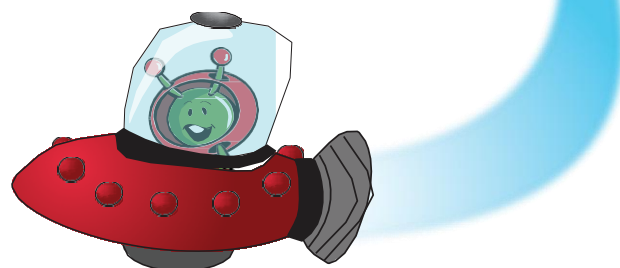


→ Satellites to the rescue

To study and understand how satellites help humans to better monitor the impact of natural disasters



© ESA



Key points	Page 3
Activity 1: The whims of the Earth and the climate	Page 4
Activity 2: Earth from sky - Match the pictures	page 5
Activity 3: Study natural disasters	page 7
Annex	page 9
Links	page 29

→ Satellites to the rescue

To study and understand how satellites help humans to better monitor the impact of natural disasters

Key points

Age range: 8 to 14 years old

Type: activity for students

Complexity: easy

Time required for the teacher to prepare: 15 min

Lesson duration: 60 min

Cost per class: 0-5 €

Location: Classroom

includes use of: computer, projector and screen

Program

In this activity, students will learn about the concept of remote observation of the Earth from space. They will also study the various climatic and industrial events taking place on Earth. Using satellite images, students will learn to link an event to a photograph taken from space. The aim is to improve their understanding of how satellites help us study various natural disasters. This resource specifically uses images taken by Sentinel-2, a mission developed by the ESA as part of the Copernicus program.

Students will discover

- Pictures taken from space
- The difference between two pictures taken on different dates
- What Earth's landscapes look like from space
- The benefits and importance of taking images from space
- The importance of Earth observation satellites in studying natural disasters

Students will improve

- Their ability to analyze images and extract relevant information from them
- Their understanding of how our planet works
- Their ability to link different images to events
- Their ability to work as a team and share their findings



→ Teacher's Guide

→ Activity 1: The whims of the Earth and the climate

In this activity, students observe images taken from the ground during or after catastrophic events. The aim is to identify the different types of disasters and to understand the challenges involved in studying and analyzing these events from space or from the ground.

Equipment

- Desktop/laptop computer
- Projector
- Optional: Printed pictures

Exercise

1. Discuss events that can occur on the Earth's surface, whether they are natural phenomena or the result of human activity. Ask the students if they can name natural disasters and whether such disasters could occur in their country.
2. Show your students a list of pictures taken from the ground, and ask them to identify the type of event represented in each image. The images can also be printed out and the students divided into small groups.
3. Work together to identify the consequences of these weather events and consider how satellite imagery might be useful in such circumstances.

Links to the illustrative pictures:

- [Hurricane in the English Channel](#)
- [Dam failure in the United States](#)
- [Wildfire in Gironde, France](#)
- [Tsunami](#)
- [Earthquake in Turkey](#)
- [Eruption of Piton de la Fournaise](#)
- [Flooding in the Yvelines, France](#)
- [Avalanche in Russia](#)

→ Activity 2: Earth from sky

In this activity, students observe pictures of various landscapes taken by satellites from space. They compare and match these images with those taken from the ground in order to improve their ability to analyze satellite images.

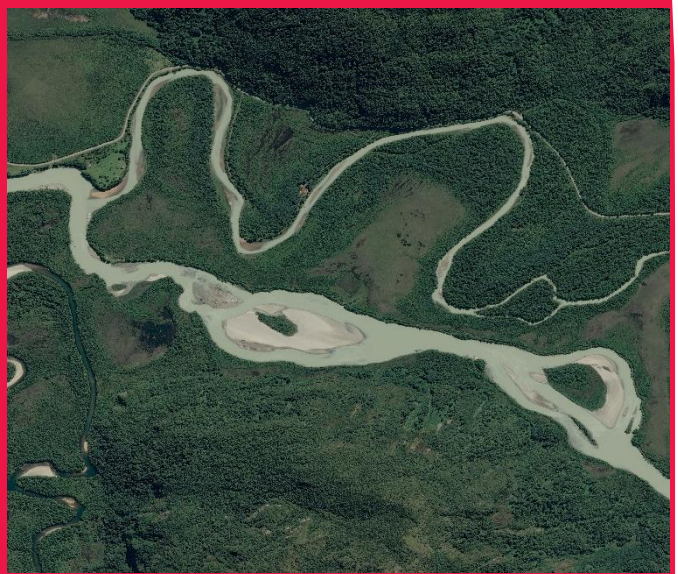
Exercise

1. Study and analyze each pair of images. Students must identify features that can be used to recognize a landscape viewed from space, based on structures visible from the ground. What elements are similar? What elements are different? Discuss the details, such as clouds, sharp ridges, vegetation, etc.

