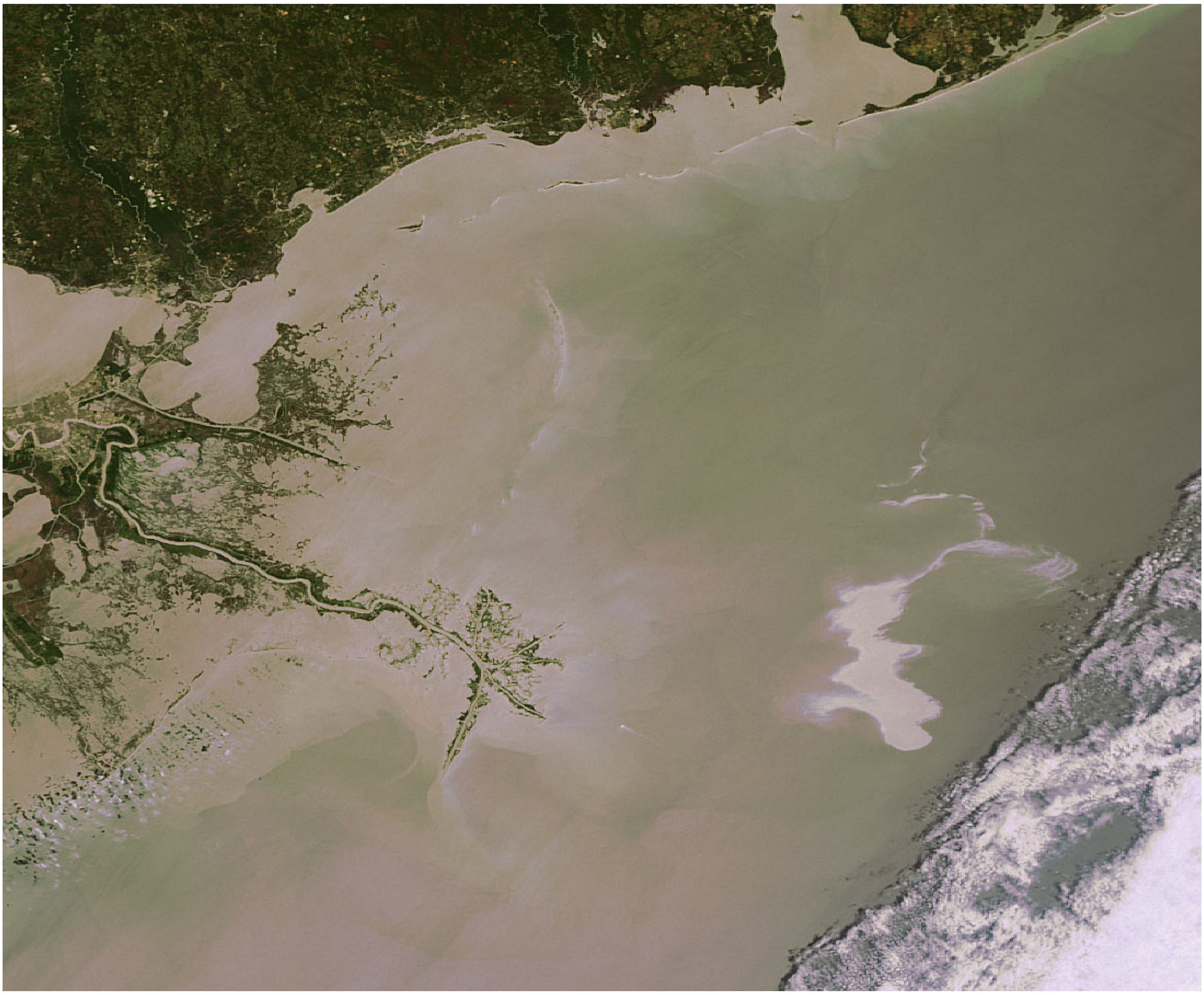
teach with space

→ COPERNICUS BROWSER CASE STUDY: OIL SPILLS FROM SPACE

EARTH OBSERVATION IN THE CLASSROOM



Envisat optical image of the oil spill (visible as a white whirl on the right) in the Gulf of Mexico.
Credit: ESA

Learning Objectives:

- Define bilge dumping and oil spills and explain the main differences between active and passive satellites.
- Describe the role of Sentinel-1 satellites in detecting oil spills and ship activity.
- Use the Copernicus Browser to explore radar imagery and identify potential bilge dumping or oil spills.
- Examine radar patterns to differentiate between oil spills, ships, and other ocean features.
- Assess the strengths and limitations of using satellites for environmental monitoring.
- Develop strategies to prevent bilge dumping or oil spills and raise awareness on the issue.

Brief Description:

This activity supports teachers in guiding their students to investigate oil spills and their impacts using satellite imagery. It includes exercises for data collection and analysis, which can be adapted to the specific focus chosen by the teacher and students. By using satellite data from the Copernicus Sentinel-1 mission, students will learn analyse these phenomena and reflect on their impacts on ecosystems and society.

Note! This activity is designed to complement the Copernicus Browser Teacher Guide, which provides more details about the platform and helps familiarise you with its features.

Fast Facts:

Subject: Geography, Biology, Physics, Environmental Sciences

Age range: 14-18 years old

Type: Student Activity

Complexity: Adaptable

Lesson time: 45 - 60 minutes

Cost: N/A

Location: Indoor

Requirements: Internet access and an electronic device (such as a tablet or laptop)

Keywords: Oil Spills, Environmental Monitoring, Bilge Dumping, Sentinel-1, Satellite Imagery, Marine Ecosystems, Climate Change, Pollution Detection, Radar Technology, Project-Based Learning, Copernicus Browser, Coastal Protection

What is Copernicus Browser?

The Copernicus Data Space Ecosystem Browser is an online application that provides easy and free access to satellite imagery from different Earth Observation (EO) missions. It provides ready-to-use satellite images and pre-configured visualisations. The browser can be accessed from a desktop browser or a mobile device.

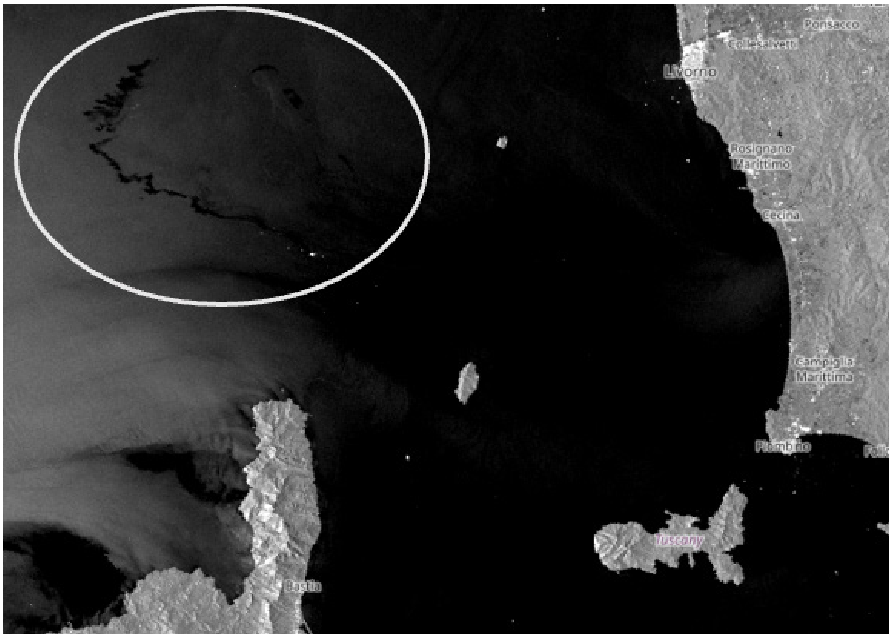
How to use Copernicus Browser for Education?

The Copernicus Browser is a powerful tool for STEM education, making it easy to bring real-world environmental data into the classroom. It supports classroom investigations and projects like Climate Detectives, helping students investigate global changes through satellite imagery. Whether you're teaching geography, physics, biology or environmental sciences, this tool provides a hands-on way to explore Earth's transformation over time.

