



# Using Sentinel-2 to identify and map wildfire events

Copernicus for GI professionals



Space



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[www.copernicus.eu](http://www.copernicus.eu)



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6.11.2017



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## Introduction

### The Problem:

- Out of control wildfires cause extreme long-term damage to the environment, wildlife, flora and property including forestry and agricultural holdings every year
- Along with improving the detection of and response times to such fires, there is also a need to improve post-event delineation, assessment and monitoring of the affected areas. Such post-event analysis can then feed back into strategies and policies for wildfire prevention, prediction, mitigation and response
- Systems for detecting wildfires and monitoring the risk of wildfire development, such as EFFIS (European Forest Fire Information System) and AFIS (Advanced Fire Information System), provide excellent up-to-date information on wildfires. However, the detection of such fires by these systems is prone to inaccuracy in terms of the exact location and extents of wildfire events and burnt areas, and failure to pick-up many of the smaller wildfires which occur and which impact the environment and local communities in a variety of ways



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## Benefits of using Sentinel-2 Imagery

- More accurate post-event delineation of wildfire extents
- Smaller areas affected by wildfires can be determined and assessed
- The need for ground surveys on often difficult terrain to determine wildfire locations and extents can be potentially reduced, or made easier
- Additional data can be used in conjunction with the imagery by a variety of organisations to better assess, monitor and respond to the areas and communities affected by such wildfires
- The information obtained can be used to carry out risk-assessments of affected and surrounding areas
- Sentinel-2 data collected over time can be used to monitor environmental recovery, especially in relation to agriculture and forestry



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## Who can benefit?

Data obtained and processed from Sentinel-2 imagery can be of benefit to both GIS and non-GIS users. Some users may wish to use GIS applications to overlay various other data layers, while others may simply want maps and images with location information and extents. Examples of organisations and stakeholders who may benefit include:

- National fire fighting units
- Police departments
- Environmental protection agencies
- Civil protection units
- Forestry and agriculture management organisations
- National parks organisations
- Farmers
- Insurance companies
- Local communities
- Wildlife interest groups



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## The Process

Below is an example of the process which can be followed to obtain and analyse Sentinel-2 imagery to produce information on wildfire burning/scarring:

- *Step 1:* Use the EFFIS system to roughly locate and date the wildfire in question
- *Step 2:* Access the Sentinel Scihub to identify and download appropriate level C-1 imagery (Alternatively, access the data and download it from Amazon S-3 (<http://sentinel-pds.s3-website.eu-central-1.amazonaws.com/> )
- *Step 3:* Use the Sentinel SNAP toolbox to carry out some initial processing and define a subset for export
- *Step 4:* Export the data for import into another GIS
- *Step 5:* Further process the image: e.g. use the cloud mask to clip the data, alter the band combinations, apply appropriate histogram stretches, and apply a Normalised Burn Ratio (NBR) to the image



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# Hardware / Software / Data

## Hardware:

- Computer with internet access and plenty of storage space

## Software:

- Sentinel SNAP Toolbox (free download from <http://step.esa.int/main/download/>)
- Quantum GIS (QGIS) (open source: free download from <https://www.qgis.org/en/site/forusers/download.html>)

## Data:

- Sentinel-2 level C-1 products downloaded from the Sentinel Scientific Data Hub in SAFE format.
- Alternatively, Sentinel-2 level C-1 products downloaded from Amazon S-3 (<http://sentinel-pds.s3-website.eu-central-1.amazonaws.com/>) in JPEG2000 format. This includes metadata in XML format, and cloud masks in GML format
- Alternatively B, Sentinel-2 level C-1 products downloaded from Planet.com (<https://www.planet.com/explorer/>)
- Administrative boundaries vector files



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## Technical Issues (1)

### Downloading, processing and storage issues

- Sentinel-2 files in SAFE format are very large (regularly 6GB+) and can take a long time to download
- Processing the files in the SNAP toolbox can be a cumbersome task
- They require a lot of storage space

### Possible Solution

- Search for and download the data in an alternative format from Amazon S-3 (<http://sentinel-pds.s3-website.eu-central-1.amazonaws.com/>)
- Individual bands can be downloaded in JPEG2000 format and merged into a multi-spectral image in a GIS . The image can then be served to a platform such as Azimap (<http://www.Azimap.com/>)
- Much smaller files, much quicker processing time, and less storage required



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## Technical Issues (2)

### Cloud cover

- Cloud cover is a major hindrance for providing accurate data on wildfires and their aftermath, especially in regions with higher levels of precipitation
- ESA's cloud mask provides a useful tool for trying to discount the effects of cloud cover on an image, especially when the image is processed. However, the cloud mask tends to miss various areas of cloud cover. This can lead to misclassification of pixel values, especially when the multi-spectral image is processed to produce a Normalised Burn Ratio (NBR) image
- This problem is compounded when the temporal dimension is considered. Cloud cover may inhibit the acquisition of appropriate imagery of the affected area within an appropriate post-event timeframe. Alternative resources may then need to be employed to acquire the necessary data to determine wildfire location, extents etc...



# Demonstration

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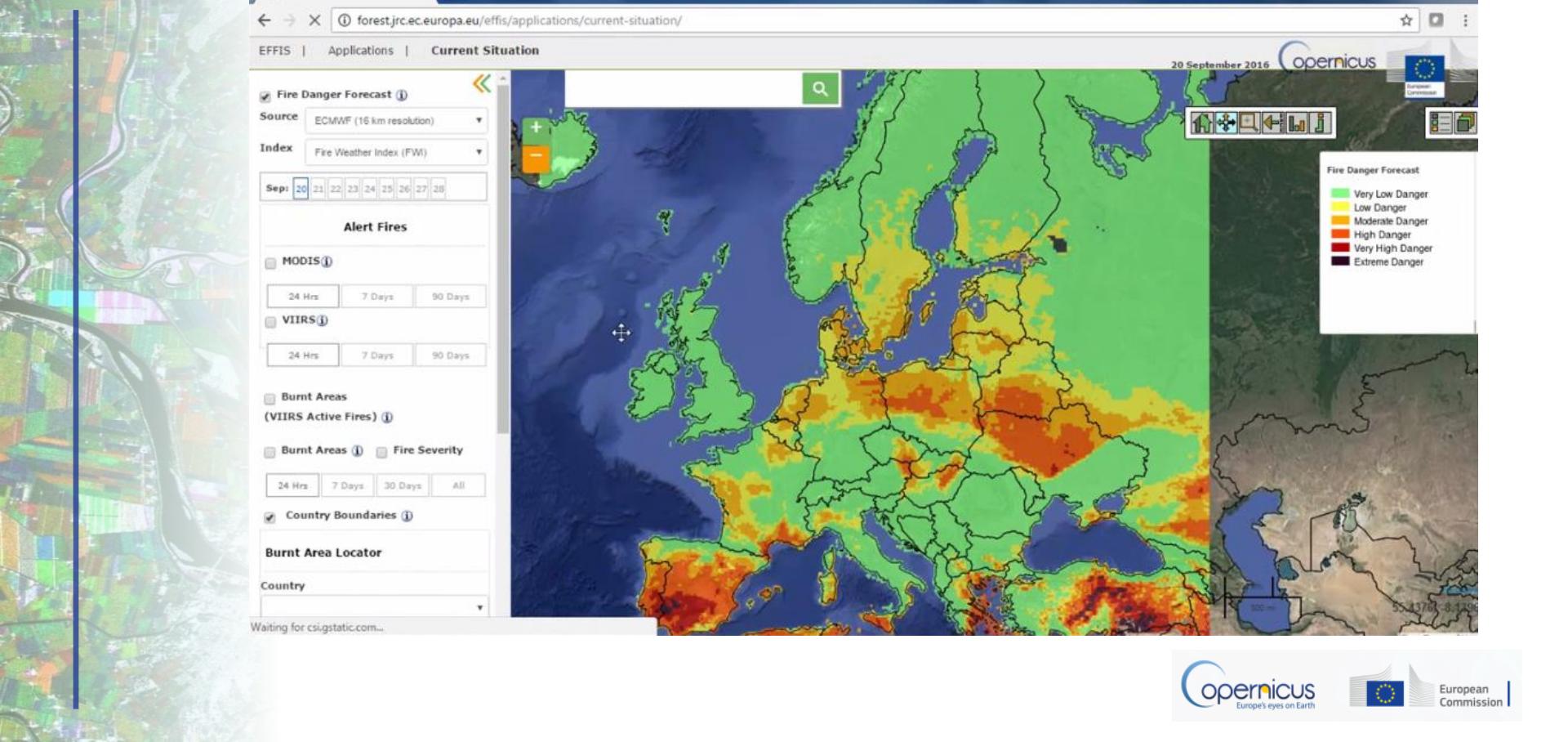
# Demonstration

The screenshot shows the homepage of the European Forest Fire Information System (EFFIS). The header features the Copernicus logo and the text "COPERNICUS Emergency Management Service". The main navigation menu includes links for "About EFFIS", "Reports and Publications", "Applications", and "Partners". A banner at the top right highlights the "New feature" of the Global Wildfire Information System Viewer. Below the banner, there are three callout boxes: one for "New feature" (requesting data via a Data Request Form), one for "Visit the brand-new Global Wildfire Information System Viewer", and one for "EFFIS Damage Assessment" showing statistics for burned areas and coverage. The main content area contains sections for "Welcome to EFFIS", "Current Situation" (with a map of Europe and the Mediterranean), and "Fire News". The footer includes links for "Last update: 04/06/2017", "JRC Mission Control", "Legal Notice", "Contact", "Search", and "Help".

