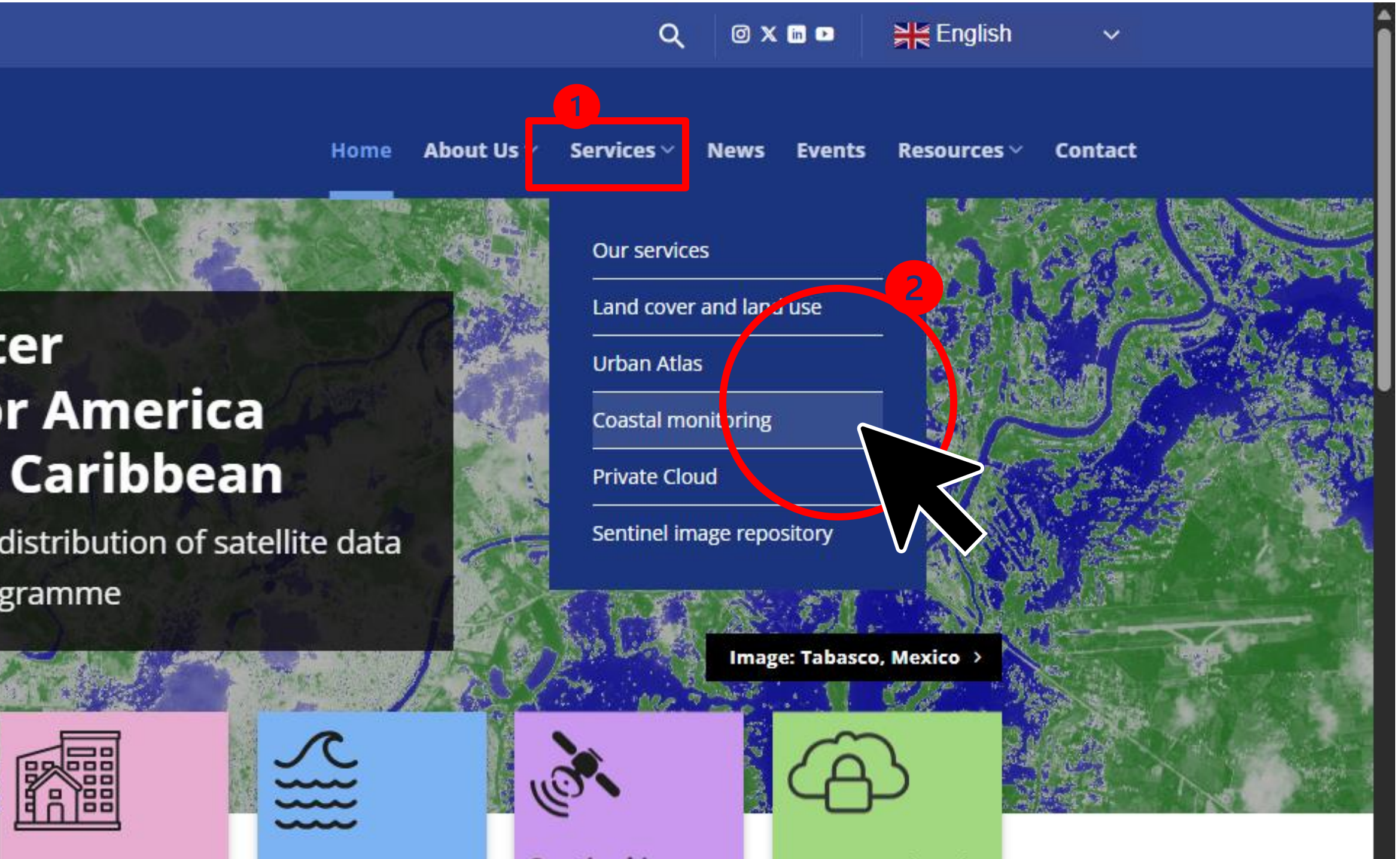
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Image: Tabasco, Mexico

Coastal monitoring

CopernicusLAC Chile will use Copernicus Marine Services to transform its global services into regional services for Latin America and the Caribbean.

Go to application

Inicio › en › nuestros servicios › monitoreo de costas

What is it?

Marine and coastal observation platform that integrates satellite and in situ data to monitor ocean and coastal conditions in Latin America and the Caribbean, ensuring accuracy and regional relevance.

Objective

Strengthen the management of the ocean and coastal areas through validated information on temperature, water salinity, sea surface height, current speed, sea ice, nutrients, carbon, transparency, turbidity and sea surface waves, among other essential parameters for scientific research and adaptation to climate change.

Methodology

We added terrain data and refined machine learning models to give these services a more precise and regionally validated character.

Based on the Copernicus Marine Services, this system adapts global models to the LAC regional scale by incorporating field observations for calibration and validation. It uses mathematical models and machine learning to improve accuracy, resolution, and local applicability, providing key tools for coastal and marine decision-making.

Project funded by
Cofinanciado por la Unión Europea
UNIVERSIDAD DE CHILE
CMM Centro de Modelamiento Matemático
Part of
Copernicus AMBASSADOR
Thanks to
NLHPC National Laboratory for High Performance Computing Chile

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+562 2978 4728

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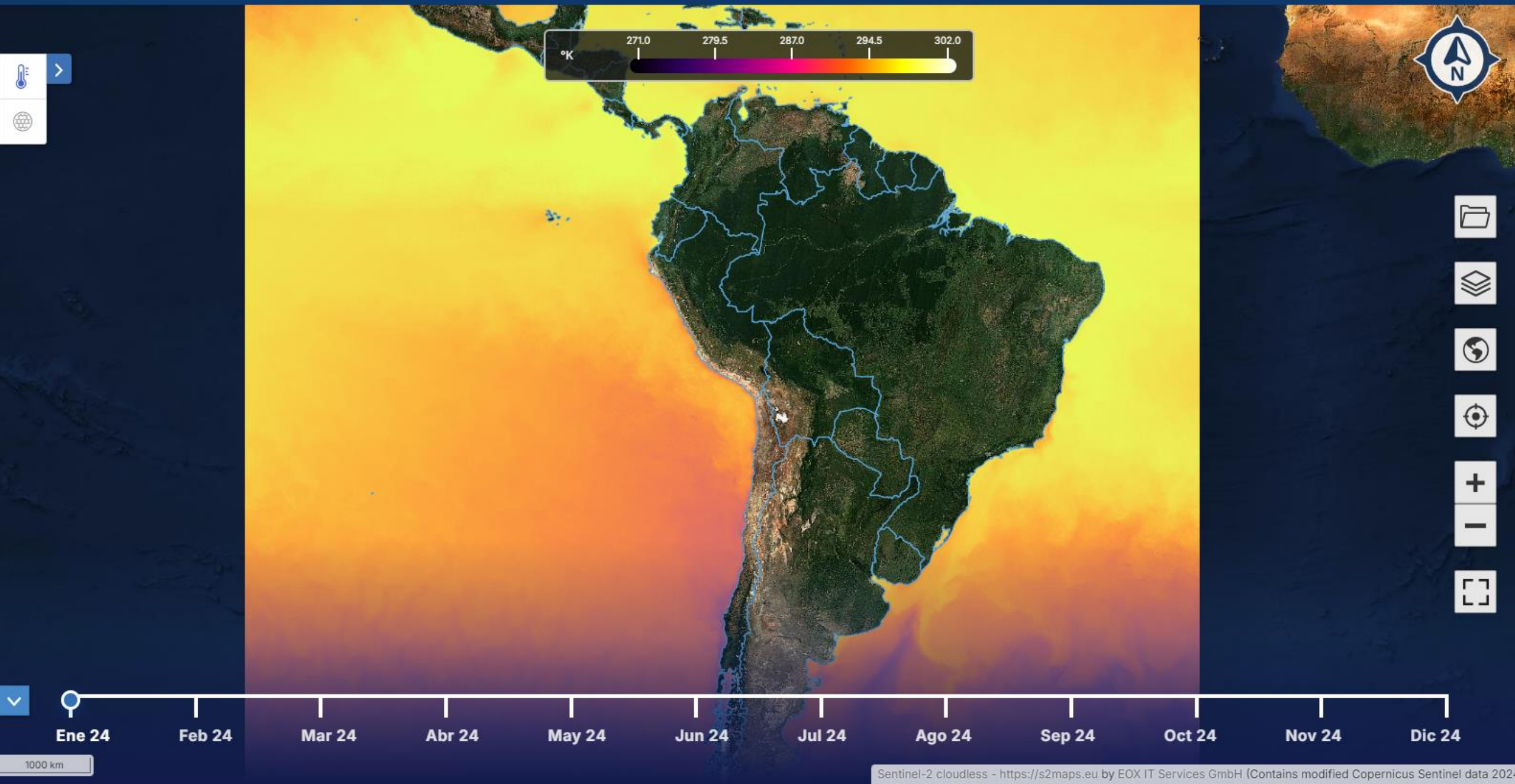
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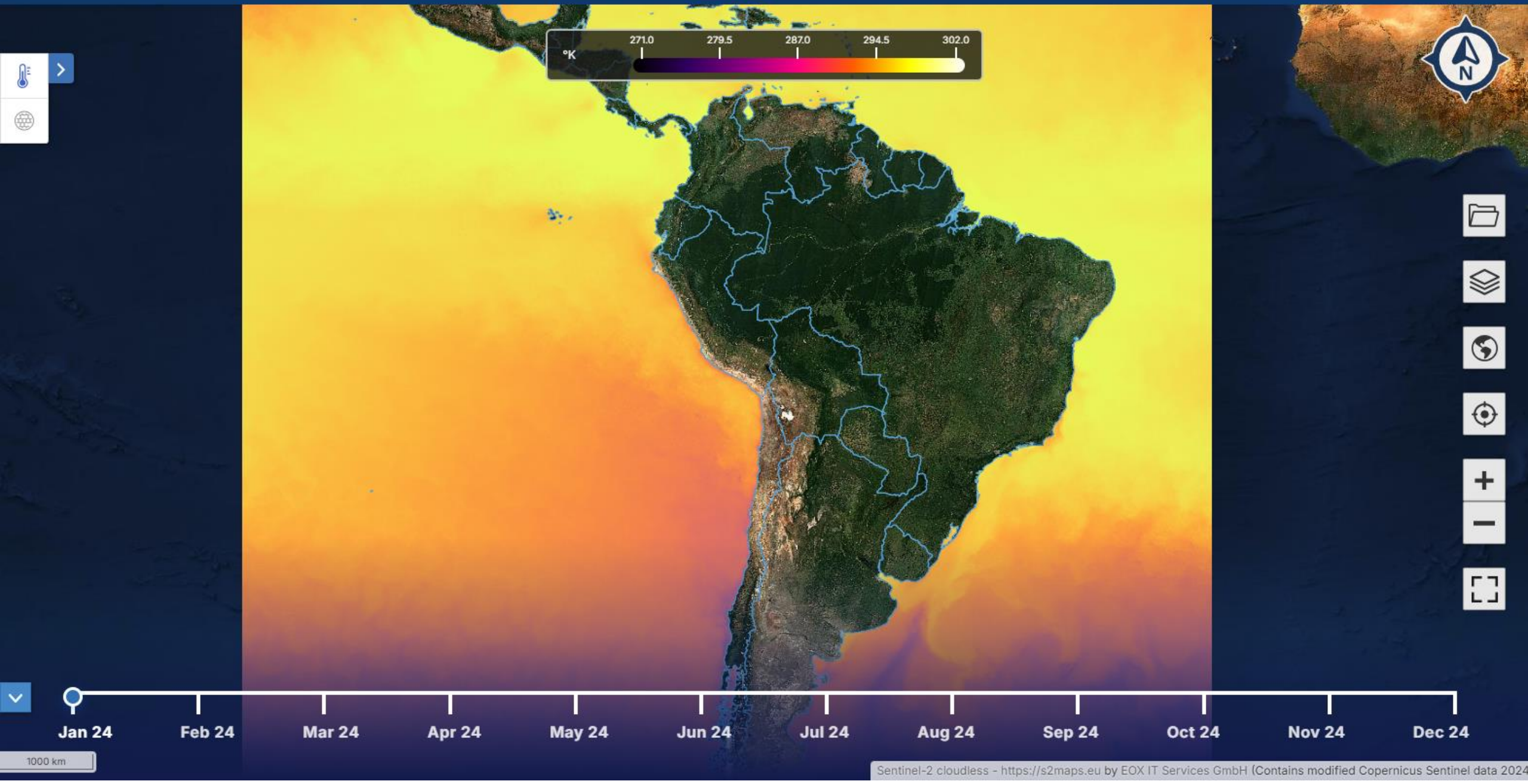