With the Copernicus Browser, it is possible to explore satellite images of almost any location, such as a city, a glacier, deserts, rainforests, or even a volcano. These images can be viewed in true colour, just as they appear to the human eye, or through different satellite modes that highlight key environmental factors like vegetation health, chlorophyll levels in water, air pollution patterns, etc.

The *compare function* and *time-lapse* features allow us to track changes on Earth over time using data from the Sentinel satellites, which have been monitoring the planet since 2014. It is possible to create series which show landscapes evolve with the seasons, measure the area of deforestation, or analyse the impact of natural disasters like volcanic eruptions. Images in different formats can be downloaded for further study and classroom activities.

By integrating the Copernicus Browser into lessons, environmental science can be turned into an interactive experience, giving students the tools to explore, analyse, and understand the world around them, like real scientists.



Oil Spill in the Mediterranean Sea, north of the French island of Corsica.
Credit: contains modified Copernicus Sentinel data (2018), processed by ESA

How to use this resource?

This activity is designed to guide students through the investigation of oil spills using satellite data from the Copernicus Sentinel-1 mission. Use the following steps to effectively implement the activity in the classroom.

Introduction to the Topic

Begin by familiarising students with the basics of the topic and discuss the environmental damage caused by bilge dumping and oil spills, as well as their impacts on marine ecosystems and society. Explain how satellites, especially Sentinel-1, contribute to detecting and mitigating such issues. Use the provided background information to set the context for the investigation. Students can also build knowledge related to the topic by watching short documentaries or videos or by conducting web research.

- *What are oil spills and bilge dumping?*
- *What are the main problems they cause for marine life and human communities?*

Get to know the Copernicus Browser

Before starting this activity, it is recommended to understand and test the Copernicus Browser tool, which can be done by consulting the Copernicus Browser Guide. It is also recommended that each student create an account/log in to the Copernicus Browser before beginning the activity, as this may take up time. Instructions for creating an account are provided in the 'Getting Started on the Copernicus Browser' section below.

Data Collection and Analysis

Students will use the Copernicus Browser to locate and analyse satellite imagery of oil spills and bilge dumping in specific regions. You can support them by:

- Guiding them in selecting time frames and zooming into affected areas like the English Channel.
- Helping them to identify key ocean features, such as ship patterns and wind farms.
- Encouraging them to explore the extent of the oil spill and examine its surrounding environment.

Discussion and Reflection

After gathering data, students should reflect on their findings by answering the guided questions provided in this resource. Facilitate this process by encouraging deeper analysis, fostering group discussions, and focusing on the practical applications of satellite imagery in environmental monitoring and pollution management.

As students examine their results, prompt them to consider the broader implications of bilge dumping and oil spills, including social, environmental, and legal aspects. Building on these reflections, encourage them to propose awareness-raising initiatives or practical measures to prevent further environmental damage.

To translate their insights into action, challenge students to create an action plan to mitigate bilge dumping and oil spills, incorporating findings from their data analysis. Emphasize the importance of realistic, actionable, and data-informed solutions, considering both local and global perspectives. Finally, inspire students to think beyond classroom discussions by exploring how they can advocate for policy changes where relevant, reinforcing the role of science in driving real-world solutions.

Background Information

What is Bilge Dumping?

Bilge dumping is the intentional and often illegal release of untreated oily wastewater (bilge water) - a mixture of water, oil, and pollutants - from ships into the ocean. This practice violates regulations like MARPOL (an international convention for the prevention of pollution from ships signed by the United Nations), which permits discharge only if the oil content is below 15 parts per million (ppm) after treatment. It typically occurs due to cost-cutting measures, poor maintenance, or the absence of treatment systems, such as oily water separators. Although smaller in scale than major oil spills, frequent bilge dumping still causes significant harm to marine ecosystems, pollutes local waters, and often goes unnoticed, resulting in long-term environmental damage.

What are Oil Spills?

Oil spills are the release of crude oil, refined petroleum, or their by-products into the environment, often caused by tanker collisions, drilling blowouts, or pipeline ruptures. While usually accidental, some spills are intentional, such as those resulting from sabotage or oil theft (e.g., illegal siphoning or pipeline tapping). These incidents can be massive, causing devastating environmental and economic consequences. Oil spills severely harm marine ecosystems, wildlife, and local communities, with damage that can take decades to reverse and cleanup efforts that are extremely costly.

Key differences between Bilge Dumping and Oil spills:

Aspect	Bilge Dumping	Oil Spill
Intent	Deliberate (illegal if untreated)	Typically, accidental (sometimes deliberate)
Volume	Small, recurring amounts	Often large, catastrophic events
Cause	Neglect, cost-cutting, or improper practices	Typically, accidents (e.g., tanker crashes)
Impact	Cumulative pollution over time	Immediate, widespread damage

Did you know?

Oil spills usually receive more attention due to their massive and visible impact. In contrast, bilge dumping often goes unnoticed despite being a persistent environmental problem.

Credit: ESA

Earth Observation Data using Satellites

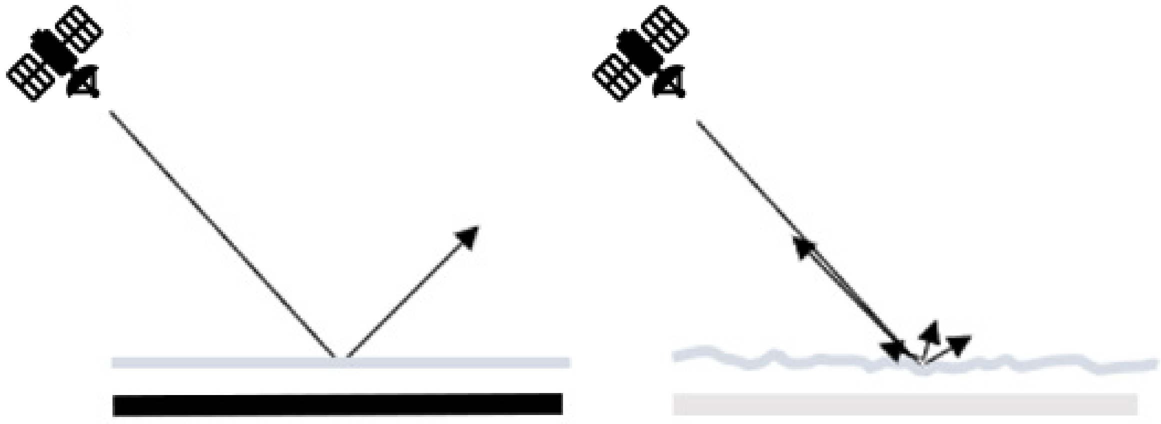
Earth Observation (EO) involves the collection, analysis, and presentation of data to better understand our planet. This data can be gathered by remote sensing platforms, such as satellites, or directly from the ground. Ground-based measurements, known as 'ground data' or 'in-situ' (on the spot), are essential for validating satellite measurements. Together, these two types of data complement each other, providing a more accurate picture of our planet's environment.

From above, satellites collect data from all around the world, even from very remote places. By doing so, they provide a global perspective and ensure frequent and continuous measurements. The data collected by satellites can be converted into actionable information, which can be used to monitor environmental factors such as air pollution, map deforestation and urban growth, Earth's temperature changes and enable rapid and resilient crisis response after natural or man-made disasters. Recognising the importance of this data, ESA continues to have Earth Observation as a key priority and has developed the Sentinel satellites for the European Union's Copernicus programme, the largest environmental monitoring initiative in the world.

Detect Bilge Dumping and Oil Spills from Space

Satellites play a crucial role in detecting oil spills and bilge dumping from space, providing a powerful tool for frequent monitoring of marine pollution on a local, regional and global scale. Among them, the Sentinel-1 mission, which is the focus of this activity, uses two satellites to provide continuous, high-resolution radar imagery of the Earth's surface. These satellites are equipped with Synthetic

Aperture Radar (SAR) technology, an active sensor that transmits radar signals to the Earth's surface and measures their reflections (as shown in the image below).



