

ESA's Earth Observation Programmes

EO Workshop

10 March 2026

Simonetta Cheli

Director of Earth Observation Programmes at ESA

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ESA in a Nutshell



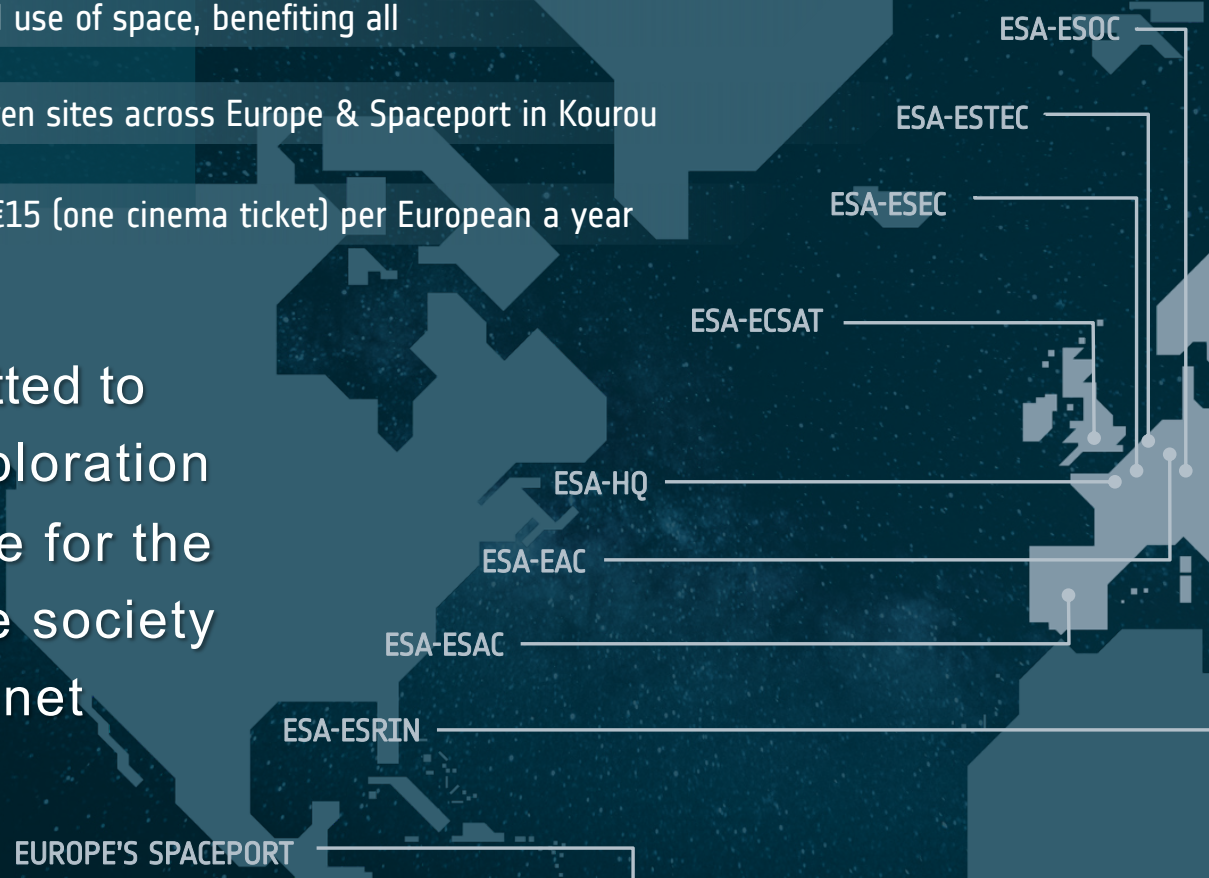
WHO 23 Member States, 2500+ staff members and total workforce of 6000+

WHY For the peaceful use of space, benefiting all

WHERE HQ in Paris, seven sites across Europe & Spaceport in Kourou

BUDGET €7.7 billion = €15 (one cinema ticket) per European a year

ESA is committed to the peaceful exploration and use of space for the benefit of people society and our planet