Lakes and rivers



©wmaster890

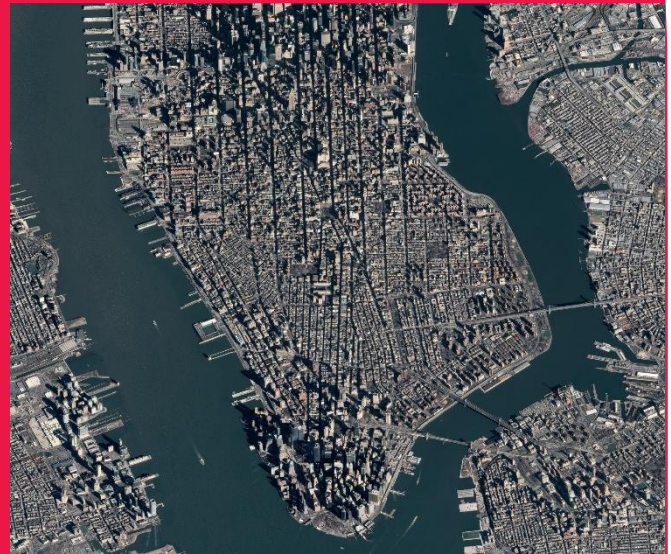


©CNES/Distribution Airbus DS

Cities



©Nikada



©CNES/Distribution Airbus DS

Mountain

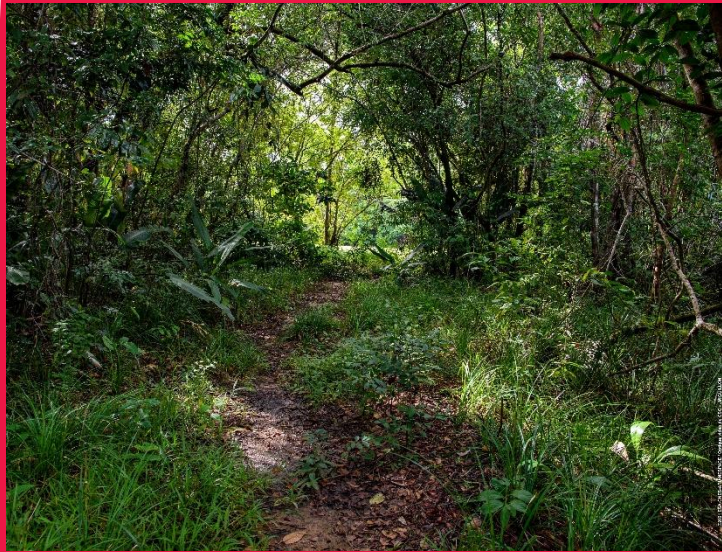


@cdblphotography



@CNES/Distribution Airbus DS

Forest



@CNES/ESA/Arianespace/Optique Vidéo CSG/JM Guillon



@CNES

→ Activity 3: Study natural disasters

In this activity, students observe pictures of landscapes taken by Earth observation satellites before and after a natural or industrial disaster. The images were captured by various Earth observation satellites in low Earth orbit, less than 1,200 km from the Earth's surface. Students analyze the pictures and match them with the corresponding event.

Exercise

1. Analyze the pictures provided in the appendix. Can you match the pairs of images? What landscape can you see in each pair? Which photos were taken before and after the event?
2. Match each pair of satellite images to the corresponding event. Students can work individually or in teams to decide where to place each 'disaster' label.
3. Compare and check your answers. Discuss your conclusions to identify which images were difficult to analyze.
4. Use this list to identify how Earth images taken from space can help us study and limit the impact of natural and industrial disasters.

Answers

Wildfires in Gironde, France, in 2022

In July 2022, the Gironde department was hit by massive wildfires. Among the different areas affected, two sectors were particularly hard hit. The first occurred on 7 July 2022 in a section of La Teste-de-Buch; the second took place on the same day near Landiras, in the southern part of the department.

The images displayed here show the heathland forest surrounding La Teste-de-Buch. The pictures were taken by the [Sentinel-2](#) satellite with a spatial resolution of 10 meters. Two dates were selected (7 and 17 July 2022), representing the periods before and immediately after the fire.

Dam failure in Jagersfontein, South Africa, in 2022

On 12 September 2022, a dam used to contain mining waste next to a diamond mine collapsed in Jagersfontein, South Africa. These images, captured by [PlanetScope](#) satellites with a 3-meter resolution, show the path of the mudflow that followed the dam's collapse. The mudflow killed one person and destroyed several homes. The images were taken before (9 September 2022) and after (12 September 2022) the event.

Flooding in Hagen, Germany, on 18 July 2021

Germany was hit by heavy rain and flooding in July 2021. These images, captured by PlanetScope satellites, show the areas affected by the flooding. The images were taken before (23 April 2021) and after (18 July 2021) the event.



An avalanche in Tibet

These images were captured on 24 June and 21 July 2016, in the Aru mountain chain in Tibet using the [Landsat 8](#) satellite, with a resolution of 30 meters. On 17 July 2016, a massive avalanche swept down a narrow valley in the mountain. When the ice stopped, it had spread a mass of debris up to 30 meters thick over an area of 10 square kilometers. Nine people, 350 sheep and 110 yaks from the remote village of Dungru were killed in the avalanche.

A cyclone in Mayotte, France

These images show the port of Mamoudzou in Mayotte during the passage of Cyclone Chido in December 2024. The Indian Ocean archipelago was battered by winds exceeding 220 km/h, which destroyed everything in their path. The images were captured by the [Maxar satellite](#) before and after the cyclone struck, with a spatial resolution of 30 cm.

Deforestation in Brazil

These images, captured by the Sentinel-2 satellite using the Normalised Difference Vegetation Index (NDVI), show the impact of deforestation in the Mato Grosso region of Brazil, at the junction of the Amazon and the Cerrado. The NDVI is an index used to quantify green vegetation. It measures vegetation health based on how plants reflect specific wavelengths of light. The images were taken seven years apart: on 7 May 2017 and 10 May 2024. In this region, the area affected by deforestation, mainly within the Cerrado which is less protected than the Amazon, covers approximately 740 km².

The eruption of Cumbre Vieja in the Canary Islands

These images were captured during the eruption of Cumbre Vieja, which became active on 19 September 2021 on the island of La Palma. The eruption was officially declared over on 25 December 2021, after causing extensive damage to buildings, roads and infrastructure, estimated at €400 million. The images use “urban false colour” rendering and were acquired by Sentinel-2 on 10 and 30 September 2021. These composite images are useful for detecting forest fires and volcanic calderas, as these features appear in shades of red and yellow.

Drought at Lake Naussac, France

These images were captured by the Sentinel-2 satellite on 2 April 2021 and 28 March 2023 over Lake Naussac, located near Langogne in Lozère, France. Over the course of two years, the water level of this artificial lake has dropped by nearly half.

