Earth observation opportunities and challenges for mapping water-related ecosystems

SDG indicator 6.6.1: Change in the extent of water-related ecosystems over time

| UN-GGIM Europe | SDG Line of Work Webinar | 12 May 2025 |

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Earth Observation Program Directorate
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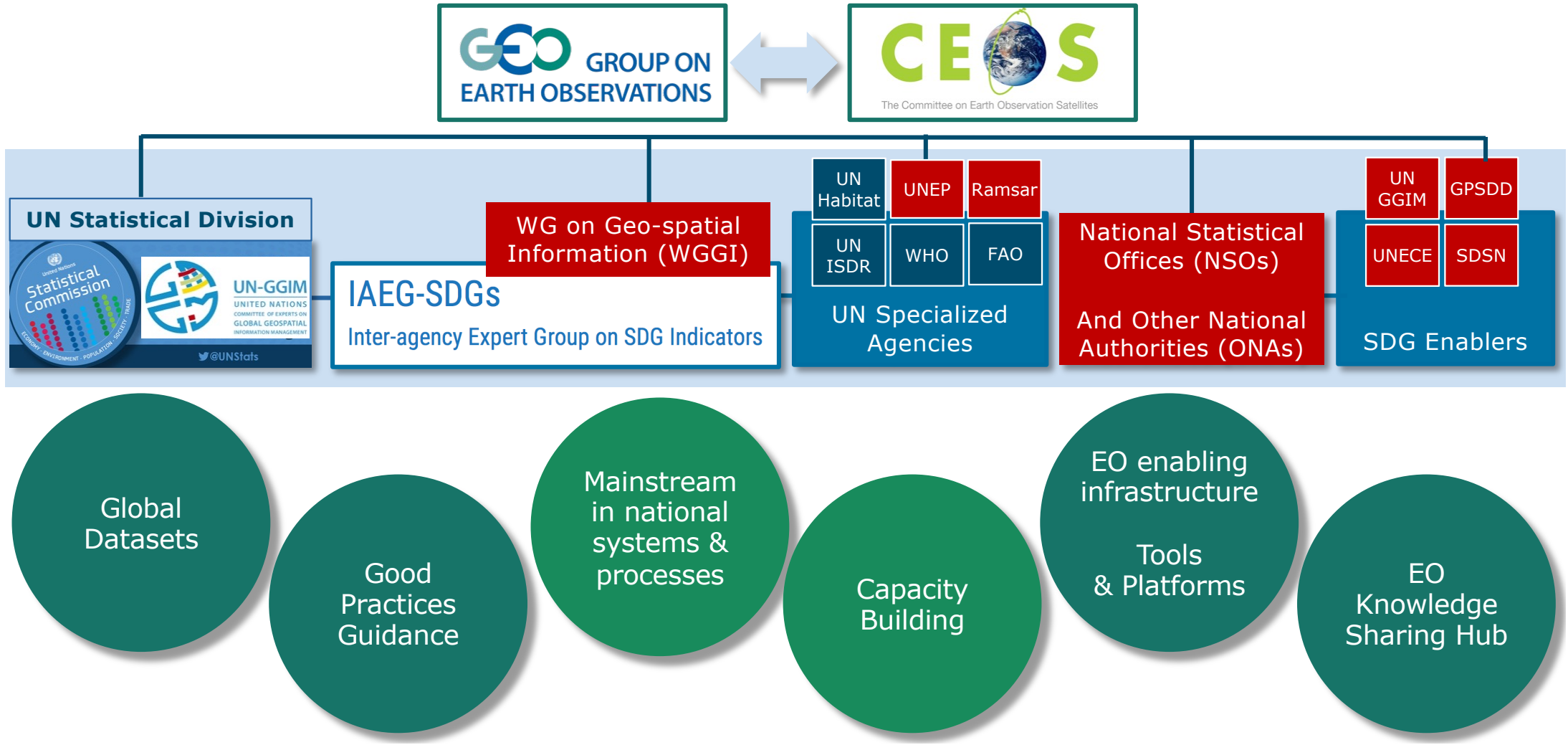
International collaboration to scale up EO innovation for the full achievements of the 2030 Agenda on Sustainable Development



Post-2025 GEO Work Programme

GROUP ON EARTH OBSERVATIONS

https://earthobservations.org

With the full support of the Committee on Earth Observation Satellites (CEOS)

Committee on Earth Observation Satellites

https://ceos.org

International collaborative effort to develop harmonized methods for wetland inventory, assessment, and monitoring

GEO WETLANDS

International collaborative effort to deliver global, free, open access to high-quality information on streamflow forecasts and historical streamflow data.

GEO GLOWS

International collaborative effort to enhance the coordination, delivery, and utilization of water quality information for the benefit of society.

GEO AQUAWATCH

Collaborative initiative to create a trusted common resource for mapping and monitoring the world's ecosystems and facilitate consistent MAE monitoring, reporting, and verification