<http://effis.jrc.ec.europa.eu/>



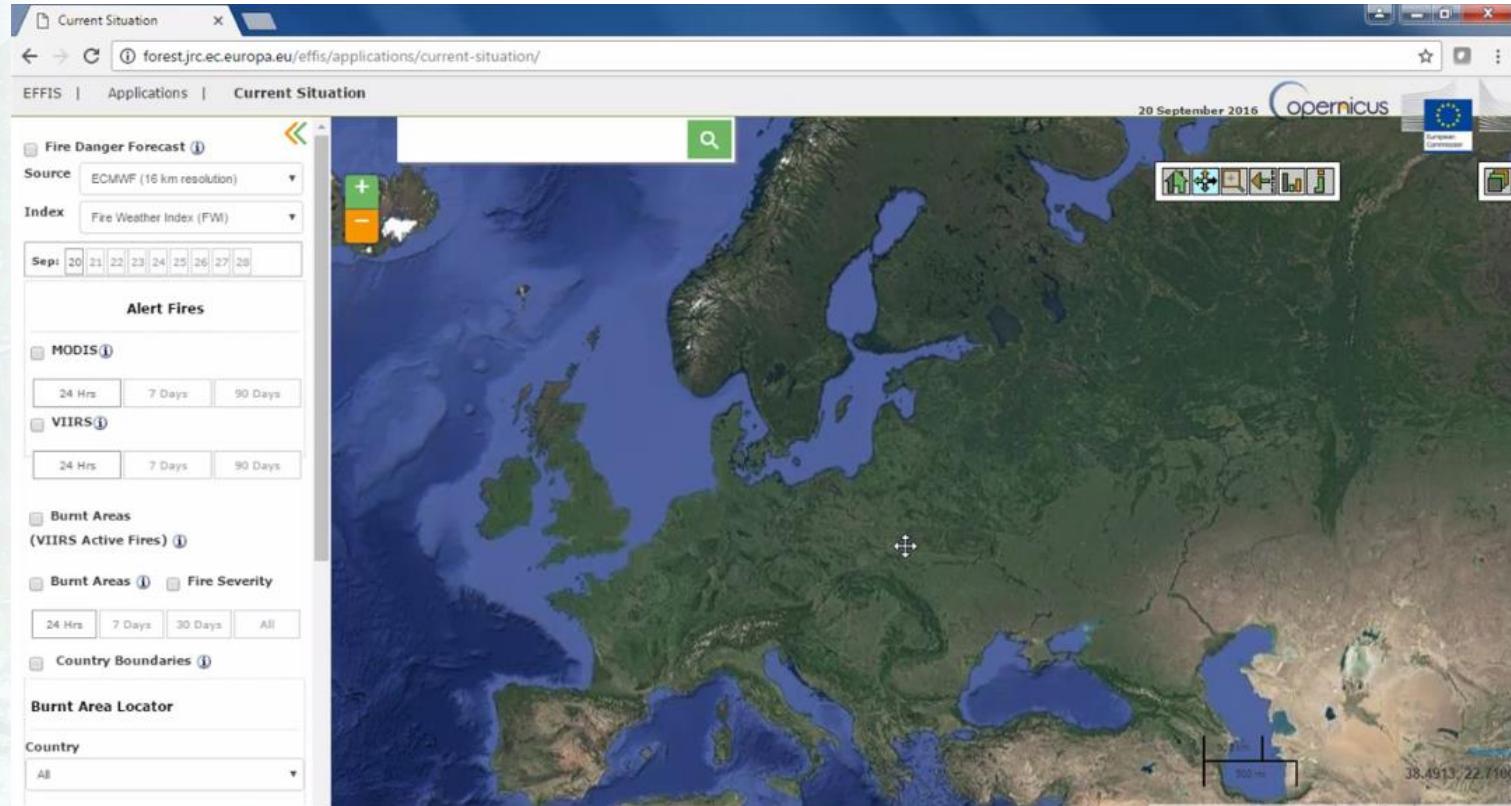
# Demonstration





# Demonstration

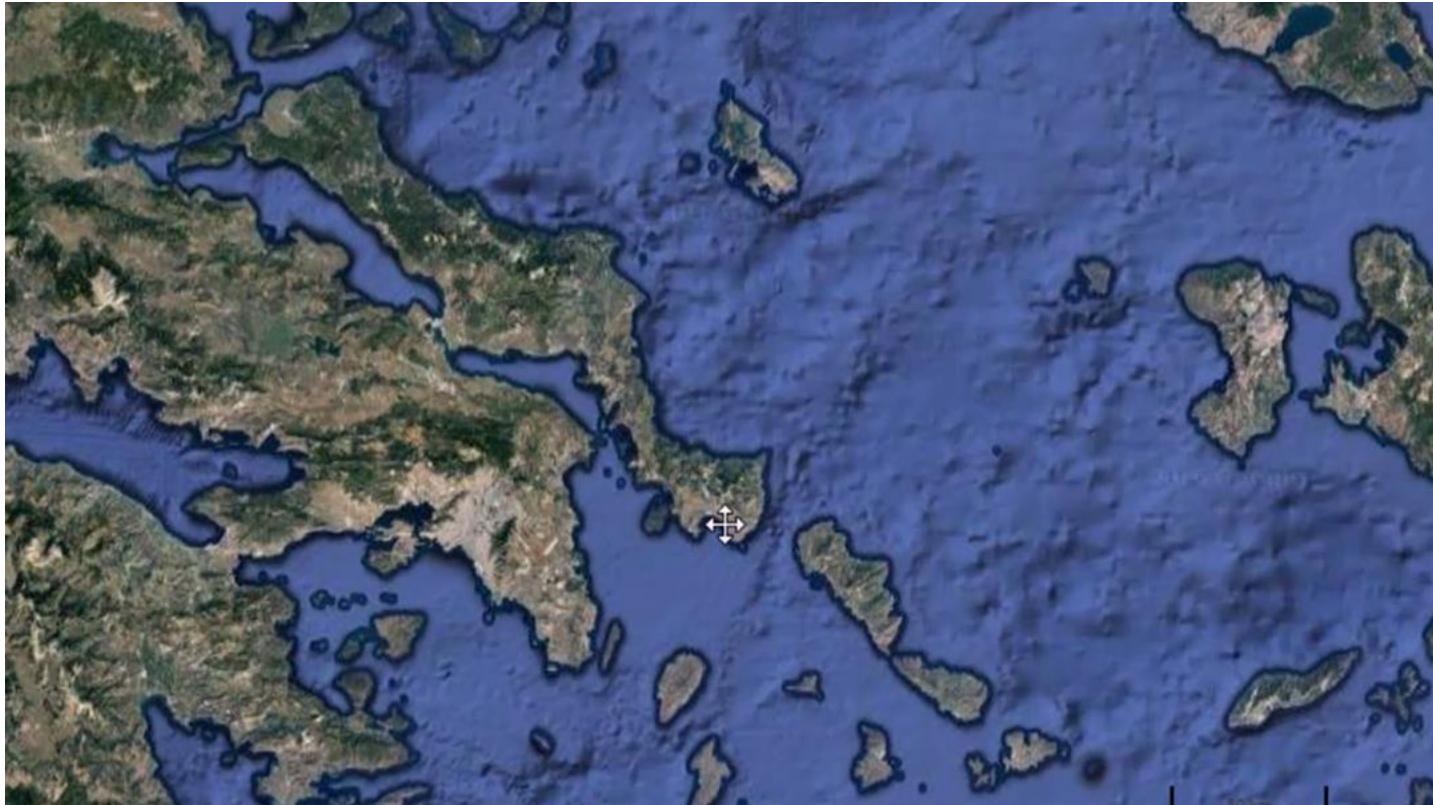
Copernicus





