

The European Union Earth Observation programme



What is Copernicus?

Copernicus is the European Union's Earth Observation Programme, which monitors our planet and its environment for the ultimate benefit of the citizens of Europe. It delivers data, information and services based on satellite Earth Observation data and in situ (non-space) data. The Programme is funded, coordinated and managed by the European Commission in cooperation with partners such as ESA and EUMETSAT.

The Copernicus programme is served by a set of dedicated satellites (the Sentinel family) and contributing missions (existing commercial and public satellites). The Sentinel satellites are specifically designed to meet the needs of the Copernicus information services and their users. Since the launch of Sentinel-1A in 2014, the European Union has initiated a process to place a complete constellation of al-

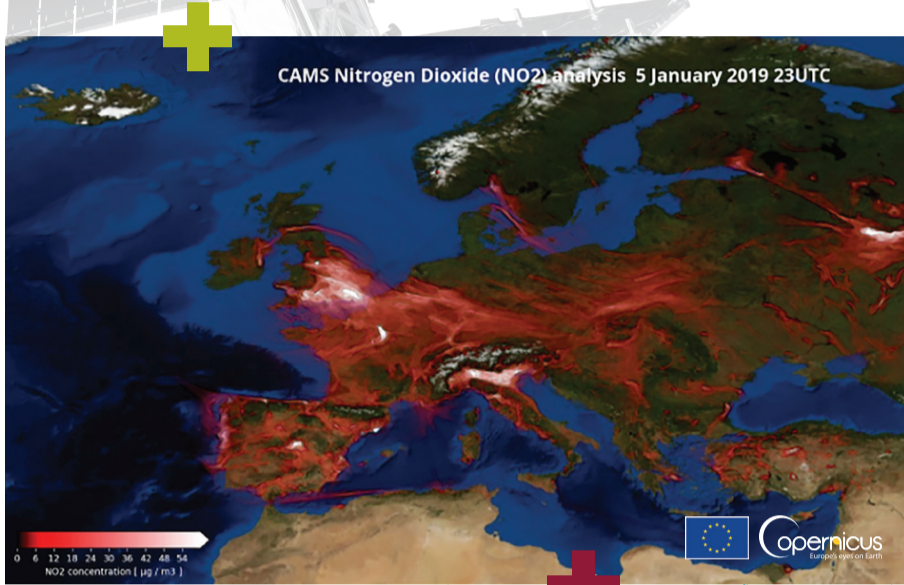
most 20 satellites in orbit before 2030. Today, there are seven Sentinel satellites in orbit, of four different types. Copernicus satellites, along with ground-based, airborne and seaborne measurement sensors, are providing vast amounts of global data.

The Copernicus services transform the wealth of satellite and in situ data into timely and actionable information by processing and analysing it. The services deliver datasets and time series that are comparable and searchable, ensuring that trends and changes are monitored. Patterns are examined and used to create better forecasts of, for example, the ocean and the atmosphere. Maps are derived from imagery, features and anomalies are identified and statistical information is extracted. These value-adding activities are streamlined through six thematic streams of Copernicus

services: the Copernicus Atmosphere Monitoring Service (CAMS), the Copernicus Marine Environment Monitoring Service (CMEMS), the Copernicus Land Monitoring Service (CLMS), the Copernicus Climate Change Service (C3S), the Copernicus Emergency Management Service (EMS) and the Copernicus Security Service.

The information services, as well as the data from which they are derived, are accessible on a full, free and open basis by anyone. This data and information is used by service providers, public authorities and international organisations to improve the quality of life for citizens of Europe and around the world, to monitor and mitigate climate change, and to preserve our fragile environment.

More information on www.copernicus.eu/en



The Copernicus Atmosphere Monitoring Service (CAMS) provides continuous data and information on atmospheric composition by monitoring and forecasting constituents such as greenhouse gases, reactive gases, ozone and aerosols. CAMS delivers consistent and quality-controlled information useful to develop applications for air pollution, health, solar energy, greenhouse gases and climate change-related topics to help policymakers, businesses and citizens address environmental concerns.

More information on <https://atmosphere.copernicus.eu/>



The Copernicus Marine Environment Monitoring Service (CMEMS) provides regular and systematic reference information on the physical and biogeochemical state, variability and dynamics of the ocean and marine ecosystems for the global ocean and the European regional seas.

The observations and forecasts produced by the service support all marine applications, including:

- Marine safety;
- Marine resources;
- Coastal and marine environment;
- Weather, seasonal forecasting and climate.

