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Copernicus for Biodiversity Workshop

BIOSPACE, February 2025

Copernicus for Biodiversity Workshop Agenda

- 15.00 Introduction, Michel Massart, European Commission, Directorate General JRC
- 15.05 Copernicus, EO Space Flagship Program, Michel Massart, EC DG JRC
- 15.15 EO Nature protection: an EU policy perspective, Bruno Combal, EC DG ENV
- 15.30 Copernicus Services and Copernicus In Situ component

State of play of the Copernicus services, the products and their interest for biodiversity monitoring.

Andreas Brink, DG JRC for Copernicus Land Service, Tina Silovic, MOI for Copernicus Marine Service, Laurence Rouil, ECMWF for Copernicus Atmosphere Service, Samuel Almond, ECMWF for Copernicus Climate Change Service, Jose Rubio, EEA for Copernicus In Situ component.

- 16.30 Coffee Break
- 17.00 Panel discussion

Relevance of the Copernicus service products for biodiversity monitoring, the potential evolution of the products towards new challenges and the strengthening of user uptake.

Jillian Campbell (UN-CBD), Alice Hughes (GEOBON), Pavel Milenov (EEA), Enrique Montes (NOOA), Steven Ramage (CEOS-GEOBON), Andrea Taramelli (ISPRA), Victor Martinez Vicente (PML)

- 18.30 End





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COPERNICUS IN A NUTSHELL

Copernicus for Biodiversity WS

BIOSPACE, February 2025

The EU Space Programme

EU SPACE PROGRAMME OVERVIEW

COPERNICUS
Earth Observation (EO) and monitoring based on satellite and non-space data

Nr.1 world provider of space data and information

GALILEO
Global satellite navigation and positioning system (GNSS)

10% of the EU GDP enabled by satellite navigation

EGNOS
Reliable navigation signals for safety of life use

Operational in 360+ airports & helipads in 23 countries

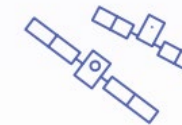
SSA
Space situational awareness monitoring and protecting space assets

Providing surveillance and tracking services to 210+ satellites

GOVSATCOM
Secure satellite communications for EU security actors

Delivering rapid support over crisis areas

AN INVESTMENT IN A FUTURE READY EUROPE



Competitive edge

Completing current satellite constellations, developing and launching the next-generation of satellites



Research innovation

Ambitious research and innovation programme benefiting from Horizon Europe



Fighting Climate Change

Monitoring biodiversity, environmental compliance and CO2 emissions (Paris Agreement)



EU as a global actor

Supporting disaster relief, humanitarian assistance and security operations



Copernicus History

1998

Baveno Manifesto

GMES

1999

“Global Monitoring for Environment and Security”

2004

EC-ESA agreement
On space component
“the Sentinels”

GMES IO

2005

GMES EU’s main
Contribution to GEOSS

2011

GMES Initial Operations
Phase begins

2012

GMES renamed to Copernicus,
Start of CLMS, CEMS

2013

EU Regulation:
full, free and open
data policy.

Copernicus 1.0

2014

launch of Sentinel-1A
Copernicus Regulation
adopted

2015

launch of Sentinel-2A,
Start of CMEMS and CAMS

2016

launch of Sentinel-3A and S-1B
Start of CSS

2017

launch of Sentinel-2B,
Launch of S-5P,
global air quality monitoring

2018

launch of Sentinel-3B and S-1B
Start of C3S

2020

launch of Sentinel-6,
topography of the global ocean.

Copernicus 2.0

2021

EU Space Programme Regulation

2023

Launch CDSE

2024

Celebration Copernicus 25 years
Launch of Sentinel 2-C and S-1C

Copernicus 3.0

Copernicus Evolution

MPF 2028-2032

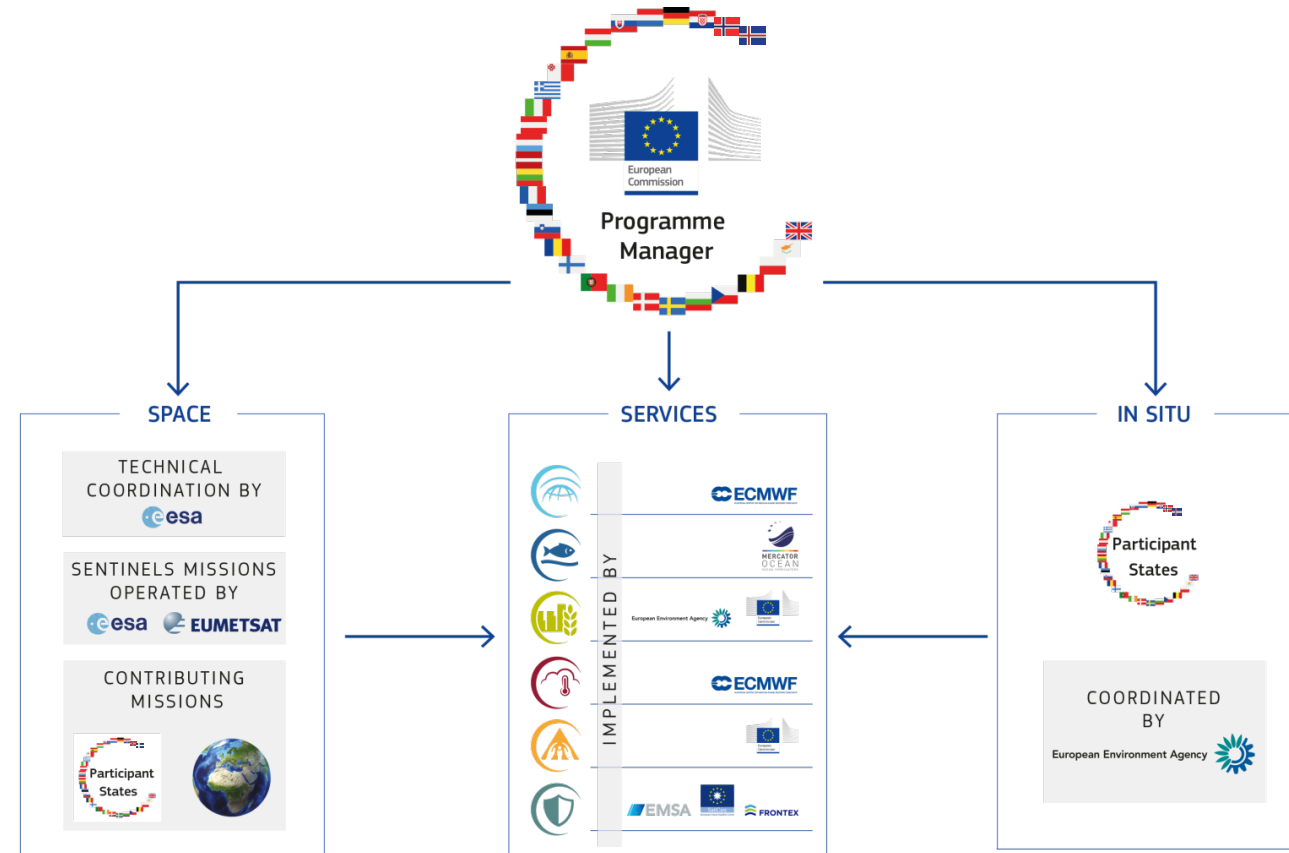


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Copernicus Overview

- Copernicus is the European Union programme aimed at developing European information **services** based on satellite Earth Observation and in situ data
- Copernicus is coordinated and **managed** by the **European Commission**
- Copernicus is **implemented in partnership** with the Member States, ESA, EUMETSAT, ECMWF, EEA, EC JRC, Mercator, EMSA, SatGen, Frontex
- Copernicus **Multiannual Financial Framework 2021-2027 > 5 billion €**
- Tool for **economic growth**
- **Operational, Sustainable, Free and Open**



Copernicus Components



Sentinels



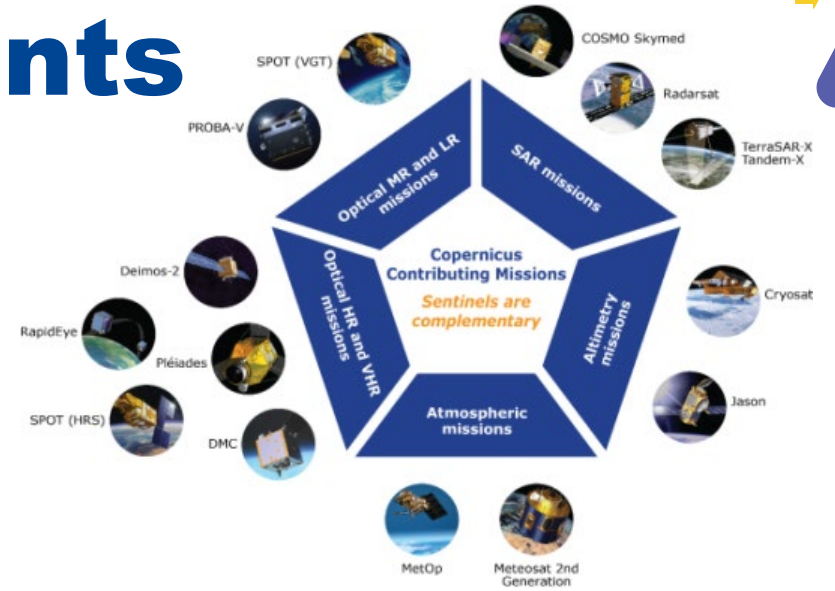
FULL, FREE AND OPEN

Six Copernicus Services

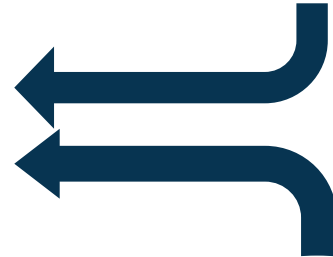


Value-added

Services



Contributing missions



In situ data

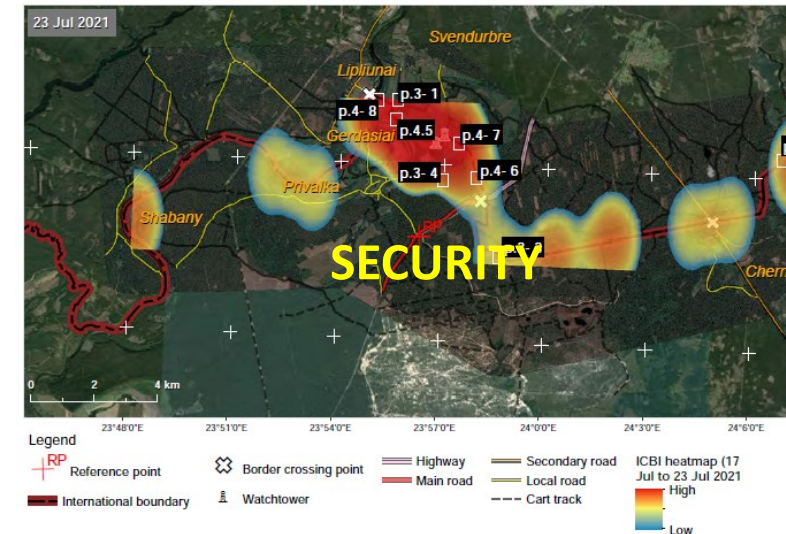
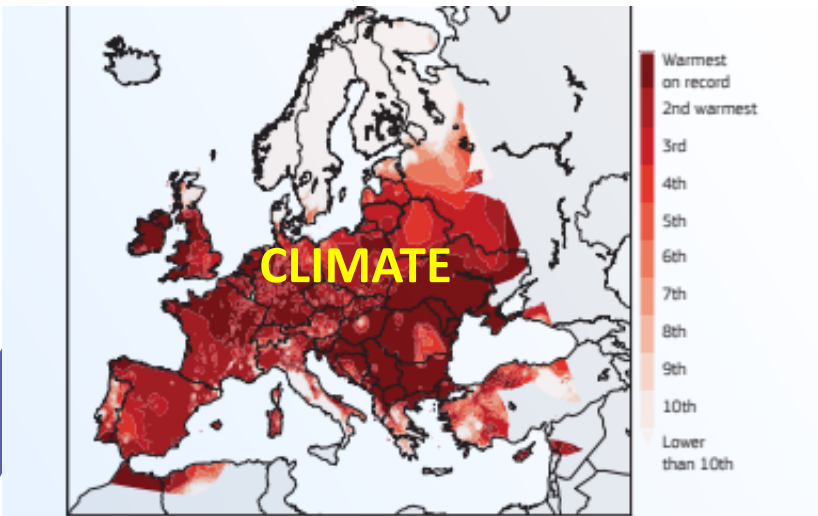
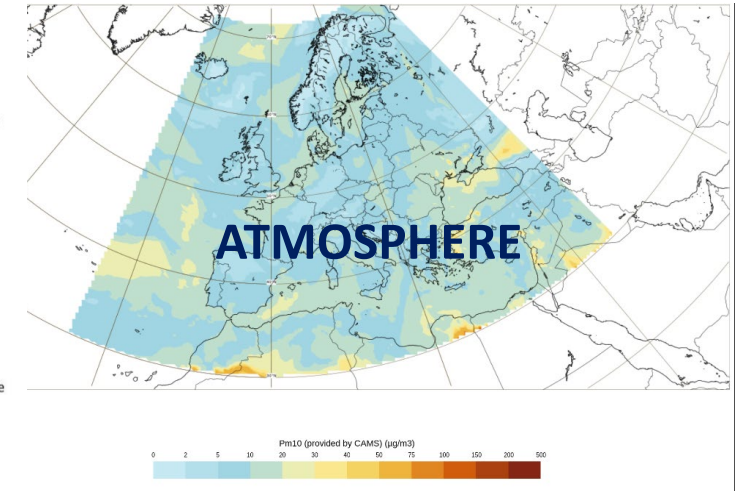
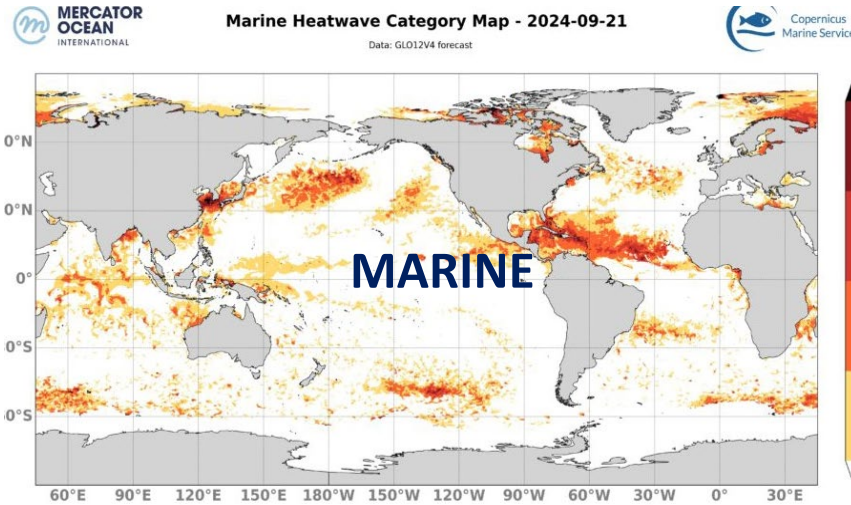
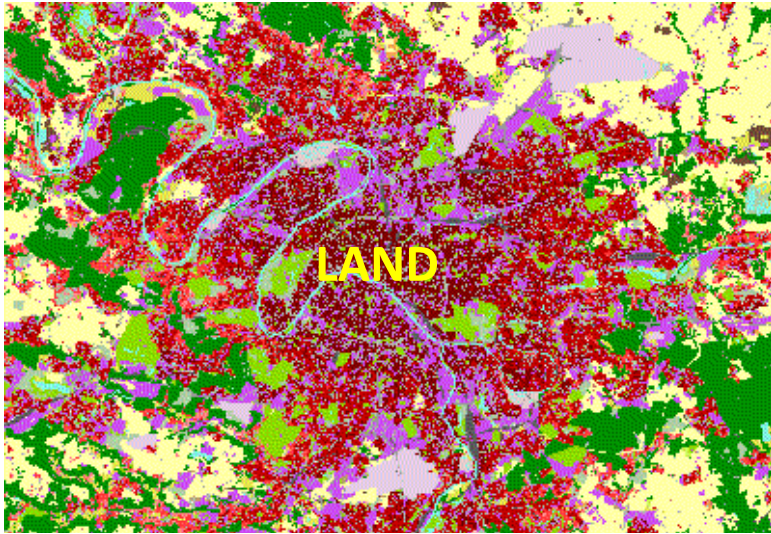


Building on existing expertise

Copernicus Land Service : 65+ industry partners / 350+ experts



The Copernicus Services



The Copernicus Sentinels

Sentinel Mission and Status

Key Features



SENTINEL-1:
4-40m resolution, 6 days revisit at equator

Polar-orbiting, all-weather, day-and-night radar imaging



SENTINEL-2:
10-60m resolution, 5 days revisit time

Polar-orbiting, multispectral optical, high-res imaging



SENTINEL-3:
300-1200m resolution, <2 days revisit

Optical and altimeter mission monitoring sea and land parameters



SENTINEL-4:
8km resolution, 60 min revisit time

Payload for atmosphere chemistry monitoring on MTG-S



SENTINEL-5p:
7-68km resolution, 1 day revisit

Mission to reduce data gaps between Envisat, and S-5



SENTINEL-5:
7.5-50km resolution, 1 day revisit

Payload for atmosphere chemistry monitoring on MetOp 2ndGen



SENTINEL-6:
10 day revisit time

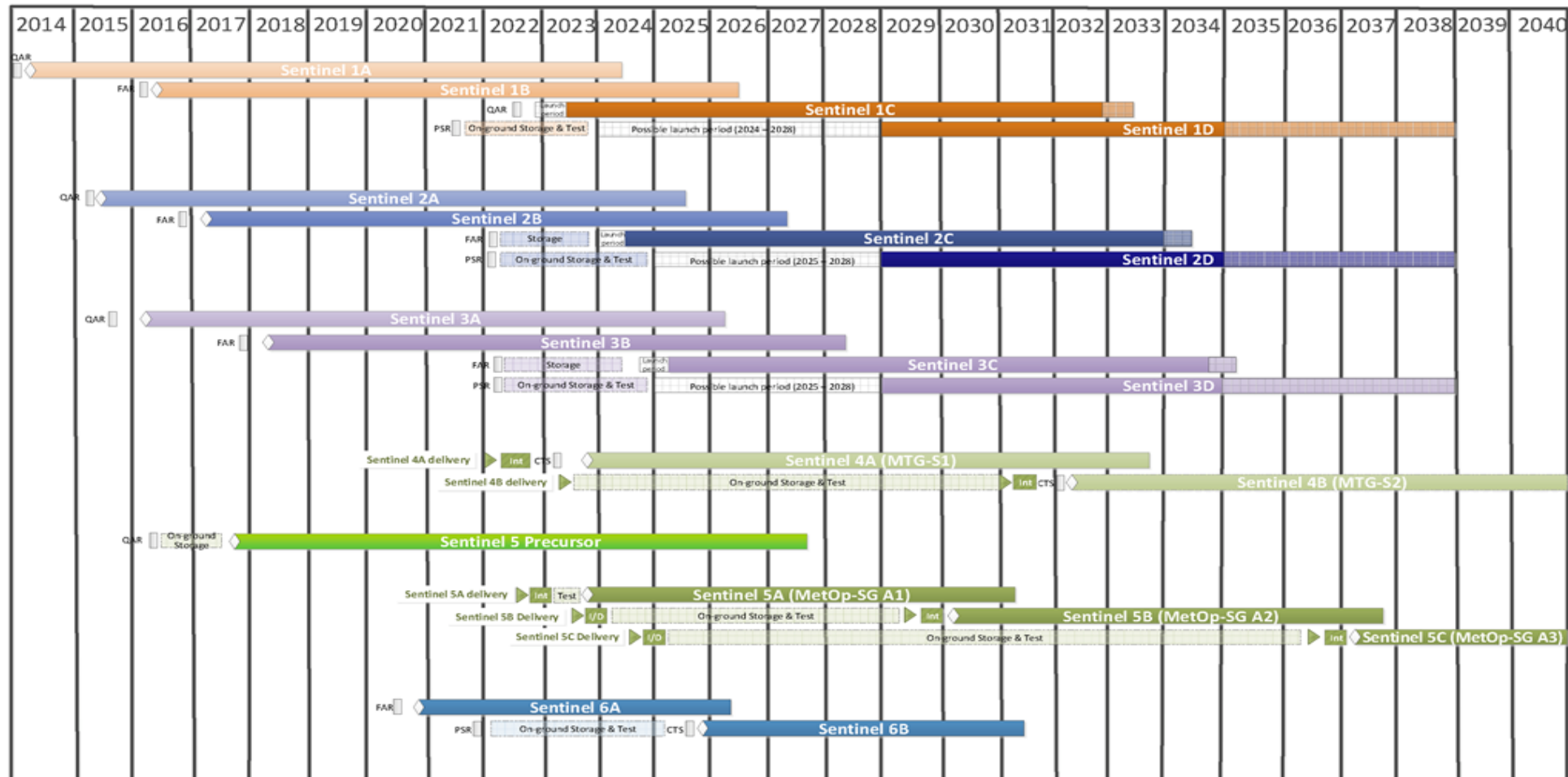
Radar altimeter to measure sea-surface height globally



Sentinel Satellite Deployment



Indicative Copernicus Constellation Deployment Schedule



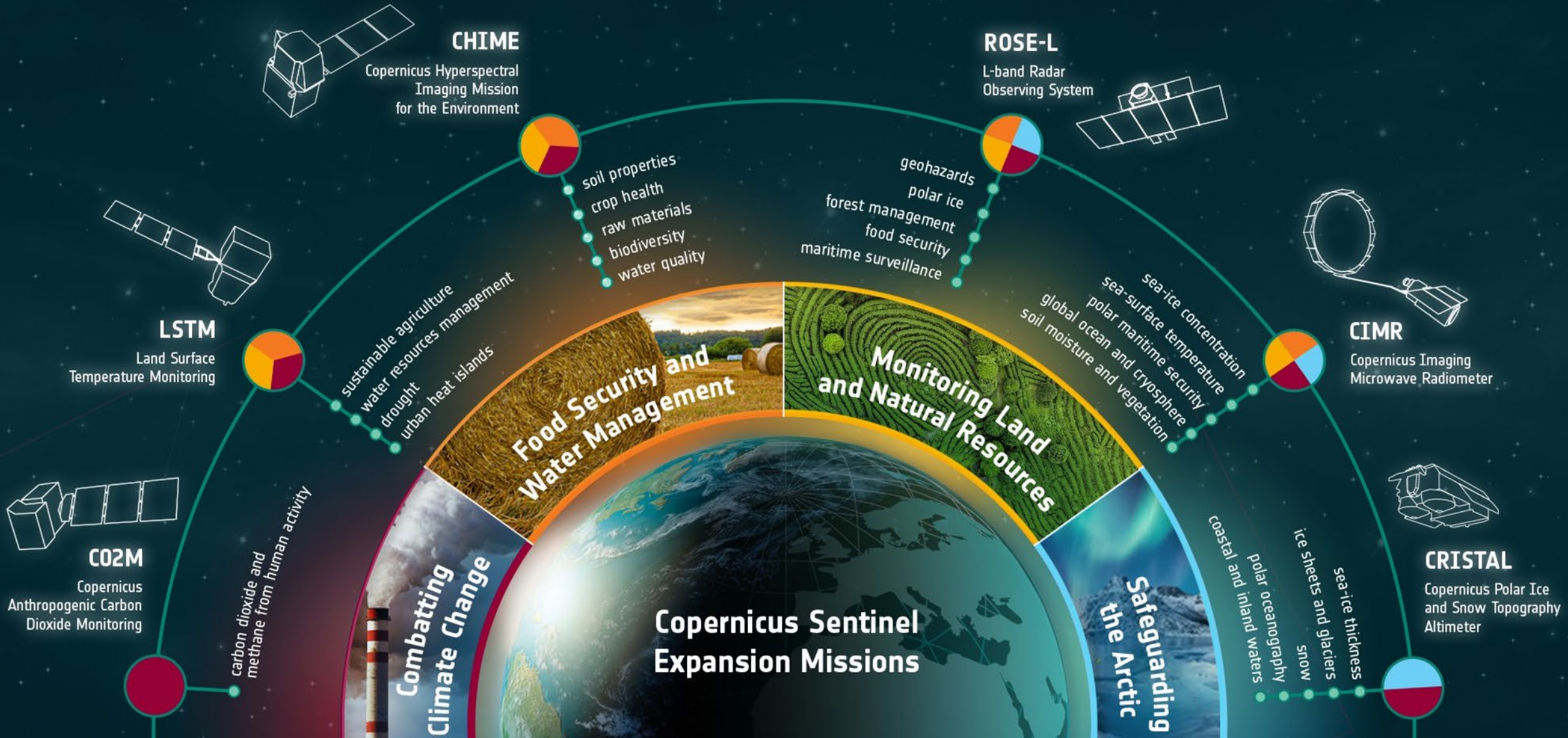
- Legend:**
- Qualification Acceptance Review (QAR)
 - Flight Acceptance Review (FAR)
 - PreStorage Review (PSR)
 - Consent to Ship (CTS)
 - On-ground Storage & Test
 - Satellite Test
 - Satellite On-ground Storage & Test
 - Satellite Assembly, Integration & Test
 - Int
 - I/D
 - Integration
 - Integration & disintegration for Satellite AIT
 - Tentative Launch Date

Date: 18 Jan 2022



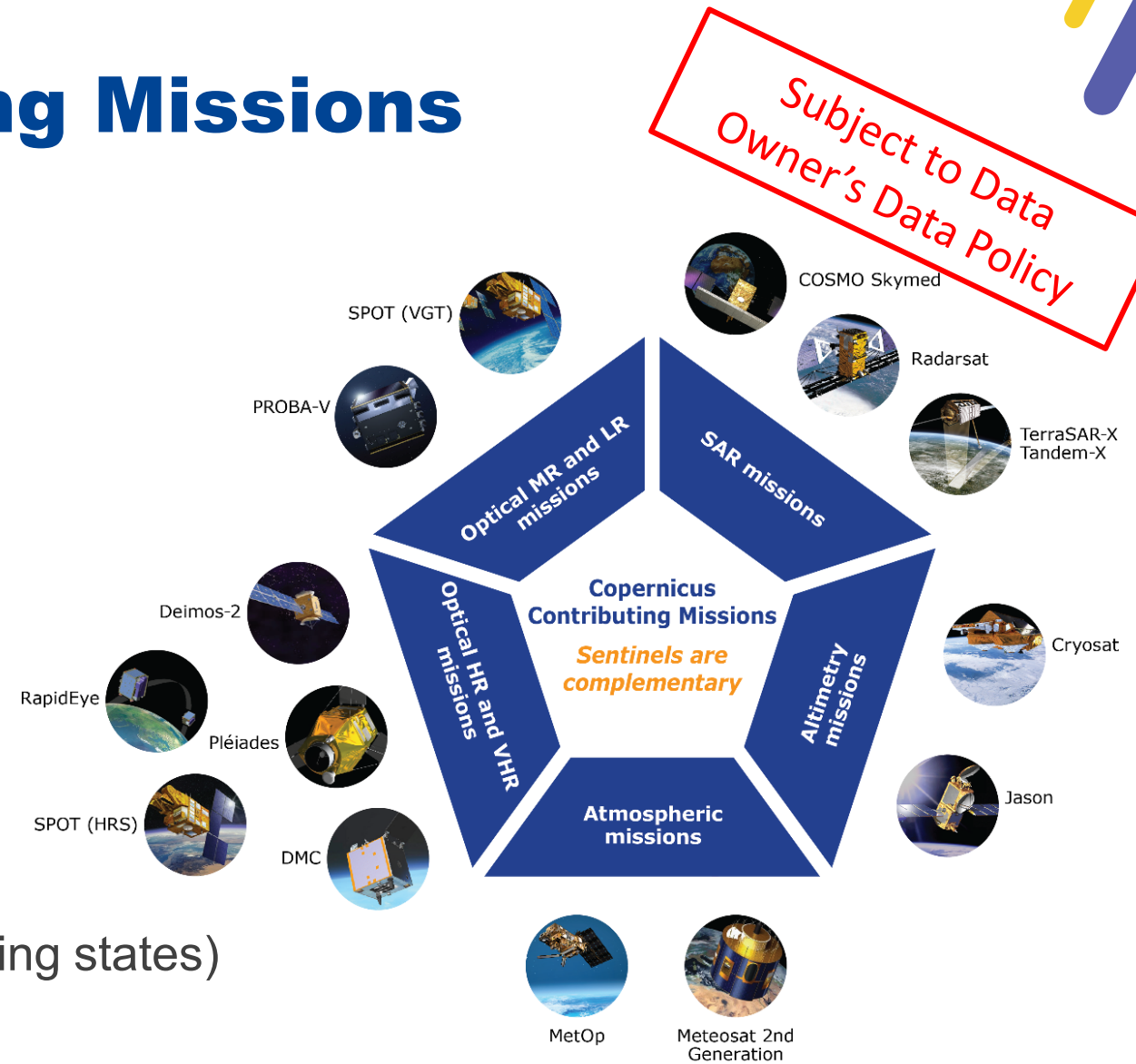
PRC
THE

Copernicus Expansion Missions



Copernicus Contributing Missions

- Emerging Companies
(EU and Copernicus participating states)
- Established Companies
(EU and Copernicus participating states)
- Non-EU Companies (Copernicus cooperating states)

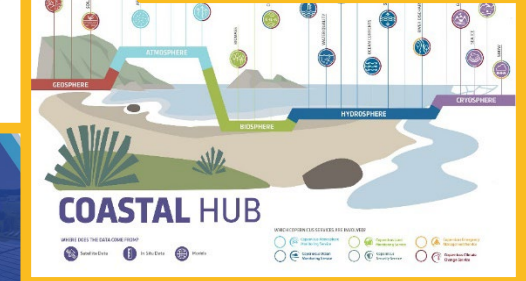
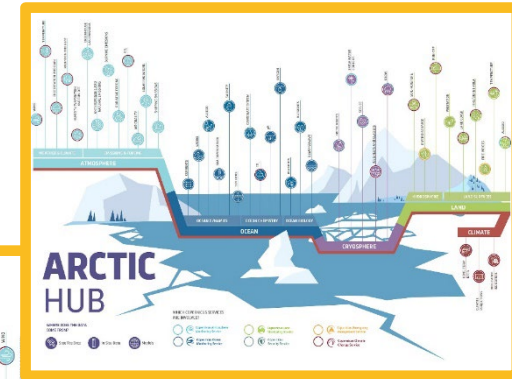