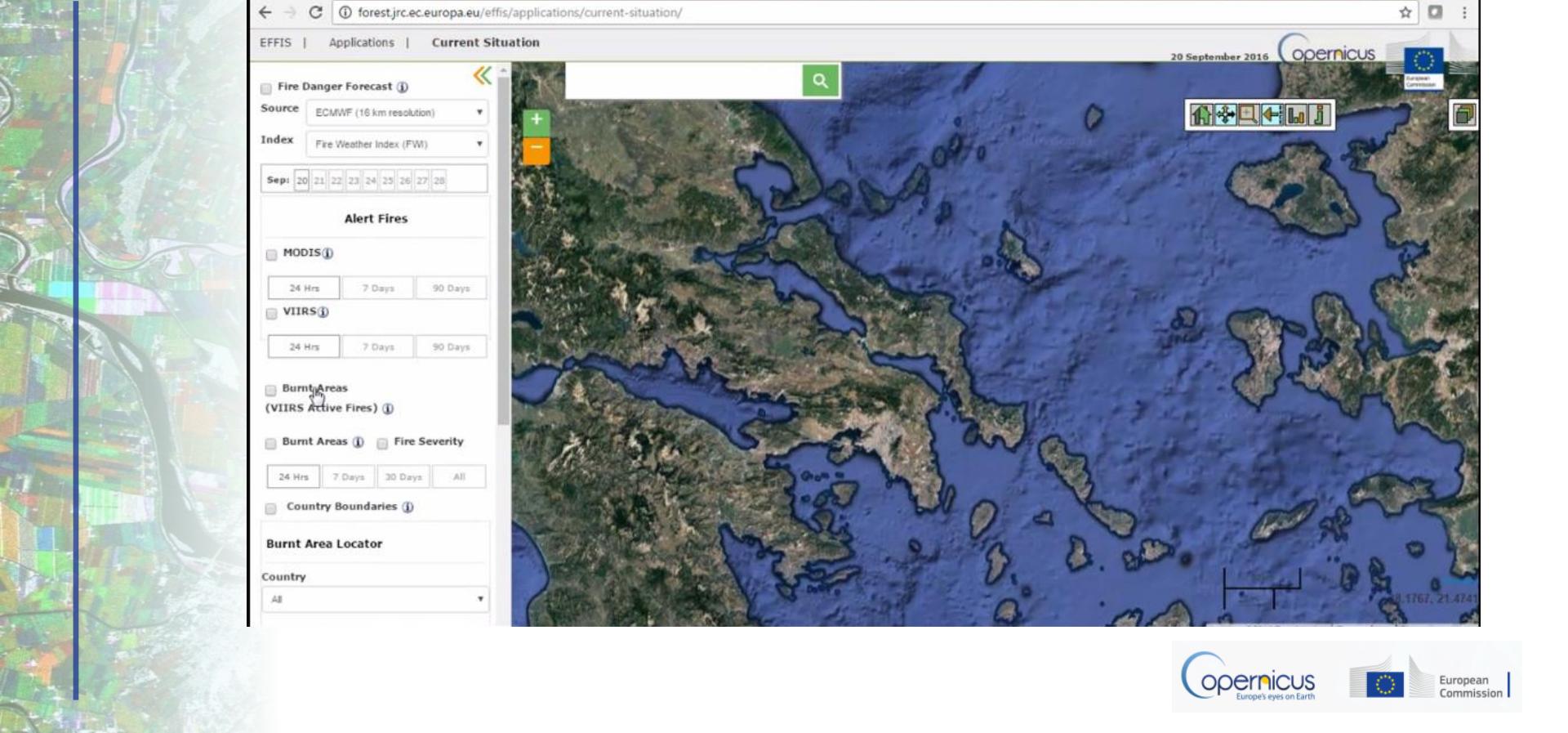
# Demonstration

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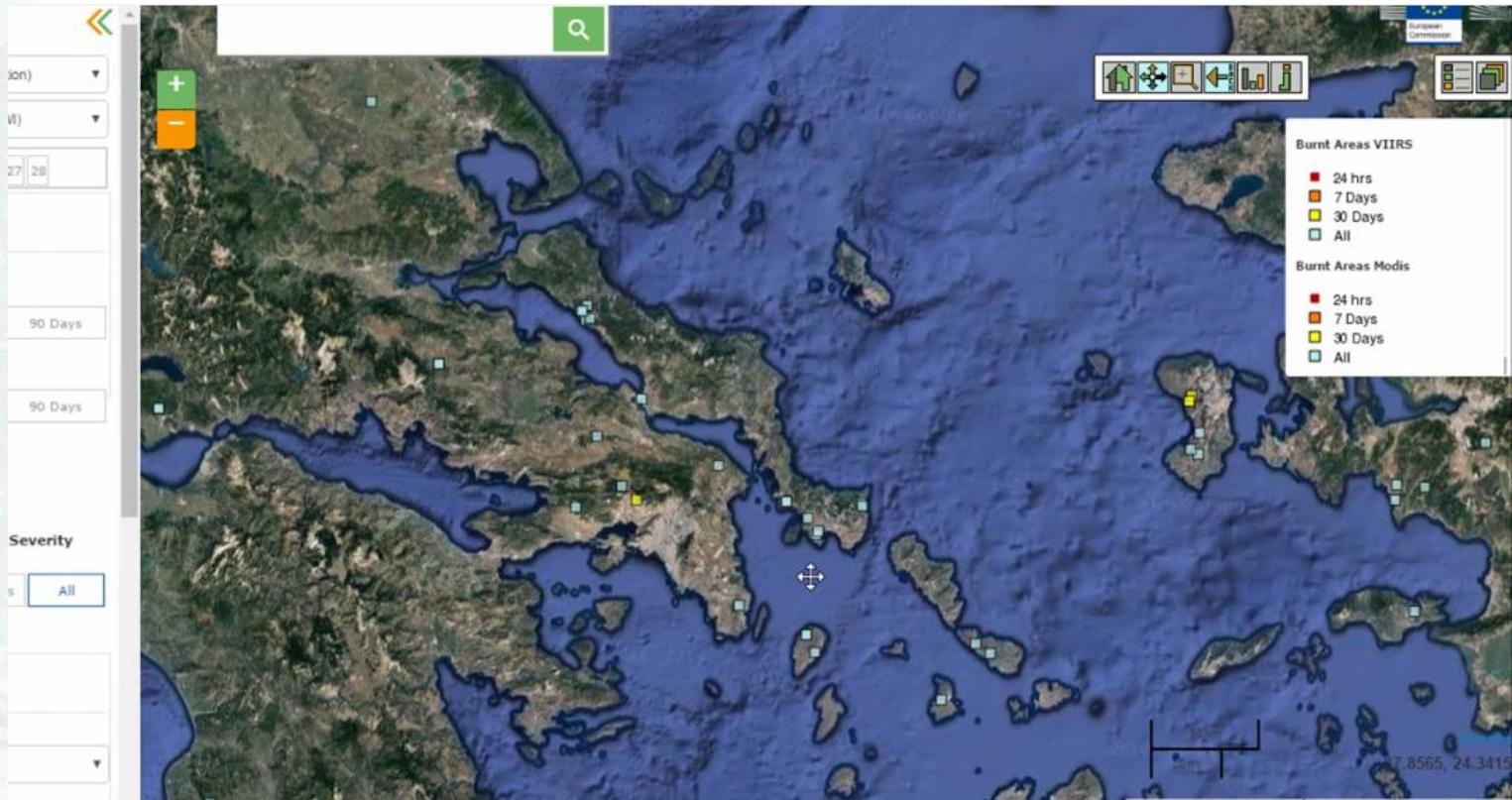
# Demonstration