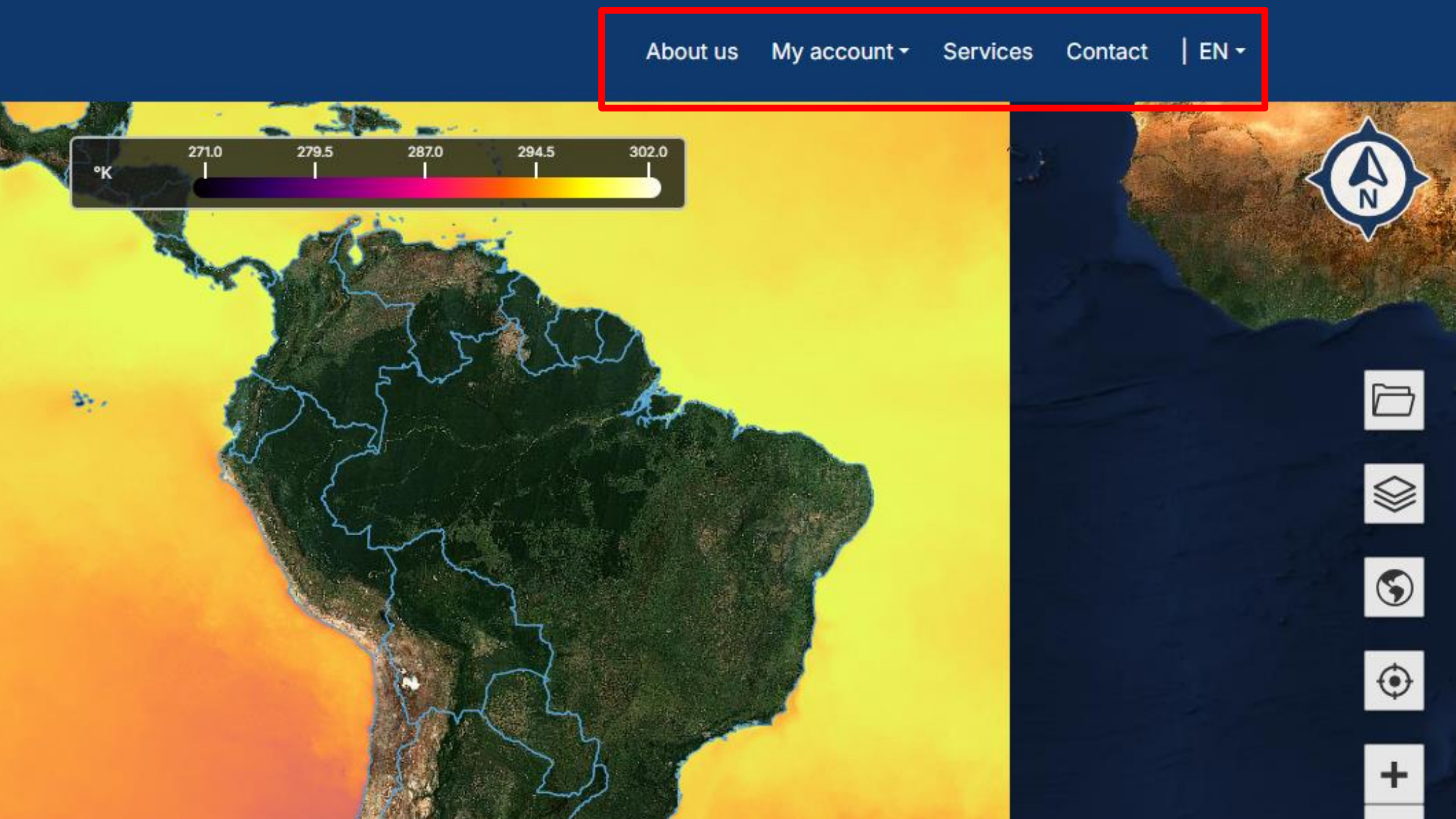
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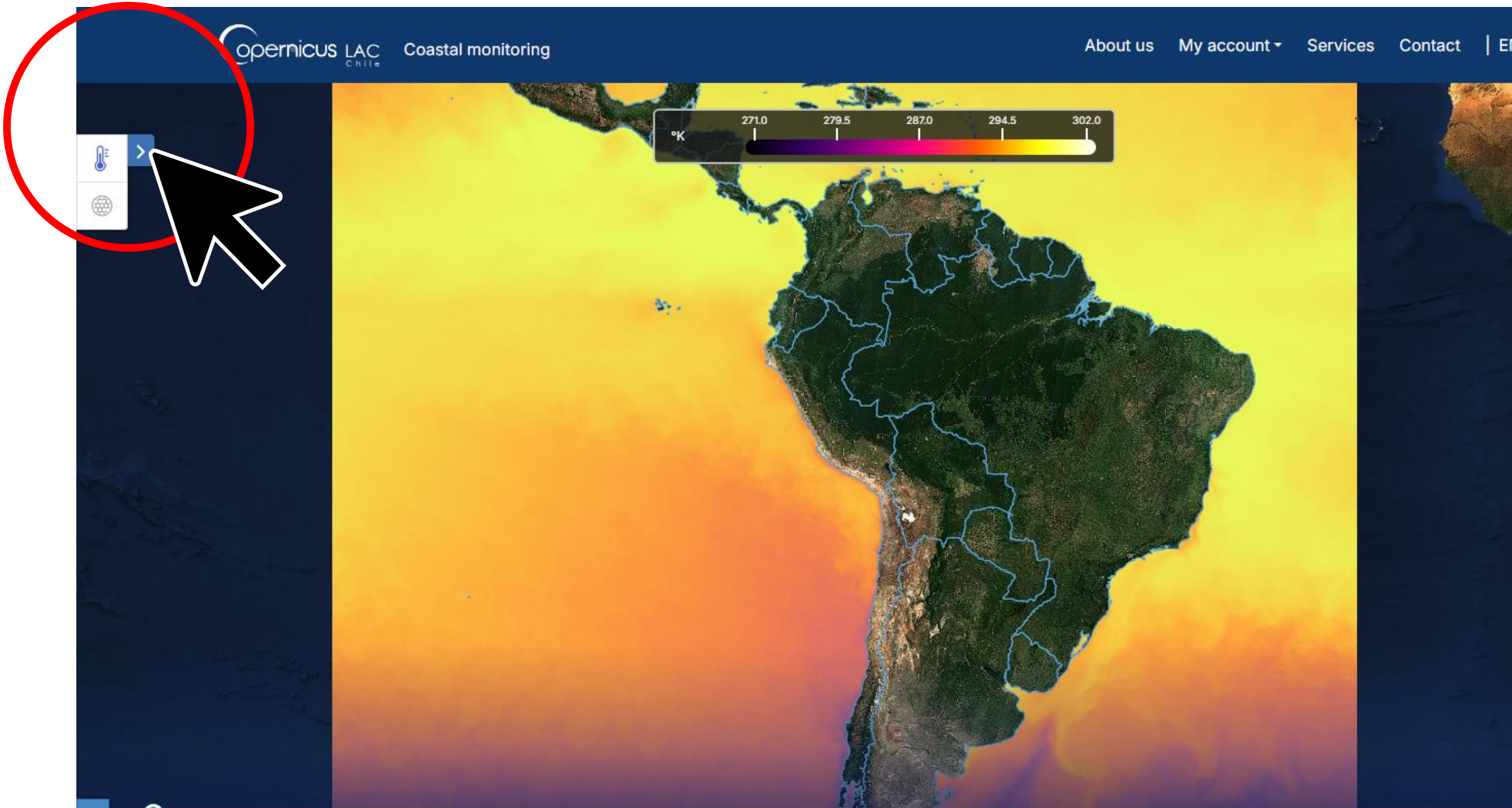
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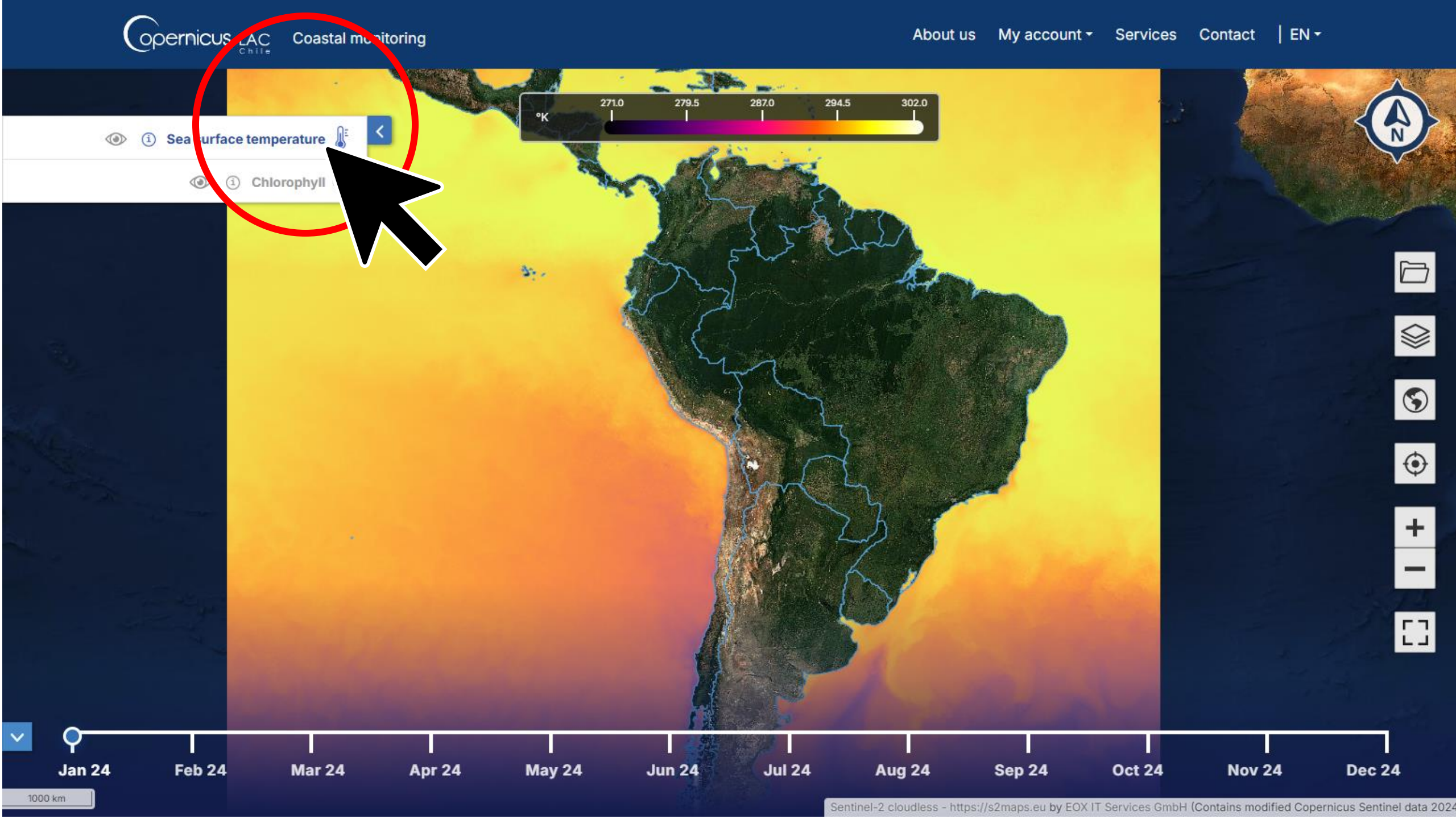