Earthquake in Turkey

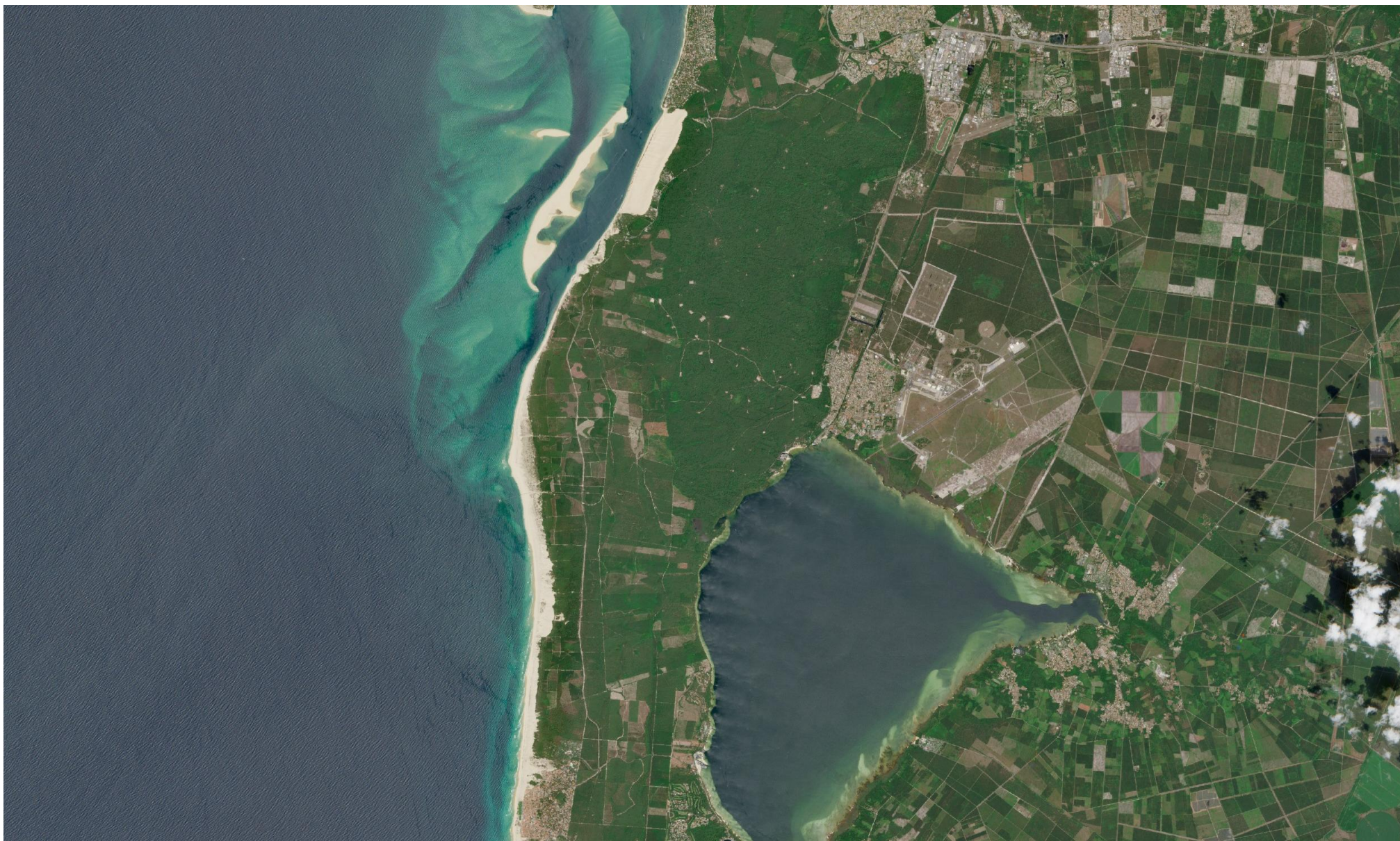
Two earthquakes measuring 7.8 and 7.5 on the Richter scale struck Turkey and Syria on 6 February 2023, killing nearly 60,000 people. These images were captured by the Maxar satellite before and after the earthquake in Islahiye, Turkey.

Tsunami in Sri Lanka

In 2004, a magnitude 9.3 earthquake triggered a tsunami that devastated Indonesia, the coasts of Sri Lanka and southern India, as well as western Thailand. The death toll is estimated at more than 250,000 lives lost, including nearly 170,000 in Indonesia, 31,000 in Sri Lanka, 16,400 in India and 5,400 in Thailand, according to official estimates. The images were captured by the Maxar satellite before (1 January 2004) and after (26 December 2004) the tsunami struck Kalutara in Sri Lanka.