How to access the Copernicus data and products

Copernicus services' portals



Thematic Hubs



<https://dataspace.copernicus.eu>

Copernicus Data Space Ecosystem (CDSE) Portal

<https://www.wekeo.eu>

WEKEO Portal



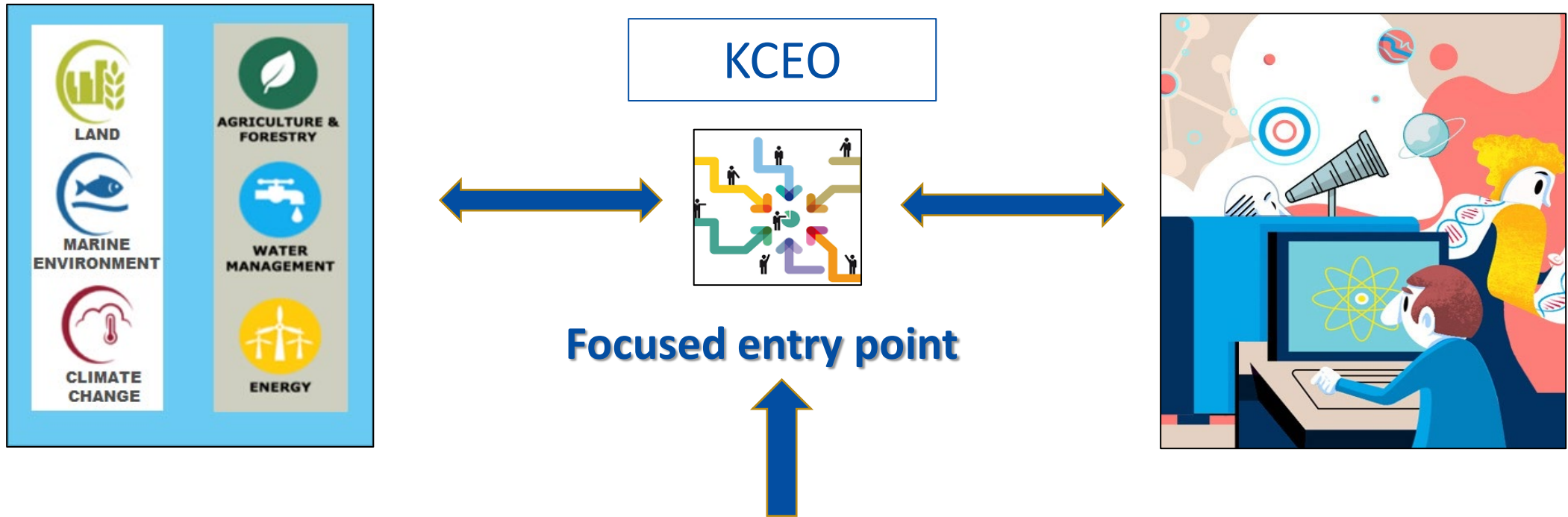
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Knowledge Centre on Earth Observation

Pillar 1: Policy Needs, Uptake & Coherence

Pillar 2: Mainstreaming R&I



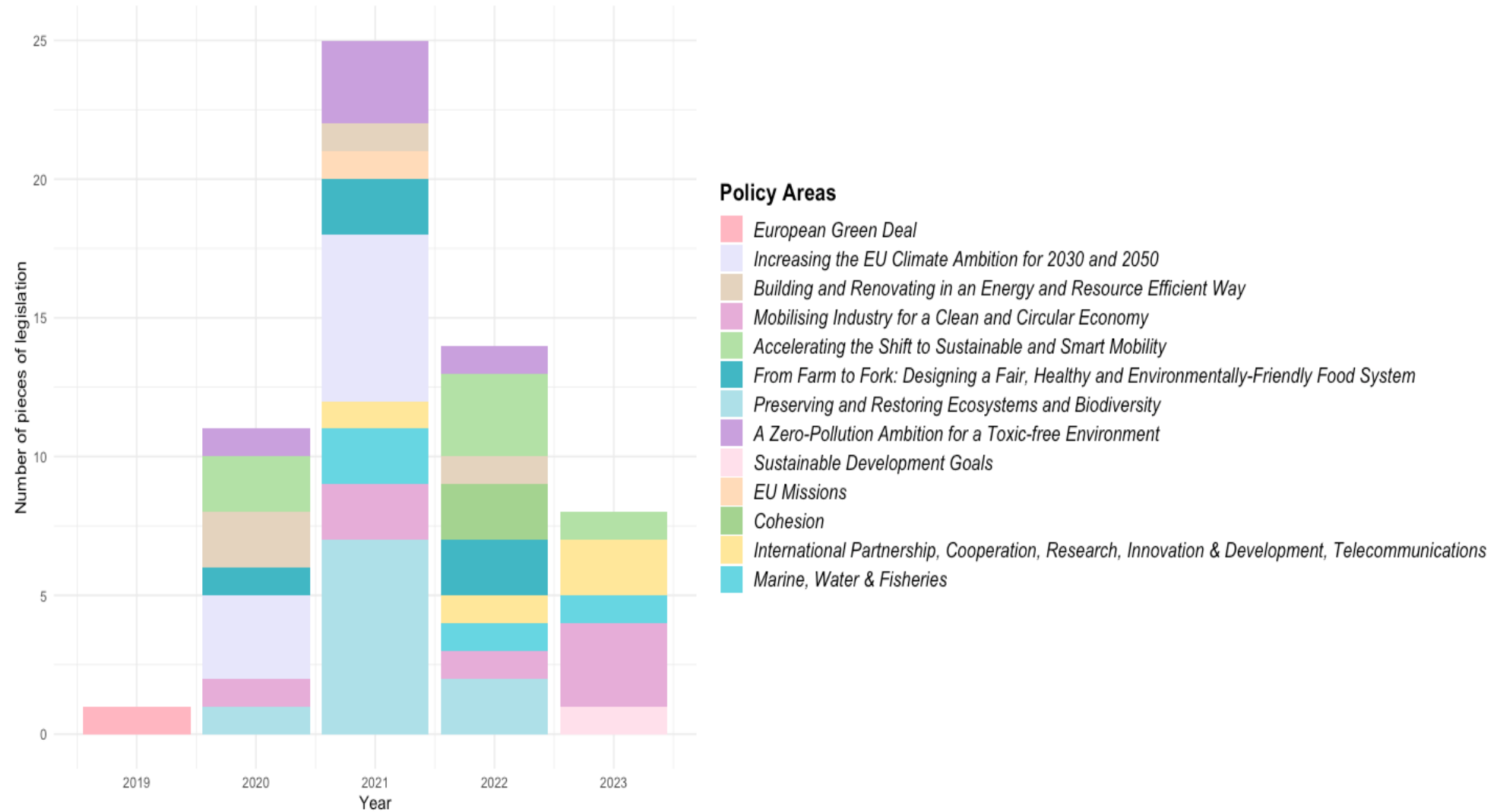
Inclusiveness & Transparency: Dialogue with external partners; international organisation; society



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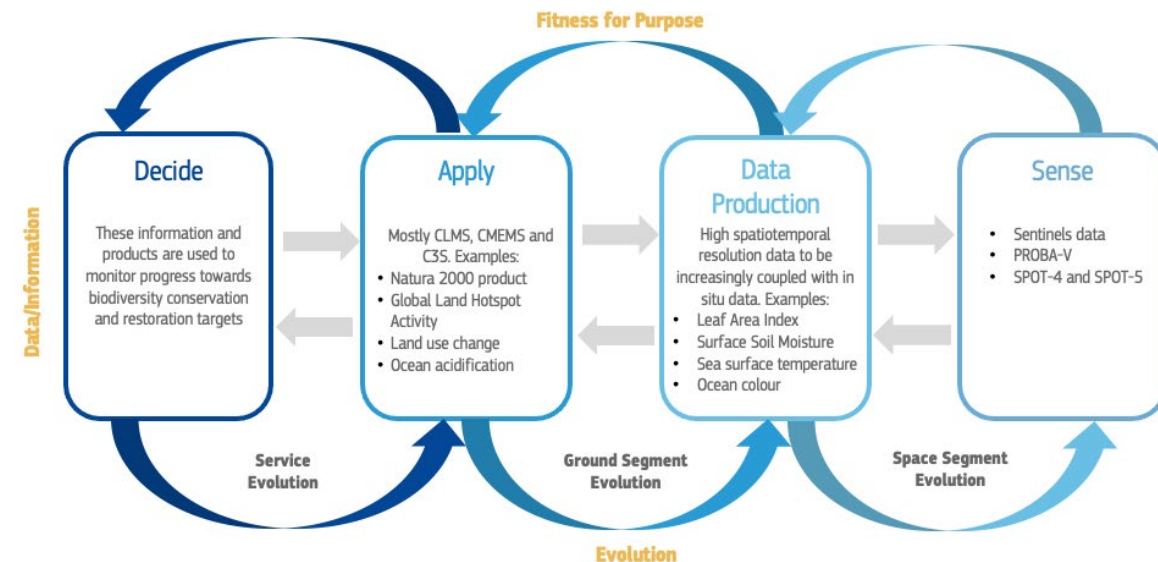
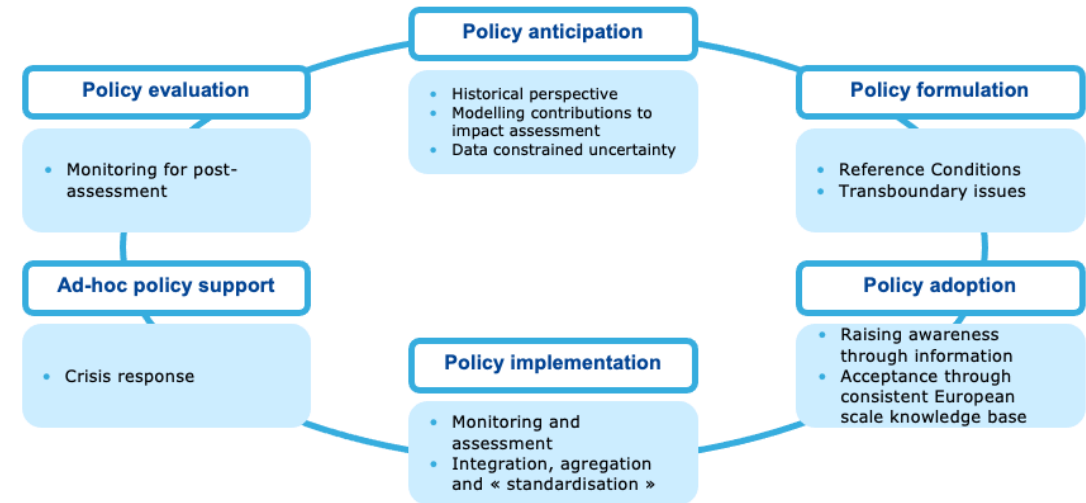
European Green Deal Legislation including Copernicus by policy area over time



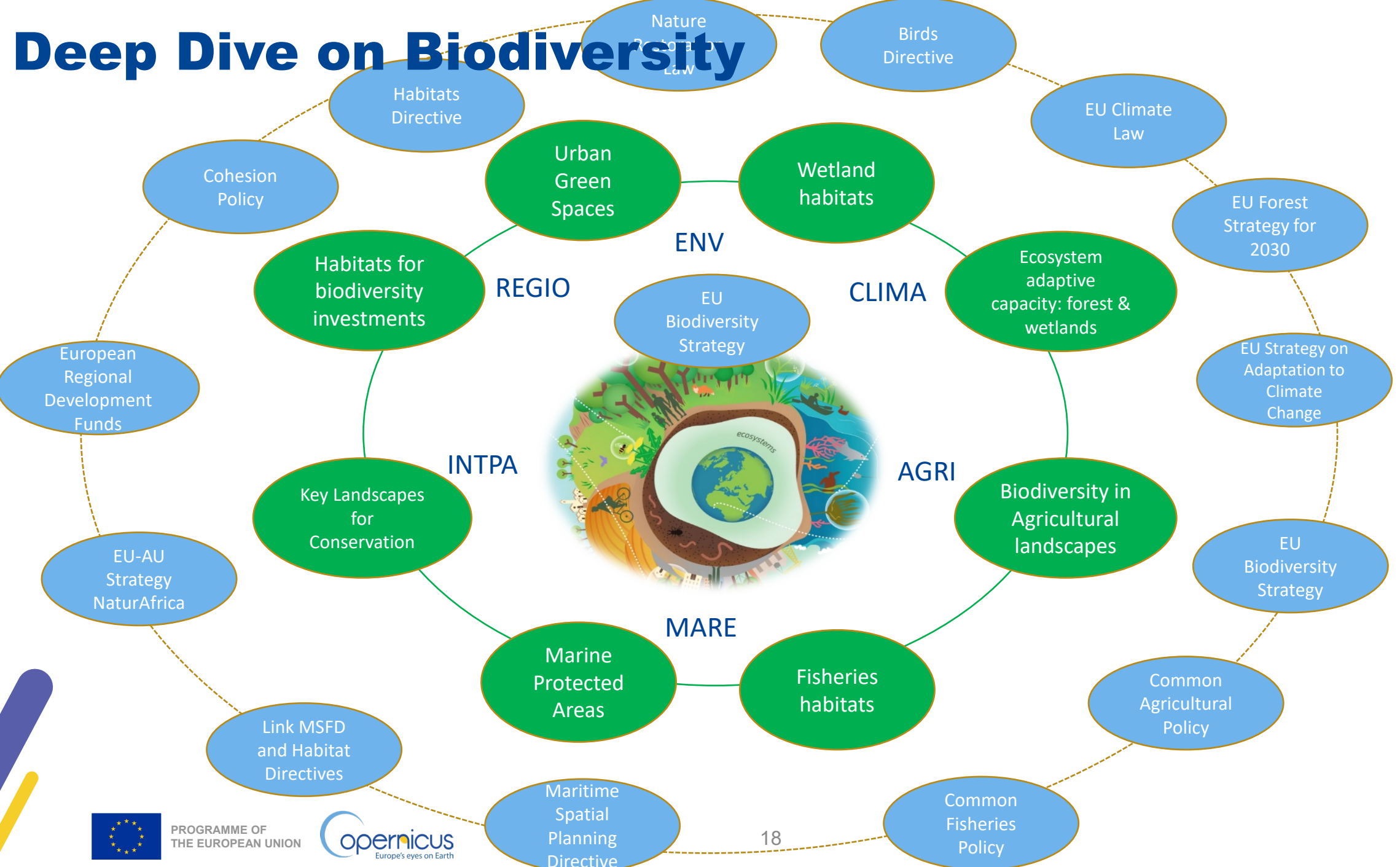
Thematic Deep Dive Methodology

Summary of steps

1. Policy needs assessment
2. Earth Observation Value Chain
3. Translation of needs into quantitative requirements
4. Assessment of fitness for purpose with regards to existing products, services, infrastructure, capacities
5. Gap analysis and recommendations for evolution



Deep Dive on Biodiversity



MONITORING OF THE EU BIODIVERSITY STRATEGY (BDS) TARGETS

NEEDS: High-resolution (HR) and long-term indicators on a yearly basis to effectively monitor progress towards the targets outlined.
STATUS: Two online tools for tracking and reporting the progress of the BDS implementation: [Actions tracker](#) and [Dashboard](#).

GAPS:

- Lack of yearly HR maps to track changes.
- Absence of suitable ground-based biodiversity data for training and validation.

MONITORING OF URBAN GREEN SPACES

NEEDS: Multitemporal HR maps covering various types of urban green infrastructures.

STATUS: [Urban Atlas](#) and [Small Woody Features \(SWF\)](#), among others, partially fulfill the need.

GAPS:

- Inadequacy of temporal frequency, thematic granularity, and spatial coverage.
- Geometric inaccuracy.

MONITORING WETLAND HABITATS

NEEDS: HR maps of delineating wetland habitats and long-term indicators for assessing overall conditions and changes.

STATUS: [Land cover map on riparian zones](#), a dataset on [long-term dynamics of surface water](#), and [in-situ soil moisture observations](#).

GAPS:

- Lack of common definition for wetlands, based on generalized, objective, and measurable criteria.
- Insufficiency in geographic coverage, thematic granularity, spatial and temporal consistency, and a lack of a long-term record.
- Absence of a user-friendly platform to facilitate products accessibility.

BIODIVERSITY MONITORING IN KEY AFRICAN LANDSCAPES FOR CONSERVATION (KLCs) FOR CONSERVATION (KLCs)

NEEDS: Detailed indicators, encompassing performance monitoring and accountability measures to support ecosystems conservation while supporting livelihoods and human development.

STATUS: EO products integrated in the [AKP](#) provide a baseline for monitoring across the selected KLCs.

GAPS:

- Insufficiency in integrating ancillary data, including socio-economic information derived from UNESCO and EU Delegations.
- Absence of a user-friendly platform to facilitate products accessibility, analysis and reporting.

BIODIVERSITY MONITORING IN AGRICULTURE LANDSCAPE

NEEDS: Indicators for biodiversity monitoring and evaluation to meet the 10% target for High Diversity Landscape Features.

STATUS: [SWF](#) and [LUCAS](#) Landscape Features module partially address the needs.

GAPS:

- Lack of integration between SWF and LUCAS module.
- Absence of independent and traceable quality assessment of SWF with respect to policy requirements.
- Inadequate frequency and latency of available products.

MONITORING SHIFTS IN GEOGRAPHIC RANGES, DISTRIBUTION AND CONDITIONS OF SPECIES POPULATION AS A FUNCTION OF CHANGING CLIMATE

NEEDS: Assessment of the impacts of Climate Change on ecosystems' functions and structures, on species abundance and distribution.

STATUS: Climatic data products are suitable for bioclimatic models.

GAPS:

- Low spatial resolution of available products.
- Lack of operability in combining bioclimatic modelling technologies with bioclimatic products (under development by C3S).
- Insufficiency in parametrising biological processes to be included in models.
- Inaccuracy and lack of performance assessment of bioclimatic models.

ASSESSMENT AND MONITORING OF EU FOREST HEALTH

NEEDS: A forest monitoring system to alert on disturbances, assess the impact of climate changes on biodiversity, and predict disturbance risks.

STATUS: Copernicus [CLC+ Backbone](#) and [High Resolution Layer Forests](#), among others, partially address the needs.

GAPS:

- Lack of HR yearly maps on forest status and changes.
- Insufficiency in delineating forest types.
- Deficiency in integrating ground and satellite data.
- Limited access to and use of training and reference data for accuracy assessment of Copernicus products.

MONITORING ESSENTIAL FISH HABITATS AND VULNERABLE MARINE ECOSYSTEMS, & MARINE BIODIVERSITY

NEEDS: HR maps for assessing marine protected areas (MPAs), characterising fisheries resources and identifying vulnerable ecosystems.

STATUS: [EYOdnet](#) and the [Copernicus Marine Service](#) partially address the needs.

GAPS:

- Lack of centralized and easy access to satellite and in-situ national data.
- Absence of informative indicators on species richness and abundance hotspots, overlaps between hotspots and MPAs, and areas impacted by cumulative impacts.
- Insufficient spatial and temporal resolutions.

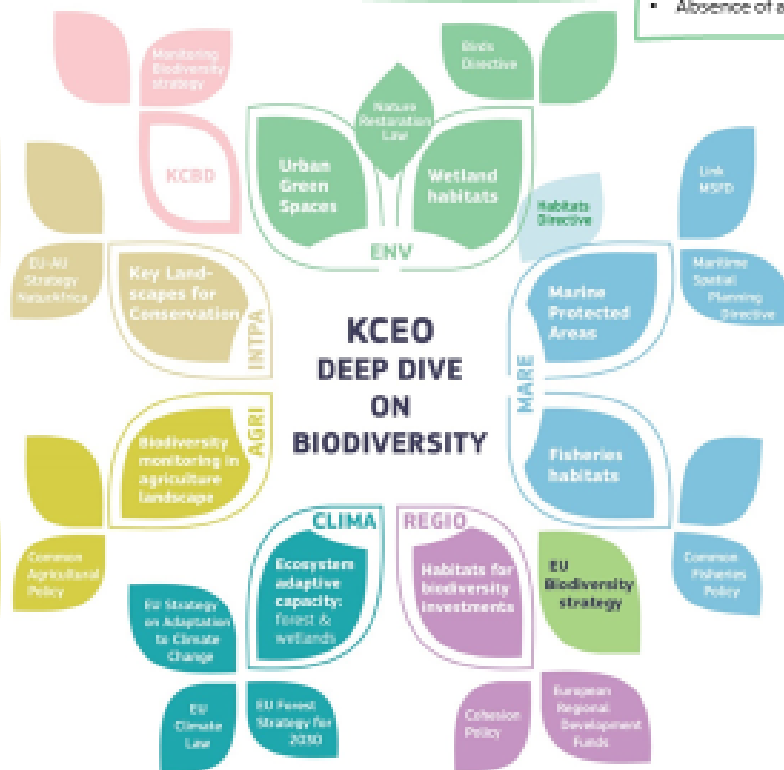
MONITORING ECOSYSTEMS HEALTH TO SUPPORT BIODIVERSITY INVESTMENTS

NEEDS: Monitoring system to guide and assess EU investments in biodiversity and ecosystems.

STATUS: Available EO products partially address the needs.

GAPS:

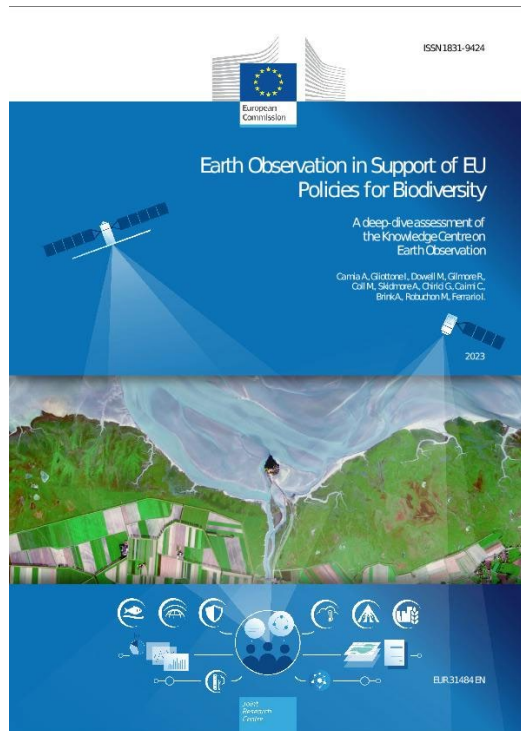
- Insufficient generation of targeted indicators, such as phenology or productivity indices.
- Lack of operability.
- Inconsistencies and gaps in the time series.
- Coarse thematic granularity of land cover maps, limiting a comprehensive understanding of ecosystems.



#	RS - Biodiversity Product (*)	EU Biodiversity Strategy Targets																Copernicus Product
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	
1	Biological effect of fire disturbance	x	x	x	x													Burnt Area
2	Biological effect of irregular inundation	x	x	x	x													Soil Water Index
3	Leaf Area Index		x		x													Leaf Area Index
4	Land Cover	x	x	x	x			x	x	x	x							Land Cover
5	Ice Cover habitat	x	x	x	x													RLIE S1+S2
6	Above ground biomass		x		x													NA
7	Foliar NPK Content						x						x					NA
8	Net primary productivity							x	x									Net primary productivity
9	Gross primary productivity							x	x									Gross primary productivity
10	FAPAR		x		x													FAPAR
11	Fraction of vegetation cover							x	x									Fraction of vegetation cover
12	Plant area index profile		x		x													NA
13	Urban habitat														x			1. Urban Atlas, 2. GHS BUILT, 3. GHS SMOD
14	Vegetation canopy height	x	x	x	x													NA
15	Habitat structure				x													NA
16	Ecosystem Fragmentation	x			x													Corine Land Cover
17	Ecosystem structural variance	x			x													Corine Land Cover
18	Land surface phenology peak							x	x									Vegetation phenology and productivity suite HR VPP
19	Land surface phenology green-up							x	x									Vegetation phenology and productivity suite HR VPP
20	Land surface phenology senescence							x	x									Vegetation phenology and productivity suite HR VPP
21	Carbon cycle		x		x													NA
22	Chlorophyll content and flux	x		x														Chlorophyll content and flux

(*) RS products prioritized as EO biodiversity metrics in Skidmore et al. (Nature ecol & evol, 2021)

General recommendations on EO support to EU biodiversity policy



- Sustained assistance to cover the “**last mile**” for an efficient uptake: products need to be tailored
- Efficiency potentially gained addressing **cross-policy needs**
- **Spatial resolution and thematic detail** more important than high time frequency
- **Time series** length, consistency and regular updates to improve e.g., for benchmarking and observing evolutions over time
- **Improving thematic details** of EO products; standard land cover classes not sufficient for many biodiversity applications. Need of a harmonised ecosystem typology classification (other communities are going in this direction).
- Integration of **in situ data** and models is key but far from operational
- **Availability of in situ data** is still a challenge
- **Access to EO products** and services for decision makers to improve

<https://publications.jrc.ec.europa.eu/repository/handle/JRC132908>



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THANK YOU

Michel Massart
European Commission
JRC D6

BioSpace25 - Biodiversity insight from Space
10 - 14 February 2025 | ESA-ESRIN | Frascati - Italy

EO and Nature protection: an EU policy perspective

Bruno Combal (PhD), DG ENV - Nature protection unit

Natura 2000

[Birds Directive](#) (1979, 2009/147/CE)

Protects all wild birds occurring in the EU + regularly migrating species.

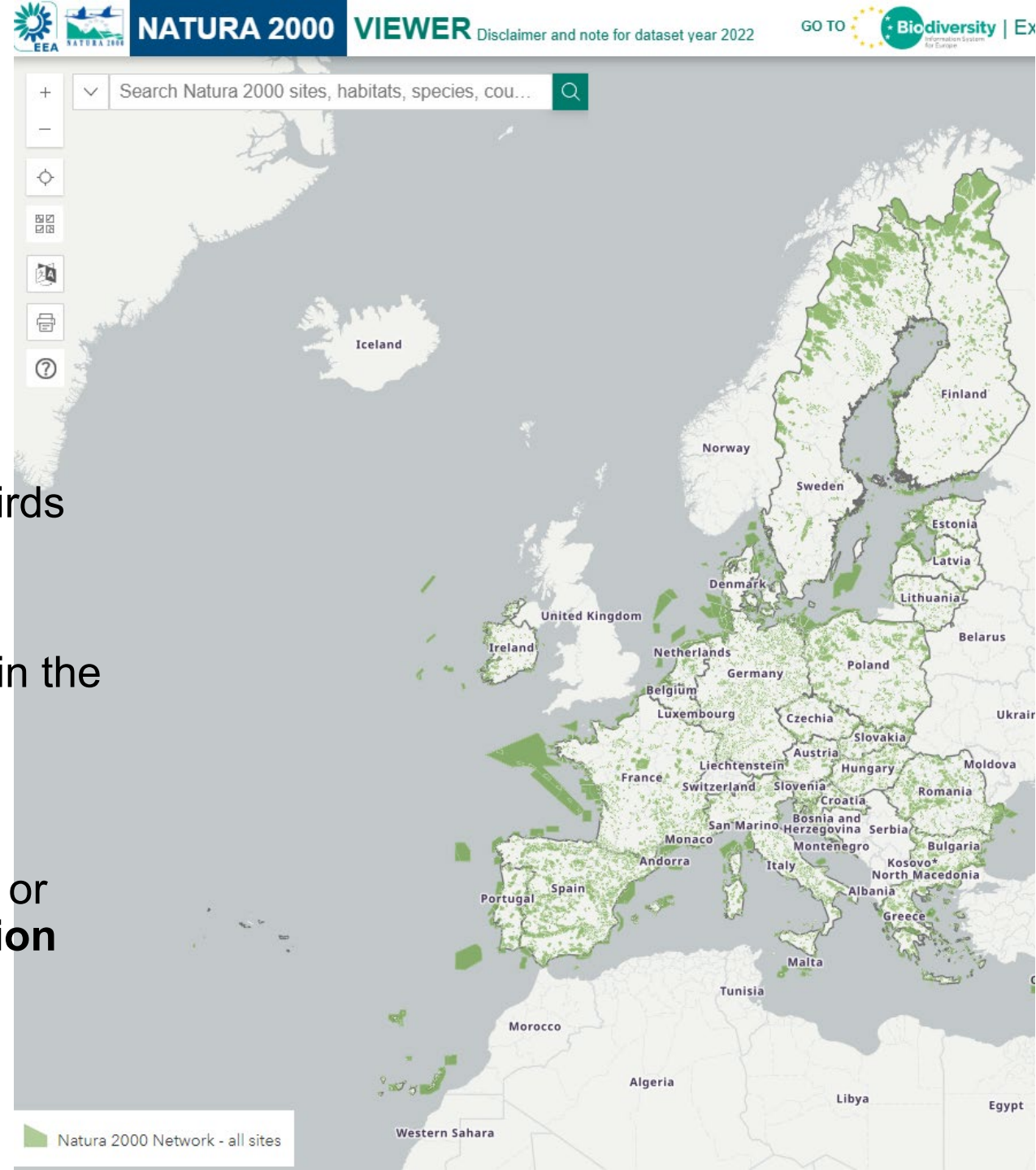
[Habitats Directive](#) (1992, 92/43/EEC)

Concerns 232 Habitats types and thousand of non-birds (fauna/flora) species.

→ The directives aim to maintenance of biodiversity in the European territory

→ Both directives requires the Member States to designate protected sites (**Natura 2000**) to maintain, or where appropriate restore, at a favorable **conservation status** habitats and species.

<https://natura2000.eea.europa.eu>



Nature Restoration Regulation

Restore EU's **land and sea areas**, and define conservation measures

Article 4: Terrestrial, Coastal, and Freshwater Ecosystems

Member States are required to implement restoration measures to improve and re-establish habitats listed in **Annex I of the Habitats Directive**. The targets includes:

- Art 4.1: Restoring at **least 30% of the total area** of these habitats that are not in good condition **by 2030**, with progressive increases to **60% by 2040** and **90% by 2050**.
- Art 4.4: **Re-establish annex I habitats** in areas where it does not occur
- Art 4.7: Ensuring that there is a continuous improvement in the quality and quantity of habitats for species listed in Annexes II, IV, and V of the **Habitats Directive**, as well as for wild birds covered by the **Birds Directive**.



Main usage of geospatial/EO information

Habitats directive

Article 4: MS must identify in their territory Habitats to protect in Natura 2000

→ Opportunity to separate habitats mapping from degradation monitoring

Article 17: MS must report on their protected habitats and species **conservation status**, occurring in their whole territory (including outside Natura 2000).

Resource intensive, sometimes not complete

Article 6.2 (compliance): MS take steps to avoid degradations in Natura 2000 sites. The Commission is interested in detecting signs of degradation.

For grasslands intensification and abandonment are the main pressures leading to the grasslands degradations.



Habitats conservation status

Parameters

Range	<ul style="list-style-type: none">Refers to the geographic extent where the habitat occurs.Criteria: range is stable or increasing.
Area	<ul style="list-style-type: none">The overall surface area occupied by the habitat within its natural range.Criteria: area is stable or increasing.
Structures and functions	<ul style="list-style-type: none">Assesses the qualitative state of the habitat: vegetation composition, ecological conditions (hydrology, substrate), and overall functionality.Includes the availability of elements necessary for long-term survival.Criteria: ecological functions are maintained, with no major pressures.
Future prospects	<ul style="list-style-type: none">Considers trends for the above parameters, as well as threats and conservation measures.Criteria: integrated evaluation of factors influencing conservation in the medium or long term.



Overall conservation status

FV	Favourable ('green')
U1	Unfavourable – Inadequate ('amber')
U2	Unfavourable - Bad ('red')
XX	Unknown (insufficient information to make an assessment)

Habitat assessments at Member State level

Choose a period, a group and then a country. Optionally, further refine your query by selecting one of the available biogeographical regions for that country.

Period...	Group...	Country...	Bio-region...	Filter
2013-2018	Bogs, mires & fens	France	All bioregions	

Note: Rows in italic shows data not taken into account when performing the assessments (marginal presence, occasional, extinct prior HD, information, etc)

Legend: FV Favourable XX Unknown U1 Unfavourable-Inadequate U2 Unfavourable-Bad

Current selection: 2013-2018, Bogs, mires & fens, France, All bioregions.

