



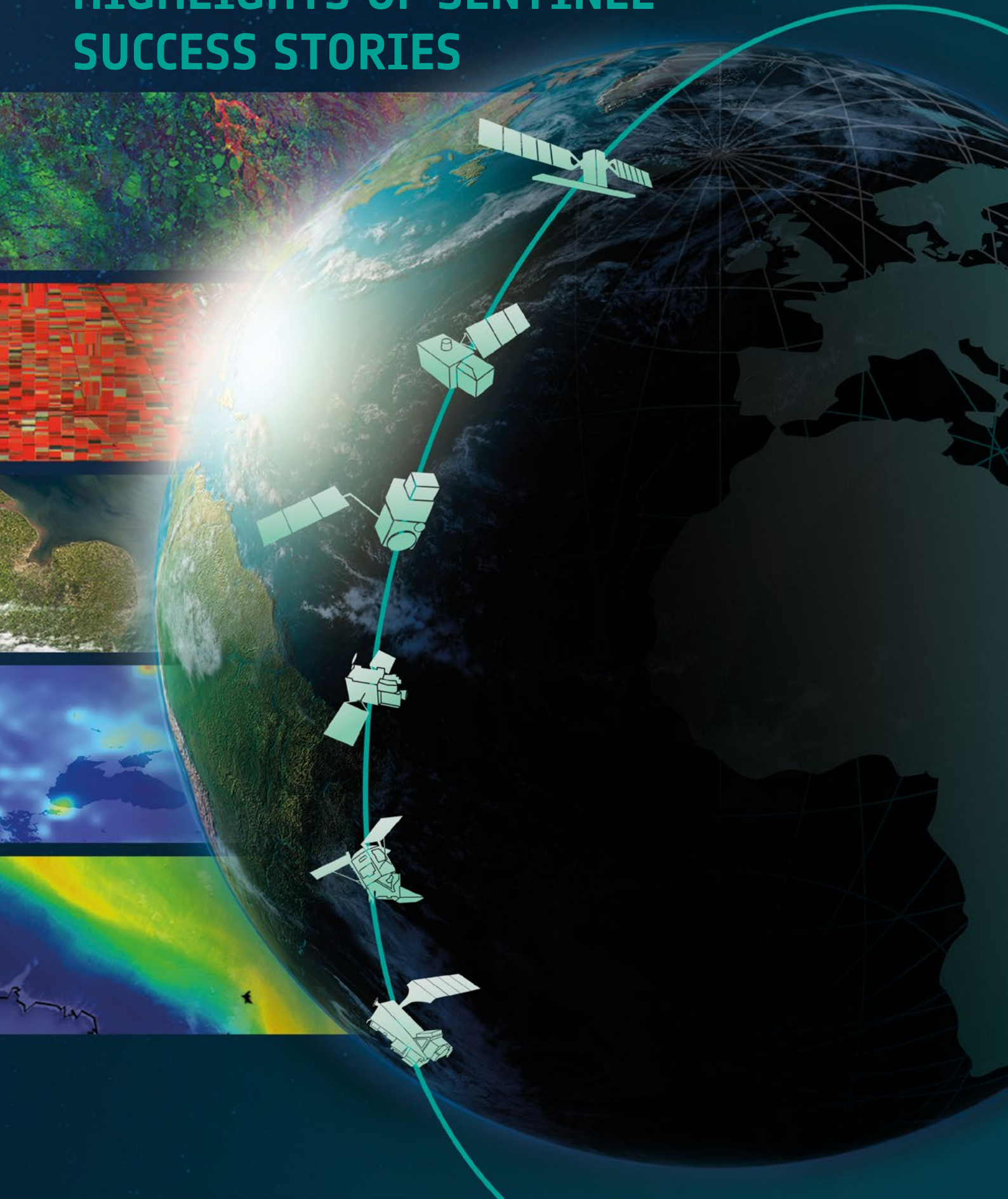
PROGRAMME OF THE
EUROPEAN UNION



co-funded with



HIGHLIGHTS OF SENTINEL SUCCESS STORIES



IMAGES CREDITS AND COPYRIGHTS

EMERGING CAPACITY FROM COPERNICUS SENTINEL-3 TO MONITOR GLOBAL WILDFIRES - Fire radiative power (FRP) data recorded over Australia Copyright: Contains modified Copernicus Sentinel data (2020)/processed by Kings College London https://bit.ly/3uE59Uo	PAGE 4
HERITAGE DATA STILL WIDELY USED TODAY - Example of building classification Copyright: © Survey Lab, © I.MODI - Building classification using I.MODI service Copyright: Survey Lab, ©I.MODI https://bit.ly/33aTZuY	PAGE 5
VIDEO AIR QUALITY MONITORING https://bit.ly/3HLd99S	PAGE 5
COPERNICUS SENTINEL-2 HELPS ADVANCE MARINE DEBRIS DETECTION - Floating plastic target off Tsamakia Beach, Greece Copyright: Contains modified Copernicus Sentinel data (2019)/processed by ARGANS Limited Drone image – University of Aegean https://bit.ly/3LpmIxx	PAGE 6
COPERNICUS SENTINELS HELP CLASSIFY RIVER ICE - Ice jam in Fort McMurray Copyright: Contains modified Copernicus Sentinel data (2020)/processed by Deltares https://bit.ly/3BhMiQf	PAGE 6
COPERNICUS SENTINEL-2 MONITORS GLACIER ICEFALL, HELPING CLIMBERS ASCEND MOUNT EVEREST - Climbing trail towards Mount Everest Copyright: Contains modified Copernicus Sentinel data (2020), processed by the Department of Geosciences, University of Oslo - Colour-coded icefall velocities at Khumbu Glacier Copyright: Bas Altena, University of Oslo https://bit.ly/3p2ytk3	PAGE 7
VIDEO MONITORING CULTURAL HERITAGE https://bit.ly/3GIjC3W	PAGE 7
COPERNICUS SENTINELS WORK TOGETHER TO MONITOR AIR POLLUTION IN RECENT US WILDFIRES - Orange cloud over California Copyright: Contains modified Copernicus Sentinel data (2020)/processed on the Sentinel-Hub EO Browser - San Francisco glows in orange Copyright: https://bit.ly/3LnPmiu https://bit.ly/3suvzW5	PAGE 8
COPERNICUS SENTINEL-2 HELPS MONITOR CORAL REEFS - Copernicus Sentinel-2 Multi-temporal Mosaic Copyright: Contains modified Copernicus Sentinel data (2018)/processed by WWF-Germany https://bit.ly/3HLVr5Z	PAGE 8
COPERNICUS SENTINEL-1 GUIDES VENDÉE GLOBE SAILORS TO SAFETY - Close up of the South Central Pacific Ocean Copyright: CLS - Coverage of the Copernicus Sentinel-1 SAR imagery during the 2020-2021 Vendée Globe Copyright: CLS https://bit.ly/3gEbTcU	PAGE 9
VIDEO GLACIER MONITORING https://bit.ly/3Lr4eg3	PAGE 9
COPERNICUS SENTINELS MONITOR ETNA'S VARIOUS ERUPTIONS - Etna from Copernicus Sentinel-2 Contains modified Copernicus Sentinel data (2021)/processed by ESA - Copernicus Sentinel-1 shows Etna's deflation Copyright: Contains modified Copernicus Sentinel data (2021)/ processed by INGV https://bit.ly/3gI3uoJ	PAGE 10