GEO Global Ecosystems Atlas

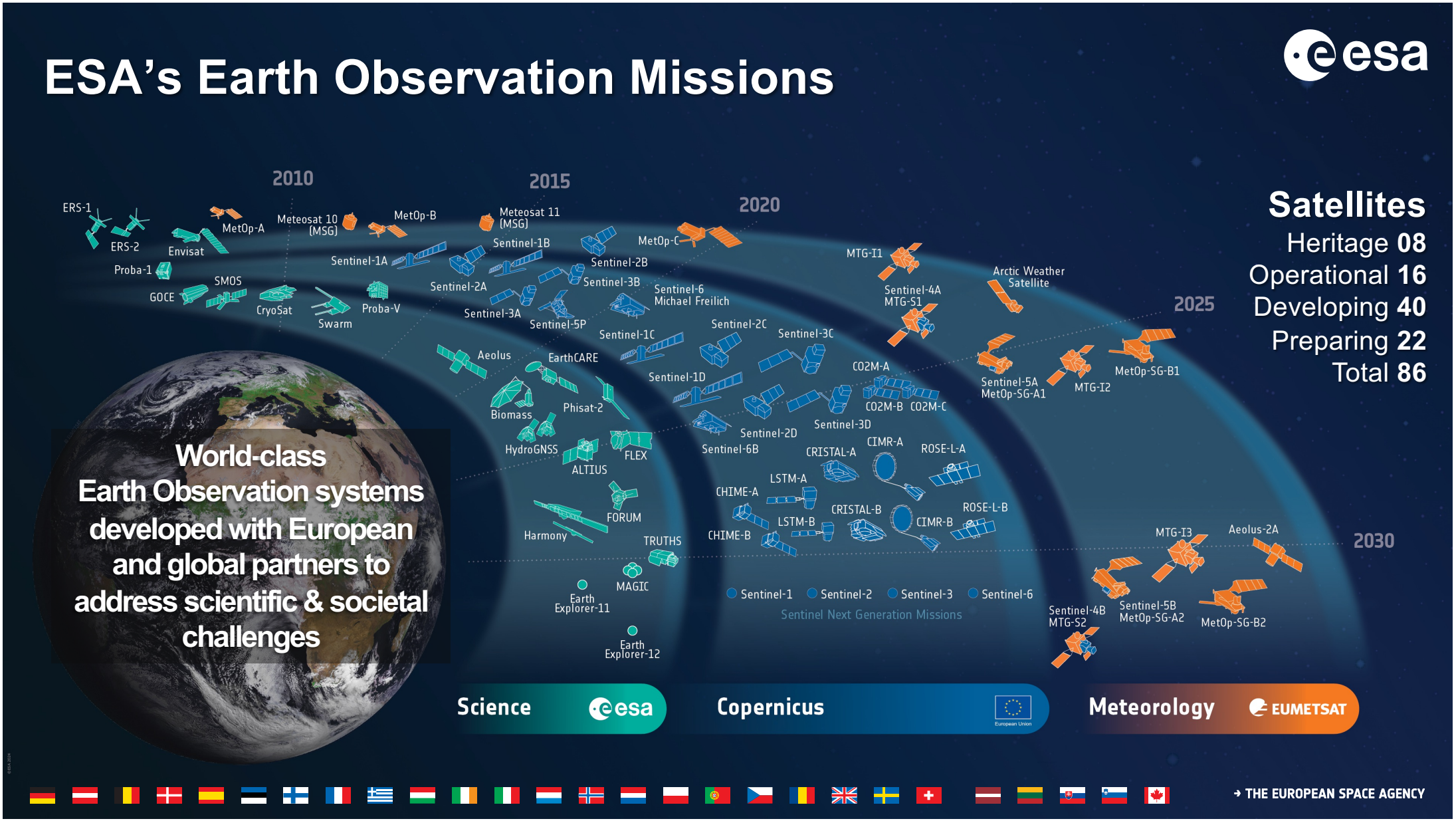
GLOBAL ECOSYSTEMS ATLAS

International collaborative effort to realize the potential of Earth Observations and Geospatial Information to advance the UN 2030 Agenda on Sustainable Development.

GEO EO4SDG

EARTH OBSERVATIONS FOR THE SUSTAINABLE DEVELOPMENT GOALS

ESA's Earth Observation Missions



World-class Earth Observation systems developed with European and global partners to address scientific & societal challenges

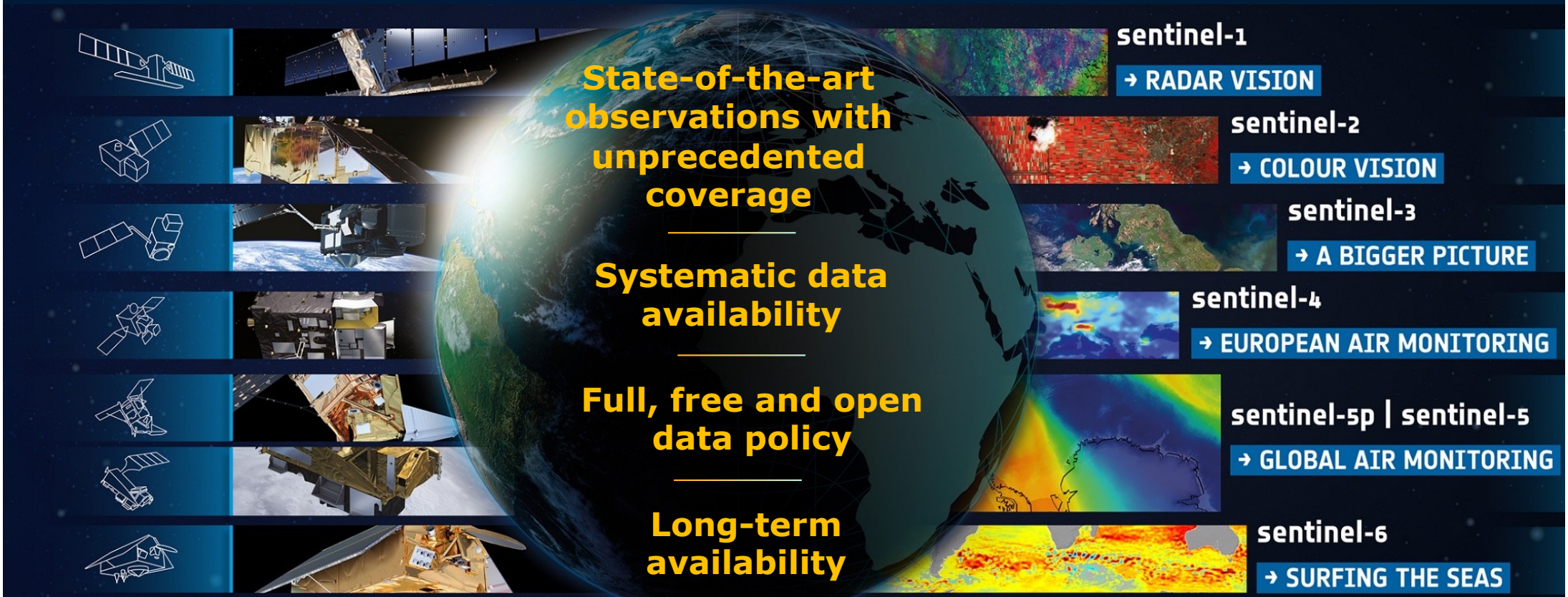
Satellites

Heritage **08**
Operational **16**
Developing **40**
Preparing **22**
Total **86**

Science **Copernicus** **Meteorology** EUMETSAT

→ THE EUROPEAN SPACE AGENCY

The European Copernicus Programme



➔ *Know more: https://copernicus.eu and https://sentinels.copernicus.eu*


PROGRAMME OF THE EUROPEAN UNION
Copernicus
Europe's eyes on Earth
co-funded with
esa
CHIME
Copernicus Hyperspectral Imaging Mission for the Environment
ROSE-L
L-band Radar Observing System
LSTM
Land Surface Temperature Monitoring
CIMR
Copernicus Imaging Microwave Radiometer
CO2M
Copernicus Anthropogenic Carbon Dioxide Monitoring
CRISTAL
Copernicus Polar Ice and Snow Topography Altimeter
soil properties
crop health
biodiversity
water quality
sustainable agriculture
water resources management
drought
urban heat islands
geohazards
polar ice
forest management
food security
maritime surveillance
sea-ice concentration/extent
global ocean and cryosphere
soil moisture and vegetation
carbon dioxide and methane from human activity
coastal and inland waters
polar oceanography
ice sheets and glaciers
snow
sea-ice thickness
Food Security and Water Management
Monitoring Land and Natural Resources
Combatting Climate Change
Safeguarding the Arctic
Copernicus Sentinel Expansion Missions