50 Year of ESA Activities and Achievements



ESA is active across every area of the space sector

Earth
Observation

Space
science

Exploration

Launchers

Human
spaceflight

Navigation

Telecom-
munications

Space Safety

Operations

Technology

+80
programmes
in parallel



World leader in science and technology

Over 100 satellites developed, tested, and operated since 1975

More than 300 launches from Europe's Spaceport in Kourou

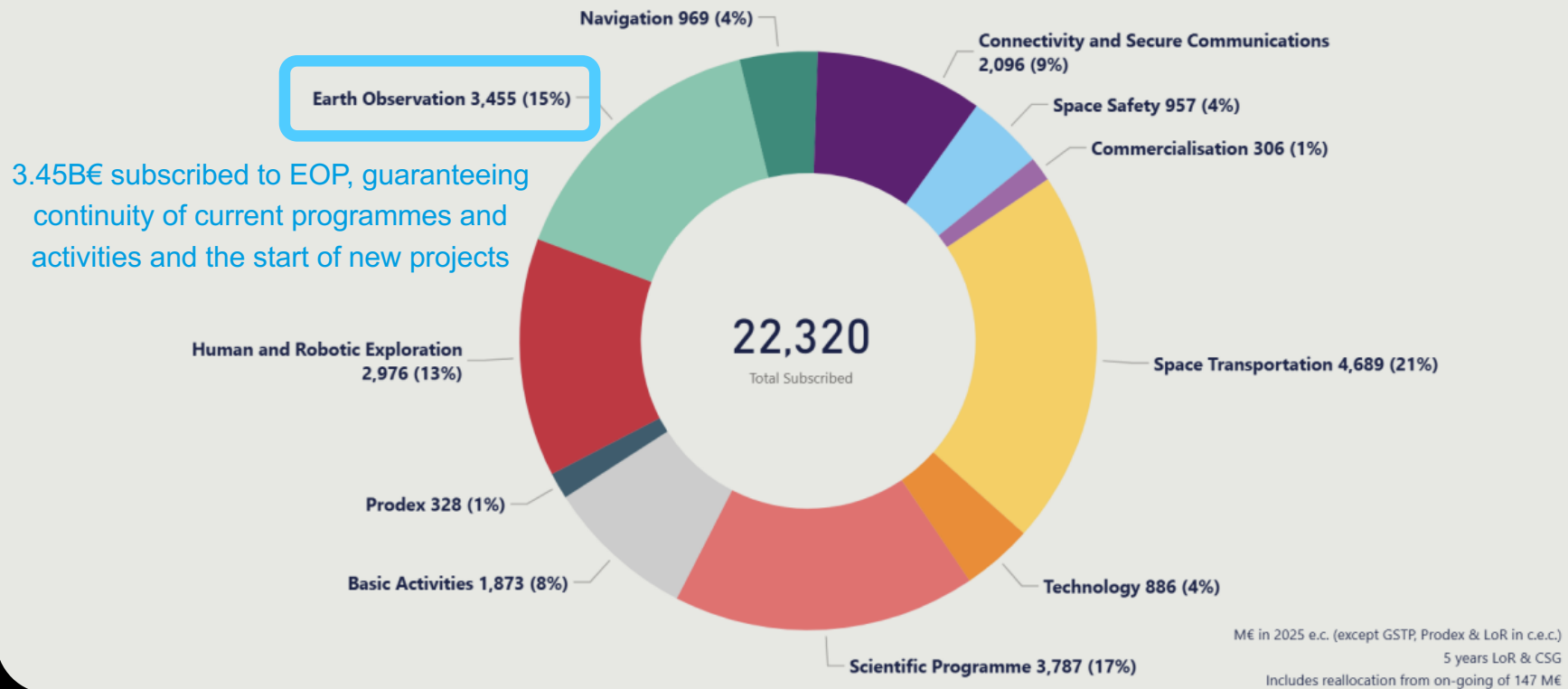


Very Successful Funding of ESA at CM25



A record 22.3 B€ budget for ESA at CM25

(over 3 years for optional and 5 years for mandatory activities)

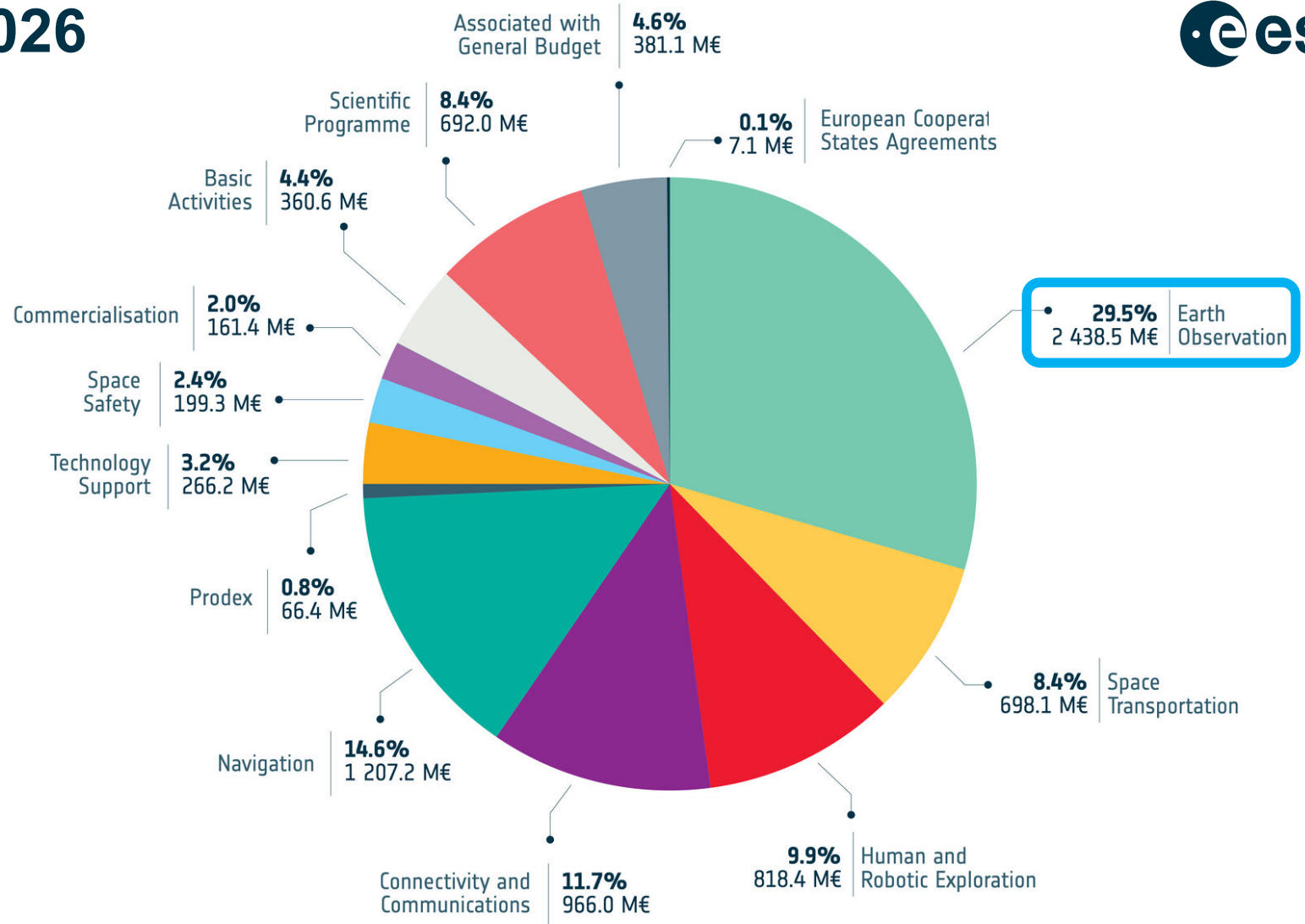


ESA Budget 2026 by domain

(~30% for EOP)



**TOTAL
8.26 B€**



* Includes activities implemented for other institutional partners



2025 - A Year of Successful Launches



AIX, Hive, Forest-3
(InCubed supported)
+ HEO Pathfinder
(Iride precursor)
15 January



Biomass
29 April



7 HEO
(IRIDE first constellation)
23 June



MTG-S1
incl. Sentinel-4
1 July



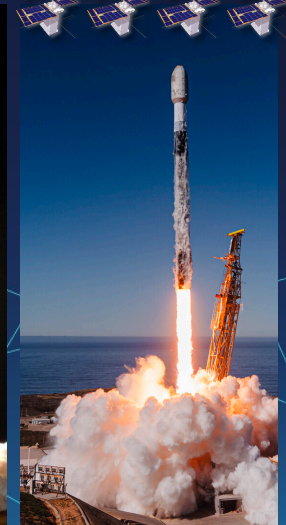
MetOp-SG A1
incl. Sentinel-5
12 August



Sentinel-1D
4 November



Sentinel-6B
17 November



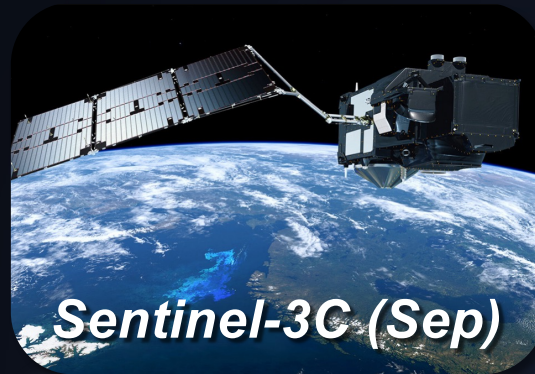
2 HydroGNSS
(Scout)
+ 8 Eaglet *(IRIDE)*
+ 2 Iceye *(GR nat. pr.)*
+ IPERLITE *(BELSPO)*
28 November



