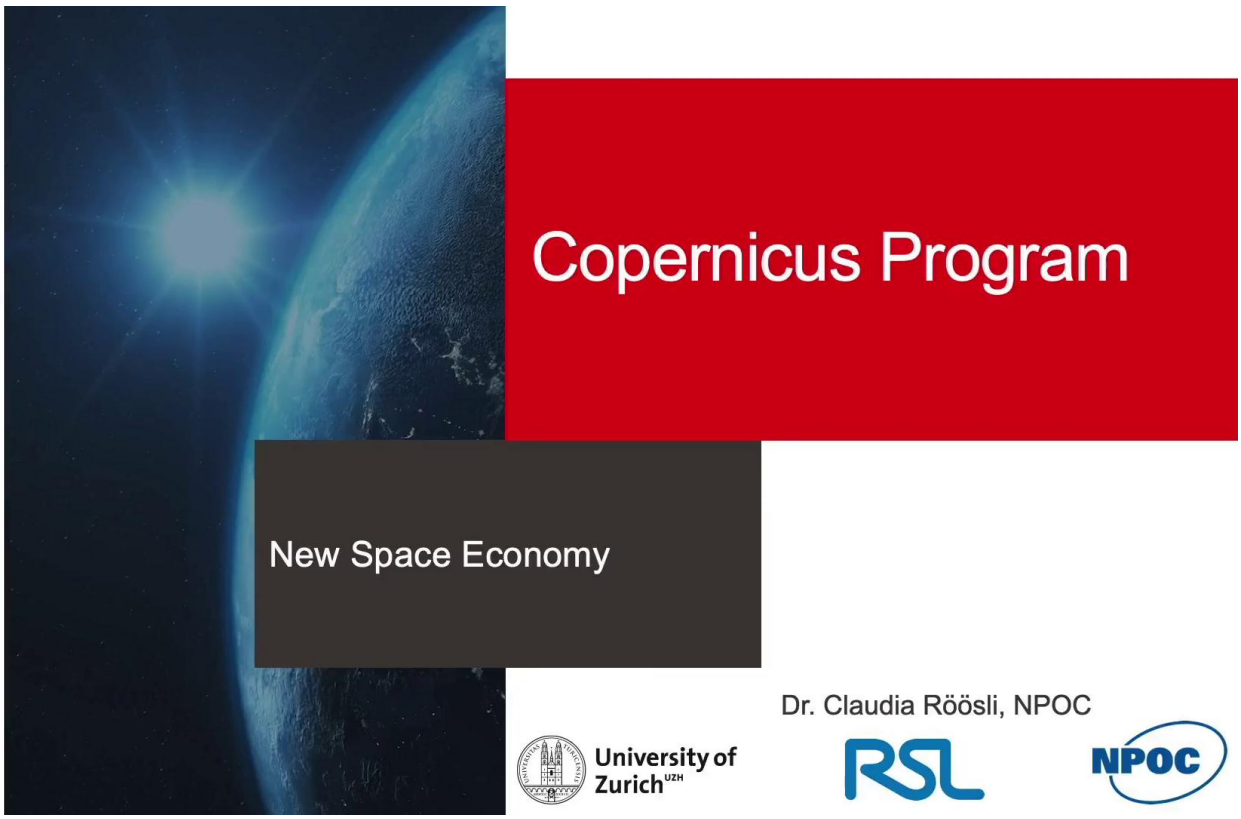

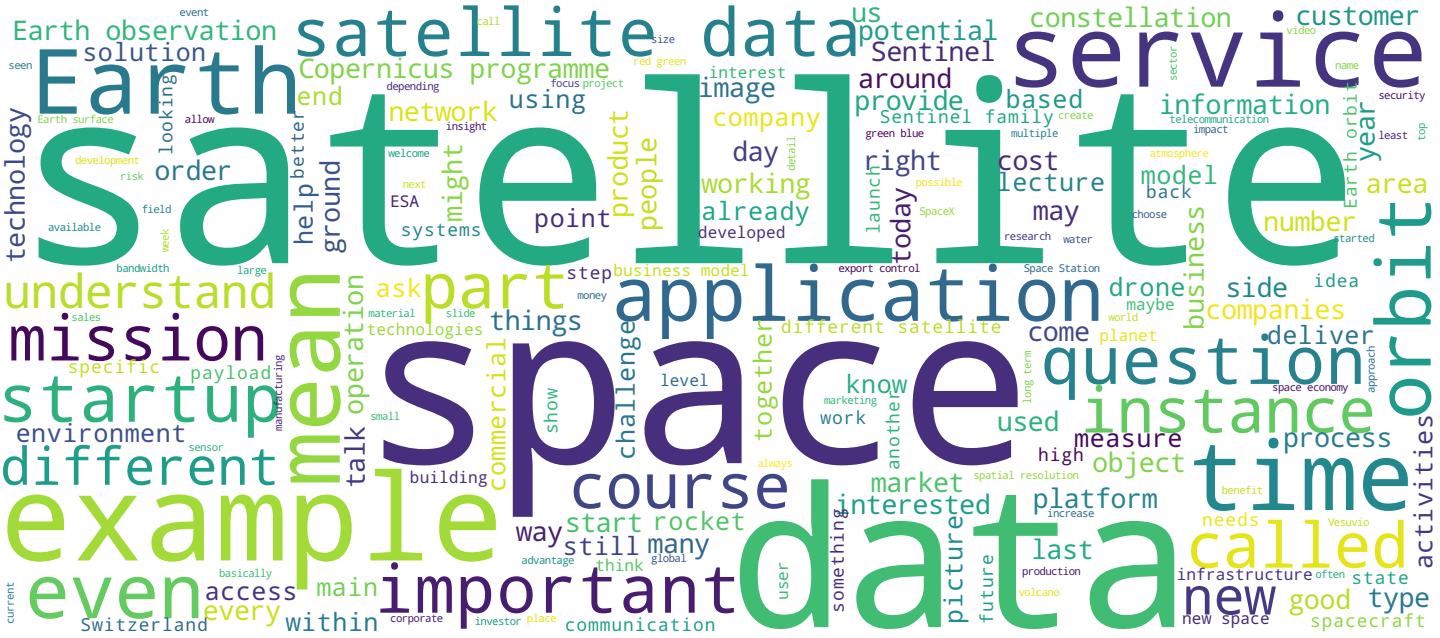

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Video

EPFL

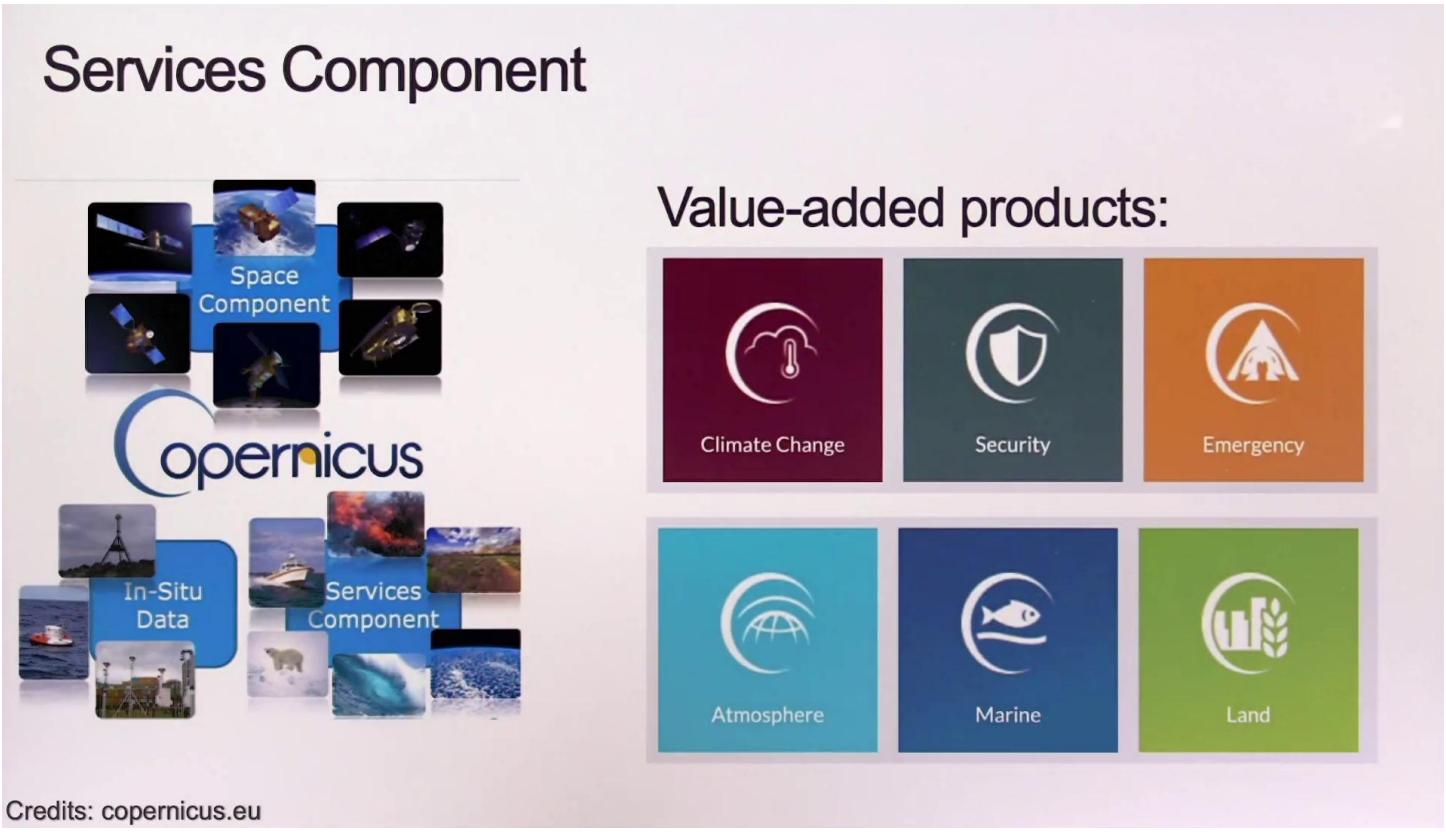
Copernicus Programme: Europe’s Eyes on Earth

Hello, and welcome to this MOOC. I'm Claudia. I'm working at the Remote Sensing Laboratories at the University of Zurich for the National Point of Contact, and I'm here to introduce you in the details of the Copernicus programme, Europe's Eyes On Earth. So the programme is designed to look at our planet and its environment for the benefit of Europe's citizens.