Copernicus Services

➔ *Know more: https://copernicus.eu/services*

Satellite fleet

Building on steady satellite data streams

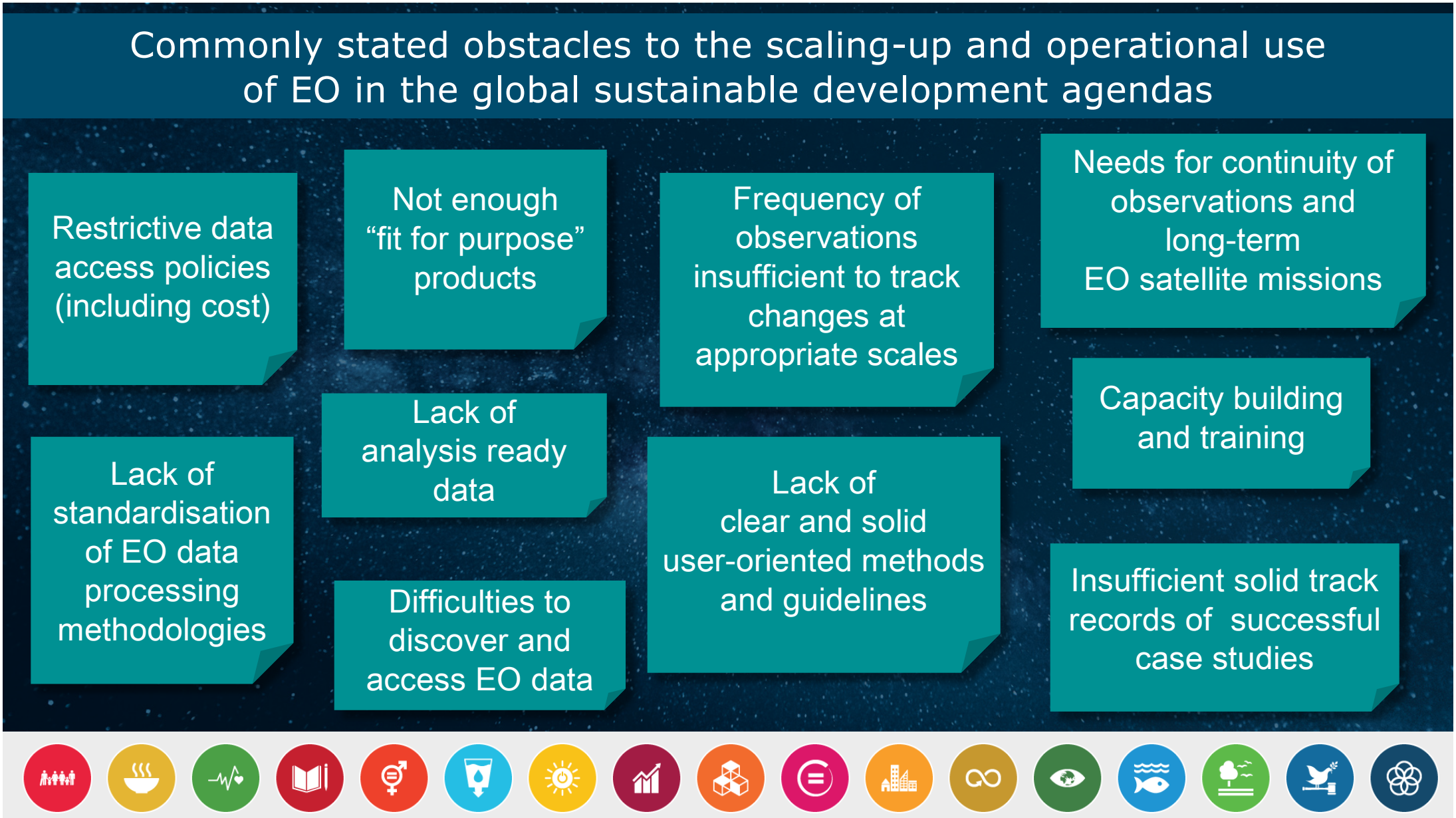
Mobilise the EO data revolution

for the benefits of all

leaving no country behind

Building on advances in information technology (AI)

High Performance Computing Infrastructures


Commonly stated obstacles to the scaling-up and operational use of EO in the global sustainable development agendas
Restrictive data access policies (including cost)
Not enough "fit for purpose" products
Frequency of observations insufficient to track changes at appropriate scales
Needs for continuity of observations and long-term EO satellite missions
Capacity building and training
Lack of analysis ready data
Lack of standardisation of EO data processing methodologies
Lack of clear and solid user-oriented methods and guidelines
Difficulties to discover and access EO data
Insufficient solid track records of successful case studies

EO data exploitation platforms

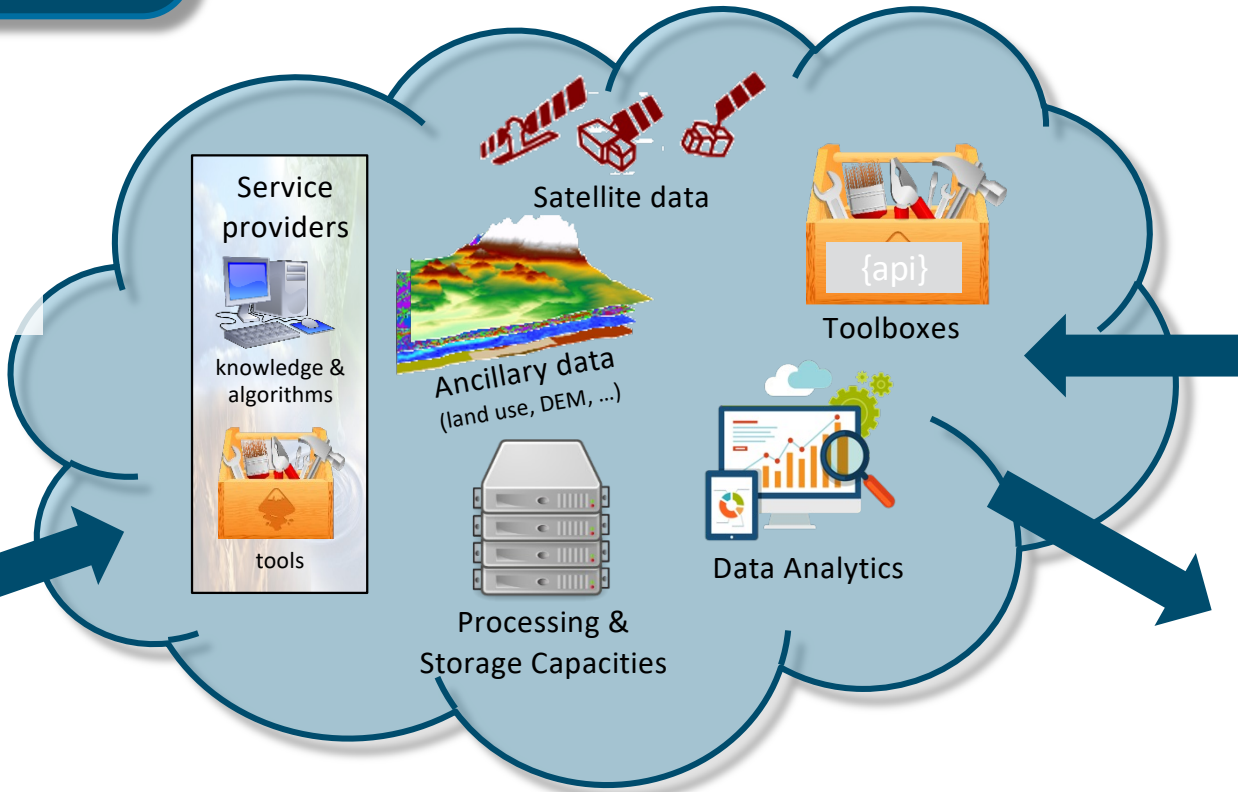
The power of the Cloud
The power of Partnerships

"Bringing the users to the data"

Simplify the extraction of information from EO data
Enable large scale exploitation of EO data
Stimulate innovation with EO data

Platforms as enabling technology

Mobile data
Crowdsourcing
citizen science



Remote access for users

User generated results

SDG Indicator 6.6.1

Change in the extent of water-related ecosystems

0.c. Indicator (SDG_INDICATOR)

Indicator 6.6.1: Change in the extent of water-related ecosystems over time

0.d. Series (SDG_SERIES_DESCR)

EN_WBE_NDQTGRW - Nationally derived quantity of groundwater (millions of cubic metres per annum) [6.6.1]

EN_WBE_NDQTRVR - Nationally derived quantity of rivers (million of cubic metres per annum) [6.6.1]

EN_LKRV_PWAC - Lakes and rivers permanent water area change (%) [6.6.1]

EN_LKRV_PWAN - Lakes and rivers permanent water area (square kilometres) [6.6.1]

EN_LKRV_PWAP - Lakes and rivers permanent water area (% of total land area) [6.6.1]

EN_LKRV_SWAC - Lakes and rivers seasonal water area change (%) [6.6.1]

EN_LKRV_SWAN - Lakes and rivers seasonal water area (square kilometres) [6.6.1]

EN_LKRV_SWAP - Lakes and rivers seasonal water area (% of total land area) [6.6.1]

EN_LKW_QLTRB - Lake water quality turbidity (%) [6.6.1]

EN_LKW_QLTRST - Lake water quality trophic state (%) [6.6.1]

