

Harnessing Earth Observation Technology for Climate Adaptation

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Collecting rich data on the world's problems is the first step toward fixing them.

Seth Stephens-Davidowitz, former Google Data Scientist

Our house
is burning...

It is
flooding...

It is being
destroyed...

And it is being
polluted.



Satellite EO technology is the only tool able to support actions in all areas and at all scales!



Increase understanding



Accelerating detection & ensuring long-term monitoring



Support in project implementation & constant evaluation

The European Space Agency & how EO data Empowers Climate Adaptation

EARTH OBSERVATION (EO)

Understanding Earth, improving lives, and fostering sustainability through space technology

We are ESA, committed to the peaceful exploration and use of space for the benefit of people, society and our planet.

Since 1975, we have been at the forefront of advancing European scientific and industrial interests in space.



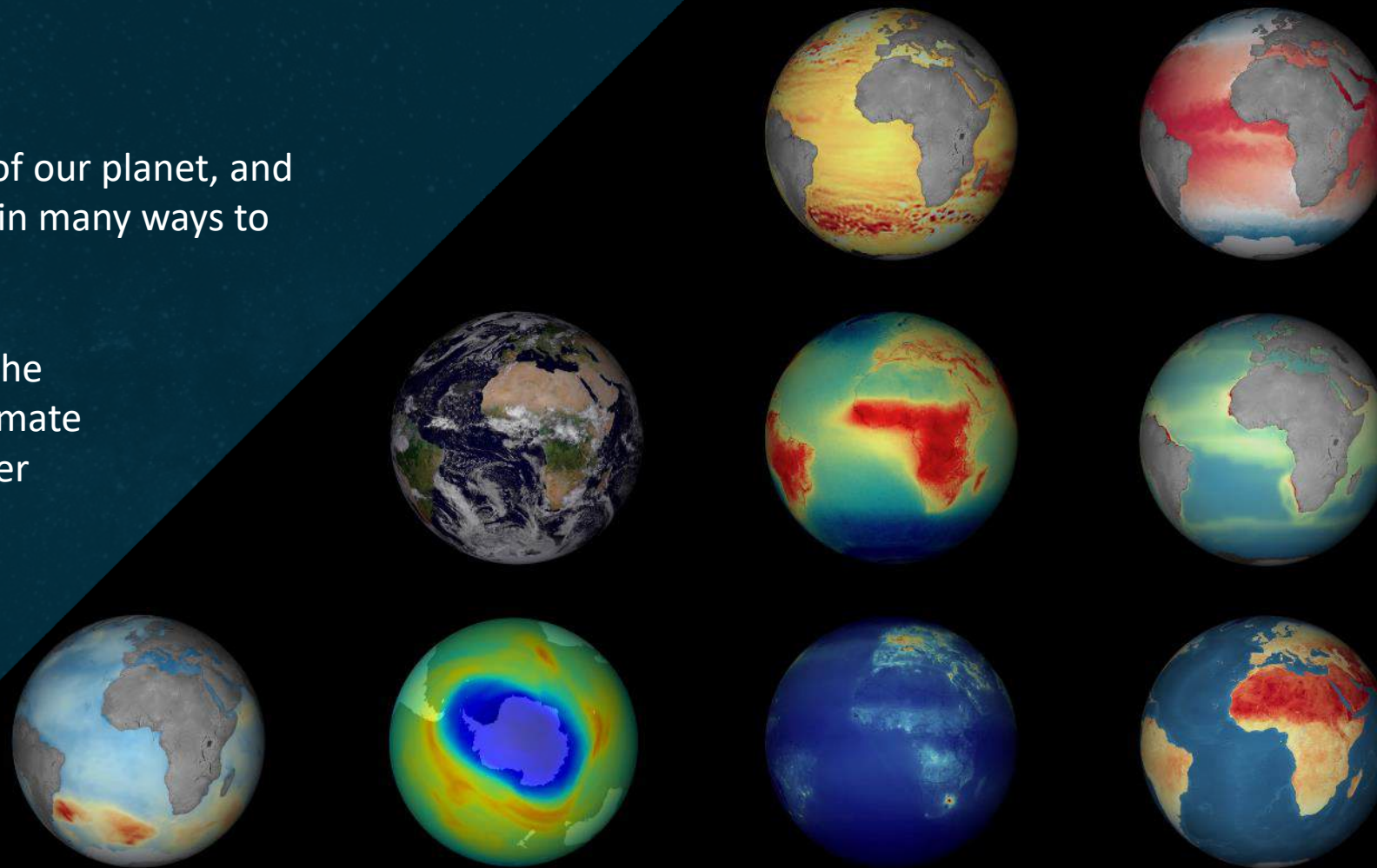
22* Member States

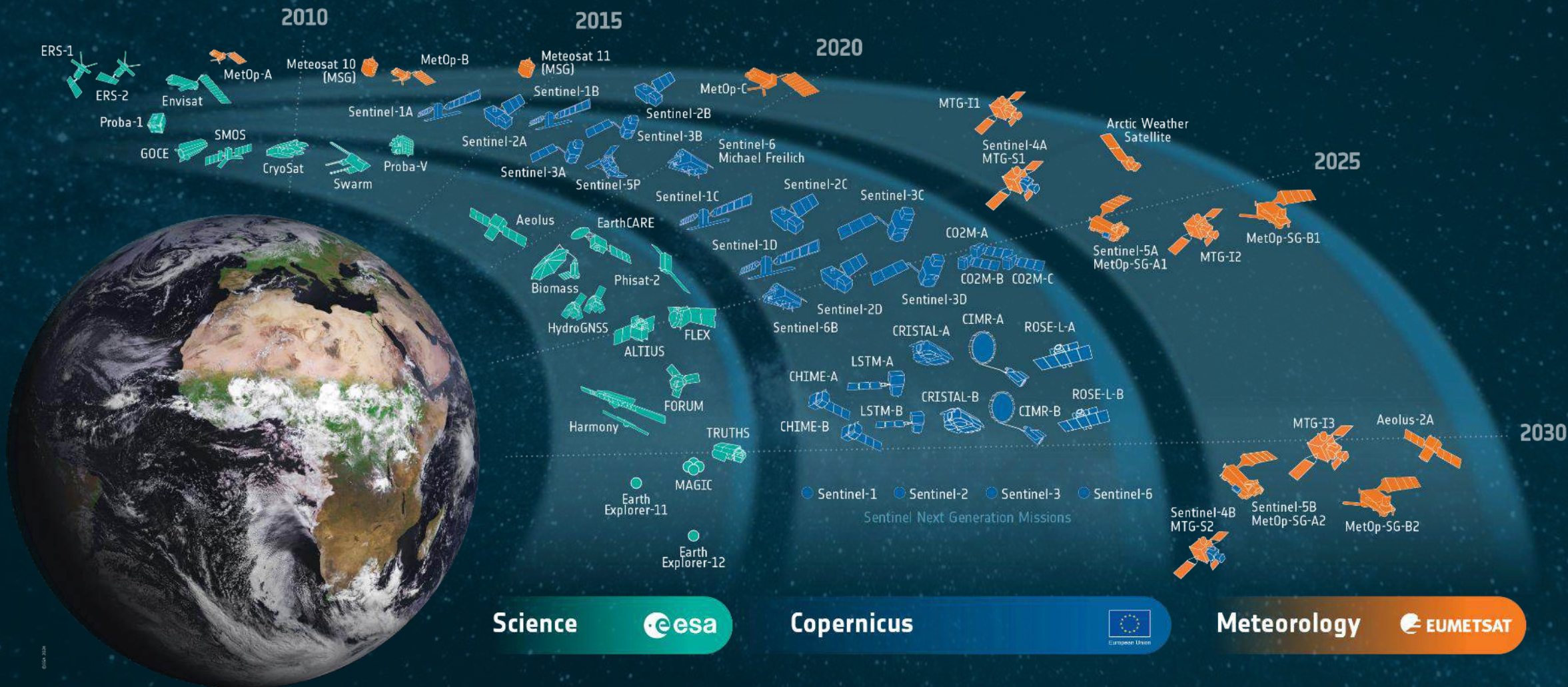
1 Long-standing Cooperating State

4 Associate Members

Satellites offer an unparalleled view of our planet, and enable us to observe and contribute in many ways to sustainable life on Earth including to:

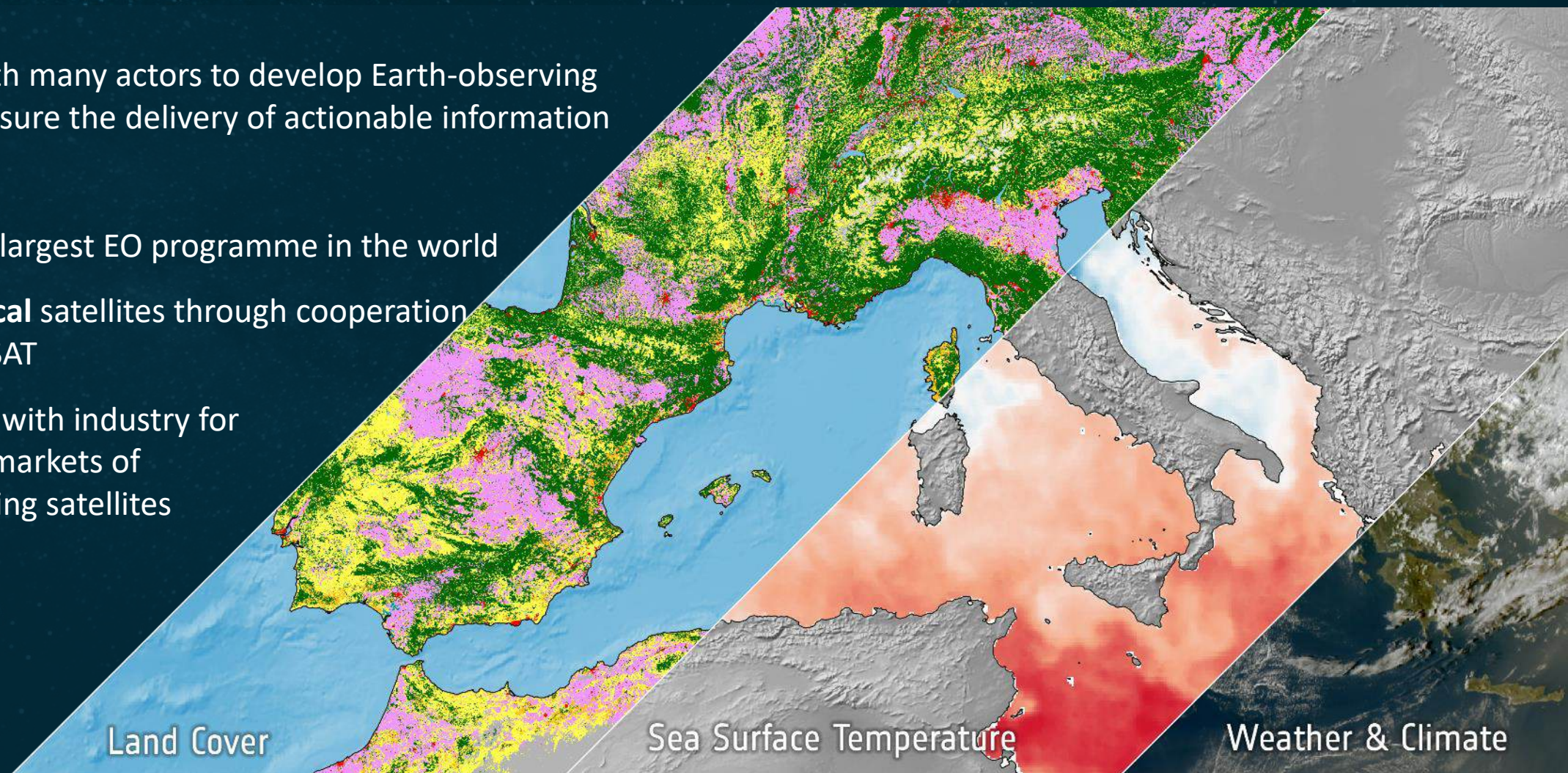
- ◆ Provide essential information on the environment and our changing climate
- ◆ Help plan rescue and aid work after disaster
- ◆ Forecast weather patterns
- ◆ Answer important questions on Earth's systems





ESA partners with many actors to develop Earth-observing satellites and ensure the delivery of actionable information from the data.