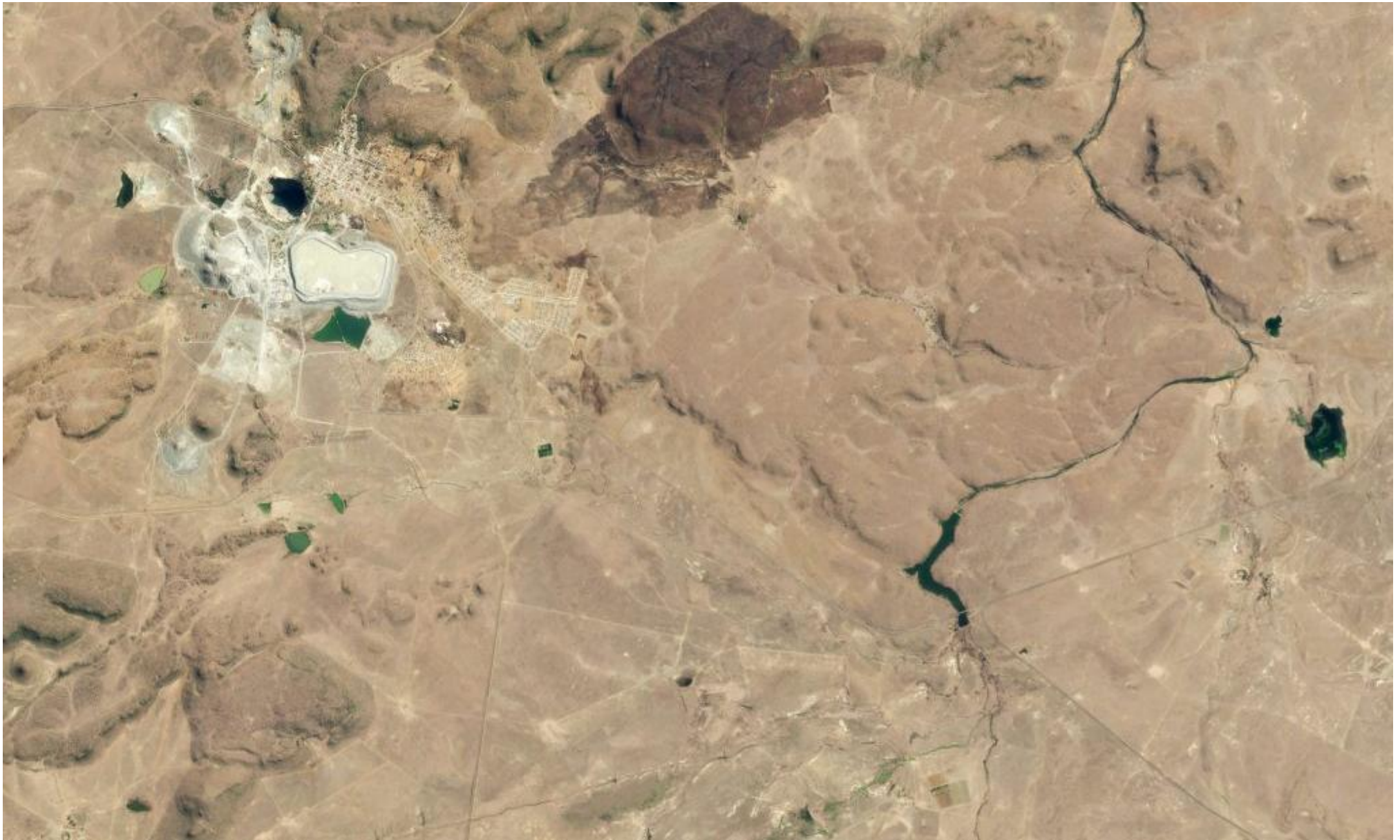
Wildfires in Gironde, France (before)



Wildfires in Gironde, France (after)



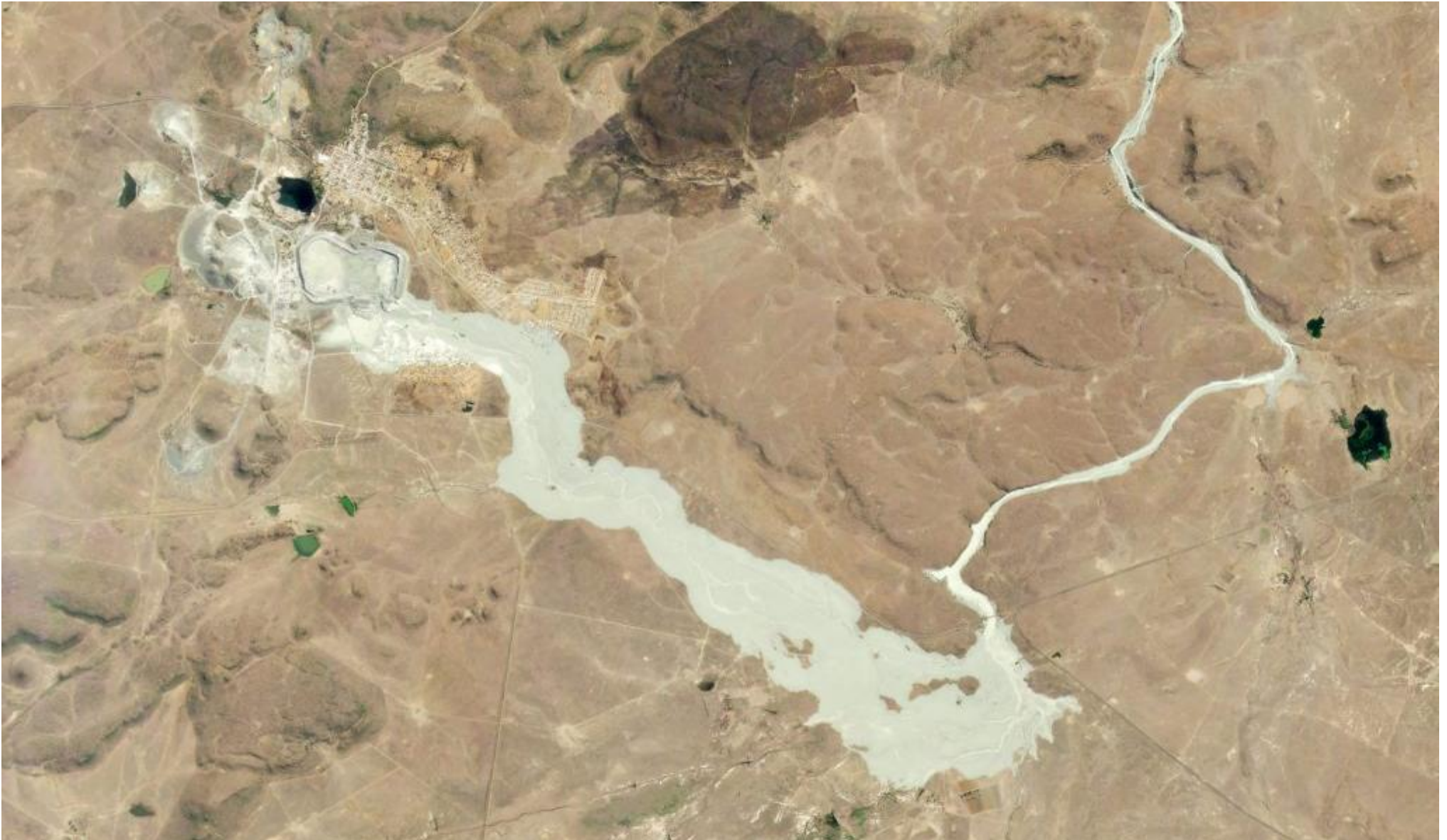
Dam failure at Jagersfontein, South Africa (before)



