

ESA Training Materials for floods, droughts, and wildfires

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Overview of relevant ESA materials



- **Floods**

- Land in Focus: Hazards and Disasters
- Course: EO Training before XIX SELPER
- Copernicus Emergency Management Service: Global Flood Monitoring

- **Droughts**

- Land in Focus: Hazards and Disasters
- Course: EO Training before XIX SELPER

- **Wildfires**

- Land in Focus: Hazards and Disasters
- Course: IV ESA EARSEL CNR School: Remote Sensing for Forest Fires
- Euro Data Cube
- Course: EO Training before XIX SELPER
- EO Browser and Jupyter Notebook tutorials

- **Land in Focus: Hazards and Disasters**


- Online course on EO land applications
- Includes a module on flood mapping using Sentinel-2 Thresholding in EO Browser showing how to map flood extent and progression over time.
- Easy, free, and can be done at any time.

- **Course: EO Training before XIX SELPER**

- Was used with the previous SELPER Course dedicated to natural disasters.
- Has a section on floods in Spanish featuring a Flood Mapping exercise in SNAP showing how to map flood extents using Sentinel-1 SAR data.
- All materials are online at eo4society

- **Copernicus Emergency Management Service: Global Flood Monitoring**

- Flood monitoring product including seasonal and impact forecasting
- Combines Sentinel-1 and meteorological data with a global high-resolution DEM and hydrological modelling
- Automatically identify flooded areas using current and historical flood data (since 2015), globally
- Multiple algorithms calculate the likelihood of every pixel being flooded -> consensus flood mapping



COURSES

EVENTS

RESOURCES

DISCUSSION


SOFTWARE

ABOUT

🔍


🔔

MARTIN PHILLIPSEN



Land in Focus – Hazards & Disasters

View Course details

 EO College

81% Complete

Last activity on October 11, 2022

W

elcome to the 'Hazards and Disasters' online courses. In the three MOOCs which are part of it, we will take a closer look at how remote sensing can answer essential questions related to the emergency response that is needed during hazardous events. Thus, disaster management heavily relies on remotely sensed data and their prompt processing in order to support decisions that can a) estimate the extent of a (natural) disaster and b) save lives by scientifically justifiable choices.

In the three lessons of this course, we will present different applications of remotely sensed data for disaster monitoring to you. At first, we will take a look at droughts, then dive into mapping flood extents using an interactive cloud-based approach before ending our course with the monitoring of fire hazards.

Land in Focus Hazards & Disasters

In Progress

Continue

Free

Course Includes

3 Lessons

8 Topics

3 Quizzes

Course Certificate

Back to Course

Land in Focus - Hazards & Disasters

81% Complete

9/11 Steps

Droughts

3 Topics | 1 Quiz

Floods

3 Topics | 1 Quiz

Flood Mapping: A global challenge

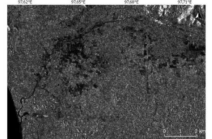
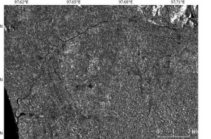
Flood mapping approaches

Tutorial: Flood Mapping with Sentinel-2 T...

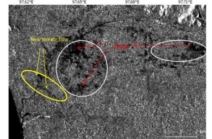
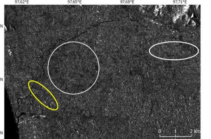
Flood Mapping Quiz

Fires


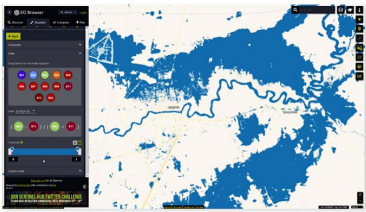
2 Topics | 1 Quiz

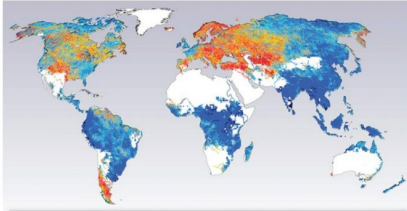


Left: VH before flood. Right: VH during flood. Source: Joffe et al. 2020.



Left: VH before flood. Right: VH during flood. Source: Joffe et al. 2020.