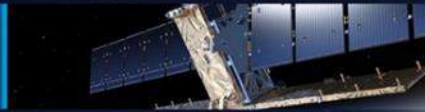
- ◆ **Copernicus** - largest EO programme in the world
- ◆ **Meteorological** satellites through cooperation with EUMETSAT
- ◆ **Partnerships** with industry for **commercial** markets of Earth-observing satellites



Rich data of Copernicus at the fingertips of everyone

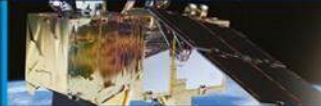


PROGRAMME OF THE
EUROPEAN UNION



sentinel-1

→ **RADAR VISION**



sentinel-2

→ **COLOUR VISION**



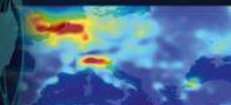
sentinel-3

→ **A BIGGER PICTURE**



sentinel-4

→ **EUROPEAN AIR MONITORING**



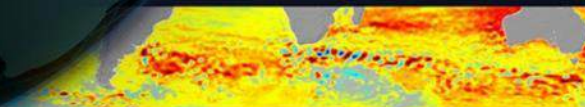
sentinel-5p | sentinel-5

→ **GLOBAL AIR MONITORING**



sentinel-6

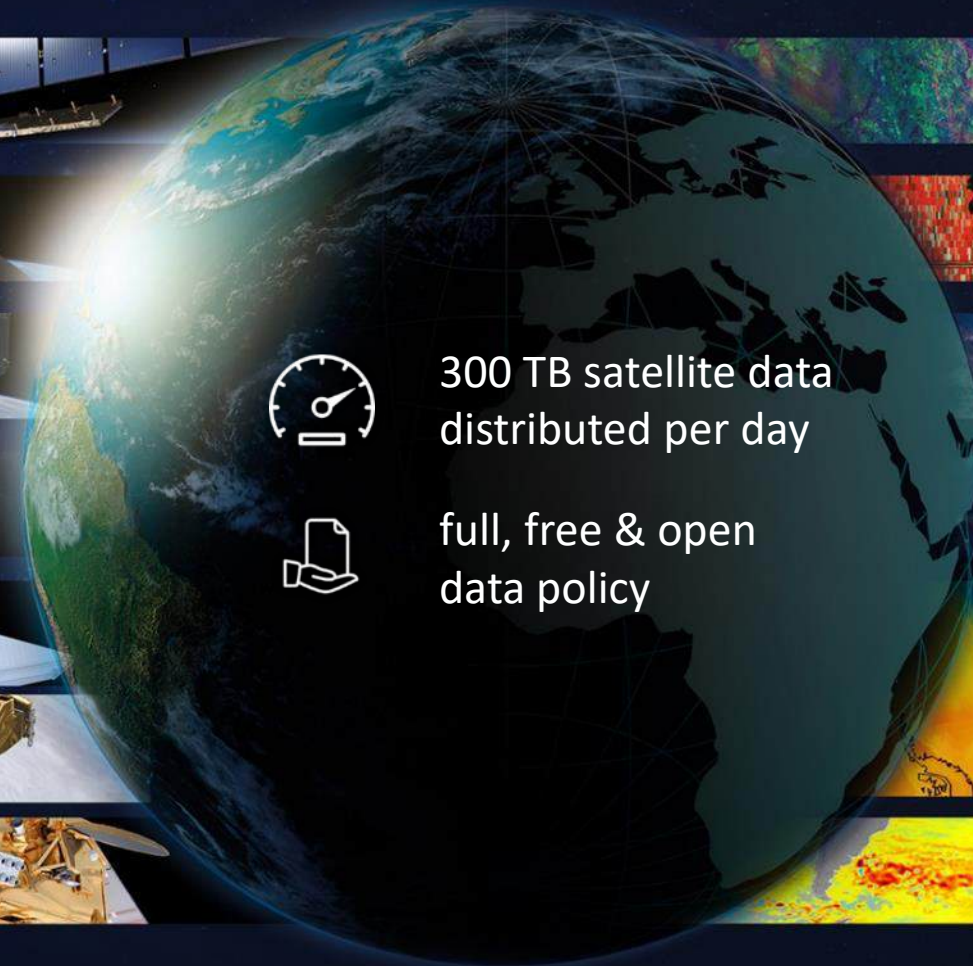
→ **SURFING THE SEAS**



300 TB satellite data
distributed per day

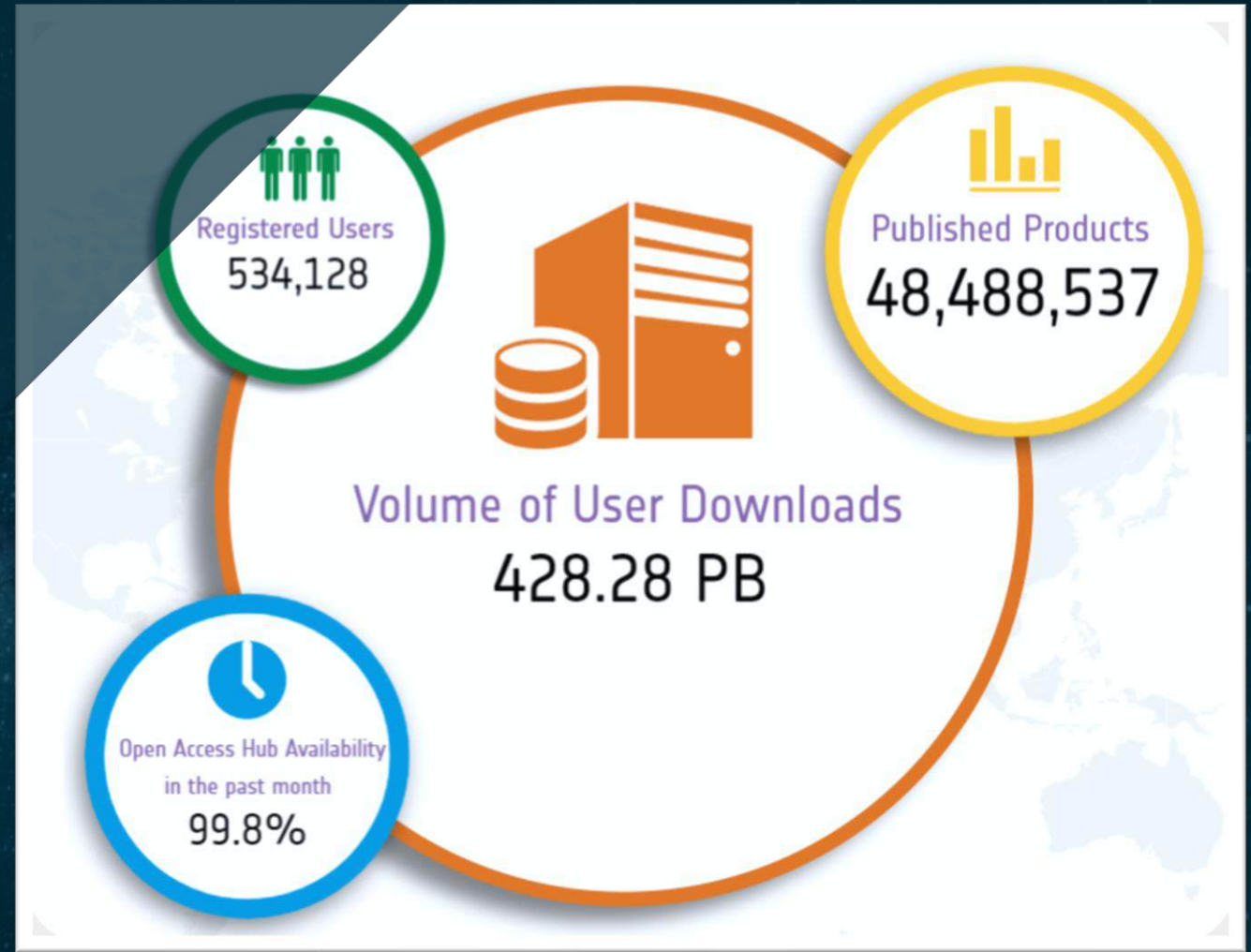


full, free & open
data policy



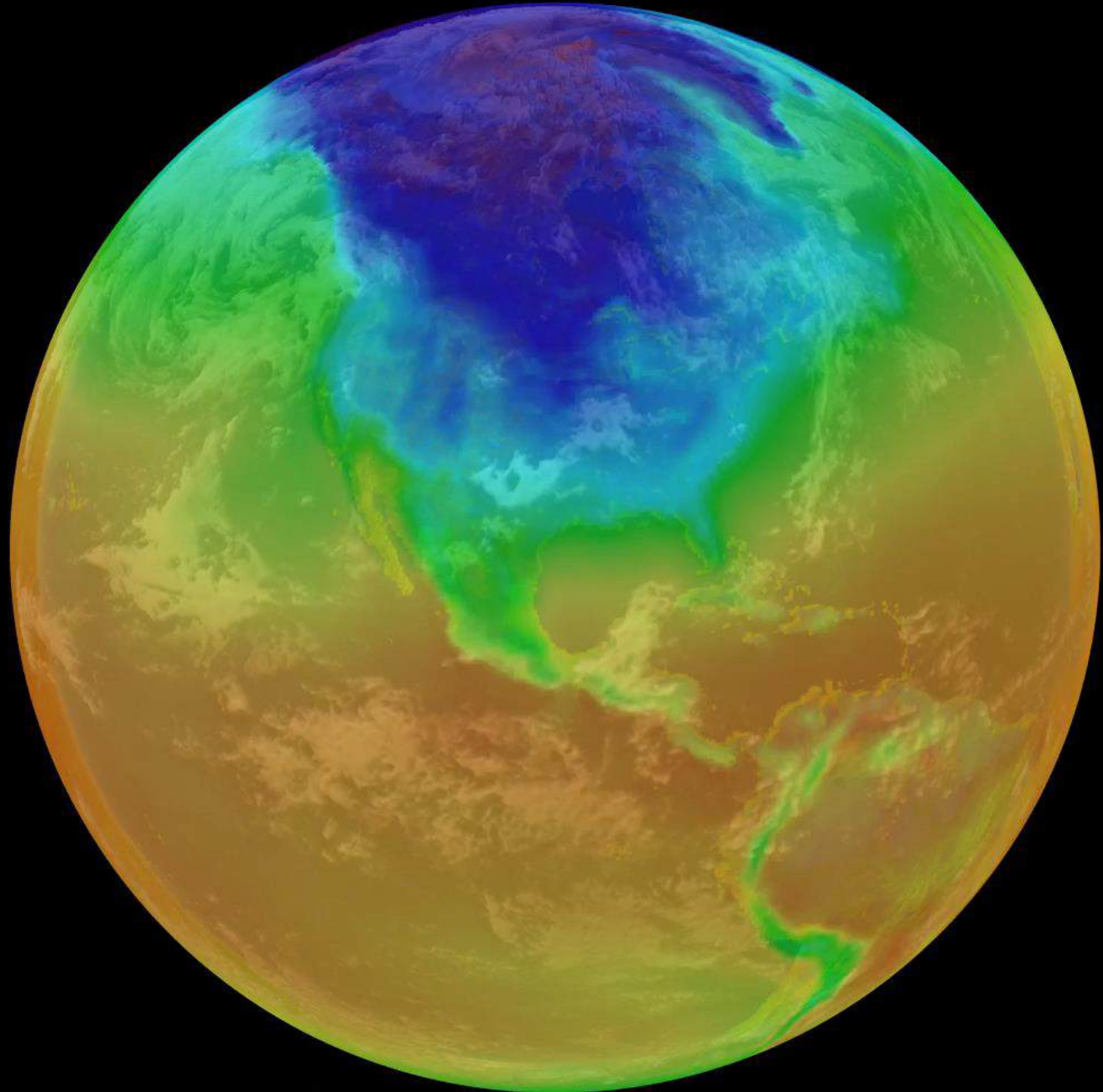
Access to Sentinel data through:

- ◆ EU/ESA Copernicus Space Data Ecosystem (CDSE) Portal: <https://dataspace.copernicus.eu>
- ◆ The WEKEO Portal: <https://www.wekeo.eu>
- ◆ 6 Copernicus services ([Atmosphere](#), [Marine](#), [Land](#), [Climate](#),...)
- ◆ Copernicus Emergency Service Portals
- ◆ 18 ESA Member State hubs
- ◆ [NASA](#), NOAA, USGS, Geoscience Australia
- ◆ Other commercial hubs





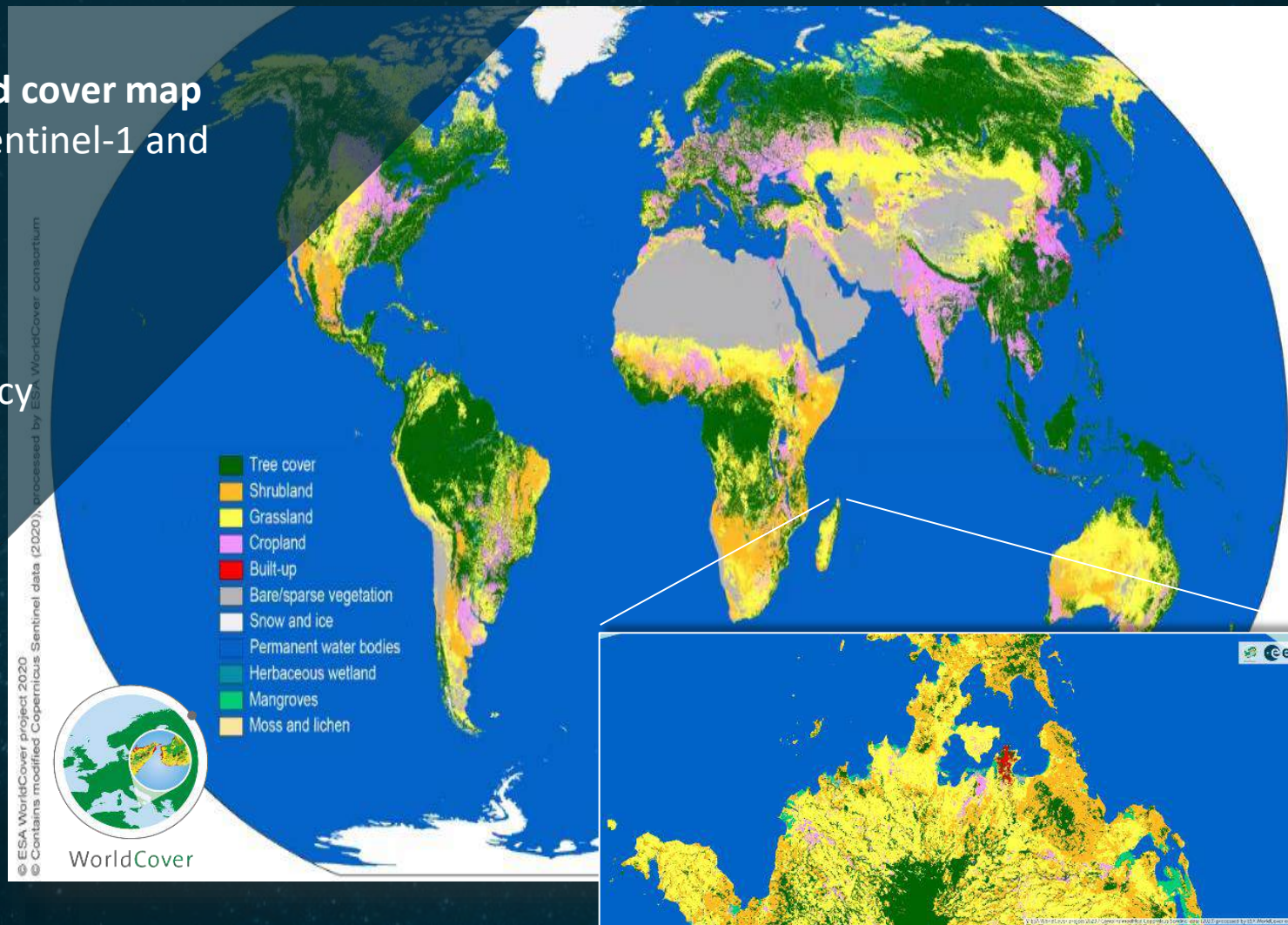
0 days 00 hours 00 minutes
Sentinel-2 constellation:
summer solstice