This technology is particularly effective for detecting oil spills and bilge dumping, even under challenging weather and lighting conditions.

What are the main differences between Active and Passive Sensors?

Active Sensors	Passive Sensors
Active sensors (like SAR) generate their own energy by emitting radar signals and measuring their reflections. They operate independently of external light or heat sources, ensuring consistent and reliable data collection under almost any conditions, including darkness, cloud cover, and poor weather.	Passive sensors rely on natural energy sources, such as sunlight or the Earth's thermal radiation, and may struggle to produce clear imagery in low-light conditions, such as at night or when clouds obscure the surface.

How SAR Detects Oil Spills & Bilge Dumping

Open water, typically roughened by wind and waves, reflects radar signals in a way that sends some energy back to the satellite sensor. In SAR images, these rough surfaces appear as bright, textured patterns - the brighter the pixel, the stronger the reflected signal.

When oil is present, it forms a thin, smooth layer that reduces the water's natural roughness. This smooth surface acts like a mirror, causing radar signals to reflect away from the satellite instead of returning to the sensor. The result is a dark, smooth area in the SAR image that contrasts sharply with the surrounding bright, rough-textured water. Scientists study these patterns to identify the location, size, and spread of oil spills or bilge dumping.

However, other factors, such as calm, wind-free water, can also create smooth surfaces that appear dark in SAR imagery. For this reason, scientists often corroborate SAR data with additional observations - such as ship locations or environmental factors like wind patterns - to confirm the presence of oil.

By integrating SAR data with other satellite observations and on-site inspections, authorities can strengthen maritime law enforcement and uncover illegal activities that might otherwise go unnoticed.

In this effort, Sentinel-1 plays a key role by:

- **Detecting** illegal bilge dumping, where ships intentionally release oily wastewater into the ocean.
- **Monitoring** large oil spills, tracking their spread, and assessing their potential impact on coastlines and marine ecosystems.
- **Supporting** emergency response efforts by providing real-time data to guide cleanup operations.

Getting Started on the Copernicus Browser

We strongly encourage you to ensure that each student has an account on Copernicus Browser before beginning the activity, as this may otherwise take up considerable lesson time. Instructions for creating an account are provided below:

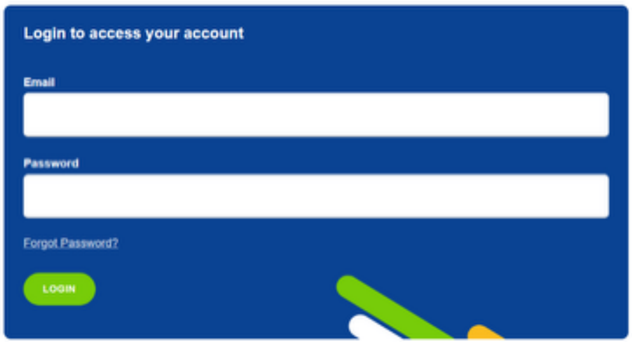
1. Go to the Copernicus Browser, which can be accessed using the following link: https://browser.dataspace.copernicus.eu/

The Copernicus Browser is available in different languages.

2. Select the language (1) in the Main Navigation Panel.
3. On the top right of the Main Navigation Panel, click on the login button (3).

Note: To complete this resource, you need an account. While it is possible to use the Copernicus Browser to download satellite images without a user account, some features of the map toolbar, such as the time-lapse function and saving pins (as needed in this resource), require you to be logged in.

Please also note that it may take some time to receive the verification email. We therefore recommend signing up before starting this activity.

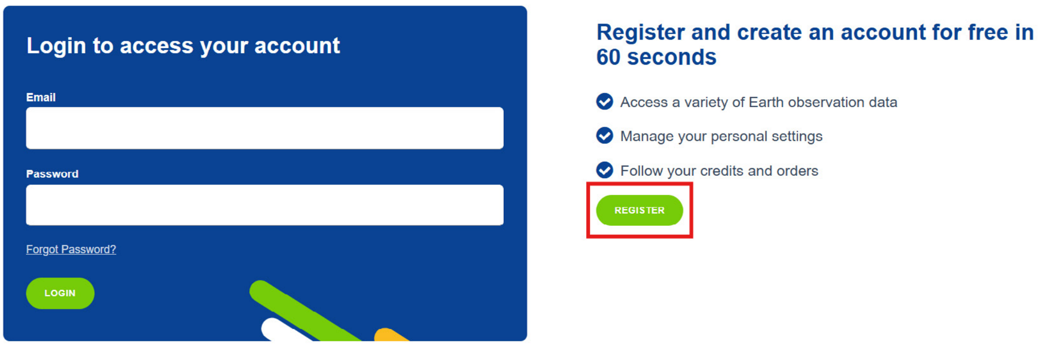


How to register on the Copernicus Browser:

Creating an account on the Copernicus Browser is free. To create an account, please follow this link: https://browser.dataspace.copernicus.eu/

1. Click on ''Login'':

2. A popup window will appear. Scroll to the bottom and click on "Register" at the bottom in green.



3. You will then be directed to a registration form that you need to fill out. After registration, you will receive a verification email. Note that it may take some time to receive it.

Questions and answers from the student worksheet

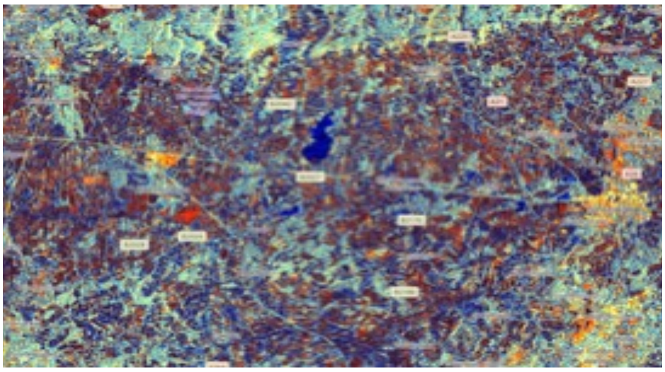
After familiarising yourselves with the Copernicus Browser and collected Copernicus Sentinel-1 data to detect and analyse oil spills and bilge dumping, you can begin a discussion and reflection on the activity using the following questions and answers. Students can work first in small groups, or a discussion with the whole class after each part of the Copernicus Browser exercise can be encouraged.

Q.1. Zoom in on the image and see what you can identify:

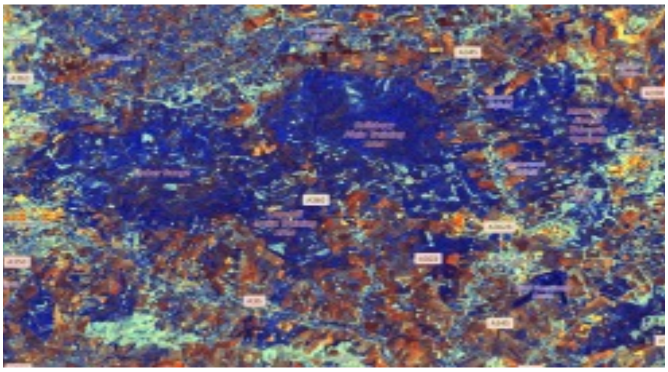
Q.1.1. What features can you see on land?

Students may identify and conclude:

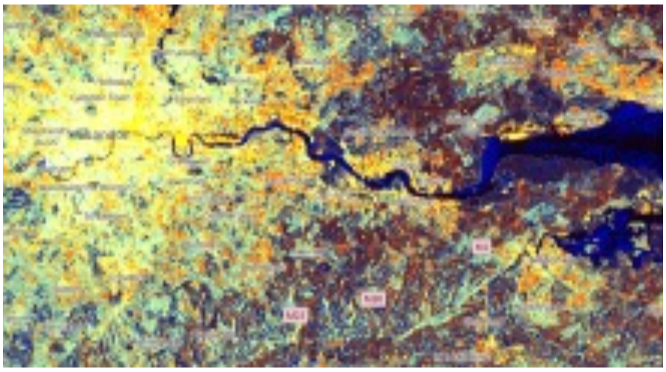
Cities and Urban Areas:
Bright yellow areas indicate high-density urban zones, such as London and surrounding towns. These bright colours are the result of strong radar reflections caused by buildings and infrastructure, which are typical in urban environments.