COPERNICUS SENTINEL-1 CATCHES ICEBERG DRIFTING TOO CLOSE FOR COMFORT - Overlay composite image Copyright: Contains modified Copernicus Sentinel data (2021)/ processed by K. Strübing https://bit.ly/3LrxgvT	PAGE 10
COPERNICUS SENTINEL-5P ADVANCES AMAZON REAL-TIME FIRE MONITORING - Satellite-based fire alerts Copyright: Contains modified NOAA/NASA data (2020), processed by MAAP https://bit.ly/3GjmjCD	PAGE 11
COMBINATION OF COPERNICUS SENTINEL-2 AND PROBA-V DATA HELP ILLUSTRATE RIVER ICE BREAK-UP - Copernicus Sentinel-2 catches ice rubble drift Copyright: Contains modified Copernicus Sentinel data (2016)/processed by Oslo University - Flowing of river ice-floes Copyright: Contains modified Copernicus and PROBA-V data (2016)/processed by Oslo University https://bit.ly/3HLuX40	PAGE 11
COPERNICUS SENTINEL-3 CATCHES SAHARAN SANDSTORM - Aosta Valley goes orange Planetski.eu - Saharan dust storm Copyright: Contains modified Copernicus Sentinel data (2021)/processed by ESA https://bit.ly/3BdfXdr	PAGE 11

HIGHLIGHTS OF SENTINEL SUCCESS STORIES

The *Sentinel Success Stories* were first launched in September 2016, when scientists, remote sensing experts and data users communicated their eagerness to feature their work, demonstrating how the Sentinel satellites of the European Union's Copernicus Programme were making a difference. This second edition contains some of the most read, followed or Tweeted stories throughout 2020-2022, demonstrating just how successful the Sentinels and their data are, in various fields of applications.

We cover regular monthly articles, either from the perspective of Mission Managers who want to relate important achievements, or also thanks to various researchers and scientists that contact us, sharing their fruitful experiences.

We hope you find this selection of stories interesting, and would love to hear any anecdotes you may have about how the Sentinel missions have helped in your work.

If you would like us to feature any of your research work in one of our future articles, please contact our editors and we may be able to publish it as the latest Sentinel Success Story.

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. The programme is funded, coordinated and managed by the European Commission in cooperation with partners such as ESA and EUMETSAT.



Read our stories

<https://bit.ly/3Bcdqjx>



Watch our videos

<https://bit.ly/3rCx9pB>



Contact our editors

**Mali Cecere, Declan Perry
and Susan Kelly** with

your proposals:

contentmatters4sentinelonline
@ejr-quartz.com

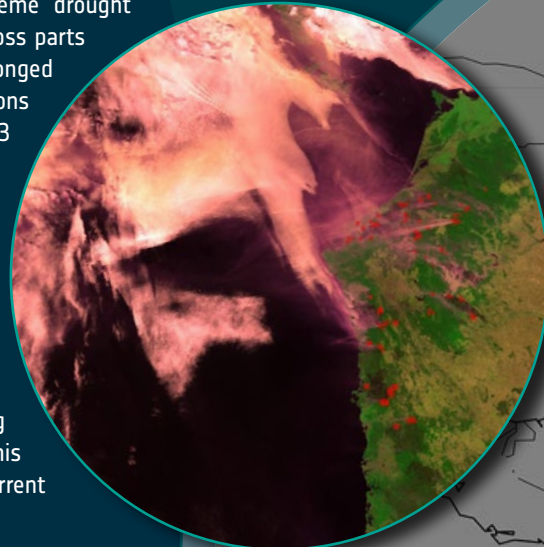
EMERGING CAPACITY FROM COPERNICUS SENTINEL-3 TO MONITOR GLOBAL WILDFIRES

17 January 2020

Australia has been struggling with severe bushfires for months now, and while experts are using all the satellite data they can to help monitor the situation, new products from the Copernicus Sentinel-3 mission will provide Fire Radiative Power information and aerosol parameters.

Record-breaking temperatures and months of extreme drought have helped trigger a series of massive bushfires across parts of Australia. Hot, dry weather together with prolonged drought and strong winds produced perfect conditions for the wildfires to rapidly spread, with more than 6.3 million hectares (63,000 sq km or 15.6 million acres) of bush, forest and national parkland already burned.

Humans are sometimes responsible for igniting such wildfires, but often the cause is lightning impacting dry vegetation. In extreme cases, bush fires can also prompt meteorological conditions such as thunderstorms, increasing the risk of lightning strikes and further fires, thus fuelling themselves. This appears to be the case for at least some of the current Australian blaze.



READ MORE:

<https://bit.ly/3uE59Uo>



HERITAGE DATA STILL WIDELY USED TODAY

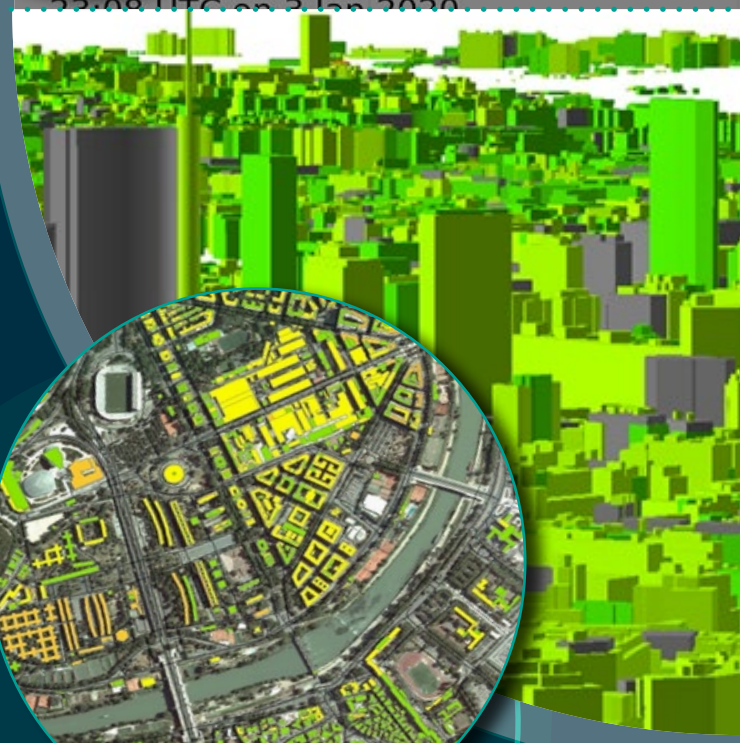
06 March 2020

For about 30 years now, ESA satellites have been cruising some 800 km above our heads, collecting information about our planet—but why are older missions still so fundamental today?

ESA has been gathering Earth observation data for a long time: it started systematic acquisition and archiving of data from other agencies' satellites in the late 1970s – known today as '[Third Party Missions](#)' – as part of the Earthnet Programme, while it launched its first European Remote Sensing satellite (ERS-1) in 1991 followed by ERS-2 in 1995 and Envisat in 2002.

The measurements that the Agency initiated with its own satellites in 1991, continue to be acquired today with evolved instruments on-board the [Sentinel](#) satellites of the European Union's Copernicus programme.

Today, there are many institutions, scientists and private companies that still rely on data from heritage (historical) missions for their work. These data are merged and compared with data from active missions, to ensure reliable measurements for the services they offer, or for scientific studies, requiring comparison of today's situation with that of the past.



READ MORE:

<https://bit.ly/33aTZuY>



AIR QUALITY MONITORING

17 January 2020

In the featured video, see how the Sentinel-5P mission of the European Union's Copernicus Programme has become a game-changer for monitoring our atmosphere, while being one of the most important sources of data for the Copernicus Atmosphere Monitoring Service.

WATCH VIDEO

<https://bit.ly/3HLd99S>

COPERNICUS SENTINEL-2 HELPS ADVANCE MARINE DEBRIS DETECTION

26 March 2020

Until recently, the exploitation of Earth Observation in the marine domain was somewhat limited, due to poor spatial resolutions and long revisit times, often extending to months or years— today, Copernicus Sentinel data and the development of multispectral techniques are bringing significant advantages in monitoring marine debris.

Floating marine debris has become a pervasive, global and increasingly critical problem, threatening wildlife and human activities throughout oceans, while creating headlines across the world.