© PlanetScope



Dam failure at Jagersfontein, South Africa (after)



© PlanetScope

Flooding in Hagen, Germany (before)



© PlanetScope



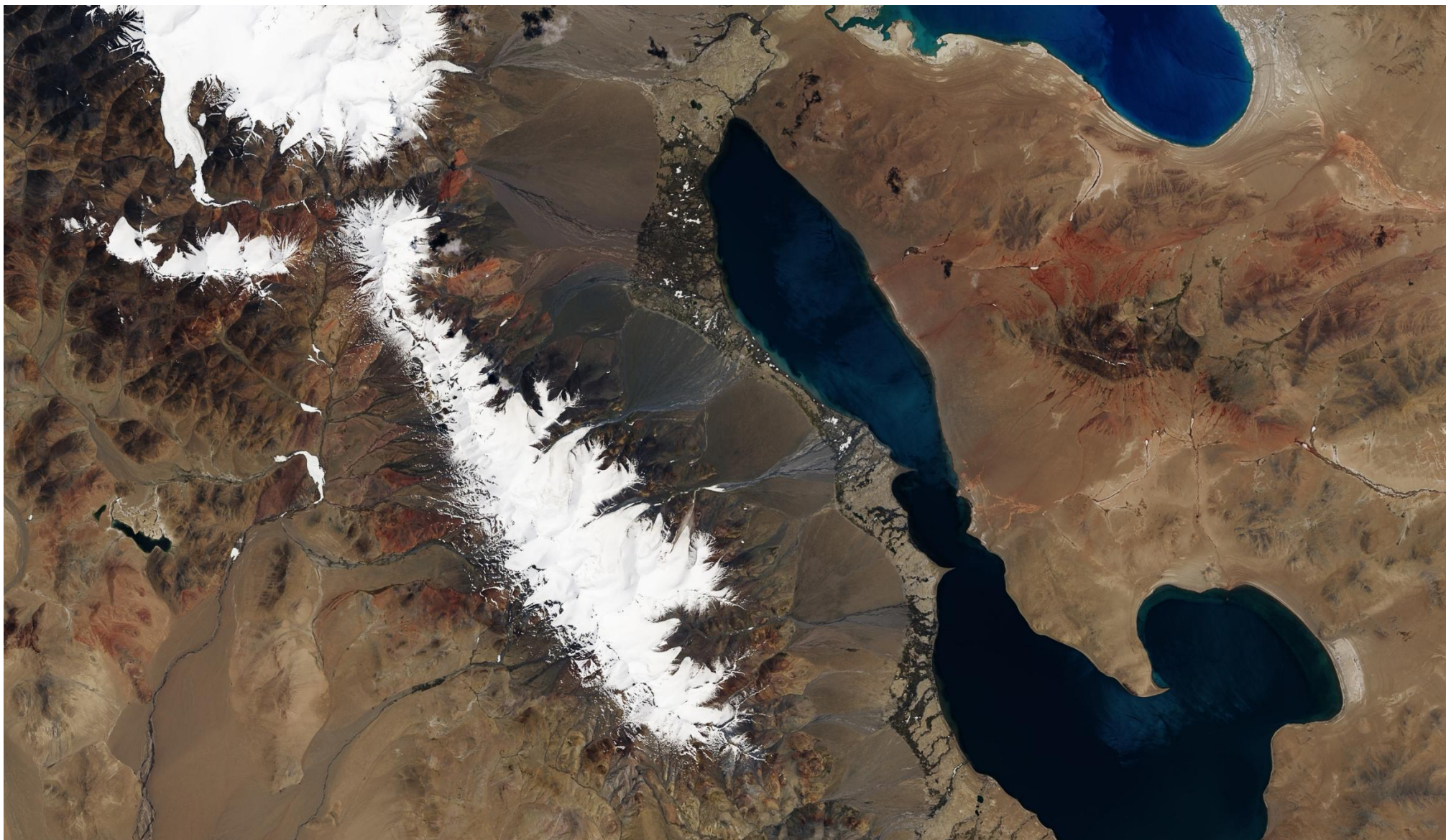
Flooding in Hagen, Germany (after)



© PlanetScope



An avalanche in Tibet (before)



© NASA/USGS

An avalanche in Tibet (after)



© NASA/USGS

A cyclone in Mayotte, France (before)