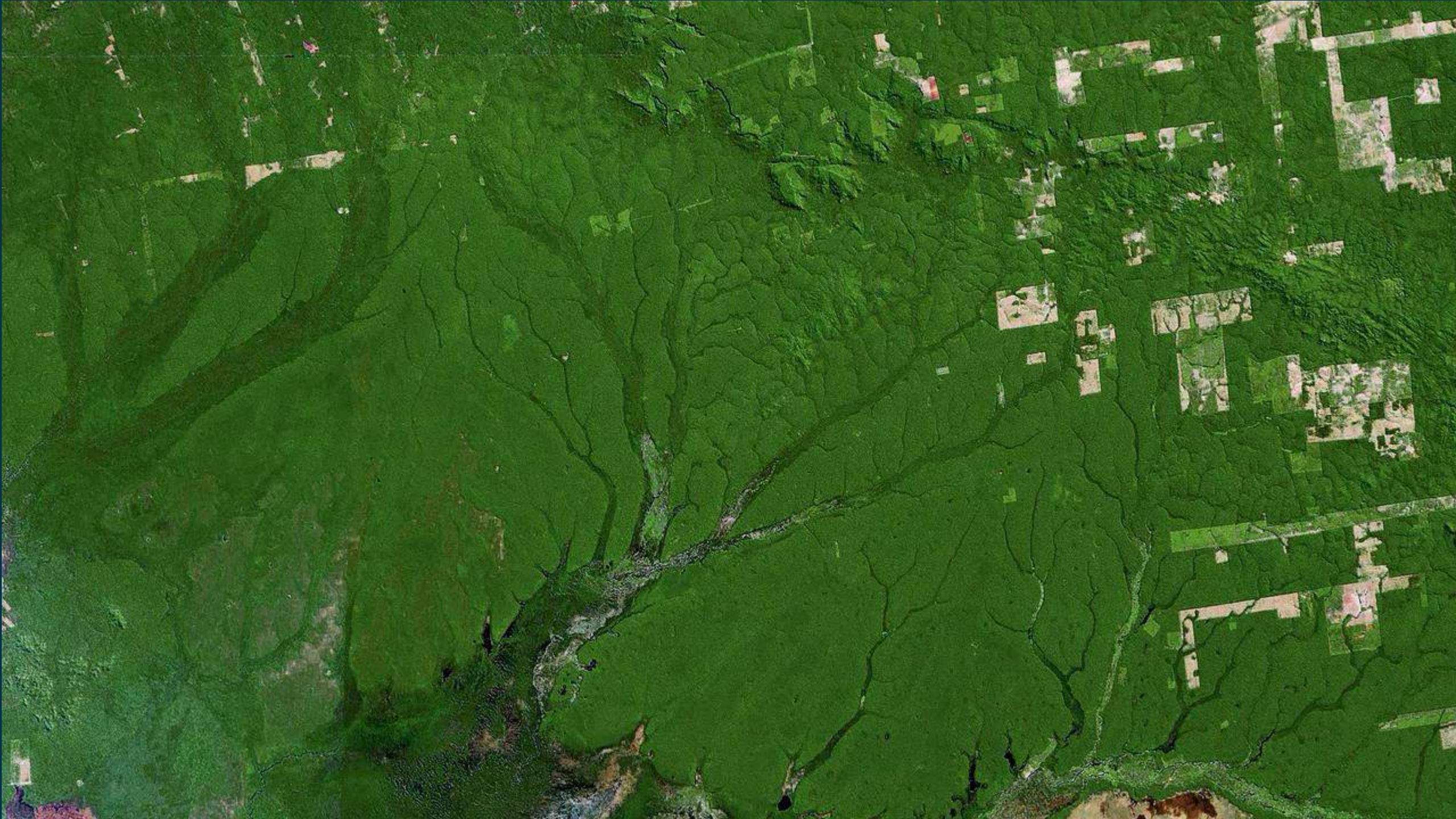
World Cover is a **freely accessible global land cover map** at 10m resolution for year 2020, based on Sentinel-1 and Sentinel-2 data

- ◆ Released on 20 Oct 2021
- ◆ 11 land cover classes $\approx 74\%$ overall accuracy
- ◆ Independent data validation, highly robust for phenology
- ◆ <https://esa-worldcover.org/>



February





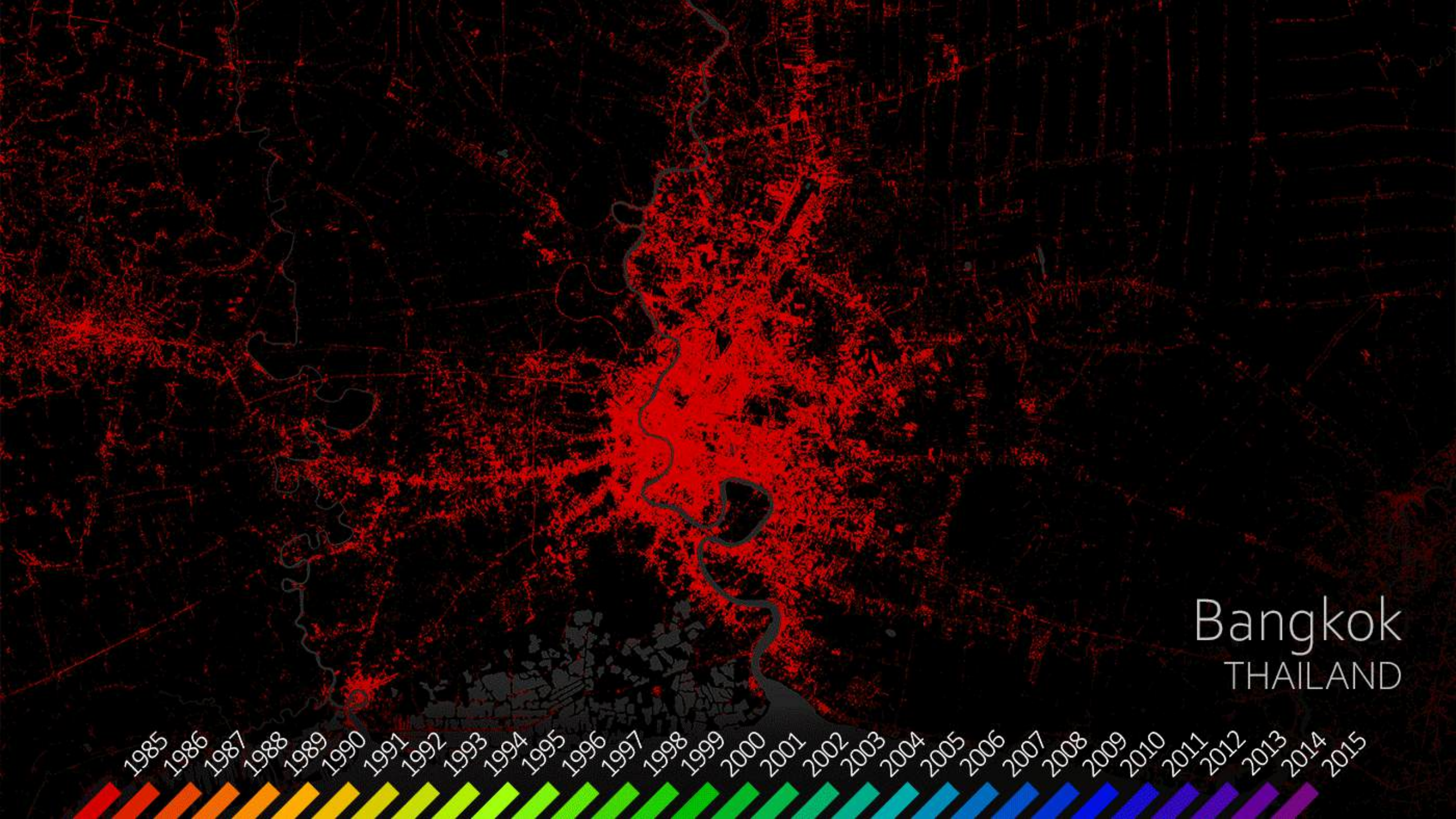


1984

Earth
Time

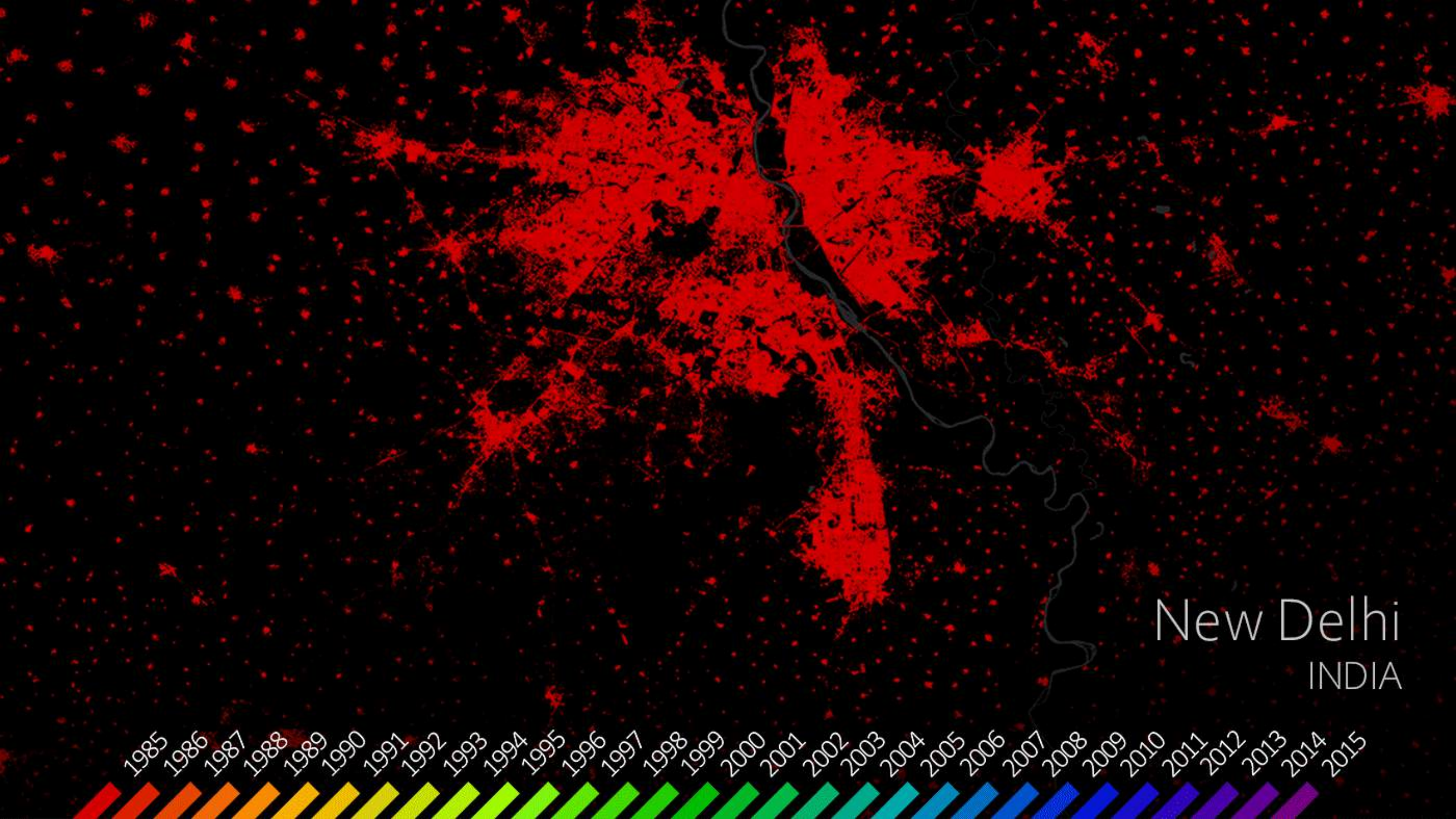


2018



Bangkok
THAILAND

1985 1986 1987 1988 1989 1990 1991 1992 1993 1994 1995 1996 1997 1998 1999 2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014 2015



New Delhi
INDIA

1985 1986 1987 1988 1989 1990 1991 1992 1993 1994 1995 1996 1997 1998 1999 2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014 2015