Member States reports																															
Habitat	Region	Range (km ²)				Area (km ²)								Structure and functions (km ²)					Future prospects				Overall assessment						Distribution area(km ²)		
		Surface	Status (% MS)	Trend	FRR	Min	Max	Best value	Type est.	Method	Status (% MS)	Trend	FRA	Good	Not good	Not known	Status	Trend	Range prosp.	Area prosp.	S & f prosp.	Status	Curr. CS	Curr. CS trend	Prev. CS	Prev. CS trend	Status Nat. of ch.	CS trend Nat. of ch.	Distrib.	Method	% MS
7110 - Active raised bogs	ALP	15600	22.44	=	≈	1	10	N/A	estimate	c	0.11	=	≈	1 - 6	1 - 4	1 - 10	U1	x	unk	poor	poor	U1	U1	=	U1	=	noChange	noChange	11700	a	26.59
7110 - Active raised bogs	ATL	15000	11.29	=	>	50	100	N/A	estimate	c	26.28	-	>	5 - 20	25 - 50	25 - 50	U2	x	good	poor	unk	U2	U2	x	U2	-	noChange	noChange	15100	a	18.06
7110 - Active raised bogs	CON	23600	19.30	=	x	36	60	N/A	estimate	d	32.28	x	>	N/A - N/A	N/A - N/A	36 - 60	FV	+	poor	poor	poor	U1	U1	=	U1	-	noChange	noChange	19300	a	28.81
7110 - Active raised bogs	MED	2000	23.53	=	x	1	9	N/A	estimate	c	78	-	x	1 - 9	1 - 9	1 - 9	U1	u	good	poor	poor	U2	U2	-	U2	-	noChange	noChange	900	a	15
7120 - Degraded raised bogs still ca...	ALP	5100	24.47	=	x	1	10	N/A	estimate	d	1.30	x	x	N/A - N/A	1 - 10	1 - 10	U1	x	poor	poor	poor	U1	U1	x	U1	=	noChange	noChange	3700	b	26.43
7120 - Degraded raised bogs still ca...	ATL	11000	7.73	=	x	10	50	N/A	estimate	c	4.37	=	≈	10 - 25	10 - 25	10 - 25	U1	x	poor	poor	bad	U2	U2	=	U2	-	noChange	noChange	10800	b	13.06
7120 - Degraded raised bogs still ca...	CON	12500	9.21	-	≈	22.40	26	N/A	estimate	c	11.72	u	<	N/A - N/A	22.40 - 26	N/A - N/A	U2	+	unk	unk	good	FV	U2	x	U2	=	noChange	noChange	11300	b	15.80
7120 - Degraded raised bogs still ca...	MED	N/A	0	N/A	N/	N/A	N/A	N/A	N/A	N/A	0	N	N/	N/A - N/A	N/A - N/A	N/A - N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N	N/A	N/A	noChange	noChange	N/A	b	0
7130 - Blanket bog (*active only)	ATL	100	0.06	=	≈	0.06	0.06	N/A	estimate	d	0	=	≈	0.05 - 0.05	N/A - N/A	0.05 - 0.05	FV	x	unk	unk	unk	XX	FV	=	FV	N/A	N/A	N/A	100	a	0.08
7140 - Transition mires and quaking ...	ALP	9500	4.18	=	≈	1	10	N/A	estimate	d	0.03	u	>	1 - 5	1 - 2	1 - 10	U1	x	good	unk	unk	XX	U1	x	U2	=	noChange	noChange	7800	b	4.80
7140 - Transition mires and quaking ...	ATL	11818.25	4.33	=	>	1.65	5.70	N/A	minimum	c	1.76	-	>>	N/A - N/A	N/A - N/A	N/A - N/A	U2	x	unk	bad	poor	U2	U2	-	U2	=	noChange	noChange	12100	b	7.98
7140 - Transition mires and quaking ...	CON	23200	6.34	=	≈	13.53	23.70	N/A	estimate	c	0.48	=	x	N/A - N/A	N/A - N/A	13.53 - 23.70	U1	-	poor	poor	poor	U1	U1	-	U1	-	noChange	noChange	18800	b	8.73
7140 - Transition mires and quaking ...	MED	N/A	0	N/A	N/	N/A	N/A	N/A	N/A	N/A	0	N	N/	N/A - N/A	N/A - N/A	N/A - N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N	N/A	N/A	noChange	noChange	N/A	b	0
7150 - Depressions on peat substrat...	ALP	1400	7.26	=	≈	1	1	N/A	estimate	d	0.48	=	≈	N/A - 0.10	N/A - 0.05	N/A - 0.50	U1	x	good	unk	unk	XX	U1	=	U1	=	noChange	noChange	1200	b	12.77
7150 - Depressions on peat substrat...	ATL	16600	11.18	x	>	N/A	N/A	22	minimum	c	28.81	x	x	21.30 - 21.30	0.40 - 0.40	0.30 - 0.30	U1	x	unk	unk	unk	XX	U1	x	U2	-	noChange	noChange	14900	b	15.54
7150 - Depressions on peat substrat...	CON	12300	18.85	=	≈	8	12	N/A	estimate	d	6.21	-	>	N/A - N/A	N/A - N/A	8 - 12	XX	x	poor	poor	poor	U1	U1	x	U2	-	knowledge	knowledge	10300	b	26.55
7150 - Depressions on peat substrat...	MED	N/A	0	N/A	N/	N/A	N/A	N/A	N/A	N/A	0	N	N/	N/A - N/A	N/A - N/A	N/A - N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N	N/A	N/A	noChange	noChange	N/A	b	0
7210 - Calcareous fens with Cladium...	ALP	4500	28.18	=	>	N/A	11.60	11.60	estimate	c	75.16	-	>	N/A - N/A	N/A - N/A	11.60 - 11.60	XX	-	bad	bad	bad	U2	U2	-	U1	-	noInfo	noChange	2300	a	26.44
7210 - Calcareous fens with Cladium...	ATL	17000	32.79	=	≈	200	500	N/A	estimate	c	81.50	=	<	100 - 300	100 - 200	100 - 200	FV	x	good	good	poor	U1	U1	=	U1	=	noChange	noChange	16700	a	42.82

Monitoring Annex I habitats

EU Grassland Watch: first attempt to go beyond CLMS specifications (EP funded project, EEA+JRC are partners), for **natural/semi-natural** grasslands

- Continuous monitoring from 1994 to now, yearly updates
- Indicators of intensification/abandonment (most important pressure on grassland biodiversity) + last mile application
- Need for community building with Member States experts: appropriation + co-creation

EU Wetland Watch: Similar approach for wetlands

- methodology: start from policy needs, define wetlands typical pressures and their proxies
- Work led by JRC Knowledge Centre on Earth Observation (KCEO)



In situ information are essential!

First objective: Training / Validation

Not enough in-situ data ready to be used

Second objective: combine EO with in-situ data (in particular on species) to better assess conservation status



In situ data: 2 Horizon projects

Biodiversity Meets Data (BMD), KO 4/03/2025

Answer the question: can we create an EU-wide IT platform, for biologists collecting in-situ data, offering data hosting, data processing (imagery, sound, eDNA, etc), and data sharing?

- Support biodiversity experts, but also EU projects (LIFE, Horizon), national projects, etc.
- Encourage normalisation (data cube, normalised taxonomy), and good practices
- Simplify data exchange (and access for Cal/Val), and encourage cross-domain research

BioDiMoBot: KO 5/02/2025 – Robotic solution, long time drifting solution (days/weeks/months), collecting water biodiversity + water properties (physical and chemical)
– on-board pre-processing, data transfer to BMD

- in-situ data intensification



Thank you



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Land Monitoring

Copernicus Land Monitoring Service for Biodiversity

Biospace 25 – ESRIN, Frascati

Usue Donezar Hoyos, Andreas Brink

12 February 2025



Essential Biodiversity Variables

- variables to measure biodiversity change
- distill the complexity of biodiversity into a manageable list of priorities
- coordinated approach to observing biodiversity on a global scale from Earth Observation and In Situ measurements
- promoted by GEO BON

GEO BON, 2024



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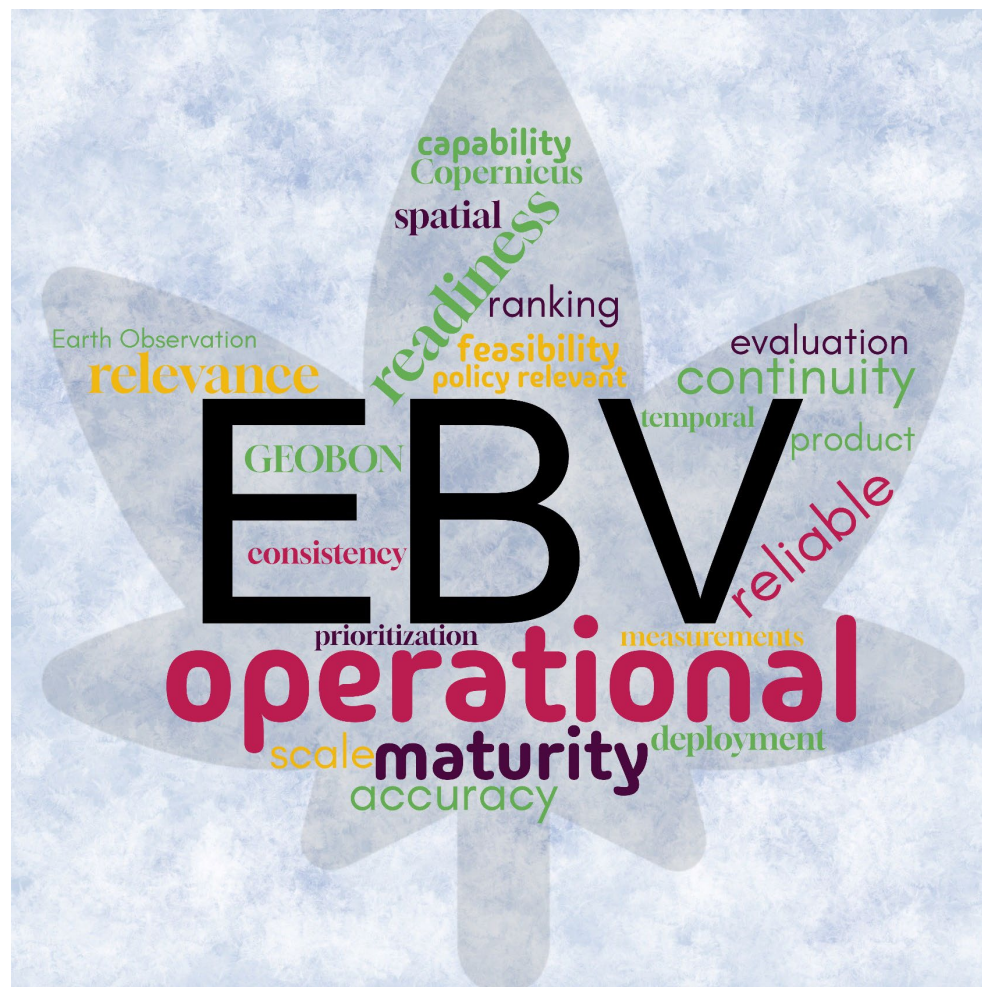
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Needs and Requirements



Skidmore, A.K. et. al (2021). Priority list of biodiversity metrics to observe from space. Nature Ecology & Evolution, Vol. 5, July 2021, 896–906



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Earth Observation based EBV's

FIT4PURPOSE	Criteria	Description
	Relevance	Use and user fully identified
	Feasibility	Maturity of the science, technology and availability of remote sensing data, the ease of access and the completeness to such data
	Remote sensing status: Accuracy	Effectiveness of remote sensing data and techniques to achieve an accurate and precise value of the remote sensing-enabled biodiversity product
	Remote sensing status: Maturity	Operational implementation

Modified from: Skidmore, A.K. et. al (2021).

Ranking remote sensing biodiversity products

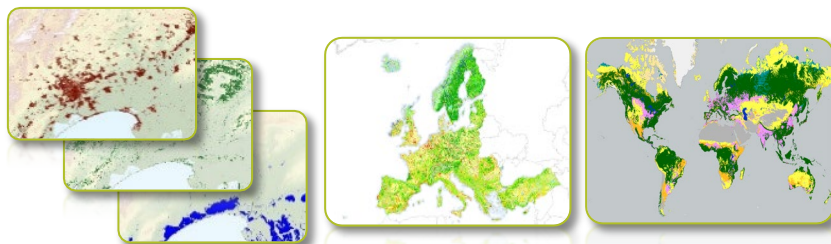
COPERNICUS LAND MONITORING SERVICE	RS biodiversity product	RS -enabled biodiversity variable	EBV class	Rank within EBV class	Rank across all EBV classes
	Fire disturbance	Ecosystem disturbance Habitat structure	Ecosystem function Ecosystem structure	1 1	1 1
	LAI	Ecosystem physiology Habitat structure Species physiology	Ecosystem function Ecosystem structure Species traits	3 3 1	5 5 21
	Land cover (vegetation type)	Habitat structure	Ecosystem structure	3	5
	Ice cover habitat	Habitat structure	Ecosystem structure	5	8
	Net primary productivity (NPP)	Ecosystem physiology Species physiology	Ecosystem function Species traits	5 2	11 28
	Gross primary productivity (GPP)	Ecosystem physiology Species physiology	Ecosystem function Species traits	5 2	11 28
	Fraction of absorbed photosynthetically active radiation (FAPAR)				
	Fraction of vegetation cover	Habitat structure	Ecosystem structure	7	11
	Peak, start, end of season	Ecosystem Phenology	Ecosystem function	8	22
Ecosystem soil moisture	Ecosystem physiology	Ecosystem function	14	28	



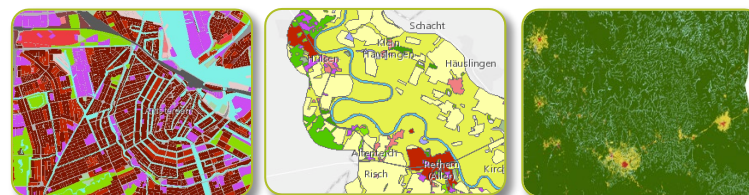
Copernicus Land Monitoring Service - products



**Land cover and
land use mapping**



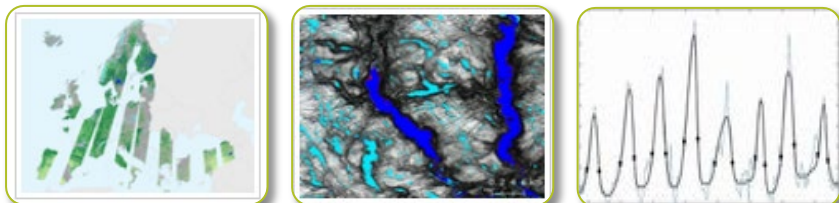
**Priority area
monitoring**



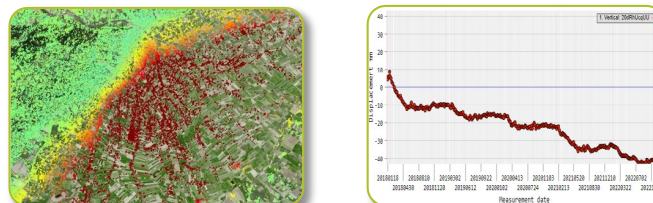
Satellite data



**Bio-geophysical
parameters**



**Ground motion
monitoring**



**Reference and
validation data**



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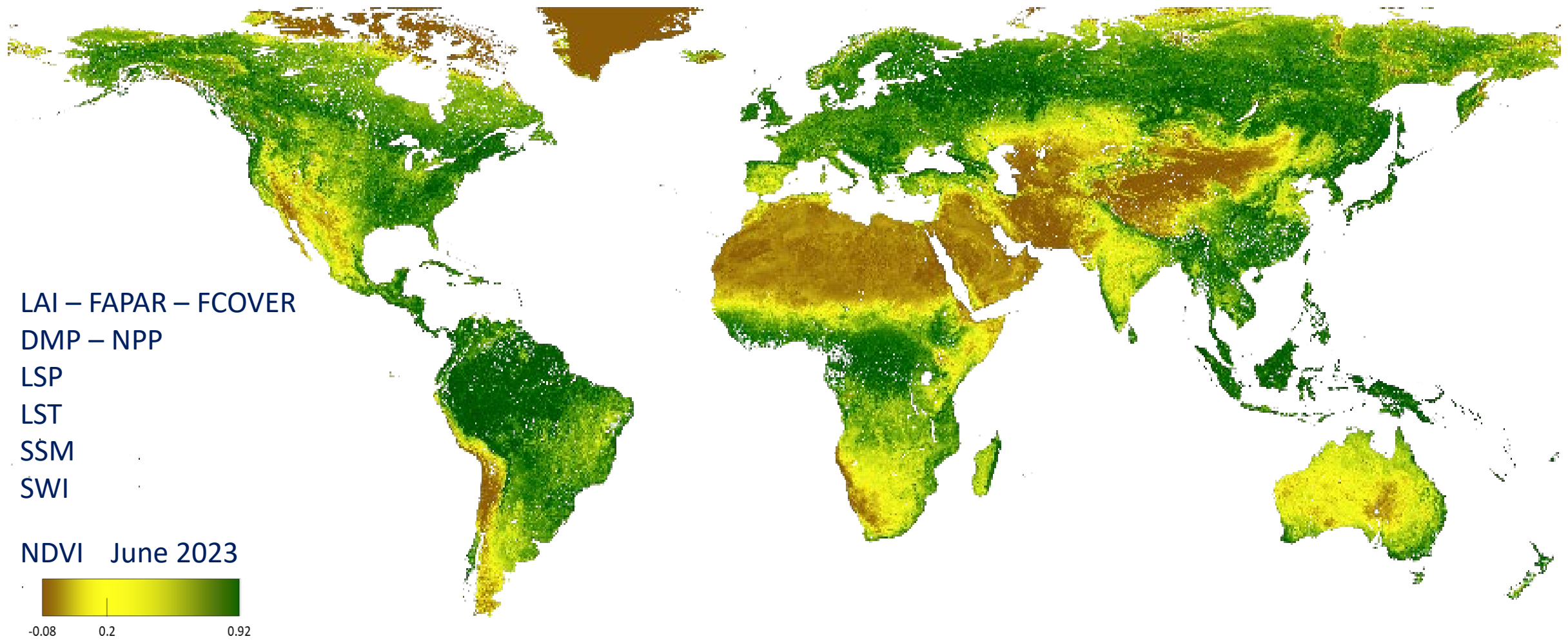
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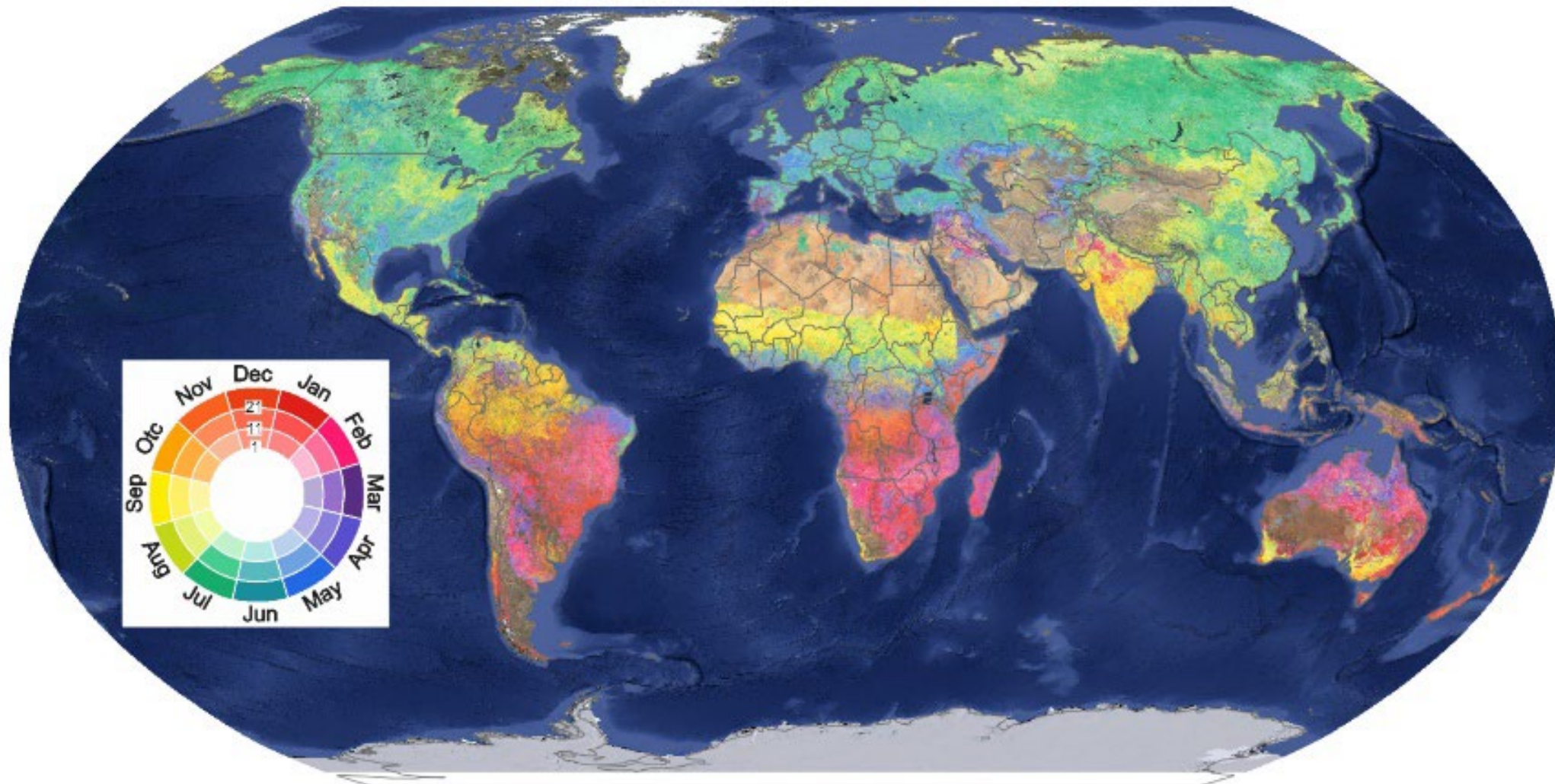
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Global biophysical variables



Land Surface Phenology



Date of the peak of growing season - 2023



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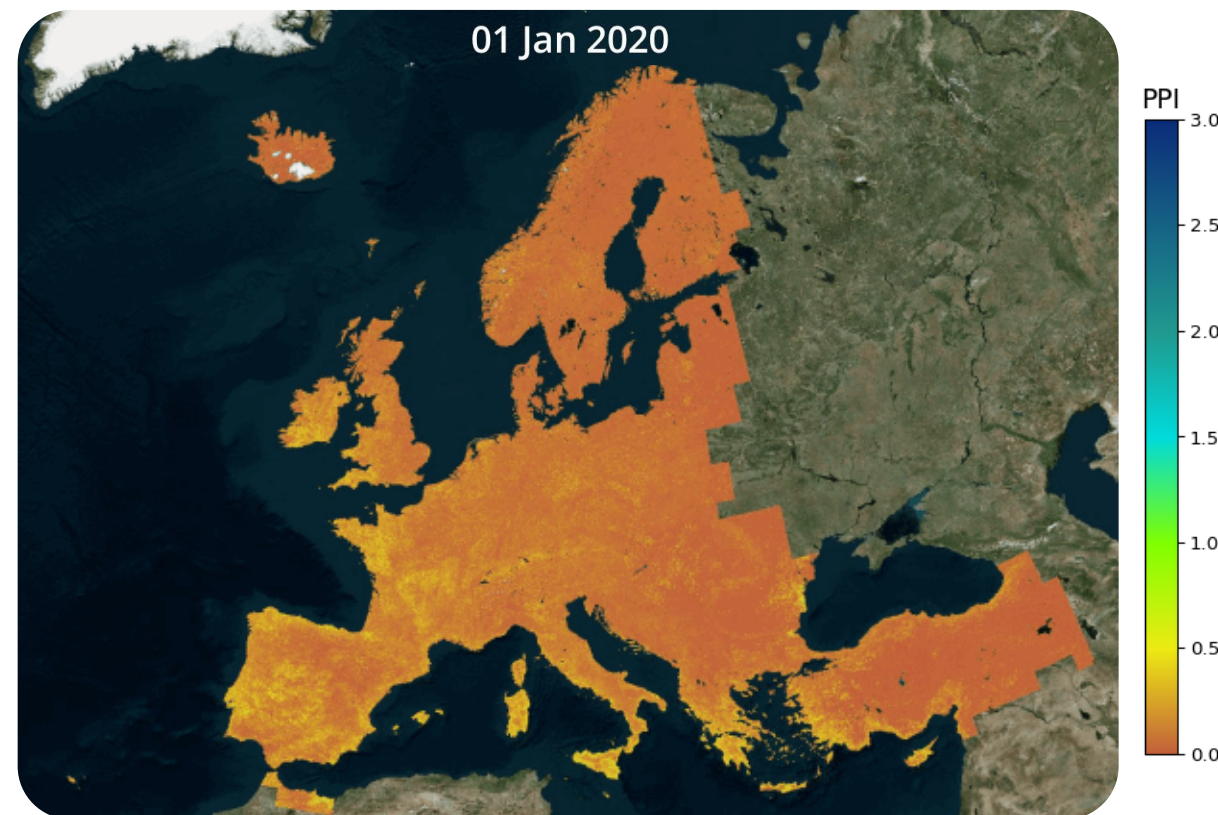


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HR Vegetation Phenology & Productivity

- 10 meter annual processing of 13 metrics.
- **Near Real-Time:** vegetation indices & biophysical variables
- **Future prospects:**
 - Tree Cover Disturbances
 - Biomass Productivity (GPP/NPP)



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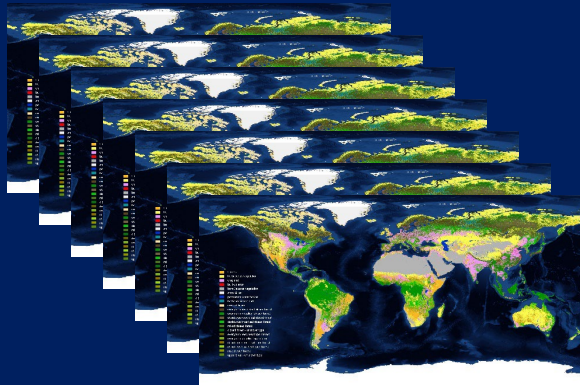
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Global Land Cover

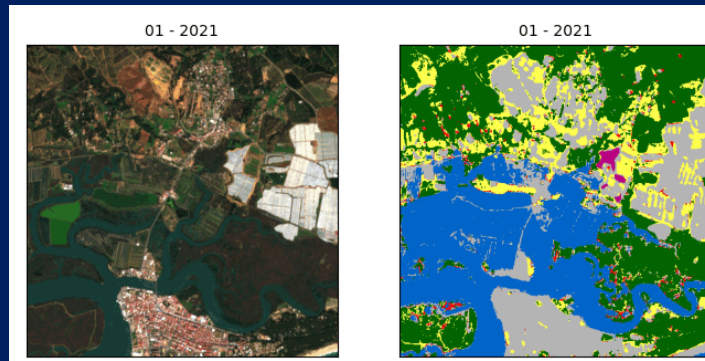
CONTINUE

- Continuation of 100m global LC
- Yearly updates (2020-2026)



ENHANCE

- Spatial resolution: towards 10 m
- Temporal resolution: towards monthly and NRT
- Improved accuracy
- Consistent change mapping



EXTEND

- Sub-annual products
- Specific Tropical Forest Products (TCD, TCPC)



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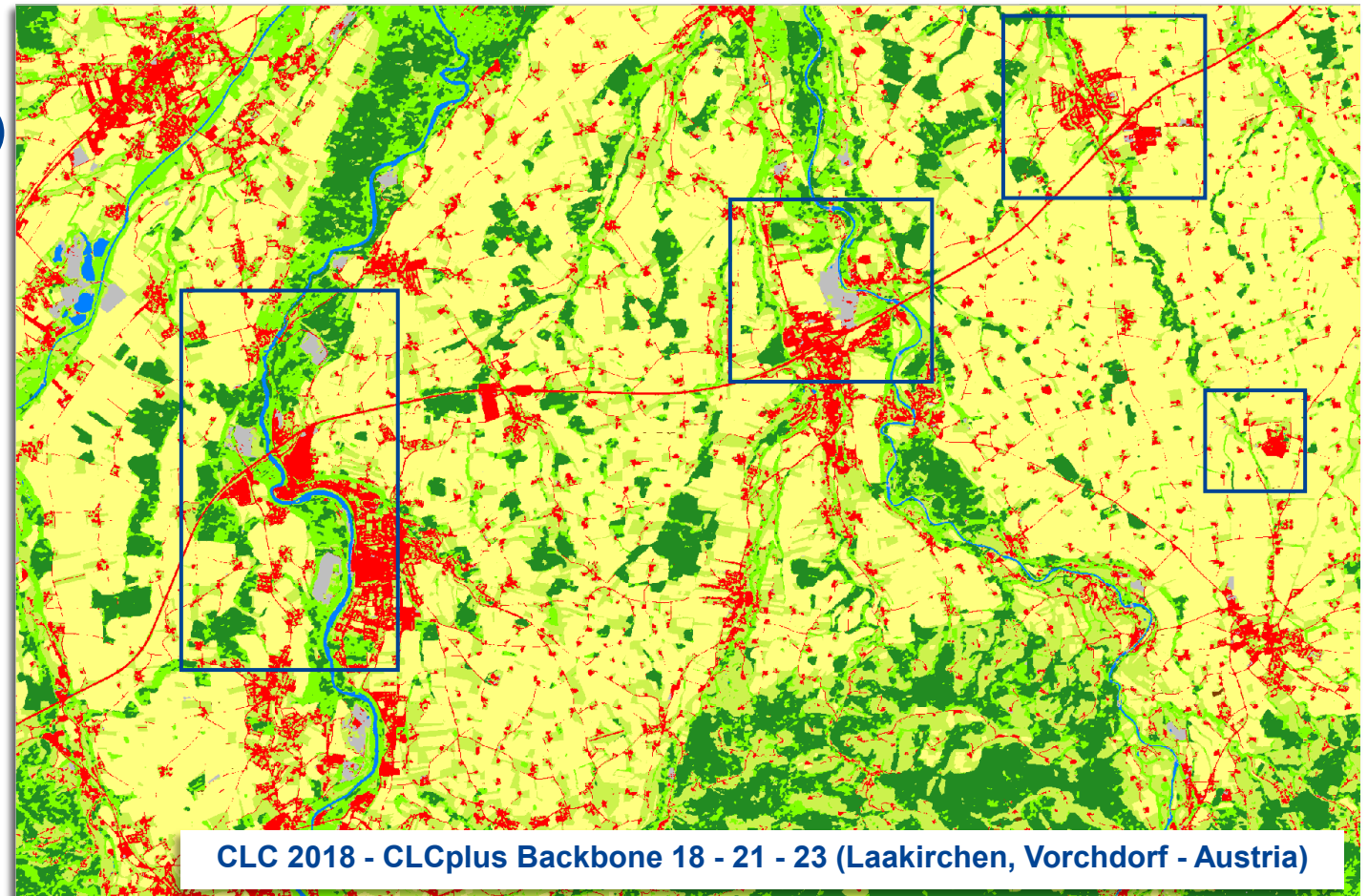
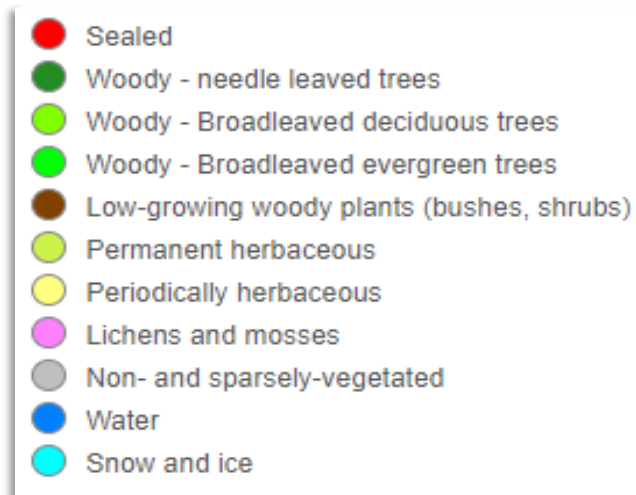