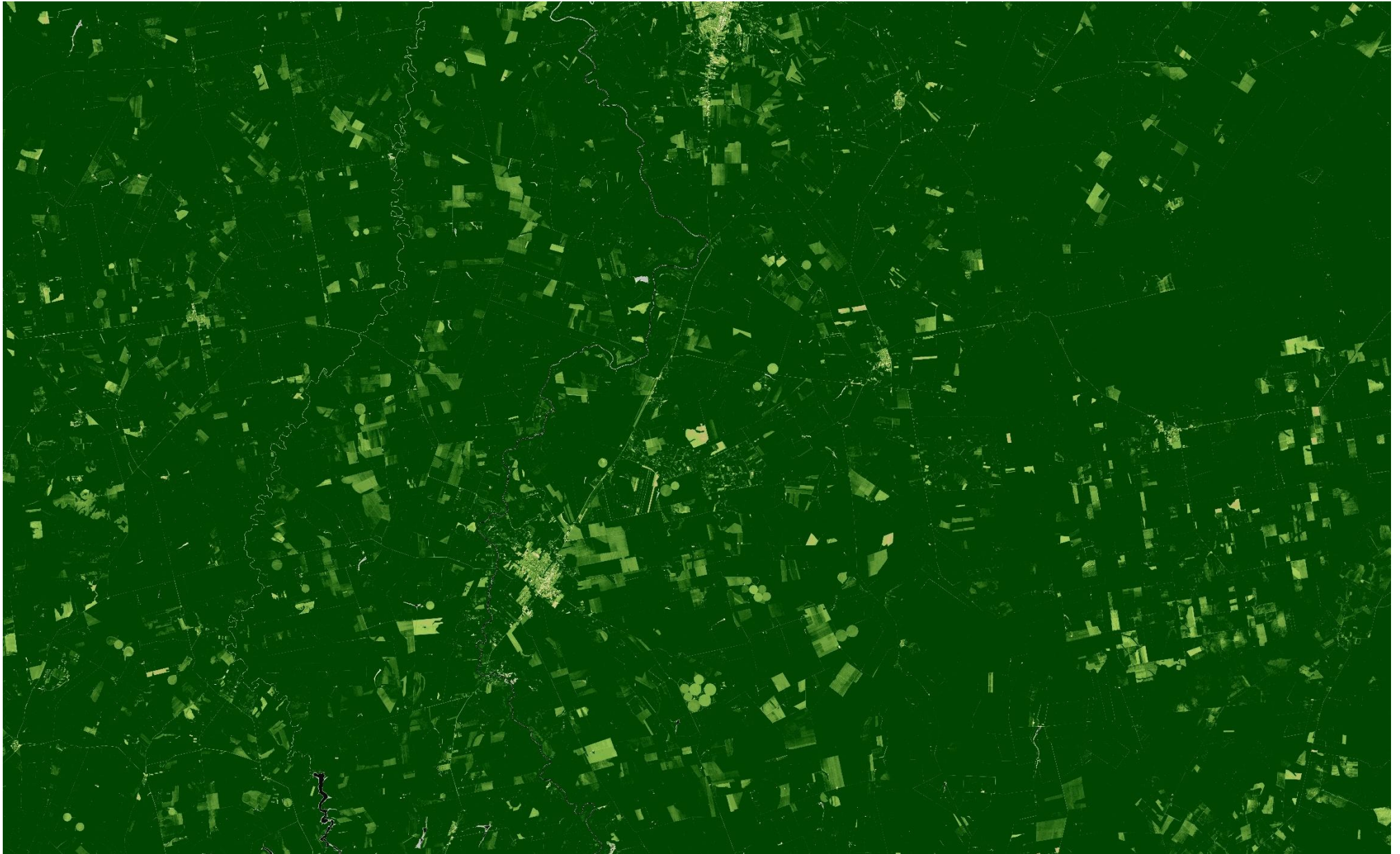
© MAXAR

A cyclone in Mayotte, France (after)



© MAXAR

Deforestation in Brazil (before)



© Copernicus Data Space Ecosystem



Deforestation in Brazil (after)



© Copernicus Data Space Ecosystem

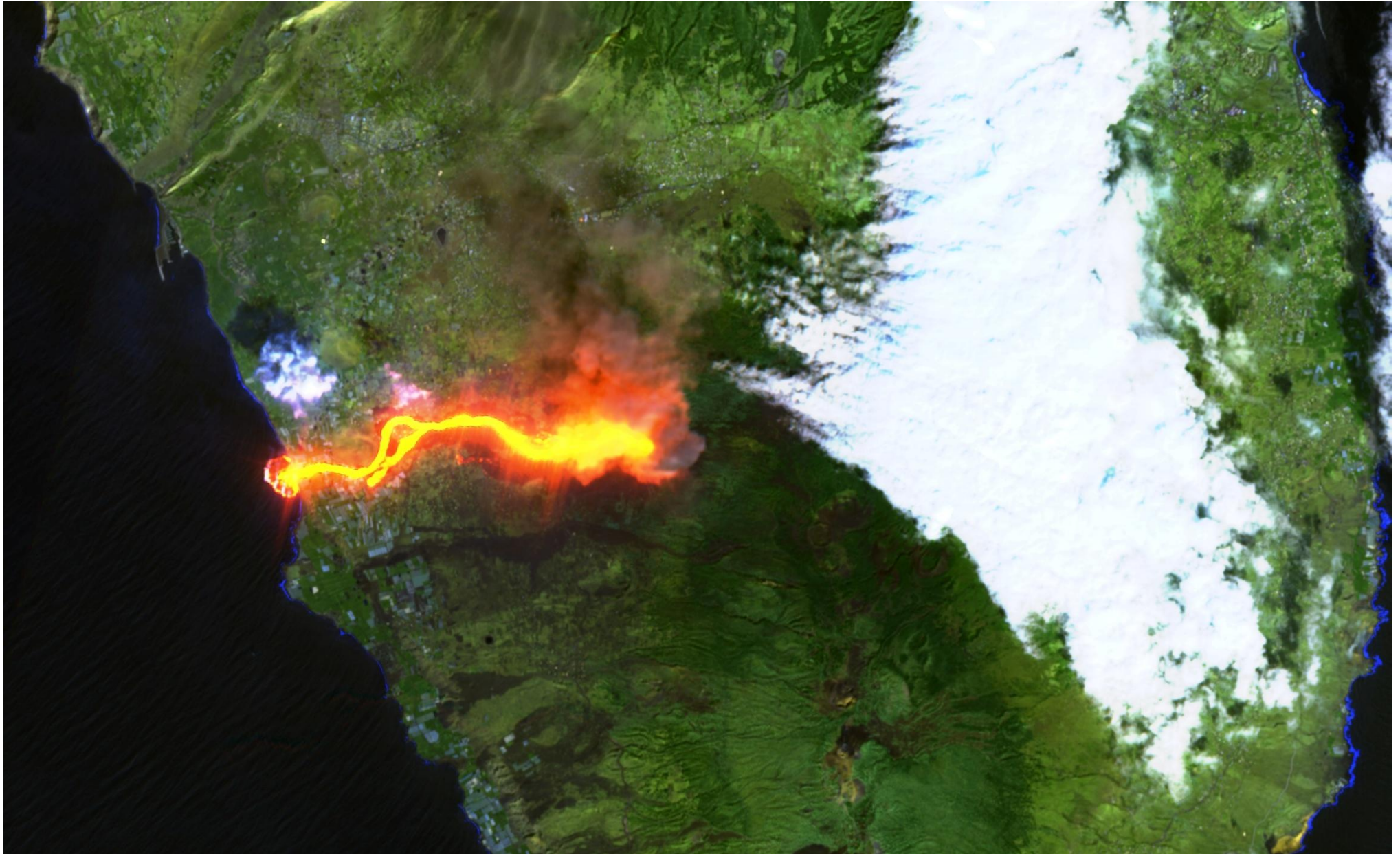
The eruption of Cumbre Vieja in the Canary Islands (before)