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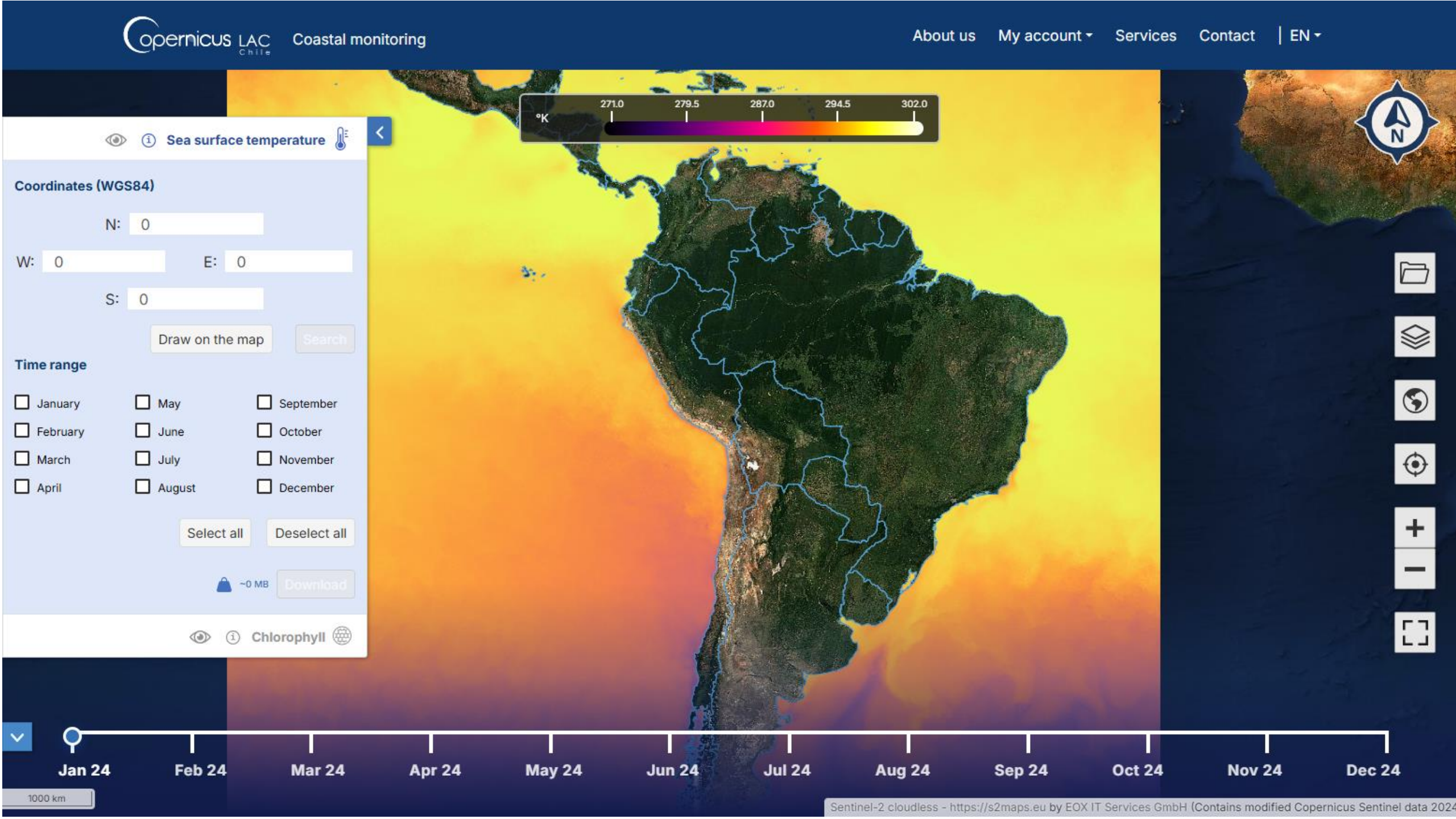
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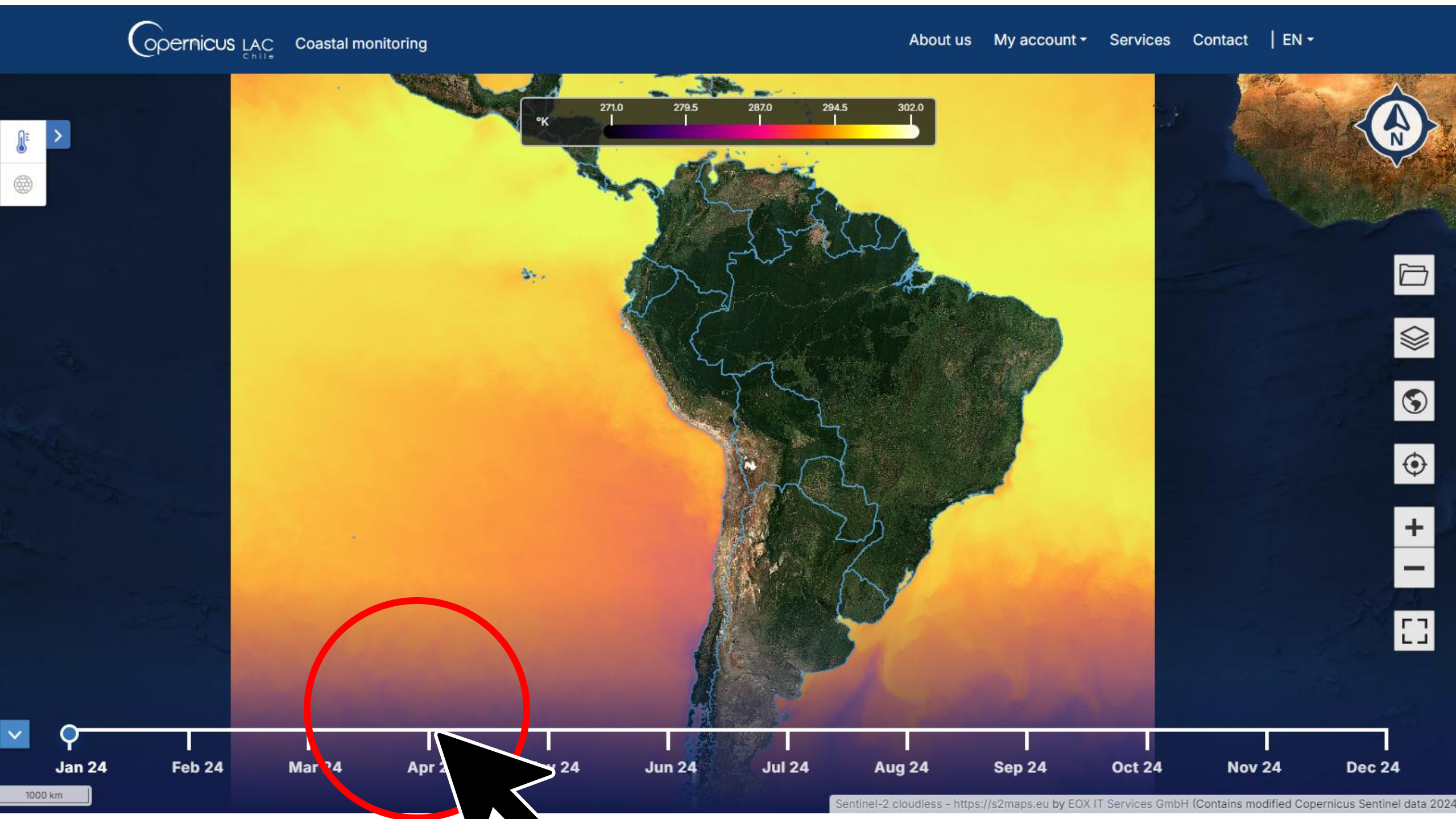
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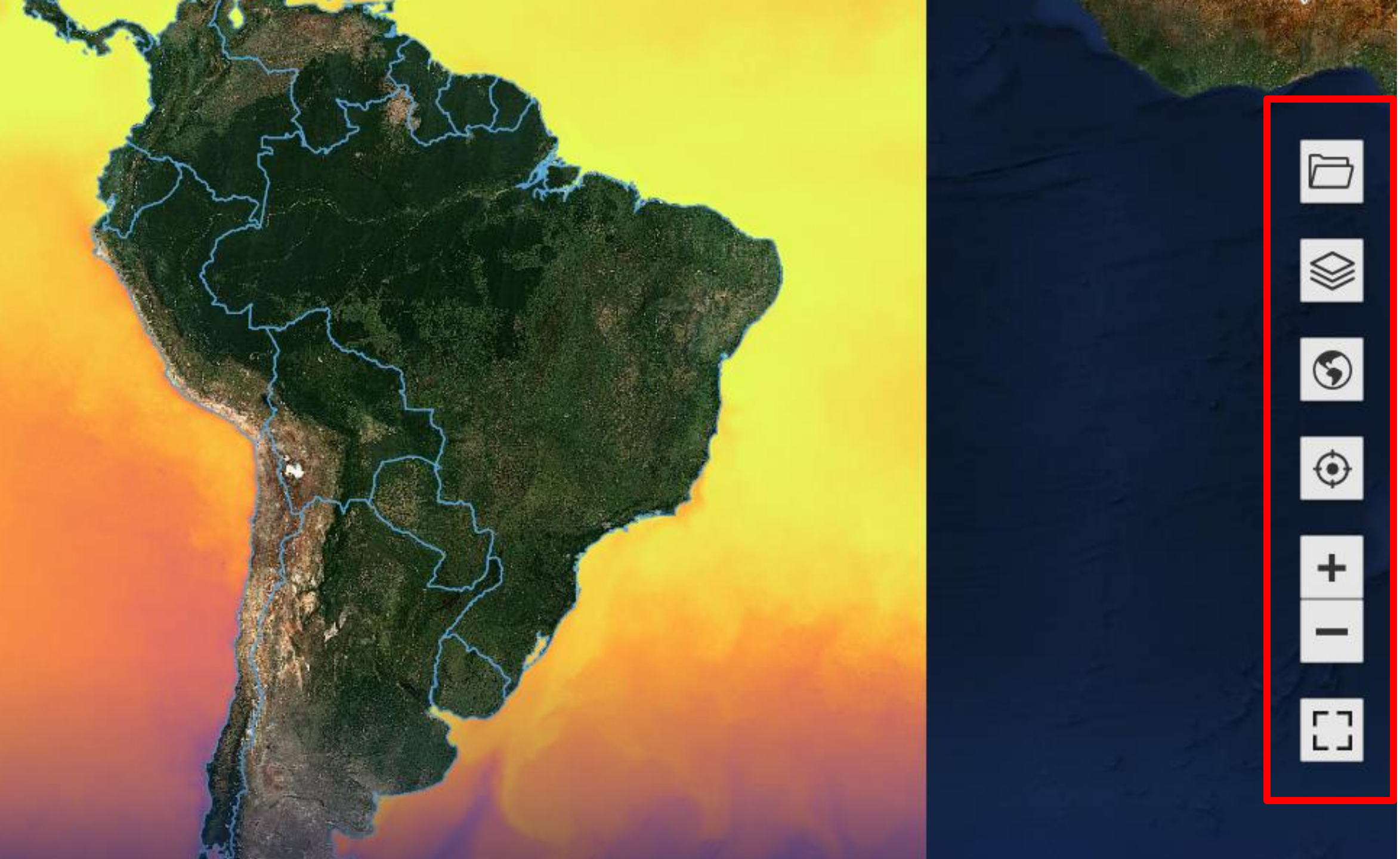

