



sentinel-1

→ RADAR VISION FOR COPERNICUS

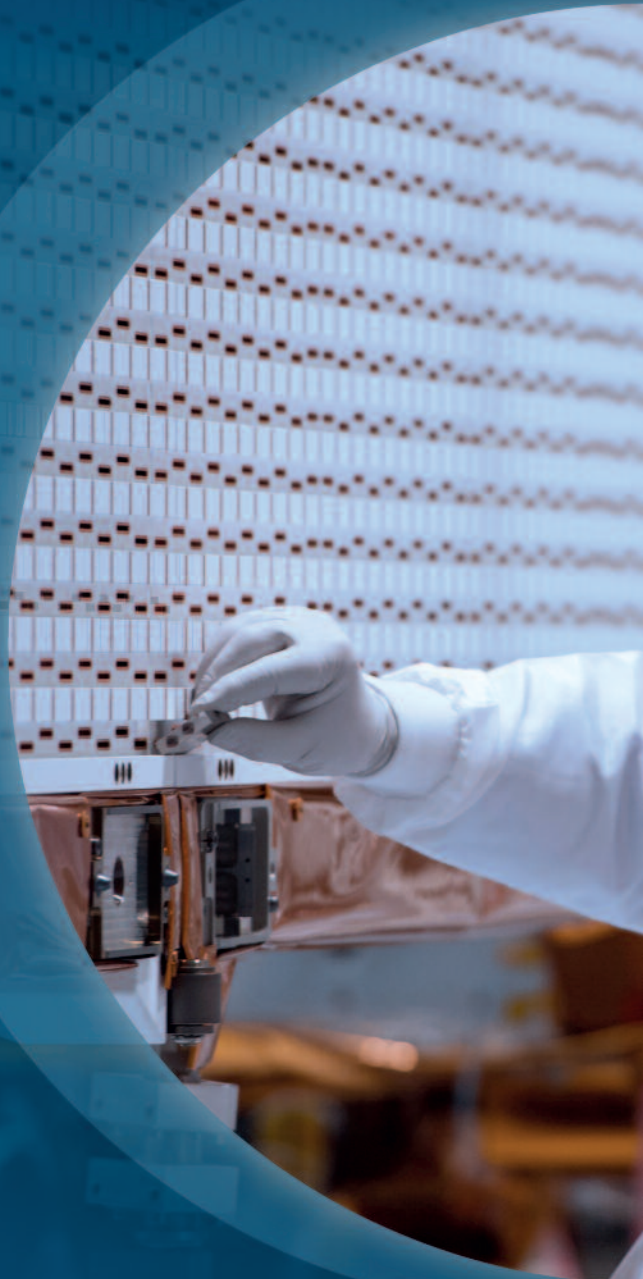
→ SATELLITES TO SERVE

The Sentinels, a new fleet of ESA satellites, are poised to deliver the wealth of data and imagery that are central to Europe's ambitious Copernicus programme. By offering a set of key information services for a broad range of applications, this innovative global monitoring programme makes a step change in the way we manage our environment, understand and tackle the effects of climate change, and safeguard everyday lives.

→ A NEW ERA

Sentinel-1 is the first in the family of Copernicus satellites. It marks a new model in Earth observation focusing on operational missions to support users for decades to come. This first satellite mission carries an advanced radar instrument to image Earth's surface through cloud and rain and regardless of whether it is day or night.

Delivering timely information for numerous operational services, from monitoring ice in polar oceans to tracking land subsidence, Sentinel-1 is playing a vital role in the largest civil Earth observation programme ever conceived.





“The full benefits of Copernicus will only be reached with the deployment of dedicated Copernicus satellites which will provide reliable, systematic space-based observations for all of its services.”

Antonio Tajani, European Commission Vice-President, 2013

→ THE POWER OF TEAMWORK

Sentinel-1, a constellation of two identical satellites, is the result of close collaboration between ESA, the European Commission, industry, service providers and data users. Designed and built by a consortium of around 60 companies led by Thales Alenia Space and Airbus Defence and Space, it is an outstanding example of Europe's technological excellence.