Planned Launches in 2026



Three planned launches (S-3C and FLEX dual launch)

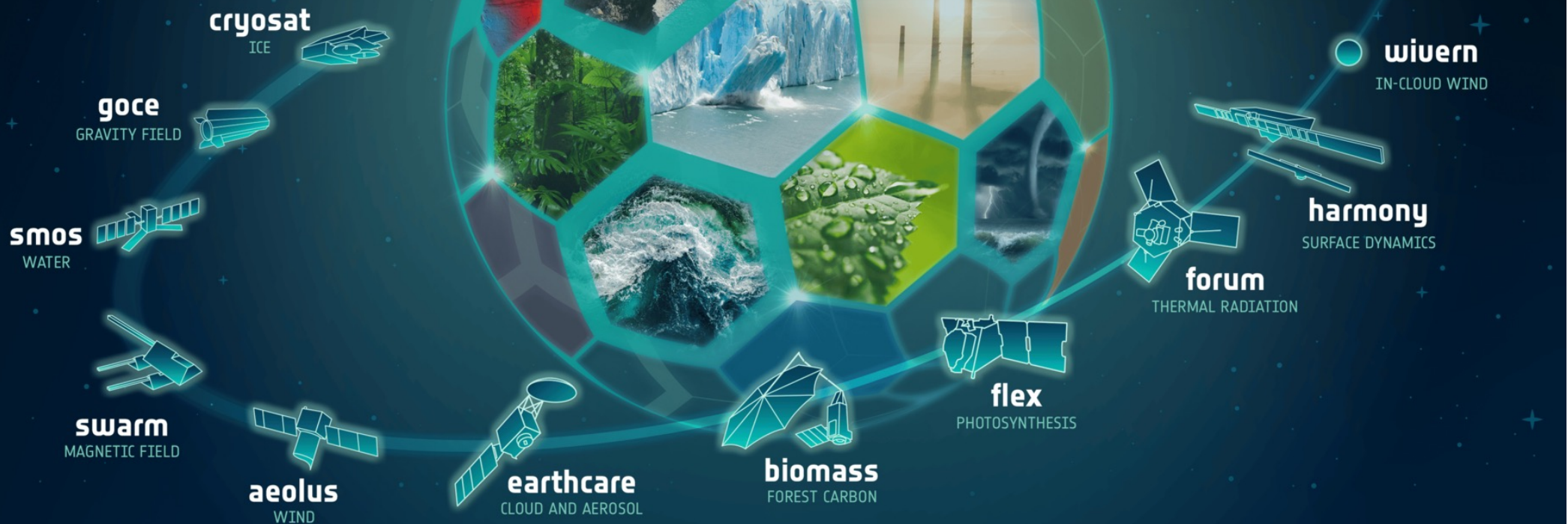


National missions



Earth Explorers

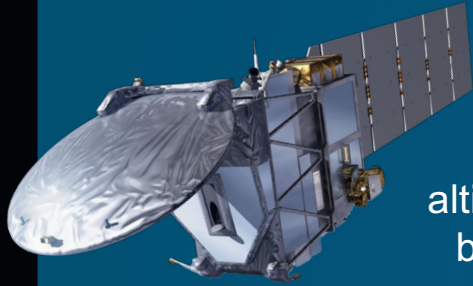
Pioneering Scientific and Technical Excellence



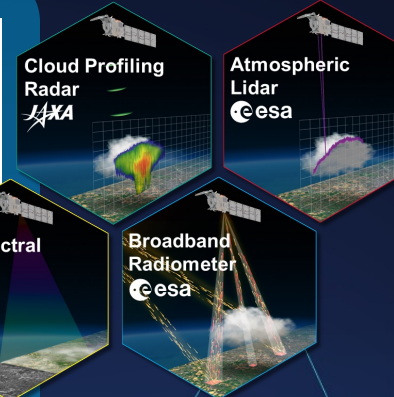
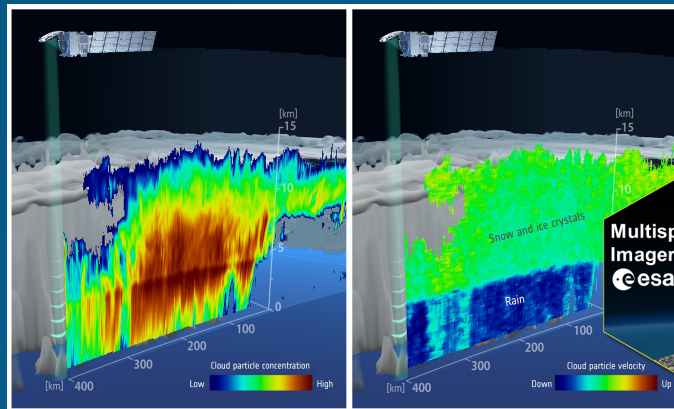
Latest Earth Explorers: EarthCARE and Biomass



EarthCARE (May 2024)

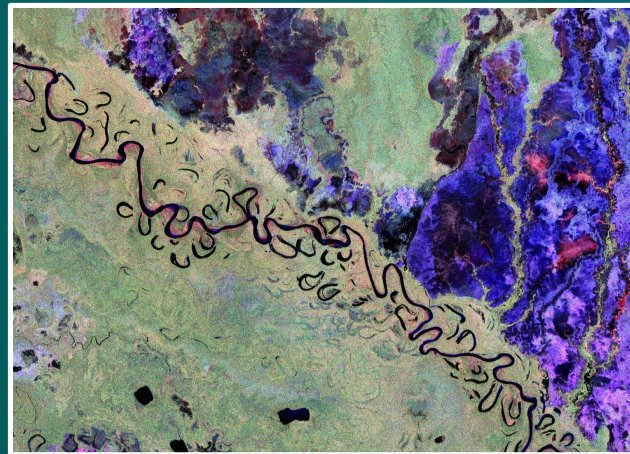
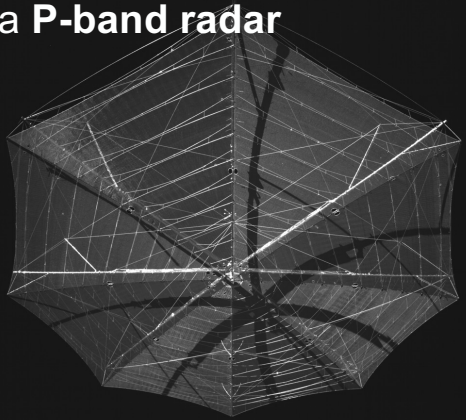