The remote observation of some floating debris is a promising tool for monitoring, but still presents a high degree of complexity given the different characteristics and size of debris, the reflective nature of the sea surface, cloud cover in the marine environment and the nature of marine circulation aggregating and dispersing debris. Aerial photography and ship surveys are very costly, and thus usually restricted to once a year, at most.

READ MORE:

<https://bit.ly/3LpmIwx>



COPERNICUS SENTINELS HELP CLASSIFY RIVER ICE

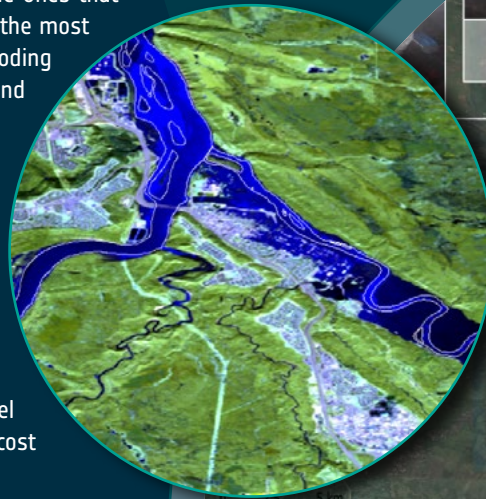
28 May 2020

River ice jams are a prime source of flood risk in cold regions. This recently occurred in Alberta, Canada, where the flooding of Fort McMurray resulted in the evacuation of the downtown district and in extensive damage. Copernicus Sentinels are lending a hand to monitor river ice conditions before ice jams affect towns and cities. On 26 April 2020, an ice jam developed on the Athabasca River in Canada, resulting in flooding of Fort McMurray.

These ice jams can occur at any time in winter, but the ones that take place during spring's river ice breakup tend to be the most common and destructive. The resulting overland flooding in Fort McMurray displaced some 13,000 people and damaged 1,200 properties.

The exact timing and location of these flooding events is difficult to precisely model and forecast. Monitoring of river ice, therefore, plays a very important role in early warning of floods, which can reduce the risk to local population and allow for hazard mitigation.

River ice monitoring relies on multiple data sources, including observations from aircraft and river level gauges. Satellite data offer flood forecasters a lower-cost and wider-coverage way to monitor river ice.



READ MORE:

<https://bit.ly/3BhMiQf>



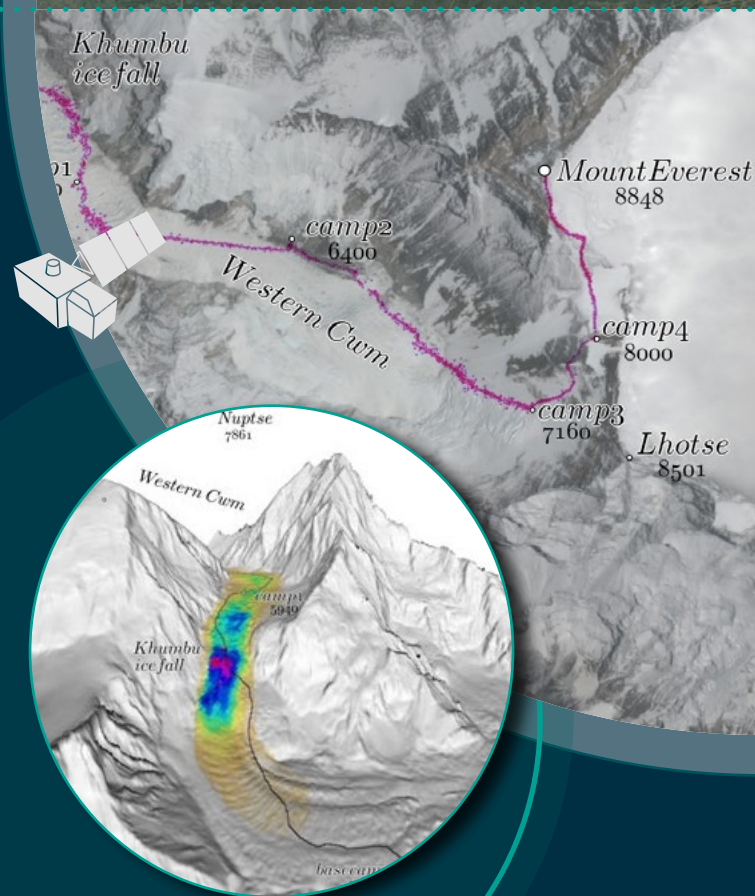
COPERNICUS SENTINEL-2 MONITORS GLACIER ICEFALL, HELPING CLIMBERS ASCEND MOUNT EVEREST

28 May 2020

Researchers from the [University of Oslo](#) have applied a technique to extract the detailed flow field of Khumbu icefall in the Nepalese mountains, from a large collection of Copernicus Sentinel-2 data—thus enhancing the capabilities of these data towards a reliable and consistent glacier mapping instrument.

When high altitude mountaineers want to climb Mount Everest from the Nepalese side, they follow a route over and along Khumbu glacier, which at lower elevations is covered with debris. Around Everest basecamp, the glacier of Khumbu starts to receive clean, blueish ice that stems from snow and ice from Western Cwm, the highest glacier in the world.

However, this ice reaches basecamp by transport through Khumbu icefall. This is a part of the glacier that runs over a steep cliff, and like a river undergoes chaotic and fast flow as it moves downwards. It is this section that climbers need to go through, in order to reach the summit of Mount Everest.