# Demonstration

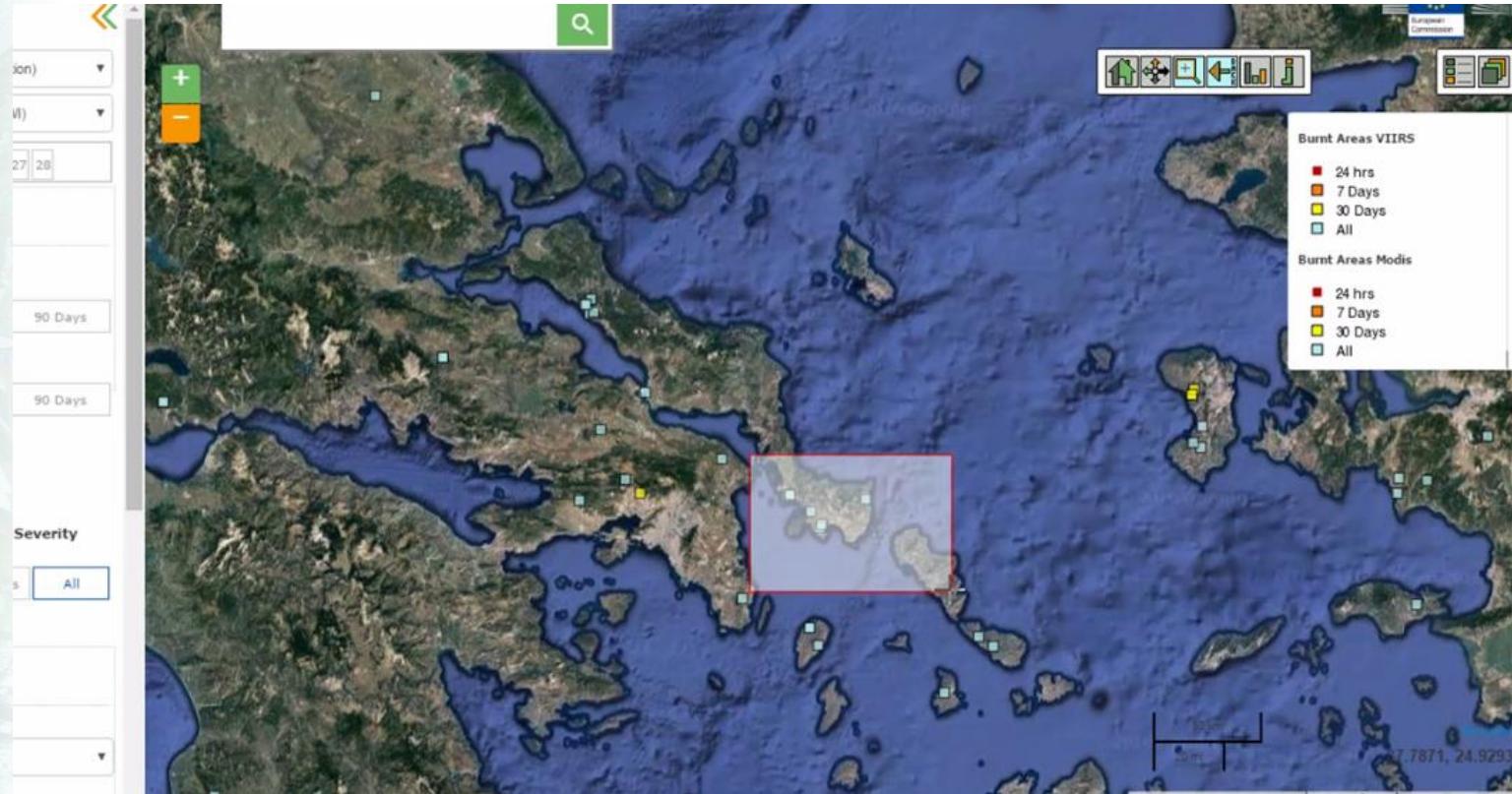
Copernicus





# Demonstration

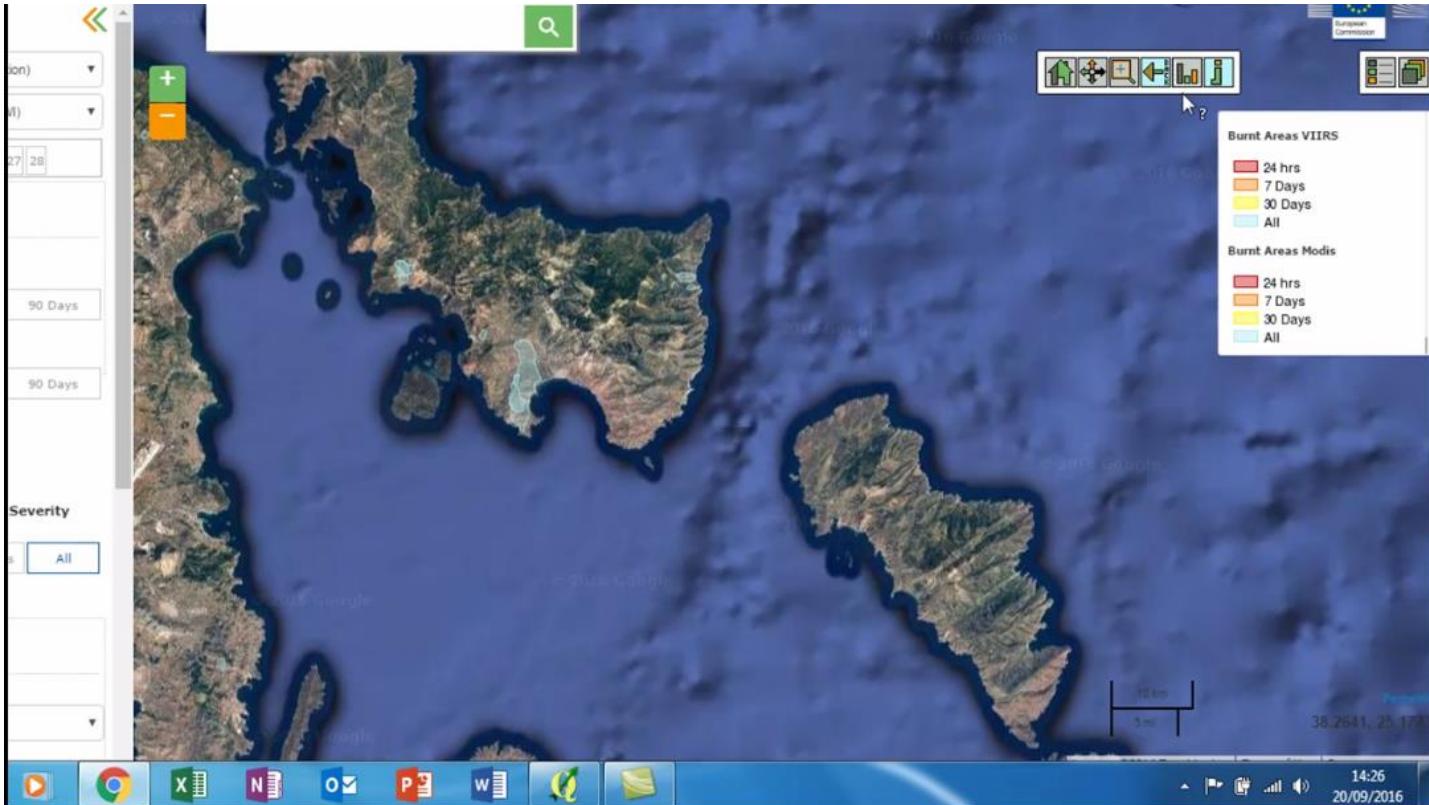
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# Demonstration

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# Demonstration

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21 22 23 24 25 26 27 28

**Alert Fires**

IS ⓘ

1rs 7 Days 90 Days

S ⓘ

1rs 7 Days 90 Days

**Burnt Areas**

Active Fires ⓘ

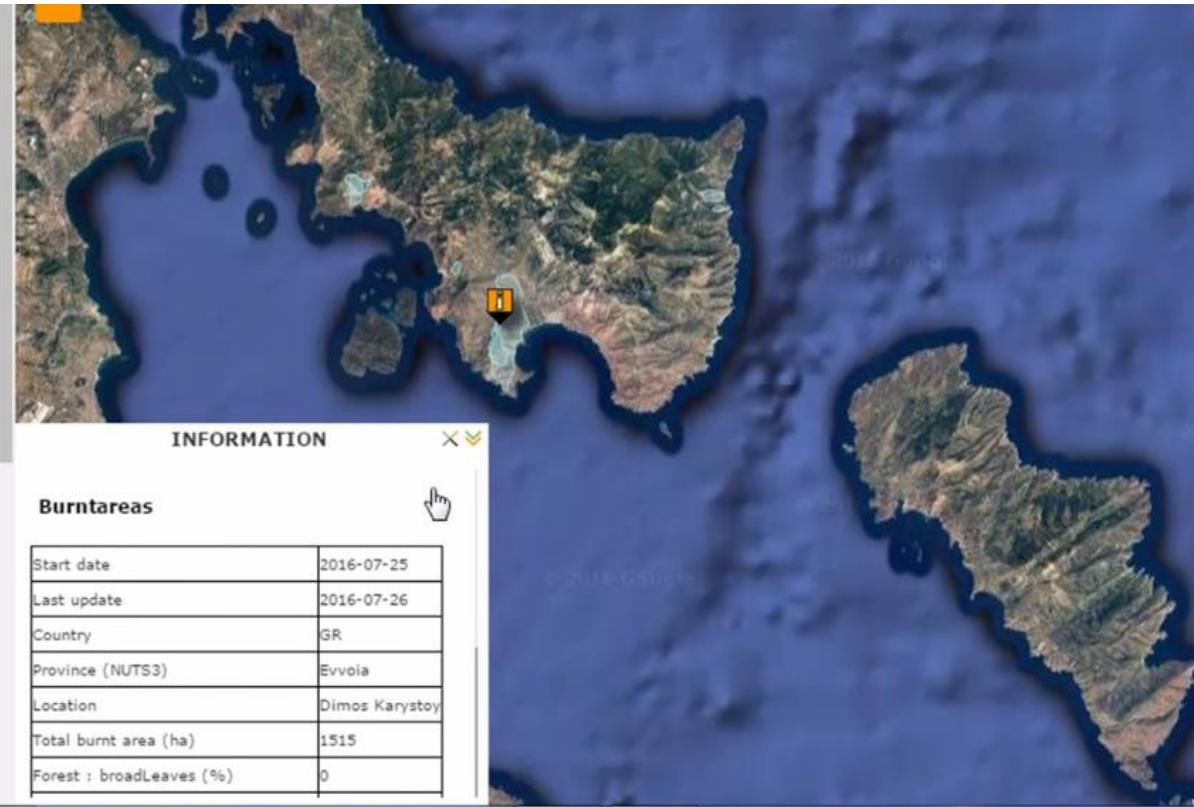
Burnt Areas ⓘ Fire Severity

7 Days 30 Days All

Country Boundaries ⓘ

**Area Locator**

▼





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# Demonstration

The screenshot shows a web browser window with the Copernicus Open Access Hub homepage. The page features a large central image of a satellite view of a coastal area with a red and green line overlay. At the top, there are tabs for "Planet Explorer Beta", "HTTPS - Welcome to ETRS89", and "Open Access Hub". A cookie consent message from ESA is displayed. The main header includes the Copernicus logo, the text "Copernicus Open Access Hub", and the European Space Agency (ESA) logo.