This mission is a **joint venture with JAXA** and provides global observations on aerosols, high altitude clouds and Earth's radiative budget for better understanding of the role of clouds and aerosols in regulating Earth's temperature



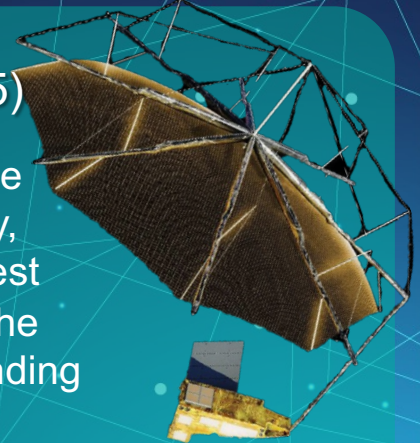
4 Instruments

The first satellite to carry a P-band radar



Biomass (April 2025)

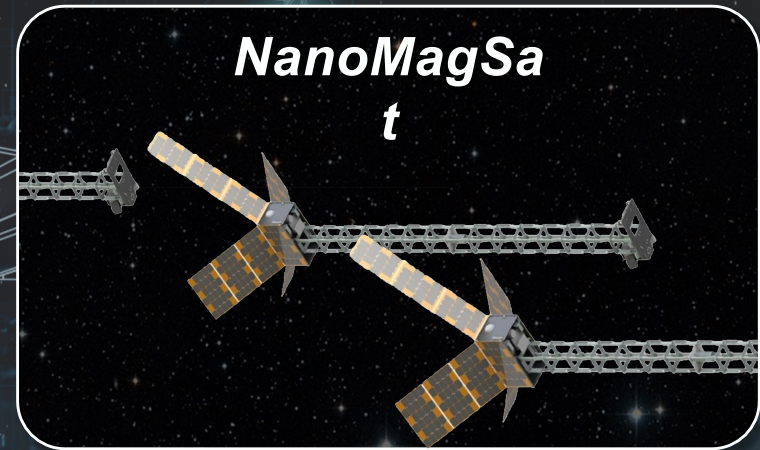
The mission's radar, capable of penetrating forest canopy, measures biomass and forest height consistently across the globe for a better understanding of the Earth's carbon cycle



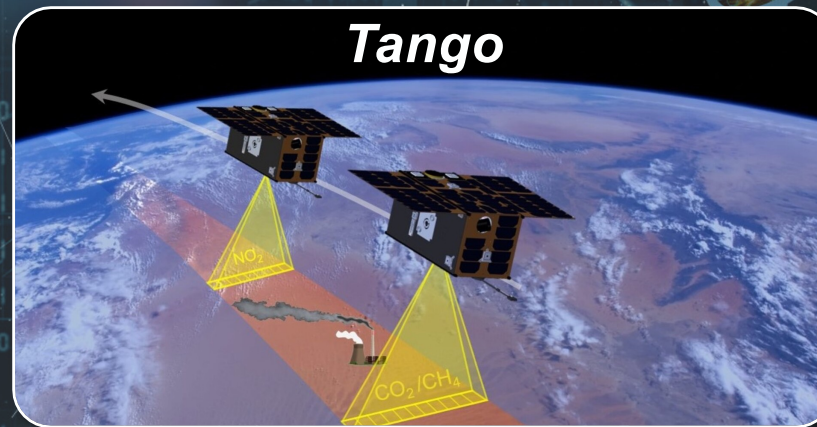
Scout Missions: Agile and Affordable Development of Small Formfactor and Innovative Missions for Value-added Science



Measure key hydrological climate variables



Measure Earth's magnetic field & ionosphere



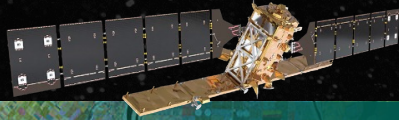
Measure methane, carbon dioxide & nitrogen dioxide



The Copernicus Space Component | Sentinels



Sentinel-1



All-weather, day-and-night radar imaging mission for land and ocean services

2014 / 2016 / 2024 ●●●○

Sentinel-2



Multispectral high-resolution imaging mission for land monitoring

2015 / 2014 / 2024 ●●●○

Sentinel-3



Multi-instrument mission for sea-surface topography, sea/land-surface temp. and ocean/land colour

2014 / 2018 ●●○○

- operational
- inactive
- To be launched

The largest producer of EO data in the world with full, free & open data policy*

> 475.000

Registered Users

20 TB

of daily data production

850+ PB

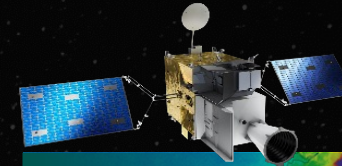
of products disseminated for services to society

Supporting 6 operational services



land atmosphere climate ocean disaster security

Sentinel-4



Geostationary atmospheric monitoring

●○ 2025

Sentinel-5/5p

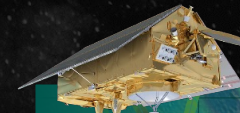


●○○ 2025

Polar orbit atmospheric monitoring

● 2017

Sentinel-6



Altimeter for global sea-surface height

●● 2020 / 2025/

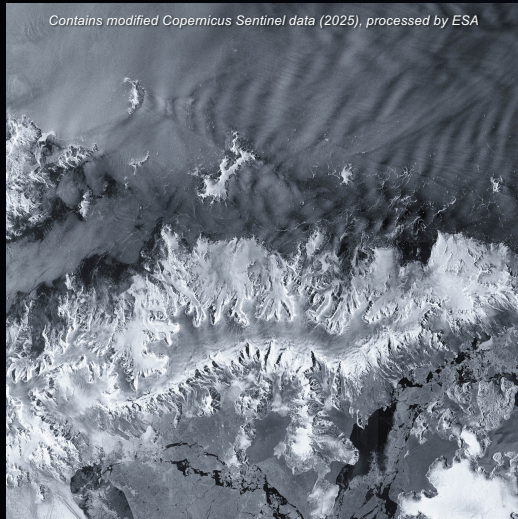
*Esa Sentinel Data Policy (Sep 2013) and EU Delegates Act on Copernicus Data and Information Policy (Dec 2013)