EN_RSRV_MNWAN - Reservoir minimum water area (square kilometres) [6.6.1]

EN_RSRV_MNWAP - Reservoir minimum water area (% of total land area) [6.6.1]

EN_RSRV_MXWAN - Reservoir maximum water area (square kilometres) [6.6.1]

EN_RSRV_MXWAP - Reservoir maximum water area (% of total land area) [6.6.1

EN_WBE_MANGC - Mangrove total area change (%) [6.6.1]

EN_WBE_MANGN - Mangrove area (square kilometres) [6.6.1]

EN_WBE_WTLN - Wetlands area (square kilometres) [6.6.1]

EN_WBE_WTLP - Wetlands area (% of total land area) [6.6.1]

EN_RSRV_MNWAC - Reservoir minimum water area change (%) [6.6.1]

0.e. Metadata update (META_LAST_UPDATE)

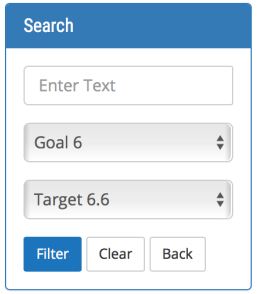
2024-07-29

0.f. Related indicators (SDG_RELATED_INDICATORS)

6.3.2, 6.4.1, 6.4.2, 6.5.1, 6.5.2, 15.3.1

0.g. International organisations(s) responsible for global monitoring (SDG_CUSTODIAN_AGENCIES)

United Nations Environment Programme (UNEP)



Goal 6. Ensure availability and sustainable management of water and sanitation for all

Target 6.6: By 2020, protect and restore water-related ecosystems, including mountains, forests, wetlands, rivers, aquifers and lakes

- **Indicator 6.6.1:** Change in the extent of water-related ecosystems over time
  See Metadata : (1)
  See Metadata : (2)

0.c. Indicator (SDG_INDICATOR)

Indicator 6.6.1: Change in the extent of water-related ecosystems over time

0.d. Series (SDG_SERIES_DESCR)

EN_WBE_HMWTL - Extent of human made wetlands (square kilometres) [6.6.1]

EN_WBE_INWTL - Extent of inland wetlands (square kilometres) [6.6.1]

0.e. Metadata update (META_LAST_UPDATE)

2024-07-29

0.f. Related indicators (SDG_RELATED_INDICATORS)

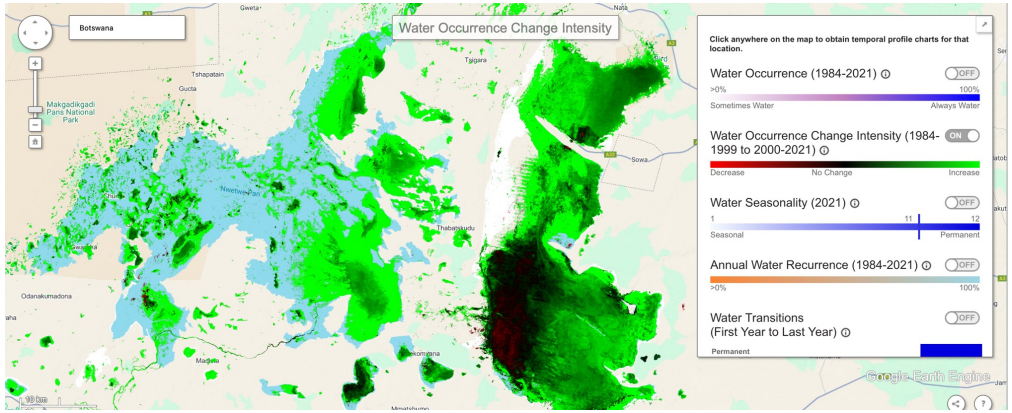
15.1

0.g. International organisations(s) responsible for global monitoring (SDG_CUSTODIAN_AGENCIES)

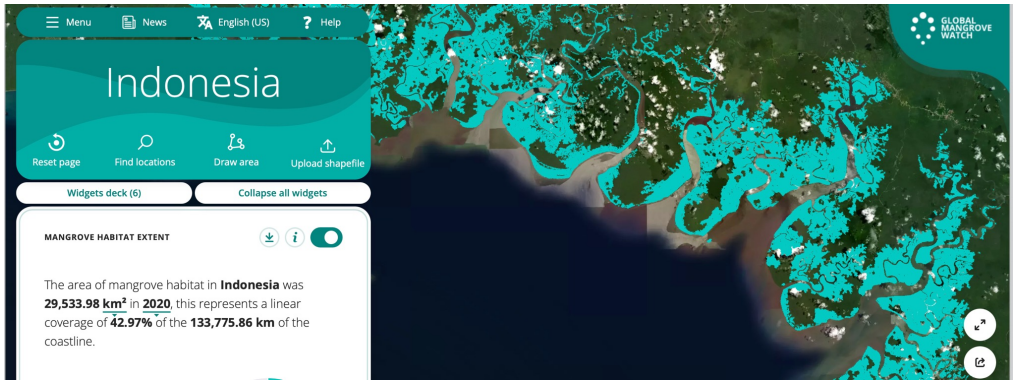
Secretariat of the Ramsar Convention on Wetlands

Global Data Sets for SDG 6.6.1

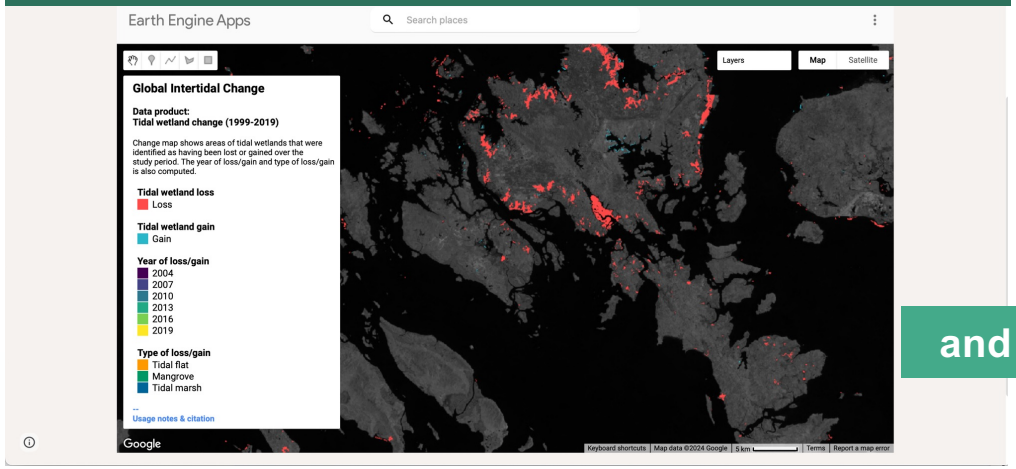
https://global-surface-water.appspot.com