**Welcome to the Copernicus Open Access Hub**

The Copernicus Open Access Hub (previously known as Sentinel Scientific Data Hub) provides complete, free and open access to Sentinel-1, Sentinel-2 and Sentinel-3 user products, starting from the In-Orbit Commissioning Review (IDR).

**Access Points**

**Open Access Hub** : access point for all Sentinel missions with access to the interactive graphical user interface.  
**API Hub** : access point for API users with no graphical interface. All API users regularly downloading the latest data are encouraged to use this access point for a better performance.  
**Sentinel-2B Pre-operational Hub** : pre-operational access point for all users to Sentinel-2B data. **Login credentials** are s2bguest:s2bguest.  
**Sentinel-3A Pre-operational Hub** : pre-operational access point for all users to Sentinel-3 L1 and L2 Land data. **Login credentials** are s3guest:s3guest.

<https://scihub.copernicus.eu/>



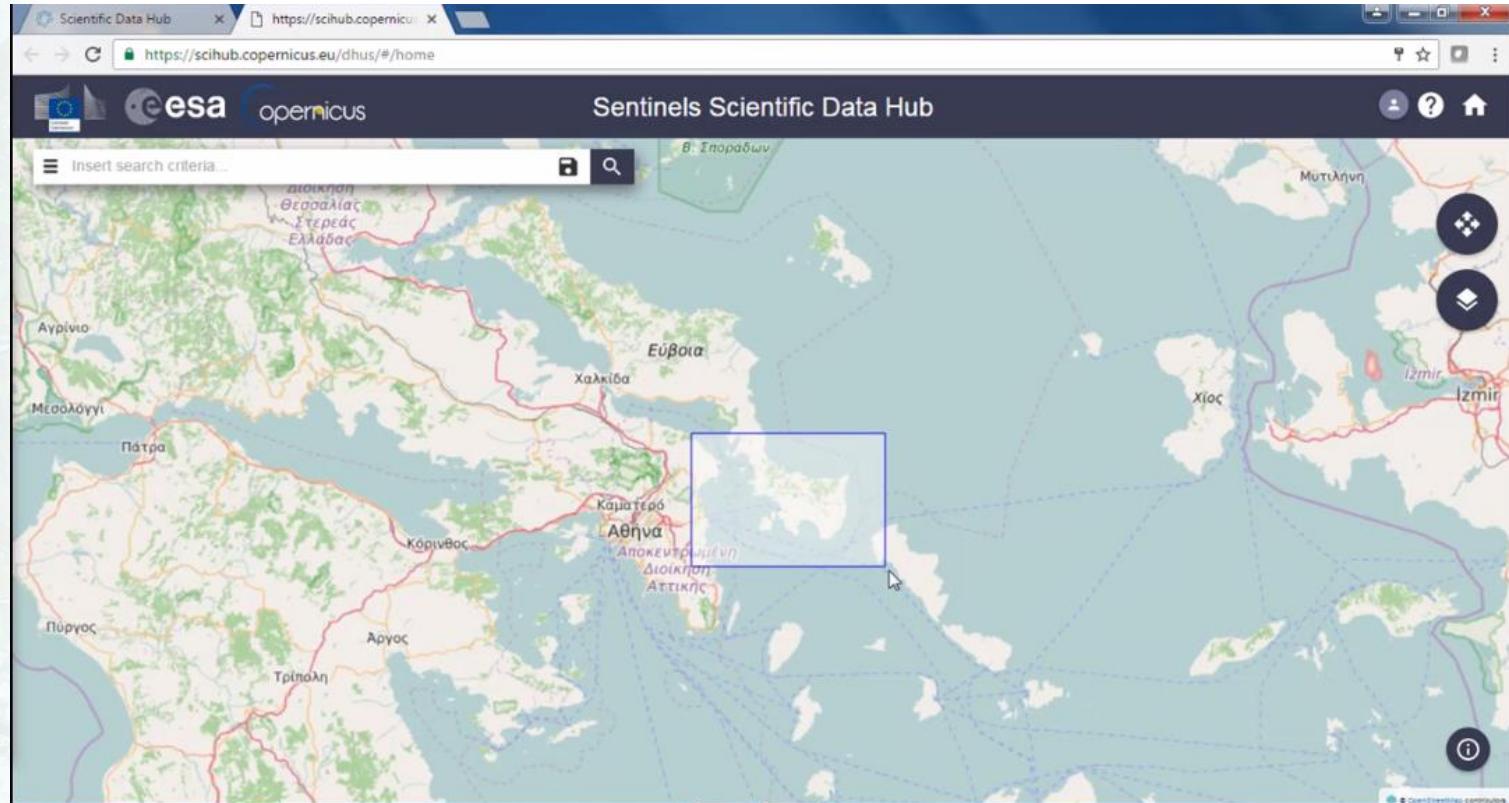
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# Demonstration

The screenshot shows the Sentinel's Scientific Data Hub interface. At the top, there is a header with the Copernicus logo, the ESA logo, and the OpenCOPERNICUS logo. The URL in the address bar is <https://scihub.copernicus.eu/dhus/#/home>. Below the header is a search bar with the placeholder "Insert search criteria..." and a magnifying glass icon. The main area features a map of Europe and parts of Africa and Asia. The map is color-coded by administrative boundaries and includes labels for various countries and cities. A legend in the bottom left corner indicates different land cover types. On the right side of the map, there are several circular icons with symbols: a hand with a star, a downward arrow, and an information sign. The map also shows various grid lines and labels for specific locations like London, Paris, and Istanbul.

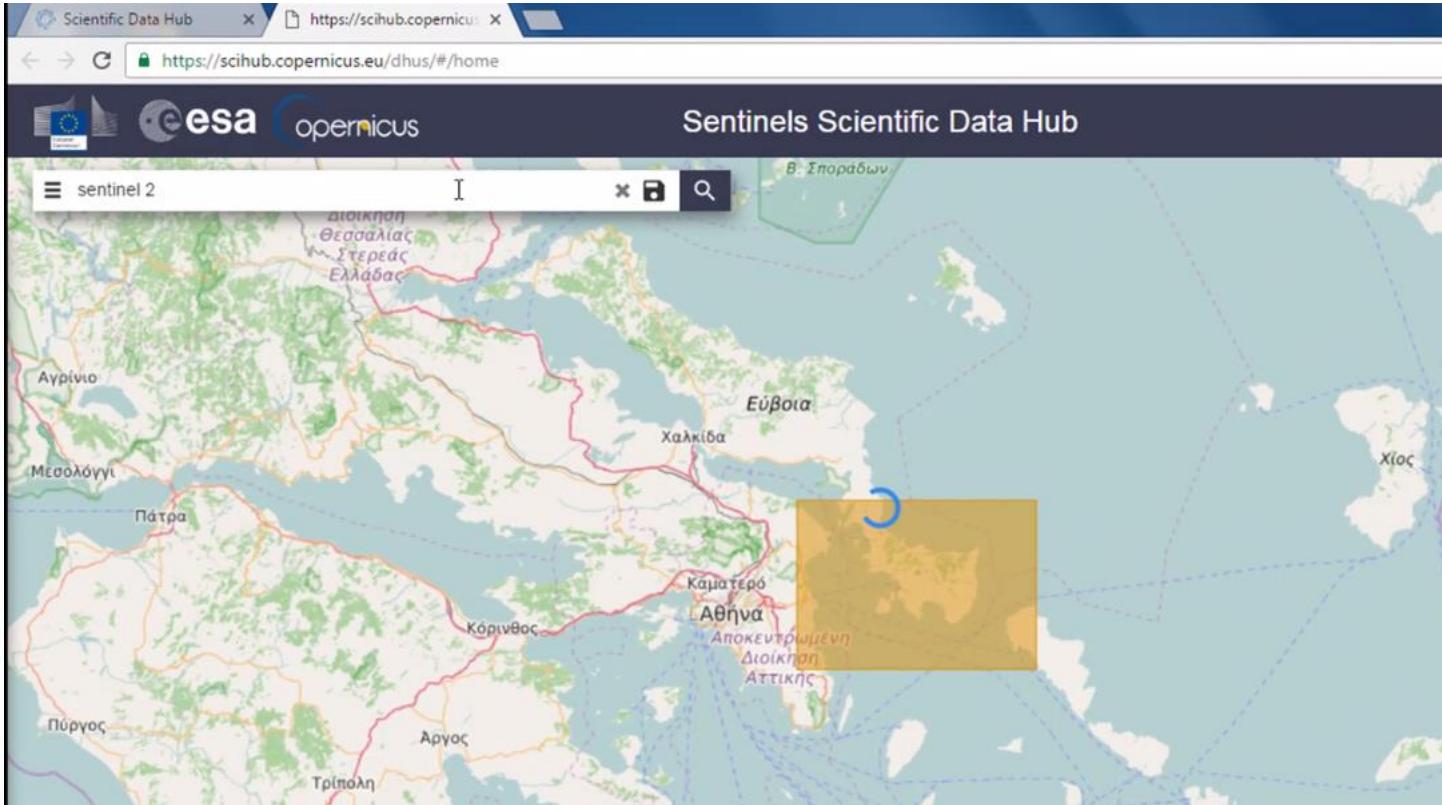


# Demonstration





# Demonstration





# Demonstration

Scientific Data Hub https://scihub.copernicus.eu/dhus/#/home

https://scihub.copernicus.eu/dhus/#/home

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Sentinels Scientific Data Hub

sentinel 2

Display 1 to 25 of 186 products.