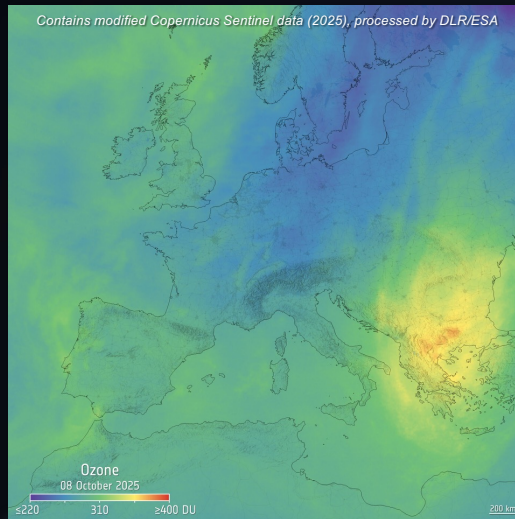
Excellent Data of Recently Launched S1D, -4A & -5A -6B



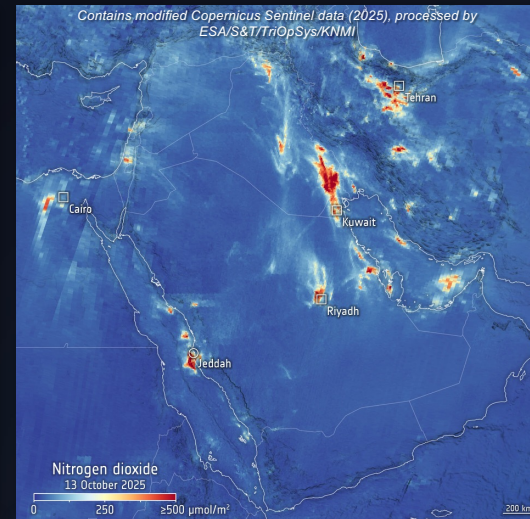
Sentinel-1D



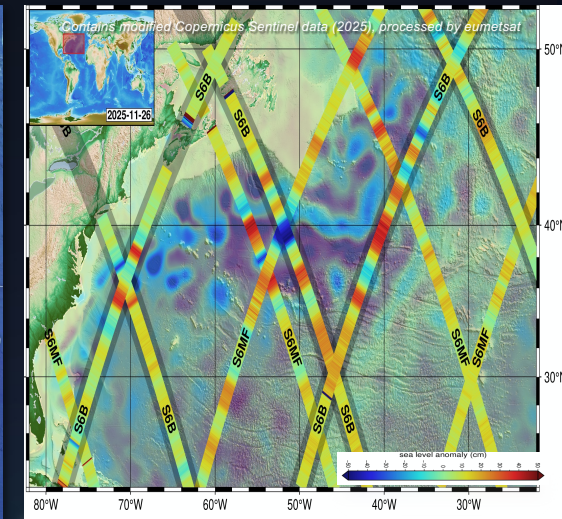
Sentinel-4A



Sentinel-5A



Sentinel-6B



Black and White radar image of Antarctic Peninsula captured on 6 November 2025

Vertical column of ozone over Europe, captured on 8 October 2025

Vertical column density of nitrogen dioxide over the Middle East, captured on 13 October 2025

Altimeter ground tracks of Sentinel-6B and MF showing the Gulf Stream current in the North Atlantic Ocean

Sentinel-1 Radar Image of Tokyo



This image is a combination of three S1 radar acquisitions during 2024 and highlights changes that occurred between each capture