August 2019



August 2019

Boulogne forest

Paris

Eiffel Tower



Paris Expo

Land surface temperature
18 June 2022



00 m



LOCAL PARTICIPATION

- ◆ context
- ◆ calibration
- ◆ training



ARTIFICIAL INTELLIGENCE

- ◆ customization
- ◆ cost reduction
- ◆ analysis potential



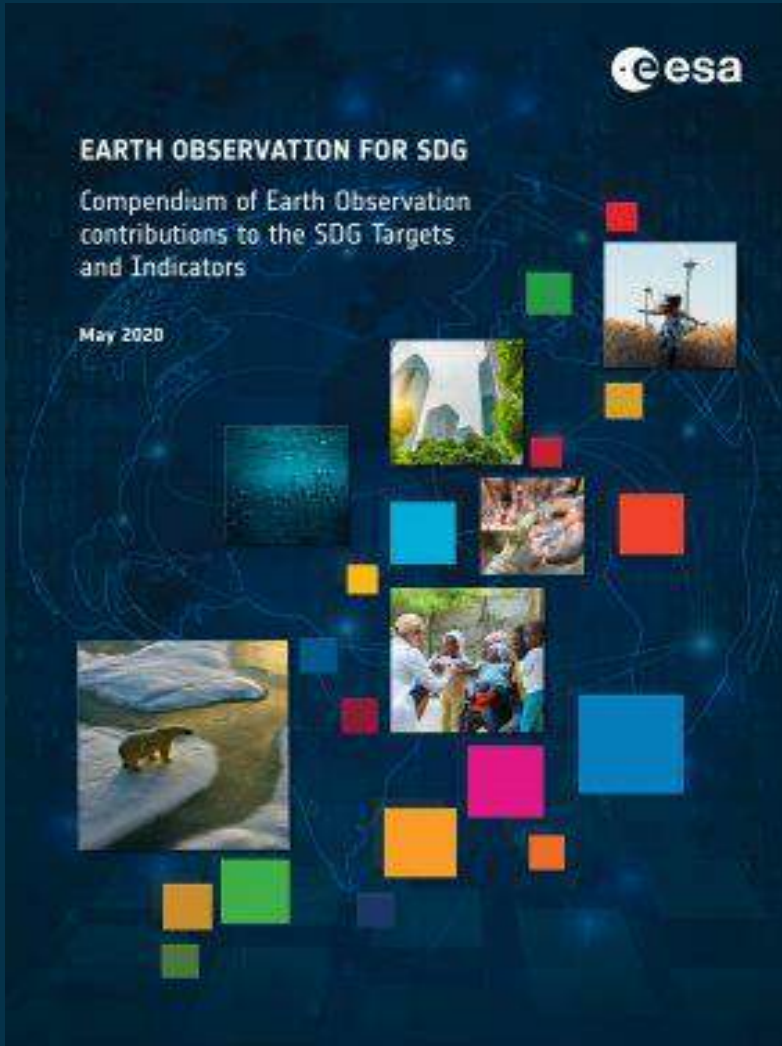
EARTH OBSERVATION

- ◆ independence
- ◆ trust
- ◆ cost effective at scale

ESA delivers actionable climate and environmental information, as well as green solutions for addressing the unique challenges faced within your projects.

- ◆ Support climate adaptation policies and projects from local to international level
- ◆ Build strategic partnerships
- ◆ Assess and understand impact of interventions
- ◆ Co-creating solutions to enhance the access to funding





SDGs with major opportunities for EO data



EO potential contribution to SDG Targets and Indicators

Target										Goal	Indicator					
								1.4	1.5	1	1.4.2					
								2.3	2.4	2.c	2.4.1					
								3.3	3.4	3.9	3.d	3.9.1				
										5.a	5.a.1					
	6.1	6.3	6.4	6.5	6.6	6.a	6.b	6	6.3.1	6.3.2	6.4.2	6.5.1	6.6.1			
								7.2	7.3	7.a	7.b	7.1.1				
										8.4						
								9.1	9.4	9.5	9.a	9.1.1	9.4.1			
								10.6	10.7	10.a						
11.1	11.3	11.4	11.5	11.6	11.7	11.b	11.c	11	11.1.1	11.2.1	11.3.1	11.6.2	11.7.1			
								12.2	12.4	12.8	12.a	12.b	12.a.1			
								13.1	13.2	13.3	13.b	13.1.1				
	14.1	14.2	14.3	14.4	14.6	14.7	14.a	14	14.3.1	14.4.1	14.5.1					
15.1	15.2	15.3	15.4	15.5	15.7	15.8	15.9	15	15.1.1	15.2.1	15.3.1	15.4.1	15.4.2			
								16.8								
17.2	17.3	17.6	17.7	17.8	17.9	17.16	17.17	17.18	17	17.6.1	17.18.1					

Questions?

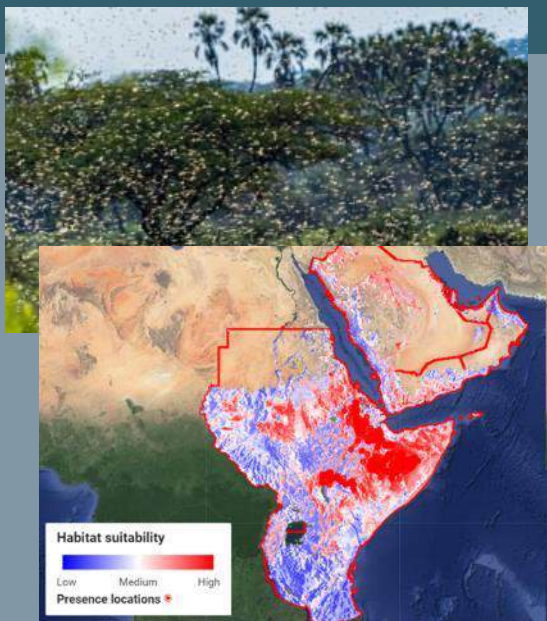
Understanding Earth, improving lives, and fostering sustainability through space technology

ESA Case Studies of Current Engagements

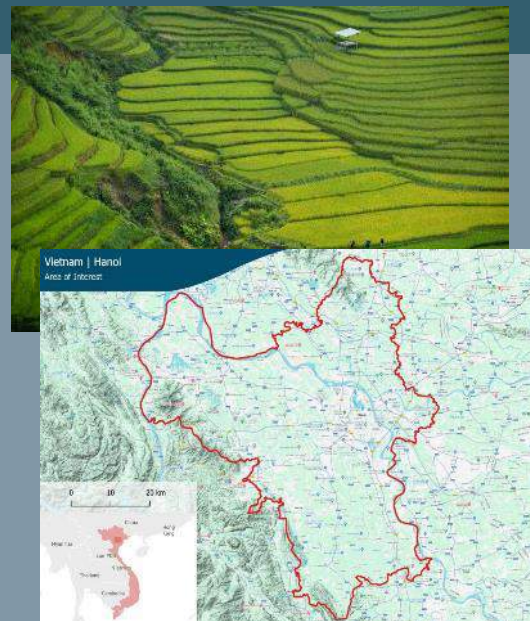
REAL-WORLD IMPACT

Understanding Earth, improving lives, and fostering sustainability through space technology

Examples of projects that received support from ESA



Desert locust impact and drought monitoring in the Horn of Africa



Enhanced land cover and land classification using AI in Vietnam



Nature-Based Solutions (NBS) Opportunity Scan for impactful NBS integration



Flood risk analytics to support resilience in South Sudan

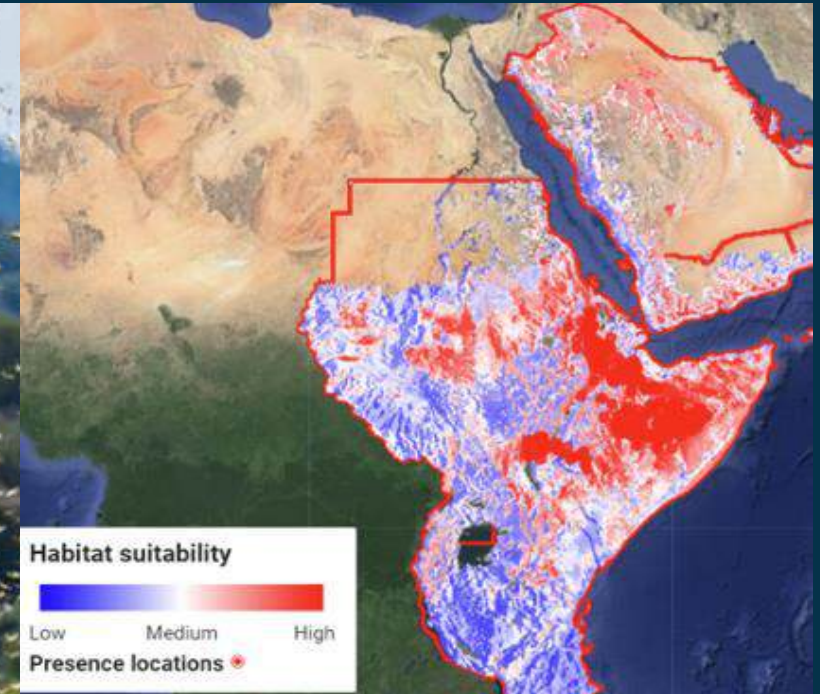
Our external partner company for this case study is with us today!

ESA developed a Desert Locust monitoring service in collaboration with the **World Bank and the East African Intergovernmental Authority for Development (IGAD)** to support early warning actions, by tracking egg breeding as well as impact assessment of damaged crop areas.

- ◆ A co-designed approach with the IGAD, a Regional Economic Community of the African Union, and the World Bank

“The desert locust mapping services are bringing in knowledge from research and data integration capabilities to service IGAD’s co-chaired food security network who are not only interested in early warning and early action, but also on level of damage and food security impacts the transboundary pest cause.”

- Project Lead and Early Warning Expert at IGAD



ESA works together with the **Asian Development Bank (ADB)** to assess the impacts of air-pollution forecasts on people's movement patterns and exposure to non-communicable disease risk factors of greater Hanoi.

- ◆ Conducting a Randomized Control Trial (RCT) that applies AI for more efficient and greater statistical power (employing an adapted U-Net model = Convolutional Neural Network)
- ◆ Enhanced land cover and land use classification algorithm to be applied to super-resolved images
- ◆ Analysing the RCT tracking data



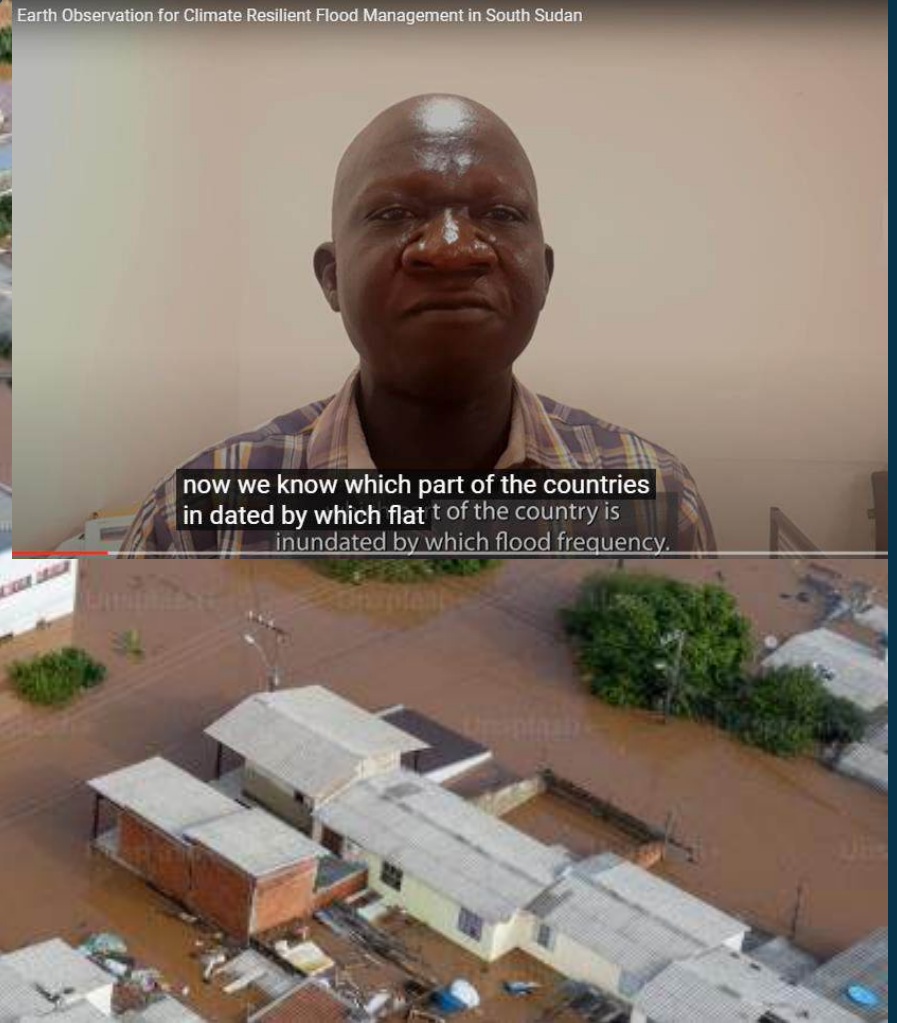
ESA works together with the World Bank and their teams on the Nature-Based Solutions (NBS) Opportunity Scan to assess most impactful NBS integration.

- ◆ Supporting over 70 cities worldwide
- ◆ Informing 2.5 billion USD of investment
- ◆ Fully open source



Our external partner company GMV from Spain for this case study is with us today & will now give you more detailed insights into how ESA and their team is working together with the World Bank on this impactful case in South Sudan!

Earth Observation for Climate Resilient Flood Management in South Sudan



now we know which part of the countries
is dated by which flat t of the country is
inundated by which flood frequency.

