



European Space Agency

sentinels

→ SPACE FOR COPERNICUS



→ MANAGING EARTH FROM SPACE

Europe's Copernicus programme has been put in place to manage the environment effectively and help respond to the challenges of global change. This innovative global monitoring programme, the largest ever conceived, offers a set of key information services for a wide range of practical applications. Since the fast provision of accurate data is central to Copernicus, ESA is developing a family of satellite missions called the Sentinels. Thanks to close cooperation between the European Union, ESA, Eumetsat and European industry, these missions are taking environmental monitoring to a new level.

→ FREE AND OPEN ACCESS TO DATA

Each of the Sentinel missions carries state-of-the-art technology to deliver a stream of complementary imagery and data tailored to the needs of Copernicus users. Most of the missions are based on constellations of two satellites to optimise global coverage and data delivery. These data are free of charge and open to users worldwide, which not only eases the essential task of monitoring the environment, but also helps stimulate enterprise, creating new jobs and business opportunities.

The launch of the first Sentinel, Sentinel-1A, on 3 April 2014 signalled the beginning for Europe's Copernicus programme and a new era for users to access environmental data on a routine basis. © ESA





→ IMPROVING DAILY LIFE

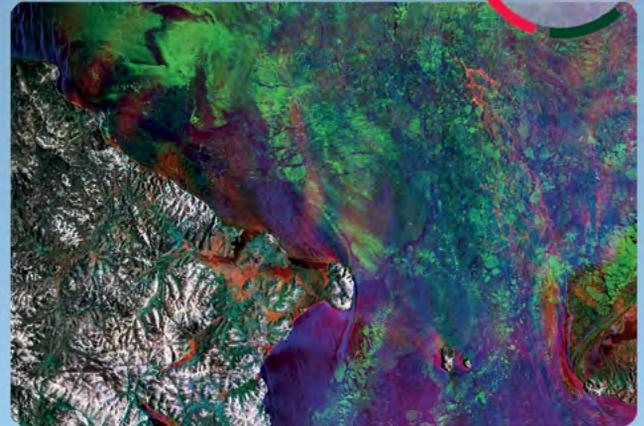
Data from the Sentinels feed into six types of services to benefit the environment and the way we live: marine, land, atmosphere, emergency, security and climate. These data are finding a myriad of uses including: mapping land cover and changes in the way land is being used, improving agricultural practices and forest management, monitoring the oceans for maritime safety and efficiency, and tracking pollution in the air we breathe. The Sentinels also offer key information for rapid response to natural disasters and to aid humanitarian efforts at times of crisis.

sentinel-1

→ RADAR VISION

Carrying an advanced radar, Sentinel-1 images Earth's surface through rain and cloud regardless of whether it is day or night. This makes it particularly useful for monitoring the polar regions, which are devoid of sunlight for much of the year. As well as being used to generate timely maps of sea ice for ship routing, Sentinel-1 also offers information on wind and waves for safe passage, and can be used to track oil spills.

Routine images taken over land can be used for precision farming and to track land-use change. Offering insight into subsidence and uplift, Sentinel-1 is suited for urban planning and for monitoring volcanic activity. Moreover, this mission is designed to deliver images for fast response to disasters such as floods.



The three Sentinel-1 radar scans in this image show differences in sea ice in the Bering Strait between December 2017 and January 2018.

© contains modified Copernicus Sentinel data (2017–18), processed by ESA



Sentinel-3's Ocean and Land Colour Instrument is used to monitor ocean ecosystems, support crop management and agriculture.

© contains modified Copernicus Sentinel data (2016), processed by ESA

sentinel-3

→ A BIGGER PICTURE

Carrying a precision radar altimeter, an advanced imaging radiometer, and a wide-swath ocean and land imaging spectrometer, Sentinel-3 supplies a wealth of data related mainly to the marine environment. Delivering critical data on the height and temperature of the sea surface, it supports ocean forecasting for maritime safety.