Road Networks:
Some linear features connecting urban areas represent major roads or highways. These appear in radar images because roads and highways can produce consistent backscatter signals, especially when they are wide, paved, and flanked by structures or vegetation that enhance radar reflection. Their linear shape and connectivity between bright urban zones help distinguish them from natural features.



Rural and Forested Areas:
Greenish or blue patches likely represent rural, agricultural, or forested regions. This is because these natural surfaces generally produce lower or more diffuse radar backscatter compared to urban areas or infrastructure.



Rivers and Waterways:
Darker linear features are rivers or streams running through the landscape. This is because water surfaces tend to absorb radar signals rather than reflect them, resulting in low backscatter. Since radar waves are not strongly reflected by smooth surfaces like water, these areas appear as dark linear features in the image.

Q.1.2. How does the water look? What features can you see on the water?

The students may note that the water appears dark with scattered bright spots, which likely represent objects or features on the surface, such as ships or offshore wind farms. This happens because water, being smooth, absorbs radar signals rather than reflecting them, resulting in a dark appearance in the radar image. However, rough and complex surfaces, like the hull of a ship or the structures of an offshore wind farm, reflect radar energy back to the satellite more effectively. This greater return from the surface results in bright spots within the image, helping distinguish these objects from the surrounding water.

Q. 1.3. How do you think we can exploit that information to identify objects on the surface from space?

We can exploit this information to identify objects on the water surface from space by analysing the following:

- Brightness: Bright spots stand out against the darker water, making objects like ships visible.
- Patterns: Clusters or alignments of bright spots could indicate shipping lanes, anchored vessels or offshore wind farms.

Comparing the distribution of bright spots with known maritime activities (e.g., fishing zones or busy ports) can help identify specific objects or events. By combining these observations with satellite imagery analysis, we can monitor maritime activity, track ships, or even detect illegal practices such as bilge dumping.

Q.2. Why are some parts of the water darker than others?

Smooth water surfaces scatter less radar energy back to the Sentinel-1 satellite and therefore appear darker. This can be caused by minimal wind activity, oil slicks, or other factors that reduce surface roughness. If there are waves and more wind, we often see more shades of grey and patterns in the water.

Q.3. Zoom in on the white dots and note down how they look.

Many appear as star-like or cross-shaped, while others are elongated.

Q.3.1. What do you imagine the dots that look like stars/crosses are?

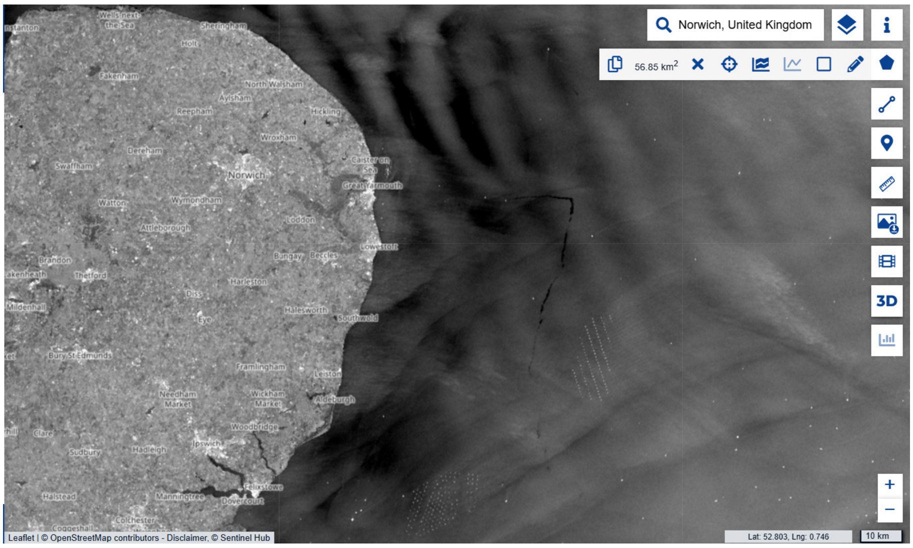
Given their size and scattered distribution, most of the white dots are likely boats or ships, as their arrangement mirrors common vessel traffic patterns in open waters.

Q.3.2 Why do you think some objects are in a pattern or formation on the water? What could they be?

The objects arranged in structured, grid-like formations are likely stationary objects, such as offshore wind farms.

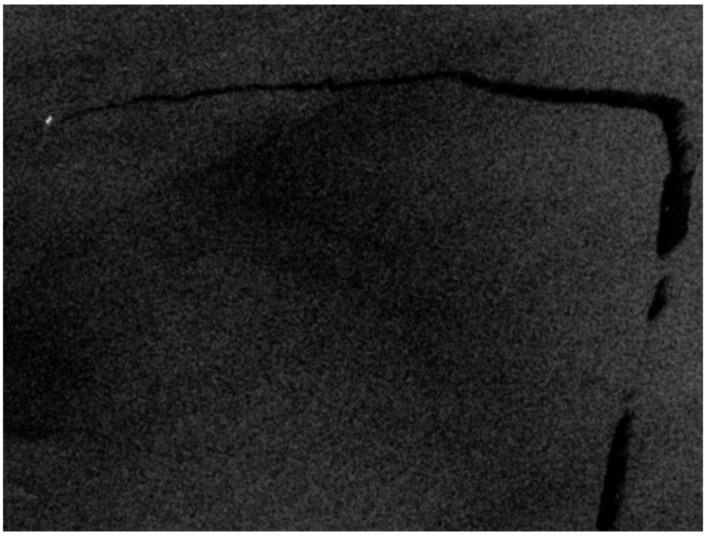
Q.4. Click on the date at the top of the menu to open the calendar. Try out different dates in February or use the arrows on each side of the date displayed to quickly navigate between available imagery.

Students should focus on the area east of Norwich (UK) and locate the oil spill, which is visible in the imagery on February 4th. It may take some time to find it, especially if they don't immediately consider the location near Norwich as a clue. Be patient and explore different areas within that region.

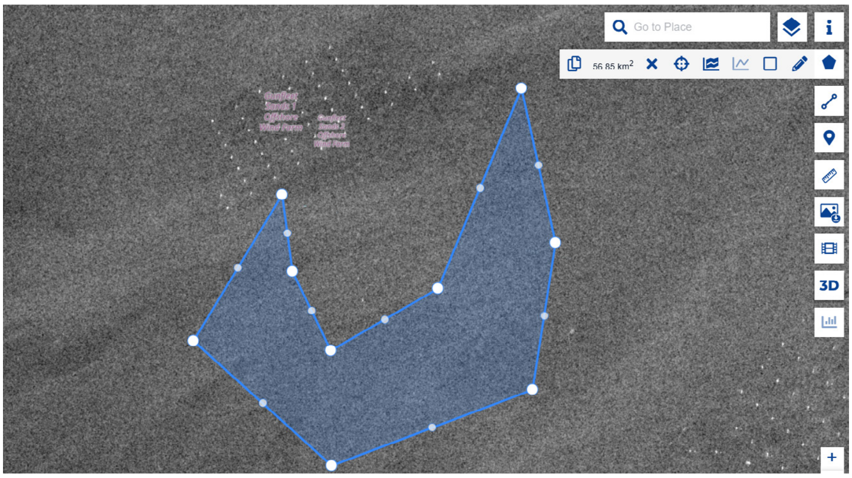


Q.4.1. Are there any land features that could block the wind? Is there a ship (white dot) or perhaps a river outlet at one end of the oil spill that we can trace the spill to?