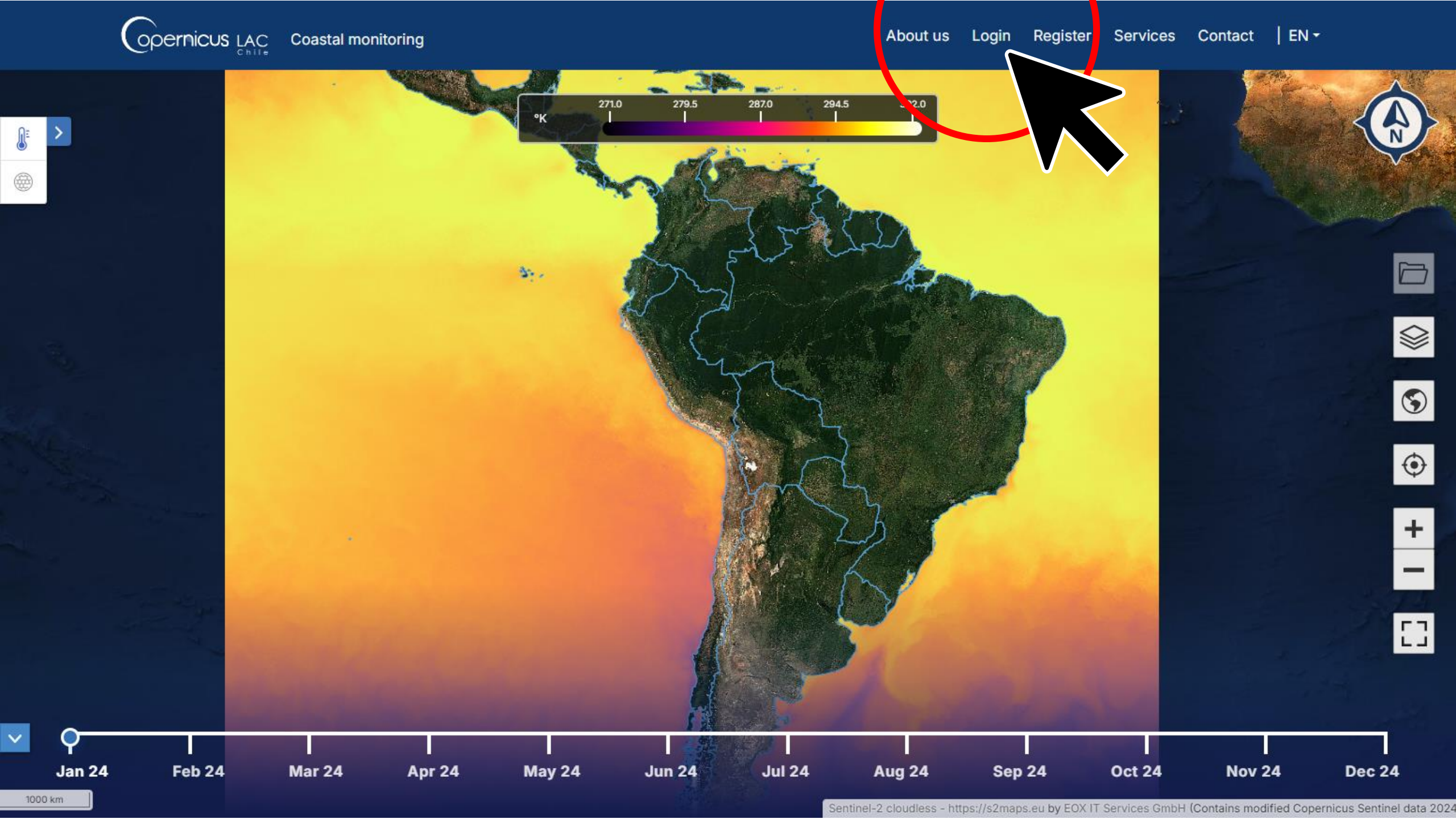
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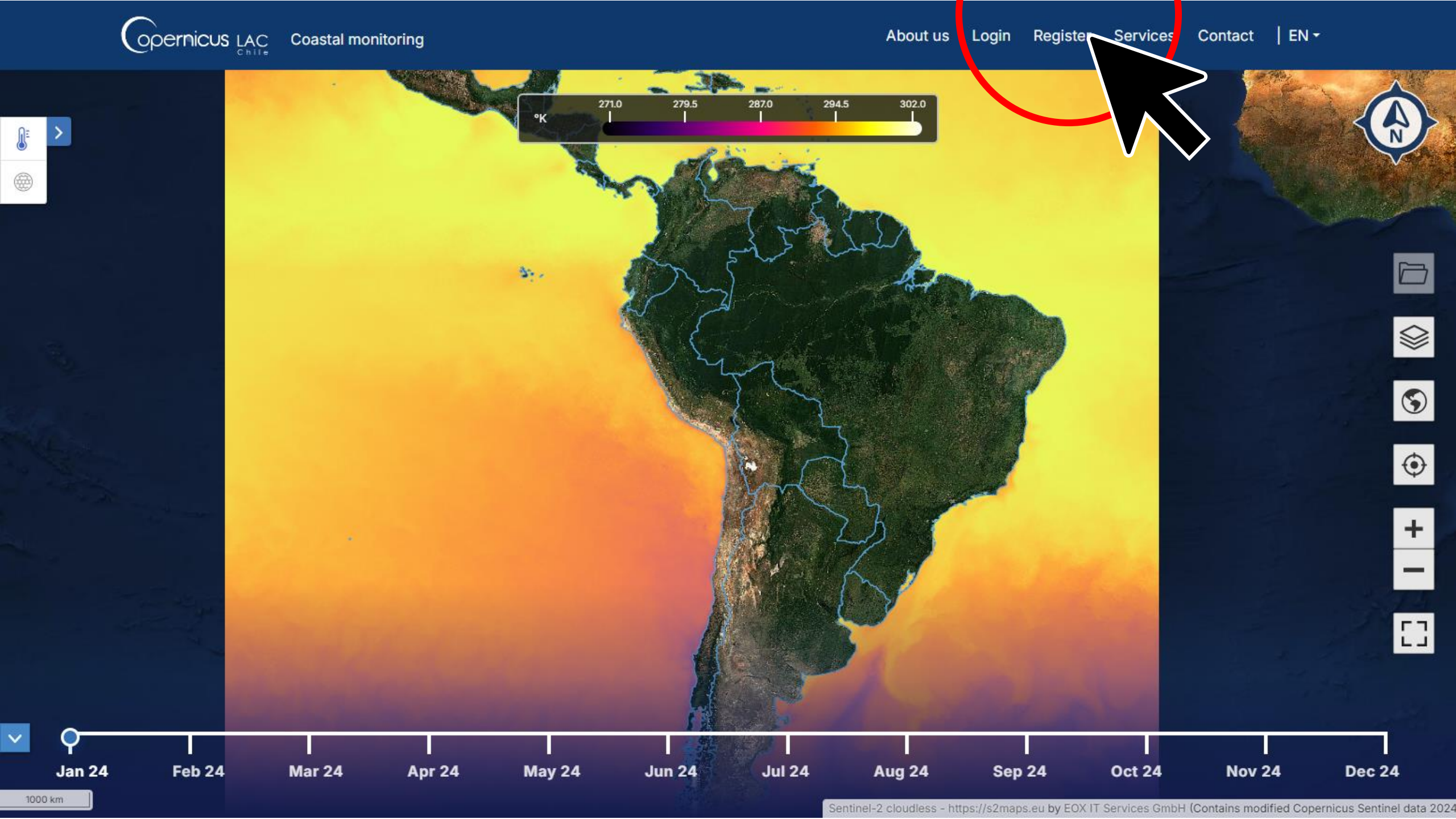
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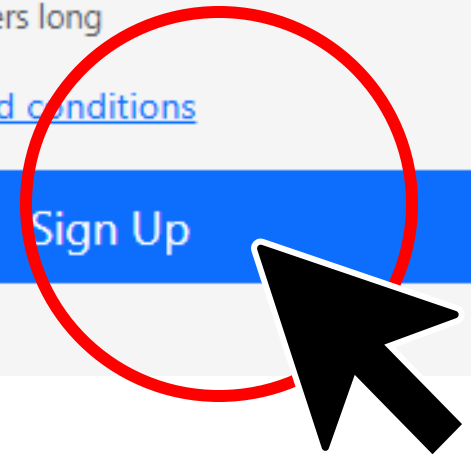