Notes

Summary

0m 06s

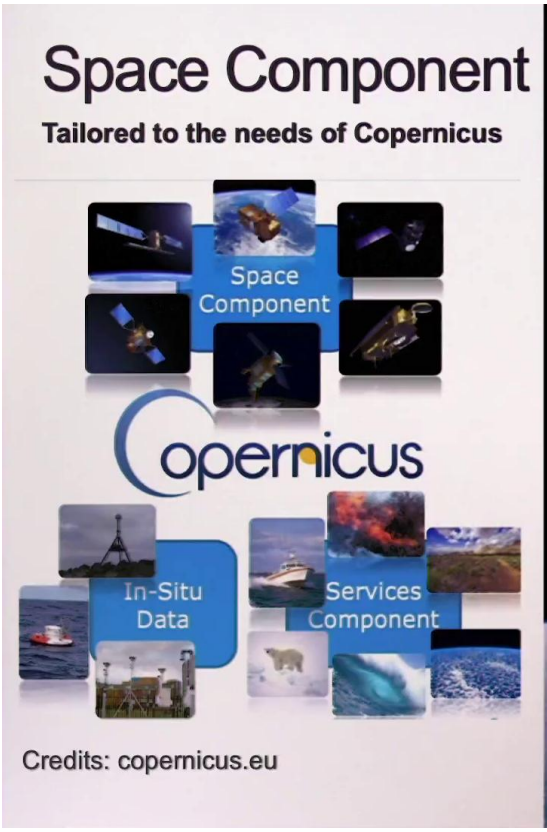


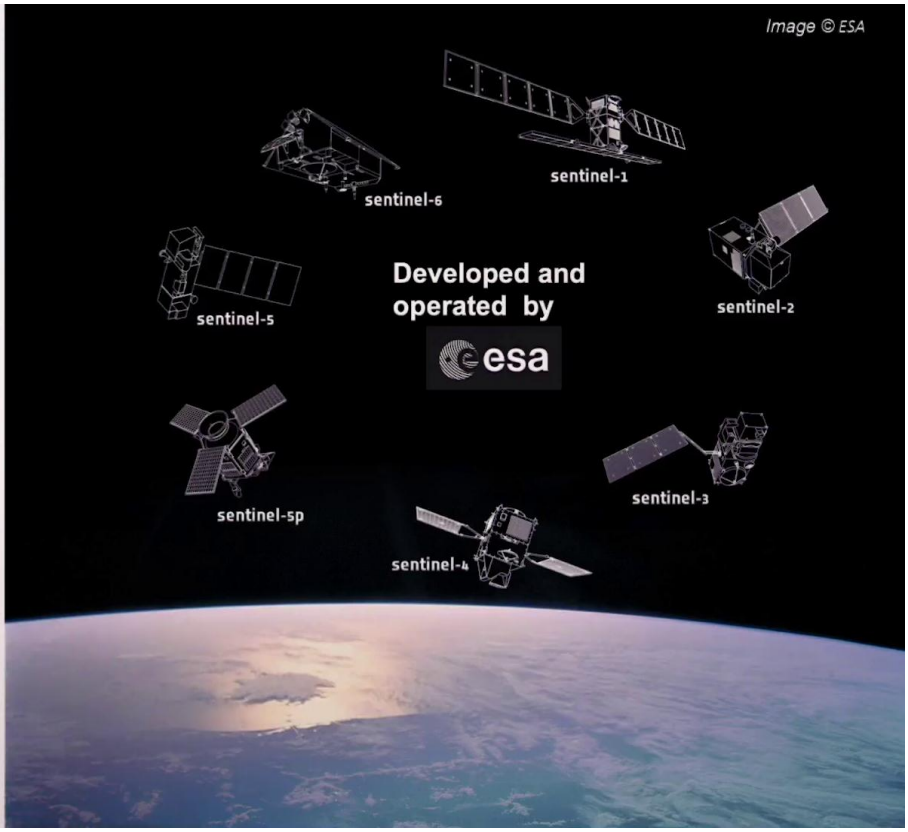
The Copernicus programme is based on three main pillars. So on one side, we have the so-called in-situ data, which are data taken from the ground, used for calibration, or adding additional measurements to other observations, such as grand stations from weather stations or sensors deployed in the ocean, or even taken, for instance, from a drone to create an image. On the other side, we have the service components. The service components are so-called higher-level products, which have a lot of information than just what you can see within a map. These so-called value-added products are categorised in these six categories of activities of the Copernicus programme. We, however, within this talk, will focus on the space component.

Notes

Summary

0m 31s





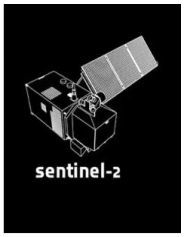
The core of the space component of the Copernicus programme is the so-called Sentinel family. The Sentinel family is developed and operated by ESA, the European Space Agency, where Switzerland is also part of. The Sentinel fleet, or Sentinel family, contains a variety of different satellites who measure the Earth in a different way, and they're tailored to the needs of the Copernicus programme. Within this talk, I will mainly focus on Sentinel-2, which is actually the satellite that is most easiest to understand for us, because it's similar to a camera in a cell phone. However, it can do more than just taking pictures in red, green, blue.

Notes

Summary

1m 29s

What process do I want to see? How to select a data source?



- **What detail do I need to see?**
  → **spatial resolution**
- **What process do I want to observe?**
  → **sensor type & spectral resolution**
- **When and how often do I need to observe?**
  → **temporal resolution**
- **How do I get and process the data?**
  → **local versus cloud solution**