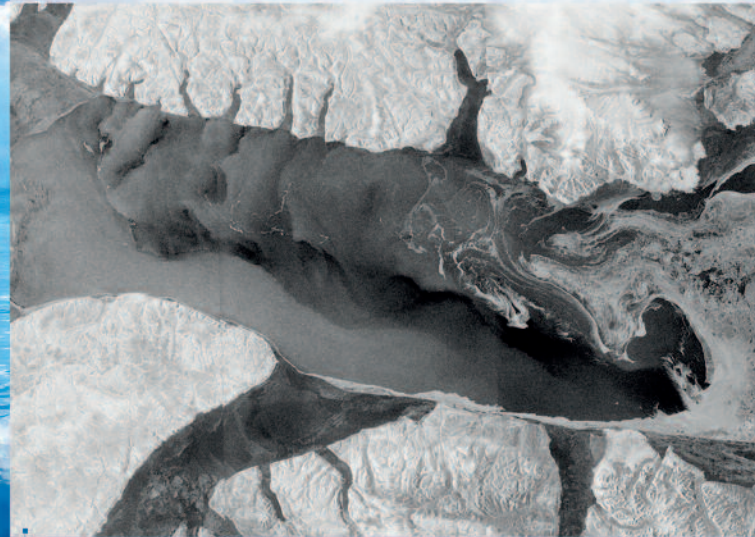
→ ACCESSING THE OCEANS

*Around 90% of world trade is shipped
by sea and European seas are
the busiest in the world.*

European Commission Mobility and Transport

The Copernicus marine services deliver vital information about the state and dynamics of oceans and coastal zones. These services not only help protect and manage the marine environment and its resources, but also aim to keep vessels safe at sea.

Sentinel-1 provides images to generate timely maps of sea-ice conditions for safe passage in our increasingly busy Arctic waters. These images are also essential for applications that, for example, focus on detecting and tracking oil spills as well as identifying polluters.



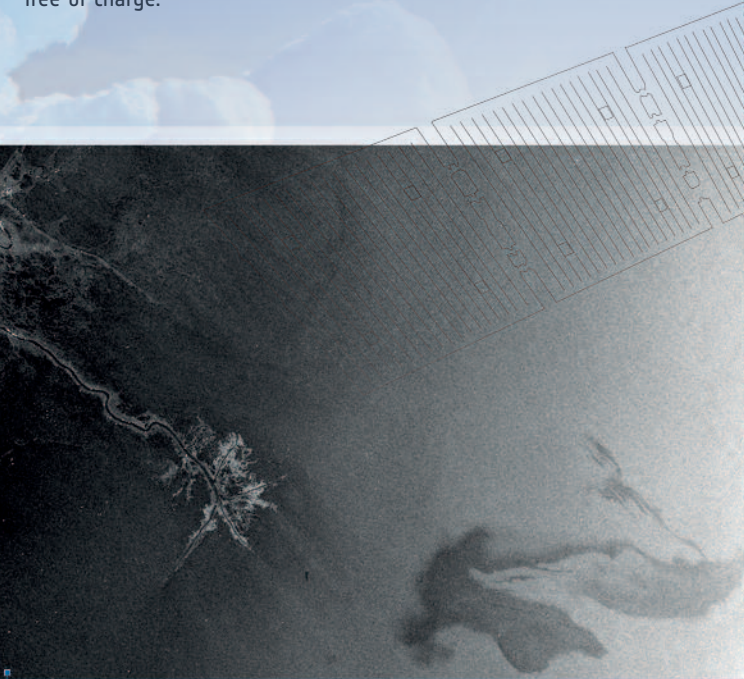
IN FOCUS

Sentinel-1 can distinguish clearly between the thinner, more navigable first-year ice and the hazardous, much thicker multiyear ice to help assure safe year-round navigation in ice-covered Arctic and sub-Arctic zones. These images are particularly suited for generating high-resolution ice charts, monitoring icebergs and forecasting ice conditions.

Ice in Lancaster Sound, Canadian Arctic, from Radarsat-2, which was programmed to simulate Sentinel-1. © MDA

As a constellation of two satellites orbiting 180° apart, revisit times and global coverage are optimised.