READ MORE:

<https://bit.ly/3p2ytk3>



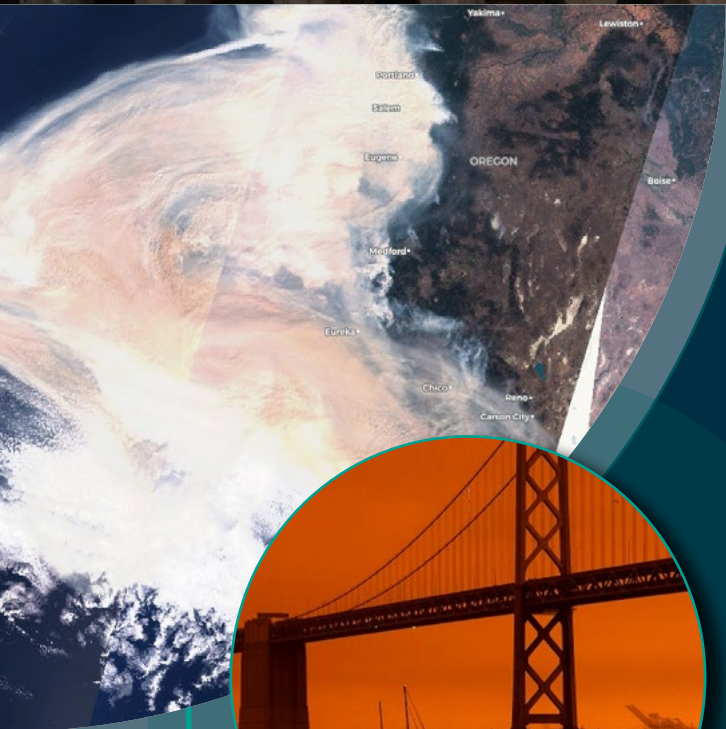
MONITORING CULTURAL HERITAGE

15 September 2020

In this video, expert interviewees explain how thanks to satellite images we can monitor the impact of human actions on the conservation of archaeological and heritage sites, such as illegal excavations and destruction in areas of conflict, as well as better understand the impact of natural events.

WATCH VIDEO

<https://bit.ly/3GIjC3W>



COPERNICUS SENTINELS WORK TOGETHER TO MONITOR AIR POLLUTION IN RECENT US WILDFIRES

15 October 2020

California, Oregon and Washington State [have been burning](#) for over a month now, leaving most of the western United States under smoke—data from the Copernicus Sentinel-2, -3 and -5P missions are providing a wealth of complementary information, needed to monitor the blazes.

Record high temperatures, thunderstorms and strong winds developed the critical conditions that allowed fires in western United States to spark and spread. Plumes of smoke from the fires were so extensive that they travelled across the US, reaching the opposite coast and even more incredibly also Europe, as depicted by NOAA.

The [Sentinel-5P satellite](#) of the European Union's [Copernicus Programme](#), dedicated to monitoring air quality, detected the increased concentrations of a series of air pollutants as emitted by the fires along the US west coast.



READ MORE:

<https://bit.ly/3suvzW5>



COPERNICUS SENTINEL-2 HELPS MONITOR CORAL REEFS

04 December 2020

Mozambique has some of the most climate-resilient coral ecosystems worldwide - and one of the world's most important reefs - Copernicus Sentinel-2 data are helping to assess where they are and what is happening to them over time.

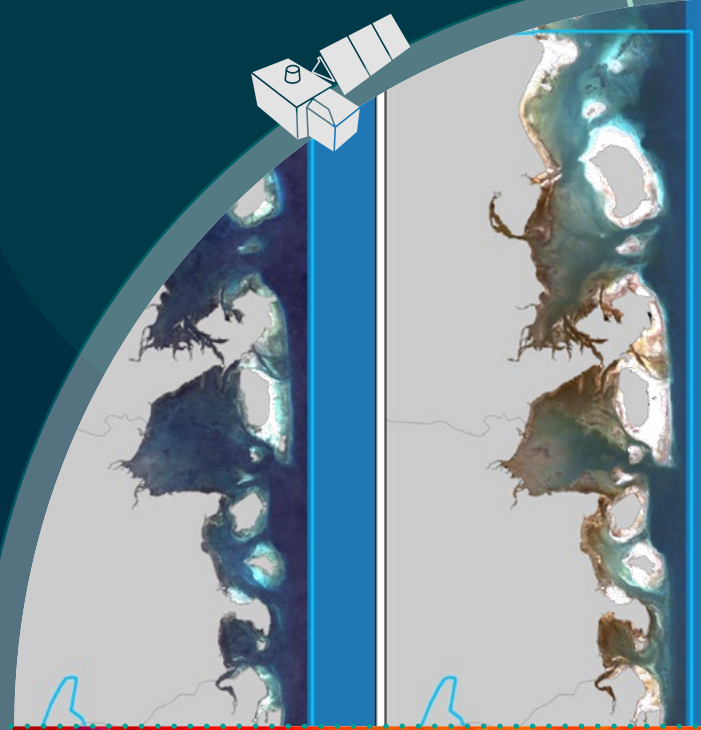
In 2018, satellite remote sensing expert Aurélie Shapiro of WWF Germany, launched an expedition with WWF-Mozambique, led by an international all-female team that used boats, depth finders, drones, apps and mobile phones to collect data on corals, seagrasses and mangroves, thus creating the first complete seascape map of the Quirimbas Archipelago in northern Mozambique.