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CLCplus Backbone

- High-resolution land cover status (10m)
- Timely availability (reference yr + 1yr)
- 11 basic land cover classes



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HRL – Tree Cover & Forests

- **Tree Cover Density (TCD)**
 - 0 – 100 % canopy density;
 - 10 meter resolution for EEA38/9;
 - Annual;
 - overall >90% accuracy with high spatial consistency.
- **Dominant Leaf Type (DLT)**
 - Coniferous / Broadleaved classification;
 - 10 meter resolution for EEA38/9;
 - Annual
- **Forest Type (FTY)**
 - Coniferous / Broadleaved classification;
 - FAO forest definition, filtering:
 - >10% TCD;
 - <0.5 ha MMU;
 - trees in agricultural and urban context (from CLC and HRL Imperviousness)
 - 10 meter resolution for EEA38/9;
 - 3 Year



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HRL Grassland

- **Grassland Status (GRA)**
 - Binary
 - Annual
- **Herbaceous (HER)**
 - Annual
 - Binary (Permanent & Temporary)
- **Ploughing Indicator (PLOUGH)**
 - Annual
 - 0 – 6+ years since identified last ploughing
- **Grassland Change (GRAC)**
 - 3-yearly
 - Classified (Gain/Loss)
- **Grassland Mowing (GRAM)**
 - Annual
 - **Events (GRAM-E)**
 - 0 – 4+ identified events
 - **Dates (GRAM-D)**
 - Four layers. One for each event
 - Day-of-Year



2012

2015

2017

2018

2020

2021

2022

2023



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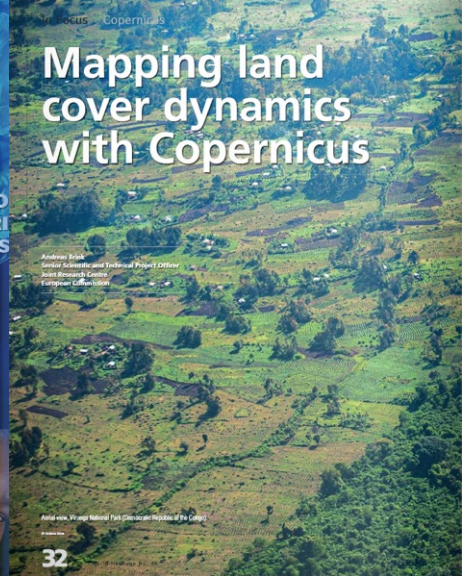
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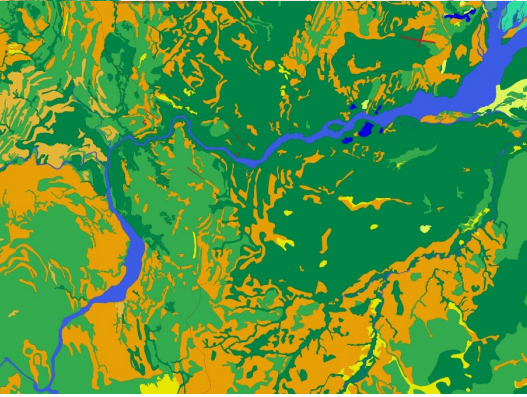
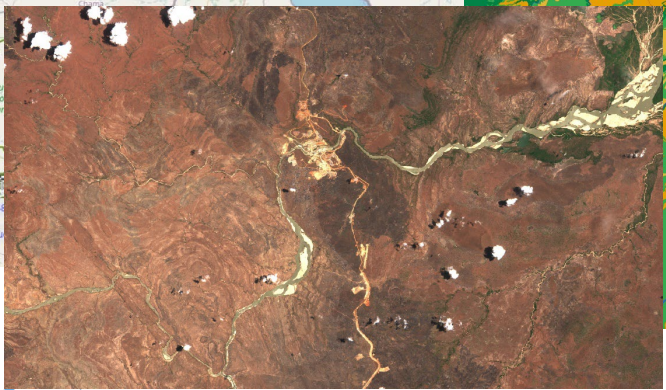
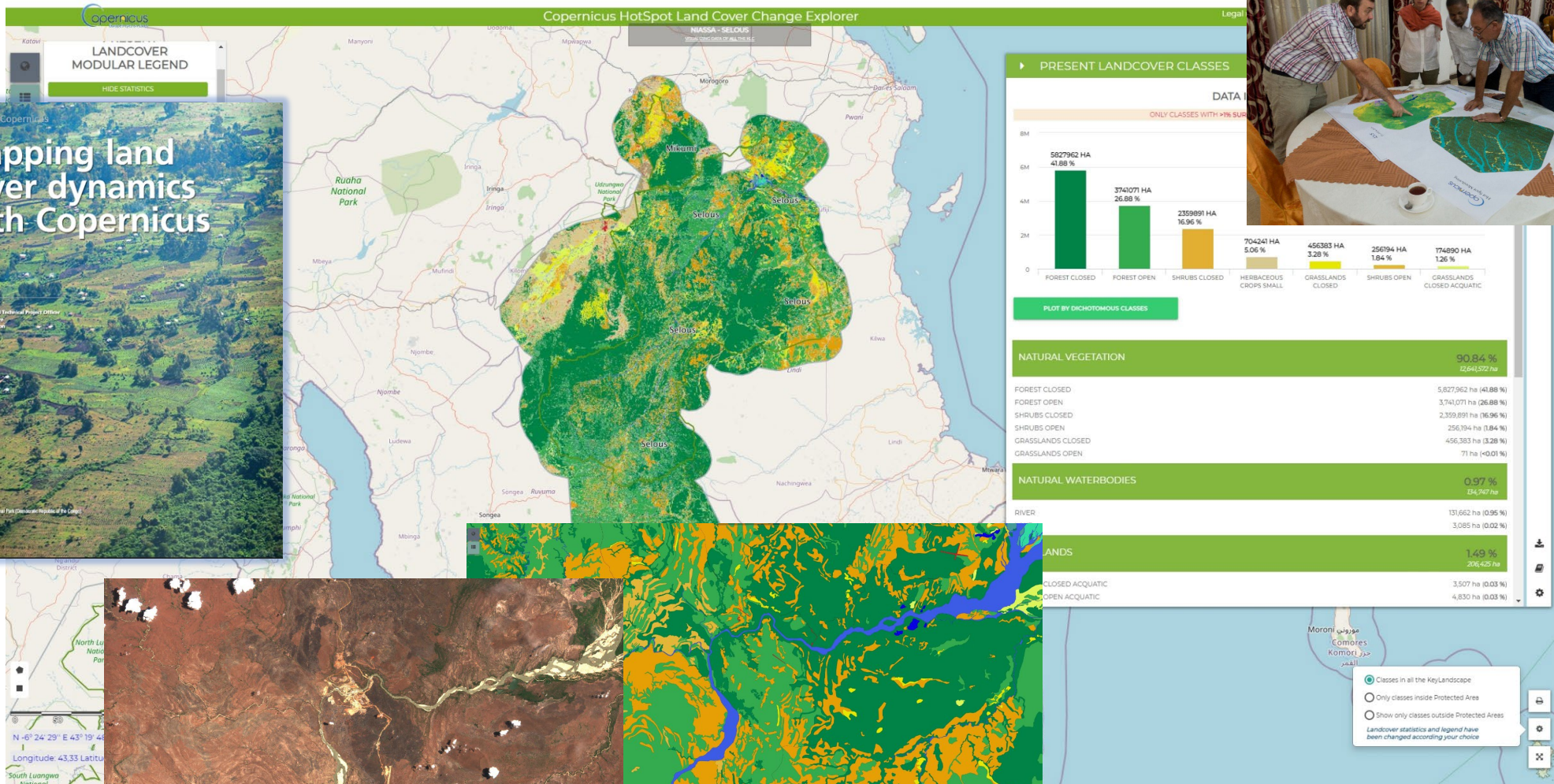
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Hot Spot Monitoring - Biodiversity



NaturAfrica
The Green Deal approach for EU support to biodiversity conservation in Africa



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Priority Area Monitoring

Urban Atlas

2006-12-18-21-24



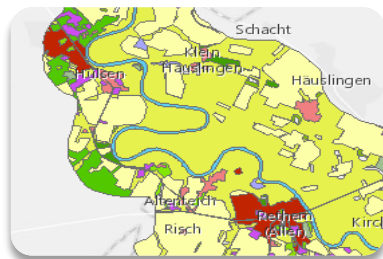
Protected Areas

2006-12-18-21-24



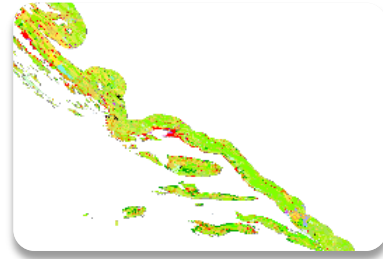
Riparian Zones

2012-18-21-24

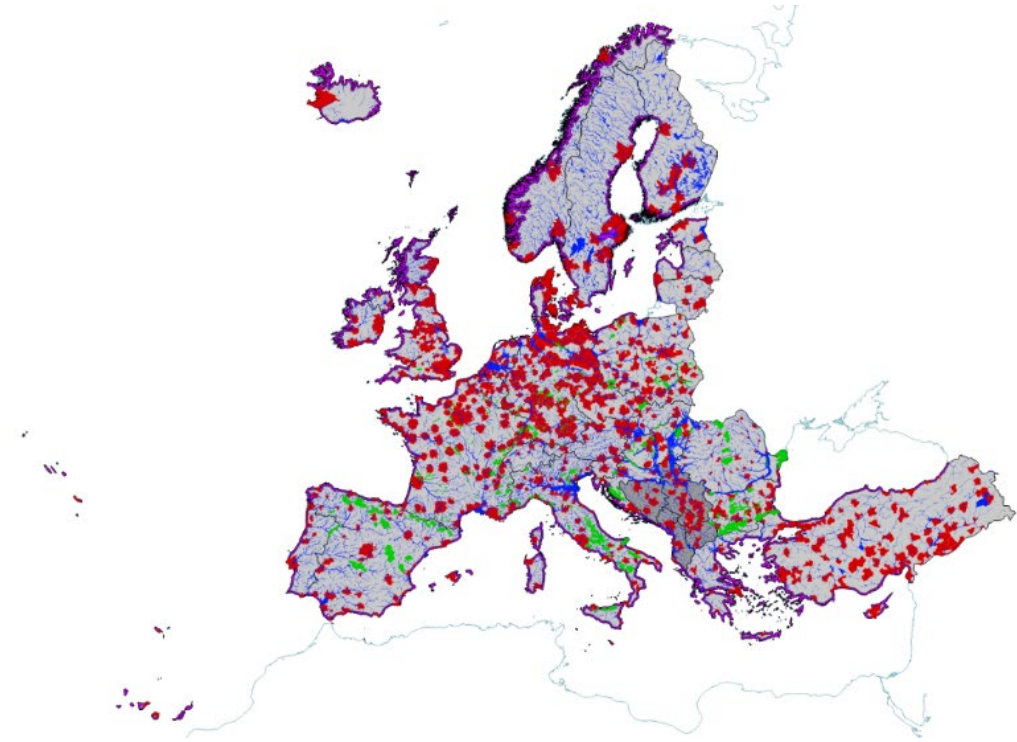


Coastal Zones

2012-18-21-24



- Vector based VHR LC/LU mapping of priority areas
- MMU 0.5 ha
- Tailored nomenclature
- Update on a 6/3 year cycle: status and change mapping



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Copernicus for CBD GBF Goals / Targets and SDG

FIT4PURPOSE
Relevance – Feasibility – Accuracy – Maturity

EBV class	Remote sensing biodiversity product	Aichi targets	SDG targets
Ecosystem Structure (an ecological structure that can be monitored at a global level)	Fire disturbance	7,9,10,12,14,15	15.2, 15.3
	LAI	5,7,9,10,12,14,15	15.2, 15.3, 15.5
	Land cover (vegetation type)	5,7,9,14,15	15.2, 15.3, 15.5
	Ice cover habitat	5,7,9,14,15	15.2, 15.3, 15.5
Species Traits (trait of an organism of known species that can be monitored at a local level)	Peak, start, end of season	5,7,9,12,14,15	15.4
	Gross primary productivity (GPP)	5,7,9,10,12,14,15	15.4
	Net primary productivity (NPP)	5,7,9,10,12,14,15	15.4
	LAI	5,7,9,10,12,14,15	15.4
Community Composition (composition of a community that can be monitored at a global level)	Peak, start, end of season	5,7,9,12,14,15	15.4
Ecosystem Function (an ecological function monitored over time at a global level)	Peak, start, end of season	5,7,9,12,14,15	15.4
	Gross primary productivity (GPP)	5,7,9,10,12,14,15	15.2
	Net primary productivity (NPP)	5,7,9,10,12,14,15	15.2
	LAI	5,7,9,10,12,14,15	15.2
	Evapotranspiration	5,7,10,12,14,15	15.2
	FAPAR	5,7,10,12,14,15	15.2
	Ecosystem soil moisture	5,7,10,12,14,15	15.2
	Fire disturbance	7,9,10,12,14,15	15.2, 15.3

Modified from: Skidmore, A.K. et. al (2021).



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Marine Monitoring

Advancing marine monitoring and protection with Copernicus Marine

Tina Silovic et al.- Mercator Ocean International



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Copernicus Marine Service



Services Opportunities Access Data Use Cases User Corner About

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Copernicus Marine Service
 Providing free and open marine data and services to enable marine policy implementation, support Blue growth and scientific innovation.

Access Data

- DATA**
OCEAN PRODUCTS
 A robust ocean data catalogue, to download or visualise data including hindcasts, nowcasts and forecasts.
- EXPERTISE**
OCEAN STATE REPORT
 Extensive annual analysis on the state of the ocean over nearly 20 years and severe/notable annual events.
- TRENDS**
OCEAN CLIMATE TRENDS
 Monitoring the health of the ocean.
[Ocean Monitoring Indicators](#)
[Ocean Climate Portal](#)
- EXPLORATION**
OCEAN VISUALISATION
 Dive into our 4D digital oceans through our 3 visualisation tools for beginner, intermediate and advanced users

Copernicus Ocean State Report 8 Release



The 8th issue of the EU Copernicus Ocean State Report (OSR) is now available online, along with an interactive Summary for policymakers. The OSR 8 is a flagship report of the EU Copernicus Marine Service, funded by the European Union and coordinated by Mercator Ocean International, and provides a comprehensive overview on the state, variability and change of the global ocean for scientists, members of the blue economy, decision makers and the general public. The OSR 8 has been established under international scientific collaboration, with contributions from over 120 participants.

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Copernicus Marine Portfolio



COPERNICUS MARINE REGIONAL OCEAN PRODUCT DIVISIONS

- 1 Global Ocean
- 2 Arctic Ocean
- 3 Baltic Sea
- 4 European North West Shelf Seas
- 5 Iberian Biscay Ireland Seas
- 6 Mediterranean Sea
- 7 Black Sea



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Copernicus Marine Products – Green Ocean



MODEL



SATELLITE



IN SITU

Chlorophyll & Primary Production

Ocean Acidification
Ocean Carbon Uptake

Ocean Deoxygenation

GREEN OCEAN

Describes the biological and biogeochemical state of the ocean

EXAMPLES OF OTHER VARIABLES INCLUDED IN OUR PORTFOLIO:



REFLECTANCE



PHOTOSYNTHETICALLY ACTIVE RADIATION



PHYTOPLANKTON SIZES CLASS TYPES



DISSOLVED ORGANIC CARBON

100m a 25 km

Hourly, daily,
monthly, yearly

10 days
forecasts

Time series up to
30 years

Updated daily



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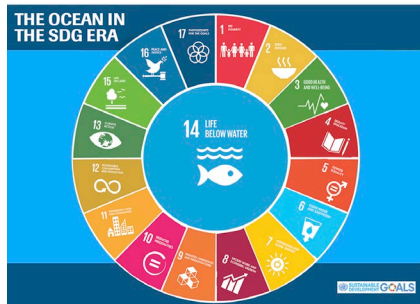


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Supporting wide range of applications



Ocean Health



Marine Conservation & Biodiversity

von Schuckmann et al., *Marine Policy* Vol 121, 2020, 104154

- | | | |
|---|---|--------------------------------------|
| 1 POLAR ENVIRONMENT MONITORING | 5 SCIENCE & INNOVATION | 9 MARINE FOOD |
| 2 CLIMATE & ADAPTATION | 6 POLICIES & OCEAN GOVERNANCE & MITIGATION | 10 COASTAL SERVICES |
| 3 OCEAN HEALTH | 7 EDUCATION, PUBLIC HEALTH & RECREATION | 11 TRADE & MARINE NAVIGATION |
| 4 MARINE CONSERVATION & BIODIVERSITY | 8 EXTREMES, HAZARDS & SAFETY | 12 NATURAL RESOURCES & ENERGY |



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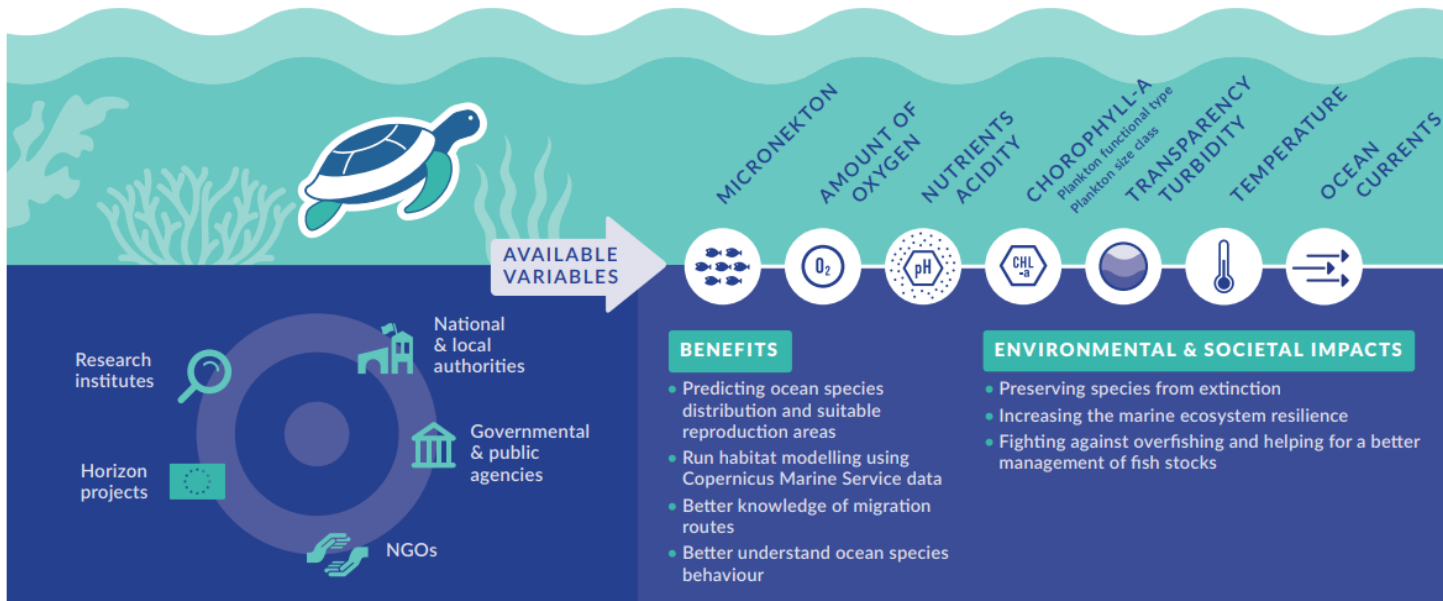


Implemented by **MERCATOR OCEAN INTERNATIONAL**



MARINE CONSERVATION & BIODIVERSITY

The Copernicus Marine Service provides key data to monitor marine biodiversity and Marine Protected Areas, preserving at-risk ecosystems.





Conservation & Biodiversity - USE CASES



Use Cases

Home > Services > Use Cases

Region: All Country: All Markets: Marine Conservation & Biodiversity

Mobile Application Demo

Search

SEAPODYM - Evaluating Conservation Impact of Marine Protected Areas for Pacific Tunas

SEA CLEARLY - A tool to assess ocean plastic transport on and by aquaculture farms

Real-time assessment of MPAs with marine megafauna movements and bio-physical ocean variables

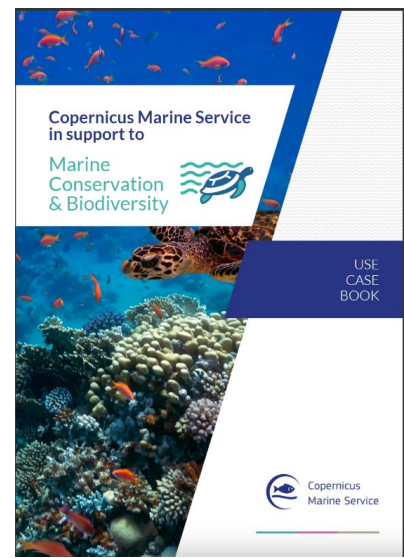
Enhancing traceability and tracking in Aquaculture and fisheries supply chain through the use of blockchain and earth observation

T-MEDNet - Tracking the effects of climate change in the Mediterranean

The MarCOSouth Western Indian Ocean Coral Bleaching Monitoring Service

From open data to marine knowledge: A service for augmented data access and reproducible data analysis

TURTLES: Effects of swimming behaviour and oceanography on sea turtle hatchling dispersal





Challenges for Conservation & Biodiversity

OCEAN ACIDIFICATION

UNITS: pH units/decade **TIME:** 1985–2022 Ocean and Water

*A decrease in pH denotes an Increase in ocean acidification.

Global Ocean	Northeast Atlantic and Adjacent Seas
-0.017 ±0002 pH units/decade	-0.017 ±001 pH units/decade

- CHALLENGES:**
- > Increasing Pollutions
 - > Over – fishing
 - > Heatwaves
 - > De-Oxygenation
 - > Ocean acidification
 - > Loss of Habitats

OCEAN ACIDIFICATION: THE OCEAN IS BECOMING MORE ACIDIC

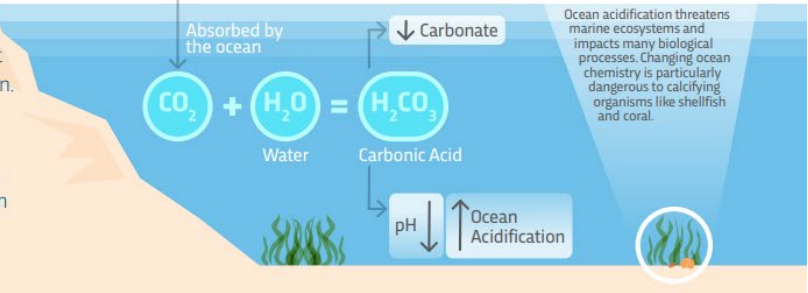


CO₂ Atmospheric Carbon Dioxide



The ocean is a major sink of anthropogenic excess CO₂. This absorption of carbon mitigates the effects of global warming, but it also results in a major threat to marine life — ocean acidification.

The pH of contemporary surface ocean waters is already 0.1 pH units lower than in pre-industrial times. As pH is logarithmic, this 0.1 pH unit change is equivalent to a nearly 30% increase in ocean acidity since pre-industrial times.

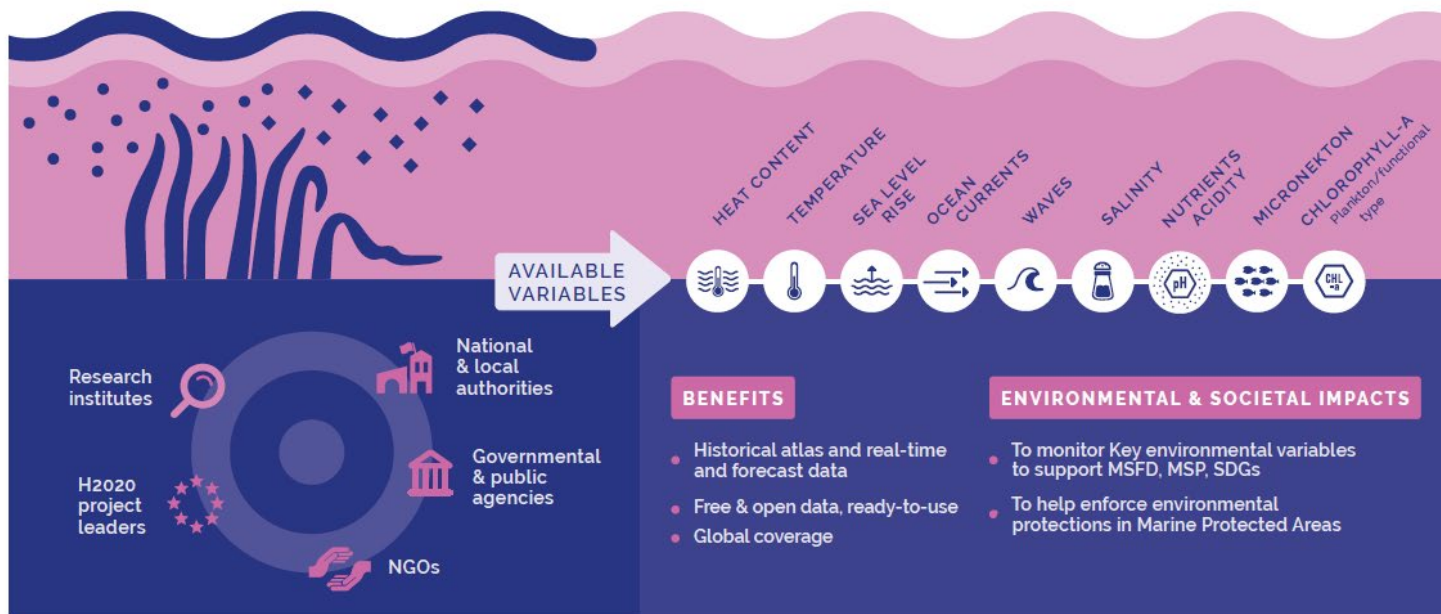


- GOALS:**
- > Protected marine biodiversity
 - > Sustainable exploitation of marine resources
 - > Environment policies



POLICIES & OCEAN GOVERNANCE & MITIGATION

Copernicus Marine Service provides key data to support European Member States in the implementation of European Directives (MSFD, MSP, SDG). It also supports Marine Protected areas to preserve at-risk and coastal ecosystems.





BLUE OCEAN

Currents, temperature, waves, sea level, ...



WHITE OCEAN

Ice coverage, velocity, concentration, Icebergs ...



GREEN OCEAN

CO₂, nutrients, oxygen, primary production, ...

Copernicus Marine Service in COPERNICUS 2:

Continuity of the Blue/White/Green Offer

+ a series of major evolutions developed depending on priorities & budget

Coastal



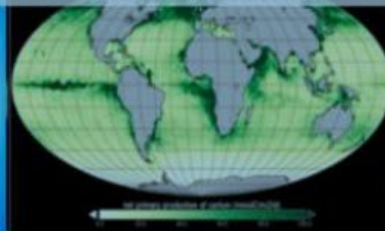
Arctic



Marine Biology



Ocean Climate



Digital services





Gathering and processing of new biogeochemical and biology *in situ* and **satellite observations**

- **New processes** in biogeochemical models (benthic/pelagic coupling, riverine inputs).
- **Ecosystem modelling** (low →mid→ high tropic level) – NECCTON project
- **Assessing scenarios** for climate change impacts on stocks and protected species – SEACLIM project
- **Digital Twin of the Oceans** (DTOs) includes ecosystem models and data, what-if scenarios.