There are no immediate land features that could block the wind and create this distinct pattern. However, there is a visible ship (a bright white dot) at one end of the oil spill, strongly indicating that the spill originates from this vessel. The spill appears to follow the ship's path, reinforcing this conclusion.



Q.5. The Copernicus Browser will then tell you the size of the area like this:



Q.5.1. Can you compare the size of the oil spill to an area with which you are familiar, such as a city or airport?

Students should estimate that the oil spill covers an area of approximately 35–40 square kilometres. To put this into perspective, this is roughly equivalent to the size Cambridge, UK (~40.7 km²) or the Paris Charles de Gaulle Airport (~32.38 km²). Comparing it to a familiar location can help visualise the scale of the spill and its potential environmental impact.

Q.6. Calculate how much oil at least could have bene dumped using this information.

If the observed oil slick covers 35 km², and we know that 1 km² corresponds to at least 1 m³ of oil, then the estimated minimum volume of oil spilled would be:

$$35\ km^2 \times 1 \frac{m^3}{km^2} = 35\ m^3$$

So, the answer to the question would be: At least 35 m³ of oil was spilled.

You may decide to ask your students to discuss how we can best combat the issue of bilge dumping using satellites and which other organisations may be involved:

Answers may include:

- **Environmental agencies** (e.g., the International Maritime Organisation, national coast guards, and local environmental protection agencies) to report oil spills and push for stronger enforcement.
- **Government officials** and policymakers to advocate for stricter regulations and harsher penalties for illegal dumping.
- **Media** to raise public awareness and put indirect pressure on companies and governments to take action.
- **Maritime industry & authorities** (e.g., shipping companies, port authorities) to encourage compliance with legal waste disposal practices.

Conclusion

Satellite sensors capable of detecting vessels at sea can cover areas larger than any other surveillance technology in a single scan and can provide approximately daily global coverage. It is now easier than ever to access and quickly obtain satellite data at a fraction of the cost of ship or aircraft reconnaissance. Satellites have already become a regular tool for tracking patterns of dark vessel activity and supporting fisheries monitoring, control, and surveillance operations, where the intelligence is used to direct surface and air patrol assets.

Case Study: Pollution in the English Channel

Student Worksheet

Introduction to the topic - Setting the Scene

Every day, thousands of ships navigate the English Channel, the busiest ocean shipping lane in the world. Nearly 200,000 ships pass through this narrow waterway annually, connecting continental Europe to the Atlantic Ocean and beyond. While these ships are vital for global trade, some engage in harmful practices, such as bilge dumping - the illegal disposal of untreated oily wastewater into the sea.

Bilge water contains oil, hazardous metals, and toxic chemicals, posing a serious threat to marine ecosystems and coastal communities. Lighthouse Reports reported in 2022 that this illegal practice happens 3,000 times every year in European waters alone. Left unchecked, bilge dumping can devastate marine life, pollute coastlines, and harm industries that rely on clean oceans, such as tourism and fishing.

In this case study, you will investigate the issue of bilge dumping in the English Channel using data from the Sentinel-1 satellite mission. Through hands-on investigation, you will learn how to identify oil spills from space and consider their environmental and societal consequences.

Credit: ESA

Data Collection and Analysis

Exercise: Oil Spills and Ship Detection

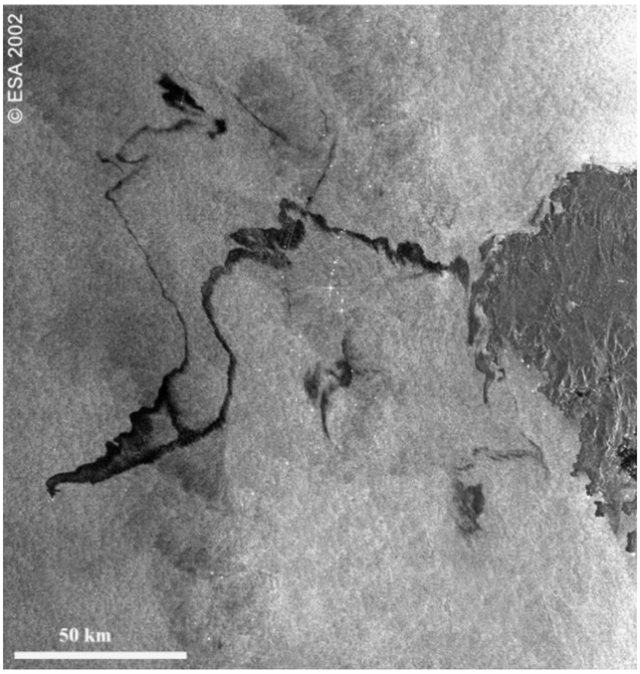
Earth Observation (EO) involves the collection, analysis, and presentation of data to better understand our planet. Oil spills can be investigated locally from the ground by taking so-called in-situ measurements and by satellites which keep an eye on these spills from space. Earth Observation data can therefore be divided into two categories: 'Ground data,' which is collected on Earth, and 'Satellite data,' which is gathered from space. Both data categories complement each other. Using this information, scientists can develop strategies to protect public health, ecosystems and safeguard the fishing and tourism industries.

Did you know?

The European Union's Copernicus Programme provides satellite data freely available to everyone, offering you the opportunity to become an Earth observer yourself! Helping to map oil spills and providing critical information for marine ecosystems are just some of the ways that the Sentinel satellites are used in Europe's Copernicus environmental monitoring programme. The Sentinel satellites also monitor our land, ice and atmosphere to understand large-scale global dynamics.

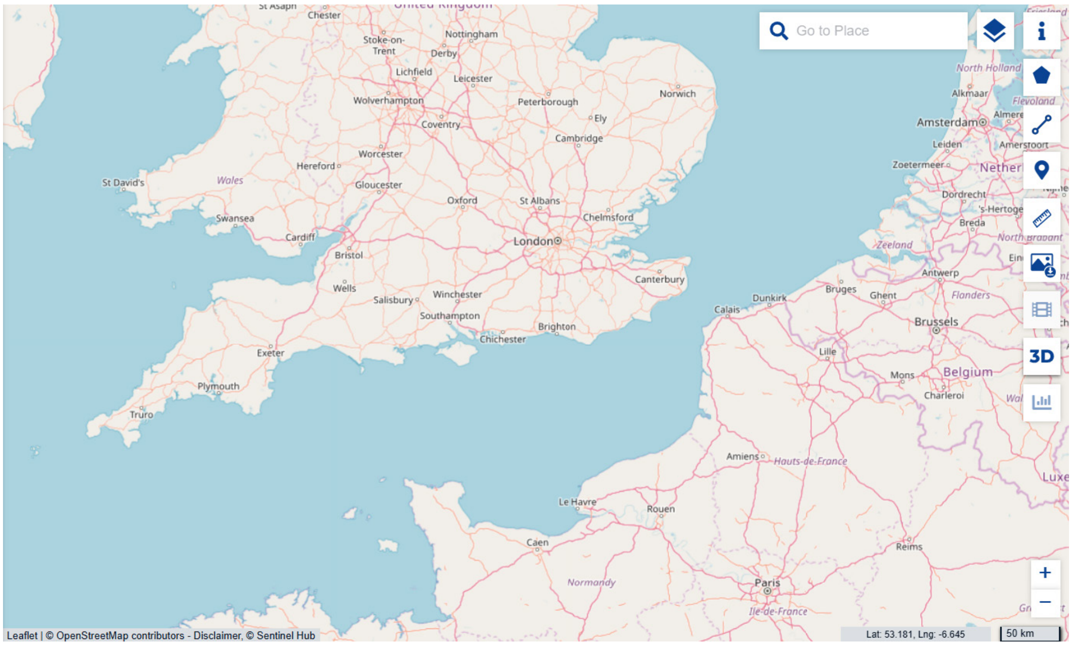
Please follow the numbered instructions in blue to get started.