CMEMS contributes in particular to the protection and sustainable management of living resources, the blue economy or the monitoring of climate change impacts on the ocean. The service publishes an annual Ocean State Report.

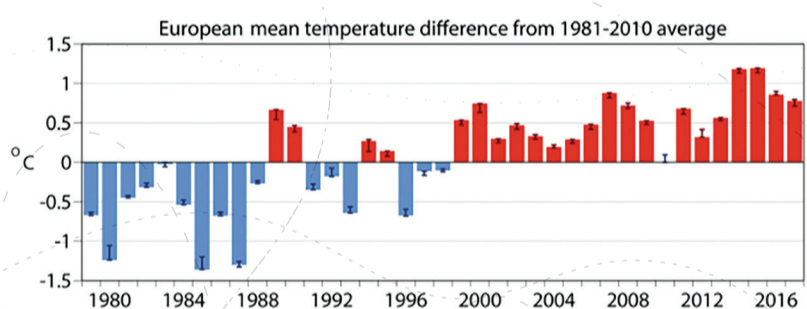
More information on <http://marine.copernicus.eu/>



The Copernicus Land Monitoring Service (CLMS) provides geospatial information on land cover (its changes), land use, vegetation state, water cycle, cryosphere and earth surface energy to a broad range of users in Europe and across the world in the field of environmental applications. The service is based on Earth Observation data combined with data from other sources.

It supports environmental and development policies, as well as applications in domains such as spatial and urban planning, forest management, water management, agriculture and food security, nature conservation and restoration, ecosystem accounting and mitigation/adaptation to climate change.

More information on <https://land.copernicus.eu/>



The Copernicus Climate Change Service (C3S) strongly supports the adaptation and mitigation policies of the European Union by providing consistent and authoritative information about the past, present and future climate change in Europe and the rest of the world.

C3S provides access to state-of-the-art quality-assured climate information, relevant to European Union sectoral policies. It delivers climate data records to monitor major climate drivers and document climate change fingerprints (e.g. surface air temperature).

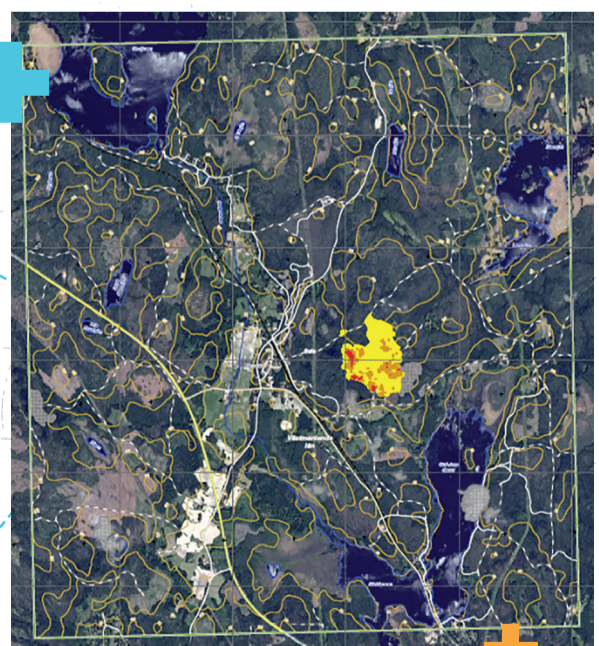
European surface air temperature anomaly for annual averages from 1979 to 2017 relative to the annual average for the period 1981-2010. Data source: ERA-Interim. Credit: Copernicus Climate Change Service/ECMWF. More information on <https://climate.copernicus.eu/>



Natural disasters affect thousands of people every year in the world. Thanks to satellite imagery, the Copernicus Emergency Management Service (EMS) provides maps to first responders, showing the impact on the ground in the first hours following a large natural disaster or a humanitarian crisis. These maps assist the organisation of the safe evacuation and sheltering of people affected by disasters such as earthquakes, volcanic eruptions, floods and forest fires.

Knowing where vulnerable citizens and infrastructure are located enables prevention measures to be taken to reduce the impact of a potential disaster. The EMS maps can also be used to monitor recovery and reconstruction after a disaster has occurred.