Select All

Request Done: sentinel 2 AND ( footprint:"Intersects(POLYGON((23.95532720250994 37.824946288676,24.789690473425196,24.789690473425196,23.95532720250994,23.95532720250994,37.824946288676)))" )

S2A MSI S2A\_OPER\_PRD\_MSIL1C\_PDMC\_20160918T211146\_R050\_V20...

Download URL: https://scihub.copernicus.eu/dhusodata/v1/Products/20160918T211146\_R050\_V20...

Mission: Sentinel-2; Instrument: MSI; Sensing Date: 2016-09-18T09:06:22.000Z; Sl...

S2A MSI S2A\_OPER\_PRD\_MSIL1C\_PDMC\_20160918T210130\_R050\_V20...

Download URL: https://scihub.copernicus.eu/dhusodata/v1/Products/e0783721-6e...

Mission: Sentinel-2; Instrument: MSI; Sensing Date: 2016-09-18T09:06:22.000Z; Sl...

S2A MSI S2A\_OPER\_PRD\_MSIL1C\_PDMC\_20160918T204736\_R050\_V20...

Download URL: https://scihub.copernicus.eu/dhusodata/v1/Products/ee688bcc-c6...

Mission: Sentinel-2; Instrument: MSI; Sensing Date: 2016-09-18T09:10:06.000Z; Sl...

S2A MSI S2A\_OPER\_PRD\_MSIL1C\_PDMC\_20160918T203434\_R050\_V20...

Download URL: https://scihub.copernicus.eu/dhusodata/v1/Products/7acba311-a5...

Mission: Sentinel-2; Instrument: MSI; Sensing Date: 2016-09-18T09:10:06.000Z; Sl...

Map showing a polygon selection over land areas in Europe, specifically highlighting a yellow box over the Aegean Sea region. The map includes labels for countries like Greece, Turkey, and surrounding islands. A legend on the right shows symbols for zoom, search, and other functions.



# Demonstration

Scientific Data Hub <https://scihub.copernicus.eu/dhus/#/home>

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Sentinels Scientific Data Hub

sentinel 2

Relative Orbit Number (from 1 to 175)

Collection

Mission: Sentinel-2

Cloud Cover % (e.g.[0 TO 9.4])

Mission: Sentinel-3

B. Σητείας

Eύβοια

Ακίδα

Καματερό

Αθήνα



# Demonstration

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Scientific Data Hub https://scihub.copernicus.eu/dhus/#/home

https://scihub.copernicus.eu/dhus/#/home

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Sentinels Scientific Data Hub

sentinel 2

Advanced Search

Sensing period From: September 2016

Sun	Mon	Tue	Wed	Thu	Fri	Sat	
35	28	29	30	31	01	02	03
36	04	05	06	07	08	09	10
37	11	12	13	14	15	16	17
38	18	19	20	21	22	23	24
39	25	26	27	28	29	30	01
40	02	03	04	05	06	07	08

to: \_\_\_\_\_

to: \_\_\_\_\_

Product Type

Processor Mode

Today Clear Close

Eύβοια  
Ακίδα  
Καματερό  
Αθήνα



# Demonstration

Scientific Data Hub <https://scihub.copernicus.eu/dhus/#/home>

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## Sentinels Scientific Data Hub

Display 1 to 4 of 4 products.

Request Done: sentinel 2 AND ( footprint:"Intersects(POLYGON((23.95532720250994 37.824946288676,24.789690473425196,24.789690473425196,23.95532720250994,23.95532720250994,37.824946288676)))" )

**S2A MSI** S2A\_OPER\_PRD\_MSIL1C\_PDMC\_20160830T224721\_R050\_V20...  
Download URL: <https://scihub.copernicus.eu/dhus/bodata/v1/Products/9>  
Mission: Sentinel-2; Instrument: MSI; Sensing Date: 2016-08-29T09:05:

**S2A MSI** S2A\_OPER\_PRD\_MSIL1C\_PDMC\_20160830T210150\_R050\_V20...  
Download URL: <https://scihub.copernicus.eu/dhus/bodata/v1/Products/1>  
Mission: Sentinel-2; Instrument: MSI; Sensing Date: 2016-08-29T09:05:

**S2A MSI** S2A\_OPER\_PRD\_MSIL1C\_PDMC\_20160823T131711\_R050\_V20...  
Download URL: <https://scihub.copernicus.eu/dhus/bodata/v1/Products/9>  
Mission: Sentinel-2; Instrument: MSI; Sensing Date: 2016-08-19T09:10:

**S2A MSI** S2A\_OPER\_PRD\_MSIL1C\_PDMC\_20160823T131213\_R050\_V20...  
Download URL: <https://scihub.copernicus.eu/dhus/bodata/v1/Products/1>  
Mission: Sentinel-2; Instrument: MSI; Sensing Date: 2016-08-19T09:10:

Products per page: 25 << < page: 1 of 1 > >> CLOSE

Bilbilia  
Korce  
Bitola  
Apokentriki  
Dioikosi  
Makedonias  
- diktas  
Makedonias  
- diktas  
Alardia  
Apokentriki  
Dioikosi  
Oseolais  
- Stereas  
Elladas  
Apokentriki  
Dioikosi  
Pleiotomikos  
- diktas  
Elladas  
kabotou  
Ελλαδα  
Αθηνα  
Aydin  
Denizli  
Isparta  
Muğla  
Kuca  
Antalya  
Denizli  
Isparta  
Muğla  
Konya  
Karaman  
Mersin  
Kuropo  
- Kibris  
Limassol



# Demonstration

Scientific Data Hub <https://scihub.copernicus.eu/dhus/#/home>

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Sentinels Scientific Data Hub

S2A\_OPER\_PRD\_MSIL1C\_PDMC\_20160830T224721\_R050\_V20160829T090552\_20160829T090847

[https://scihub.copernicus.eu/dhus/odata/v1/Products\('9788e3b9-b13e-48b6-ade3-ce5295bbe9e2'\)/value](https://scihub.copernicus.eu/dhus/odata/v1/Products('9788e3b9-b13e-48b6-ade3-ce5295bbe9e2')/value)

Request Done: s2aOperPrdMsil1cPdmC\_20160830T224721R050V20160829T090552\_20160829T090847

Footprint

Quicklook

Attributes

Inspector

Summary

Date: 2016-08-29T09:05:52.000Z

S2A\_OPER\_PRD\_MSIL1C\_PDMC\_20160829T090552\_20160829T090847.SAFE

Products per page

← →

X Download

Map showing the footprint of a Sentinel-2 satellite over a rural area in Turkey, with a green polygon indicating the acquisition area. A Quicklook image shows a 5x5 grid of satellite tiles. An Inspector panel displays the product identifier S2A\_OPER\_PRD\_MSIL1C\_PDMC\_20160829T090552\_20160829T090847.SAFE.



# Demonstration

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The screenshot displays a web-based interface for managing Sentinel-2 satellite data products. On the left, a vertical sidebar lists several product thumbnails, each with 'S2A MSI S2A...' labels. The main content area is divided into two sections: 'Attributes' and 'Inspector'.