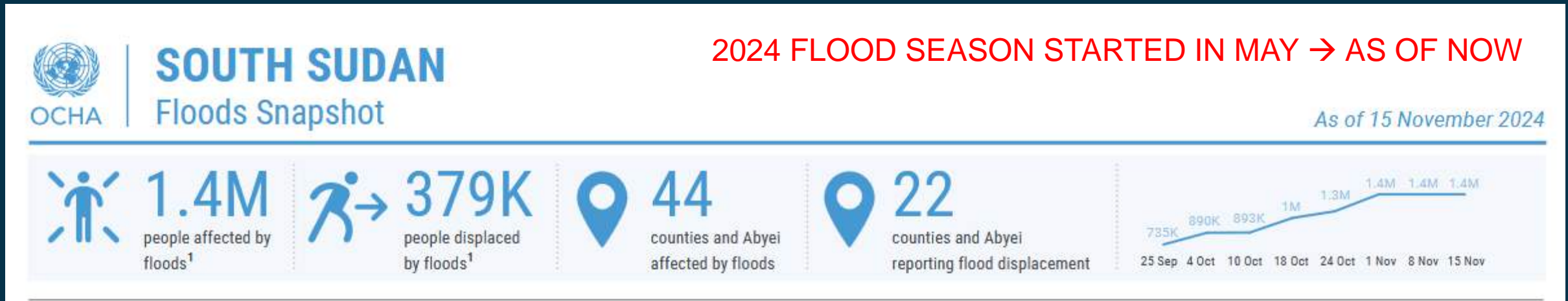
Case study in South Sudan

FLOOD RISK ANALYTICS FOR RESILIENCE

Presented by Carlos Domenech, Section
Head for Climate Services, GMV

Understanding Earth, improving
lives, and fostering sustainability
through space technology

Experienced **5 consecutive years** of **devastating floods**, affecting **over 1 mill. people each year**, and since last year receiving more **refugees and returnees from Sudan**.



In Renk and Malakal counties, humanitarian partners have reported **a substantial rise in cholera cases** due to inflows from Sudan, limited access to clean water and sanitation and ongoing flooding.

Gaps in flood preparedness efforts, posing challenges in **effectively responding to ongoing emergencies** and preparedness measures.

CASE STUDY OBJECTIVES

Assessment of the extent and occurrence of the flooding in recent years (2015 – 2022)

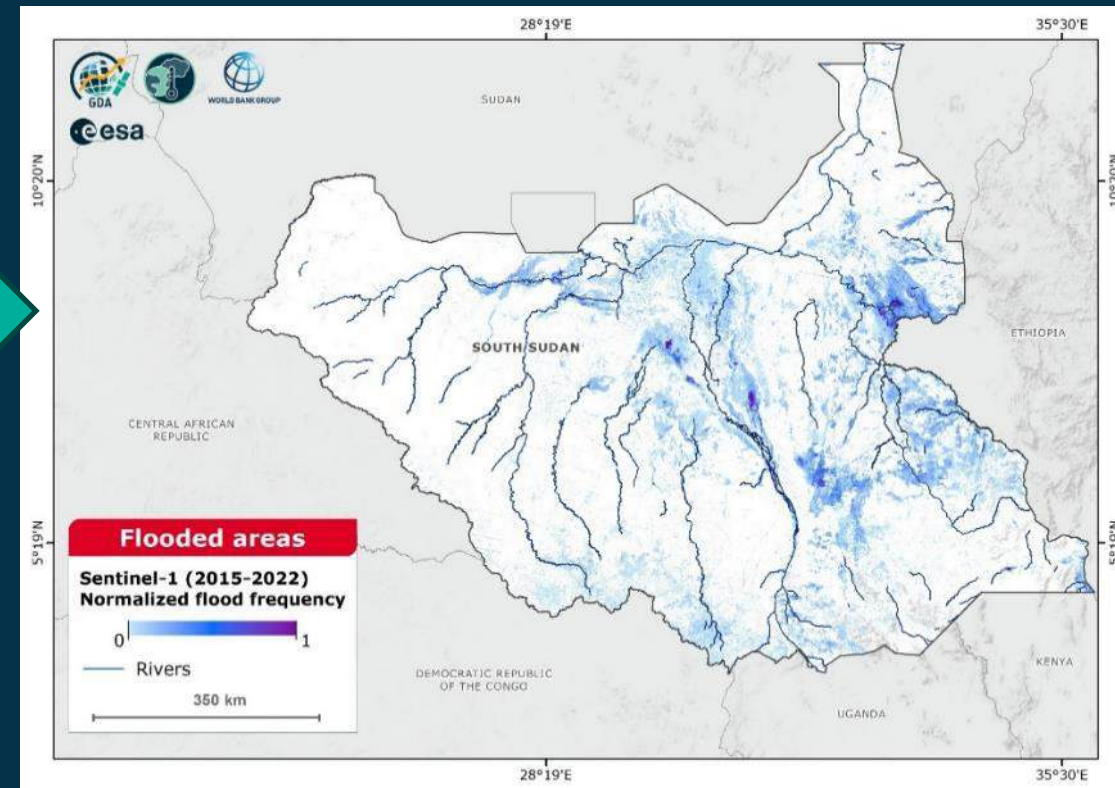
In South Sudan using remote sensing data to support and inform the design and targeting of a US\$ 225 million **World Bank project** (Climate Resilient Flood Management Project (P179169))

Aug
2022

Feb
2024

ESA GDA CLIMATE RESILIENCE project
South Sudan case study

1. EO-based Flood Hazard Maps (Frequency, persistence, seasonal patterns & multi-sensor)
2. Flood Exposure Assessment



COLLABORATION



Creativity



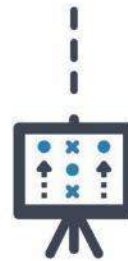
Teamwork



Partnership



Development



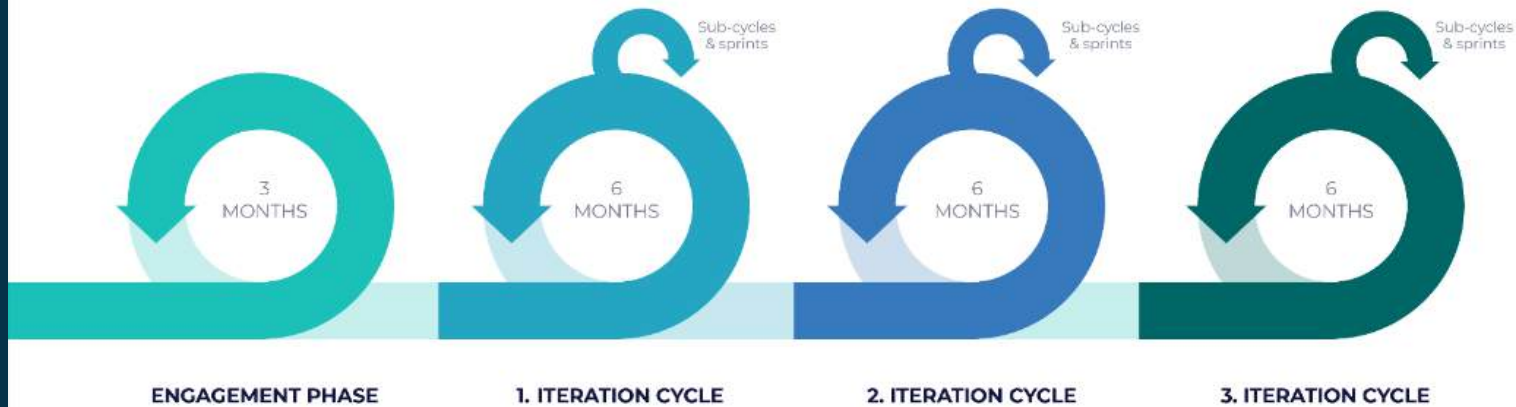
Solution



Communication

Engagement Phase & Development Cycles

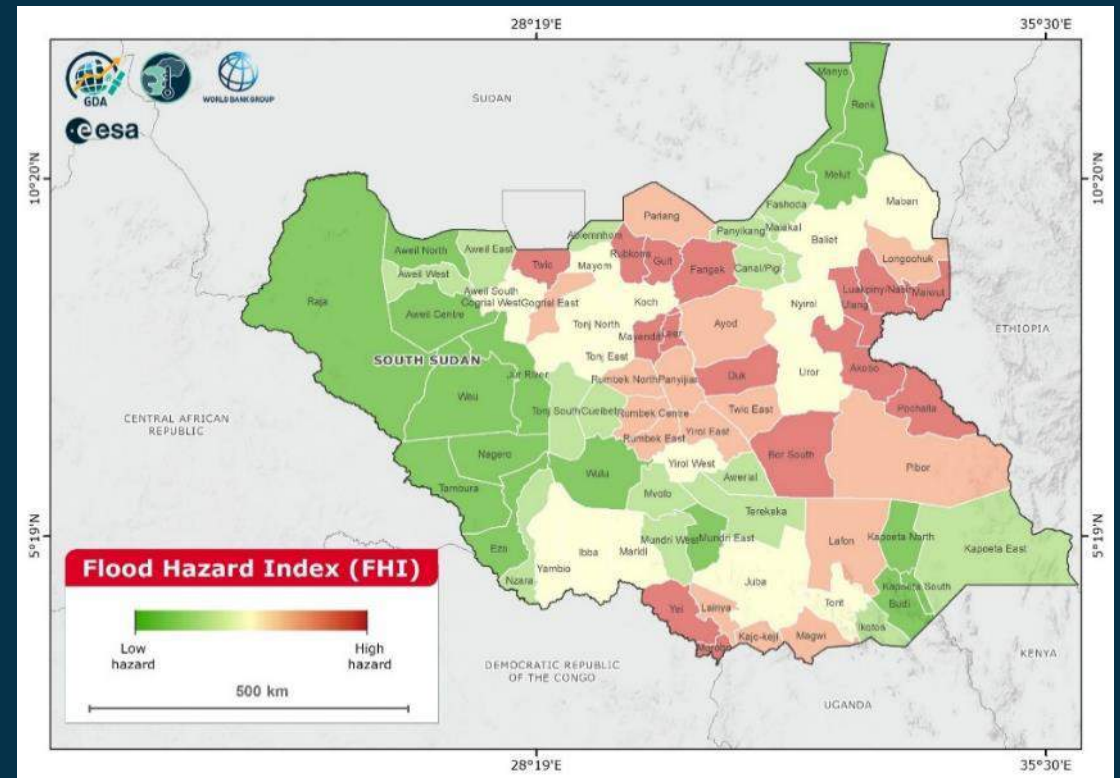
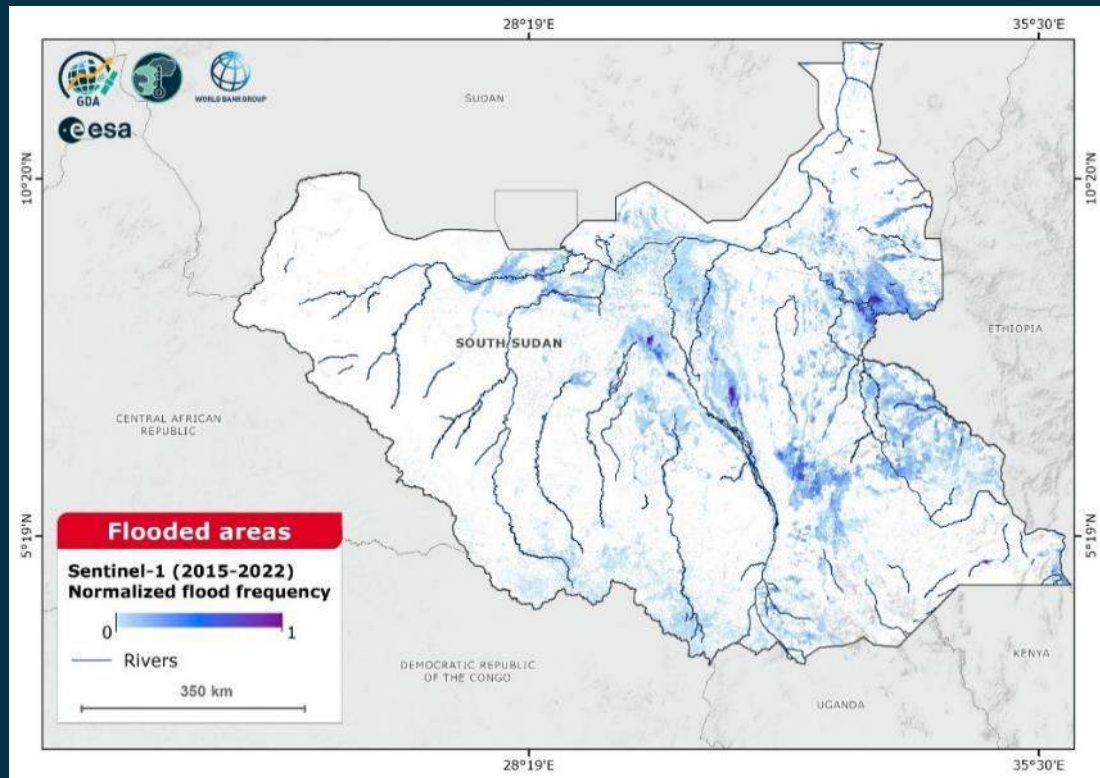
Focus on strategic needs & continuously assessing technical feasibility of service operationalization



PRODUCTS DELIVERED

The analysis at national level resulted in:

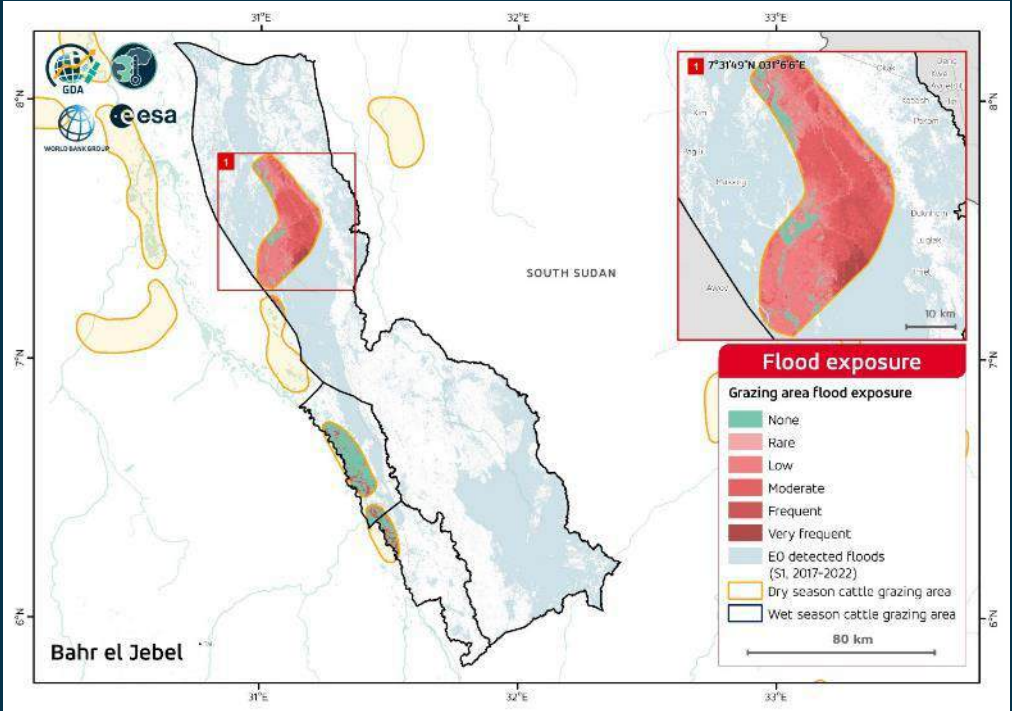
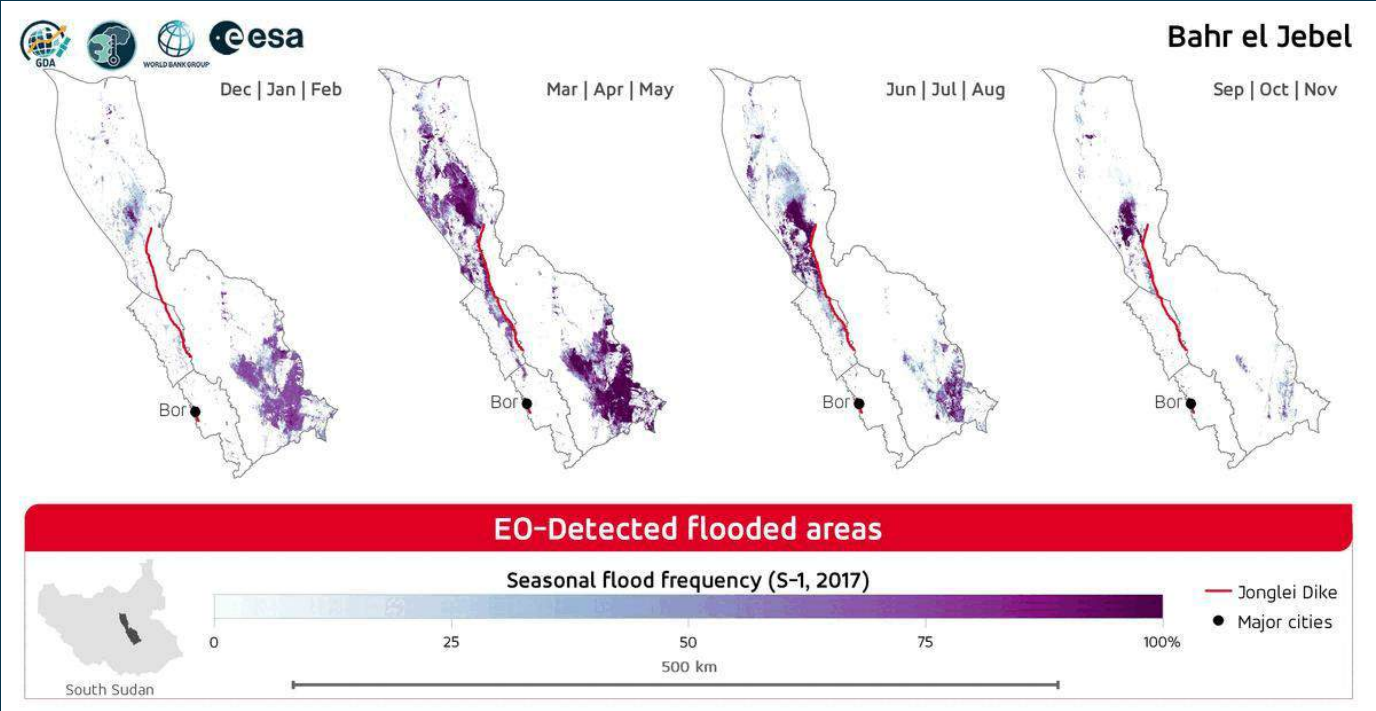
- A national flood hazard map
- Flood Hazard Index map accounting for flood frequency and extension to identify the most vulnerable areas



PRODUCTS DELIVERED



Detailed analysis in targeted basins focused on Flood seasonality, persistence and the potential exposure of key assets



THE WORLD BANK PROJECT AFTER GDA

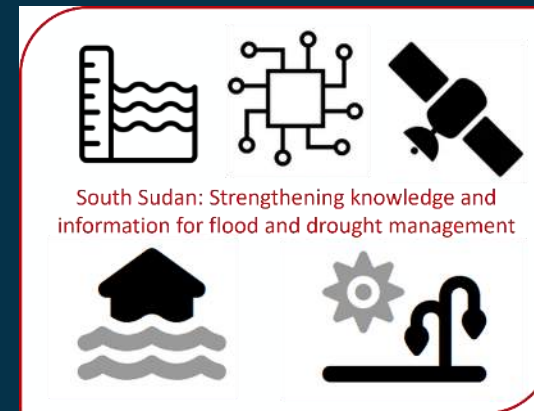
Aug 2022

Feb 2024

ESA GDA CLIMATE RESILIENCE project
South Sudan use case

World Bank Regional Climate Resilience Project (RCRP) - (P180171)

- **Global Facility for Disaster Reduction and Recovery (GFDRR) grant**
- **Length:** 12 months (+ 4 months) → 16months*
- **Budget:** \$ 249,000.00 (+ \$49,950) → \$ 298,950*
- **Type:** Competitive
- **Method:** Request for Proposal
- **Outcome:** Awarded to GMV led consortium



June
2023

Aug
2023

Dec
2023

Mar
2025



EoI

RfP

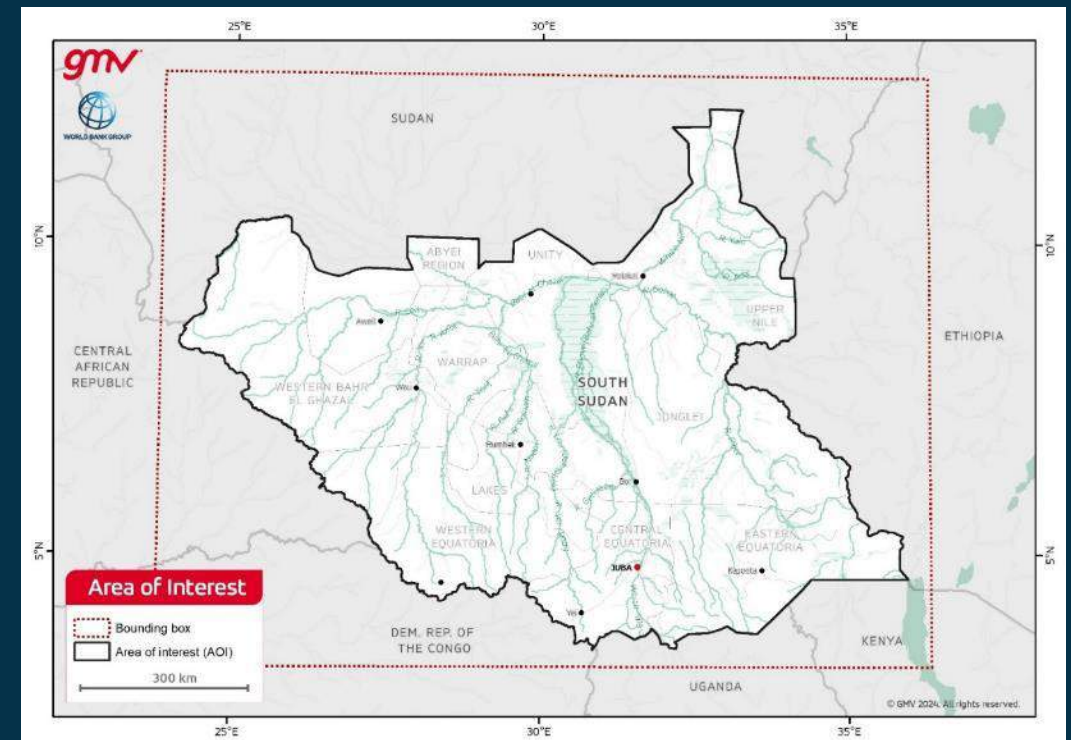
KOM

WORLD BANK project

* includes a contract modification for new EO-based activities contracted in Nov 2024

SCALABILITY OF THE CASE STUDY

1. Processing **36 global datasets** for **enhancing data** and information for water resources management
2. **In-situ river discharge data rescue + treatment** (229 stations/timeseries)
3. Develop **flood and drought hazard and exposure** maps
4. Piloting **2D flood inundation models** (pluvial and fluvial) for Malakal city*
5. Develop a **pilot tool** and a roadmap to improve data and information availability for **water management**
6. Develop a **pilot tool for real-time flood monitoring** in South Sudan and upstream White Nile River basins
7. **Workshops** towards **capacity building** and transfer knowledge on water resources management



Geospatial Visualization Tool


South Sudan

Explore South Sudan's geospatial visualization tool, a centralized site for accessing and analyzing hydrological data. Discover insights on flood, drought, and hydrometeorological patterns to support effective water resource management.

South Sudan 📍

Flood Drought Hydrometeorological

Access detailed flood data to assess both hazard and exposure across South Sudan. Analyze and compare EO-based and model-based flood information, including flood extent, depth, and return periods, to better understand flood risks and support proactive planning.

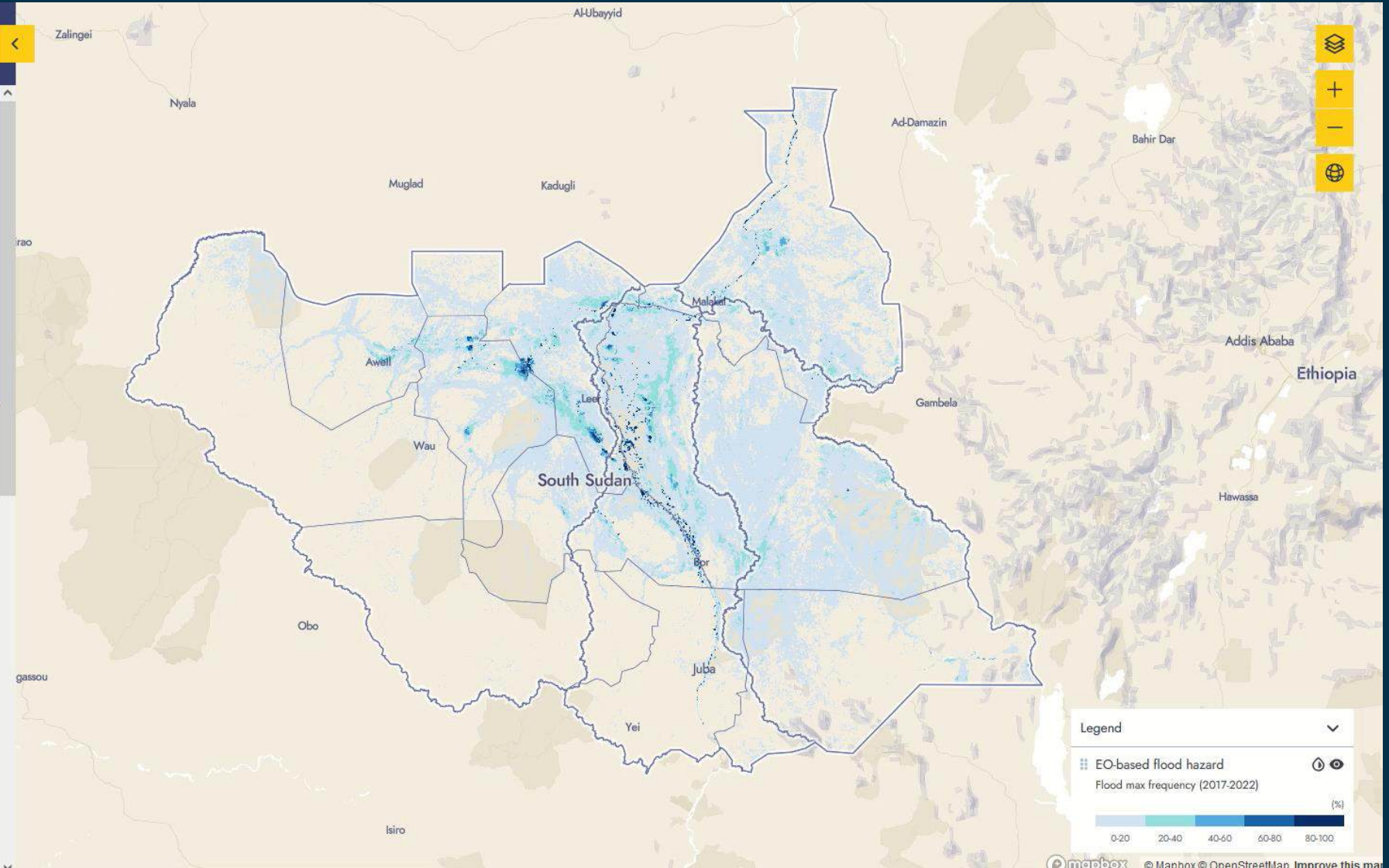


Wolfgang Hasselmann

FLOOD HAZARD

EO-based flood hazard 📄 📍 🌑 🌒

Flood hazard maps based on Earth Observation (Sentinel-1 and VIIRS sensors) (2017-2022)