In 2002, WWF helped establish the Quirimbas National Park (now a UNESCO Biosphere Reserve) to protect 7500 sq. km of rich miombo forests (that include four of the "big five" species) as well as the neighbouring marine area, full of magnificent coral reefs, islands, mangroves and abundant marine life, including all five protected marine turtles.

Occupying less than one percent of the ocean floor, coral reefs are home to more than twenty-five percent of marine life. The corals are essential nurseries for extremely diverse aquatic life, supporting thousands of fish species and crabs, which feed more than a million people. These habitats are associated with mangroves, seagrasses,

READ MORE:

<https://bit.ly/3HLVr5Z>



COPERNICUS SENTINEL-1 GUIDES VENDÉE GLOBE SAILORS TO SAFETY

28 January 2021

Globe—set off from Les Sables-d'Olonne in western France, with a route of some 25,000 nautical miles (approximately 46,000 km) going through the Atlantic and into the heart of the Southern Ocean. Data from the Copernicus Sentinel-1 satellite have been used to identify risky iceberg areas, providing the safest route for the skippers.

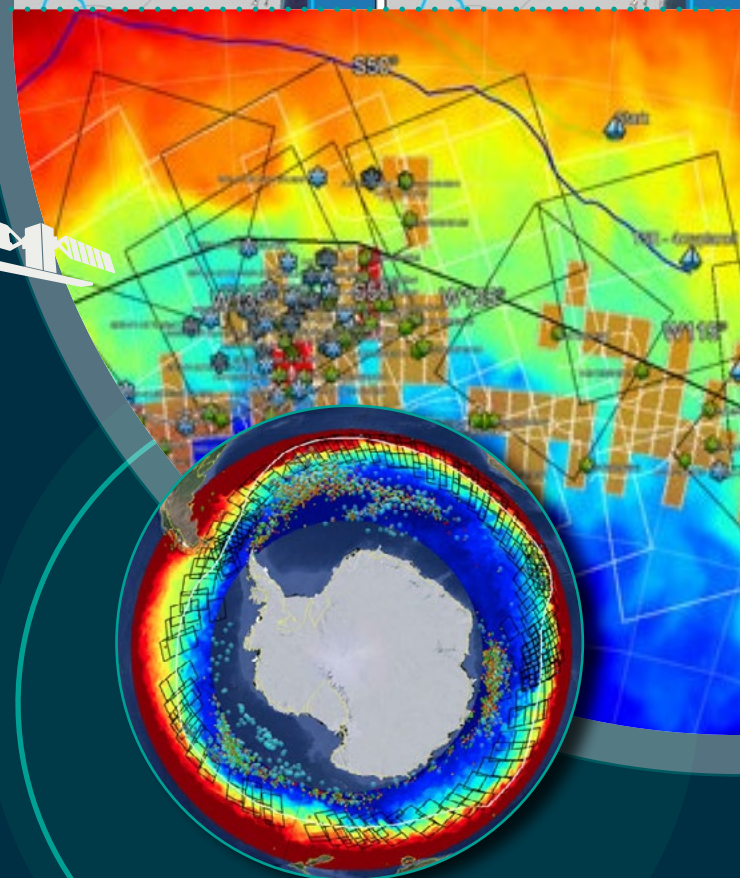
During this incredible solo race, the 33 fearless sailors have to deal with all sorts of difficulties, besides loneliness – from the risk of icebergs, to the danger of unidentified floating objects, fierce winds, huge waves and swells.

To ensure the safety at sea of sailors and their boats, CLS – a subsidiary of the French CNES space agency and CNP – uses information from satellites to detect and monitor icebergs. This information comes from satellites carrying altimeters, as well as those carrying synthetic aperture radar (SAR) –such as Sentinel-1 of the European Union's Copernicus Programme.

Satellites are the only way of detecting and monitoring icebergs effectively in the remote Southern Oceans.

READ MORE:

<https://bit.ly/3gEbTcU>



GLACIER MONITORING

04 December 2020

In this video, Bas Altena of Utrecht University describes in detail just how Copernicus Sentinel-2 imagery is enhancing glacier monitoring.

WATCH VIDEO

<https://bit.ly/3Lr4eg3>

COPERNICUS SENTINELS MONITOR ETNA'S VARIOUS ERUPTIONS

21 April 2021

With Europe's tallest active volcano of 3325 metres frequently erupting, volcanology experts are using data from the Copernicus Sentinels to monitor the situation for environmental and safety impacts, since its various recent explosions.

On 16 February 2021, one of the world's most active volcanoes, Italy's Mount Etna, erupted twice in less than 48 hours, cascading a fountain of lava and ash into the sky.

The first eruption caused large lava flows to descend eastwards into the Valle del Bove, travelling for approximately 4 km, but the second major explosion on 18 February caused the lava also to run for about 1.3 km down the volcano's southern flanks.

Ash from the eruptions covered the city of Catania, so authorities monitored developments in the nearby towns at the base of the volcano. The eruption also forced the temporary shutting of Sicily's Catania Airport, which often happens when the volcano is active.