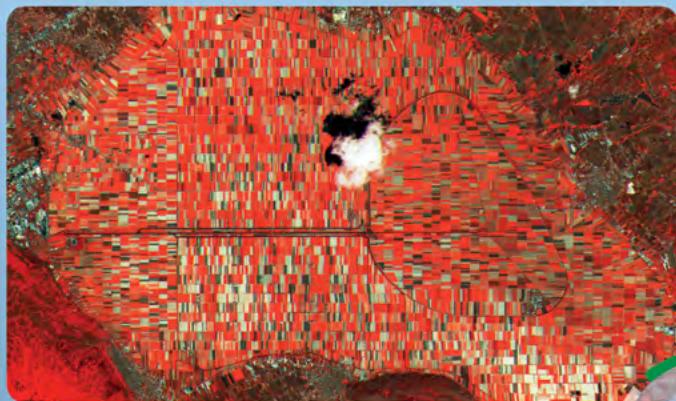
In coastal zones, this is also important for predicting extreme events such as storm surges and floods. Additionally, ocean-colour data provide key information to monitor seawater quality and pollution. Applications using data acquired over land include fire detection and land-cover mapping. Sentinel-3 also provides information to map the topography and extent of ice and to monitor the height of lake and river water.

sentinel-2

→ COLOUR VISION

Sentinel-2 carries a high-resolution multispectral optical imager to monitor changes in vegetation. With a growing global population in mind, this mission offers key information to optimise crop yield, thereby helping to improve food security. Data can be used to measure leaf area index, leaf chlorophyll and leaf water content to monitor plant growth, which is particularly important during the growing season.

The mission is being used to generate land-cover maps, to track changes in the way land is being used and to monitor the world's forests. In addition, it provides information on pollution in lakes and coastal waters. Images of floods, volcanic eruptions and landslides contribute to disaster mapping and help humanitarian relief efforts.



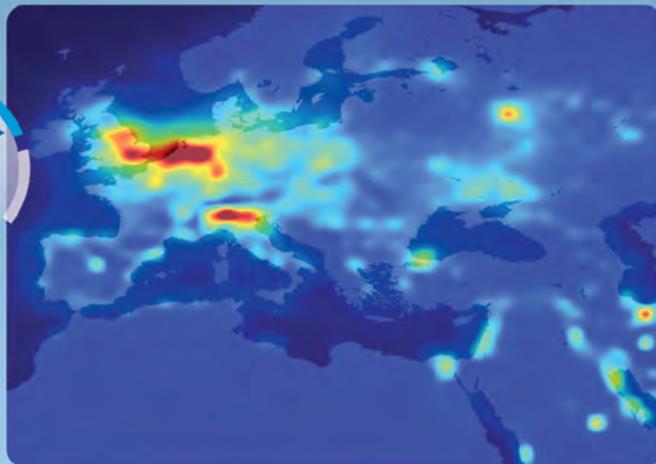
This Sentinel-2A false-colour image from July 2015 shows agricultural structures in the Abruzzo region of central Italy. The shades of red and other colours indicate differences in vegetation and chlorophyll content.

© contains modified Copernicus Sentinel data (2015), processed by ESA



DATA ACCESS

Dedicated ground infrastructure ensures the systematic provision of data along with free and open access for users.



Nitrogen dioxide over Europe. The Sentinels dedicated to monitoring the atmosphere provide critical information for timely forecasts on air quality. © KNMI

sentinel-5p | sentinel-5

→ GLOBAL AIR MONITORING

Sentinel-5 is an ultraviolet to shortwave infrared spectrometer carried on the polar-orbiting MetOp Second Generation A series of satellites. The mission also makes use of data from a number of MetOp Second Generation's instruments. Complementing Sentinel-4, Sentinel-5 provides wide-swath, global coverage data to monitor air quality around the world.

Sentinel-5 Precursor is the forerunner of Sentinel-5. It is a satellite carrying the Tropomi imaging spectrometer to provide timely information on a multitude of trace gases and aerosols affecting air quality and climate. Both Sentinel-5 and its predecessor are crucial for monitoring and tracking global air pollution, and arming decision-makers with critical information to support policy making.