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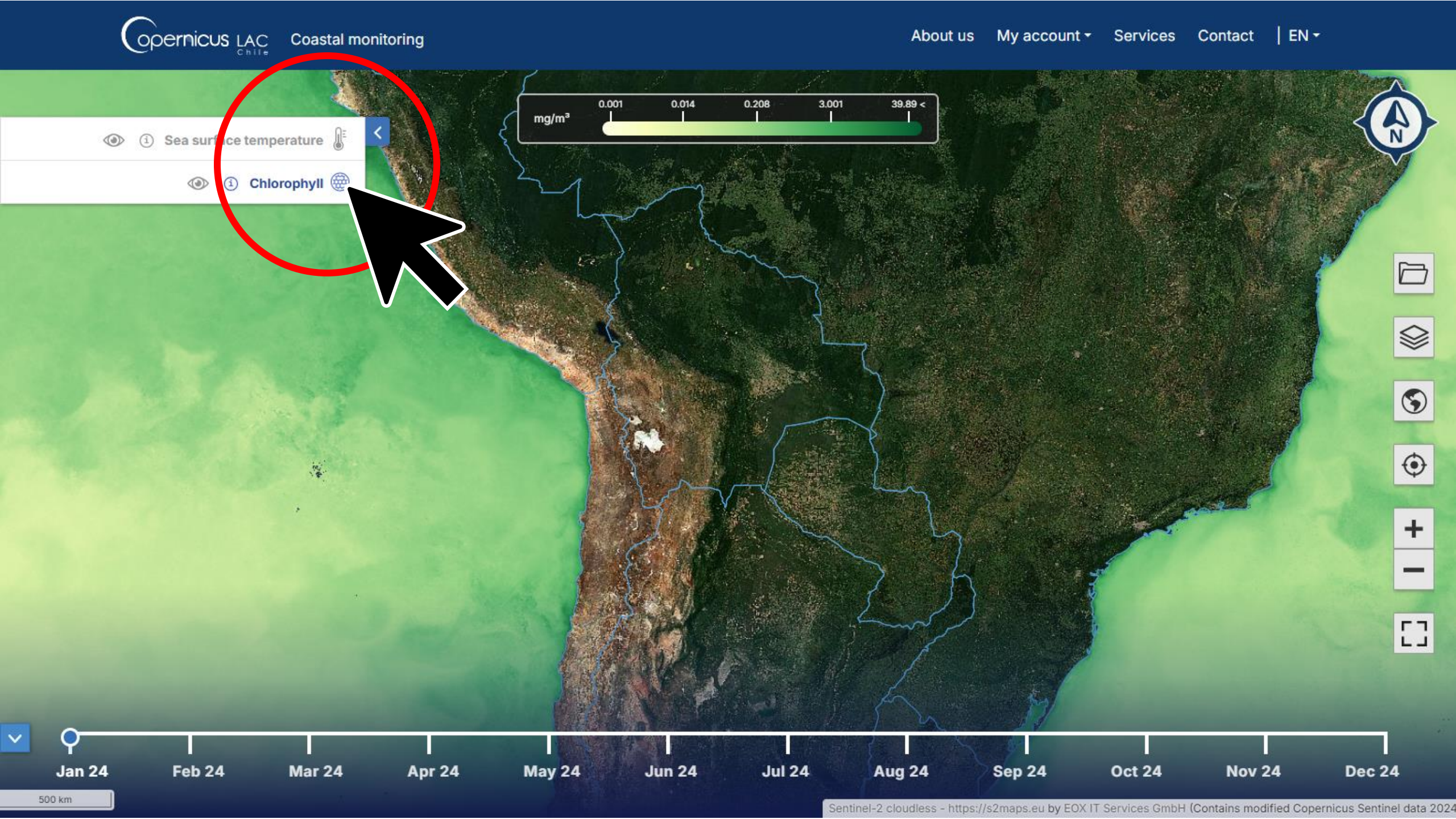
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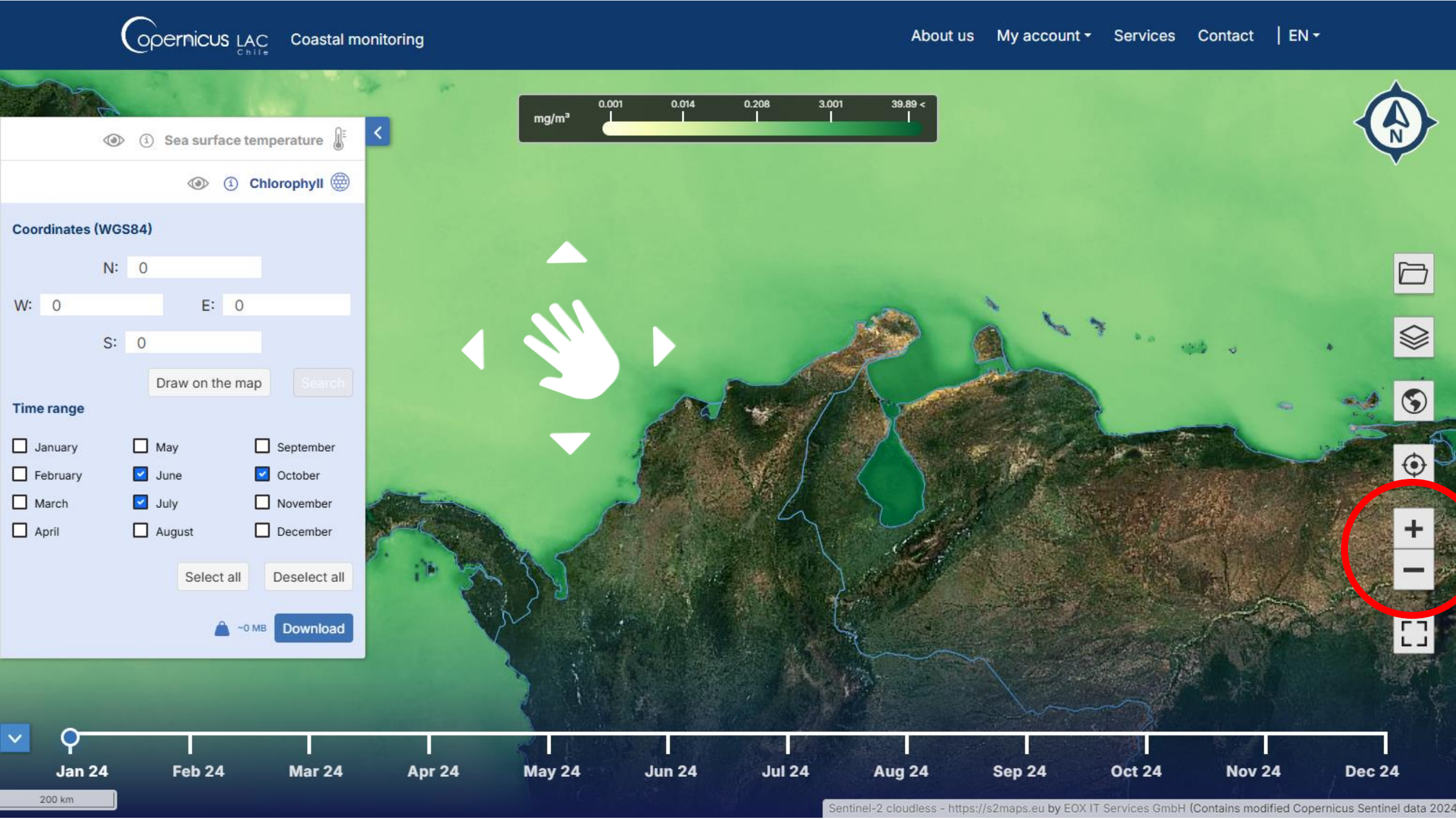
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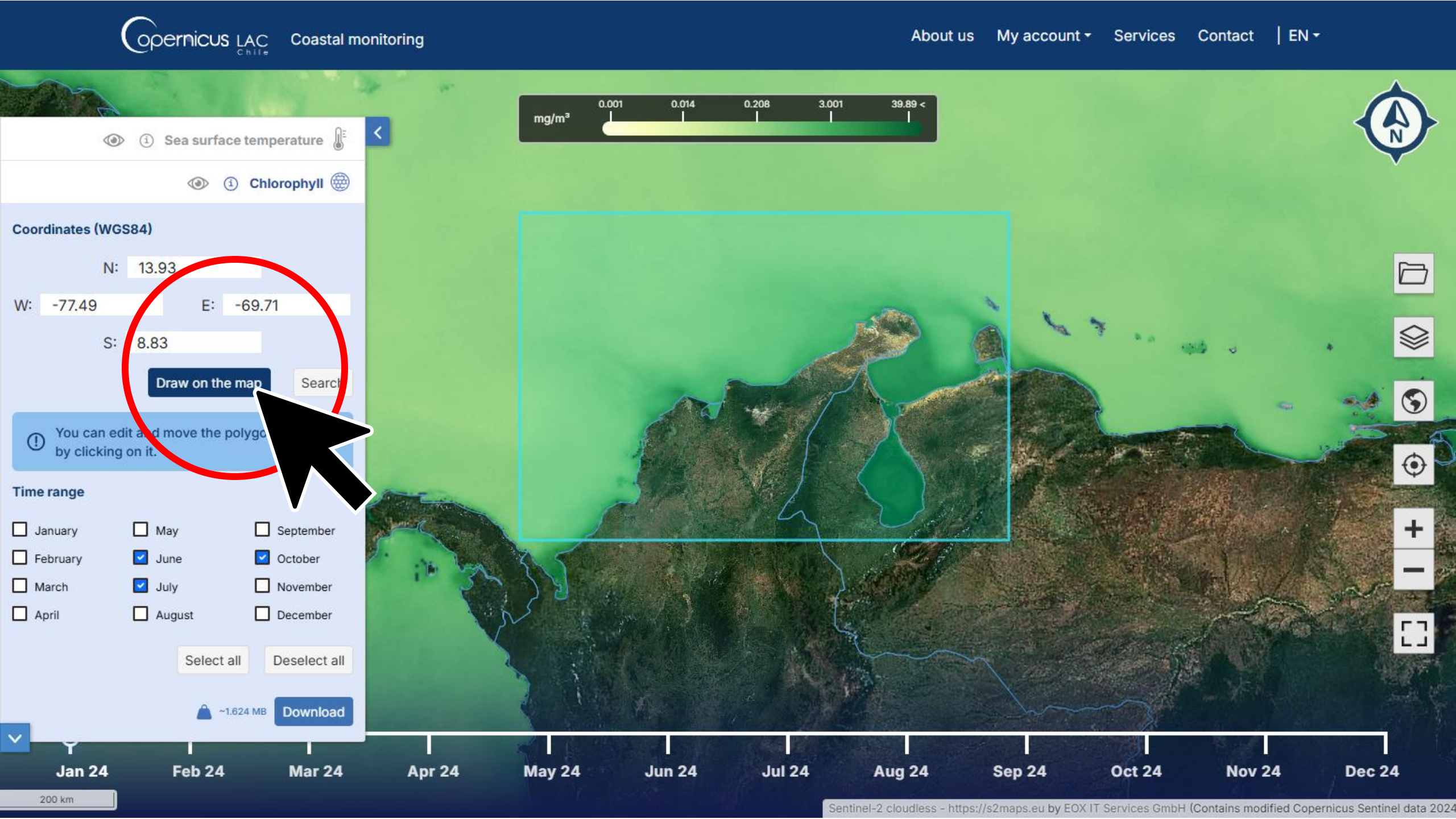
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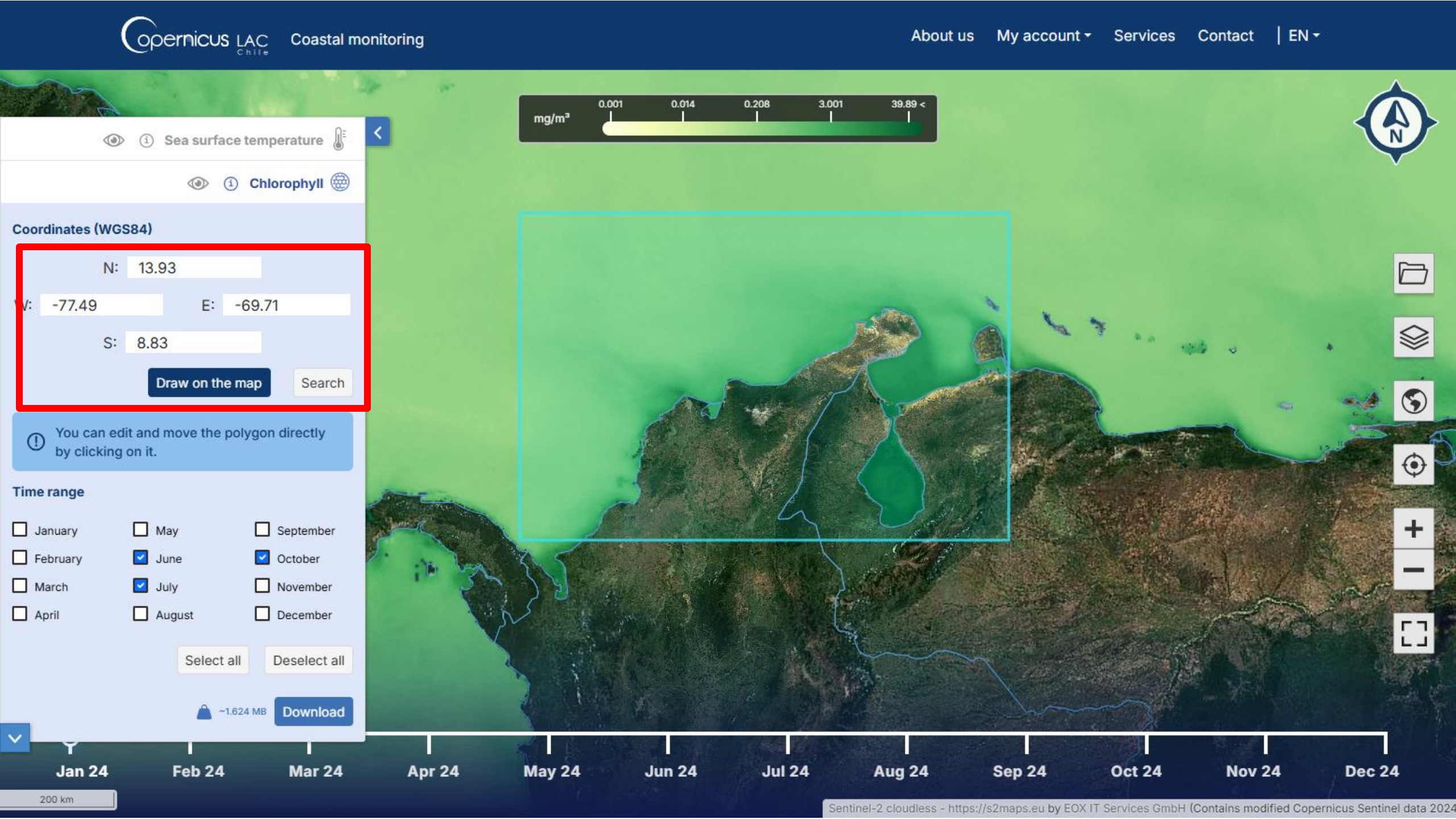
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mg/m³
0.001
0.014
0.208
3.001
39.89 <
N
Sea surface temperature
Chlorophyll
Coordinates (WGS84)
N: 13.93
W: -77.49