Inform marine biodiversity and food resource management

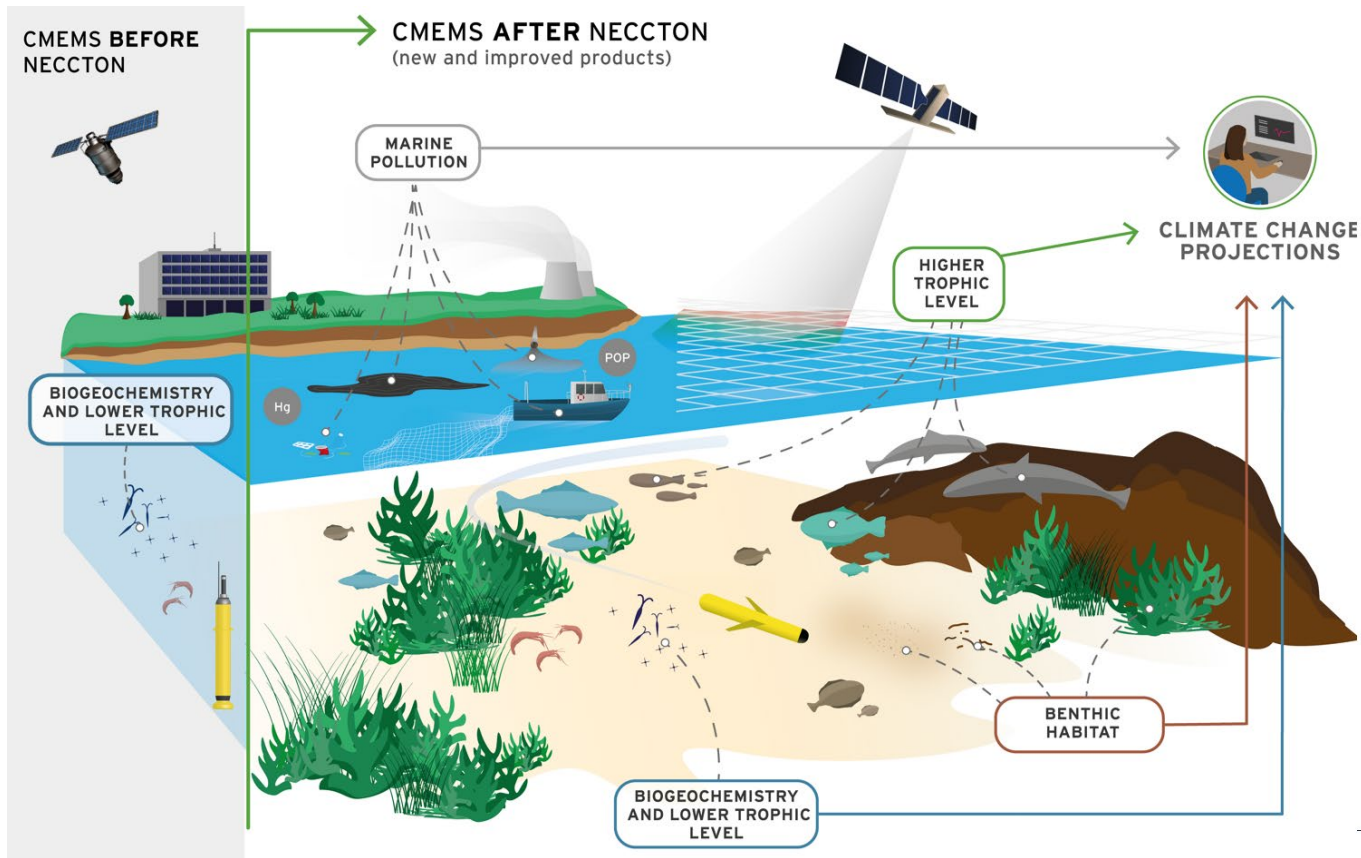


Convention on Biological Diversity





Towards a new offer for marine biology



NECCTON

neccton.eu

PI: Stefano Ciavatta, MOI



→ enable CMEMS to inform marine biodiversity conservation and food resources management, by fusing innovative ocean ecosystem models and new data



NECCTON products

Pelagic Biogeochemistry

- Mesozooplankton biomass
- Micronekton biomass
- Suspended particulate matter (SPM)
- POM (Particulate Organic Matter)
- DOM (Dissolved Organic Matter)
- Reflectance

Benthic

- O₂ near bottom
- pH near bottom
- Light at bottom
- CO₂ flux to bottom
- Carbon in sediment
- Macrozoobenthos
- Benthic flora
- Sedimentary rates

Nekton

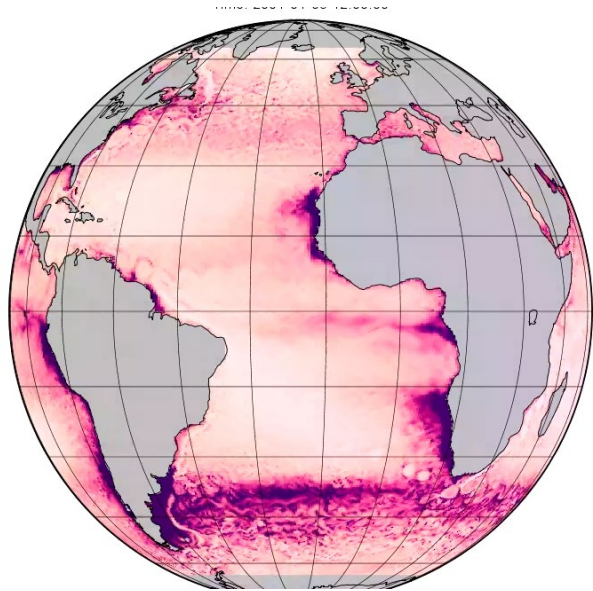
- Small-pelagic biomass
- Large pelagics biomass
- Marine mammals
- Unspecified fish and biomass
- Higher Trophic Level Habitat
- Demersal fish

Stressors

- Plastic
- Persistent Organic Pollutants
- Mercury
- Oil
- Fisheries pressure
- Climate change stressor index
- Stressors
- Multi-stressor index



New essential ocean variables (EOVs)



GLORYS Ocean physics reanalysis + PPsat (or BGCH model) = zooplankton

Products 1



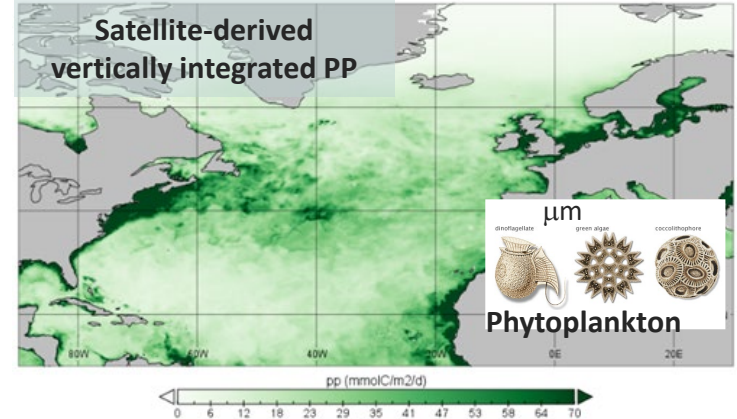
Global ocean low and mid trophic levels biomass content hindcast
GLOBAL_MULTIYEAR_BGC_001_033
Models
Global, 0.083° × 0.083° × 3 levels
1 Jan 1998 to 31 Dec 2023, daily
Temperature, velocity, nekton, plankton, optics

Season and year had no effect on 40-Hz calling rates, but prey biomass did, confirming its food-associated function for the first time..

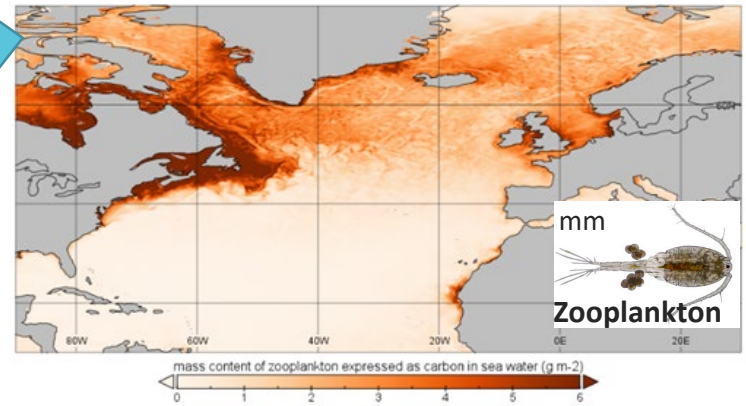
Food talk: 40-Hz fin whale calls are associated with prey biomass

Miriam Romagosa¹, Sergi Pérez-Jorge¹, Irma Cascão¹, Helena Mourão², Patrick Lehodey³, Andreia Pereira⁴, Tiago A. Marques^{5,6}, Luís Matias⁴ and Mónica A. Silva¹

2019 - Nov 1: satellite derived NPP



2019 - Nov 1: predicted biomass of zooplankton

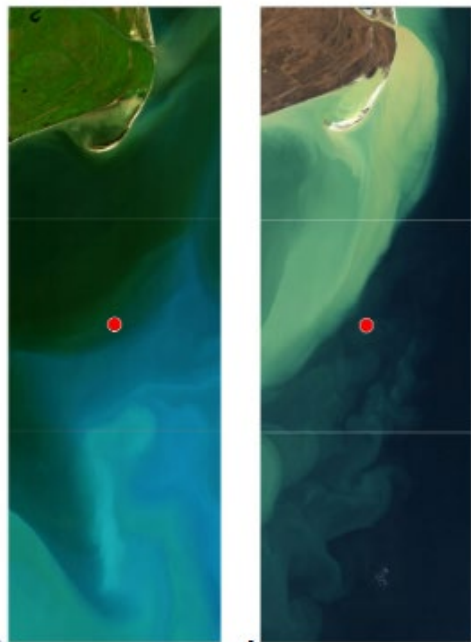




NECCTON D4.2 Assessment of L2 PRISMA production chain, outputs and transferability

Braga, Federica (Researcher)¹ ; Profeti, Giuliana (Researcher)¹ ; Lazzari, Paolo (Researcher)² ; Alvarez, Eva (Researcher)³ ; Marco Scarpa, Gian (Researcher)⁴ ; Manfè, Giorgia (Researcher)¹ ; Gonzalez Vilas, Luis (Researcher)⁵ ; Sikakala, Jozef (Researcher)⁶ ; Brando, Vittorio (Researcher)¹

Show affiliations

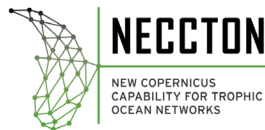


- ✓ PRISMA (PRecursores IperSpettrale della Missione Applicativa) is a hyperspectral imaging mission launched by the Italian Space Agency (ASI)
- ✓ covers a spectral range of 400–2500 nm with high spatial resolution
- ✓ **potential** for enhancing the understanding of aquatic ecosystems through hyperspectral imaging, (→advanced atmospheric correction algorithms tailored for marine and coastal environments are necessary)
- ✓ PACE compared with in situ hyperspectral data from WATERHYPERNET to test the transferability of the validation approach
- ✓ **outcome:** integration of PRISMA data with biogeochemical models can enhance the description of plankton and optically active properties



Major evolutions planned in Copernicus 2 (2021-2028) via R&D projects (Horizon) will expand marine biodiversity monitoring and protection supporting EU policy needs

- ✓ Gathering and processing new biogeochemical and biology in situ and **satellite observations**
- ✓ **Data assimilation** of new satellite products (including biogeochemistry and biology)
- ✓ **Habitats for key protected species** (e.g. marine mammals), **Marine Protected Areas** design.
- ✓ Assessing scenarios for climate change impacts on stocks and protected species.
- ✓ **Critical role** of present (S2, S3) and future (**CHIME, S2NG, S3NG**) **Sentinel missions** and in-situ observations (e.g. acoustic data, plankton imaging, omics, pollutants, plastic, fish surveys and landings)
- ✓ **Digital Twin of the Oceans** (DTOs) includes ecosystem models and data, MPAs DTO, what-if scenarios





Marine Monitoring

THANK YOU



Copernicus Marine Service



Newsletter

tsilovic@mercator-ocean.fr



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BioSpace25 - Biodiversity insight from Space
10 - 14 February 2025 | ESA-ESRIN | Frascati - Italy



Copernicus Climate Change Service (C3S) for Biodiversity

Samuel Almond (& C3S)
European Centre for Medium Range Weather Forecast / Copernicus Climate Change Service (C3S)



Climate
Change

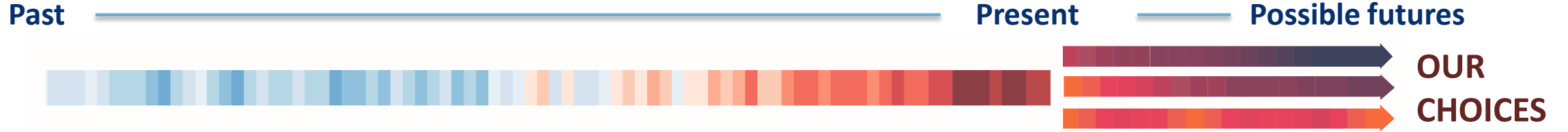
Climate Change & Biodiversity – Context

- Climate change is playing an increasingly important role in the decline of biodiversity.
- Large changes in biodiversity are expected to occur if climate change continues at its current pace
- Climate change has shown to impact the health of ecosystems, influencing shifts in the distribution of plants, pest & disease, animals, and even human settlements.
- Climate change affects:
 - ecosystem dynamics, ecosystem structure, function and health
 - Distribution and abundance of species and habitats
 - Intensity and frequency climatic extremes - fires, storms & periods of drought.
- Ecosystem structure, landscape phenology, community composition, ecosystem function and species populations are all essential biodiversity variables (EBVs) which can be monitored with remote sensing biodiversity products (Skidmore et al. 2021) and Copernicus products
- Copernicus Climate Change Service, and its data can play a key role in adaptive ecosystem management



Climate Change

CLIMATE DATA FOR BIODIVERSITY



C3S PRODUCTS

Observations



Reanalysis



Seasonal to decadal predictions



Climate projections



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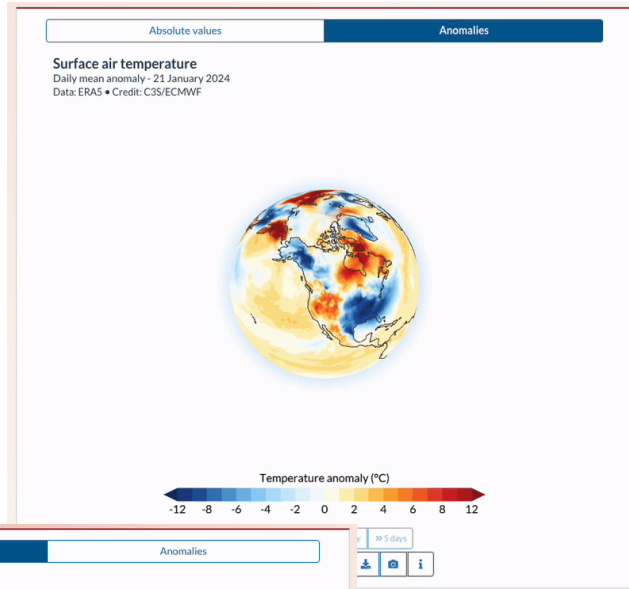




Climate
Change

C3S Global reanalysis: ERA5

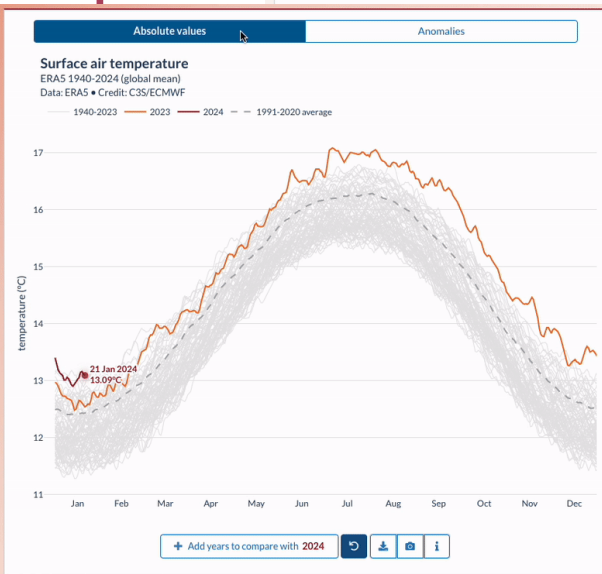
ERA5: Full-observing-system global reanalysis for the *atmosphere, land and ocean waves*



- Most popular dataset in the CDS
- > **100 TB** daily downloads
- No gaps in space/time, integrator of all observations
- Over 100 billion observations used so far
- Hourly snapshot 31 km resolution up to about 80 km height
- Available from **1940 onwards**
- Daily updates 5 days behind real time
- It relies on external gridded products: SST and sea-ice cover; GHGs, aerosols, TSI, (diagnostic) ozone

<https://doi.org/10.1002/qj.3803>

The ERA5 scientific journal paper (2020) has now topped 10,000 citations



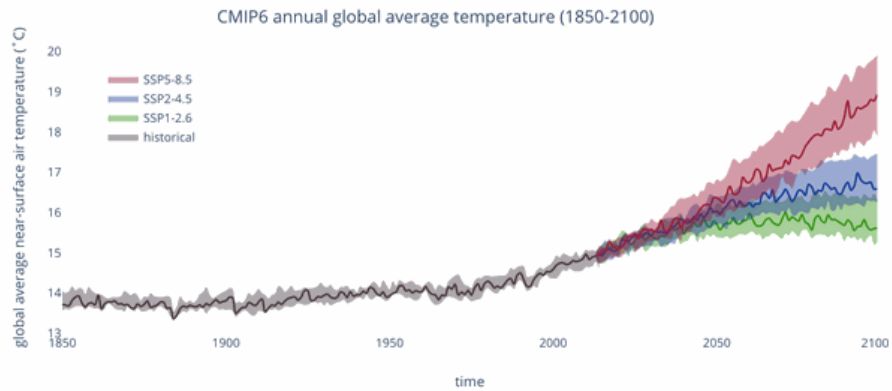
ERA5 Surface air temperature from Climate Pulse app, including (absolute values and anomalies).



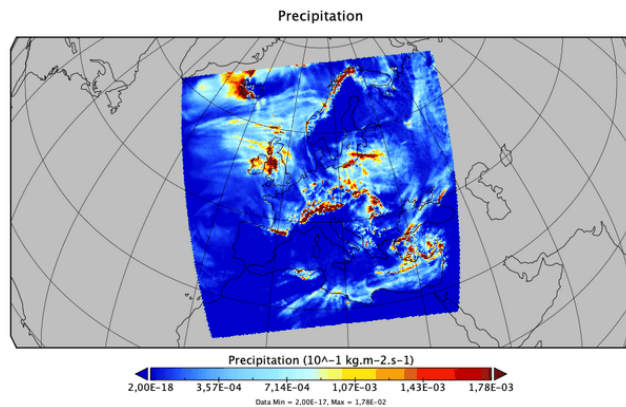


Climate Change

Climate projections: Global, Regional & the IPCC Climate Atlas



CMIP6 annual global temperatures 1850 - 2100

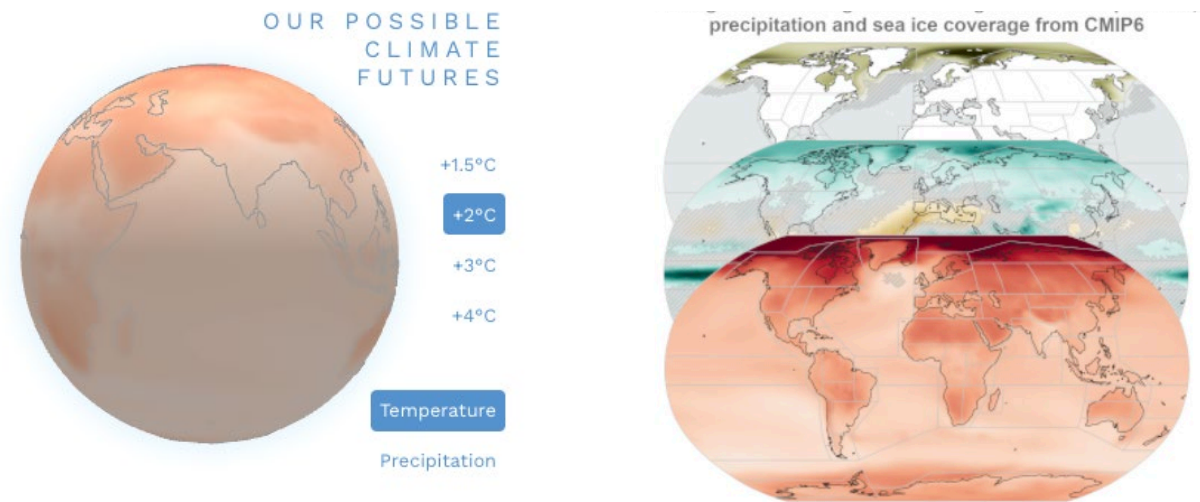


Downscaled Euro-CORDEX projections

Gridded monthly climate projection dataset underpinning the IPCC AR6 Interactive Atlas

[Dataset](#)
[Global](#)
[Atmosphere \(surface\)](#)
[Atmosphere \(upper air\)](#)
[Climate projections](#)

This catalogue entry provides gridded data from global (CMIP5 and CMIP6) and regional (CORDEX)



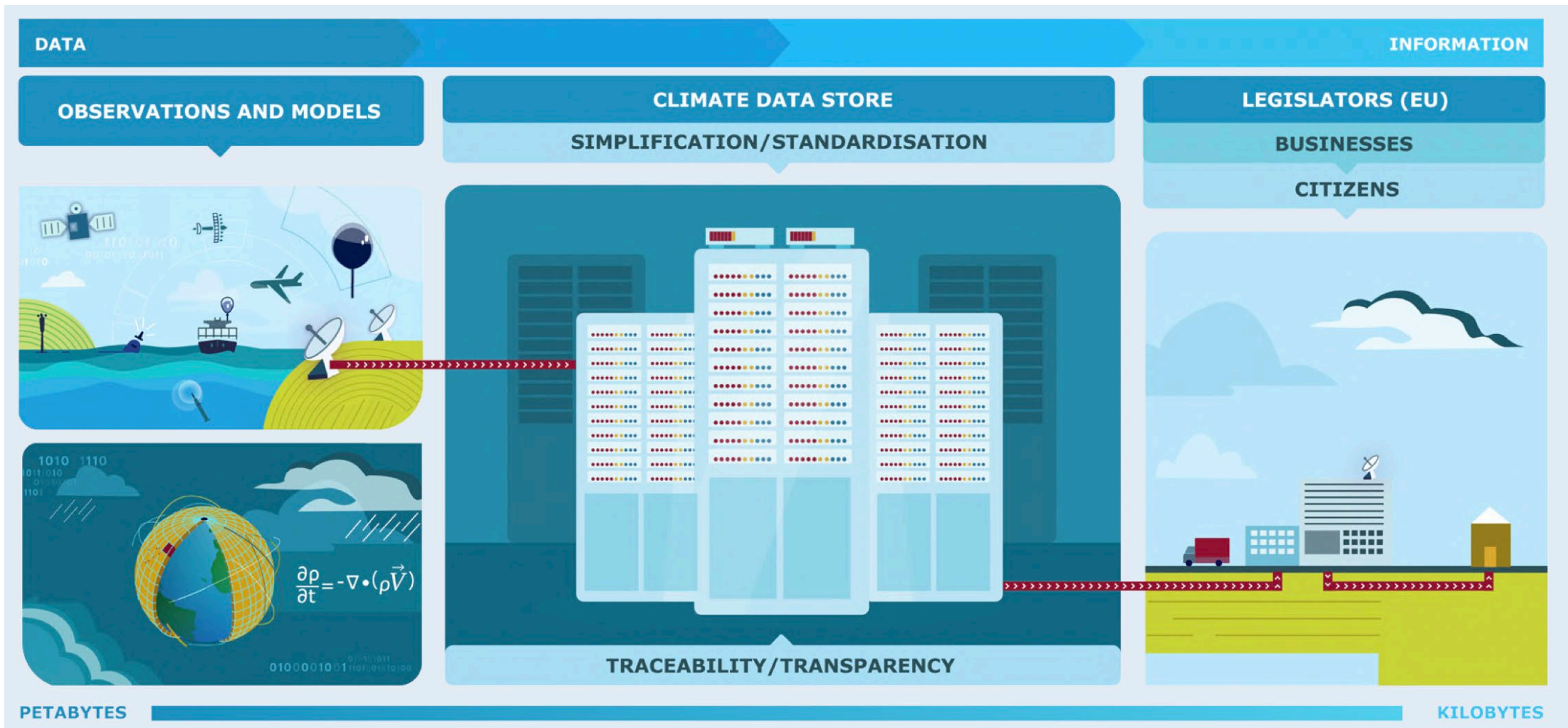
A novel tool (data and viewer) for IPCC AR6 for flexible **spatial** and **temporal** analyses of observed and projected climate change information





Climate Change

More Than Climate Data..... Climate Information

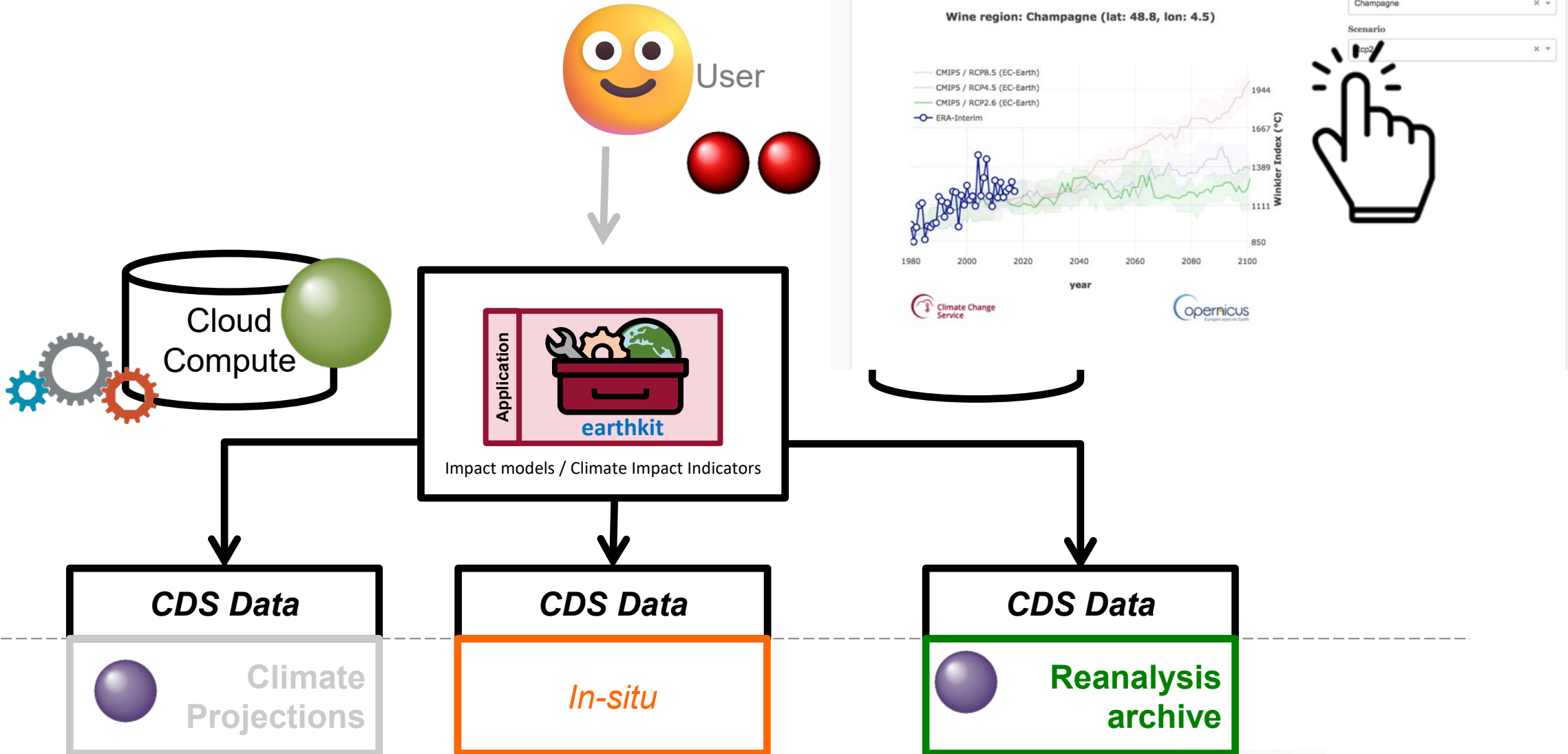


Typical download: **70 TB /day**



Climate Change

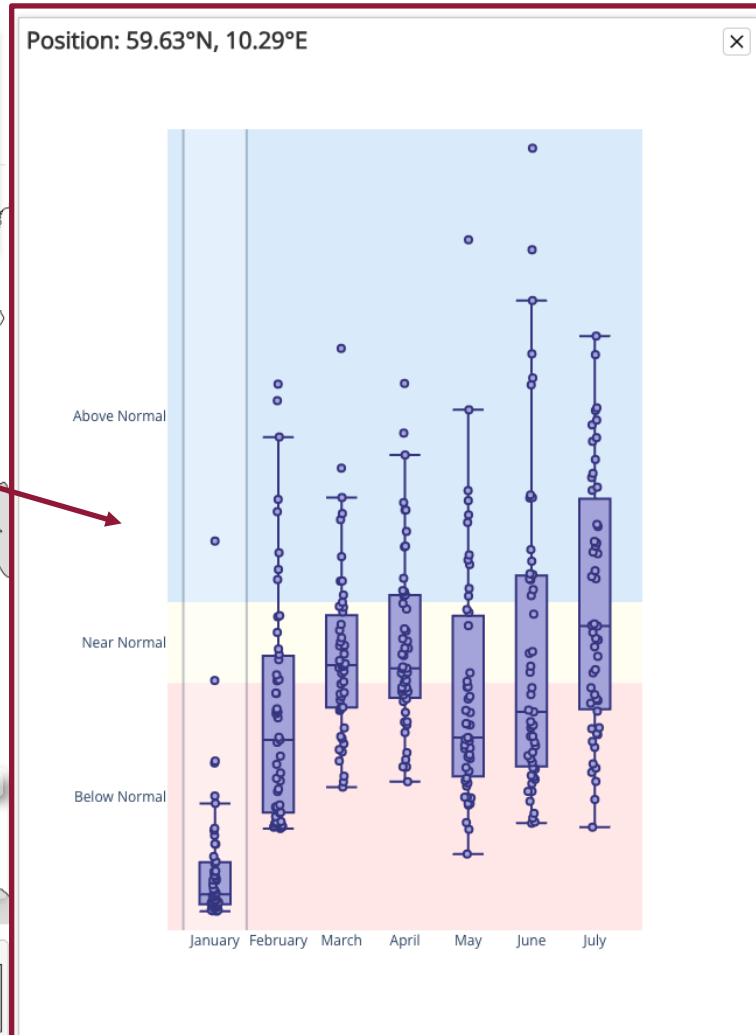
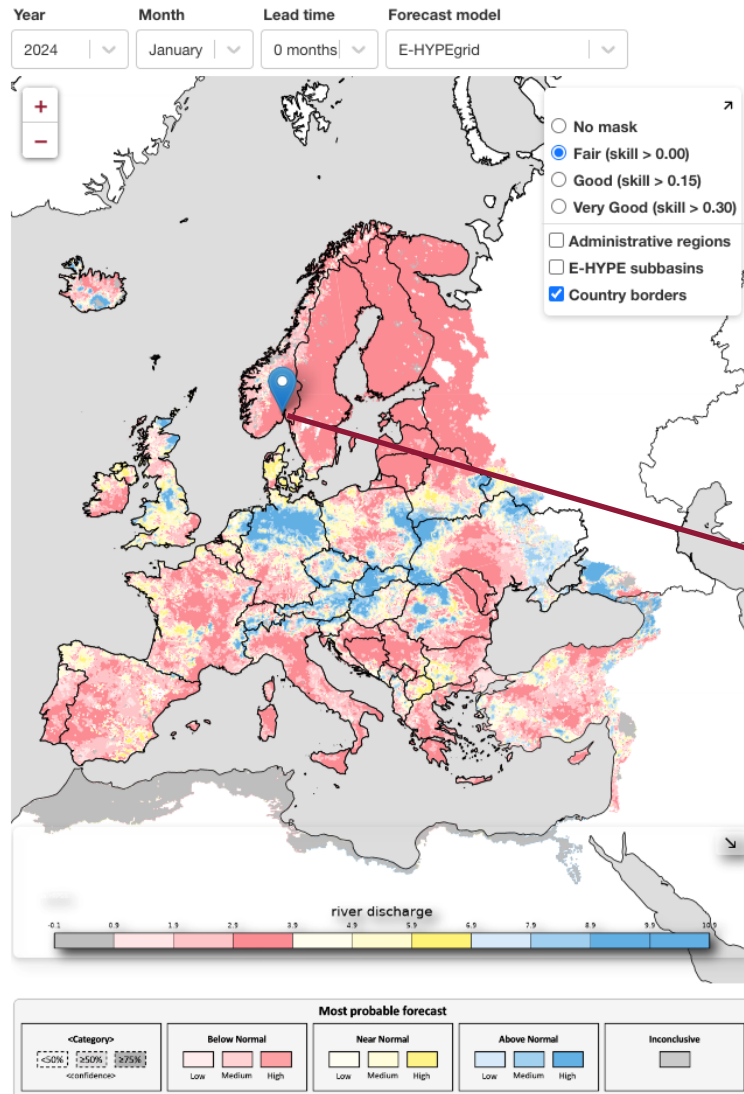
The C3S Application Strategy





Climate Change

Operational water sector: C3S European hydrology seasonal forecasts



C3S operational multi-model seasonal hydrological prediction service for Europe – *soon to include more climate and hydrological models*

Example: 7-month river discharge forecast from **January 2024** for **River Drammen in Norway**