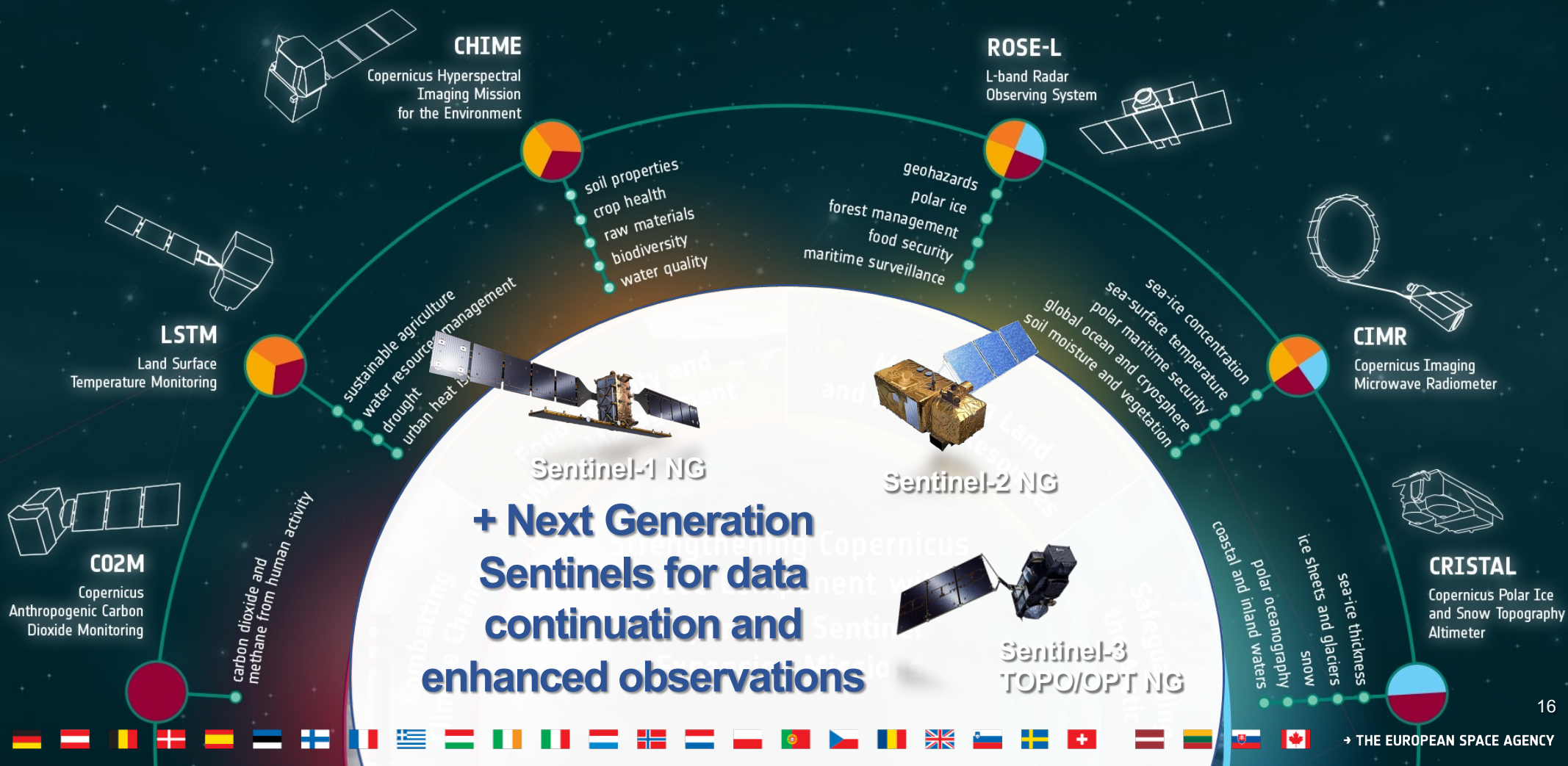
→ THE EUROPEAN SPACE AGENCY

Copernicus Space Evolution

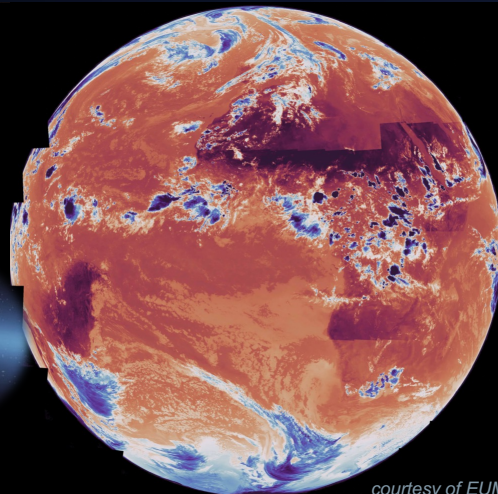


PROGRAMME OF THE
EUROPEAN UNION

co-funded with



Recent Launches of MTG-S1 and MetOp-SG A1



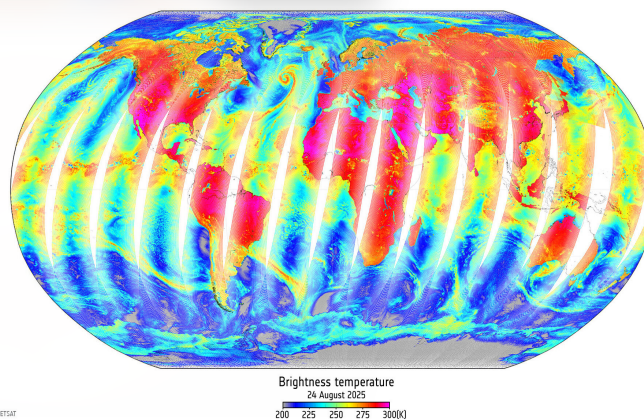
courtesy of EUMETSAT

MTG-S1 (incl. S4, July 2025)

First ever European sounding satellite in geostationary orbit, hosting also the new Copernicus Sentinel-4 atmospheric monitoring mission

MetOp-SG A1 (incl. S5, Aug. 2025)

First next generation European polar-orbiting weather satellite, hosting also the Copernicus Sentinel-5 atmospheric monitoring mission as well as evolved and new instruments designed to deliver essential data for weather forecasting, storm prediction and climate monitoring.



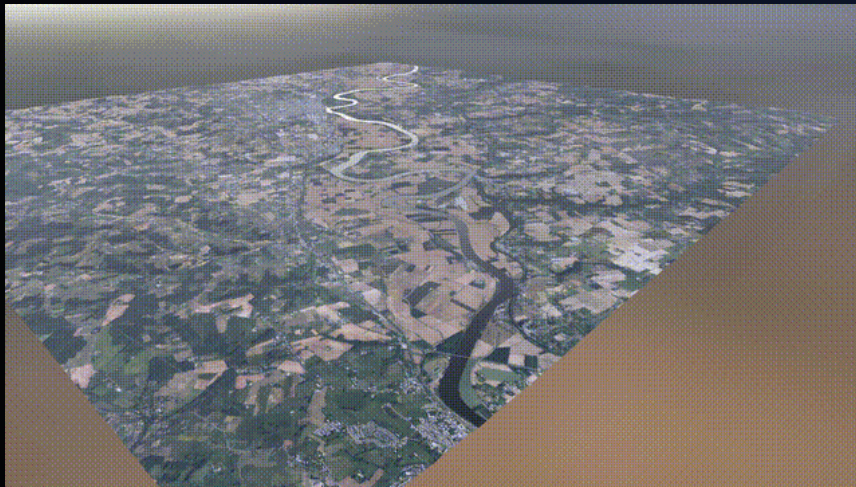
ESA's Digital Twins

ESA delivers actionable climate and environmental information, as well as green solutions for society, while fostering disruptive innovations and business ideas.

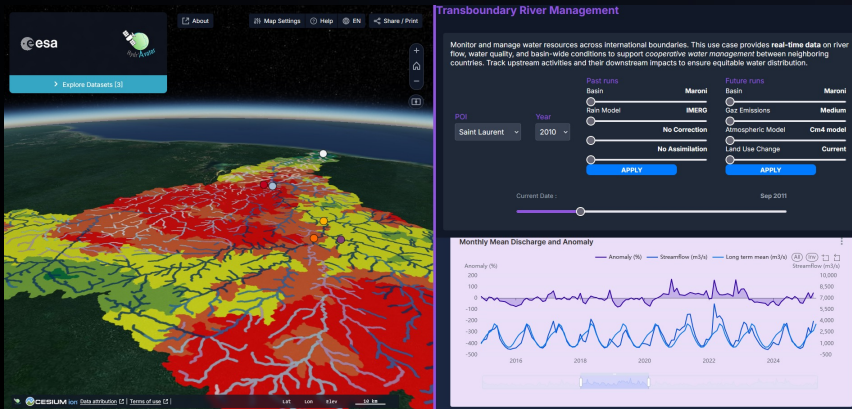
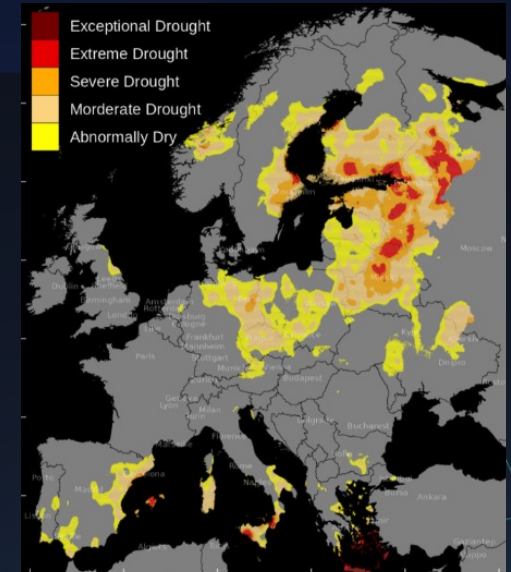
- ◆ Support climate and environmental policies from local to international level
- ◆ Build strategic partnerships for space applications
- ◆ Enable understanding of impacts of policy actions using digital twin models of Earth's systems