E: -69.71
S: 8.83
Draw on the map
Search
You can edit and move the polygon directly by clicking on it.
Time range
January
February
March
April
May
June
July
August
September
October
November
December
Select all
Deselect all
~1.624 MB
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Jan 24
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200 km
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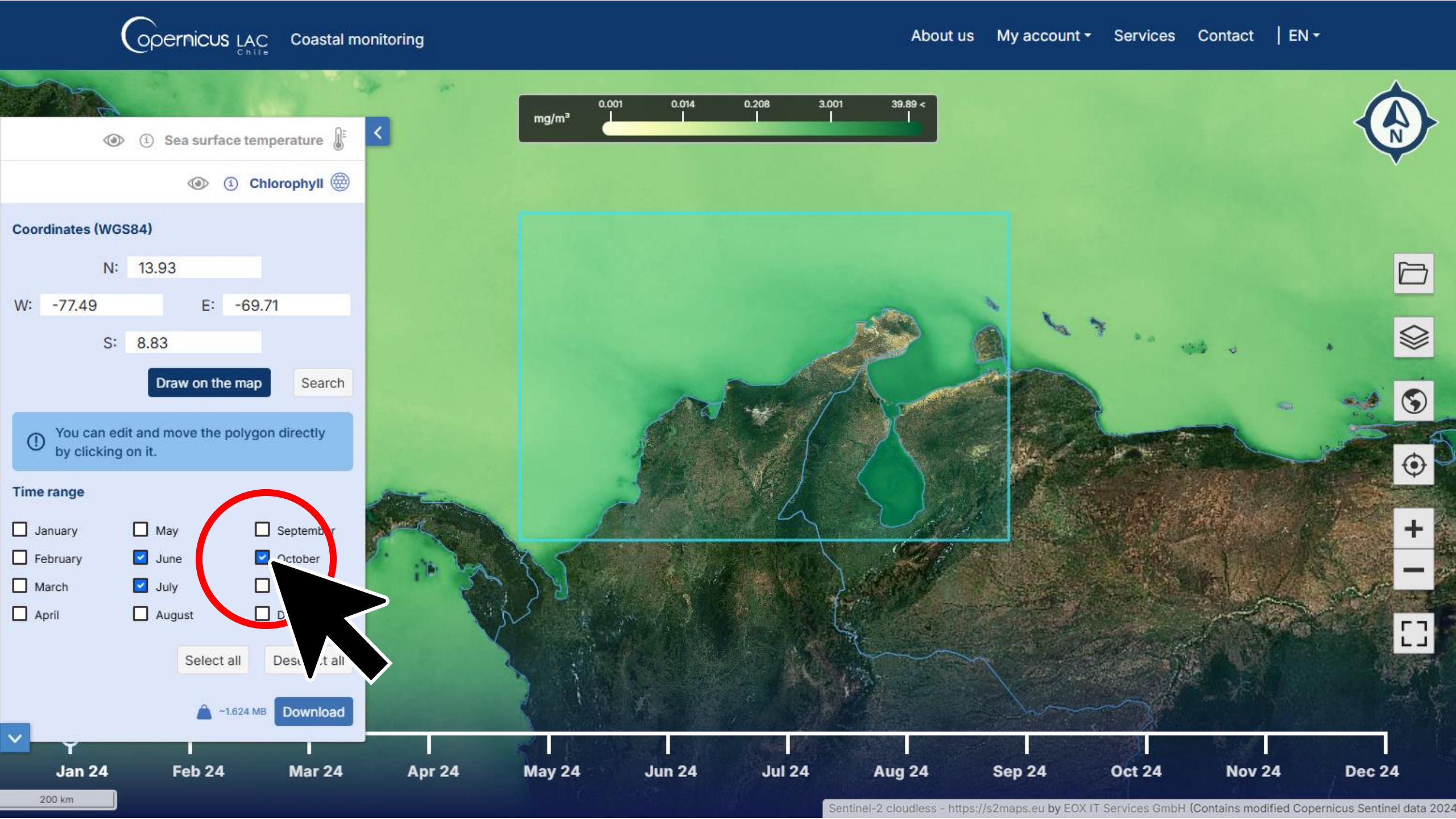
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mg/m³ 0.001 0.014 0.208 3.001 39.89 <