© Copernicus Data Space Ecosystem



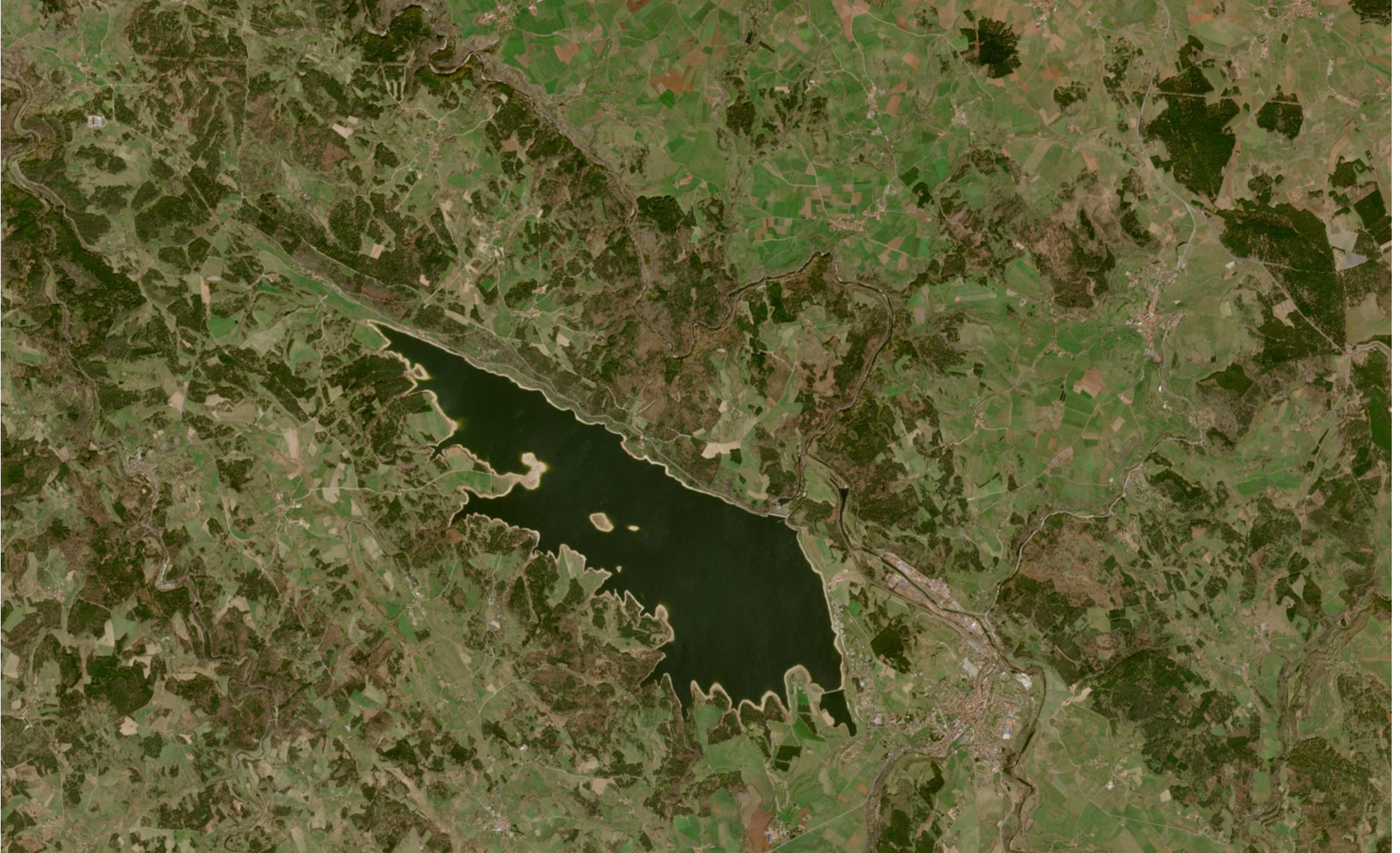
The eruption of Cumbre Vieja in the Canary Islands (after)



© Copernicus Data Space Ecosystem



Drought at Lake Naussac, France (before)



© Copernicus Data Space Ecosystem

Drought at Lake Naussac, France (after)



© Copernicus Data Space Ecosystem

Earthquake in Turkey (before)