2500

2000

1500

1000

750

500

250

100

50

25

10

5

2

Increase

































Flood frequency

Decrease

Return period (years)

Lectures, tutorials (that you can follow along), and a quiz. For both floods, droughts, and wildfires

<https://eo-college.org/courses/hazards-and-disasters/>



→ THE EUROPEAN SPACE AGENCY

Course: EO Training before XIX SELPER



Access


Descarga en un único archivo zip
(246 MB)

Description















Educational materials from the EO Training before the XIX SELPER International Symposium: *Sentinels for Vegetation and Natural Disasters* held online from 8-12 November 2021, with sessions mostly in Spanish.

Materiales de formación del [Curso de Formación en Observación de la Tierra ligado al XIX Simposio Internacional de SELPER: Sentinelas para Vegetación y Desastres Naturales](#), que tuvo lugar online del 8-12 Noviembre 2021, con las sesiones mayoritariamente en Castellano.











Acceda a continuación a las grabaciones de las sesiones (clic en), diapositivas de las presentaciones (clic en), y datos de los ejercicios (clic en), o descargue todas las diapositivas y datos desde el link en el panel izquierdo.  

Las grabaciones de las sesiones de este curso están publicadas en  [la lista de reproducción del canal de Youtube EO Open Science](#).

Día 1 – Lunes 8 Noviembre 2021 – Intro & Terremotos

-   Introducción a las Actividades de Observación de la Tierra de la ESA (teoría), F. Sarti (22 MB)
-   Materiales educativos de la ESA (teoría), A. Castro Gómez (4 MB)
-   Acceso a datos de Sentinel y demo de visualización en SNAP (teoría), A. Castro Gómez (2 MB)
-   Intro a la misión SAOCOM y sus productos (teoría), J. Milovich (3 MB)
-   Modelos Digitales de Elevación (teoría), J. Candia (5 MB)
-   Interferometría con SAOCOM (teoría), J. Milovich (3 MB)
-   Modelos Digitales de Elevación e Interferometría con SAOCOM (ejercicio), J. Milovich & J. Candia (2 MB & 178 KB)

Día 2 – Martes 9 Noviembre 2021 – Inundaciones

-    Mapeo de zonas inundadas con S1 en SNAP (ejercicio), A. Castro Gómez (4 MB & 41 MB)
-   Observación Satelital aplicada a detección de sequías (teoría), B. Flores Rojas (1 MB)
-  Descarga de datos del CHRS Data Portal (ejercicio), B. Flores Rojas
-   Índices de sequía con QGIS y SNAP (ejercicio), B. Flores Rojas (3 MB & 10 MB)
-  Presentación de CRETEALC (teoría), S. Camacho (300 KB)
-  Observación de la Tierra: Apoyando las agendas globales para el desarrollo sustentable (teoría), S. Camacho (900 KB)

All in Spanish!

Last year's EO Training before XIX SELPER

Has materials, recordings, and ppts on flooding, wildfires, earthquakes, etc.

<https://eo4society.esa.int/resources/eo-training-xix-selper/>

Part of Copernicus Emergency Management Service

- Exposure mapping (population and built-up area)
- Early warning and monitoring
 - Constant automatic monitoring
 - On-demand mapping, within 8 hours
- Uses Sentinel-1 SAR data, 20m resolution

[Check this out for more info on GFM!](#)



