EU SPACE ACTIVITIES SUPPORTING SUSTAINABLE LIFE, WORK AND RESEARCH IN THE ARCTIC

Funded by
the European Union

EU space investments and services play a pivotal role in enhancing safety, connectivity and observation capabilities in the rapidly evolving Arctic region.

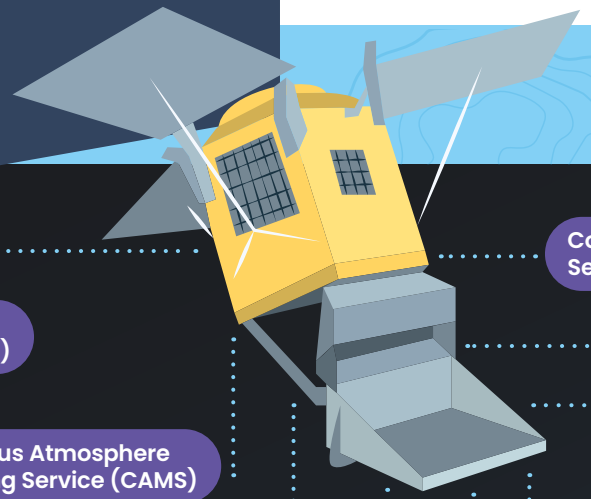
These advancements help provide more efficient monitoring and a better understanding of the changing Arctic environment, and enhance regulatory compliance.

What is the EU Space Programme?

The EU Space Programme encompasses Earth observation, satellite navigation, connectivity and research. It is funded by the EU and implemented in collaboration with the European Space Agency (ESA), the European Union Agency for the Space Programme (EUSPA), the European Organisation for the Exploitation of Meteorological Satellites (EUMETSAT), the European Centre for Medium-Range Weather Forecasts (ECMWF), EU Member States and other partners.

The flagship components are: Copernicus (Earth observation); Galileo GNSS (navigation and positioning); and European Geostationary Navigation Overlay Service EGNOS (navigation service for aviation, maritime and land-based users). Upcoming flagship initiatives include the EU space-based secure connectivity system IRIS², and Space Traffic Management.

Read on to learn about these elements of the EU Space Programme and how they help tackle diverse challenges across the Arctic region



Copernicus Climate Change Service (C3S)

Copernicus Marine Service (CMEMS)

Copernicus Atmosphere Monitoring Service (CAMS)

Galileo

Copernicus Land Monitoring Service (CLMS)

Copernicus Emergency Management Service (CEMS)

European Geostationary Navigation Overlay Service (EGNOS)

Services developed by EU-funded projects

Copernicus Maritime Surveillance Service (CMSS)

Effective emergency preparedness and response in the Arctic

Ensuring that Arctic regions, including northernmost Europe, have adequate response capabilities is crucial for safeguarding human life and protecting fragile ecosystems. EU space-based services facilitate wildfire and flood monitoring, search and rescue operations, and disaster response cooperation.

Arctic risks

The harsh Arctic environment poses challenges for diverse activities on land and at sea. Climate change is increasing unpredictability while intensifying and multiplying risks, such as:

- oil spills
- landslides
- maritime emergencies
- wildfires, occurring in Finland, Sweden, Norway, Iceland, Greenland and Canada
- flooding, expected to increase across Northern Fennoscandia.

EU contributions

Monitoring of wildfires and flooding

The Copernicus Emergency Management Service (CEMS) provides real-time and historic data to support disaster risk reduction, emergency response and recovery.

It includes European and global services dedicated to flood and wildfire tracking:

- On-Demand Mapping
- European Flood Awareness System (EFAS)
- Global Flood Awareness System (GloFAS)
- European Forest Fires Information Service (EFFIS, covering European Arctic)
- Global Wildfire Information Service (GWIS, with circumpolar application).