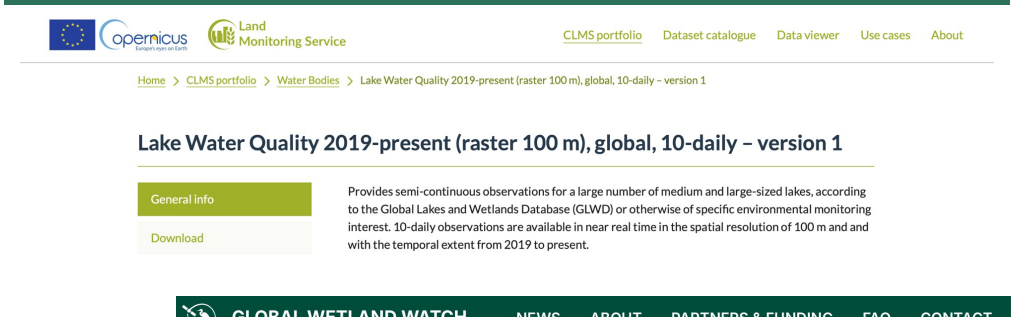
https://www.globalmangrovewatch.org



https://www.globalintertidalchange.org

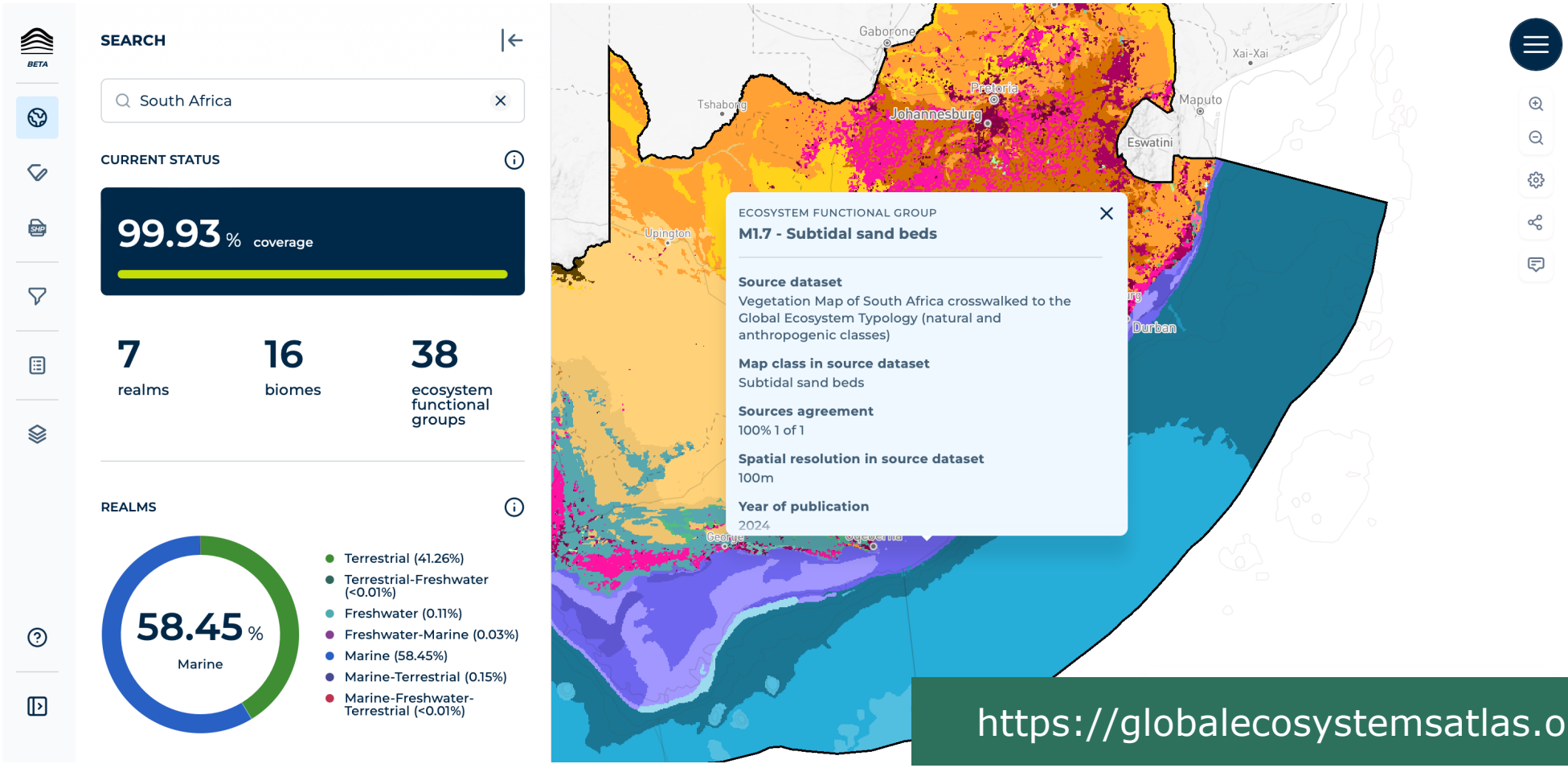


https://land.copernicus.eu/en/products/water-bodies/



and soon ....

Global Data Sets: *GEO Global Ecosystems Atlas*



https://globalecosystemsatlas.org

WorldWater: Advanced Surface Water Dynamics

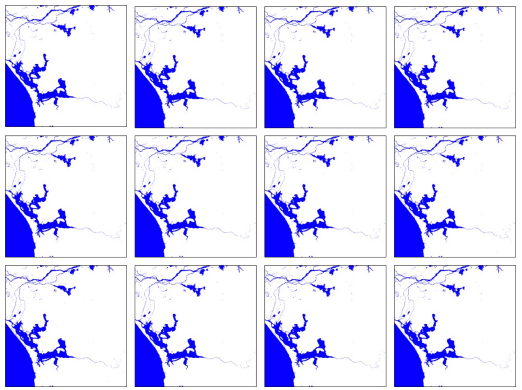
Empower national and regional stakeholders with EO data and tools
to better monitor their water resources and report on the global water agenda.

WorldWater

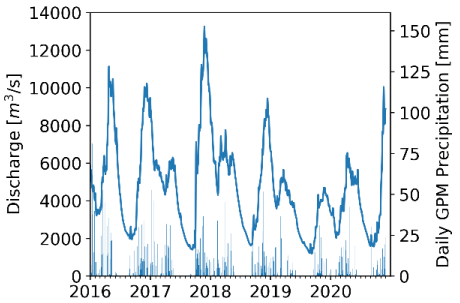
New advanced algorithms.
for the monitoring of the intra-annual and inter-annual variations of surface waters, in extent and volume.

