

OBSERVING THE EARTH FROM THE SPACE WITH THE ESA¹



ESA/NASA. [Samantha in Cupola](#)

INTRODUCTION

We are all facing the consequences of a constantly changing world, but thanks to satellites we are in a better condition to understand our planet, especially regarding to global changes.

Satellites can be used to predict climate, to provide information to improve agriculture or maritime security, to help in natural disasters and several everyday applications.

To start, we can watch this video from the ESA: https://youtu.be/GapnNdb_0SU

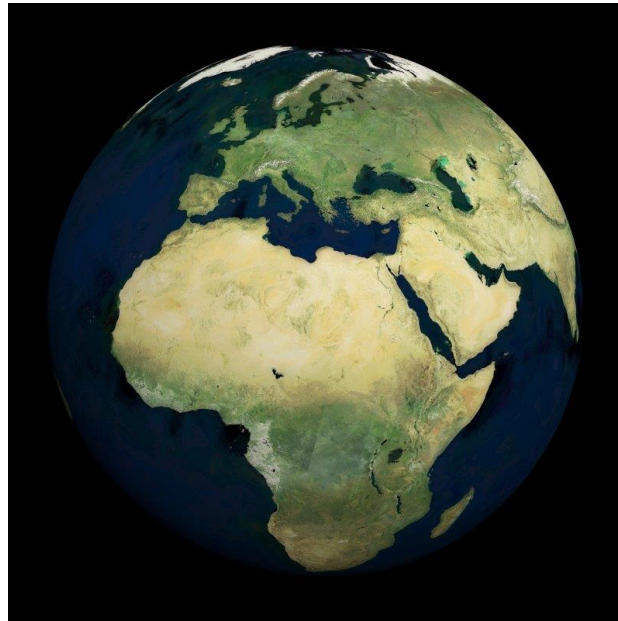
HOW CAN WE OBSERVE THE EARTH?

For several centuries, the only way to get a good point of view of a large portion of the Earth was to get a high point. Then, the invention of hot-air balloons and planes made it easier to observe the Earth.

¹ Adapted from: <http://esero.es/practicas-en-abierto/observa-la-tierra-desde-el-espacio/>
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Along the space era, satellites are used very often to observe our planet. Since they watch the Earth from a very long distance, they are also called remote sensing satellites.

In the next image, you can see a real picture of the Earth taken from the space:



ESA. [The World seen by Envisat's MERIS](#)

More detailed and recent images from the Earth surface and the atmosphere are taken by satellites located in low orbits along the North and South poles.

Since the Earth is spinning below them, those satellites can take pictures from the whole planet's surface in a few days.



ESA. [ESA-developed Earth observation missions \(CC BY-SA\)](#)

From about 800 km height, satellites can “see” our planet from different points of view. Different sensors can see different aspects such as topography, temperature, or atmosphere composition.

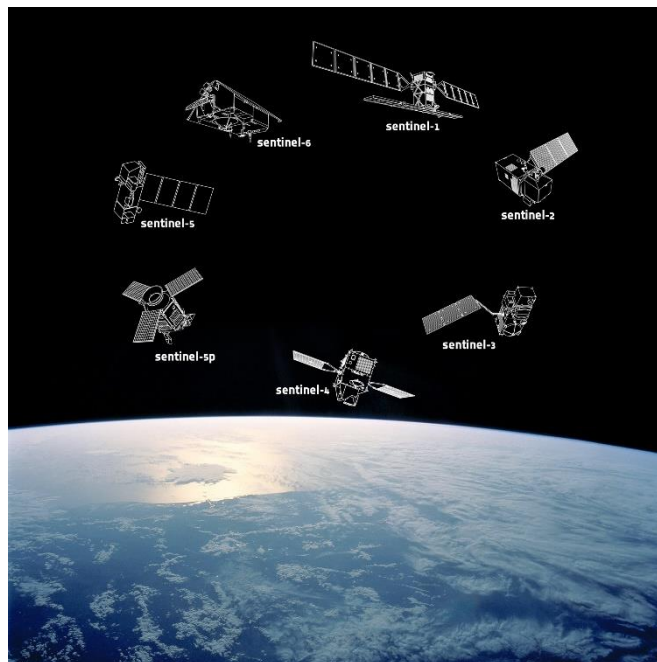
https://www.esa.int/ESA_Multimedia/Videos/2016/04/The_many_faces_of_Earth#.XpmTF5isXhw.link