READ MORE:

<https://bit.ly/3gI3uoj>



COPERNICUS SENTINEL-1 CATCHES ICEBERG DRIFTING TOO CLOSE FOR COMFORT

21 May 2021

An unnamed tabular iceberg drifting eastward towards the uninhabited Saunders Island was caught by the Copernicus Sentinel-1 satellite—making its monitoring a near-real-time event.

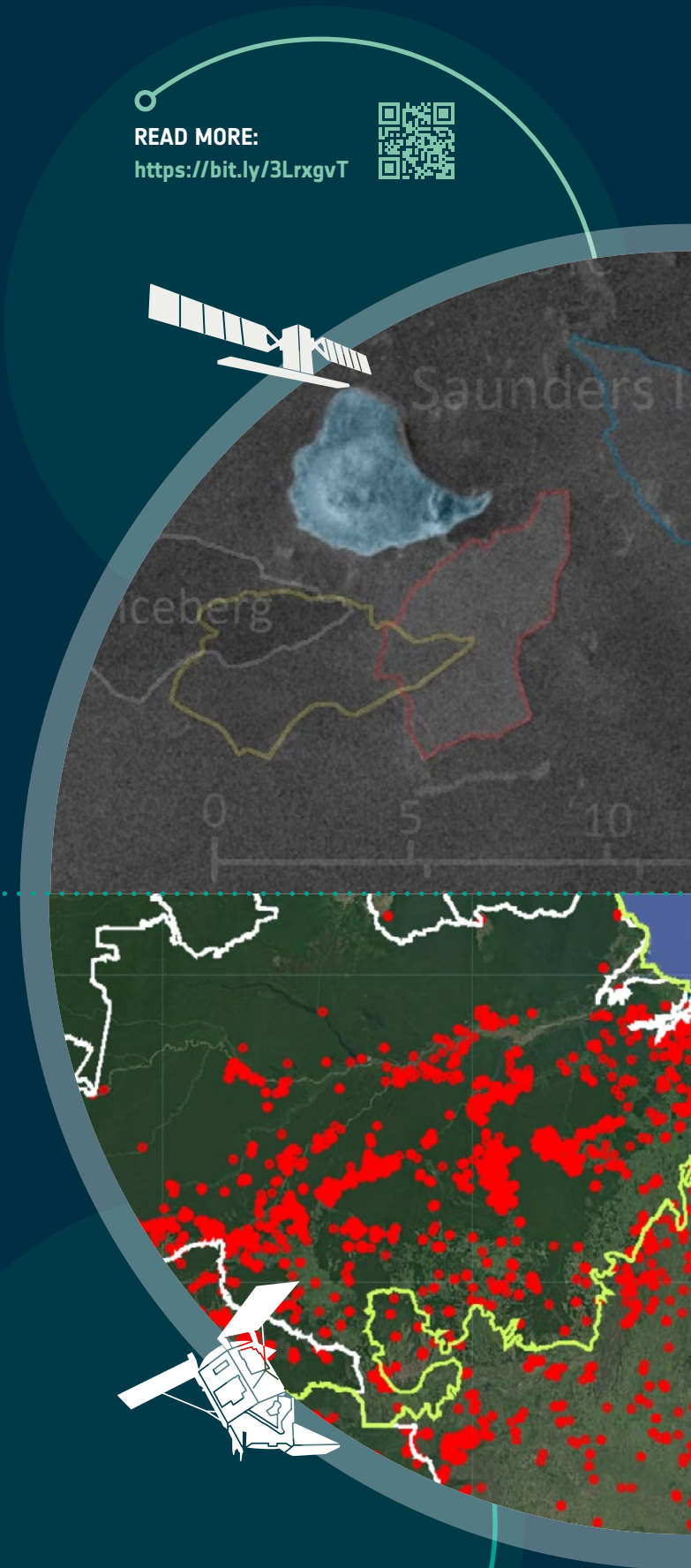
At the end of April 2021, an iceberg with its longest axis of about 7.3 nm approached eastwards through the Scotia Sea, towards Saunders Island in the Southern Atlantic Ocean.

With a size of about 40 km², similar to that of the tabular iceberg, the island is of volcanic origin and situated in the central part of the South Sandwich Islands on the East Scotia Ridge. Its highest elevation is the [Mount Michael](#) volcano at 990 m, which has erupted repeatedly since 2000, and whose summit crater contains a persistent lava lake—one of only eight in the world.

Data from the [Sentinel-1](#) mission of the European Union's [Copernicus Programme](#) documented the situation. Images show the tabular iceberg very close to the southern coast of Saunders Island (image 1). Because of its volcanic origin, the island has no distinct shelf but a steep slope, which allows the iceberg to drift very near the coastline, despite its assumed draught of several decametres.

READ MORE:

<https://bit.ly/3LrxgvT>



COPERNICUS SENTINEL-5P ADVANCES AMAZON REAL-TIME FIRE MONITORING

05 February 2021

MAAP (Monitoring of the Amazon Project), a programme within the organisation Amazon Conservation, focuses on real-time monitoring of deforestation and fires. Copernicus Sentinel-5P data are a game changer in their work to monitor Amazon fires.

Launched in 2015, [MAAP \(Monitoring of the Amazon Project\)](#) is a key programme within [Amazon Conservation](#), a Washington DC-based organisation with sister organisations in Peru and Bolivia (referred to collectively as the Amazon Conservation Alliance).