Collecting Data



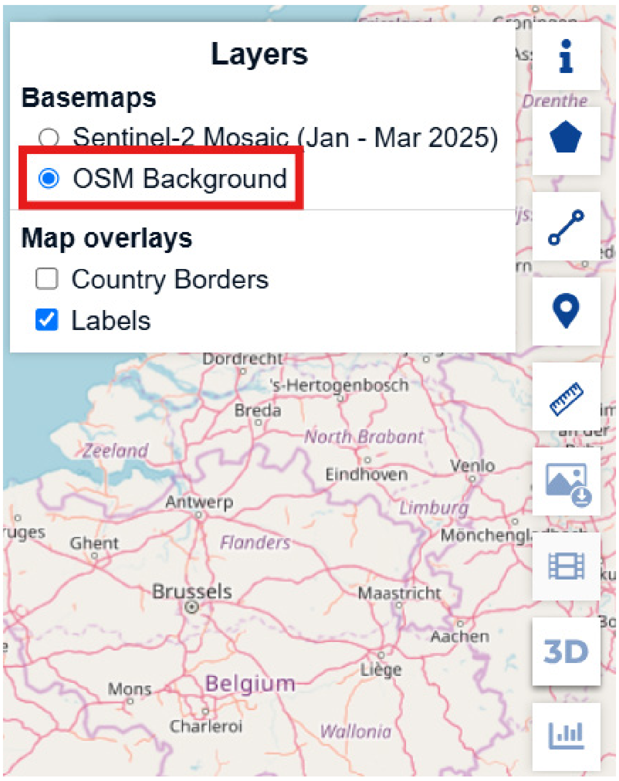
Oil spill originating from the stricken Prestige tanker, lying 100 km off the Spanish coast
Credit: ESA

1. Navigate or search on the map until you can see the whole area around the English Channel and the North Sea off the coast of the Netherlands.

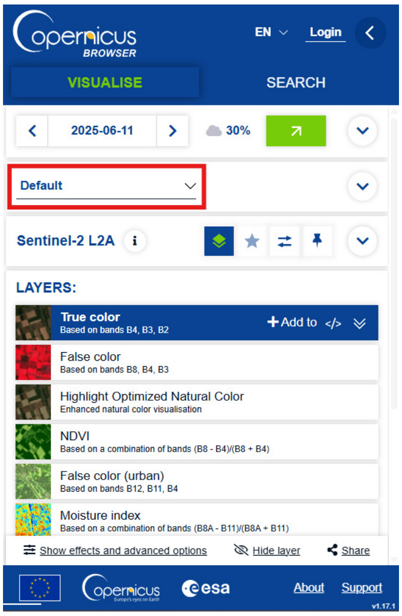


Attention

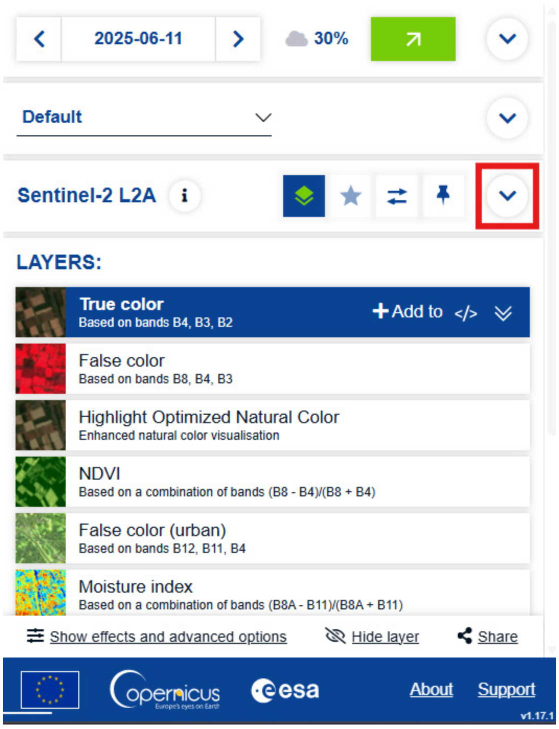
The pre-selected basemap (background) is a mosaic of different satellite images and may sometimes be mistaken for the images you visualise. To change this, go to the top right-hand side corner, and change from Sentinel-2 Mosaic to OSM Background.

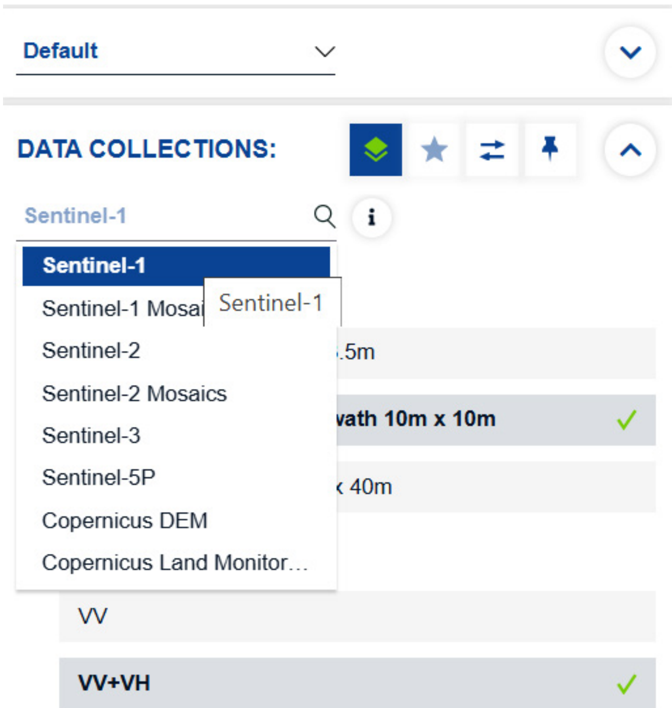


2. In the Main Navigation Panel on the left, choose the configuration “default” in the “Visualise” tab

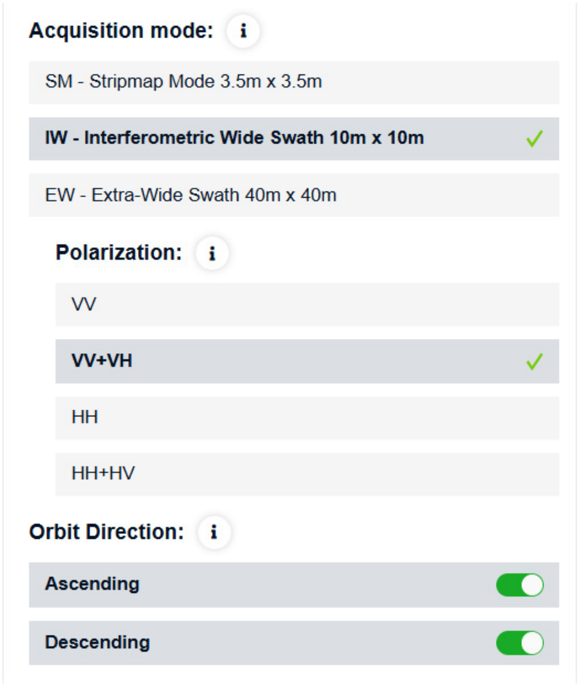


3. Under ‘Data Collections’, choose ‘Sentinel-1’. This is the Copernicus radar satellite.

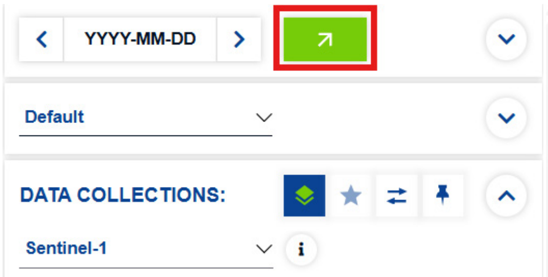




4. Leave the settings as default (IW acquisition mode, VV+VH Polarization, Ascending and Descending Orbit Direction).

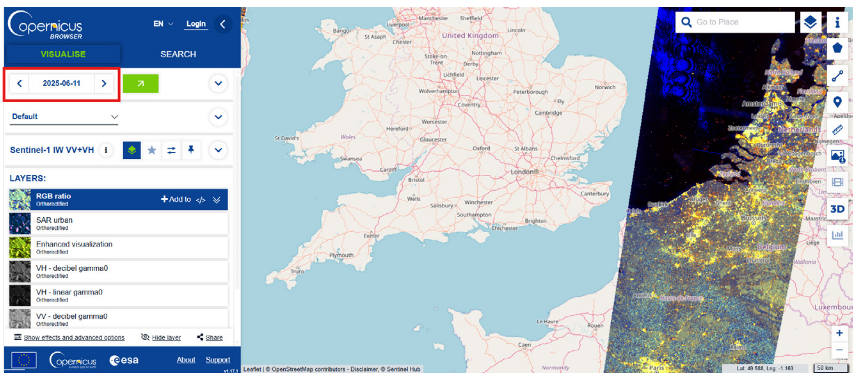


5. Press 'Show latest date' at the top of the menu. You may have to zoom in on the map a bit before you can push the button.