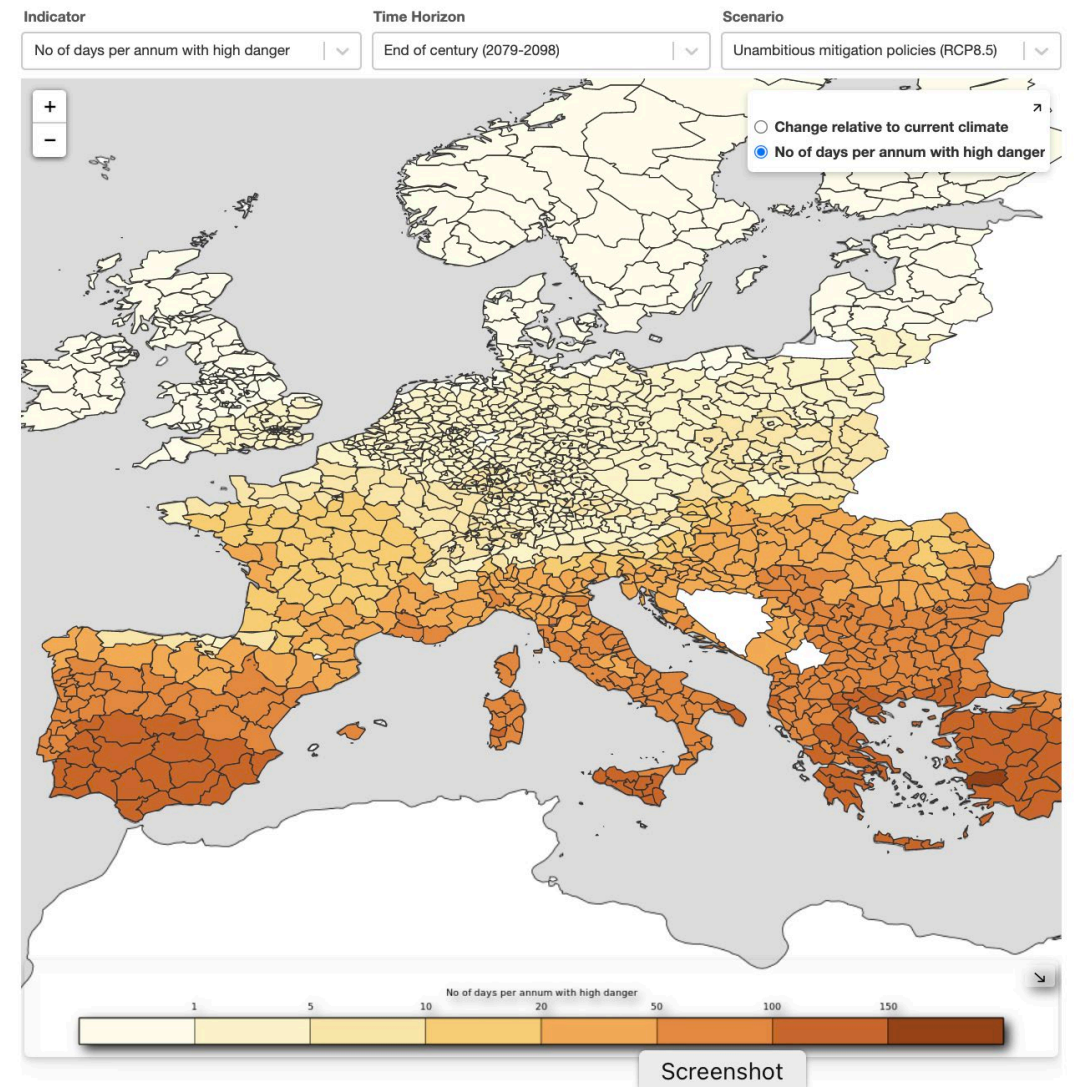
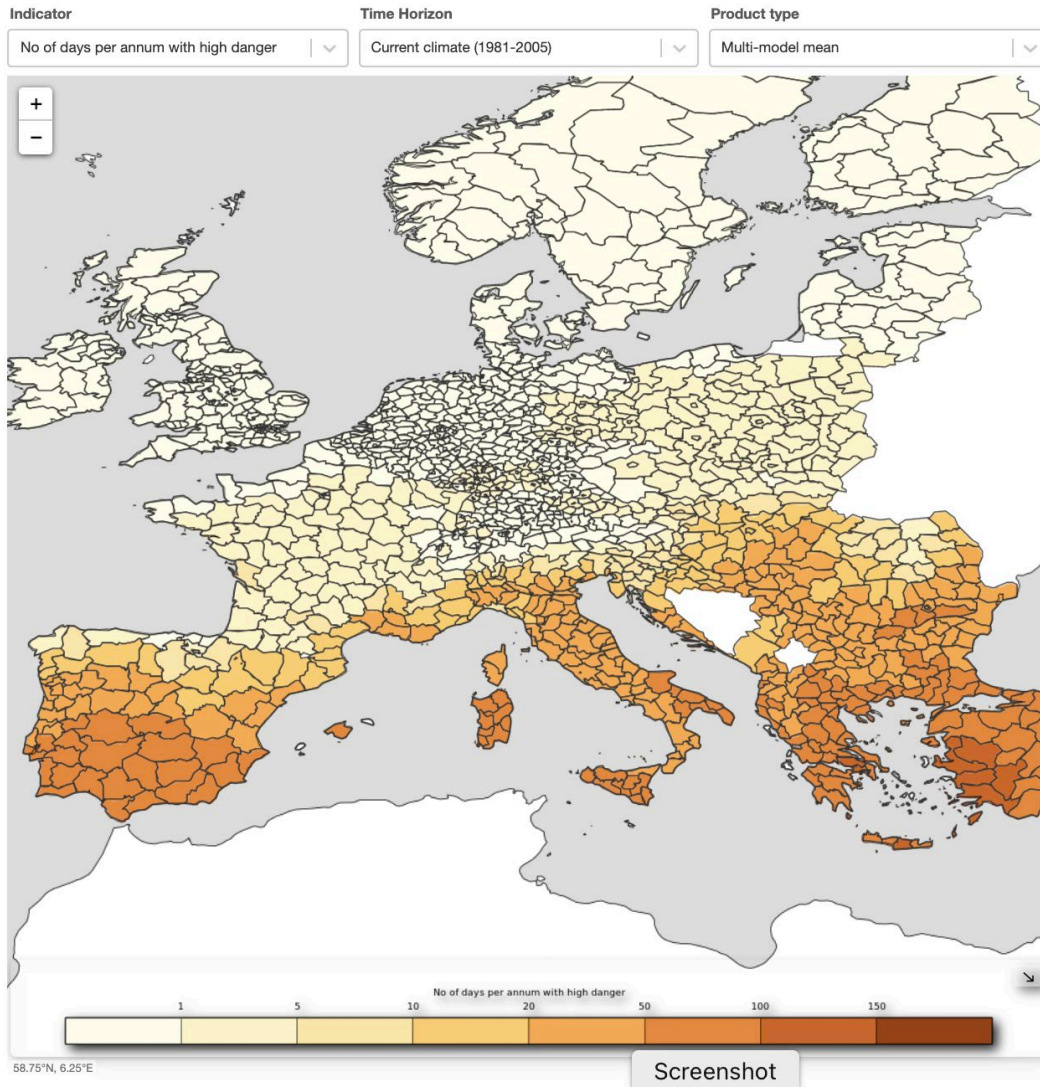
Below normal river flow expected 4 of the next 7-months

Also provide hydrological model output forced with ensemble climate projections



Climate
Change

Europe's Evolving Fire Risk





Climate Change

Biodiversity: Demonstrator Service



North Atlantic pelagic fish

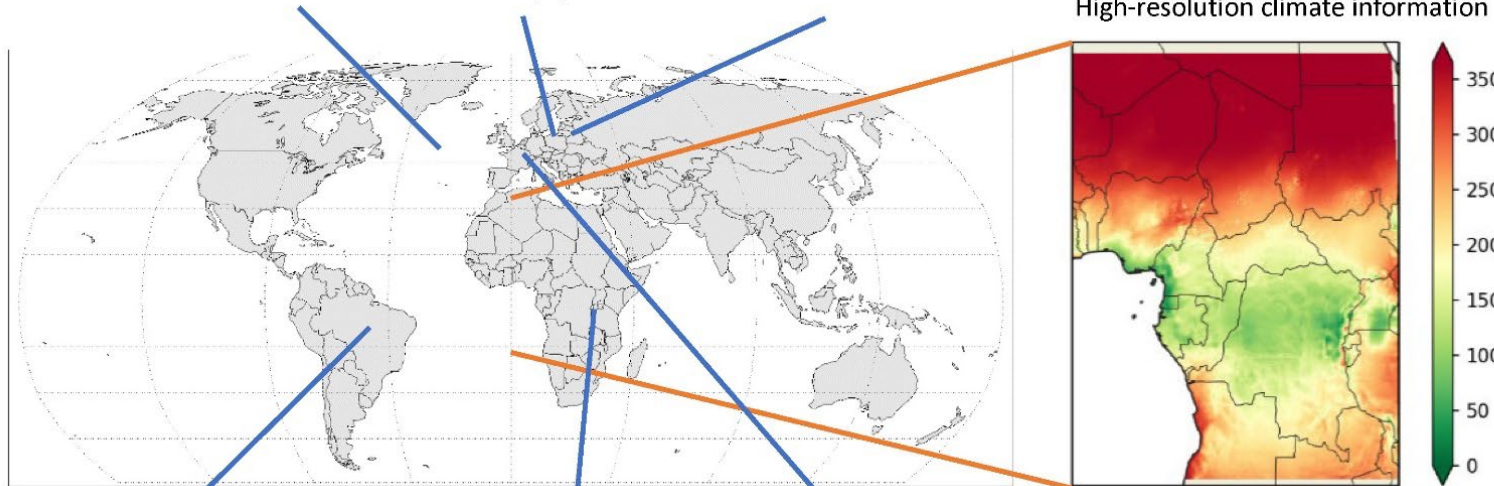


Baltic seal populations

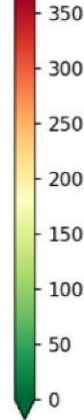


Grassland ecosystems

- habitat suitability
- species distribution
- species fitness and reproduction
- ecosystem services



Number of dry days



Goldenheaded lion tamarin



Tropical forest biodiversity



Hedgerow ecosystems

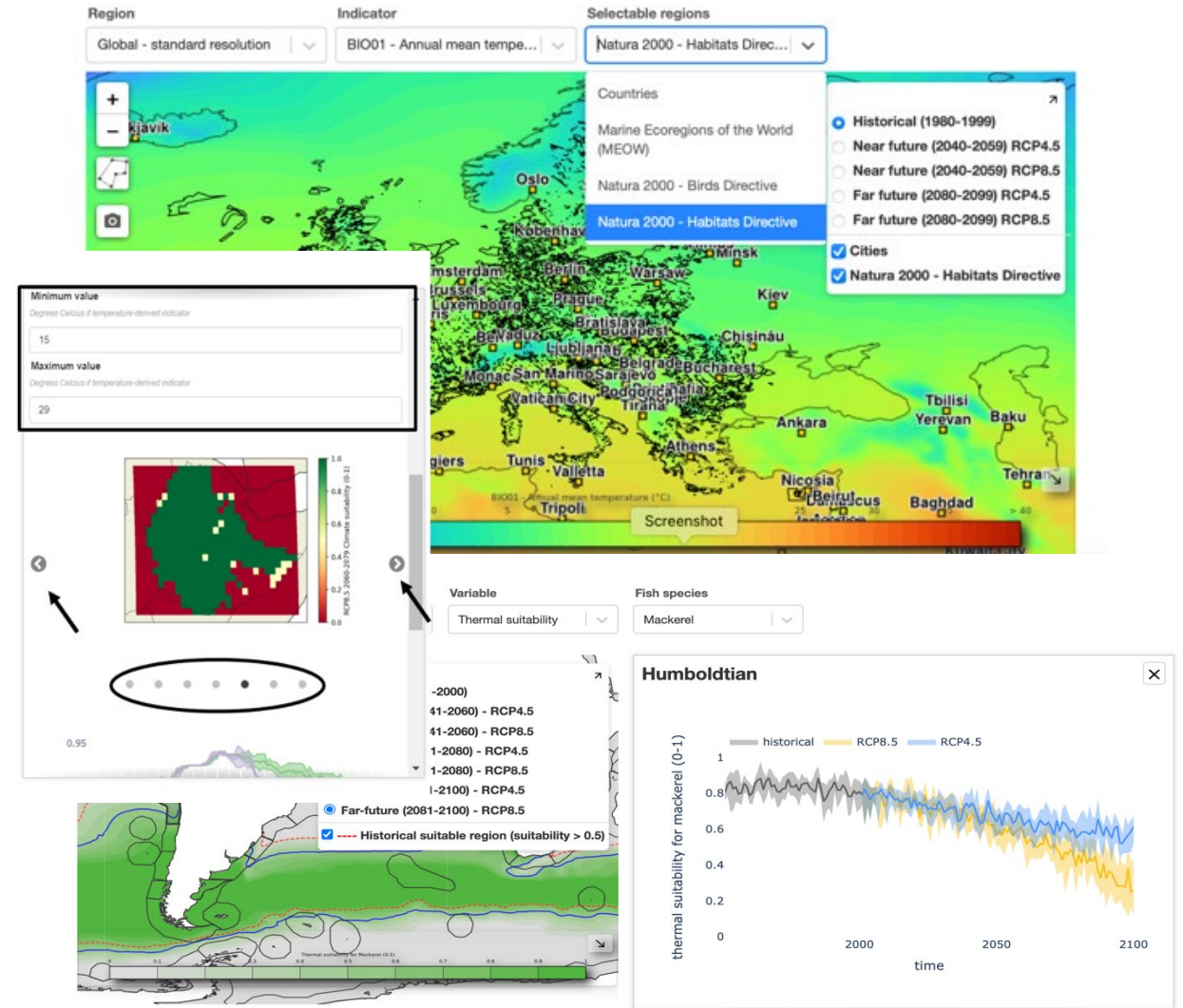


- The service provides **two datasets of 79 customized bioclimate indicators** for the past, present and future.
- The indicators are derived climate datasets, i.e. ERA5 for historical reconstruction and CMIP climate projections data
- The service also offers **bioclimate data at a 1km x 1km grid** for selected locations, which responds to **high-resolution** requirements of specific biodiversity challenges



Applications to Support Biodiversity: Assessment of Climatic Suitability

- Interactive applications to visualize and explore 75 key bioclimate indicators (Europe & Global)
 - Data developed for biodiversity community in Climate Data Store (CDS)
 - Explore per country or by Natura 2000 site*
 - User can use a species 'climatic envelope' to help identify when climatic conditions are no longer suitable (leading to stress, dispersal, extinction, ...)
 - Dedicated case studies for:
 - European grasslands,
 - Hedge species (flora)
 - Marine fish species & Marine Protected Areas (MPA)
- Exploring the impact of climate suitability on key species & European landscapes



Note: The blue line in the map is drawn at the threshold where the thermal suitability equals 0.5 to create a representative cut-off point between suitable and unsuitable regions. You can compare this blue line with the equivalent region for the historical period (red dotted line).

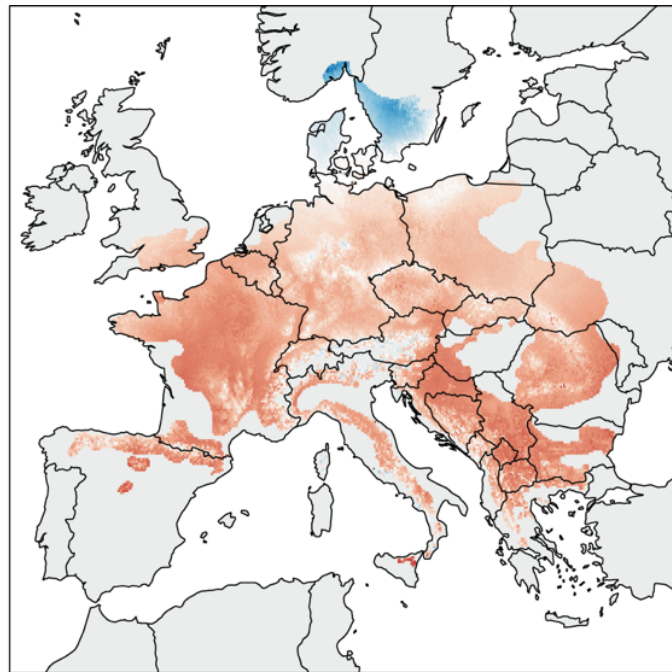
* Application was developed in old infrastructure



Climate
Change

Example Application: Climatic suitability of key European tree species

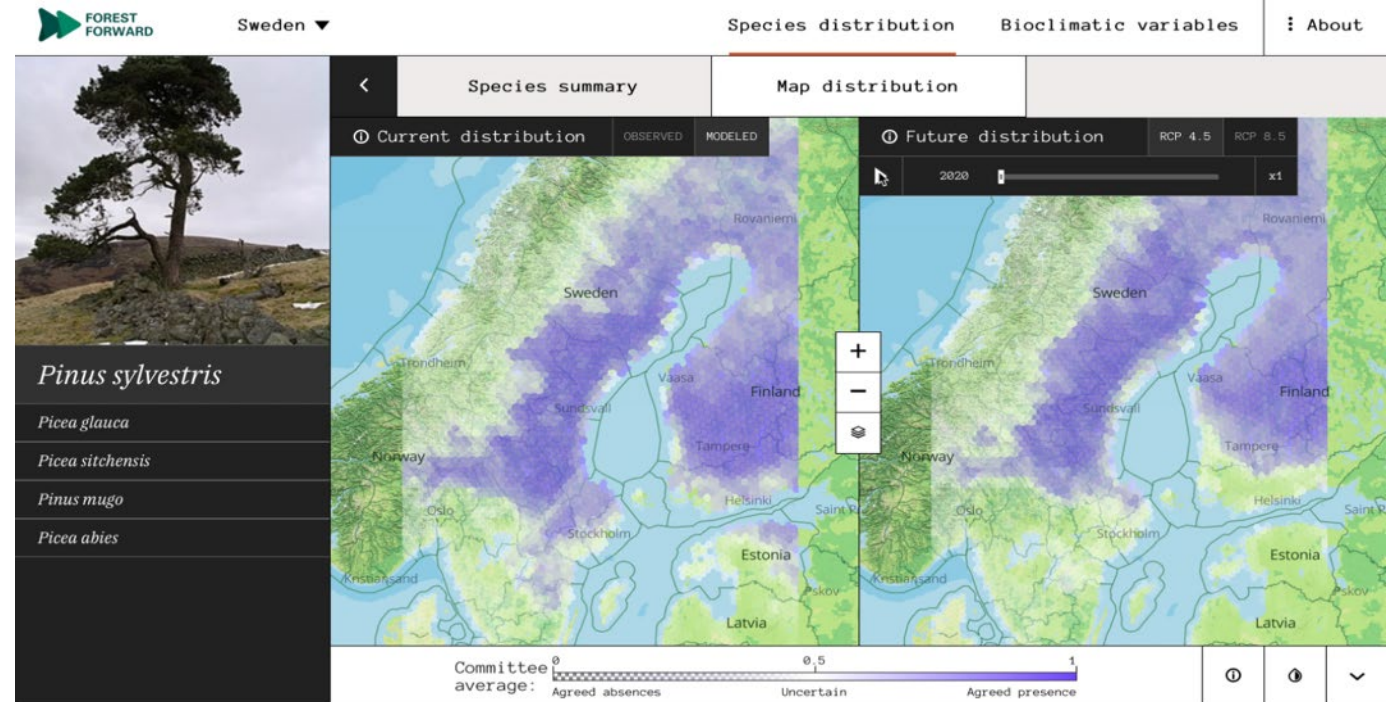
Climate data can help inform future species distribution and productivity – supporting biodiversity applications



<-50 -30 -10 10 30 >50

Beech tree growth changes from 1986 to 2016 relative to the 1955–1985 period mean.

Source: [Martinez del Castillo et al, 2022](#).



C3S data enabled Tecnalia (Spanish SME) to provide distribution maps for key European tree species. Such info can support establishing climate resilient forest (EU Forest strategy 2030)

Thank you for your attention



Climate Change



Copernicus EU



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www.copernicus.eu
climate.copernicus.eu



Copernicus Atmosphere Monitoring service: supporting BIODIVERSITY

Laurence ROUIL (ECMWF)

Director of CAMS

Biospace 2025 – ESA/ESRIN – 13th Feb 2025



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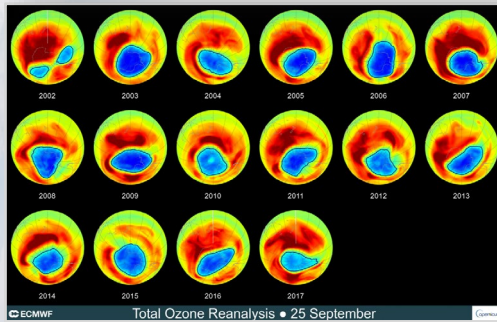
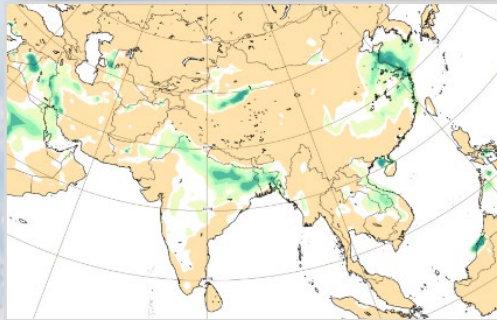
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Atmosphere
Monitoring

CAMS SCOPE – Atmospheric Composition



CAMS provides open & free information products based on Earth Observation about:

- past, current and near-future (forecasts) global atmospheric composition;
- the ozone layer;
- European air quality;
- emissions and surface fluxes of key pollutants and greenhouse gases;
- solar radiation;
- climate radiative forcing.

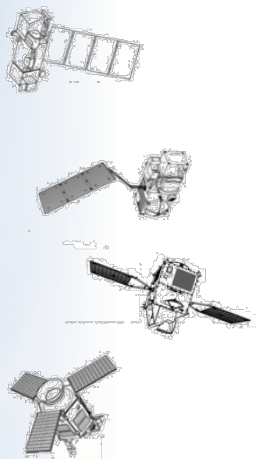
<http://atmosphere.copernicus.eu>
<http://ads.atmosphere.copernicus.eu>



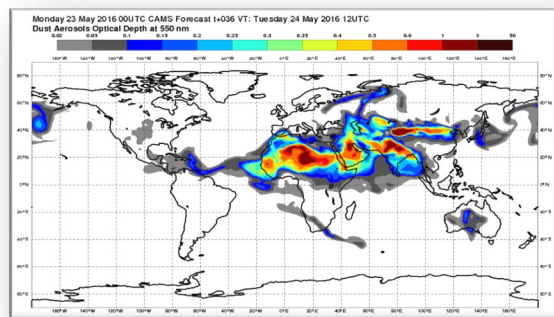
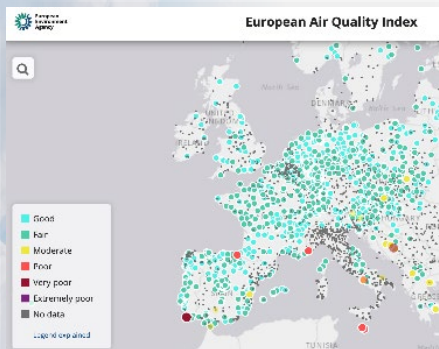


Atmosphere Monitoring

CAMS WORKFLOW (Combining observations with models)

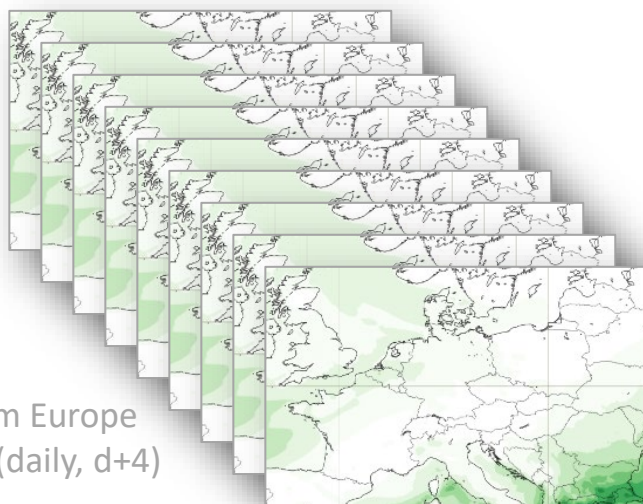


Earth Observation from satellite (>80 instruments) and in-situ (regulatory and research)

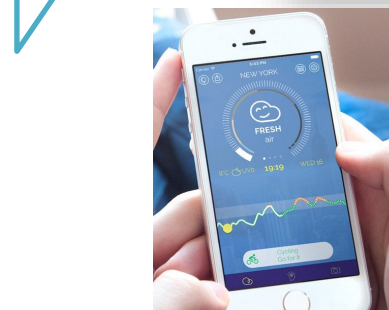
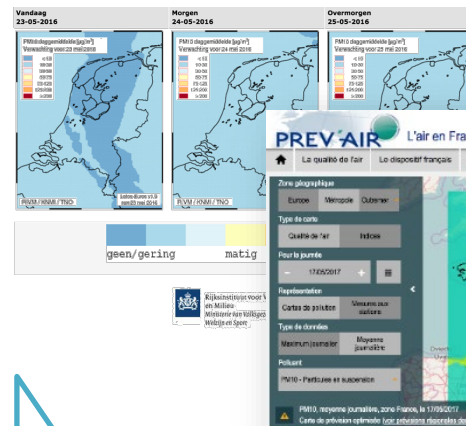


40km Globe (twice daily, d+5)

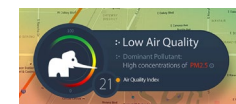
CAMS main operational data assimilation and modelling systems



10km Europe (daily, d+4)



Major multiplication factor (100Mil+)



CAMS users >23500 (>3050 routine)

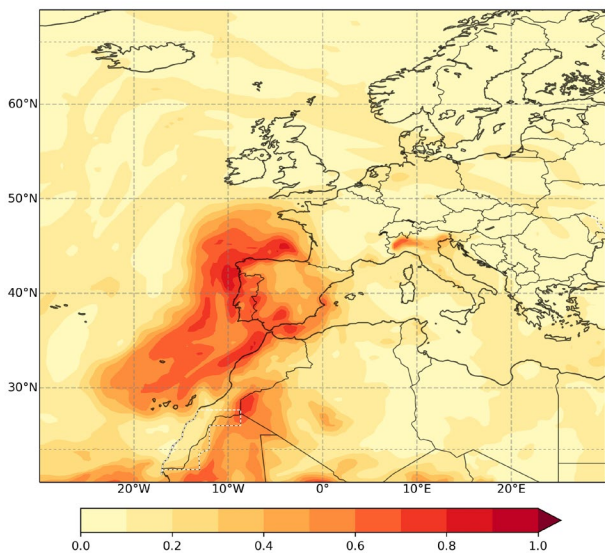


Example of services related to air pollution

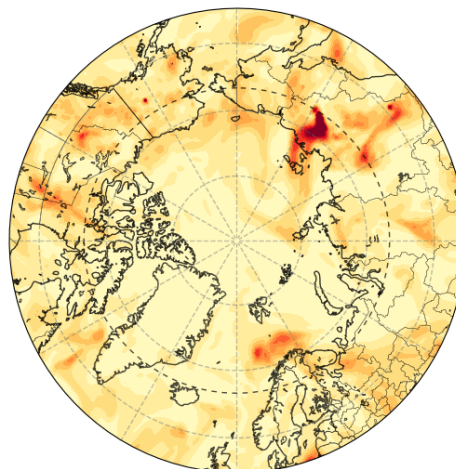
Atmosphere Monitoring

Dust plumes

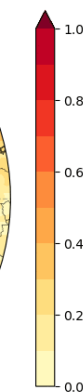
CAMS Forecast Total Aerosol Optical Depth at 550nm
20230221T00 valid for 20230221T00



CAMS Forecast Total Aerosol Optical Depth at 550nm
20240619T00 valid for 20240619T00



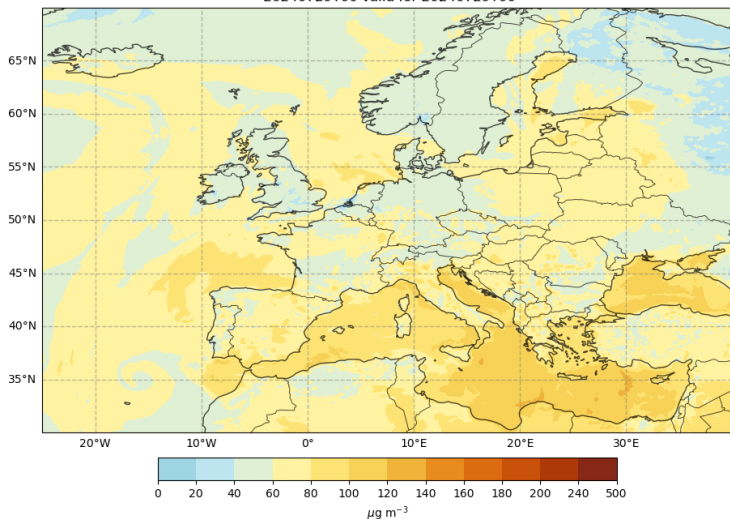
Wildfires



- <https://atmosphere.copernicus.eu>
- <https://policy.atmosphere.Copernicus.eu>
- <https://ads.atmosphere.copernicus.eu/cdsapp#!/search?type=dataset>

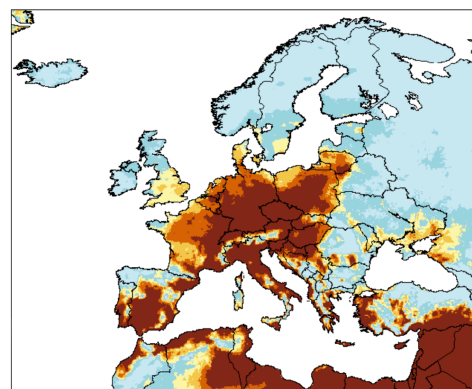
Reanalyses of air quality metrics (since 2013)

CAMS Regional Ensemble Forecast o3 conc at 0m:
20240729T00 valid for 20240729T00

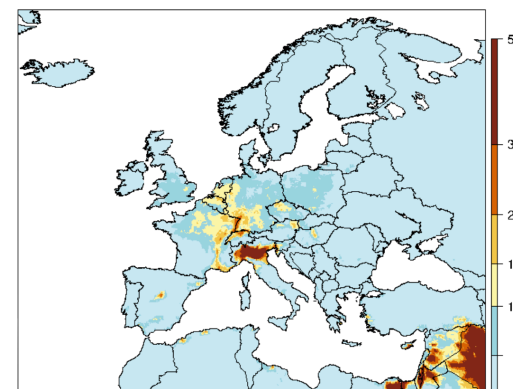


PM ₁₀	PM _{10, exc}	PM _{2.5}	O ₃	O_{3, exc}	SOMO35 (O ₃)	AOT40 (O ₃)	NO ₂	SO ₂	CO _{max}
------------------	-----------------------	-------------------	----------------	---------------------------	--------------------------	-------------------------	-----------------	-----------------	-------------------

Ozone 2023 analysis
T100 Nb of days with exceedance of daily highest 8-hour mean of 100 µg/m³



Ozone 2023 analysis
T120 Nb of days with exceedance of daily highest 8-hour mean of 120 µg/m³



Air pollution episodes



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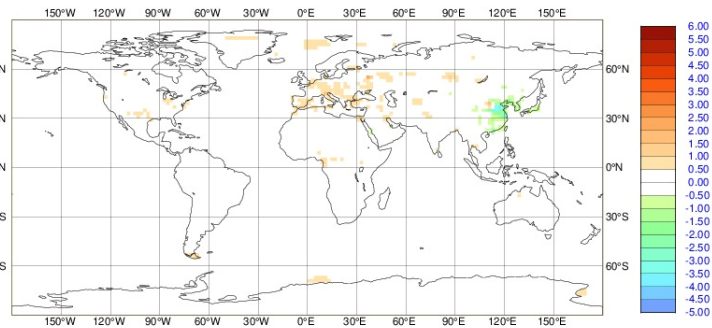
Atmosphere
Monitoring