350 000
EFFIS visitors
used data on the AMAP-Arctic area in 2023

25 million
GWIS accesses
for AMAP area data in 2023

Disaster response cooperation

The EU Civil Protection Mechanism (UCPM) enhances disaster prevention, preparedness and response by strengthening civil protection cooperation between EU Member States and partner countries, including Iceland and Norway. Upon request for assistance through the UCPM, the Emergency Response Coordination Centre coordinates and facilitates assistance and/or expertise from EU Member States and UCPM Participating States – often using EU Space Programme resources. Recently, this mechanism has helped respond to diverse emergencies including wildfires in Canada and Sweden, and volcanic activity in Iceland.

UCPM mission for wildfires in Canada

Maritime and terrestrial search and rescue

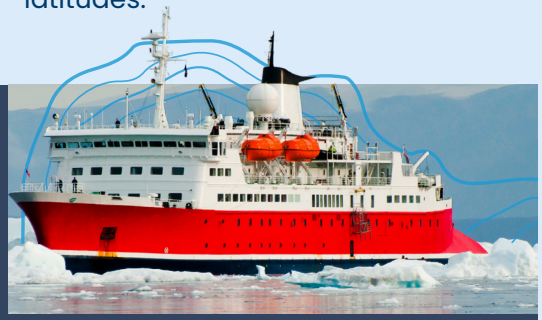
Galileo offers superior coverage and enhanced positioning and timing for search and rescue (SAR) teams in Arctic waters and across northern lands.
Its SAR service swiftly relays distress signals to relevant SAR responders, thanks to dedicated instruments in Galileo satellites, aiding life-saving efforts. Unique to Galileo, its **Return Link Service** automatically confirms to those in distress that their signal has been received, a feature particularly valuable in remote Arctic seas. In 2021, Galileo SAR capabilities proved crucial during large rescue exercises around Norway's Svalbard archipelago.

EU systems work together to protect human life and the Arctic environment. **Copernicus Sentinel-1 satellites** provide radar images that allow authorities to quickly reach spill sites, assess risks, and take action, when combined with accurate positioning from Galileo.

Safe and sustainable navigation and development in the Arctic

To support safe and sustainable development, the EU offers vital satellite services for navigation, communication and ice monitoring in the Arctic, both at sea and on land.

EU systems enhance signal coverage in the Arctic, addressing the generally poorer reception compared to more southern latitudes.



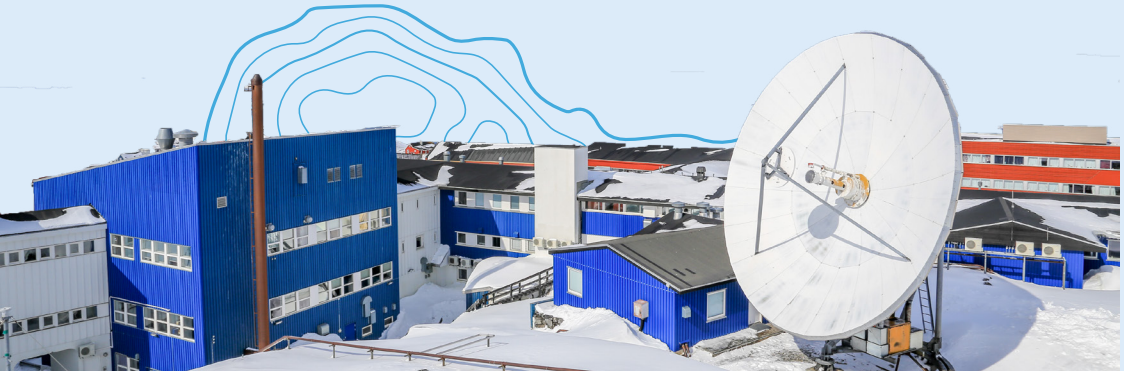
Challenges

Arctic shipping, cruise tourism and offshore operations are expanding. However, operating in Arctic seas involves various challenges. Similar challenges apply to movement across Arctic lands.