**Attributes** section:

- Summary**
  - Date: 2016-08-29T09:05:52.000Z
  - Filename: S2A\_OPER\_PRD\_MSIL1C\_PDMC\_20160830T224721\_R050\_V20160829T0905
  - Identifier: S2A\_OPER\_PRD\_MSIL1C\_PDMC\_20160830T224721\_R050\_V20160829T0905
  - Instrument: MSI
  - Satellite: Sentinel-2
  - Size: 5.67 GB
- Product**
- Instrument**

**Inspector** section:

- S2A\_OPER\_PRD\_MSIL1C\_PDMC\_20160830T224721\_R050\_V20160829T0905
  - AUX\_DATA
  - DATASTRIP
  - GRANULE
  - HTML
  - rep\_info
  - INSPIRE.xml
  - S2A\_OPER\_MTD\_SAFL1C\_PDMC\_20160830T224721\_R050\_V20160829T0905
  - manifest.safe



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# Demonstration

sentinel 2

S2A\_OPER\_PRD\_MSIL1C\_PDMC\_20160830T224721\_R050\_V20160829T090552\_20160829T090847

Display 1 to 4 of 4

Request Done: sentinel 2

footprint:"Intersection of S2A and MSI footprints"

37.824946288676,25.942561829868403  
37.92520367201223,25.96641748120883  
37.94806337880557,25.974133476637995  
38.094605094263365,26.02365796573396  
38.24127441200121,26.072978836566246  
38.387781352702895,26.123352257124623  
38.534376174523885,26.173886023184043  
38.681050125939706,26.22450524977468  
38.82774528664677,26.275254000509268  
38.84524306097101,26.28132116962585  
38.84524306097101,26.281321169625848  
38.97435777818509,26.326090339136293  
39.12092792828411,26.37679186850775  
39.267241911736505,26.42824002356057  
39.413572535392014,26.479407759935032  
39.56008752220362,26.52958429995324  
39.659060091646644,26.56392245309749  
39.706494138919325,26.58037951376255  
39.74785808141946,26.595310107396948  
39.852485749144094,26.633076168736626  
39.99903498468286,26.684068311953418  
40.14544171247748,26.736021537957733  
40.29169021549722,26.78913167026636  
40.437949698945935,26.842420969749345  
40.58135660310608,26.896286617009813

S2A MSI S2A MSI S2A MSI S2A MSI

Download Missions

S2A MSI S2A MSI S2A MSI S2A MSI

Download Missions

S2A MSI S2A MSI S2A MSI S2A MSI

Download Missions





# Demonstration

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Sentinel Scientific Data Hub

S2A\_OPER\_PRD\_MSIL1C\_PDMC\_20160830T224721\_R050\_V20160829T090552\_20160829T090847

Mission datatake id: GS2A\_20160829T090552\_006196\_N02.04

Orbit number (start): 6196

Pass direction: DESCENDING

Processing baseline: 02.04

Processing level: Level-1C

Product type: S2MSI1C

Radiometric quality: PASSED

Relative orbit (start): 50

Sensing start: 2016-08-29T09:05:52.000Z

Sensing stop: 2016-08-29T09:08:47.000Z

Sensor quality: PASSED

Instrument

Platform

Products per page

◀ ▶

X

Download

Map

Legend

Help

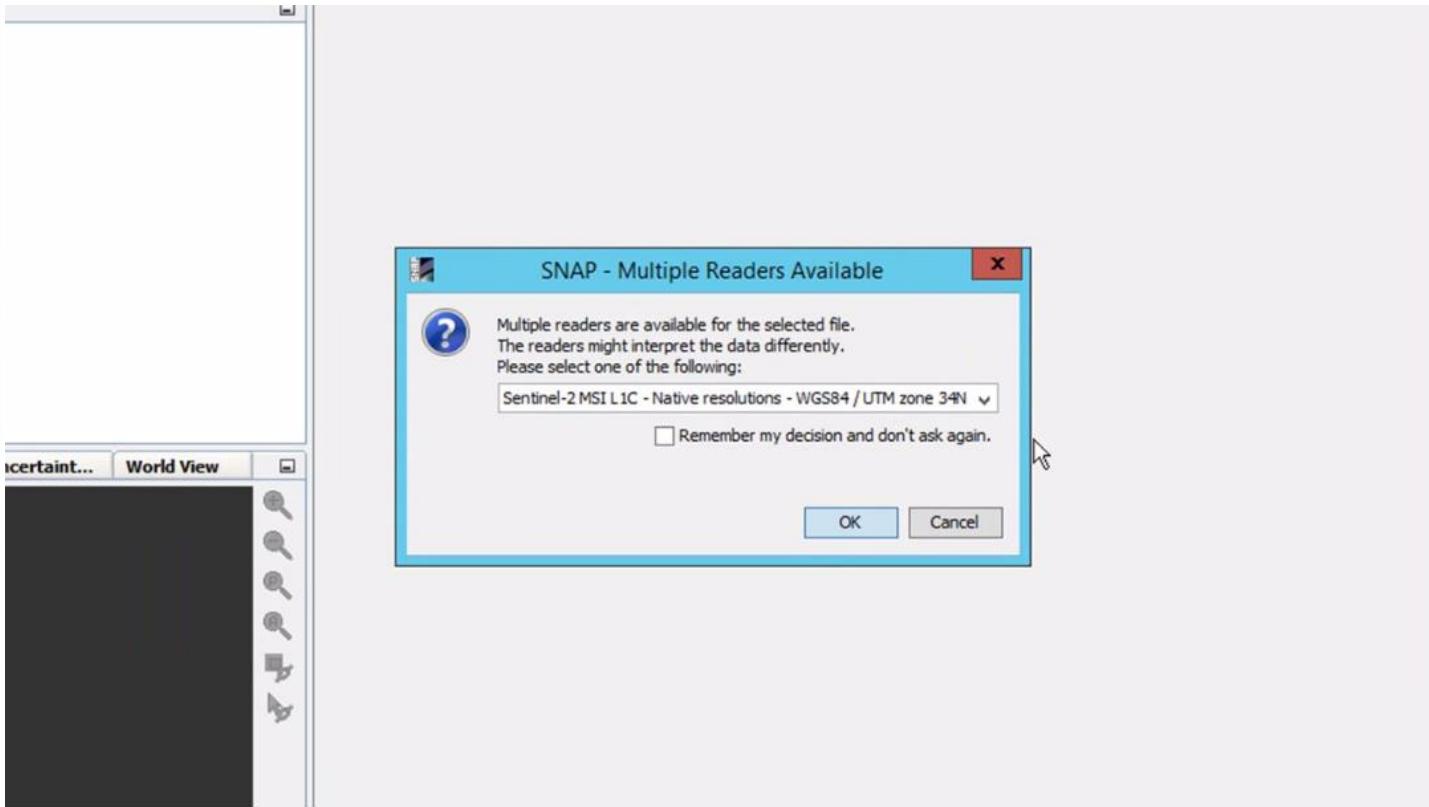
Home

Çankırı  
Kırıkkale  
Yozgat  
Nevşehir  
Aksaray  
Niğde  
Karaman  
Mersin  
Kıbrıs - Cyprus  
Limassol