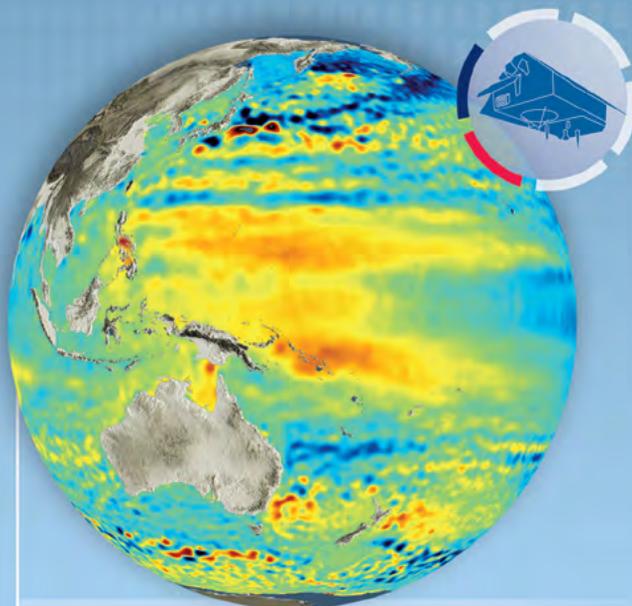
Ozone hole as measured by Sentinel-5P in November 2017. Although stratospheric ozone appears to be on the road to recovery, Sentinel-5P and Sentinel-5 will continue to monitor this vital layer of the atmosphere. © contains modified Copernicus Sentinel data (2017), processed by DLR/ESA

sentinel-4

→ EUROPEAN AIR MONITORING

Sentinel-4 is an ultraviolet, visible and near-infrared spectrometer carried on the Meteosat Third Generation Sounder satellites. The mission also makes use of data from Meteosat Third Generation's infrared sounder instrument, and also from the flexible combined imager and lightning imager, both of which are carried on the Meteosat Third Generation Imager satellites.

From geostationary orbit, Sentinel-4 delivers data every hour. Complementing Sentinel-5, it provides information on a wide range of trace gases and pollutants, such as nitrogen dioxide, sulphur dioxide and aerosols to forecast and monitor air quality over Europe. It also provides information on ozone and solar radiation for UV forecasting, and contributes to climate monitoring.



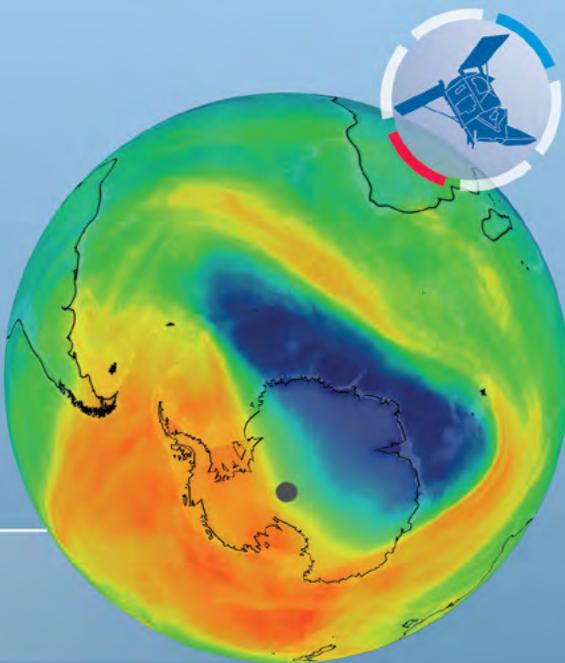
Latest estimates show that global sea level is rising by about 3 mm a year. Sentinel-6 will continue to map global and regional sea-level change.
© CLS/LEGOS/CNES

sentinel-6

→ SURFING THE SEAS

Sentinel-6 carries a radar altimeter to provide high-precision and timely observations of the topography of the global ocean. This information is essential for the continued monitoring of changes in sea level, a key indicator of climate change. It is also essential for operational oceanography.

Mapping up to 95% of Earth's ice-free ocean every 10 days, it offers vital information on ocean currents, wind speed and wave height for maritime safety. The data are also important for protecting and managing the increasingly busy coastal zones. Sentinel-6 builds on heritage from the Jason series of ocean topography satellites and from ESA's CryoSat mission. Importantly, this new mission is designed to complement ocean information from Sentinel-3.





sentinel-1

carries a radar to provide all-weather, day-and-night imagery to monitor oceans, ice and land, and to aid emergency response.



sentinel-2

carries a high-resolution multispectral imager to monitor land and vegetation cover.



sentinel-3

carries an instrument package including a radar altimeter, an imaging radiometer and an imaging spectrometer to monitor oceans and land.



sentinel-4

is a spectrometer carried on the Meteosat Third Generation Sounder satellites. It is dedicated to monitoring air quality over Europe.



sentinel-5p

carries a spectrometer, primarily to monitor global atmospheric pollution.



sentinel-5

is a spectrometer carried on the MetOp Second Generation satellites. It is dedicated to monitoring global air quality.



sentinel-6

carries a radar altimeter to measure global sea-surface height for operational oceanography and for climate studies.

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