THE SENTINEL FAMILY

The Copernicus program has a set of satellites (the Sentinel family) that are helped by other satellites (commercial or public satellites in orbit)

In 2014 the ESA launched the Sentinel-1A, a process in which the European Union intends to have almost 20 satellites orbiting around the Earth before 2030.

Every Sentinel mission is formed by two satellites, which allows to accomplish the requisites of covering and frequency, so they offer a good set of data to the Copernicus program.



ESA. [Sentinel family](#)

<https://youtu.be/TAnfJzzZL7A>

- SENTINEL-1

The Sentinel-1 mission comprises a constellation of two polar-orbiting satellites, operating day and night. The mission provides continuous radar mapping of the Earth.

- SENTINEL-2

The Copernicus Sentinel-2 mission comprises a constellation of two polar-orbiting satellites placed in the same sun-synchronous orbit, phased at 180° to each other.

SENTINEL-2 makes a significant contribution to Copernicus themes such as climate change, land monitoring, emergency management, and security.

- SENTINEL-3

The main objective of the Sentinel-3 mission is to measure sea surface topography, sea and land surface temperature, and ocean and land surface color with high accuracy and reliability to support ocean forecasting systems, environmental monitoring, and climate monitoring.

- SENTINEL-4

The main objective of the SENTINEL-4 mission is to monitor key air quality trace gases and aerosols over Europe

- SENTINEL-5

SENTINEL-5 is focused on air quality and composition-climate interaction with the main data products being O3, NO2, SO2, HCHO, CHOCHO and aerosols. Additionally SENTINEL-5 will also deliver quality parameters for CO, CH4, and stratospheric O3 with daily global coverage for climate, air quality, and ozone/surface UV applications.

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CHALLENGE: EXPLORE THE EARTH USING SATELLITES

Challenge 1: Take a picture of our school with Google Earth.

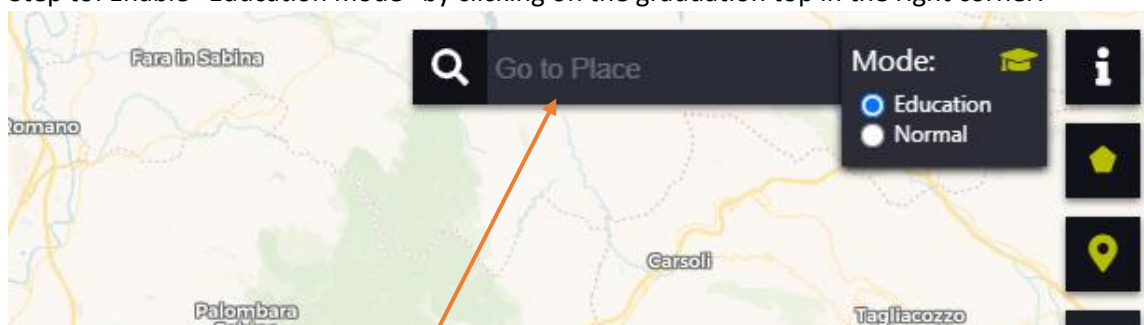
Use [Google Earth](#) to take a picture of our school. Take a screenshot of the school in Google Earth and paste it in a word document. Do not close it, we will use it later.

Challenge 2: Using EO Browser to map Toro's humidity

EO Browser will allow us to visualize images taken by the Sentinel family of satellites. Using these images, we will be able to analyze what is happening on Earth on any meteorological issue, natural catastrophe or fires, for example.