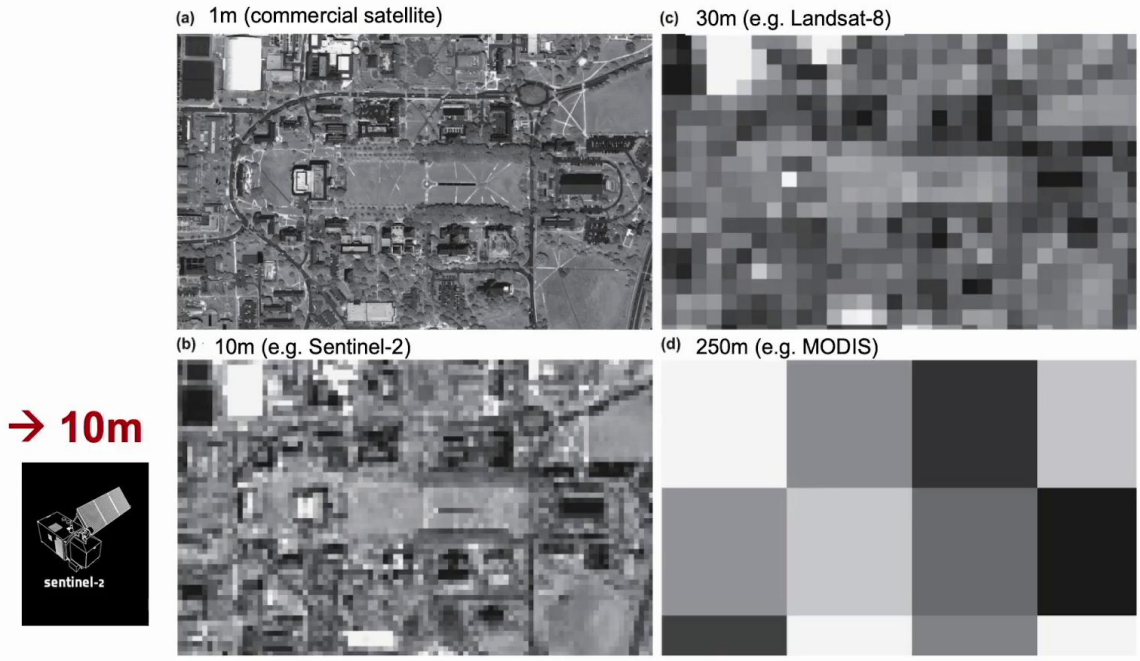
When you're working with satellite data, or when you want to make an application with satellite images, then you need first to ask you some basic questions. So the first question is, what process do you want to see? And depending on this process, you're going to choose the data source. The different satellites are characterised by different spatial resolution, spectral resolutions, and the so-called temporal resolutions. I will give you some insight in the next slides on these questions. And fourth, but not last, you need also to consider what platform you can and want to use for the processing itself.

Notes

Summary

2m 13s

Spatial Resolution



Liang et al "Chapter 1 - A Systematic View of Remote Sensing."

The first decision we have to reflect on is the spatial resolution. Spatial resolution means, in our understanding, the size of one pixel on the ground. So at the top left, you see, for instance, the resolution with a one-metre commercial satellite. So nowadays, the satellites can measure below a metre in resolution. At the bottom, you see the data we are usually working with, which is the 10-metre resolution of Sentinel-2. On the other side, you have also different satellite images with either several tens of metres resolution or hundreds of metres resolution. Depending on your application, for instance, if you look at the continental scale or a local scale or globally, you choose the satellite of your interest.

Notes

Summary

2m 57s

Sensor type & Spectral resolution

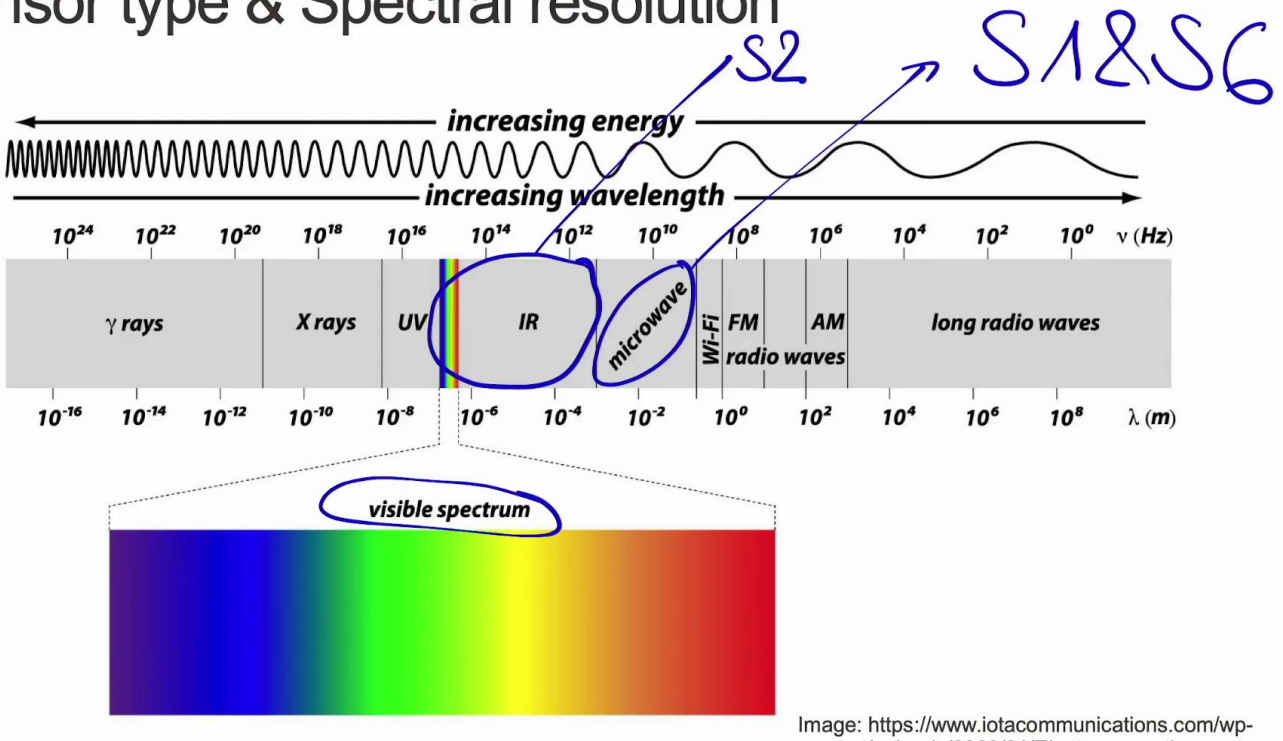


Image: https://www.iotacommunications.com/wp-content/uploads/2020/01/Electromagnetic-spectrum.jpg