More information on <https://emergency.copernicus.eu/>



EMS mapping activations to cover forest fires © European Union

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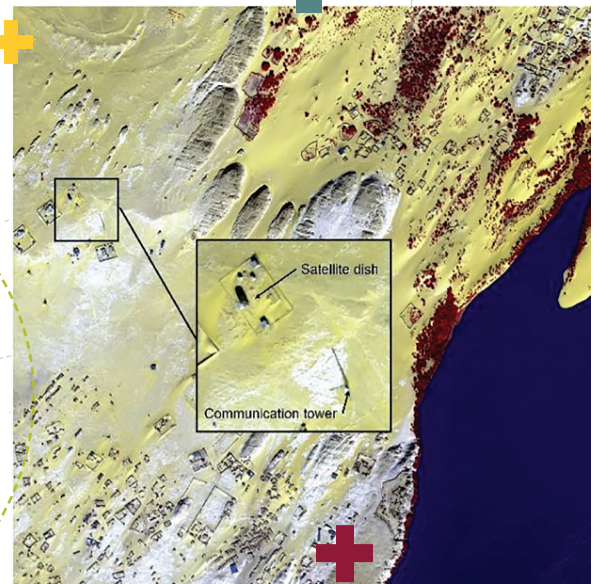
copernicus.eu



The Copernicus Security Service applications aim to support European Union policies by providing information in response to Europe's security challenges. The applications focus on three key areas:

- Copernicus Maritime Surveillance provides satellite image products for monitoring activities at sea by European maritime authorities.
- Copernicus Border Surveillance Service improves the situational awareness at the EU's external borders, contributing to saving lives at sea and tackling cross-border crime.
- Copernicus Service in Support to EU External Action provides geospatial intelligence in support of global EU security commitments, such as crisis mitigation and risk assessment outside the EU territory.

More information on <https://www.copernicus.eu/en/services/security>



EU External Action - © SatCen

Space Component



The Copernicus Sentinels are the programme's dedicated Earth Observation satellites. They ensure an independent and autonomous Earth Observation capacity for Europe. There are six Sentinel families, covering a broad range of Copernicus observation needs, ranging from day-and-night all-weather observations, to land and ocean surfaces, sea-surface topography, and air quality, measuring trace gases in the atmosphere. In addition to these dedicated satellites, Copernicus is making use of satellite data from contributing missions, either from private companies or from institutional partners through dedicated agreements.

More information on <https://spacedata.copernicus.eu/>



- Sentinel-1A** • Synthetic Aperture Radar
- Sentinel-1B** • Synthetic Aperture Radar
- Sentinel-2A** • Multi-spectral optical sensor
- Sentinel-2B** • Multi-spectral optical sensor
- Sentinel-3A** • Medium resolution optical sensor and Altimeter
- Sentinel-3B** • Medium resolution optical sensor and Altimeter
- Sentinel-5P** • Atmospheric Chemistry sensor

Planned and ordered

- Sentinel-4** • Atmospheric Chemistry sensor
- Sentinel-5** • Atmospheric Chemistry sensor
- Sentinel-6** • Radar Altimeter



In situ Component

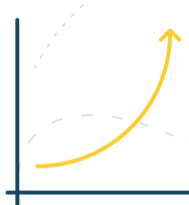
The Copernicus programme provides accurate, high-quality data and information. It also relies on in situ observations from ground, sea-, and air-borne sensors, as well as geospatial ancillary or reference data. The in situ component is mainly used to identify data access gaps and bottlenecks, support the provision of cross-cutting data, manage partnerships with data providers to improve access and use conditions, and to broker innovative solutions with services, providers or national authorities.

More information on <https://insitu.copernicus.eu/>



AERONET-Europe calibration facility - © Concepcion Bayo

The Copernicus ecosystem: Rapidly growing user uptake



300,000 users of Copernicus data and services products.

Data Access

Copernicus data and information is available on a full, free and open basis. Data from the Copernicus Sentinels is accessible for download through dedicated infrastructures operated by the European Space Agency (ESA) and EUMETSAT. In addition to the data-hubs, EUMETCast, a system that broadcasts data and transfers some Sentinel data directly to the users' desk. Copernicus services information is made available through dedicated websites.

For users who do not wish to transfer data to their own systems, data is available through the DIAS (Data and Information Access Services) allowing users to process and analyse Copernicus data and information in the cloud.