Follow the next steps to complete the challenge:

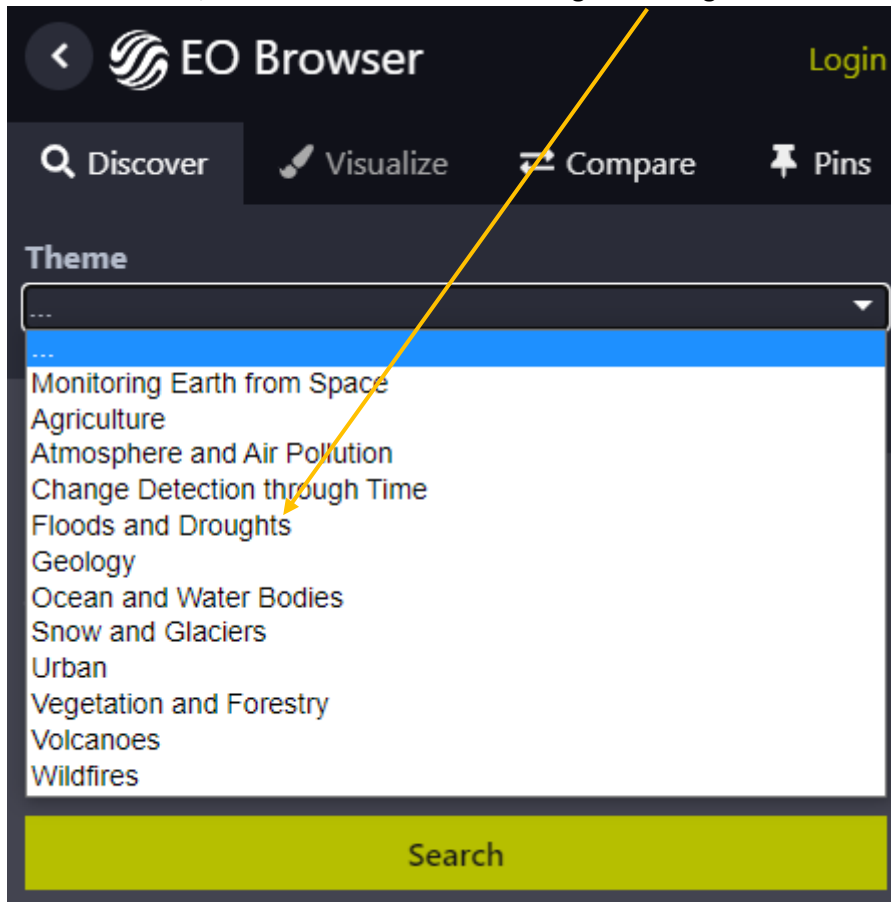
1. Go to EO Browser: <https://apps.sentinel-hub.com/eo-browser/>
2. Step to: Enable "Education mode" by clicking on the graduation top in the right corner:



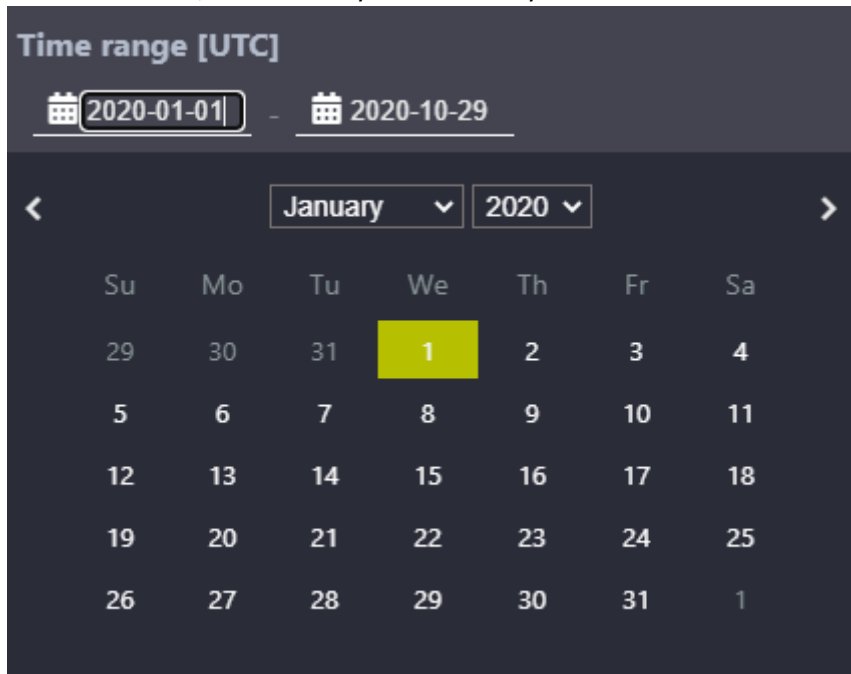
3. Look for Toro in the "Go to place" field.

² Adapted from <https://sentinel.esa.int/web/sentinel/missions>

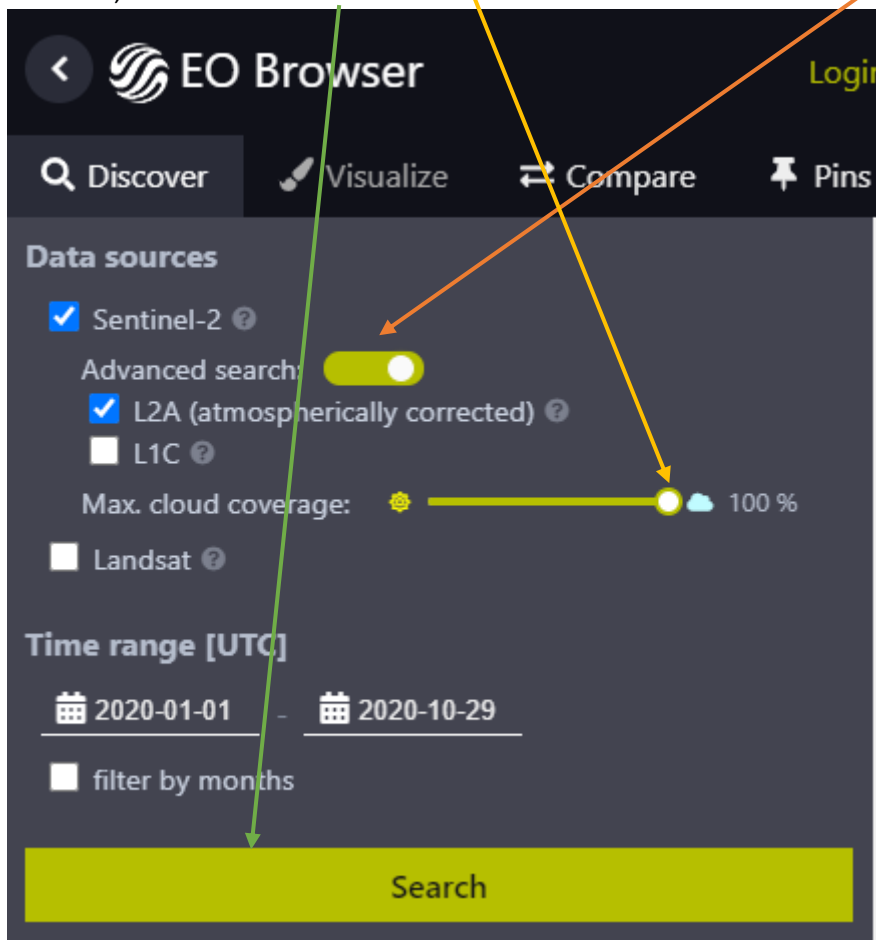
4. In the left menu, search for the theme “Flooding and Droughts”