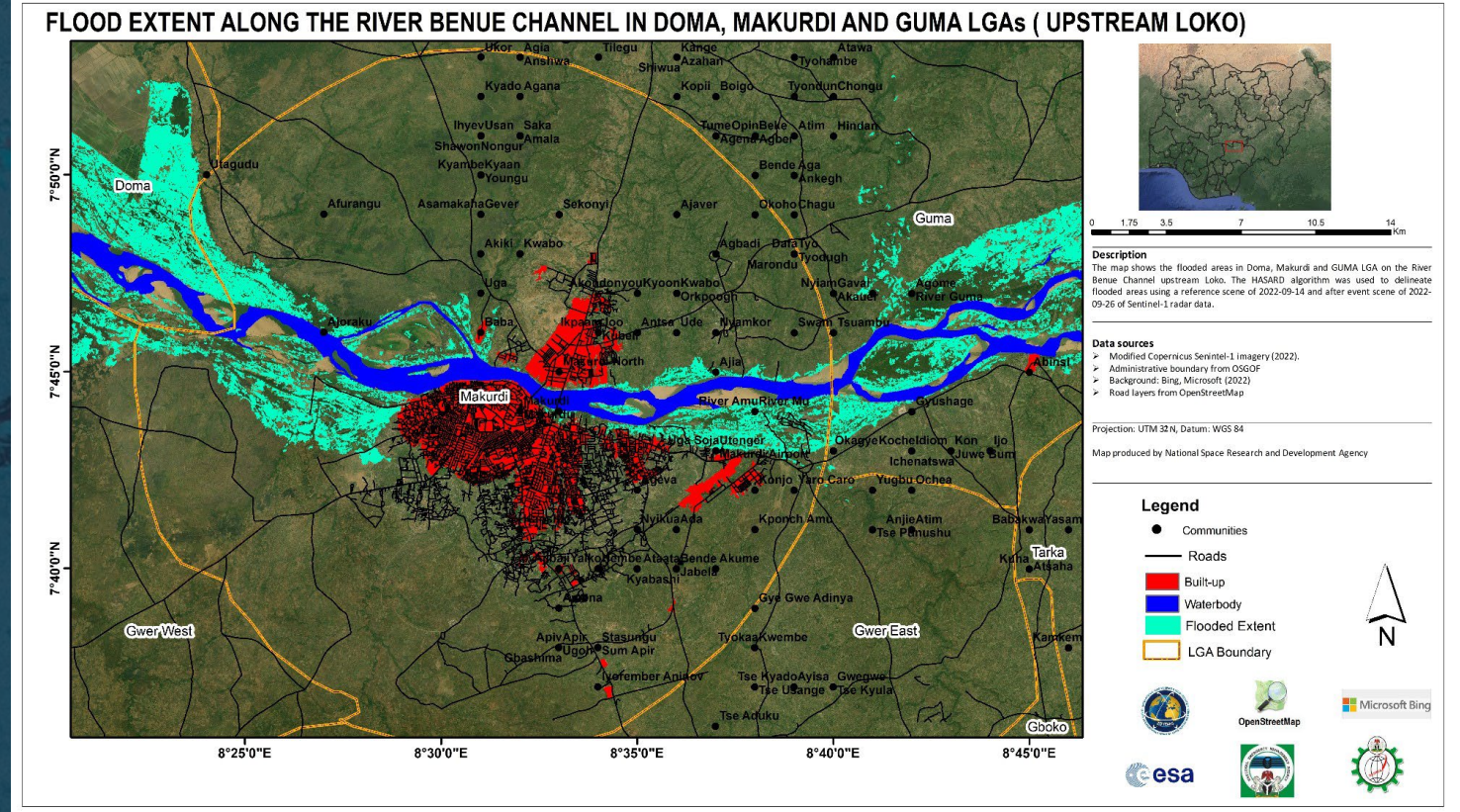
Emergency Management

Floods

The European Flood Awareness Systems (EFAS) and Global Flood Awareness Systems (GloFAS) provide complementary flood forecast information to relevant stakeholders that support flood risk management at the national, regional and global level.



EFAS  GloFAS 



Global Flood Awareness System (GloFAS):
Global Flood Forecasting Service, with **Global Flood Monitoring** products integrated.

- **Land in Focus: Hazards and Disasters**

- Online course on EO land applications
- Includes a module on drought mapping using Google Earth Engine, showing how to map drought severity and extent using Sentinel data
- Easy, free, and can be done at any time.

- **Course: EO Training before XIX SELPER**

- Was used with the previous SELPER Course dedicated to natural disasters.
- Has a section on droughts in Spanish, and features an exercise on the use of QGIS for drought mapping.
- All materials are online at [eo4society](http://eo4society.com).

- **Land in Focus: Hazards and Disasters**
 - Includes a module on wildfire mapping using Google Earth Engine, showing how to map wildfire extent and burn severity using Sentinel data.
- **Course: IV ESA EARSEL CNR School: Remote Sensing for Forest Fires**
 - All course materials are available online at eo4society.
 - Includes practical exercises on forest fire mapping using SNAP, EO Browser,
 - and the ESA Climate Change Initiative (CCI) toolbox in Jupyter Notebook (Python), for mapping soil moisture changes for wildfire prediction.
- **Course: EO Training before XIX SELPER**
 - Has sections on wildfires in Spanish, and features exercises on the use of EO data for wildfire and vegetation fires.
- **EO Browser and Jupyter Notebook tutorials**
 - Tutorials that show how to map wildfires using Sentinel data in EO Browser and using Jupyter Notebook.
- **Euro Data Cube**
 - Contains Jupyter Notebooks, incl. for mapping bushfires using Sentinel data.
 - Run the 'Data Access' notebook first, then 'Australian_Bushfires'. Requires registration, but is free to use.