Re-analyses: the best estimate

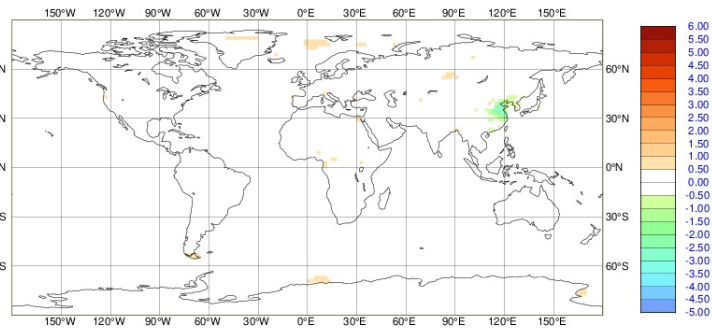
Example : Tropomi tropospheric NO2

Using CAMS re-analysis (2003-NRT) of atmospheric composition

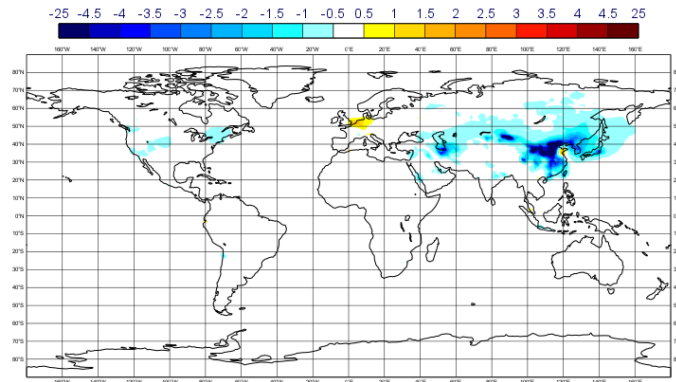
S5P NO2 first-guess departures



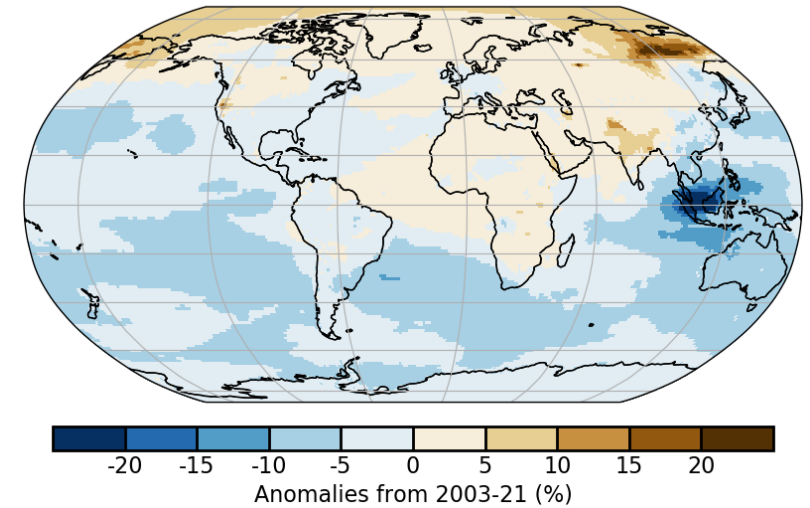
S5P NO2 analysis departures



ASSIM minus CONTROL



Ex: 2021 CO anomaly



Assimilation of TROPOMI NO2 data reduces the CAMS NO2 analysis over Asia and improve the quality of the assessment

Active since 12 Oct 2021



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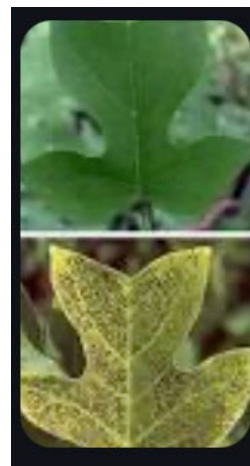
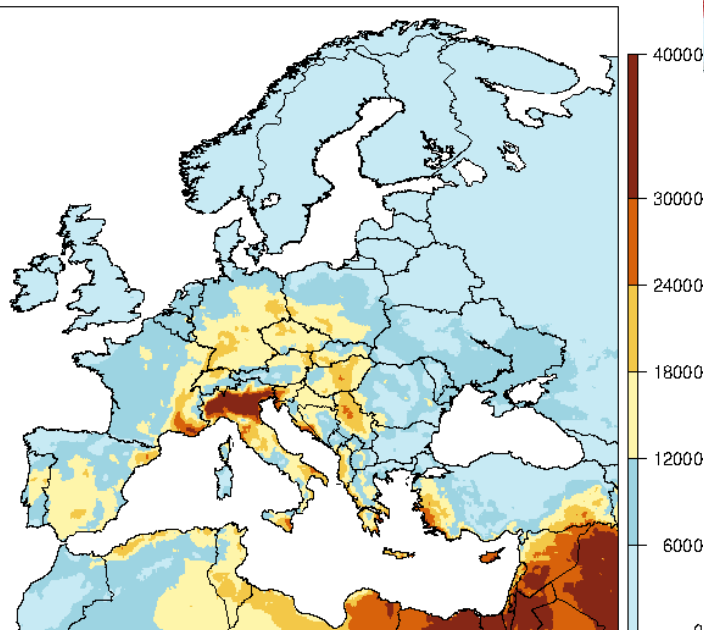
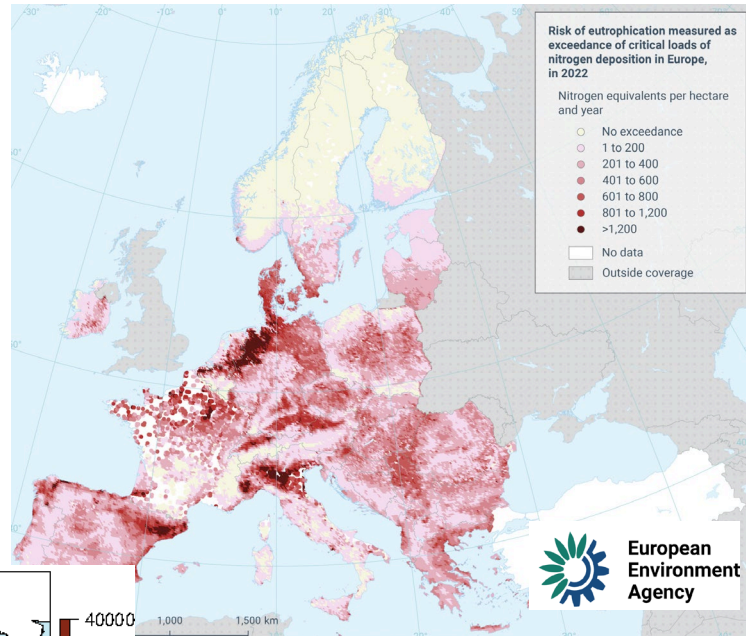




Atmosphere
Monitoring

Air pollution and biodiversity

AOT40 : to measure impact
of O3 on ecosystems
CAM5 reanalysis for 2022



Science of The Total Environment

Volume 753, 20 January 2021, 141791



Assessing critical load exceedances and ecosystem impacts of anthropogenic nitrogen and sulphur deposition at unmanaged forested catchments in Europe

Martin Forsius ^a, Maximilian Posch ^b, Maria Holmberg ^a, Jussi Vuorenmaa ^a, Sirpa Kleemola ^a, Algirdas Augustaitis ^c, Burkhard Beudert ^d, Witold Bochenek ^e, Nicholas Clarke ^f, Heleen A. de Wit ^g, Thomas Dirnböck ^h, Jane Frey ⁱ, Ulf Grandin ^j, Hannele Hakola ^k, Johannes Kobler ^h, Pavel Krám ^l, Antti-Jussi Lindroos ^m, Stefan Löfgren ^j, Tomasz Pecka ⁿ, Pernilla Rönnback ^j, Milan Váňa ^a

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<https://doi.org/10.1016/j.scitotenv.2020.141791>

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UNECE Air convention :

<https://unece.org/environmental-policy-1/air>



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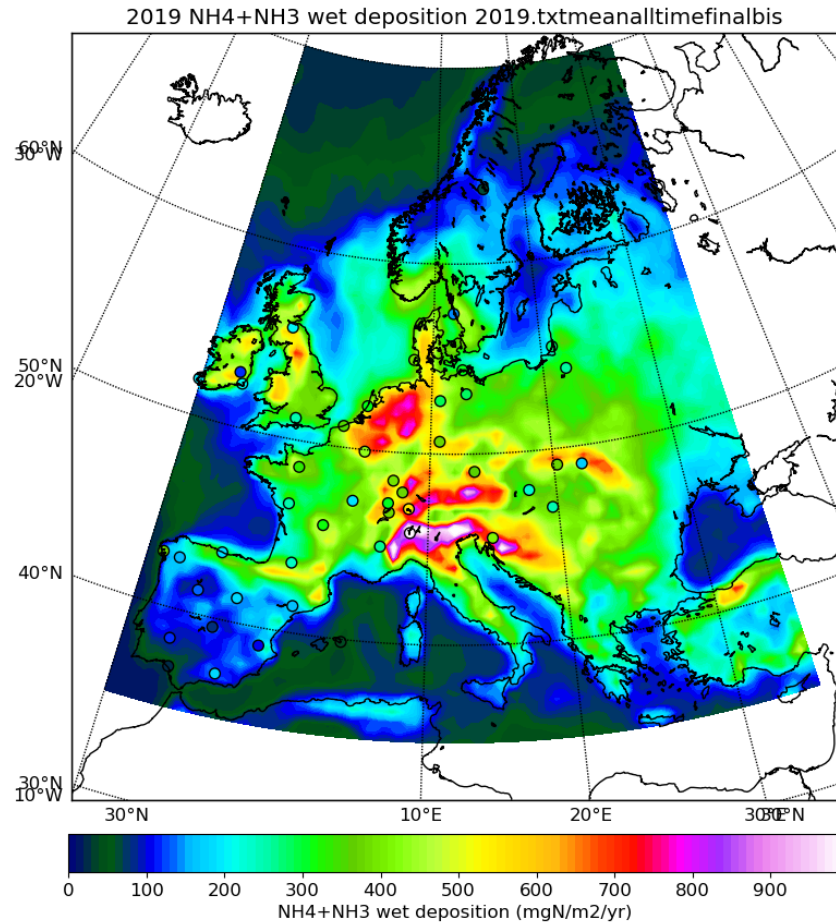


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In preparation within CAMS : deposition products



CAMEO H2020 project : <https://www.cameo-project.eu/>

– Deposition flux products to be improved by:

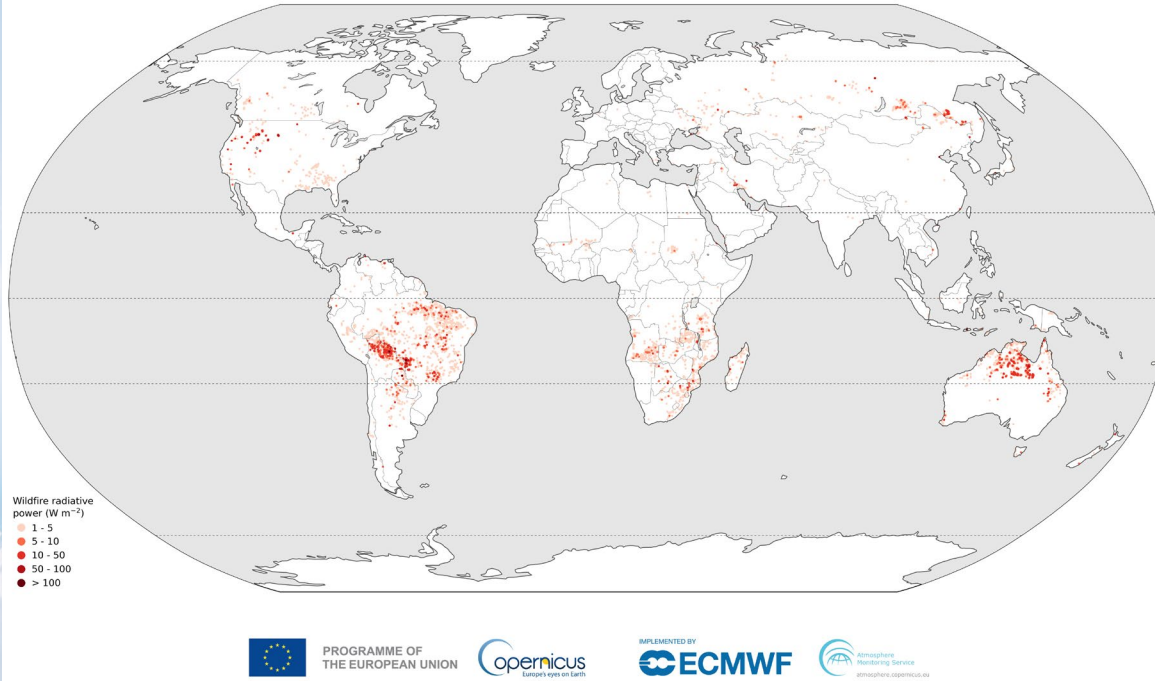
- DA of improved AQ retrievals from Geostationary GEMS, Sentinel4, TEMPO missions: high-temporal resolution over Asia, Europe and North-America
- Utilise satellite-based emissions inversion framework (CO2MVS) in global CAMS system for deposition flux correction
- Improved DA methodology
- Increased number of in-situ observations for evaluation
- Improved emission data and inventories (more timely, activity better and variability)
- Observation based correction of surface fluxes
- Provision of uncertainty information





Fire emissions monitoring in CAMS: Global Fire Assimilation System (GFAS)

GFAS Total Fire Radiative Power - October 2024



Global Fire Assimilation System (**GFAS**); see <https://ads.atmosphere.copernicus.eu/cdsapp#!/dataset/cams-global-fire-emissions-gfas?tab=overview>

Uses satellite observations of Fire Radiative Power (FRP)

- Currently Aqua and Terra MODIS FRP observations
- FRP from VIIRS, Sentinel-3, and geostationary satellites are being tested and implemented

Global Coverage at ~10km Resolution

- *Daily Output: 1-day behind NRT*
- Hourly Output (+24-h means): 7-hours behind NRT

Emissions of aerosols and gases are estimated using factors dependent on vegetation type.

Injection heights calculated using *Plume Rise Model* and IS4FIRES schemes

- Application : Summary of forest fires in Europe, combining C3S, CAMS and EFFIS (European Forest Fire Information System) information, published for each year in the European State of the Climate report.
 - 2023 report: <https://climate.copernicus.eu/esotc/2023/wildfires>

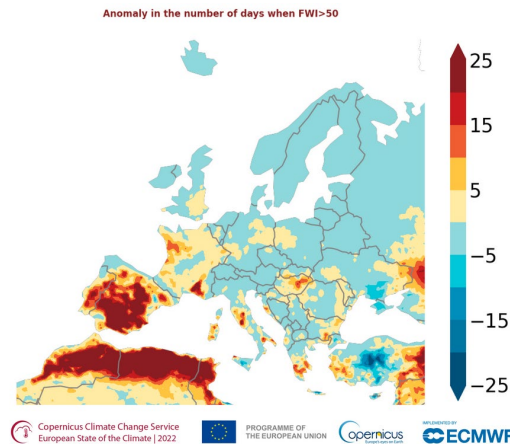


Figure 2. Anomaly in the number of days in 2022 with Fire Weather Index > 50, relative to the average for the 1991-2020 reference period. These conditions are when 'critical' fires, those above 10,000 ha, can develop. Data source: FWI based on ERA5. Credit: Copernicus EMS/ECMWF.



Atmosphere
Monitoring

R e s s o u r c e s :

- **CAMS website and news :** <https://atmosphere.Copernicus.eu>
- **Datasets provided by the CAMS services freely available on the Atmosphere datastore:** <https://ads.atmosphere.eu>
- **Policy services:** <https://policy.atmosphere.Copernicus.eu>
- **Aerosol alert service:** <https://aerosol-alerts.atmosphere.copernicus.eu>

Implemented by ECMWF as part of The Copernicus Programme

News Events Press Tenders Help & support Search

Europe Copernicus Europe's eyes on Earth Atmosphere Monitoring Service

Data About us What we do



Atmosphere Data Store

Datasets User guide Live Background

8 Aug 2024 Check our information page to find more yourself to use ADS Beta.

Dive into this wealth of information about the Earth's past, present and future atmosphere

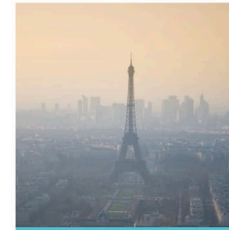
Search

API Access the full data store catalogue, with search and availability features.

Training Copernicus Atmosphere Monitoring Service (CAMS) data tutorials

earthkit Open-source Python tools simplifying data access, processing, analysis, visualisation

Today's air quality forecasts



Europe



Worldwide



Seasonal Atmospheric Recap

In Focus



Global carbon dioxide and methane monitoring

CAMS provides observation-based information on CO₂ and CH₄ natural fluxes and anthropogenic emissions and their trends in support of the Paris Agreement.

Aerosol Alerts My alerts Gallery Evaluation About

City

Mon Jan 13 2025 15:00

Implemented by Copernicus ECMWF

Contribution to PM₁₀ in Paris (2023-03-01-07)

Potential impact on PM₁₀ in Paris (2023-03-01-07)

Country impact/contribution

Explore the potential impact of country emissions reduction on PM_{10/2.5}, ozone and NO₂ based on EMEP perturbation runs and the country contributions for PM_{10/2.5}, using LOTOS/EUROS tagging method.

daily_impact yearly_impact

daily_contrib yearly_contrib

PM10 only mean (µg/m³), 2023-03-01-07

Sector apportionment

Inspect the potential impact of different measures affecting sector emissions at targeted cities, make custom scenarios and inspect chemical regimes with the Air Control Toolbox.

daily_forecasts

Map of daily mean concentrations of PM10 for 2023-03-01-07

Policy scenarios

Investigate how the air quality will improve in 2030 through implementation of the Clean Air Programme Directive (EU) on the reduction of national emissions of certain atmospheric pollutants.

daily_forecasts





Atmosphere Monitoring

Thank you !

Laurence.rouil@ecmwf.int



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In situ

Copernicus In-Situ Component

**Cross-cutting in-situ activities
supporting biodiversity applications**

José Miguel Rubio Iglesias (EEA)

BIOSPACE 25, 13 February 2025



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In situ

In-situ data in Copernicus

Copernicus in-situ data: observations, **geospatial reference** and ancillary data licensed or provided for use in Copernicus

What for?

- **Production and validation** in Copernicus services
- As stand-alone **observation** products
- **Cal/Val** of satellite sensors

Without in-situ data, Copernicus simply cannot deliver its data, products and services



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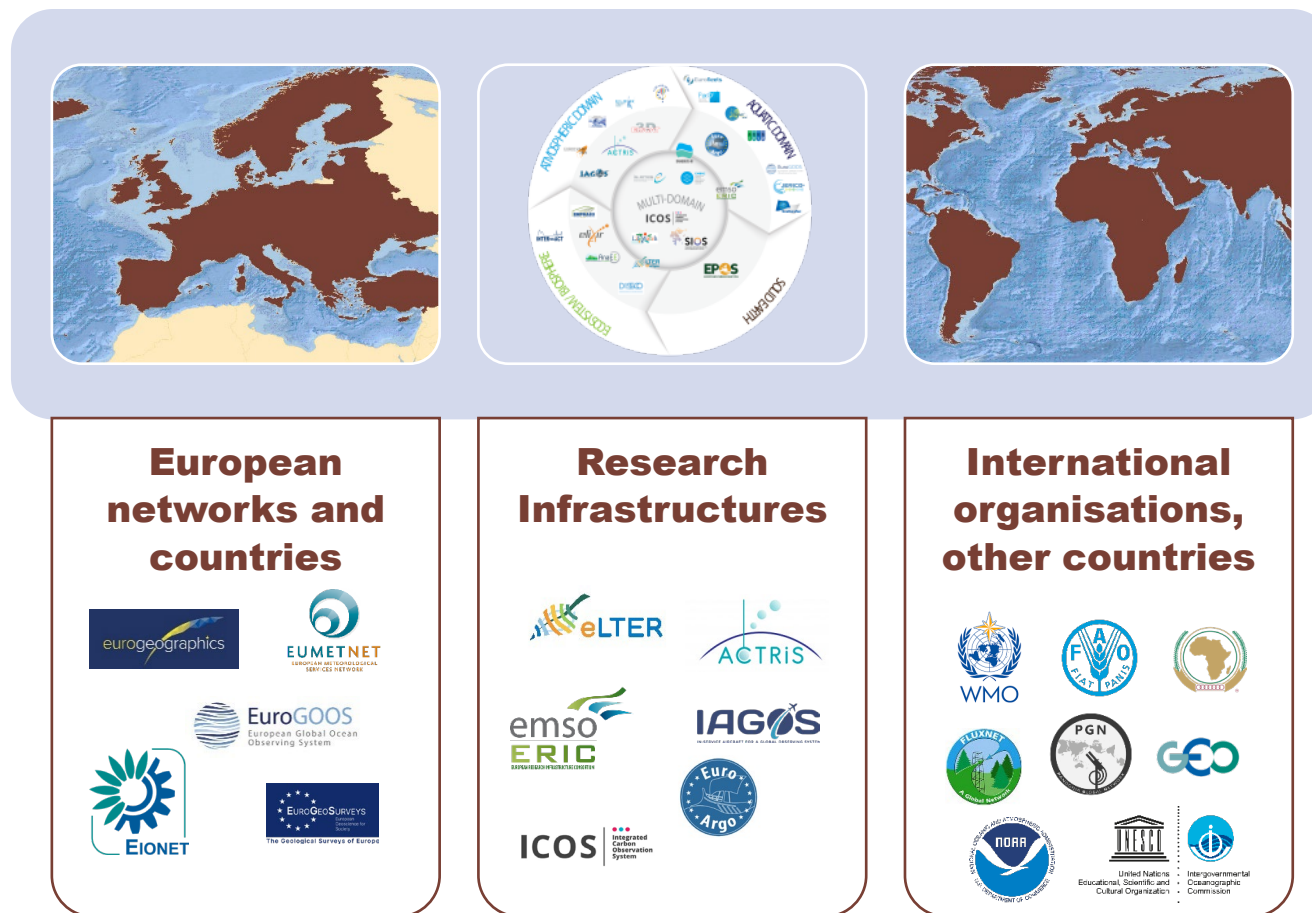
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Where does in-situ data come from?

In situ

In Situ data comes from a **myriad of data providers** and networks at national, regional and global level.



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In situ

Governance of the Copernicus In-Situ

Entrusted Entities access and manage in situ data directly according to their operational needs on a day-to-day basis.

The **EEA** intervenes when a coordinated approach to accessing in situ data is required at a programmatic level: “cross-cutting activities”



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In situ

Cross-cutting coordination activities (2021-2028)

- State of Play report
- Copernicus In-Situ Data Requirements (CIS²)
- Factsheets

STATE OF PLAY



- Copernicus Reference Data Access Portal (CORDA)
- Access to specific in situ data

DATA ACCESS



- Licensing agreements
- Use cases
- Inventory of data providers

ENGAGING WITH DATA PROVIDERS



- In Situ Working groups
- Thematic Reports, inventories
- GEO, R&D

SUPPORT AND ADVICE



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Copernicus in-situ data requirements

In situ

Capturing data requirements: the CIS² database

- Overview of Copernicus in situ data requirements and how these are met
- **Comprehensive list of products, data providers (European and global) and key datasets**
 - 330 Copernicus products, 357 in situ requirements, 900 data providers and networks
- Ongoing reviews and updates with support from Entrusted Entities, two versions per year
- Dashboards under development

<https://cis2.eea.europa.eu/>

Copernicus Participating States Networks All Data Providers

Start typing to filter by any column value

Country	Name	Website	Type	Services/Components
Austria	Technical University of Vienna Technische Universität Wien	https://www.tuwien.ac.at/	Research	Copernicus Land Monitoring Service
Austria	Managementservice Linz GmbH	https://portal/unden/pos		
Austria	University of Veterinary Medicine Vienna Veterinärmedizinische Universität Wien	https://ni.ac.at		

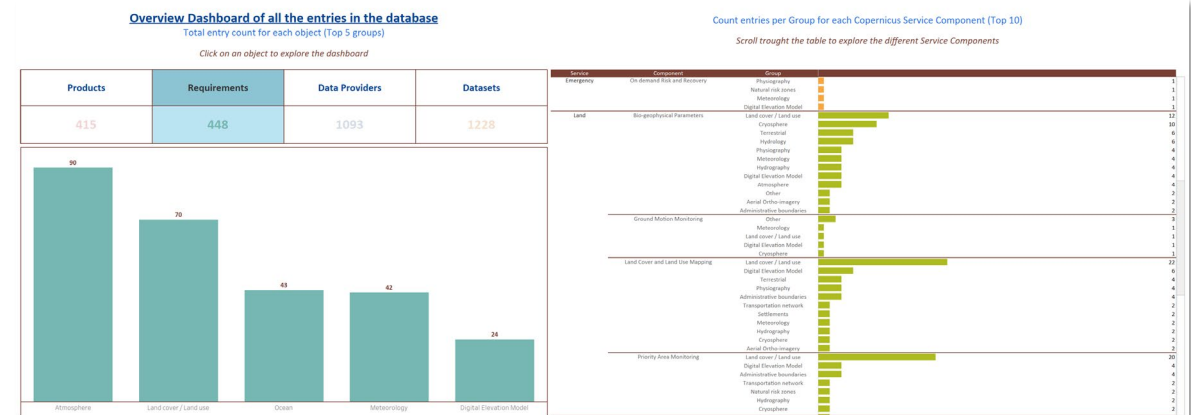
All providers

Product copernicus service

Type	Product component
Data provider: Private	Biogeophysical Parameters
Commercial	Land Cover and Land Use Mapping
	Maritime Surveillance
	Priority Area Monitoring
	Reference and Validation Data
Institutional	Biogeophysical Parameters
	Climate Change
	Early Warning
	Emergency Mapping
	Ground Motion Monitoring
	Land Cover and Land Use Mapping
	Maritime Surveillance
	On demand Risk and Recovery
	Priority Area Monitoring
	Reference and Validation Data
	Subsidence Data
N/A	Support to EU Operational and Security
	Atmosphere Monitoring
	Biogeophysical Parameters
	Early Warning

Number of Datasets

Data provider name (data all providers)	Data provider type
Alfred Wegener Institute	Public
CMAP	Commercial
Centre de Informacao Geoespacial do Exército	Public
Dirigjo-Serv do Território	Institutional
Directorat-General for Territorial Development	Institutional
EMODnet-Physics	N/A
EuroGeographics	Public
European Border and Coast Guard Agency	Public
European Commission	Institutional
European Centre for Medium-Range Weather Fore.	Institutional
European Commission	Institutional
European Environmental Agency	Institutional
European Global Ocean Observing System	Public
European Meteorological Services Network	Institutional
European Multi-disciplinary SeaFloor and water col.	Public
European Space Agency	Public
European Union LRT Cooperative Data Centre	Public
EUROSTAT	Institutional
Geoflames Team	Public



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State of Play : key issues encountered

In situ



Access conditions and use restrictions



Insufficient spatial coverage



Uncertain sustainability of critical networks



Fragmentation and heterogeneity



Lack of alignment with data providers



Insufficient acknowledgement



Not long enough historical high time series



More data needed on specific areas



Increasing demands in frequency and resolution



Rapid accessibility



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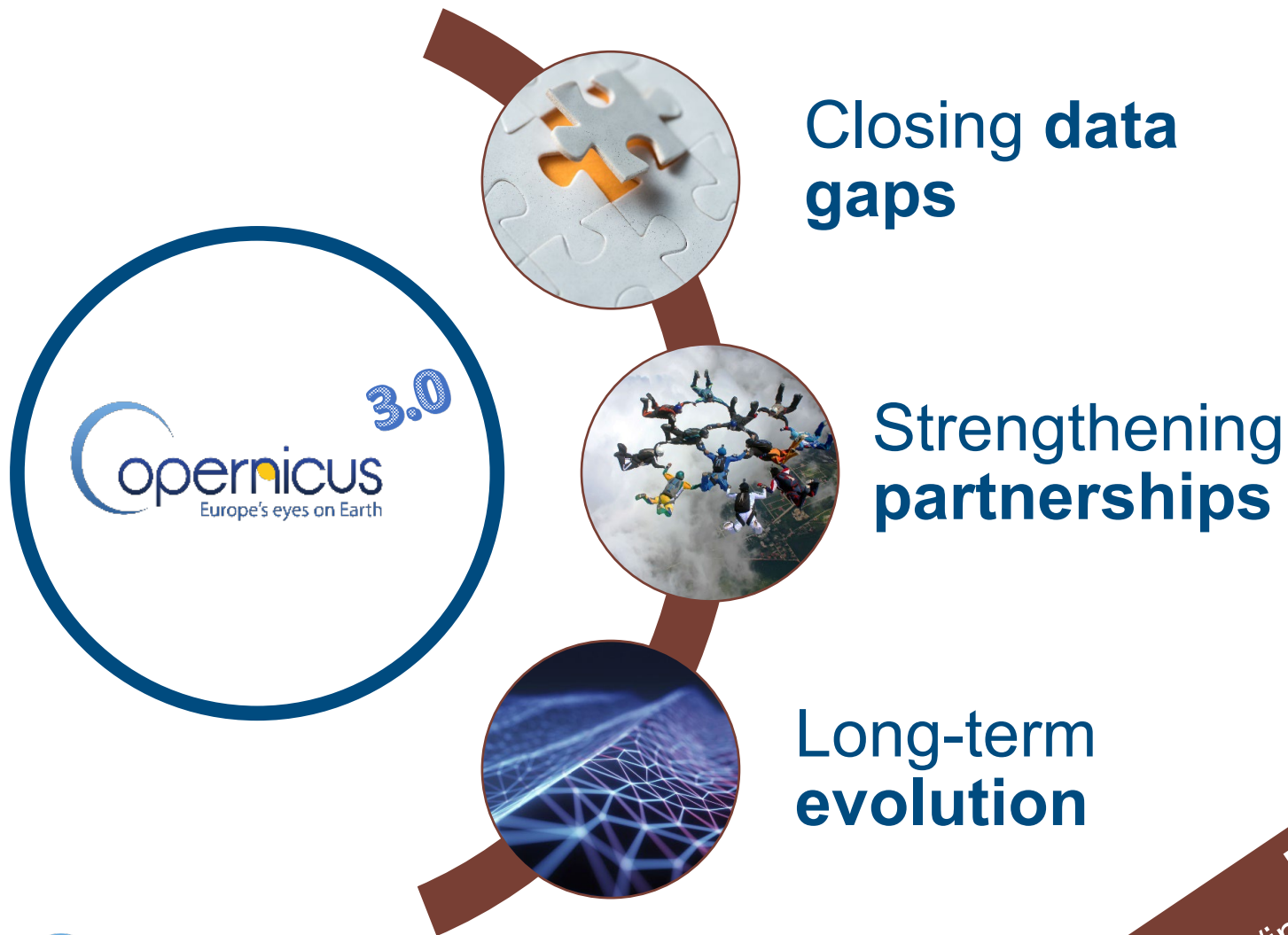


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In situ

State of Play: Areas for evolution



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More information on <https://insitu.copernicus.eu/state-of-play>