- sea ice
- darkness
- remoteness
- harsh weather conditions
- distance from search and rescue infrastructures

Detailed land monitoring

Spatial planners, forest managers and farmers in the North benefit from information provided by the **Copernicus Land Monitoring Service (CLMS)** – on land cover characteristics and changes, snow and ice cover, land use, vegetation state, water cycle and Earth surface energy variables.



EU contributions include

Data on wave height and direction, sea ice and small icebergs

The **Copernicus Marine Service** (CMEMS, operated by Mercator Ocean international) supplies ship captains with vital information on wave height and direction, sea ice and small icebergs.

Sentinel-1 satellites provide accurate data on sea ice.

Over 2 200 users accessed CMEMS models and sea ice products in 2020-2023.

Copernicus Marine data is being used to monitor and forecast iceberg drift.

Maritime safety and security, customs, law enforcement, marine pollution monitoring, and fisheries control

The **Copernicus Maritime Surveillance Service** (CMS Service, managed by the European Maritime Safety Agency EMSA) provides essential information to enhance safety in high latitudes. This service benefits shipping companies, insurers, resource extractors and researchers.

Enhanced positioning services

The **Galileo Global Navigation Satellite System (GNSS)** helps ships of all sizes to navigate safely in remote Polar waters. Accurate navigation allows vessels to optimise routes, reducing fuel consumption and carbon emissions – a significant advantage in Arctic conditions where higher fuel use and ice considerations are prevalent.

Additionally, Galileo supports safety and efficiency in on-land activities such as reindeer herding, tourism and transport.

Earth observation and climate monitoring

Understanding Arctic changes requires sustained monitoring of sea ice, sea level, water temperature, ice cap and glacier melting, and other variables. Satellites, *in situ* observations and numerical models provide information on the status and trends of Arctic lands and seas, contributing to evidence-based decision-making at all levels of Arctic governance.

Challenges

The Arctic is warming up to four times the global average, with impacts on ecosystems, species and human activities, in particular those of Indigenous Peoples.

Key climate indicators

The **Copernicus Climate Change Service** (C3S, operated by the ECMWF) aggregates climate data to support Arctic, European and global policy decisions.
Copernicus data indicate:

The 5-year average temperature over Arctic lands has risen above pre-industrial levels by **3.3°C**

The Greenlandic ice sheet has lost over **6500 km³** of ice since 1976

Since the 1980s, Arctic sea ice extent has decreased by **36%**

Environmental monitoring in the Arctic Ocean

The **Copernicus Marine Service (CMEMS)** enhances understanding of the Arctic Ocean's status and changes, including cryosphere changes, salinity, and chlorophyll presence.

Tracking emissions and atmospheric concentrations

The **Copernicus Atmosphere Monitoring Service (CAMS, operated by ECMWF)** provides data on air pollutants, greenhouse gases and black carbon deposition, and tracks ozone layer and UV radiation – issues of particular concern in the Arctic.

International cooperation and collaboration

The **European Commission's Joint Research Centre** (JRC) actively contributes to international Arctic monitoring efforts through its participation in Sustaining Arctic Observation Networks (SAON).

The **Canadian Space Agency** and the European Commission concluded a Copernicus Agreement in 2022, focusing on the Arctic region and climate action. Among others, Canadian users will be provided with simplified access to data from Copernicus.

AuroraSpace project (Interreg Aurora, 2023-2026) aims to improve the accessibility of space education available in Finland, Norway and Sweden and to increase secondary school students' interest in space.

Environmental protection in the Arctic

The Arctic environment is particularly vulnerable and thus requires close monitoring. Climate change is especially rapid in the Arctic, and accurate data on changes to ecosystems and species are crucial for adaptive conservation and management.