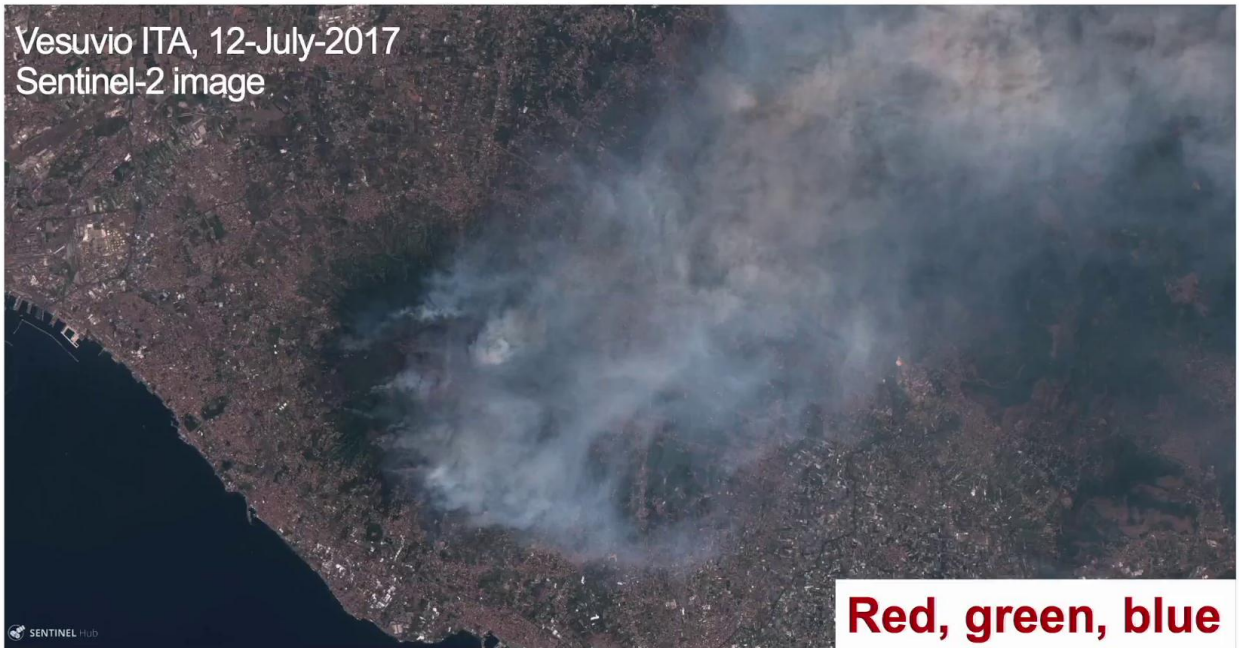
The second question you have to ask yourself is the question of the spectral resolution. And this is also very closely connected to the sensor type you're going to choose. Sentinel-2, the optical one that is working just with the emitted light from the sun and what is reflected from the Earth's surface, is recording in the visible spectrum, so down here, which means the red, green, blue channel that we are also observing with our cell phone cameras. However, where it's very powerful and where the advantage of satellite comes into play, it's recording in this entire area. So there are more than ten channels recorded by Sentinel-2, also in the infrared range. On the other side, we have, for instance, Sentinel-1 and Sentinel-6, who are active in the microwave area. Sentinel-1 and 6, they're even active satellites, so they're sending out some radar pulses that will be reflected from the Earth's surface in order to observe different processes. Why would you be interested in using microwave and an active signal, is that Sentinel-1 can penetrate through clouds and also is not dependent on sunlight. That means it can also measure during night, when there is no sunshine.

Notes

Summary

3m 47s

Sensor type & Spectral resolution



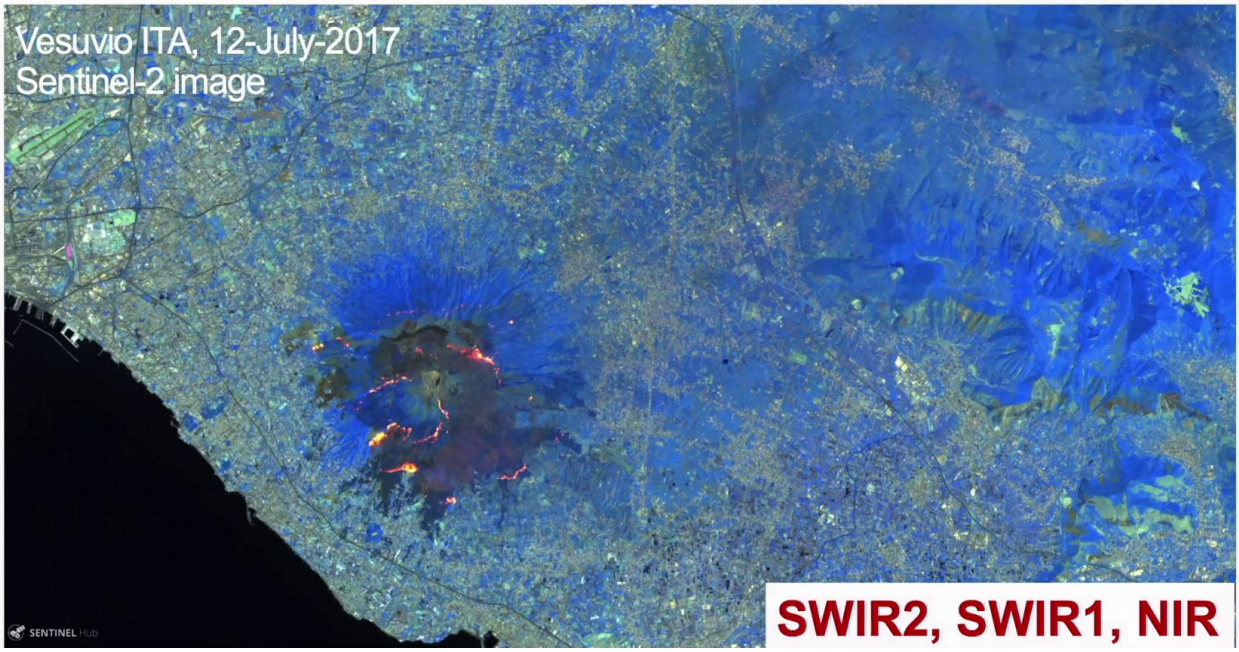
In order to give you a better understanding what I mean with using different bands and what it can show you. Additionally, here is an example of a Sentinel-2 image of the Vesuvio in Italy in July 2017. You can see here Naples, the city up here, and the one who know the region, this is the Vesuvio, the volcano. Some of you might know Vesuvio is not active currently, but there is still a lot of smoke. So the question is, where does this smoke come from?