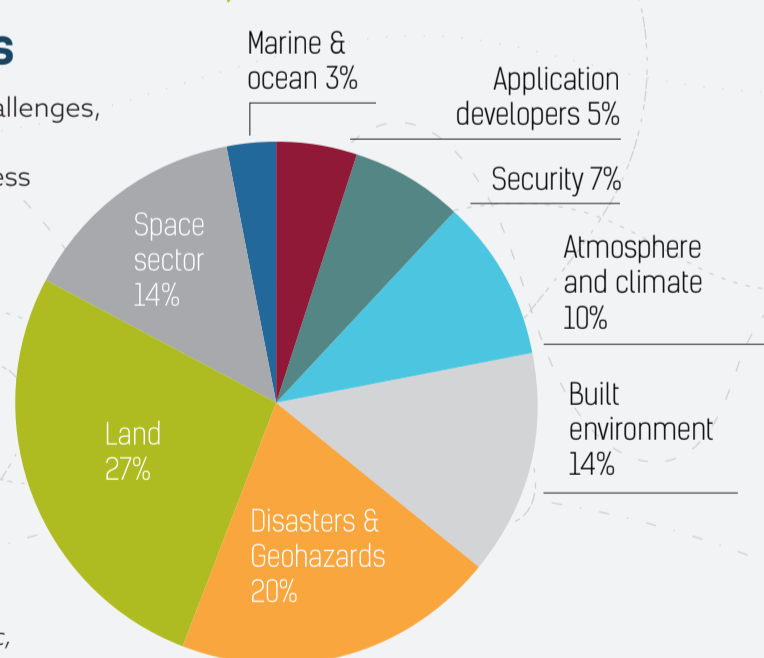
More information on <https://www.copernicus.eu/en/access-data>

Socio-Economic Benefits

Copernicus helps us address key societal challenges, such as climate change, natural disasters or border control. It also creates endless business opportunities.

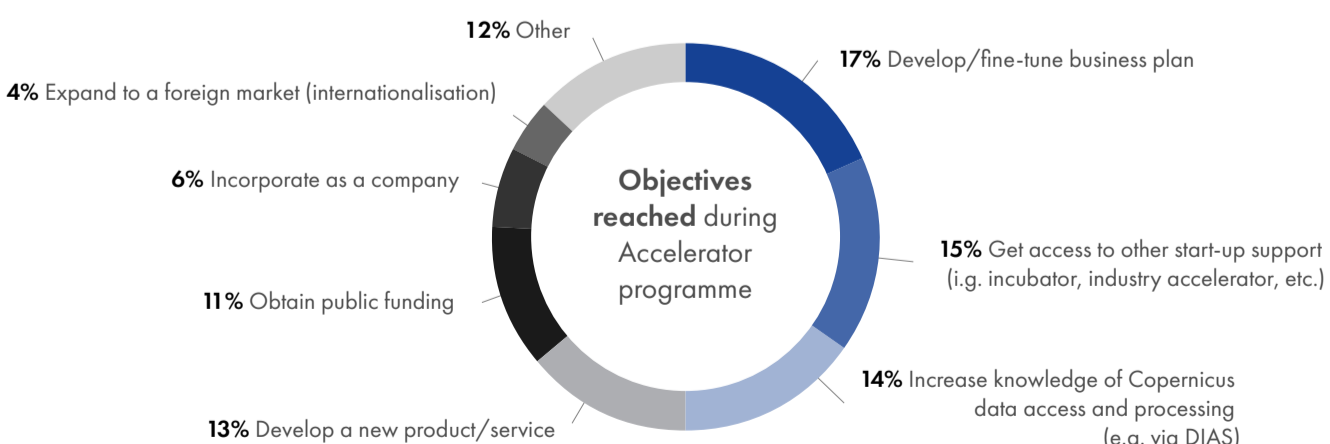
Between 2017 and 2035, Copernicus is expected to generate €67 to €131 billion in benefits to the European society. This is ten to twenty times the cost of the programme. Interestingly, more than 80% of the benefits are expected to be generated outside of the space sector, through the use of Copernicus data in other parts of the economy (agriculture, fisheries, insurance, air quality...).

Copernicus benefits by sector (including economic, societal and environmental benefits)



User Uptake Activities

The European Commission has developed actions to support users of Copernicus and maximise the benefits of the programme. More than two hundred Copernicus Relays and Copernicus Academy members in all European regions act as local ambassadors and support over 300 awareness events every year. Copernicus info sessions and Copernicus Hackathons are organised every month. Dedicated training and course material has been developed in the context of the Copernicus Skills programme. Hundreds of start-ups are supported by the Copernicus Start-up programme, through funding, coaching or networking opportunities. Copernicus now has over 300,000 users, largely exceeding original expectations.



International Cooperation

During its term as Chair of the Committee on Earth Observation (CEOS) in 2018, the European Commission with Copernicus laid the foundation for an international carbon and Greenhouse gas monitoring system to support the implementation of the Paris Climate Agreement. Cooperation Arrangements with third countries provide additional value to the European Union in a reciprocal manner (e.g. access to satellite data and in situ data, cooperation on data processing, data assimilation into models and products of the Copernicus services).

It creates enabling conditions for European industry and service providers in the partner country markets to foster the uptake of European-developed downstream service products.