Sea surface temperature

Coordinates (WGS84)

N: 13.93

W: -77.49

S: 8.83

Draw

You can edit and move by clicking on it.

Time range

- [ ] January
- [ ] February
- [ ] March
- [ ] April
- [ ] May
- [x] June
- [x] July
- [ ] August

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Jan 24 Feb 24 Mar 24 Apr 24 May 24 Jun 24 Jul 24 Aug 24 Sep 24 Oct 24 Nov 24 Dec 24

200 km

Preview

Close

Chlorophyll

501.730,47 km² | EPSG:3857 WGS84

nc

- June 2024
- July 2024
- October 2024

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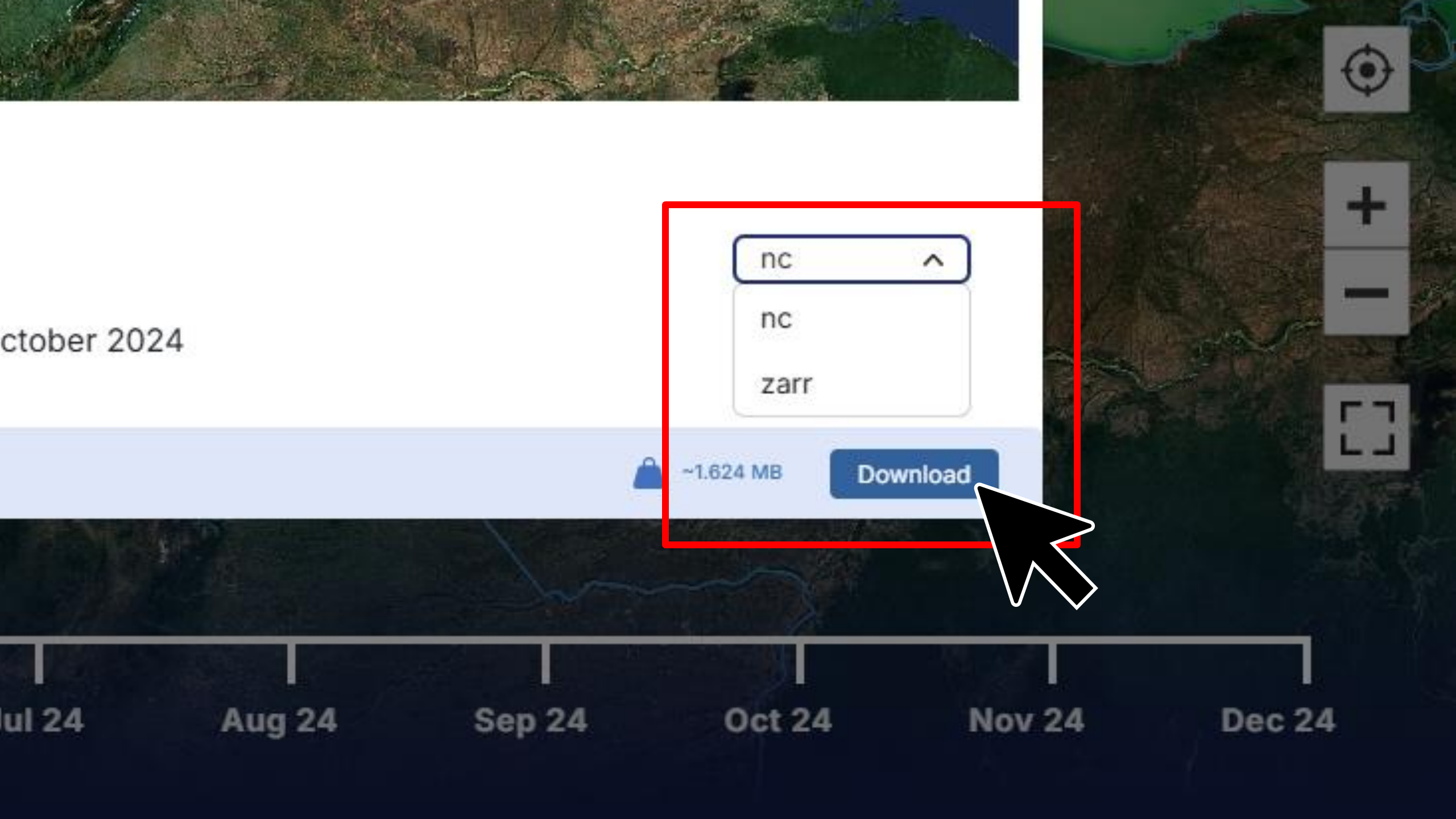
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ul 24
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Cerrar

N°	Download date	Latitudes	Longitudes	Variables	Product dates	Status
01	29-05-2026	8.83° , 13.93°	-77.49° , -69.71°	CHL	06-2024 ...	
02	28-05-2026	-18.95° , -17.41°	-71.99° , -69.83°	CHL	03-2024	Completed
03	28-05-2026	-18.95° , -17.41°	-71.99° , -69.83°	CHL	03-2024	Completed
04	28-05-2026	-18.95° , -17.41°	-71.99° , -69.83°	SST	03-2024	Completed
05	28-05-2026	-18.95° , -17.41°	-71.99° , -69.83°	SST	03-2024	Completed
06	13-05-2026	-15.02° , -14.74°	-75.88° , -75.38°	CHL	11-2024	Completed
07	13-05-2026	-15.02° , -14.74°	-75.88° , -75.38°	SST	11-2024	Completed

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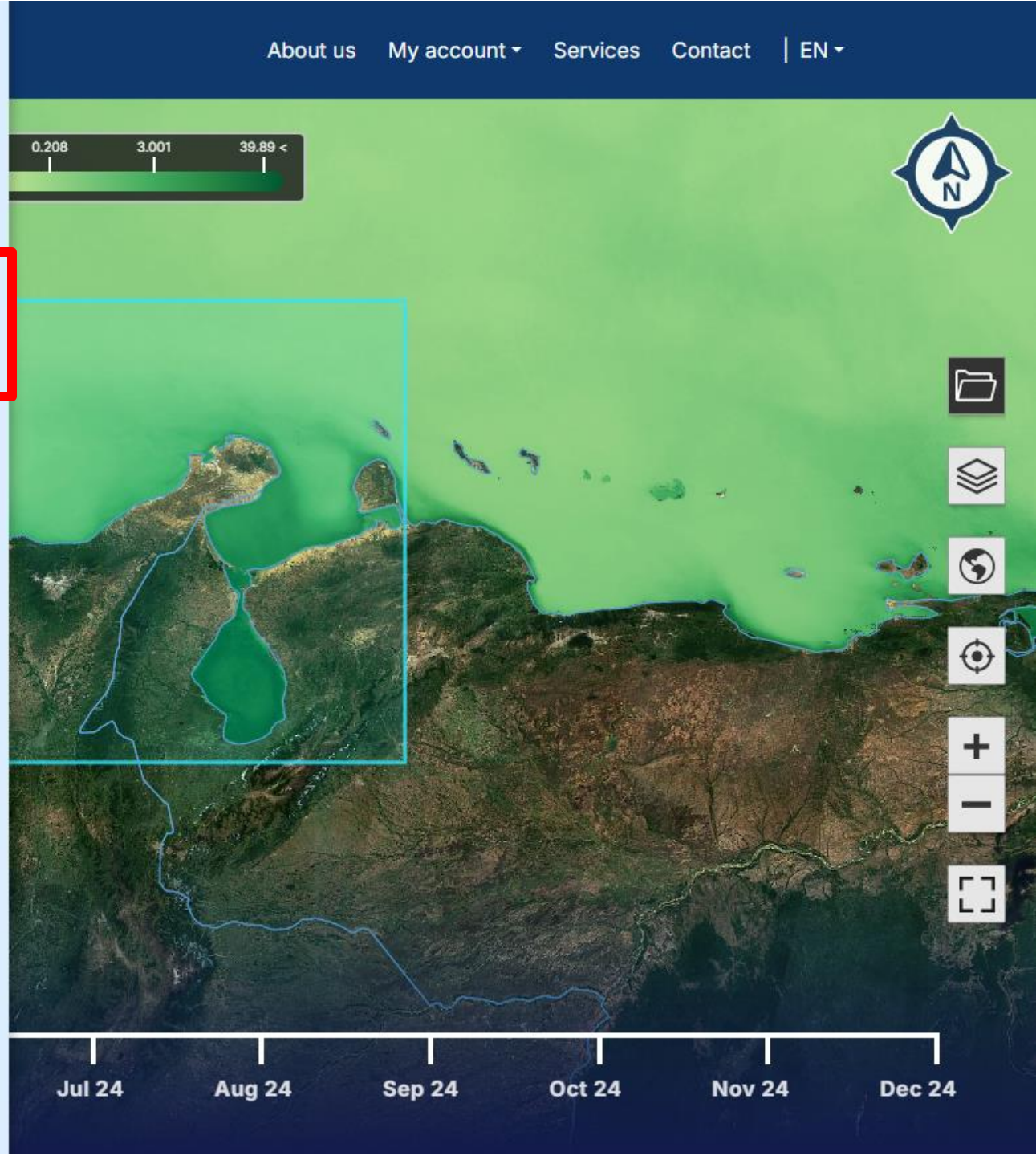