Notes

Summary

5m 15s

Sensor type & Spectral resolution



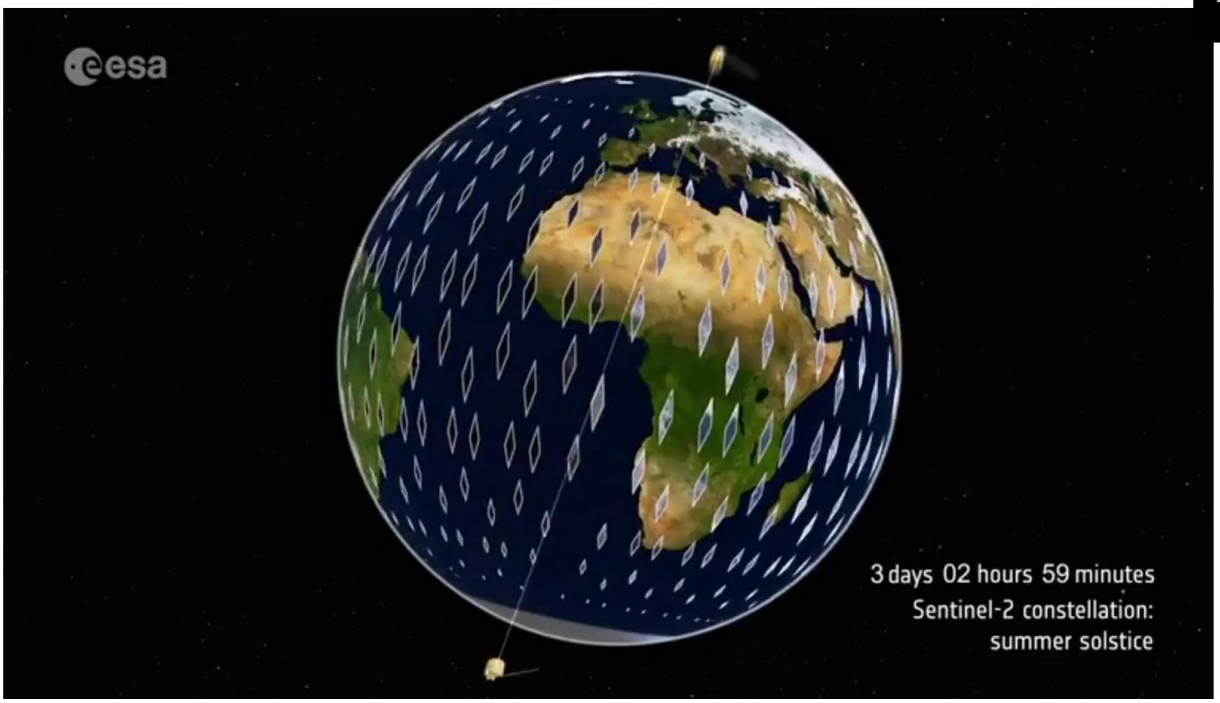
Looking now at not a red, green, blue image, but at the image using the infrared channels— so shortwave infrared one and two, and then here, infrared— you can suddenly see a lot more details around the volcano. So the smoke is disappeared, and you see some fire fronts from a wildfire on the slopes of Vesuvio, the volcano.