Tip

The most recent date may only display data for parts of the area of interest, as shown in the picture above. You can change the dates in the top left corner and navigate to a date with more data available.

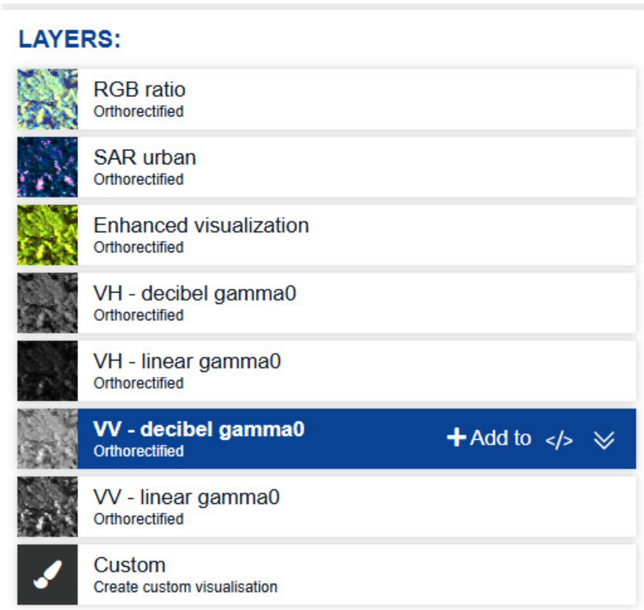


- Q.1 Zoom in on the image and see what you can identify:
  - Q.1.1. What features can you see on land?
  - Q.1.2. How does the water look? What features can you see on the water?
  - Q.1.3. How do you think we can exploit that information to identify objects on the surface from space?

Note down your observations and considerations.

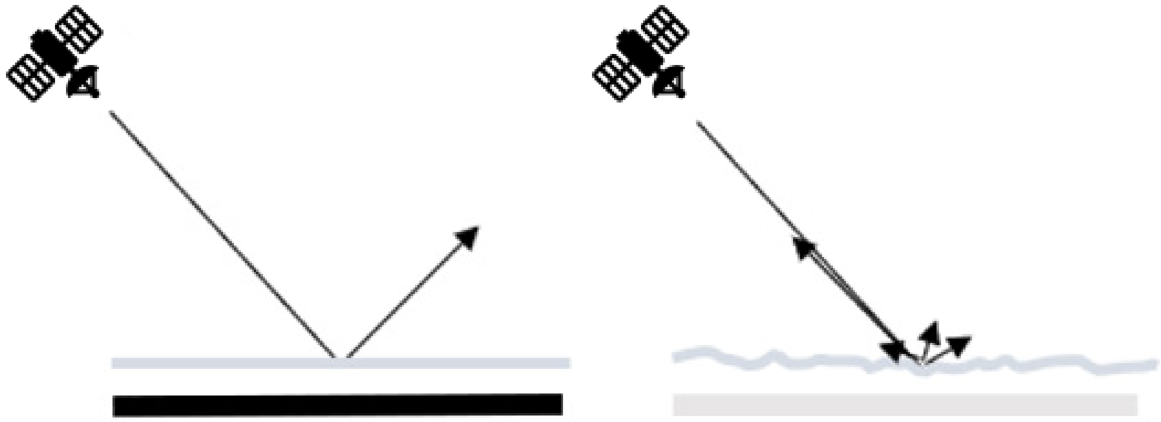
6. Under 'Layers', choose 'VV – decibel gamma0'.

This layer shows one of the polarisations that the Sentinel-1 satellites can capture: 'Vertical Vertical', where both the transmitted and received radar waves are vertically polarised. Polarisation describes the direction in which a wave oscillates as it moves.



Imagine a fence with vertical bars. If you shake a rope side to side, the bars will block it, but if you shake it up and down, it will pass through. Similarly, radar waves are sent out and received, oscillating in a specific direction - just like a rope can be swung at different angles, (e.g. up and down or side to side). In VV polarisation, the waves oscillate vertically (up and down) when transmitted and are received in the same vertical alignment.

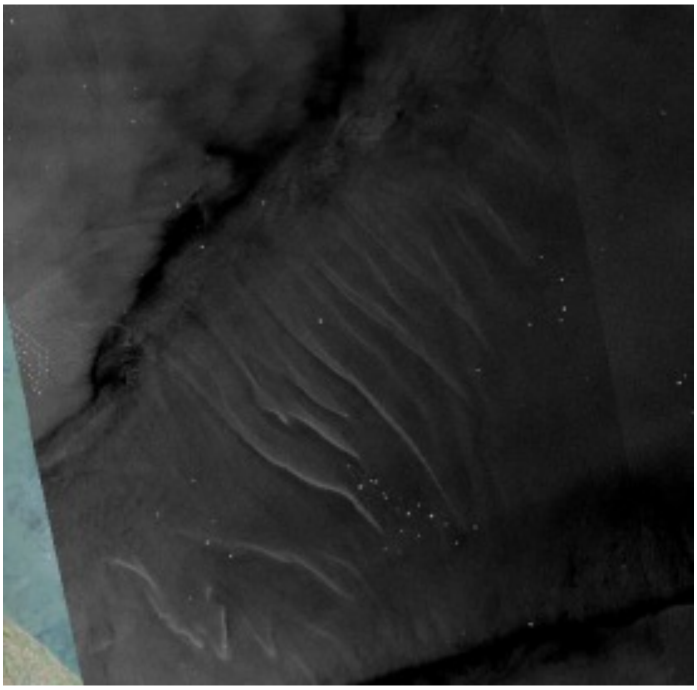
VV polarisation is highly sensitive to rough surfaces, like ocean waves, because these surfaces scatter the radar signal in multiple directions, increasing the amount of signal that returns to the satellite. This makes it useful for detecting water movement and identifying smoother areas caused by bilge dumping or oil spills.

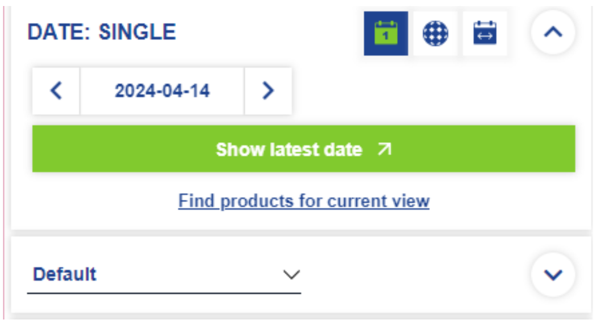


Radar relies on the return of the signal it sends out. A black image indicates a flat, mirror-like surface where radar bounces off predictably away from the receiver. To return a signal, the surface must be roughened by water. The brighter the pixel, the more signal is returned from that point on the image.

Q.2. Why are some parts of the water darker than others?

If the VV image is completely black over the sea, navigate back a couple of dates (at the top of the menu) until you find an image where the ocean appears grey instead of black on VV imagery.