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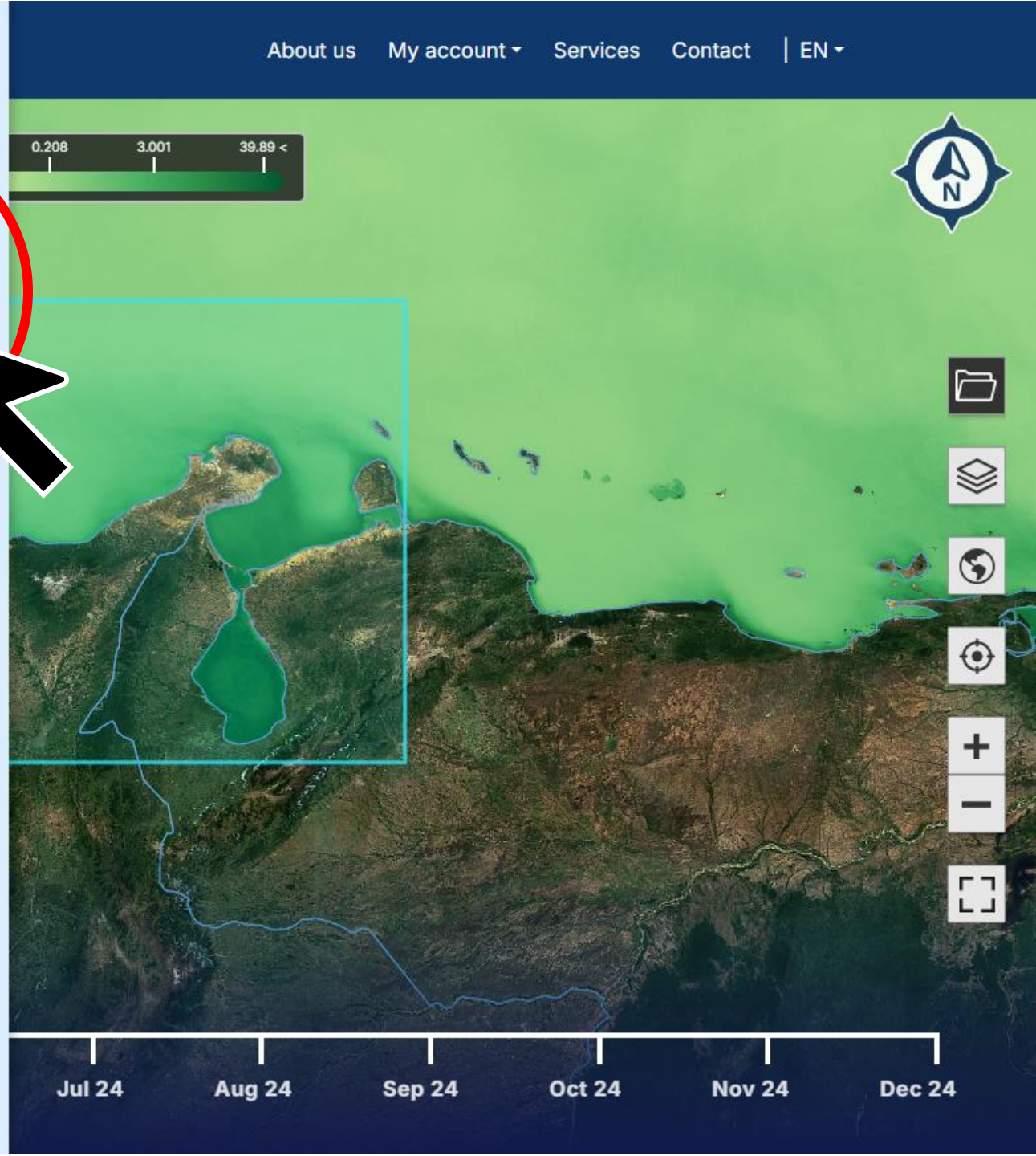
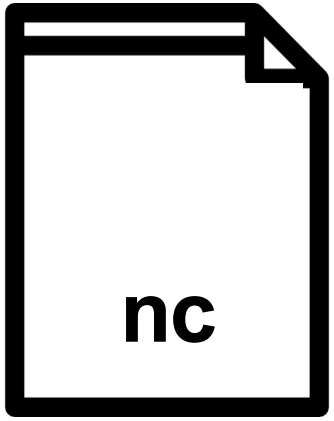


NetCDF



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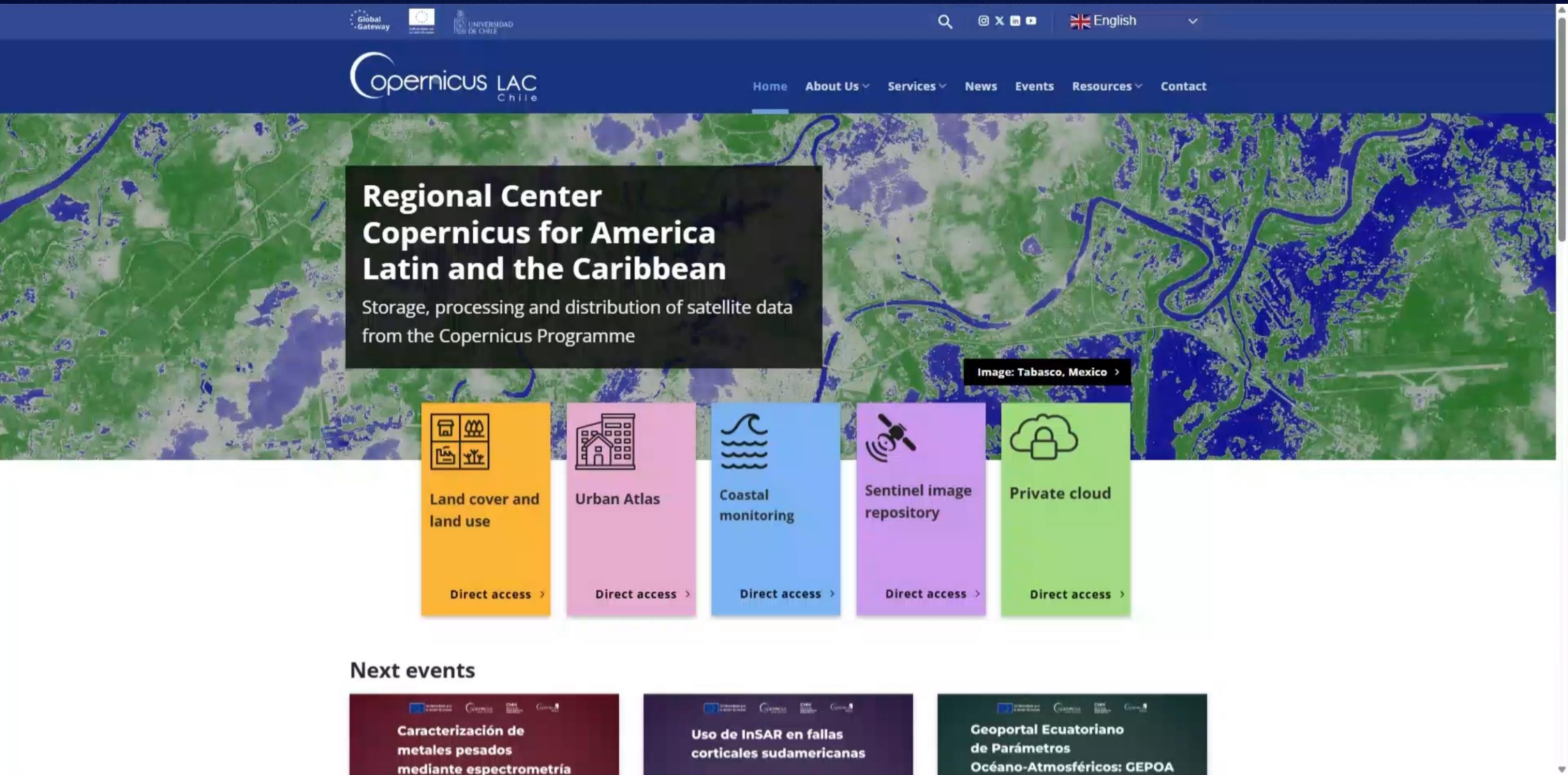
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What kind of information do you use?

Coastal Monitoring

Copernicus LAC Chile

Coming up next

Workshop structure:

- **Block 1 –** Introduction and context | 60 min
- **Block 2 –** Data access and exploration | 30 min
- **Block 3 – Indices construction and spatial analysis | 120 min**
- **Block 4 –** Workshop wrap-up and closing discussion | 30 min

Break

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Hands-on

Applying Satellite Data in the Workshop

Coastal Monitoring

Coastal Monitoring Service Workshop

Copernicus LAC Chile

This workshop introduces the access, exploration and analysis of oceanographic products derived from the CopernicusLAC Chile Coastal Monitoring Service.

Satellite observations will be used to analyze physical and biogeochemical variables of the ocean surface in order to characterize:

- Marine productivity patterns
- Environmental conditions in the Caribbean Sea

Two key variables are analyzed:

- Sea Surface Temperature (SST) – 2 km resolution
- Chlorophyll-a concentration (Chl-a) – 1 km resolution

Both datasets correspond to monthly satellite fields for the year 2024.

→

Coastal Monitoring

Coastal Monitoring Service Workshop

Copernicus LAC Chile

Workshop Objective

The objective of this workshop is to analyze Sea Surface Temperature (SST) and Chlorophyll-a concentration (Chl-a) in order to compute three simplified oceanographic indicators.

These indices provide an approximation of different aspects of marine ecosystem functioning.

Indices analyzed:

- Potential primary productivity index (approximate NPP)
- Coastal eutrophication index
- Environmental vulnerability index

→

Coastal Monitoring

Coastal Monitoring Service Workshop

Copernicus LAC Chile

Study Area: Caribbean Sea

The analysis focuses on the Caribbean region, where satellite observations allow the monitoring of environmental variability.

The study includes:

- Predefined regional study areas
- Marine Protected Areas (MPAs)
- Satellite observations of SST and chlorophyll

This spatial framework allows comparison between:

- Protected areas
- Surrounding marine regions.

→

Coastal Monitoring

Coastal Monitoring Service Workshop

Copernicus LAC Chile

Skills Developed During the Workshop

Participants will learn how to:

- open scientific datasets in NetCDF format
- manipulate oceanographic data using Python
- visualize oceanographic patterns
- compute simplified bio-oceanographic index
- analyze spatial patterns in the Caribbean Sea and Marine Protected Areas (MPAs)

Coastal Monitoring

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Data Processing Workflow

Step 1 – Data access (Morning)
Satellite datasets downloaded from the Copernicus platform.

Step 2 – Data exploration
Visualization of SST and chlorophyll patterns.

Step 3 – Index computation
Calculation of simplified indices combining temperature and productivity.

Step 4 – Spatial analysis
Comparison of environmental conditions across study areas and MPAs.

Coastal Monitoring

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Password

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Copernicus LAC Chile

Coastal Monitoring Workshop Survey

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