In partnership with the UNEP freshwater team

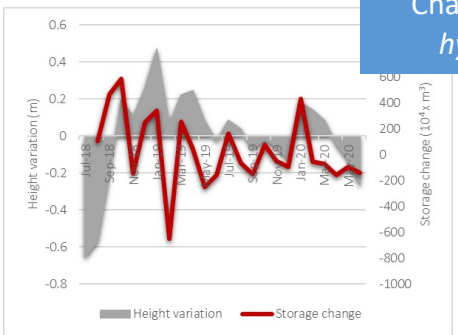
https://worldwater.earth



Changes in Surface Water Extent
Monthly water occurrences



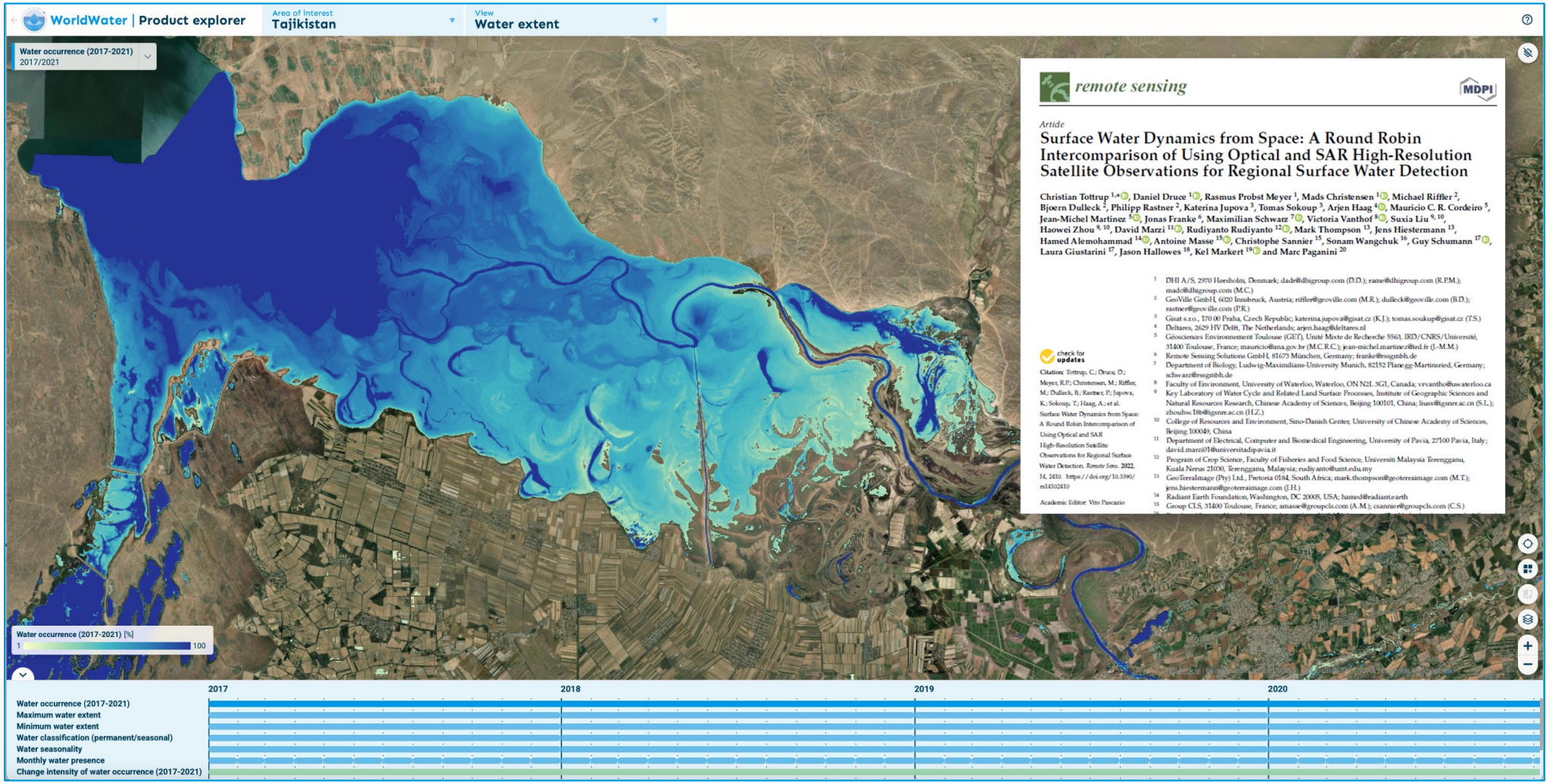
Changes in River Discharge
hydrological modelling



Changes in Lake Water Storage
surface water level variations

→ THE EUROPEAN SPACE AGENCY

Changes in surface water extent



remote sensing

MDPI

Article

Surface Water Dynamics from Space: A Round Robin Intercomparison of Using Optical and SAR High-Resolution Satellite Observations for Regional Surface Water Detection

Christian Tottrup [1,*], Daniel Druce [1], Rasmus Probst Meyer [1], Mads Christensen [1], Michael Riffler [2], Bjoern Dulleck [2], Philipp Rastner [2], Katerina Jupova [3], Tomas Sokoup [3], Arjen Haag [4], Mauricio C. R. Cordeiro [5], Jean-Michel Martinez [5], Jonas Franke [6], Maximilian Schwarz [7], Victoria Vanthof [8], Suxia Liu [9,10], Haowei Zhou [9,10], David Marzi [11], Rudiyanto Rudiyanto [12], Mark Thompson [13], Jens Hiestermann [13], Hamed Alemohammad [14], Antoine Masse [15], Christophe Sannier [15], Sonam Wangchuk [16], Guy Schumann [17], Laura Giustarini [17], Jason Hallowes [18], Kel Markert [19] and Marc Paganini [20]

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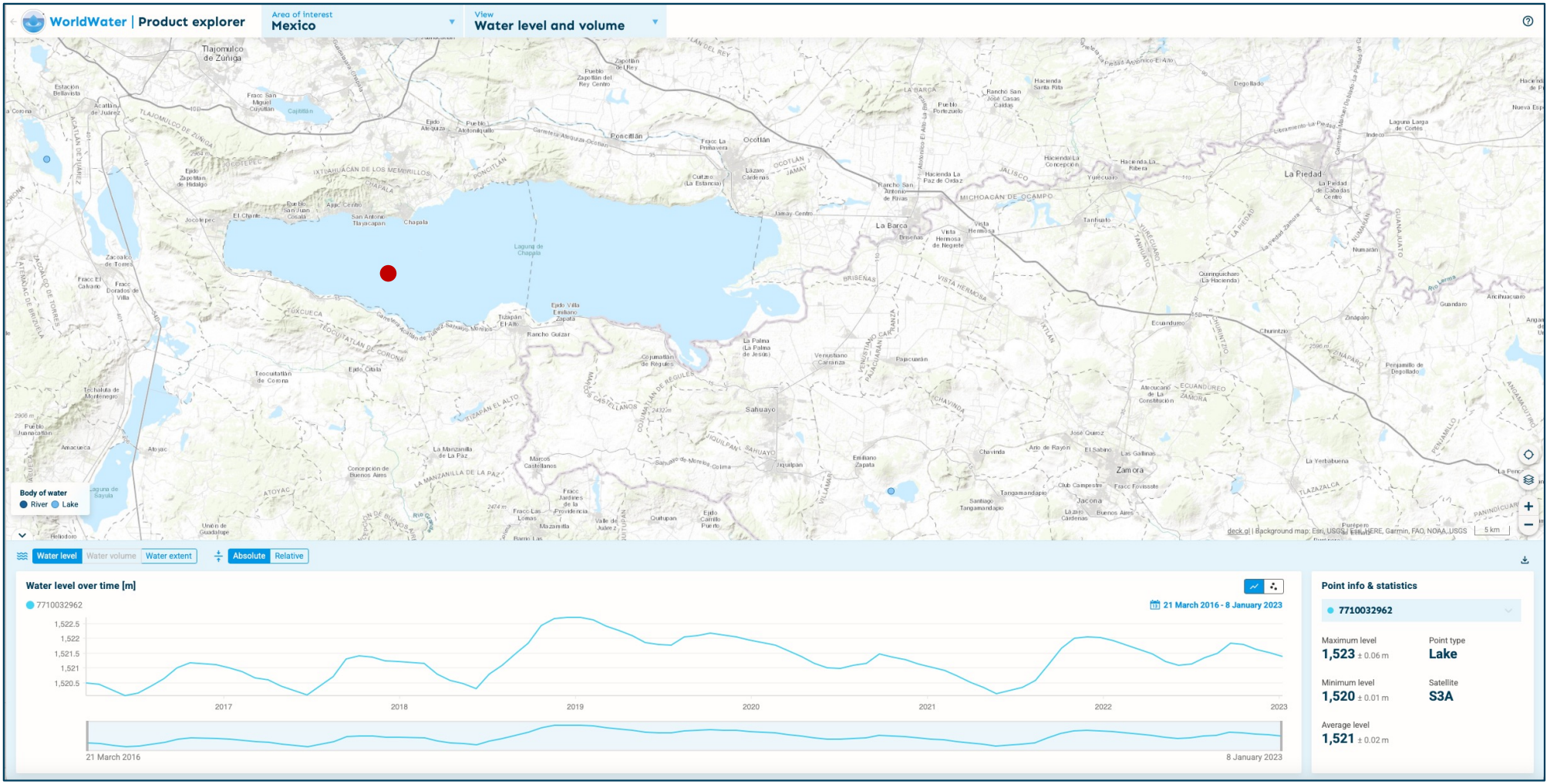
14 Radiant Earth Foundation, Washington, DC 20005, USA; hamed@radiant.earth
15 Group CLS, 31400 Toulouse, France; amasse@groupcls.com (A.M.); csannier@groupcls.com (C.S.)