Notes

Summary

5m 50s

Temporal Resolution – Revisit Time

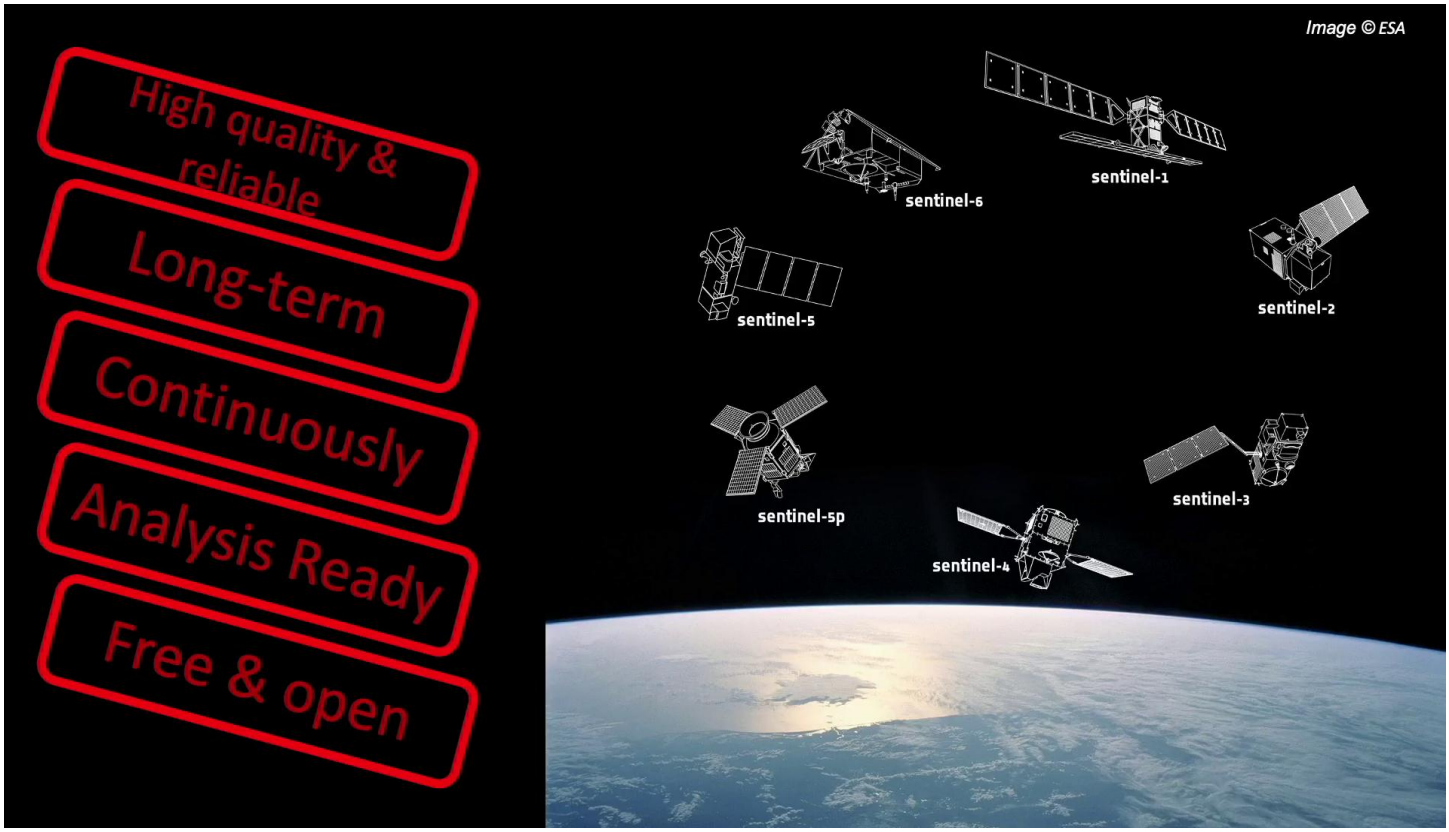


The next question you have to ask yourself is what temporal resolution do you need. So the revisit time, that means how often do you need a new picture of the area of your interest. What you can see here are Sentinel-2A and Sentinel-2B orbiting in tandem around the Earth and taking pictures from everywhere. And after exactly five days, you have the entire globe covered with the two satellites. So if we zoom in, however, into Europe, you can even see that Europe gets an overflight and a picture about every three days. So in conclusion, you get every five days a picture over the equator, and in our areas about every three days.

Notes

Summary

6m 17s



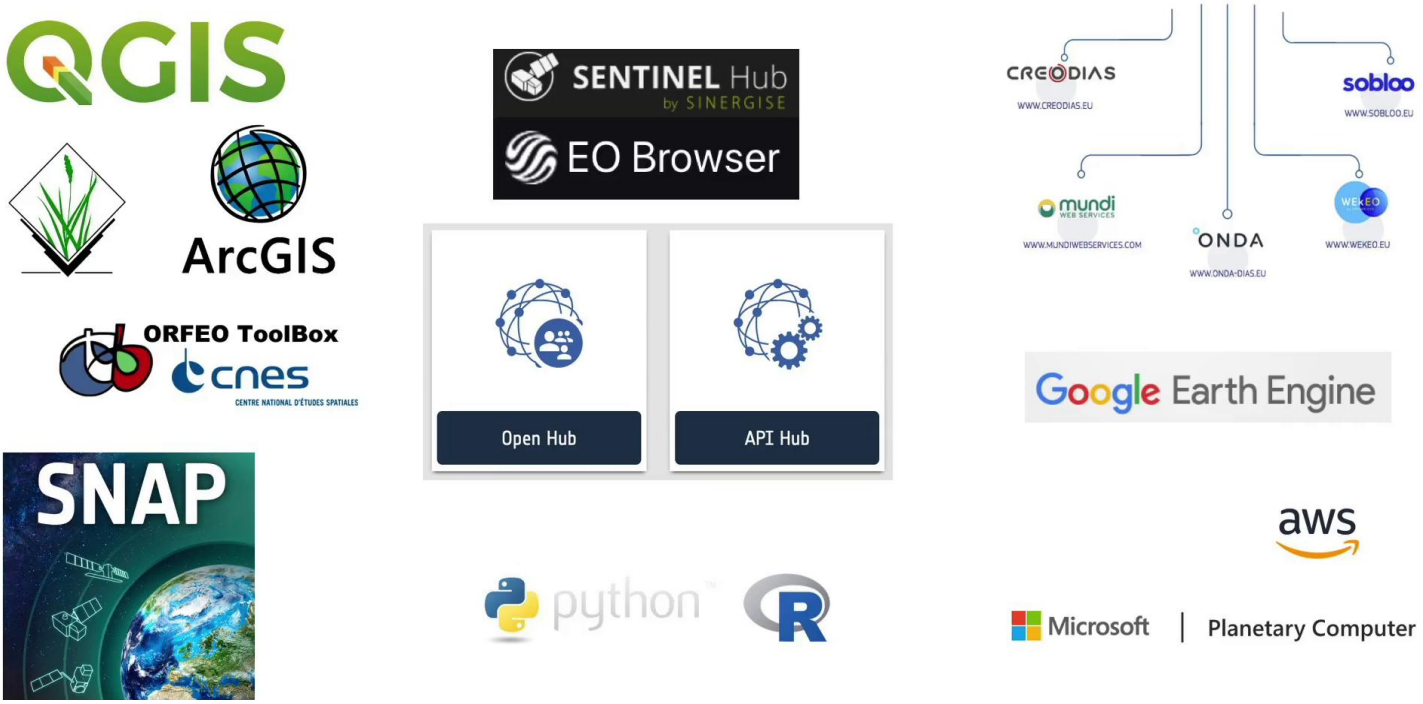
Now, we heard a lot about capabilities that the Sentinel satellites have. However, what is new with this Sentinel family is actually that they provide a very high quality and reliable product continuously all the time, every five days or every three days depending on the satellites, and on a long-term basis. Long-term basis means it's scheduled for even more than 30 years. And what is even more important, the data is analysis-ready. So the data you can get is, for instance, in the level two, is already corrected for clouds detection, or for the atmosphere, or georeference. So you can just take the images without knowing exactly how the instrument on a satellite is working. And last but not least, everything is free and open. Even if you are not part of the Copernicus programme— Switzerland is unfortunately not yet part of it— you can get the data even for commercial use on a global scale.