Course: IV ESA EARSSEL CNR School: Remote Sensing for Forest Fires



IV ESA EARSSEL CNR School: Remote Sensing for Forest Fires

Theory and practical materials



Access

Download in a single zip file (137 MB)

Description

Educational materials from the IV ESA EARSSEL CNR School: Remote Sensing for Forest Fires held in Rome, Italy, on 3-5 October 2019. Download specific blocks here below or access the full theory and practicals from the window left side link.

- Introduction to ESA EO Programme and to ESA CCI Programme in the context of Fire (S.Plummer/F.Sarti, ESA)
- ESA EO Data Access and Users Services (non Copernicus) (V.Amans, ESA)
- An Overview of remote sensing for Forest Fires (R.Lasaponara, CNR)
- Theory/Demo: Self Organized Maps (SOM) for Burned Areas and Fire Severity. Fire Emissions: Sentinel- based monitoring (R.Lasaponara / M.Danese, CNR)
- Demo: Machine Learning for Burnt Area Mapping (D.Stavrakoudis, Aristotle University of Thessaloniki)
- Theory: Reminders of SAR basics. Discussion on challenges of S1 for Fire applications (A.Pepe, CNR)
- Exercise: Burned area mapping with S1 (SNAP) (A.Castro, RSAC c/o ESRIN / A.Pepe, CNR)
- Theory: Satellite Time Series Analysis. Combined InSAR/SAR-Amplitude-based approaches for Change Detection Analyses (A.Pepe, CNR)
- Reminders of Theory and Exercise: Burned area mapping with S2 (SNAP) (T.Smejkalova, Copernicus Research and User Support Service – RUS Copernicus)
- Reminders of Theory and Exercise: Active fire mapping with S3 (SNAP) (G.Karadimou, RUS Copernicus)
- Reminders of Theory and Exercise: Aerosol monitoring with Sentinel-5P (M.Castro Gómez, RUS Copernicus)
- Exercise: Soil Moisture for Fire Hazard Estimation (CCI Toolbox, Python) (A.Castro, RSAC c/o ESRIN)
- Exercise: EO Browser Wildfire case study (S1, S2 and S5-P) (A.Castro, RSAC c/o ESRIN)

<https://eo4society.esa.int/resources/iv-esa-earssel-cnr-school-2019/>

Use cases

Air Pollution

Measuring Air Pollution from Space



Air pollution is a serious problem worldwide - especially in large urban areas. According to the WHO (World Health Organization), some 4.2 million premature deaths each year are linked to air pollution. According to data the European Environment Agency published, around 90% of city dwellers in Europe are subjected to air pollutants at levels deemed harmful.

- ESA EO BROWSER TUTORIAL
- MORE ABOUT AIR POLLUTION
- BLOG ON AIR POLLUTION

<https://www.sentinel-hub.com/explore/education/>

Etna Eruption

Volcano from Space



In early spring of 2017, the biggest Sicilian volcano - Etna - awakened and erupted several times. Let's observe the event using satellite imagery. Can we find satellite images of any previous Etna eruptions?

- ESA EO BROWSER TUTORIAL
- ETNA ERUPTION PYTHON EXAMPLE

Wildfires

Wildfires from Satellite Images



In recent years, we hear a lot of news about wildfires occurring in areas, where they did not occur often in the past. In spring and summer of 2018, we have witnessed the boreal forests in Siberia burning at extraordinary rates; last summer the wildfires suddenly erupted in Portugal; in September of 2017, California was in flames, with firefighters fighting more than 9000 fires and in the beginning months of 2020, wildfires in Australia have destroyed thousands of homes and more than 5 million hectares of land. We can observe them with satellite imagery.

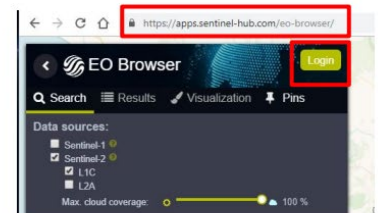
- ESA EO BROWSER TUTORIAL
- WILDFIRES AND SATELLITE IMAGERY

1- Wildfires Case Study in EO Browser

<http://apps.sentinel-hub.com/eo-browser/>

Register **for free** with an email address, to have full access to all the tools.