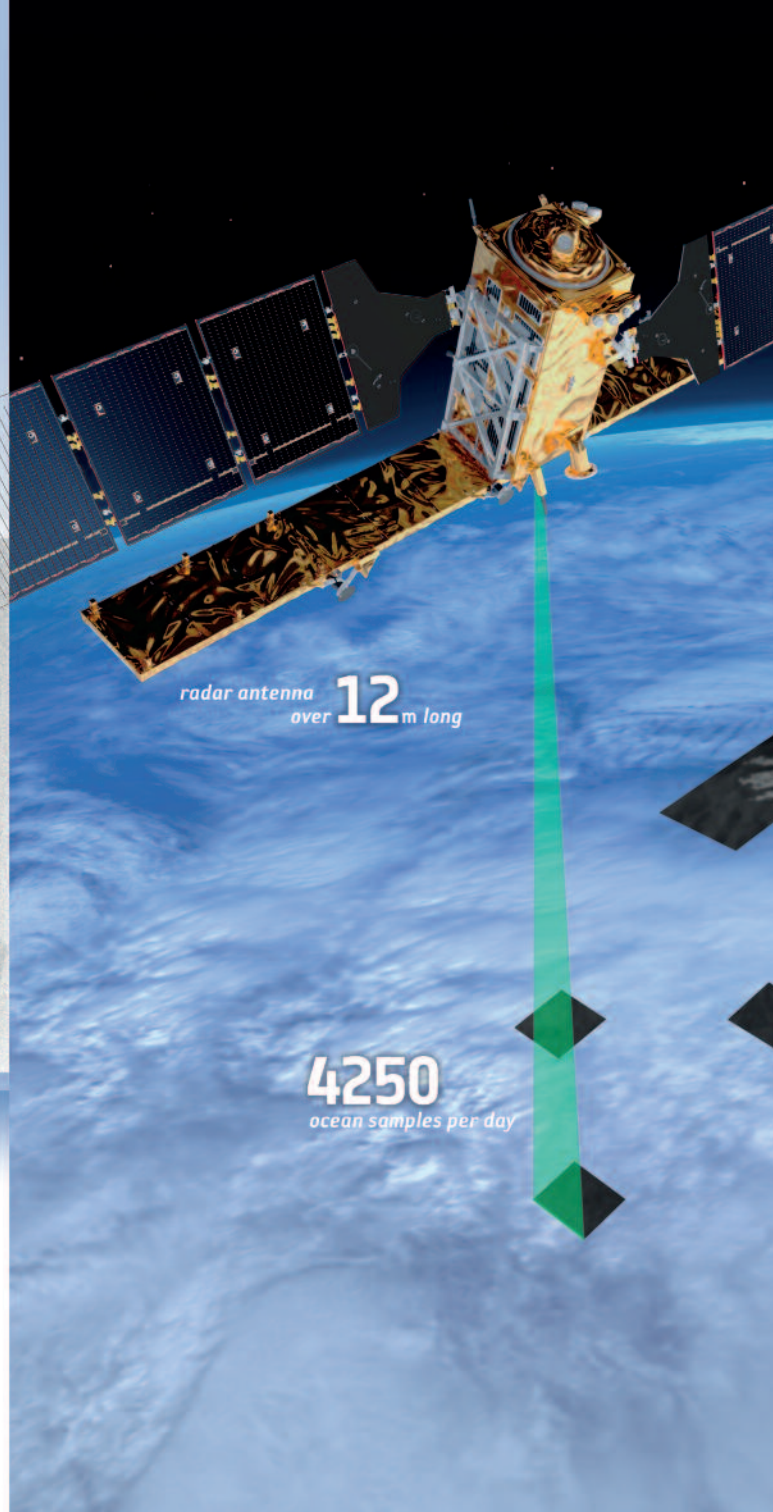
In addition to transmitting data to a number of ground stations for rapid dissemination, Sentinel-1 also carries a laser to transmit data to the geostationary European Data Relay System for continual data delivery. Data from the Sentinels are used worldwide and are free of charge.



MAKING WAVES

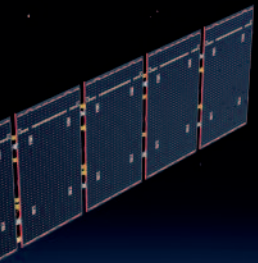
Continuous sampling of the open ocean offers information on wind and waves. This is useful for understanding interactions between waves and currents and to improve efficiency for shipping and wave-energy applications, potentially resulting in economic benefits. In addition, these observations can be used to track the paths of oil slicks and other pollutants.

The 2010 oil spill in the Gulf of Mexico as seen by Envisat. © ESA



radar antenna
over **12** m long

4250
ocean samples per day



constellation offers **6** days
global revisit every

250 km
wide swath

1.5 TB
of data delivered per day

ESA has developed the Copernicus space component. This comprises six families of Sentinels and contributing missions from other space agencies. A unified ground segment, through which the data are streamed and made available for the Copernicus services, completes the space component.

→ TRACKING CHANGES

The satellites' frequent revisits over the same area allow changes in land cover to be closely monitored. This is particularly useful for keeping an eye on tropical forests that are typically shrouded by cloud and for detecting illegal timber harvesting.