check for updates

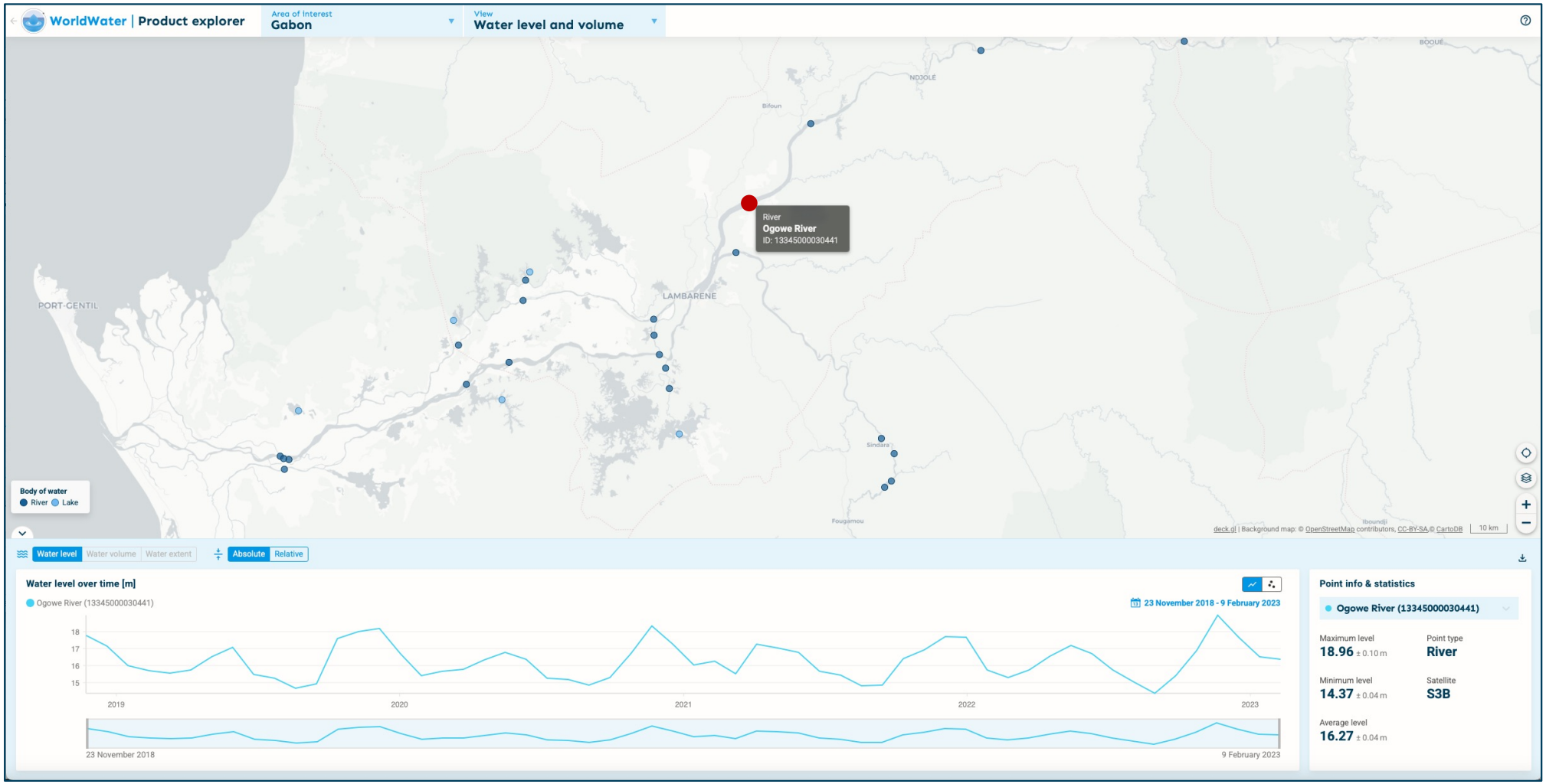
Citation: Tottrup, C.; Druce, D.; Meyer, R.P.; Christensen, M.; Riffler, M.; Dulleck, B.; Rastner, P.; Jupova, K.; Sokoup, T.; Haag, A.; et al. Surface Water Dynamics from Space: A Round Robin Intercomparison of Using Optical and SAR High-Resolution Satellite Observations for Regional Surface Water Detection. *Remote Sens.* 2022, *14*, 2410. https://doi.org/10.3390/rs14102410

Academic Editor: Vito Pascazio

Changes in lake water storage



Changes in river discharge



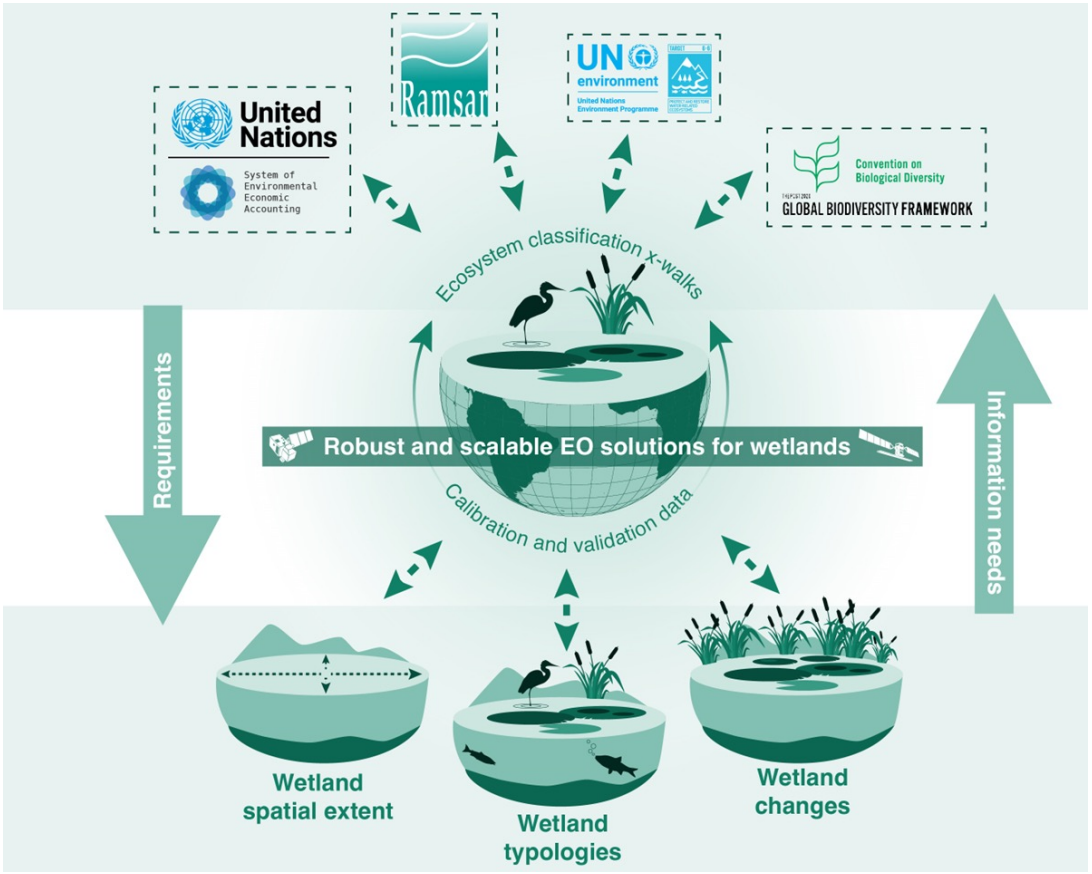
EO for Wetland Inventory (EO4WI)

EO4WI
WETLAND INVENTORIES

https://www.eo4wi.earth

Develop scalable EO solutions to automatically identify, delineate, classify the spatial extent of wetlands ecosystems (i.e., wetland spatial extent disaggregated by wetland types), and their changes, and derive indicators on wetland extent and changes, at different spatial aggregation levels (e.g., by administrative units and river basins).