Login with your username & password.



ESA UNCLASSIFIED - For Official Use



Slide 4
European Space Agency

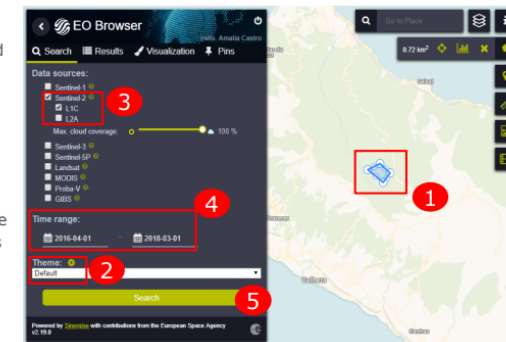


1- Wildfires Case Study in EO Browser

Note that in the **Wildfires Theme** it is **not possible to display time series** (the feature is not yet available).

So to reproduce the steps taken in the Case Study:

1. Make sure you have an **AOI drawn** over the burned area (it can be a small section of the burned area)
2. In Search, under Theme choose **Default** (not Wildfire)
3. As Data sources, keep **Sentinel-2 L1C**
4. Next we need to display an image. However, it can be **any image**, because this will simply allow us to access the Time Series tool. Once inside the tool, the time range (i.e. how far back in time the time series goes) can be adjusted. You could enter the same time range as the wildfire case study, for example.
5. Click **Search**



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Slide 14
European Space Agency

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- **Wildfires**

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- [Euro Data Cube](#)
- [Course: EO Training before XIX SELPER](#)
- [EO Browser and Jupyter Notebook tutorials](#)




JupyterLab

For interactive prototyping, programming and visualization, our JupyterLab instance is well-suited to run Python-based workflows in an IDE-like environment. Required libraries and useful tools are installed out of the box, so that users can get started with little overhead. It's the most convenient way for Python programmers to interact with openEO Platform.

GET STARTED →

OPEN JUPYTERLAB →




openEO Platform Editor

The Editor is an interactive and visual user interface in the Browser. It gives easy access to all functionalities without requiring programming experience. Users can get an overview of available data sets and processes or monitor the status of their processing workflows. A block-based workflow editor helps beginners without programming experience to run their use cases.

GET STARTED →


OPEN EDITOR →



JavaScript

Primarily for use in browser-environments, but also includes support for NodeJS and TypeScript


GET STARTED →



Python

Development in all Python environments, including advanced support for Jupyter

GET STARTED →



R Language

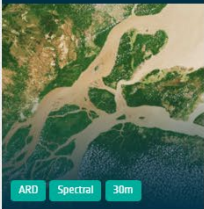
R Language support with nice integration into RStudio and RMarkdown

GET STARTED →

DATA COLLECTIONS


Below you can find a selection of our major data collections. You can also browse through [all available data collections](#).

Landsat-8 L2



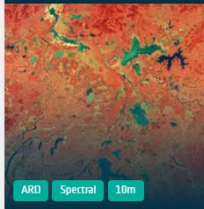
ARD Spectral 30m

Sentinel-1 GRD



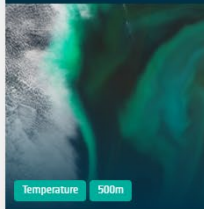
ARD SAR GRD 10m

Sentinel-2 L2A



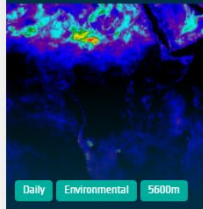
ARD Spectral 10m

Sentinel-3 SLSTR



Temperature 500m

Sentinel-5P N02



Daily Environmental 5600m

More powerful, and customizable, and also more advanced

<https://openeo.cloud/about/>

Transform your local EO workflow to regional/global using OpenEO's cloud processing and analytics environment

Works as an API, accessible in the interfaces you are familiar with:
JupyterLab, Python, JavaScript, Rstudio, or web-based workflows.

All interfaces share the OpenEO client-side library.
Combine predefined and user-defined functions.

Strong and active community with [a great forum](#)

Supports integrated Machine Learning algorithms and AI

Still in development
Not free to call, but has a free trial

**More ESA EO courses and materials on floods,
droughts, and wildfires available at
<https://eo4society.esa.int/>**

**The CEOS calendar of future EO events:
<https://training.ceos.org/>**