Land cover information is also important for agricultural practices such as forecasting crop yields, making Sentinel-1 a valuable complement to the Sentinel-2 multispectral optical mission. Moreover, this new mission is specifically designed for fast response to aid emergencies and disasters such as flooding and earthquakes.



RADAR VISION

Sentinel-1's ability to 'see' through cloud and rain and in pitch darkness makes it particularly useful for monitoring floods. It can provide images with a resolution of 10 m and within a few hours of acquisition to aid emergency response. Images acquired before and after a flood offer information on the extent of inundation and can be used to help assess damage to the environment and property.

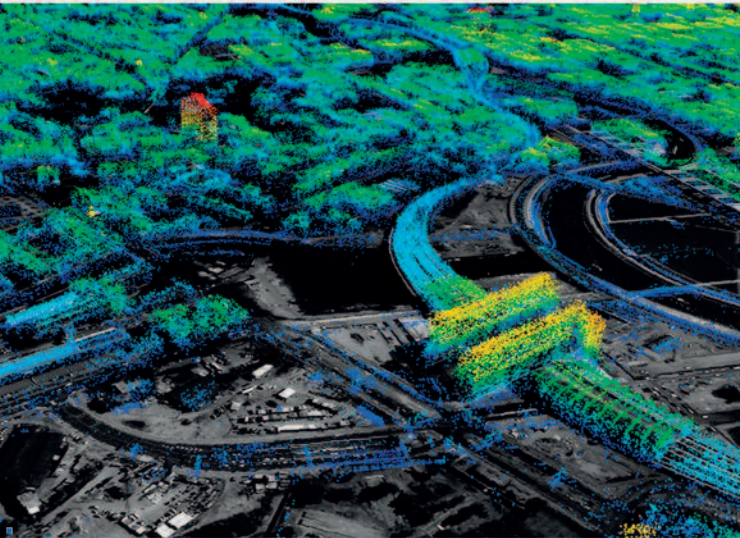
Floods in Charron, Charente-Maritime, France. Maps derived from Envisat, Radarsat and Spot imagery. © SERTIT 2010

While the mission offers timely information for a multitude of operational applications, it continues more than 20 years of radar imagery.

The archive is not only essential for practical applications that need long time series of data, but also for understanding the long-term impacts of climate change. Sentinel-1 will, therefore, help arm decision-makers with the information they need to make informed choices for a sustainable future.

Land is a finite resource: how it is used constitutes one of the principal reasons for environmental change, with significant impacts on quality of life and ecosystems, as well as on the management of infrastructure.

The European Environment Agency



WATCHING EVERY MOVE

Radar images are the best way of tracking land subsidence and structural damage. Systematic observations mean that ground movement barely noticeable in everyday life can be detected and closely monitored. As well as being a valuable resource for urban planners, this kind of information is essential for monitoring shifts from earthquakes, landslides and volcanic uplift.

Uplift and subsidence in Berlin, Germany, as detected by satellite radars. Different colours represent different rates of deformation. © DLR



FACTS AND FIGURES



launch	Sentinel-1A in April 2014, Sentinel-1B in 2015
launcher	Soyuz rocket from Kourou, French Guiana
orbit	Polar, Sun-synchronous at an altitude of 693 km
revisit time	Six days from two-satellite constellation
life	Minimum of seven years
satellite	2.8 m long, 2.5 m wide, 4 m high with 2×10 m-long solar wings and a 12 m-long radar antenna
mass	2300 kg (including 130 kg fuel)
instrument	C-band synthetic aperture radar (SAR) at 5.405 GHz
operational modes	Interferometric wide-swath mode at 250 km and 5×20 m resolution Wave-mode images of 20×20 km and 5×5 m resolution (at 100 km intervals) Strip map mode at 80 km swath and 5×5 m resolution Extra wide-swath mode of 400 km and 20×40 m resolution
receiving stations	SAR data: to ground stations in Svalbard Norway, Matera Italy, and Maspalomas Spain, and via laser link through EDRS. Telemetry data: transmitted to and from Kiruna Sweden
main applications	Monitoring of sea ice, oil spills, marine winds & waves, land-use change, land deformation, among others, and for responding to emergencies such as floods and earthquakes
project management	Developed, operated and managed by various ESA establishments
funding	ESA Member States and the European Union
prime contractors	Thales Alenia Space, Italy (satellite); Airbus Defence and Space, Germany (SAR instrument)
data access	sentinel.esa.int

www.esa.int/sentinel-1



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