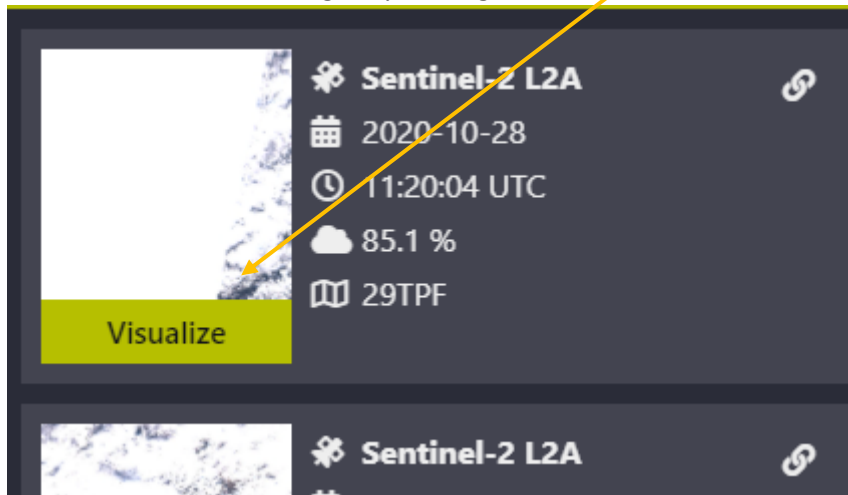
5. Select the dates, from January 1st until today:



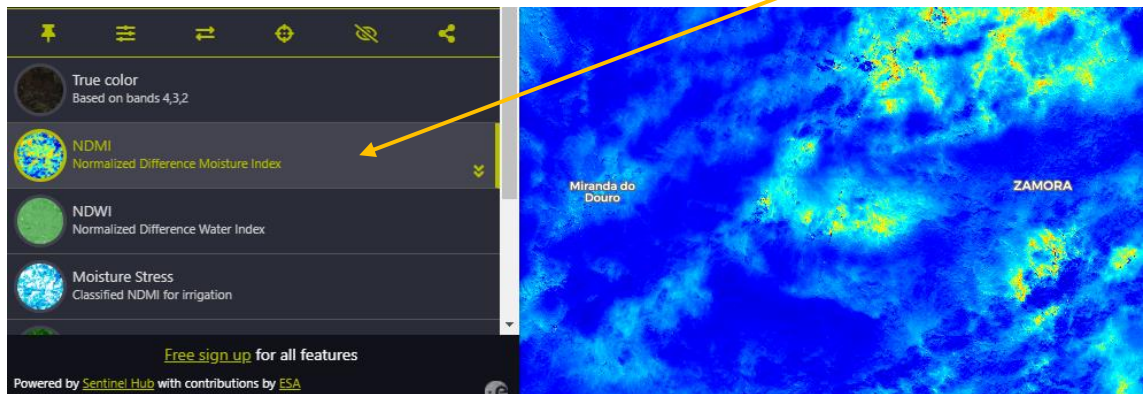
6. We can also choose maximum cloud coverage by clicking on advanced search. Once we are done, we click on "Search":



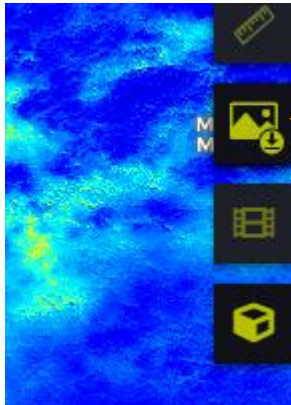
7. We choose one of the images by clicking on "Visualize":



8. We get the image and now we can choose the filter. We will select “NDMI” to visualize the moisture of the zone.



9. We can download the images using the button on the left:



10. To finish the challenge download 4 different pictures for different months and analyze the moisture difference between the seasons in Toro (winter, spring, summer and fall). Paste the images in a word document together with the image of the first challenge. Write the date under the images and then write your conclusion about the moisture difference.