© MAXAR

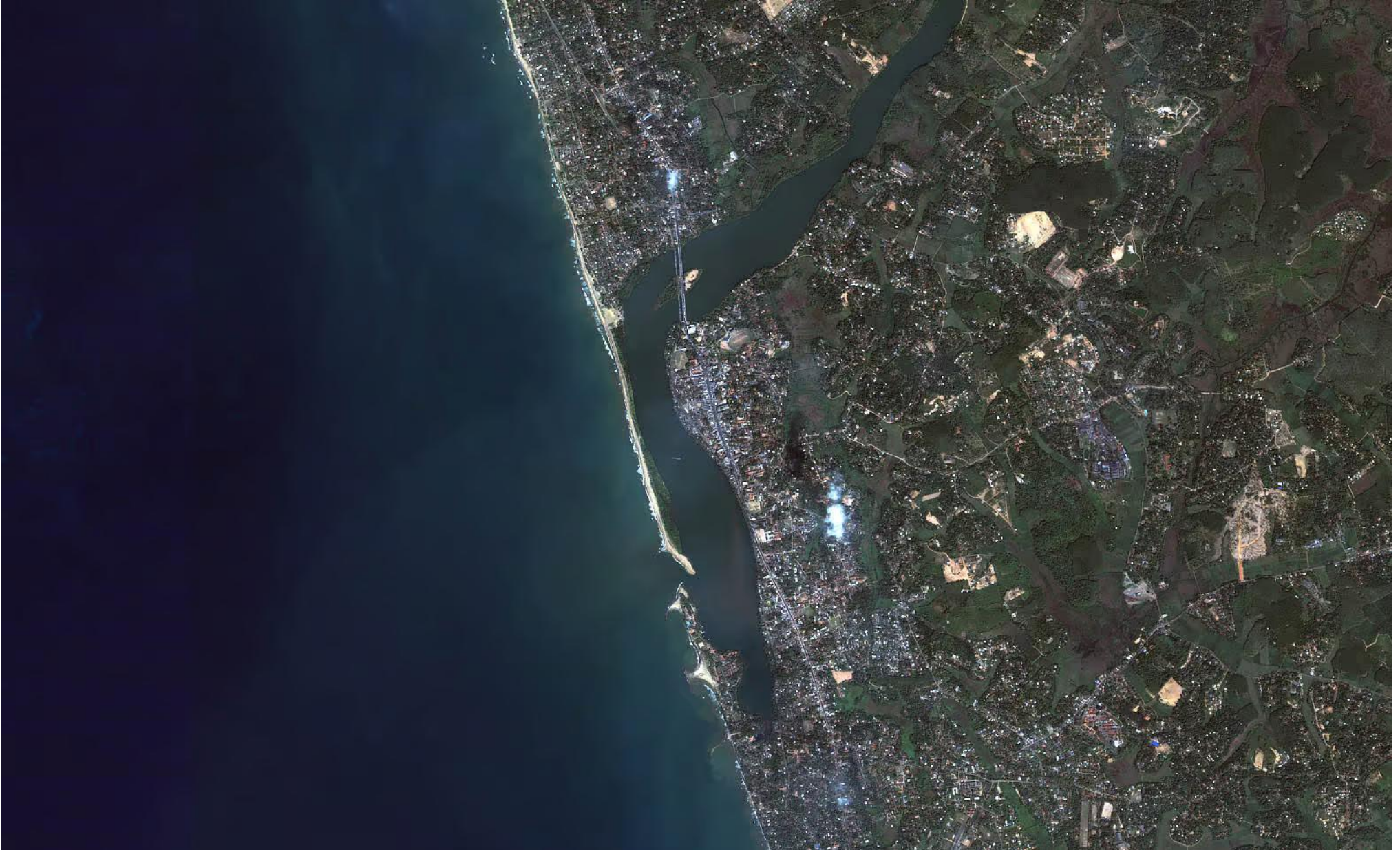


Earthquake in Turkey (after)



© MAXAR

Tsunami in Sri Lanka (before)



© MAXAR



Tsunami in Sri Lanka (after)



© MAXAR



Bonus: Tsunami in Sri Lanka (during the wave)



© MAXAR

Disaster tags:

**WILDFIRES
IN FRANCE**

**WILDFIRES
IN FRANCE**

**AVALANCHE
IN TIBET**

**DEFORESTATION
IN BRAZIL**

**AVALANCHE
IN TIBET**

**DEFORESTATION
IN BRAZIL**

LAKE NAUSSAC

DROUGHT AT

LAKE NAUSSAC

DROUGHT AT

**FLOODING IN
GERMANY**

**THE ERUPTION OF
CUMBRE VIEJA**

AFTER

**FLOODING IN
GERMANY**

**THE ERUPTION OF
CUMBRE VIEJA**

AFTER

AFTER



**EARTHQUAKE
EN TURQUIE**

**CYCLONE
IN MAYOTTE**

**TSUNAMI IN
SRI LANKA**

**EARTHQUAKE
IN TURQUIE**

**CYCLONE
IN MAYOTTE**

**TSUNAMI IN
SRI LANKA**

**DAM FAILURE IN
SOUTH AFRICA**

BEFORE

BEFORE

BEFORE

BEFORE

BEFORE

BEFORE

BEFORE

AFTER

**DAM FAILURE IN
SOUTH AFRICA**

AFTER

AFTER

AFTER

BEFORE

BEFORE

AFTER

AFTER

AFTER

AFTER

BEFORE



→ LINKS

Resources from ESA and ESERO France

Pictures of the activity:

<https://drive.google.com/file/d/1idURFpyJDkDDuHcAQg8wVLSRfnekk4mj/view?usp=sharing>

Educational resources:

www.esa.int/Education/Classroom_resources

<https://esero.fr/en/ressources/>

ESA Kids website:

www.esa.int/esaKIDSen

Paxi's activity book:

<http://esamultimedia.esa.int/multimedia/publications/PaxiFunBook>

ESA Missions

Sentinel-2:

http://www.esa.int/Our_Activities/Observing_the_Earth/Copernicus/Sentinel-2

PlanetScope: <https://earth.esa.int/eogateway/missions/planetscope>

Further information

ESA Kids website on climate change:

<https://www.esa.int/esaKIDSen/Climatechange.html>

ESA Kids website on 'Europe's Space Sentinels':

https://www.esa.int/kids/en/learn/Earth/Climate_change/Europe_s_space_Sentinels

Explore Sentinel images with Copernicus Browser:

https://esero.fr/wp-content/uploads/2024/12/copernicus_browser_guide_FR.pdf

Discover satellite images through the 'Earth from Space' memory game:

https://esero.fr/wp-content/uploads/2024/10/Memory_paysage.pdf



teach with space – Satellites to the rescues

www.esa.int/education

<https://esero.fr>

The ESA Education Office and ESERO France would like to thank you in advance for your comments:

ESA: teachers@esa.int

ESERO France: esero.france@cnes.fr

An ESERO France and CNES production

Copyright © ESA, ESERO France, CNES