MAAP's target has always been advancing the dynamic new field of real-time monitoring. For the first four years, it focused on real-time deforestation monitoring, and in 2019 it also expanded to real-time fire monitoring.

This extension to real-time fire monitoring was made possible by their innovative new use of Copernicus Sentinel-5P imagery. Fire monitoring can be done with satellite-based heat alerts, which has the caveat of detecting thousands of points but not distinguishing between small (routine) and major fires.

READ MORE:

<https://bit.ly/3GJmjCD>



READ MORE:

<https://bit.ly/3HLuX40>



COMBINATION OF COPERNICUS SENTINEL-2 AND PROBA-V DATA HELP ILLUSTRATE RIVER ICE BREAK-UP

16 March 2021

The monitoring of frozen river break-ups at high latitudes is a daunting task, where hazards such as flooding and infrastructure damage can occur in mere days and are difficult to forecast—the monitoring from space of how river ice break-ups unfold and progress could help mitigation efforts, create data for reanalysis and aid hazard assessments.

Researchers from the [University of Oslo](#) have demonstrated the feasibility of such a spaceborne system, by simply combining data from pre-existing satellites with those of the current [Sentinel-2](#) satellites of the European Union's [Copernicus](#) Programme.

Every year when spring arrives, snow from the previous winter starts to melt. This meltwater finds its way through the snowpack, accumulating in creeks and rivers. However, these rivers are still covered by ice, which also tends to melt. While more and more meltwater is delivered to the rivers, the water pressure under the ice cover increases. Similarly, on top of the ice cover the snow and ice layer slowly melt, becoming thinner. Eventually, the water pressure can be of such magnitude that it is able to crack the ice, resulting in a river ice break-up.

COPERNICUS SENTINEL-3 CATCHES SAHARAN SANDSTORM

05 February 2021

On 6 February 2021, a huge windstorm from the Sahara reached large parts of the Alps and Pyrenees, giving the snow and surrounding area a sepia coloured nuance, and creating a Mars-like atmosphere—Copernicus Sentinel-3 caught it in real-time, adding to its ability of supplying aerosol estimates.

The phenomenon of Saharan sandstorms reaching Europe can occur various times throughout winters.

Strong southerly winds in Africa took the sand into the sky, atmospheric air currents pushed it northwards and when it hit the mountain ranges of Europe it descended, covering the surroundings like an orange blanket.

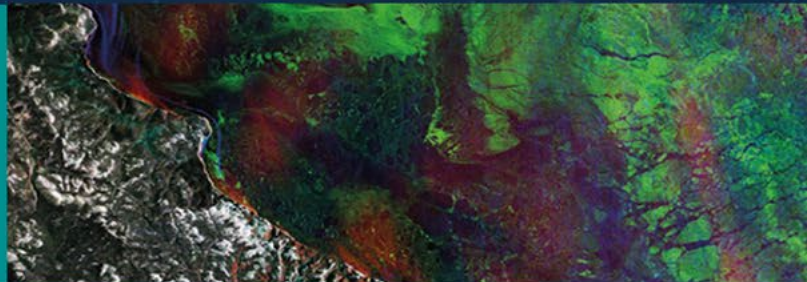
The OLCI (ocean and land cover instrument) sensor on the [Sentinel-3 mission](#) of the European Union's [Copernicus](#) Programme caught the drift of the sandstorm, as shown in the featured images.

READ MORE:

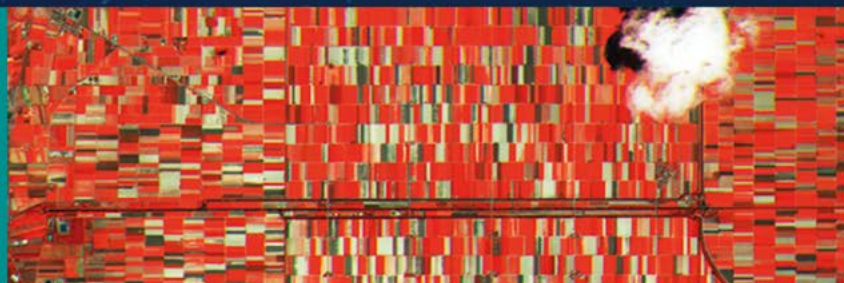
<https://bit.ly/3BdfXdr>



sentinel-1
RADAR VISION



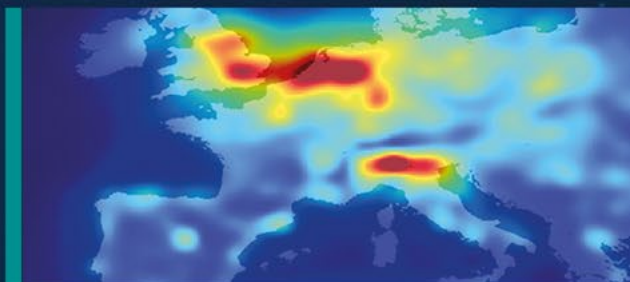
sentinel-2
COLOUR VISION



sentinel-3
A BIGGER PICTURE



sentinel-4
EUROPEAN AIR MONITORING



sentinel-5p | sentinel-5
GLOBAL AIR MONITORING