Notes

Summary

7m 09s

How do I get and process the data?



Now, you might be very eager to discover the satellite data by yourself. So as a first step, I would highly recommend you to go on a browser-based solution such as the EO browser, where you can just browse and discover the satellite data by yourself. Or if you're interested in the original data, you can go to SciHub and download all the images from the different satellites directly. As a second step, you can then use a normal GIS software, as all images are georeferenced. For instance, the open source software QGIS, or you can also use softwares like the SNAP, which is the software made for having different processing toolboxes on top for the different Sentinel satellites. If you know already that you're going to process a large amount of data, you can also consider directly the cloud solutions such as the DIASes, which are part of the Copernicus programme, or you go into the commercial cloud processing platforms such as the Amazon Cloud or the Microsoft Planetary Computer or the Google Earth Engine for an easy processing of the satellite data. Last but not least, you can for sure also use all normal programming softwares, where, for instance, Python and R, also have toolboxes to process these different type of data.

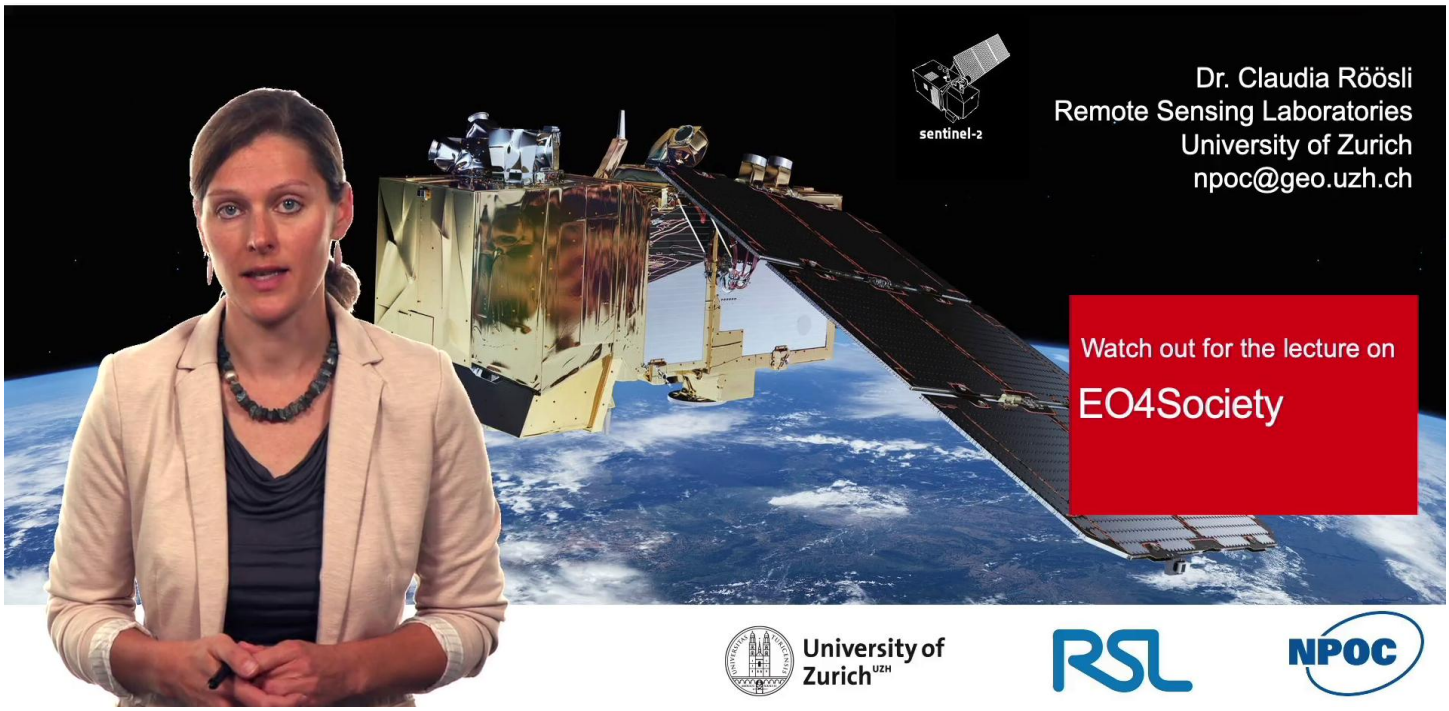
Notes

Summary

8m 13s

Thank you!

Image: ESA



With that, I just want to highlight if you're interested in more applications, watch out for the lecture or the MOOC on EO for society. Otherwise, from my side, just thanks a lot for your attention. And if you have more questions about how to use the satellite data, contact us via email. We are here for any Swiss entity in Switzerland to help dealing with the satellite data. Thank you.

Notes

Summary

9m 36s