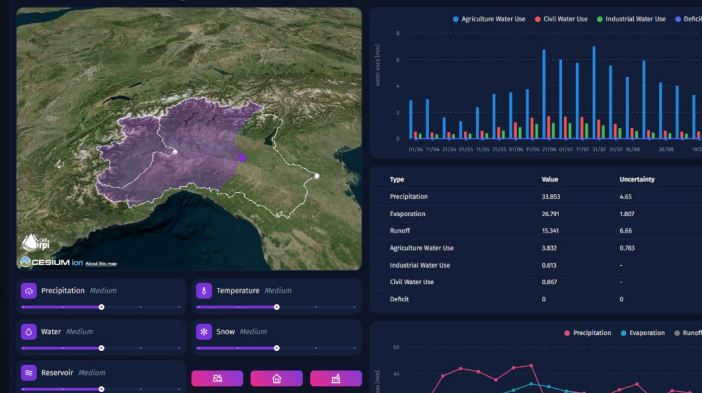
Digital Twin Component Example – Large Scale Hydrology



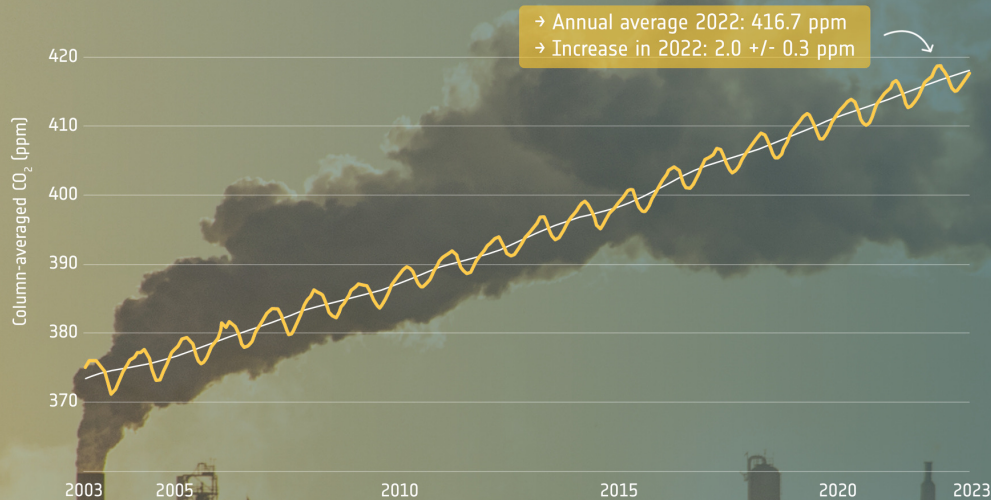
- High resolution hydrological modelling
- European drought monitoring
- What-if scenarios for water management
- Flood risk
- Land slides risk



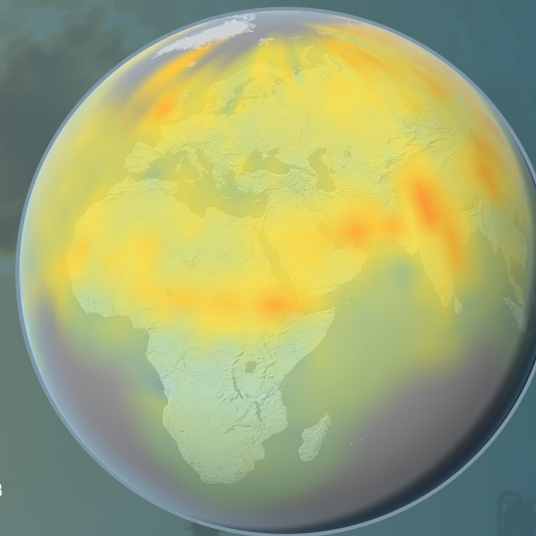
Water Resources Management



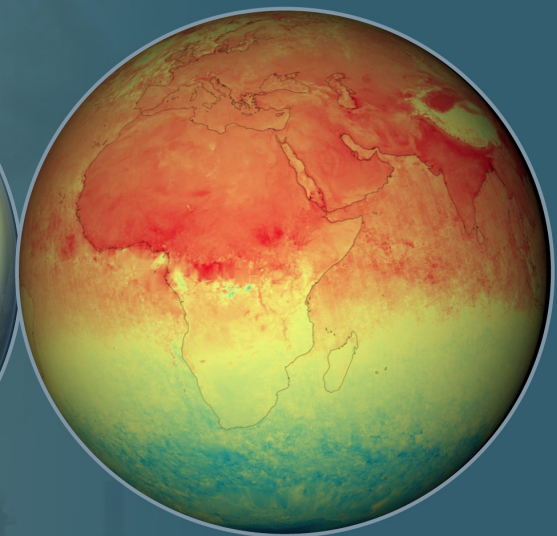
Atmospheric Greenhouse Gases



Atmospheric Carbon Dioxide (CO₂) from satellites
 Copernicus Climate Change Service dataset 2003–2022 (December) using algorithms and brokered products from CCI with data from Copernicus Atmosphere Monitoring Service



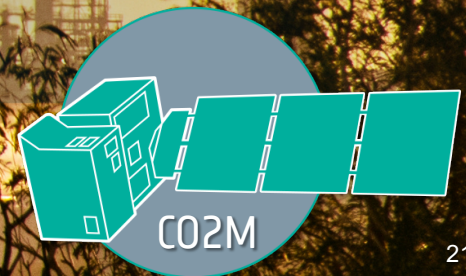
Atmospheric carbon dioxide [XCO₂] - ESA CCI
 365 400 ppm



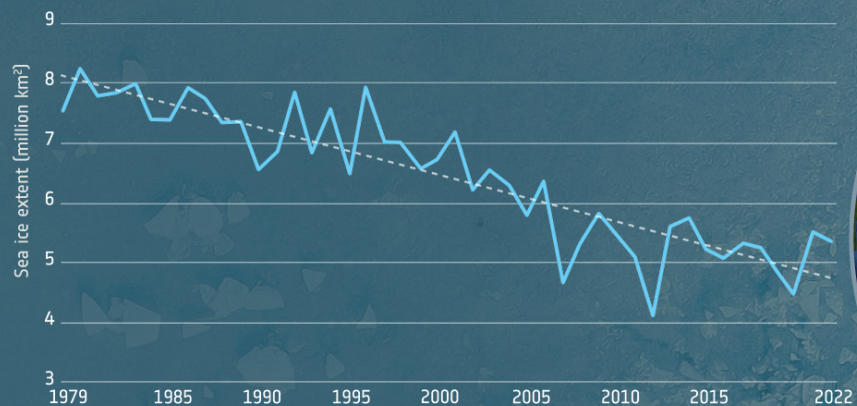
Column-averaged methane - 2020 (ppbv)
 1650 1825 2000