Exercise: Oil Spills and Ship Detection

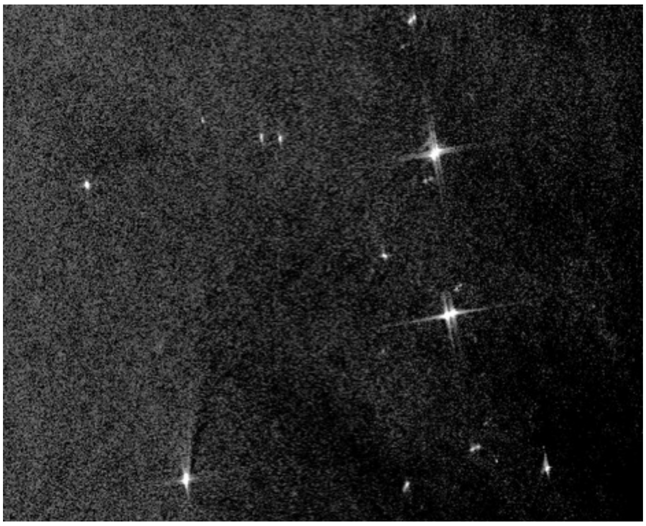
B: Ship Detection

We can use radar signals to detect ships! When radar signals bounce off objects like ships or wind turbines on the water's surface, they scatter the signal, creating bright spots in the images. This results in a couple of useful features that we will exploit:

- Objects on the surface of the water stand out in images.
- If the surface is smooth, that part of the image will be very dark.

We can identify objects like ships because they show up as white dots on the water.

Q.3. Zoom in on the white dots and note down how they look.
Q.3.1. What do you imagine the dots that look like stars/crosses are?
Q.3.2. Why do you think some objects are in a pattern or formation on the water? What could they be?



Now that we understand the imagery, we can start to look for oil spills!

C: Oil Spills

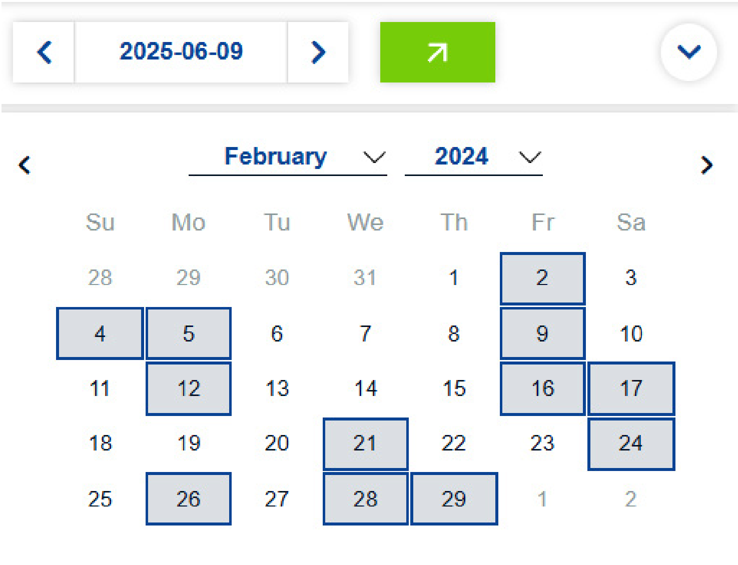
1. Make sure you have the 'VV – decibel gammao' visualisation selected.

Oil spills are very characteristic in VV radar imagery. Oil floats on top of the water and creates a smooth layer, which acts like a mirror surface for the radar signal. On days that are windy enough, any oil spills will appear pitch black on a grey background. Without wind, we may not be able to distinguish the water from the oil.

Environmental campaigners in Norwich, England had seen a ship dumping oil off the east coast back in February 2024.

Use what you have learned above, examine radar imagery on the Copernicus Browser and see if you can find the oil spill east of Norwich, England in February 2024

Q.4. Click on the date at the top of the menu to open the calendar. Try out different dates in February or use the arrows on each side of the date displayed to quickly navigate between available imagery.



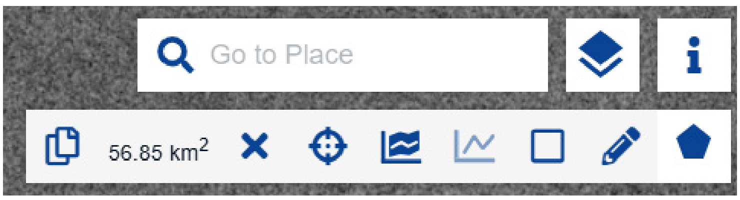
Note that the calendar in Copernicus Browser highlights dates where there is imagery available over the area you can currently see on your screen. Take care to navigate around the map if you cannot see anything, or to get options for different dates.

Due to wind-free areas also appearing black, we must consider not just the 'oil spill' itself, but also what is immediately around it:

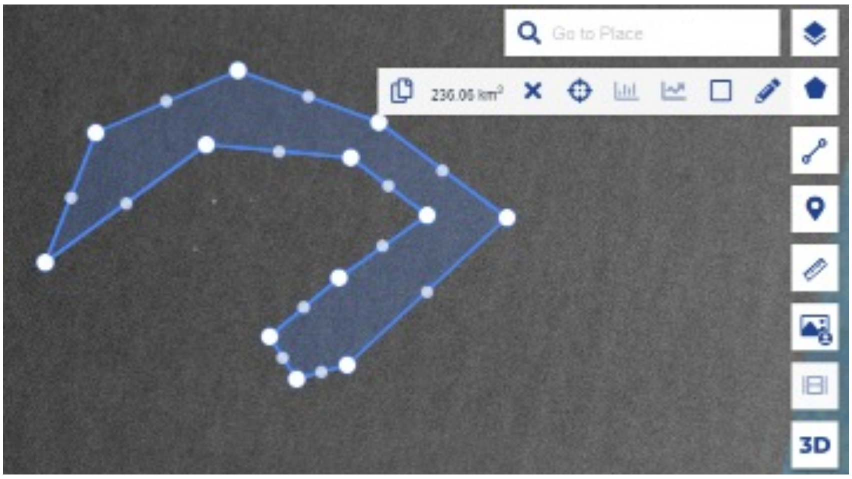
Q.4.1. Are there any land features that could block the wind? Is there a ship (white dot) or perhaps a river outlet at one end of the oil spill, that we can trace the spill to?

D: Calculate the Amount of Oil

1. Once you have identified the oil spill, use the area of interest tool, and draw a polygon following the borders of the spill.



2. Q.5. The Copernicus Browser will then tell you the size of the area like this:



Q.5.1. Can you compare the size of the oil spill to an area with which you are familiar, such as a city?

We know that the minimum amount of oil on water required for it to be visible on radar imagery is 1µm (1 micron/micrometre), which is the same as 0.000001m.

To estimate the amount of oil that was dumped we need to know:

- The size of the area,
- How thick the layer of oil is.

If there is an observed slick of oil covering 1 km2, then the minimum volume of the oil covering this surface is at least 1 m3:

(this was calculated like this)

$$1000 \text{ "m"} \times 1000 \text{ "m"} \times 0.000001 \text{ "m"} = 1\times10^6 \text{ "m"}^{\text{"2"}} \times 1\times10^{(-6)} \text{ m} = 1 \text{ "m"}^{\text{"3"}}$$

So, we know that 1 km2 of oil covering water is equal to at least 1 m3 of oil spilled.

Q.6. Calculate how much oil at least was dumped using this information.

If you have time left, see if you can find any other oil spills:

- Choose an area around Europe where there are lots of ships and start investigating.

→ Links

Related activities

ESA Projects

ESA's Earth Observation missions
https://www.esa.int/Applications/Observing_the_Earth/ESA_for_Earth

Climate Detectives project
https://climatedetectives.esa.int/

ESA Resources and other supportive materials

Copernicus Browser Guide

Copernicus Browser Case Study: Algal Blooms from Space - Earth Observation in the Classroom

Copernicus Browser

The Copernicus Data Space Ecosystem Browser
https://browser.dataspace.copernicus.eu/

The ESA Education Office welcomes feedback and comments
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