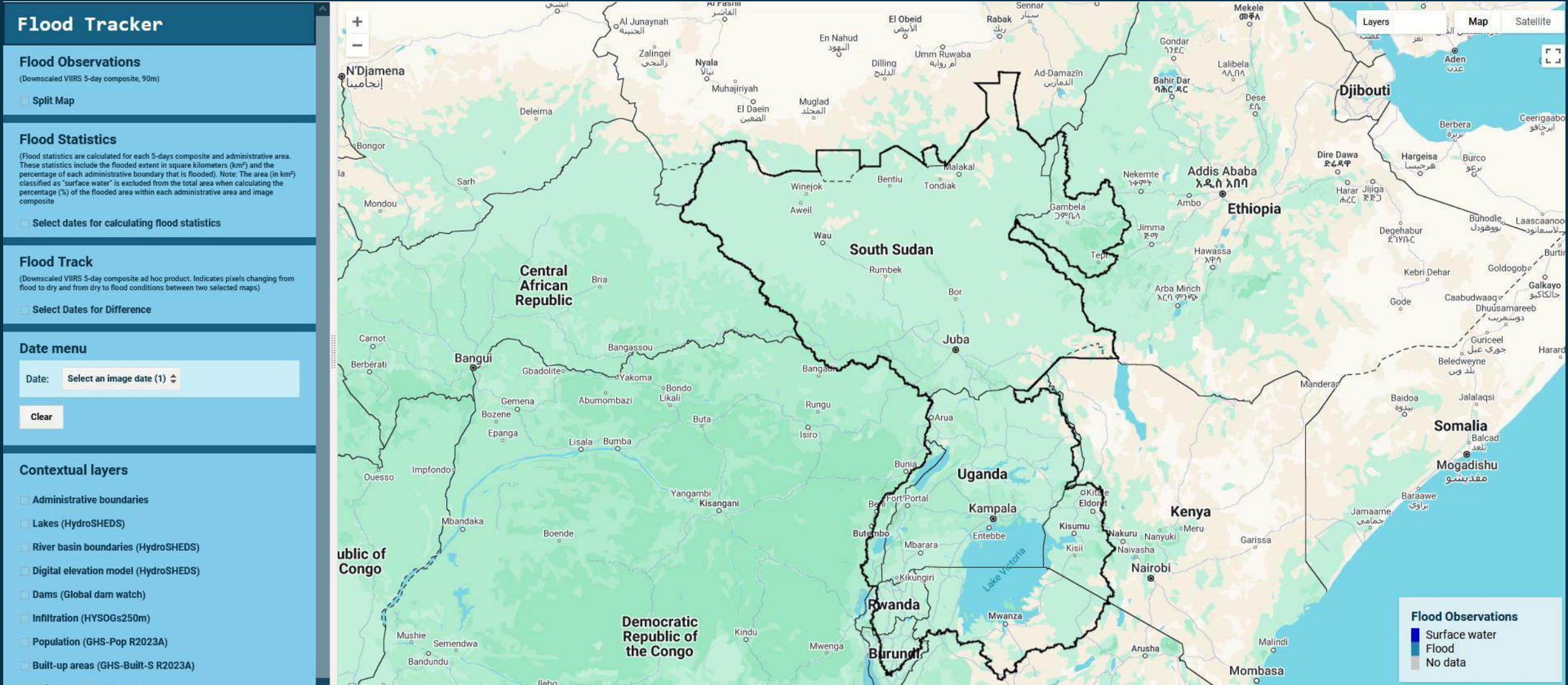


Legend

EO-based flood hazard 📄 📍

Flood max frequency (2017-2022) (%)

0-20 20-40 40-60 60-80 80-100



December 2024						
S	M	T	W	T	F	S
1	2	3	4	5	6	7
8	9	10	11	12	13	14
15	16	17	18	19	20	21
22	23	24	25	26	27	28
29	30	31				

- 10th South Sudan representative at the **GDA Industry Day** (virtual presentation)
- 12th GMV to deliver a **workshop** to WB & MWRI on on Earth Observation and the pilot tool for transboundary **real-time flood monitoring** upstream river basins of South Sudan

January 2025						
S	M	T	W	T	F	S
			1	2	3	4
5	6	7	8	9	10	11
12	13	14	15	16	17	18
19	20	21	22	23	24	25
26	27	28	29	30	31	

- 13th and 14th : **workshop** on Earth Observation and **data** availability for **water resources management**
- 15th and 16th : **workshop** on **pilot tool** to improve data and information availability for **water management**
- XX January/February: **Roadmap discussions and next steps discussions**

- Both the ESA GDA and WB-funded projects are great examples of **how EO bridges the gap from science to action for the government on the ground.**
- Next: High potential for operationalization of these EO-based tools in follow up projects & capacity building for sustainable uptake of these EO-based solutions by the government.

- Very **positive feedback** received on the collaboration:

*“Our team (WB) and **Ministry of Water Resources and Irrigation (MWRI)** have **emphasized the significant value of EO services**, particularly in a **Fragility, Conflict, and Violence (FCV)** affected country with **limited capabilities for ground measurements, high vulnerability to floods** in terms of both magnitude and persistence, **vulnerable population, and limited national capacity** for disaster risk reduction.”*

*“Our team (WB) is actively **bolstering national capabilities by integrating the use of EO for effective flood management** through various World Bank financed operations, including the **Regional Climate Resilience Project (P180171, RCRP)**. We're taking steps to seamlessly **incorporate these practices into project activities**, contributing to the overall development and resilience of the ministry and country overall.”*

THANK YOU

Carlos Domenech, Section Head for Climate Services, GMV
cdomenech@gmv.com

Questions?

Understanding Earth, improving lives, and fostering sustainability through space technology




Assisting AF Implementing Entities

ESA TAILORED SUPPORT TO YOU

Understanding Earth, improving lives, and fostering sustainability through space technology

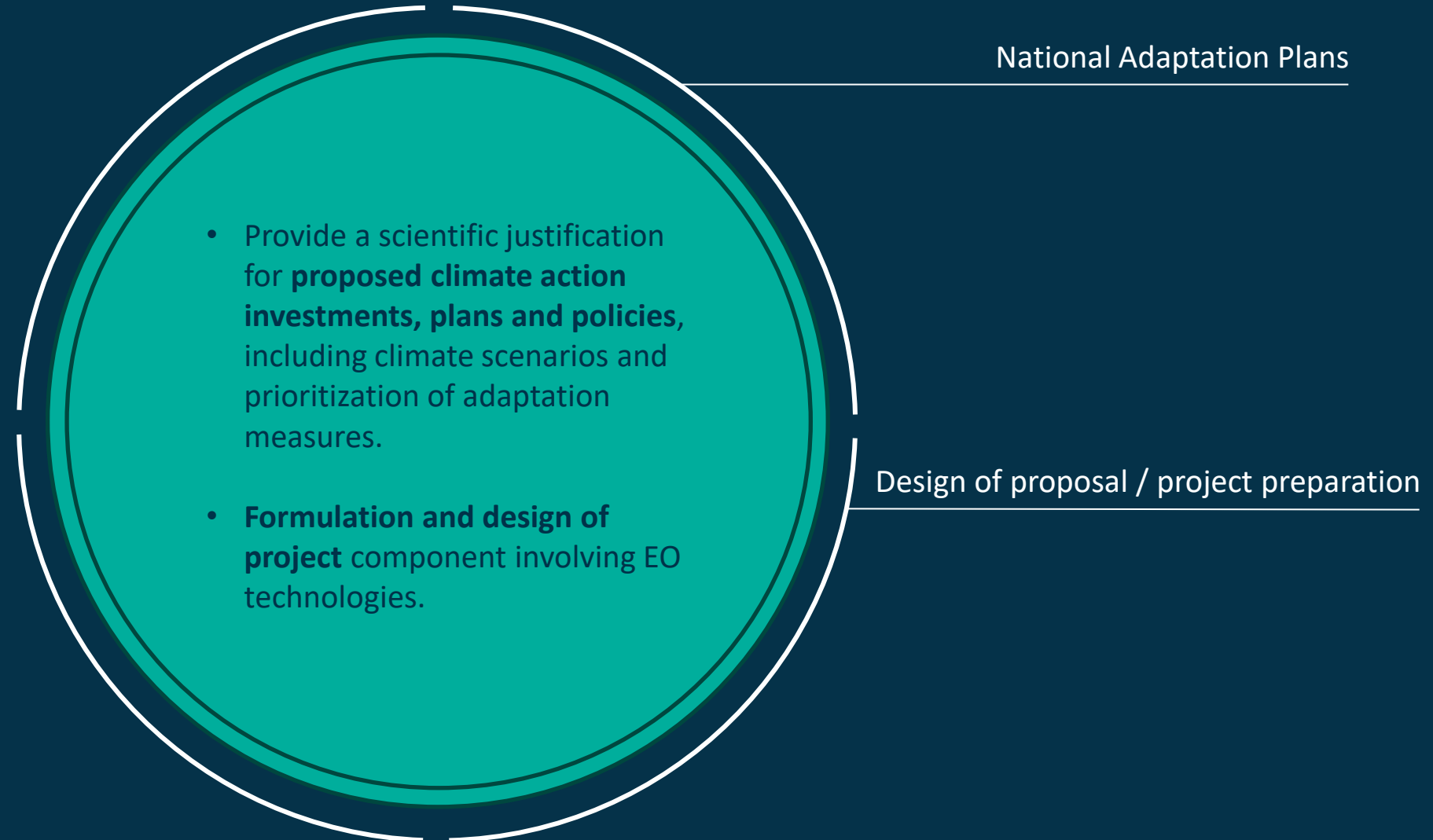
How can ESA support AF Implementing Entities?

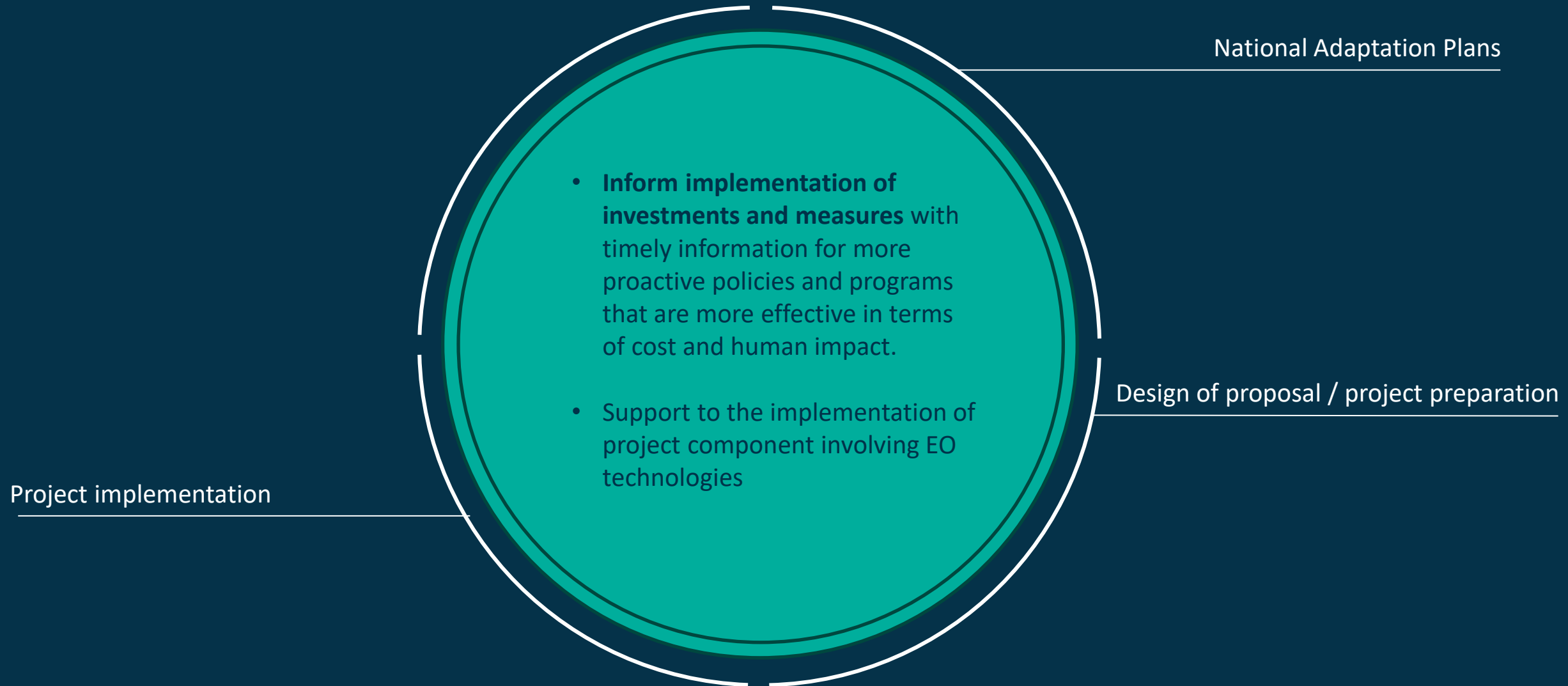
ESA can provide support to implementing entities on the use and integration of Earth Observation technologies to inform processes related to accessing Adaptation Fund financing as well as ensure the efficient and impactful use of the funding. This entails the mobilization of potential ESA support to:

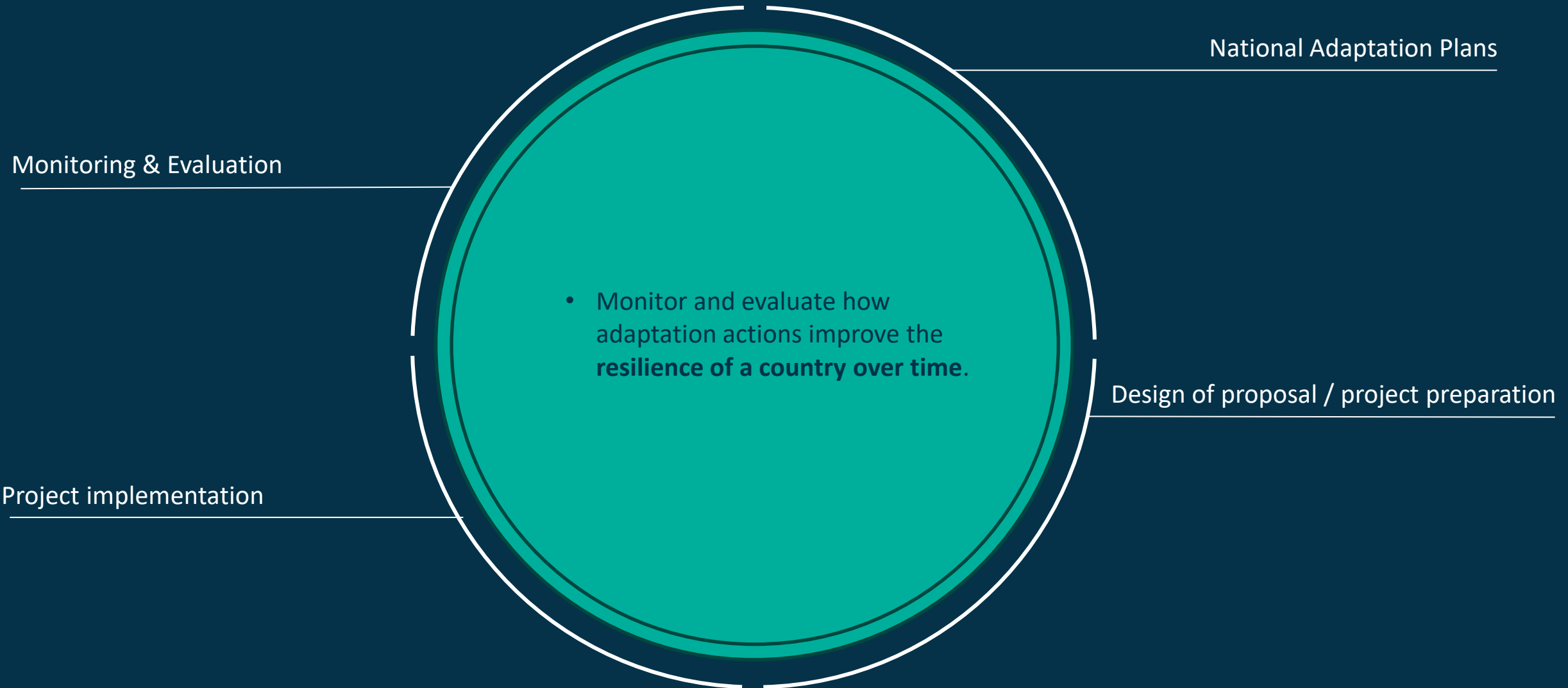
-  Inform the elaboration of National Adaptation Plans
-  Support implementing entities throughout the Adaptation Fund project cycle
-  Strengthen the capacity of implementing entities to better receive and manage climate financing

National Adaptation Plans

- Provides independent information to **identify and quantify the current state and trends in climate risks** to different systems or sectors.
- **Consistent and broad spatial coverage** of the Earth's systems and resources, including locations that may have been rendered inaccessible.







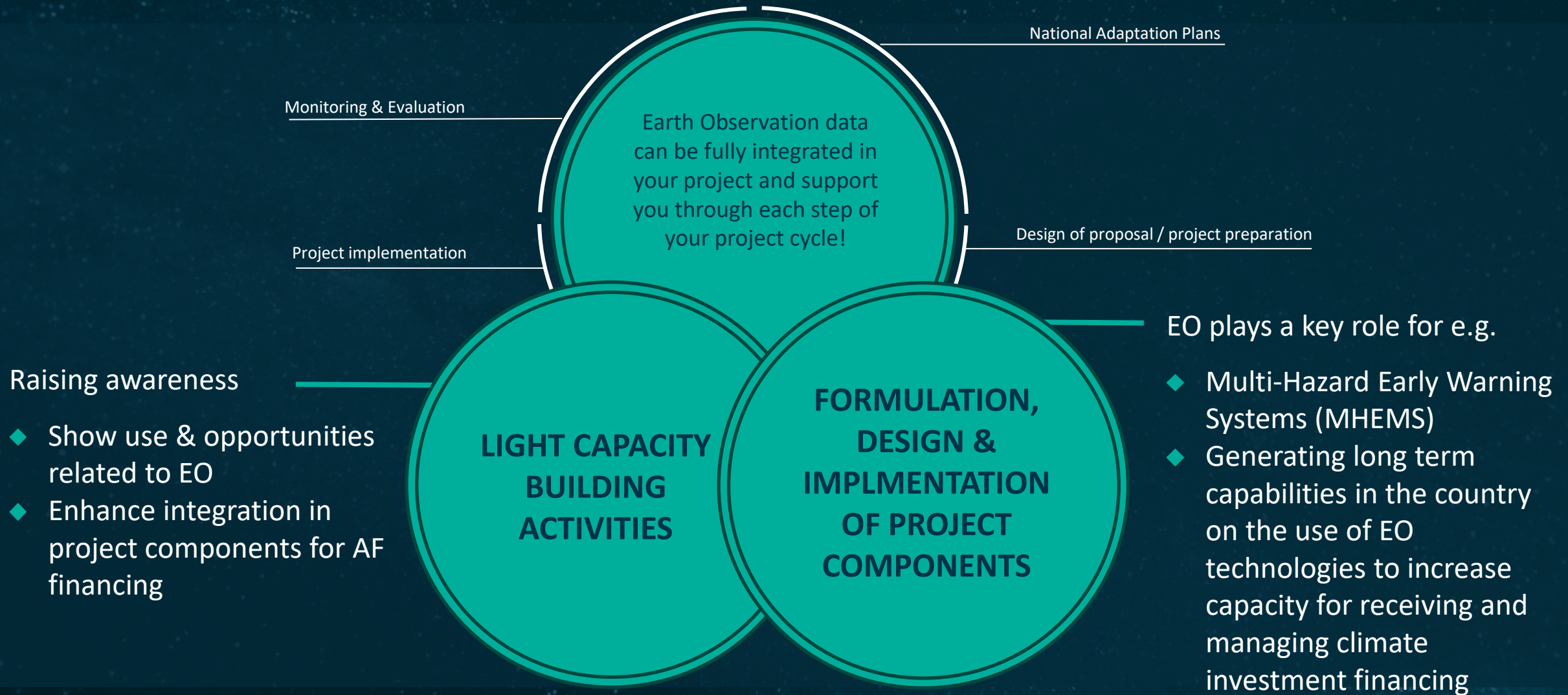
Monitoring & Evaluation

Earth Observation data
can be fully integrated
in your project and
support you through
each step of your
project cycle!

National Adaptation Plans

Design of proposal / project preparation

Project implementation



The main programmatic vehicle used to provide support to you is the ESA's **Global Development Assistance (GDA)** programme, which aims at supporting the integration of Earth Observation technologies in climate and development finance projects.



Through GDA, ESA mobilizes a **consortium of European partners** to support Implementing Entities on the development, integration and adoption of EO technologies.



Co-construction and **Coordination** are at the centre of this programme.



Explore GDA at: gda.esa.int

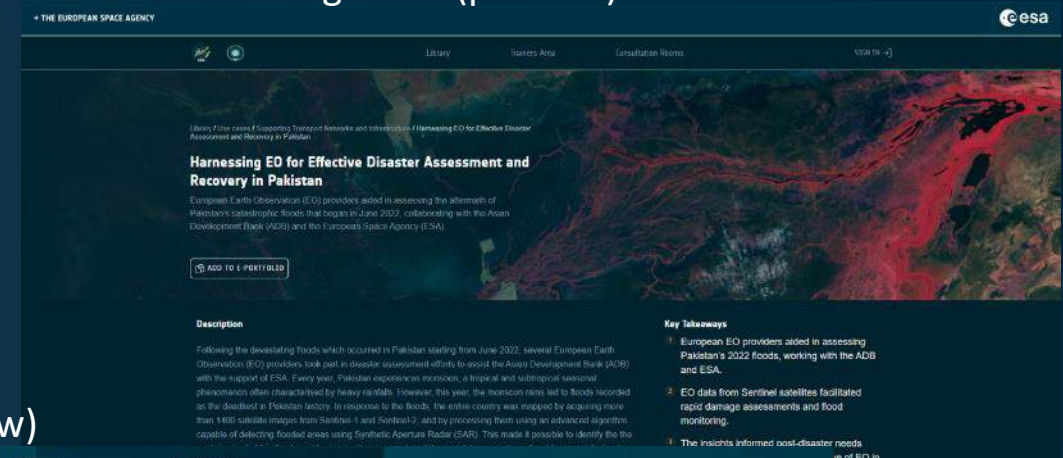


Two key cross-cutting platforms to support IEs on accessing documentation and automated EO services:

- ◆ The ESA GDA Knowledge Hub
- ◆ The ESA GDA Analytics Processing Platform (APP)

Both are fully open-source & scalable!

ESA GDA Knowledge Hub (preview)



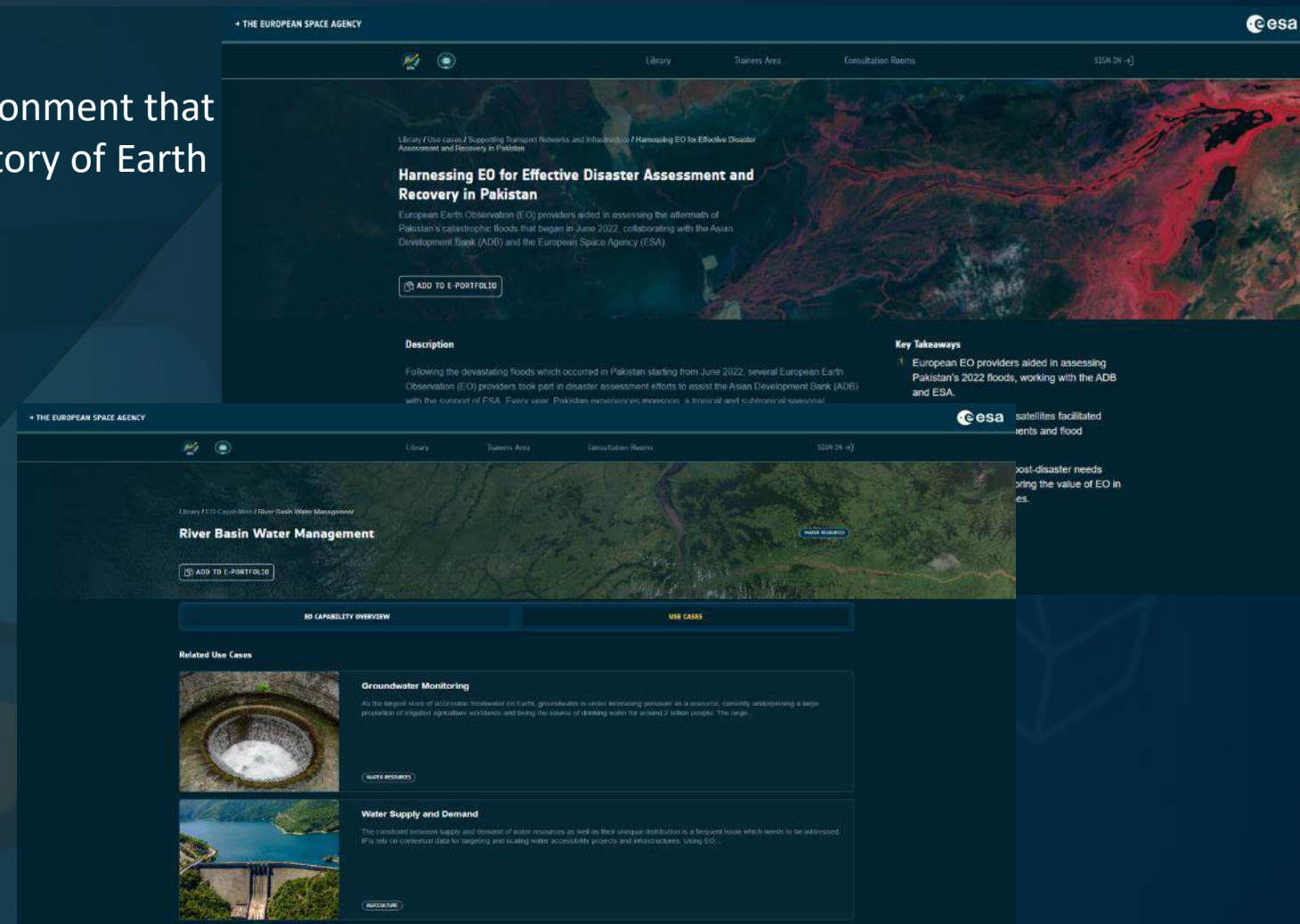
ESA GDA APP (preview)





The **ESA GDA Knowledge Hub** is an online environment that will provide an extensive and interactive repository of Earth Observation (EO) service capabilities:

- ◆ For development operations
- ◆ Informative
- ◆ Rich in examples & resources



ESA GDA Knowledge Hub (preview)



The ESA GDA Analytics Processing platform is a non-expert user-friendly analytical environment that will allow users to execute EO-based analytics on the fly anywhere on earth.

- ◆ User-centric design approach
- ◆ Services include, for example:
 - Flood mapping, Vegetation monitoring, Building detection (for exposure)



ESA GDA APP (preview)

Are you interested in receiving support in one of the following ways?

Building on EO analytics for a NAP

Simply brainstorming on the use of EO?

Building capabilities locally on the use of EO technologies

Using EO to strengthen the proposal you are drafting

Integrating EO in your M&E systems

Designing a project component that integrates EO technologies



Contact us!

Direct via ESA staffs: Alex Chunet (alex.chunet@esa.int) & Anika Ruess (anika.ruess@esa.int)
or via your Adaptation Fund focal point / contact



Engage and Exchange Ideas

Q&A

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