EU actions using satellite data for the Arctic environment

EU space-based services support nature conservation, ecosystem accounting and climate change mitigation and adaptation. This is facilitated by the **Copernicus Land Monitoring Service (CLMS)**, jointly implemented by the European Environment Agency (EEA) and the Joint Research Centre (JRC). Researchers can track Arctic land surface variables affected by the rapidly changing climate, such as diminishing snow and ice cover, and greening and browning of the region. For example, initiatives include the **EO4wildlife Platform for Wildlife Monitoring**, based on products from the Copernicus Marine Service and developed under Horizon 2020. It was created for scientists, biologists, ecologists and ornithologists involved in the conservation, protection and management of marine wildlife.

The seabird tracking database, managed by an international NGO Birdlife, stores over 10 million bird locations globally, including across the Arctic, and links to 60 Copernicus data products.

What are Galileo and EGNOS?

Galileo is the EU's Global Navigation Satellite System (GNSS), offering enhanced navigation, positioning and timing information. Unlike other global satellite navigation systems, Galileo is a civilian system, designed with a focus on providing secure services to end users.

EGNOS (European Geostationary Navigation Overlay Service) is Europe's regional Satellite-based Augmentation System (SBAS). SBASs are used to augment the signals of GNSSs so that they can be used for Safety-of-Life applications.

What is Copernicus?

Copernicus is the Earth Observation (EO) component of the EU Space Programme. It provides information services based on satellite and *in situ* (ground) data, and advanced modelling capacities.

Copernicus is served by a set of dedicated satellites, referred to as the Sentinels, and other contributing commercial and public satellites. The six Copernicus core services translate collected data into user-focused, and largely free-of-charge products, used across the Arctic and around the world.

Where to find Copernicus data?

The **Copernicus Arctic Hub** is a portal that consolidates Arctic-relevant data from across the Copernicus ecosystem. Launched in November 2023, the hub serves as a valuable resource for policy, management and research users.

Future Copernicus developments

The **Copernicus Expansion Missions,** planned for launch from the late 2020s onwards, include three missions of high relevance for the Arctic:

- **Copernicus Imaging Microwave Radiometer (CIMR)** is designed to monitor global change with a focus on the polar region.
- **The Copernicus Polar Ice and Snow Topography Altimeter (CRISTAL)** will enhance monitoring of sea-ice thickness, snow depth and ice-sheet elevation.
- **Radar Observing System for Europe in L-band (ROSE-L)** will monitor geohazards, observe and track land use, agriculture and forestry, provide high resolution soil moisture data, and monitor the Arctic and cryosphere.

The 2024 **Copernicus Polar Roadmap for service evolution** proposes recommendations for service development in the polar domain in the next 5-10 years. Identified advancements include: improving user access to data and products; increasing efforts to develop new models and algorithms; facilitating in situ observations; and increasing outreach to stakeholders and the public.

Explore the **Copernicus Arctic Hub**

The EU Space Programme and the European Space Agency

The **European Space Agency (ESA)** conducts scientific research and builds new space technologies. This intergovernmental organisation is a key cooperation partner for the EU Space Programme, responsible for the technological development of Copernicus and Galileo satellites.

The European Commission and European Space Agency have, for example, agreed to jointly advance Earth System Science with three flagships: Polar Regions and Global Impacts; Ocean Health; and Biodiversity.

Space and the EU's Arctic policy

The EU's Arctic policy prominently positions space solutions as key EU contributors to the region's sustainable development and protection.

A deeper understanding of changes, underpinned by the availability of satellite data, also guides ongoing EU policymaking and initiatives in the Arctic.

ARCTIC REGIONS FACE DIVERSE, FAST-EVOLVING CHALLENGES – AND EU SPACE-BASED SERVICES PLAY A VITAL ROLE IN TACKLING THEM SUSTAINABLY

Learn more about EU space investments and services

Explore the **EU Space Programme**

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EU space solutions contribute to Arctic safety, connectivity and knowledge-building, helping support the region's sustainable future.

The EU in the Arctic

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