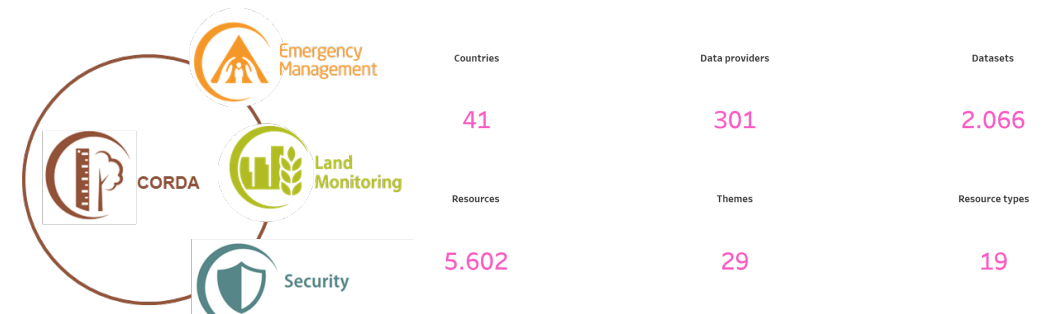
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Access to geospatial data: CORDA

In situ

- Single entry point node to national and regional geospatial data
 - Data hosted in origin by default
 - Continuous monitoring and update
 - Semantically harmonized multi-country databases for key topics
 - Restricted for Copernicus service providers and data providers
- <https://corda.eea.europa.eu/>



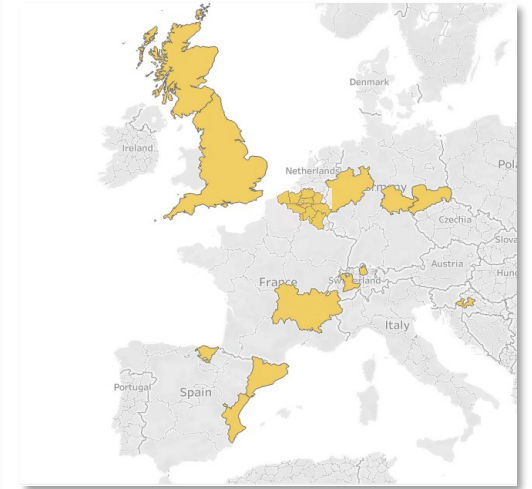
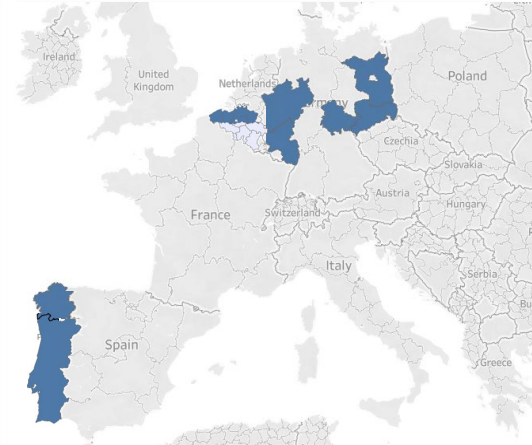
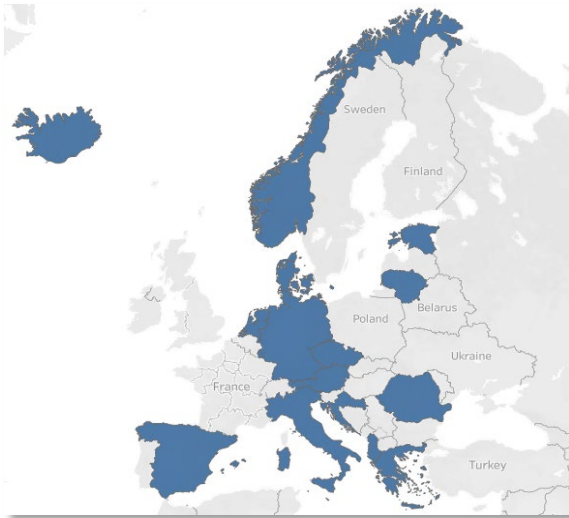
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Examples of downloadable data in CORDA

In situ



Wetlands

- 15 national datasets
- 8 regional datasets

LiDAR

- 15 national datasets
- 16 regional datasets



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In situ

Engaging with data providers

National Data Providers | Data Provider Networks | All Data Providers

Greece

Country	Name	Website	Type	Requirement groups
Greece	Department of Geodesy and Surveying - Aristotle University of Thessaloniki (AOU)		Research	Other
Greece	Democritus University of Thrace, Department of Environmental Engineering, Special Account for Research Funds	http://www.recom.duth.gr/	Research	
Greece	Hellenic Centre for Marine Research, Institute of Oceanography (IOO)	http://www.hcmr.gr/en/	Research	
Greece	National Observatory of Athens (NOA)	http://www.gis.noa.gr/services/GPS/NOA.php	Research	
Greece	Biomedical Research Foundation of the Academy of Athens	https://www.bioacadem.gr/	Research	
Greece	University of Athens Institute of Accounting Systems and Applications	http://forecast.uoa.gr	Public	
Greece	National Cadastre and Mapping Agency S. A.	http://www.estratogeia.gr/files/wn/Pages/Defa.../all.aspx	Public	
Greece	National Technical University of Athens, Physics Department	https://www.physics.ntua.gr/~nrcak/en.html	Public	
Greece	University of Crete	http://www.uoi.gr/	Public	

All providers

Product experience service

Type

Number of datasets

Number of providers

Use of Italian national land cover / land use data to support identification of difficult mapping areas along coastal zones

Summary

Abstract data like the Copernicus data for Italy were used to support the thematic interpretation and Q-QA of the production of CLM4 crop type mapping of "Wetland Cover". The use of national archive data was necessary to increase the consistency of some variables in other years and the availability of the LULU data. With the digital interpretation data based on the field validation, the accuracy risks support the usual interpretation of official data. The map of the Italian land use system process, among other things, information about habitats and their evaluation at scale of 1:50,000 and 1:25,000.

Datasets used

- Map of the National System of Italy, Carta della Rete, Italian Institute for Environmental Protection and Research - Istituto Superiore per la Protezione e la Ricerca Ambientale (ISPRA)

Data providers

- Italian Institute for Environmental Protection and Research

Preview

Use of Austrian LPIS data in the production of HRL VLCC - crop type product

Summary

LPIS data is key for calibration and validation of HRL VLCC (Vegetation Level Cover Characteristics) Crop Type products (CTY). The HRL VLCC CTY for reference year 2015 is a 30m raster product with a variable crop type nomenclature (17 broad crop classes). While some other CLM4 products can also rely on visual interpretation, this is no longer feasible for large scale classification of crop type level. Production of CTY is currently ongoing and the product is neither published nor validated yet but that results from the internal validation show that the results are significantly better in all areas where detailed LPIS data is available as input for the production. LPIS data for Austria are provided by the Agricultural Agency.

Datasets used

- Internal Reference Austria 2012, Agricultural Agency

Data providers

Agricultural Agency (AMA)

Preview

Comprehensive inventory of data providers and networks

Use cases of national data in Copernicus

Copernicus Services Framework Agreement

Between: **EuroGeographics AISBL**, an international non-profit organisation under Belgian Law, with its registered office at address Rue du Nord, 16, 1000 Brussels, Belgium. Registration N°033.627.112

Hereafter "EuroGeographics" or "the Association";

And: [Name], a national organisation having the status of a [], registered under the laws of [] with its registered address [], Registration N° (if any) [], VAT N° (if any) []

Hereafter "the Member";

Hereby duly represented by []

License agreement for the use of data and/or products for the Copernicus Services

1. PARTIES

This License is agreed between:

EUMETNET, Avenue Des Chateaux, 3, 1080 Brussels, Belgium. Licensor of the data and/or products to be used herein, acting on behalf of its Members, represented by Eric PETERMANS, Member or related to the Licensor

and

The European Environment Agency, (hereinafter referred to as the "EEA") acting under delegated tasks for the European Commission and Copernicus. The Commission makes the delegation agreement on the implementation of the Copernicus Land Monitoring Services and the Data Component entered into with the European Union on 1 December 2014, implemented for the purpose of this license agreement by Mr. Hans Bruyninckx, Executive Director

and representing the following Copernicus Service Operator:

European Commission Joint Research Centre (Emergency Management Service and the Land Monitoring Service);
The European Environment Agency (Land Monitoring Service);
Meteo France (Marine Forecasting Monitoring Service);
Frontis, European Maritime Safety Agency and European Centre for Crisis (Disaster) Service;
European Centre for Medium-Range Weather Forecasting (Atmosphere Monitoring Service and Climate Change Service)

hereinafter collectively referred to as the Licensor for the purpose of this agreement where a provision applies without distinction to the EEA or a Copernicus Service Operator.

2. HEREMITICISM

The Licensee is authorized to use the data and/or products referred to in Article 1 and described in Annex 1 (and referred to as the Data). This Data is provided as specified hereafter:

- For use by those organizations with a delegated authority from the European Commission (the Copernicus Service Operator) in order to help fulfil the terms of their respective delegated agreement.

This Permitted Use shall be in accordance with the Limitations of Use as described under Article 4 below.

The terms and conditions of the present license agreement shall apply notwithstanding the provisions of Framework Contract No. 016-020017/2014/L1, signed between the EEA and



Overarching licensing agreements for Copernicus use

Engagement with thematic communities, programmes and initiatives



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Use cases of in-situ data in Copernicus

In situ

Validation of the Copernicus Land Monitoring service's bio-physical products.

Use Case | Created 09 Aug 2024 | Published 27 Aug 2024 | Modified 13 Jan 2025

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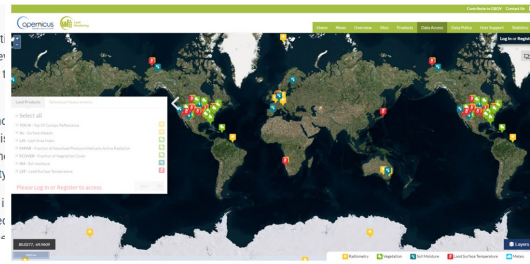
Resources > Folder of all use cases > Validation of the Copernicus Land Mon...

Summary

The Copernicus Land Monitoring Service (CLMS) performs systematic terrestrial cryosphere variables, i.e., the bio-geophysical status and energy portfolio focuses on land temperature and reflectance observations from satellite surfaces.

This results in a continuous timeseries of Vegetation indicators, Land Surface Temperature, and Reflectance observations suited for environmental analysis and decision-making, providing a comprehensive view of the Earth's energy dynamics, enabling information on climate change mitigation, sustainable land use, water management, and biodiversity.

Importantly, validation against in-situ or ground-based observations shows that CLMS are consistent, fit for purpose, and meeting key user quality requirements with well-validated and quality-controlled in-situ data and networks.



Geographical distribution of stations and networks used by the Copernicus Land Monitoring Service for validation of biophysical products. Credit: Copernicus Land Monitoring Service (CLMS) / Joint Research Centre (JRC).

Lake water quality

Use Case | Created 09 Aug 2024 | Published 27 Aug 2024 | Modified 13 Jan 2025

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Resources > Folder of all use cases > Lake water quality

Summary

Lake water quality information helps manage valuable ecosystems for nature and human activities and documents the impact of climate change and pollution. Lake water quality is vital to understanding not only the quality of the water in the lake, but also changes in land use as well as water chemistry, temperature and quality of contributing streams and rivers. It is of critical importance to aquatic ecology, and often to water supply. Changes to optical properties can indicate the influence of land use change, changes in water quality.

The Copernicus services produce several water quality related products:

- Turbidity (water clarity);
 - Trophic state index based on chlorophyll-a;
 - Lake surface reflectances measuring the apparent colour of the water.
- The next generation of products is expected to include additionally:
- Total suspended matter concentrations;
 - Chlorophyll-a concentration as a direct measure of phytoplankton biomass;
 - Harmful algal blooms of cyanobacteria.

Satellite data, such as those provided by Copernicus Sentinels, greatly reduce the potential for 'accessibility bias', whereby in-situ observations are taken from easily accessible areas rather than the best scientifically. Additionally, satellite observations can be taken from areas that are difficult to access.



Use of national habitat types in Iceland to support the production of CLC+ raster product

Use Case | Created 26 Jun 2024 | Published 12 Jan 2017 | Modified 14 Jan 2025

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Resources > Folder of all use cases > Use of national habitat types in Iceland...

Summary

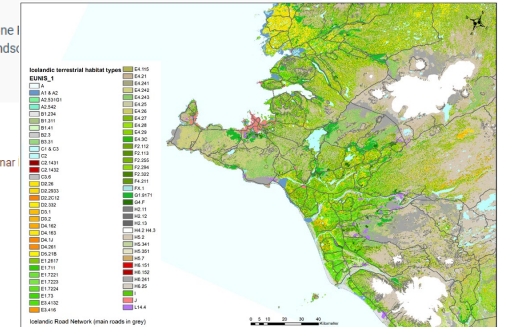
In the CLMS Land Cover and Land Use Mapping production of the CLC+ Backbone habitat map was used for sample point interpretation especially for complex lands and herbaceous areas which are difficult to differentiate on satellite images.

Datasets used

- Icelandic Terrestrial habitat types (EUNIS classification) map (Kortasjá Náttúrufræðistofnunar Náttúrufræðistofnun Íslands)

Data providers

- Icelandic Institute of Natural History (IINH)



Use of Spanish national data in supporting post-wildfire damage assessment

Use Case | Created 26 Jun 2024 | Published 16 Aug 2023 | Modified 13 Jan 2025

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Resources > Folder of all use cases > Use of Spanish national data in support...

Summary

On 15th August 2023, a wildfire broke out on Tenerife, Canary Islands, Spain, particularly affecting Arafo and Candelaria municipalities, with potential risks of spreading to other areas. The affected region in the Forestal Natural Park, and poses a threat to the Teide National Park, the Mapping service was activated with the EMSR685 code to monitor the over 12,000 hectares, and about 207 buildings were identified as potentially affected. The Spanish national data (The Forest Map) was used as a reference to produce the P07-Wildfire delineation and grading product. The Spanish national data (The Forest Map) was used as a reference (i.e. agriculture production and crop, forest stand information etc.) to produce the P14 - Impact assessment on assets and population affected areas by fire severity.

AO1: TENERIFE

	Unit of measurement	Destroyed	High damage	Moderate damage	Height to light damage	Total affected
Burnt area	ha	0.0	87.2	825.6	11027.7	11900.5

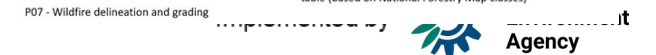
P14 - Impact assessment on assets and population affected areas by fire severity

	Unit of measurement	High damage	Moderate damage	Height to light damage	Total affected
Burnt area	ha	87.2	825.6	11027.7	11900.5
P07 (Buildings)	ha	71.89	747.99	4344.39	5163.27
P14 (Buildings)	ha	0.00	84.00	279.96	353.96
P14 (Buildings)	ha	0.00	0.00	0.00	5.57
P14 (Buildings)	ha	0.00	0.00	0.00	19.95
P14 (Buildings)	ha	0.00	0.00	185.52	185.52

P15 - Impact assessment on selected aspects

An extraction from the affected forest classification table (based on National Forestry Map classes)

P07 - Wildfire delineation and grading



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Copernicus Europe's eyes on Earth



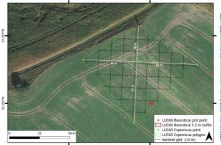
Relevant reports and inventories

In situ



Assessment of the current usage of LUCAS survey in Copernicus

With focus on production activities within Land Monitoring Service and Emergency Management Service – Mapping component



Version: 2.2
Date: 20/09/2024

This report has been produced under the Framework Service Contract (EAS/DS/SP/2022) for the provision of services supporting the European Environment Agency's activities cross-cutting coordination of the Copernicus programme in the data domain – Observational Data

Assessment of the use of LUCAS in Copernicus Land production activities

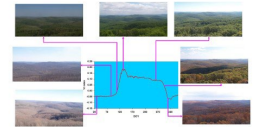
<https://insitu.copernicus.eu/resources/library/assessment-of-the-current-usage-of-lucas-survey-in-copernicus-january-2024>

Metadata inventory of historical in-situ data for vegetation phenology products

<https://insitu.copernicus.eu/resources/library/global-phenology-inventory>



Metadata inventory of historical in-situ data for vegetation phenology products



Version: V1.0
Date: 30/03/2024
This report has been produced under the Framework Service Contract (EAS/DS/SP/2022) Lot 1 for Services supporting the European Environment Agency's (EEA) cross-cutting coordination of the Copernicus programme in the data domain – Observational Data



Roadmap for a crowdsourcing campaign for in-situ data collection to support Copernicus Land Monitoring Service (CLMS) activities

Preparatory work for a crowdsourcing campaign supporting the HR Vegetated Land Cover Characteristics – Grassland Mowing Product (GSM)



Version: 1.1
Date: 17/12/2024

This report has been produced under the Framework Service Contract (EAS/DS/SP/2022) for the provision of services supporting the European Environment Agency's activities cross-cutting coordination of the Copernicus programme in the data domain – Observational Data

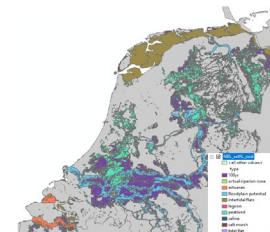
Crowdsourcing approaches for the collection of grassland mowing events

<https://insitu.copernicus.eu/resources/library/crowdsourcing-campaign>

Assessment of the availability of wetlands dataset for CLC+

Table 1: requirements for wetland data for CLMS

Requirement	
spatial coverage	EEA38 + UK (pan-European coverage)
temporal coverage/ update frequency	annually, 3-yearly
Reference years	2018, 2021, 2022-
Format	vector or raster
resolution	MMU 0.5ha; 10m
Licensing	free and open, or for Copernicus projects use
	needed
	LAEA
	~ 80%
	separation of unmanaged and managed wetlands
	differentiation between water and wetlands
	Inland wetlands: inland marshes, peatbogs (exploited, unexploited),
	coastal wetlands: salt marshes, saline, intertidal flats,
	water courses, lakes and reservoirs, transitional waters, sea & ocean
	differentiation inland water and sea water
	visual interpretation, semi-automatic processing



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In situ



insitu.copernicus.eu
copernicus.insitu@eea.europa.eu



SUBSCRIBE!!!



Ongoing in situ support activities

In situ

Design of a crowdsourcing campaign

Design a **pilot crowdsourcing-based campaign** in support of CLMS (grassland mowing events under HR VLCC).

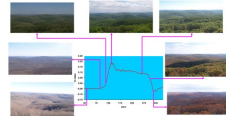


Support on the future of LUCAS survey

Inventory of phenology datasets

Creation of **inventory of in-situ historical metadata of data** relevant for vegetation phenology products: citizen science, phenocams and ecological observatories.

Historical In-situ Metadata
Inventory for vegetation
phenology products



Version: VXX
Date: XX
This report has been produced under the Framework Service Contract ESAC/DIR/2016/1 for the Service supporting the Copernicus Ground-based Agency (EGSA) cross-cutting coordination of the Copernicus programme's in situ data activities - Observational data.

Inventory of phenology datasets



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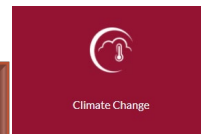
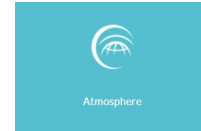


In situ

Requirements for in-situ data at global level

Feedback from the IEA, linked with the coordination of Copernicus' access to in situ data. Some of these results may also be reported by the individual Copernicus Services.

Entity	Signed	Status / Impact
United States – U.S. State Department	October 2015	Nothing to report.
Australia – Geoscience Australia	November 2015	A Technical Operating Agreement was signed May 2017 by the IEA and Geoscience Australia. The purpose of the agreement is 'to facilitate dialogue and data sharing between Copernicus Australia and Copernicus'.
Brazil – Ministry for Science, Technology, Innovation and Communication of Brazil	March 2018	Within the frame of the Cooperation Arrangement and based on a specific request, climate and meteorological observations have been delivered by the Brazilian Meteorological Institute (INMET) to Copernicus.
Chile – Undersecretariat of Telecommunications of the Republic of Chile	March 2018	Within the frame of the Cooperation Arrangement and based on a specific request, historical and real time meteorological observations have been delivered to Copernicus via the National Weather Office of Chile and University of Chile.
Colombia – Institute of Hydrology, Meteorology and Environmental Studies of Colombia	March 2018	Dialogue has been initiated and concrete in situ data requirements defined by the Copernicus Services have been passed on to the Institute of Hydrology, Meteorology and Environmental Studies of Colombia (IDEAM). No concrete results have been achieved.
India – Department of Space of India	March 2018	Dialogue has been initiated and concrete in situ data requirements defined by the Copernicus Services have been passed on to the Indian Space Organisation (ISRO). No concrete results have been achieved.
Ukraine – Ukraine State Space Agency	May 2018	Nothing to report.
Serbia – Ministry of Education, Science and Technological Development of Serbia	June 2018	Nothing to report.
African Union – African Union Commission	June 2018	Nothing to report.
Canada – Canadian Space Agency	May 2022	Within the frame of the Cooperation Arrangement and based on a specific request, a large amount of climate and meteorological observations have been delivered to Copernicus by Environment Climate Change Canada.
Panama – National Authority for Government Innovation	December 2022	Nothing to report.
Japan – Ministry of Economy, Trade and Industry of Japan	January 2023	Dialogue has been initiated (April 2022) and concrete in situ data requirements defined by the Copernicus Services have been passed on to the Ministry of Economy, Trade, and



More than 10 International Arrangements with non-EU countries

Hydrology

- River discharge
- Reservoir volumes

Atmosphere

- Concentrations of major air pollutants (NO_x, PM₁₀, PM_{2.5}, CO, SO₂, HCHO, Pb, TSP, C₆H₆, among others).
- Improved observation of size resolved chemical composition of aerosol.
- Improved global observations of greenhouse gas concentrations and related species (CO₂, CH₄, N₂O, 14C, ...).
- Vertically resolved concentration data of pollutant gases and aerosol.
- Solar radiation and UV.

Climate

- Surface observations from all stations registered in WMO Oscar/Surface

Land

- Land cover ground observations, and for some specific areas of interest, crop type observations
- Water quality observations
- Water level observations
- Soil moisture information
- GBOV complementing stations



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New Copernicus In-Situ website – subscribe!

In situ

COPERNICUS IN-SITU COMPONENT

Copernicus relies on the availability of a wide variety of in-situ data. These data are used for production and validation of Copernicus products and are also provided to users as observations in their own right.

[Image story](#)

Image © Isra'la Atmospheric Observatory/Clarity BAYN Ltd/Cover

Copernicus and its In-Situ Component

In-situ data, namely observations and geospatial reference data, are crucial for the generation, calibration and validation of satellite data, products and services of Copernicus, the Earth Observation component of the EU Space Programme.



Copernicus is the European Union's revolutionary Earth Observation component of the EU Space Programme. It transforms information from multiple sources, including the Sentinel satellites and in-situ observations. Into operational services for keeping watch over the planet – from the land to the ocean, atmosphere and climate.



For its operations, Copernicus relies on ground-based, air and sea borne monitoring systems, geospatial and ancillary data from a range of providers. These data constitute the "Copernicus In-Situ Component" and in-situ observations. Into operational services for keeping watch over the planet – from the land to the ocean, atmosphere and climate.



The Cross-Cutting Coordination of the Copernicus In-Situ Component, led by the European Environment Agency (EEA), maps the availability of data and identifies gaps or bottlenecks in access. It also supports the provision of cross-cutting data and information, and manages partnerships with data providers to improve access and use.

In-situ data in Copernicus and its governance



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Use of Polish national data LiDAR in the production of CLMS Urban Atlas Building Block Height (BBH) product (2012) Copernicus In Situ

High quality LiDAR data has been used as first scenario for generating the Copernicus Land Monitoring Service (CLMS) Urban Atlas Building Block Height (BBH) dataset (production process) when reaching the target year (2012). These are the main data.

Use of data from Austrian Automatic Tracking Total Station of ground movements for the validation of the European Ground Motion Service (EGMS) product | Copernicus In Situ

The daily ground monitoring measurements in X, Y and Z coordinates are acquired by continuous Automatic Tracking Total Station (ATTS) systems. The ATTS are autonomous geodesic devices for 3D monitoring of deformations. They consist of optical targets.

Use of French Ground Movements database for the validation of the European Ground Motion Service (EGMS) product | Copernicus In Situ

The French national database of ground motion includes positions of landfills for each French department and for one of the EGMS validation areas (French Pyrenees Alps). The core files include point coordinates of different registered phenomena.

Use Cases

Data Providers

As part of the Copernicus In-Situ Component Information System (CIS), the EEA maintains a list of national, European and international in-situ data providers to Copernicus.

Country	Name	Website	Type	Requirement group
Albania	Institute for Public Health (ISHP)	http://ishp.gov.al	Public	Atmosphere
Albania	Agency of Environment and Forestry (AOF)	http://aof.gov.al	Public	Atmosphere, Ocean
Albania	Ministry of Tourism and Environment	https://turizm.gov.al	Public	Atmosphere
Albania	GOVERN DENDROBA, Minister of Mod Ambient, Agriculture & Sustainable Development (Department of Mod Ambient) (Dendroba) (ARF)	http://www.ara.al	Public	Atmosphere
Argentina	Argentine Antarctic Survey and the Argentine Antarctic Army Command	https://copernicus.gov.ar/arc/arc/index.php	Research	
Armenia	Armenian Environmental Monitoring and Information Center	http://www.amemc.am	Public	
Australia	Copernicus National Scientific Data Infrastructure Research Unit	https://www.cnsdi.gov.au	Public	
Australia	Australian Antarctic Division Department of the Environment, Energy and Heritage	https://www.aad.gov.au	Public	

In-situ data providers

In-Situ Component: Looking back and moving forward | Copernicus In Situ

The European Commission Agency (ESA) has a mandate from the Commission to oversee the state of in-situ data and to ensure the smooth operational delivery of this data to key entities like Copernicus Services, the European Space Agency, and ESA/ESTEC.

Reflecting on Copernicus, ground motion service and in-situ data at EEA over the years | Copernicus In Situ

Do not use it for operational purposes. All changes will be regularly overwritten towards EEA/Andreas has been an in-situ provider of the European Environment Agency (EEA), serving under various in the development of the Copernicus programme.

An Illustrated History of the In-Situ Component of Copernicus | Copernicus In Situ

Making Copernicus 20th anniversary. Reflections on In-Situ critical role in Earth observations, overcoming early challenges, and future significance.

Articles

Review of global in situ data for lakes and reservoirs

Global Lakes Reservoirs Report Catalogue v1.0.zip

Tags: #Lakes #Spatial data #Observations #Water

Copernicus components

Technical Reports

Copernicus Climate Change Service

Why are in-situ data essential?

The Copernicus Climate Change Service (C3S) mission is to support adaptation and mitigation policies of the European Union (EU) by providing consistent and authoritative information about climate change. C3S offers free and open access to climate data and tools based on the latest available science and responds to user requirements defined by the Global Climate Observing System (GCOS).

The product portfolio of C3S is built around the concept of Essential Climate Variable (ECV) as defined by GCOS. These variables are used to monitor how the climate has been changing in the past and also how it will change in the future.

In-situ observations are fundamental to the quality of C3S products and services, and they must be preserved to enable future productions of Climate Data Records and Earth System Analysis. In general, C3S needs access to essential in-situ observations to perform three main tasks:

- Climate readiness. In-situ observations provide essential information about the past climate, its variability and change. Observations are fundamental to user requirements defined by the Global Climate Observing System (GCOS).
- Calibration and validation of satellite observations. In-situ observations enable production of multi-decadal C3S providing information about many different ECV datasets from calibrated and validated satellite data.
- Evaluation and improvement of climate models. In-situ observations are used to compare model results against observations.

State of Play

Copernicus In Situ Newsletter

The events of the past 6 months have seen observations around the globe as countries grapple with the social, medical and economic impacts of the coronavirus pandemic. In this context, this newsletter reflects on the status and progress of rock observations within the Copernicus In-Situ component and by associated partners.

Featured

- The COVID-19 crisis affects information on the state of our environment, climate, and weather, derived from in-situ observations.
- Interview with Miki Cary, Secretary General and Executive Director, Eurogeographics.
- Some emerging approaches of potential value for the Copernicus In-Situ component.

Newsletter

https://insitu.copernicus.eu

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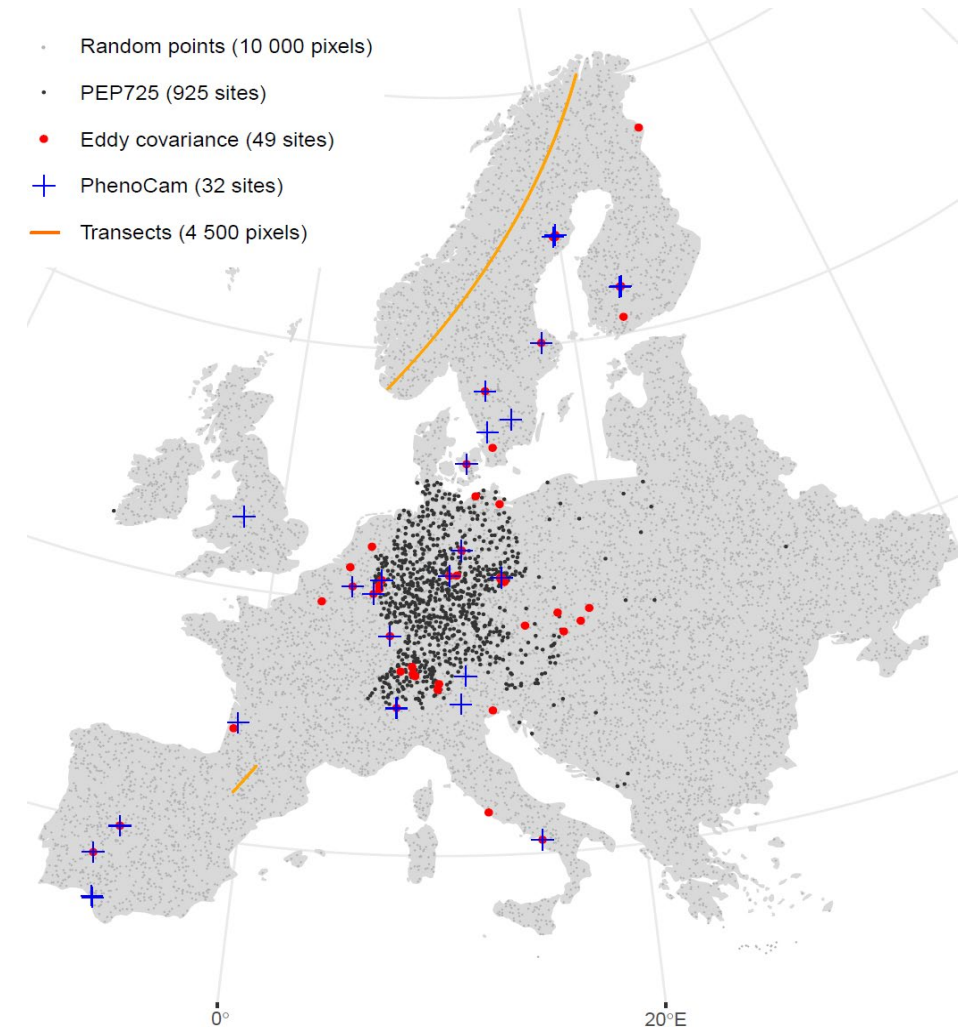
European Environment Agency

Calibration against reference data

Reference datasets

- **GPP:** from eddy covariance (flux towers): 49 sites
- **PhenoCam:** greenness from phenological camera images: 32 sites
- **PEP725 ground phenological observations:** manual field observations: 925 sites
- **Agricultural crop data (Belgium, Austria):** 150 + 278 + 600 fields

Tian, F., et al., 2021, Calibrating vegetation phenology from Sentinel-2 using eddy covariance, PhenoCam, and PEP725 networks across Europe. Remote Sensing of Environment, 260, 112456.



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