Free and open source tools will be made available on the ESA OpenEO platform

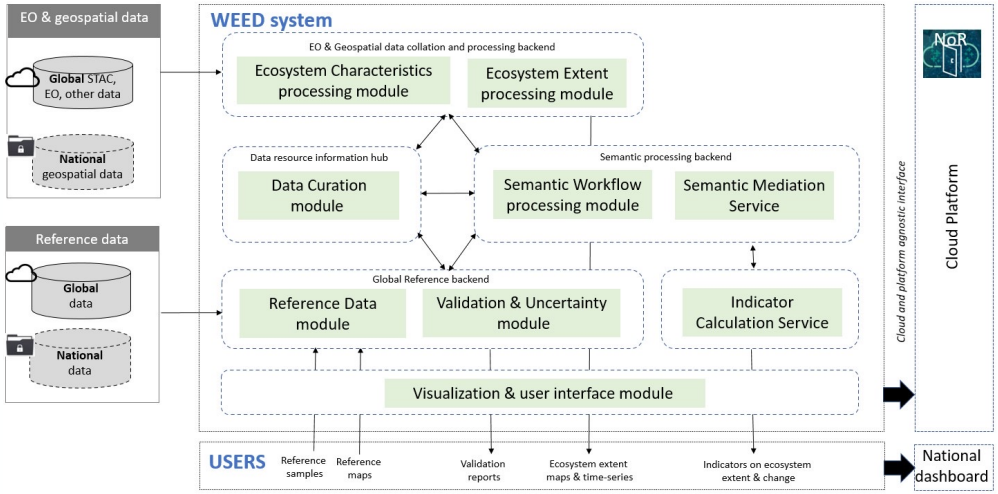


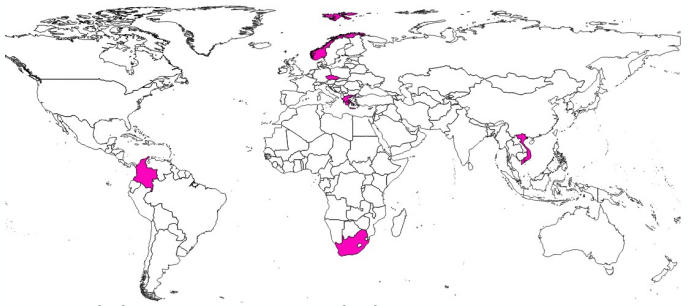
World Ecosystem Extent Dynamics (WEED)

Objectives:

- **Develop** a globally applicable EO-integrated solution, for a comprehensive mapping of the extent and distribution of terrestrial, freshwater and coastal ecosystems, according to different ecosystem typologies, and for monitoring the temporal variations in the extent and distribution of ecosystem types.

https://esa-worldecosystems.org/



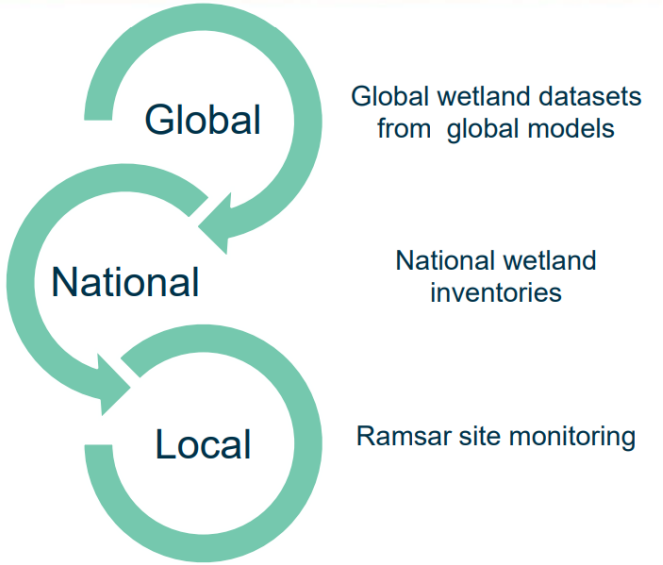


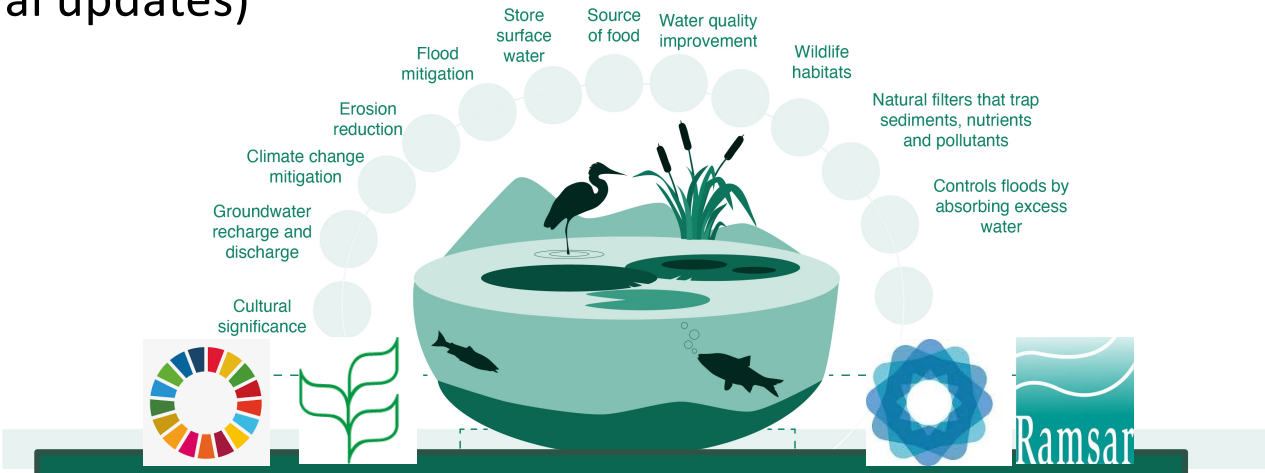
10 national demonsrations including GR, NO, CZ, ZA, CO, VN
1 continental demonstration (Europe)

Kick-off:	**September 2024**
Duration:	**24 months**
Budget:	**1,800 k€**

Monitoring the extent of Wetland Ecosystems, a 3-tier approach

- Monitor and map ‘all’ water-related ecosystems at scale in 10m spatial resolution (with annual updates)
- Contribute to global agendas and frameworks





A global wetland inventory serves as a vital tool for monitoring and reporting requirements outlined in numerous global agendas.

We need a system capable of informing subnational policies while maintaining compatibility at a global scale

Take home messages

- The uptake of Earth Observation in the monitoring of water-related ecosystems can benefit from the availability of a **steadily increasing flow of satellite data of suitable characteristics** and from the **emergence of affordable digital solutions** to address the size and complexity of satellite observations.
- Despite the growing awareness among countries that traditional monitoring must be complemented with satellite observations to meet the ambition of the SDGs, **the uptake of Earth Observation is still slow and unevenly adopted by countries.**
- **A number of challenges still need to be adequately tackled for countries to fully embrace EO technologies in their national monitoring and reporting processes on SDG 6.6.**
- There is a need for a **stronger collaboration between countries and EO experts, to enable the potential of Earth Observation to be fully realised to monitor progress on SDG 6.6 Target and report on the SDG 6.6.1 indicator.**