Global methane concentrations - ESA CCI

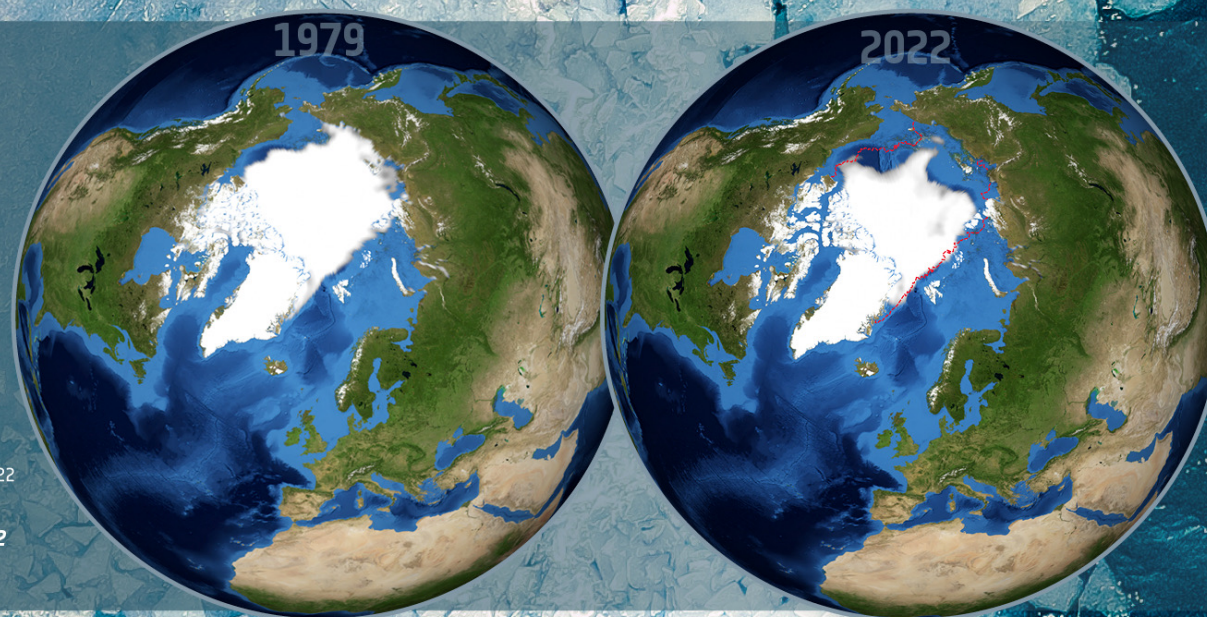
While carbon dioxide is more abundant in the atmosphere and therefore more commonly associated with global warming, methane is around 30 times more potent as a heat-trapping gas, albeit more short-lived.



Evolution of Arctic Sea Ice Extent and Thickness



Late summer (September) sea-ice extent in the Arctic as measured by satellites 1979–2022
 © EUMETSAT OSI SAF data, with R&D input from ESA CCI



Arctic sea ice extent (September 1979 - September 2022)
 Source: OSI SAF data redistributed by CMEMS. © (2022) EUMETSAT

Climate projections, informed by satellite data, show that the Arctic Ocean is likely to experience 'ice free' summers before 2050.

CRISTAL



ESA's EO Programmes



FUTURE EO

Continuing to deliver world class Earth Observation systems and earth science

COPERNICUS

Continuing and enhancing our eyes on Europe and the World

ERS-EO

Responding to resilience & security challenges

INCUBED

Supporting industrial innovation

DIGITAL TWIN EARTH

Enhancing understanding, characterisation & modelling of the Earth



FutureEO Programme Activities for 2026-2028



FutureEO is ESA's primary research and development initiative for Earth Observation, designed to pioneer new satellite missions & technologies



For 2026-2028 the programme will deliver:

- Completion and launch of **Earth Explorer 10 “Harmony”**
(Harmony will study Earth's ocean, ice, and land dynamics at high resolution)
- Concept consolidation and preliminary design of **Earth Explorer 11 “Wivern”**
(Wivern will measure wind inside clouds and deliver profiles of rain, snow & ice water)
- Final design of the **New Generation Gravity Mission “NGGM”**
(NGGM will monitor Earth's gravity field with superior resolution as part of the ESA-NASA Mass-change And Geosciences International Constellation “MAGIC”)
- Selection, implementation and launch of **SCOUT missions 5 and 6**
(Agile, low-cost, rapidly developed small satellite missions to demonstrate innovative EO technologies and science concepts)
- **Earth Action**: Actionable climate & environmental information and green solutions for society, while fostering disruptive innovations and business ideas



COPERNICUS

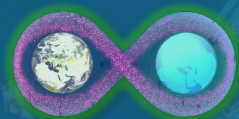


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DIGITAL TWIN EARTH



- Final design and production of **Sentinel-2 Next Generation** (Multi-spectral optical mission for land monitoring with higher resolution & faster revisit than 1st gen.)
- Final design and production of **Sentinel-3 Next Generation Optical** (Mission on marine and land surface temperature, colour and topography with higher resolution than 1st gen.)

- Deliver a **set of EO Digital Twin Components** (Interactive, virtual replicas of Earth's systems (e.g., hydrology, forests) using high-resolution satellite data, AI, and advanced modelling)

INCUBED



- Support the **development of innovative, commercially viable EO products and services**



New Security Programme: European Resilience from Space



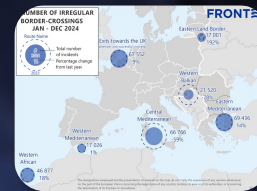
Enhanced situational awareness of EU & Member States:

- Early detection of crisis,
- Intelligence, Surveillance, Reconnaissance,
- Geospatial support

Contributes to preparedness, supports decision-making and action for security and defence



- **Earth-Observation sensors:** VHR optical & radar, possibly advanced sensors
- **Fast revisit capability:** large EO constellations
- **Guaranteed, secure and fast access to data:** Global, Reactive, Reliable
- **Meeting both civil & military needs**



ERS-EO PROGRAMME

Element 1
 Prepare & accelerate the EU's EO Governmental Services (EOGS), based on user needs & security requirements defined by the EC

Element 2
 Federated system of national and multi-lateral resources for a scalable & adaptable solution tailored to diverse user needs & operational contexts

- Federation
- Cluster 1 Alpstar
- Cluster 2 ECSA+
- Space Resilience Nodes

ESA Supporting Development of European EO



ESA as Enabler/Partner

Φ-lab Support & InCubed Co-funding



Accelerate the future of EO through disruptive and transformational innovation



For innovation with strong commercial appeal InCubed accelerates the journey from idea to market by providing co-funding, technical support, and networking for businesses in the EO sector

ESA as Anchor Customer

Third Party & Copernicus Contributing Missions



Earthnet Third Party Missions



ESA buys data for R&D and science needs



Copernicus Contributing Missions

ESA via the Copernicus programme buys data and distribution services for operational public needs



Thank You

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