Copernicus

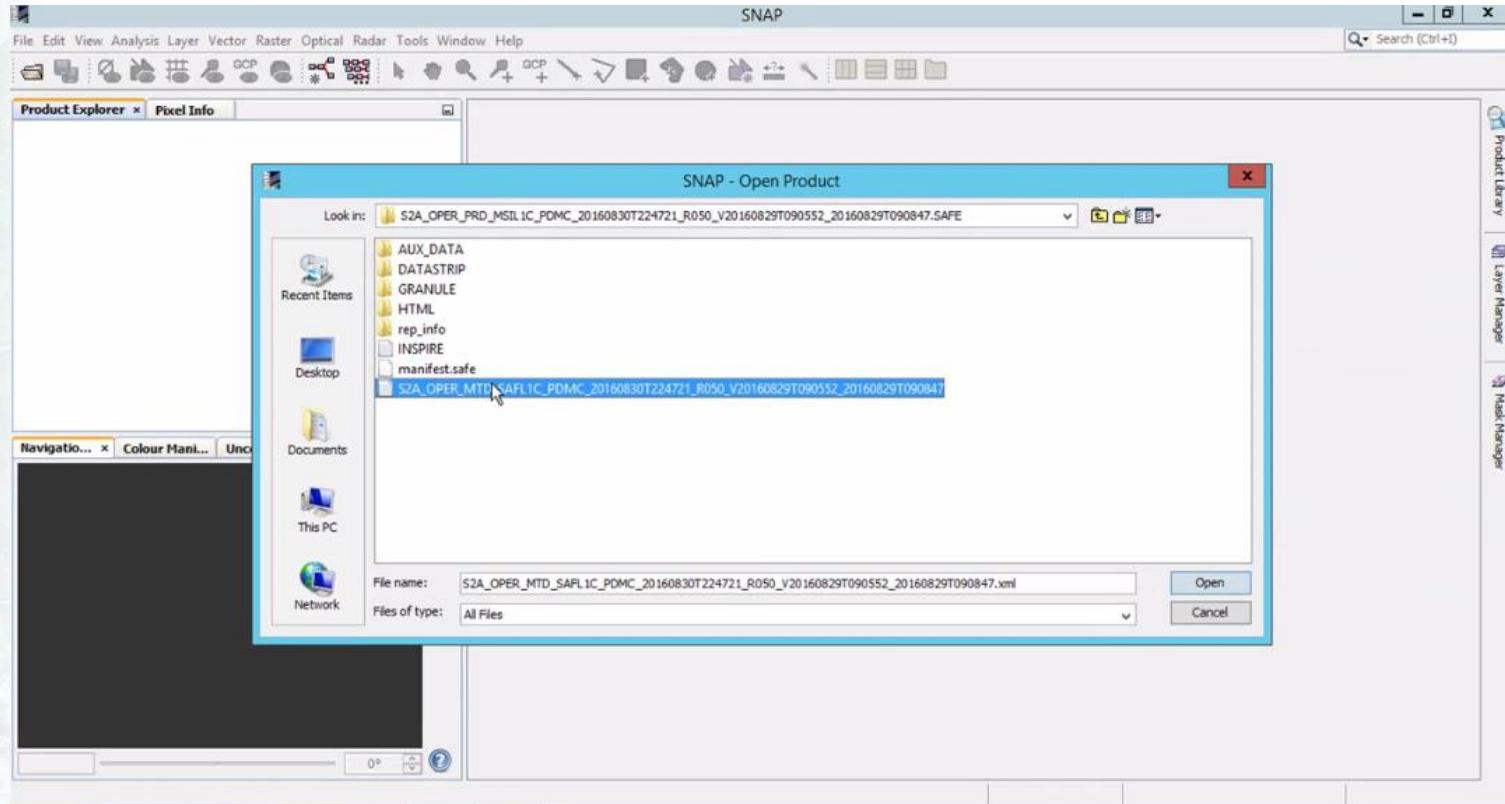
# Demonstration





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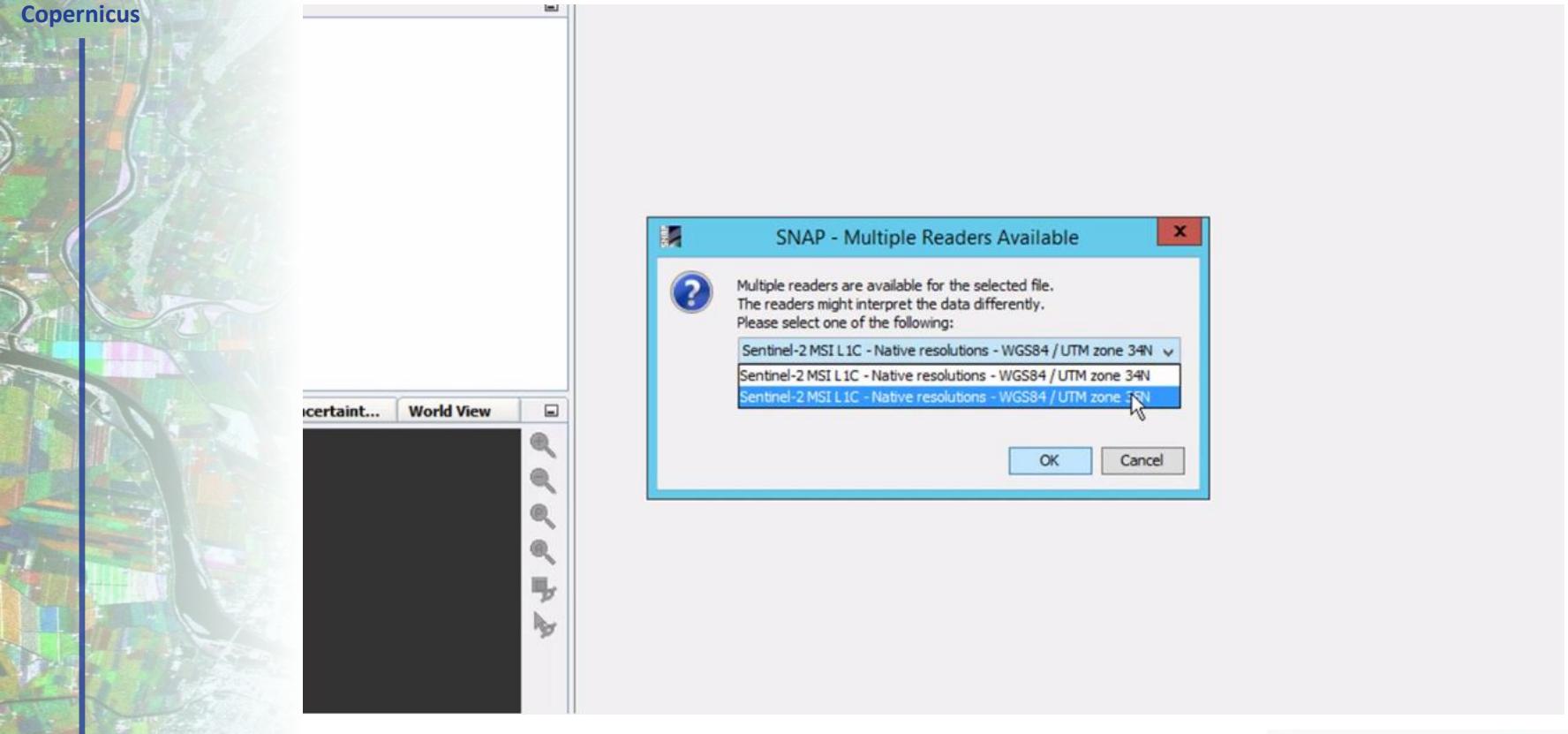
# Demonstration





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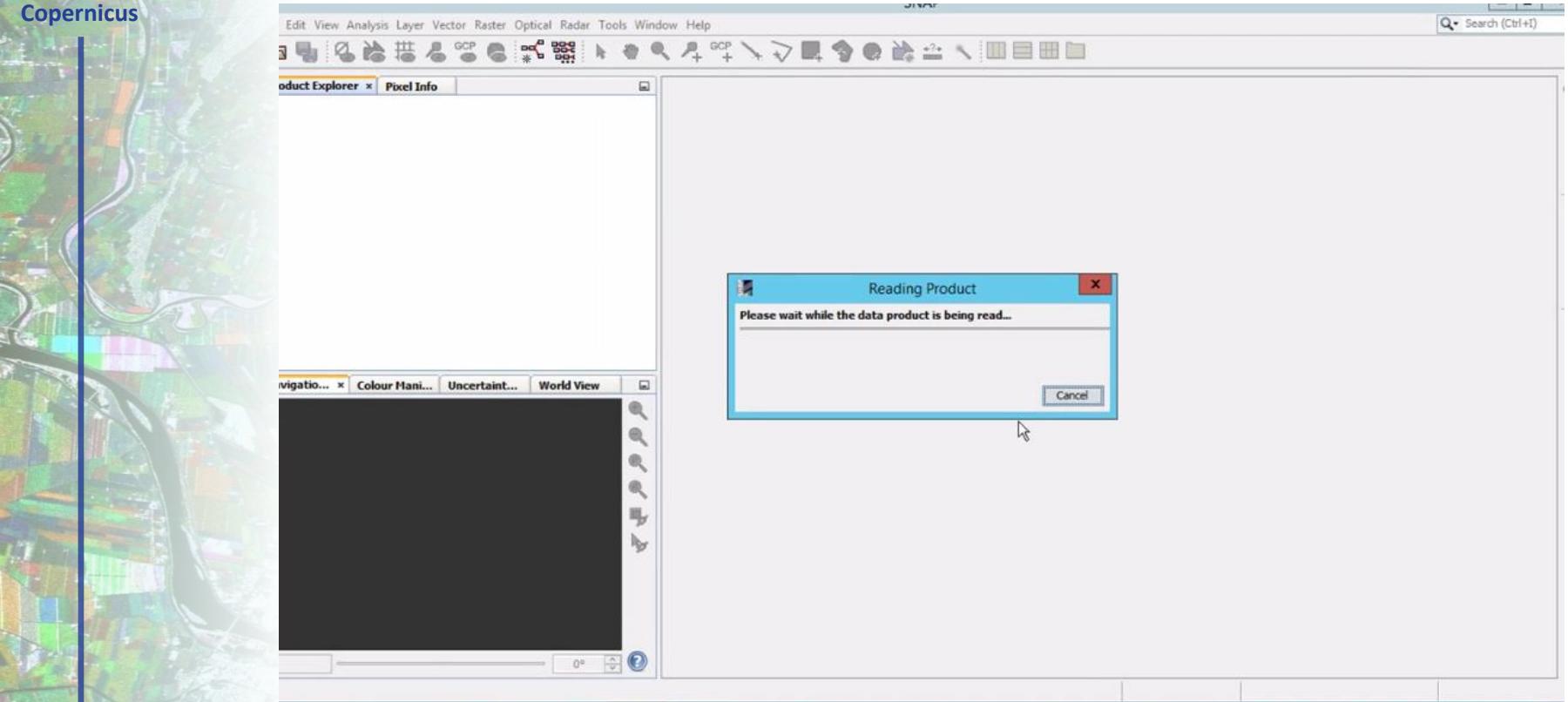
# Demonstration





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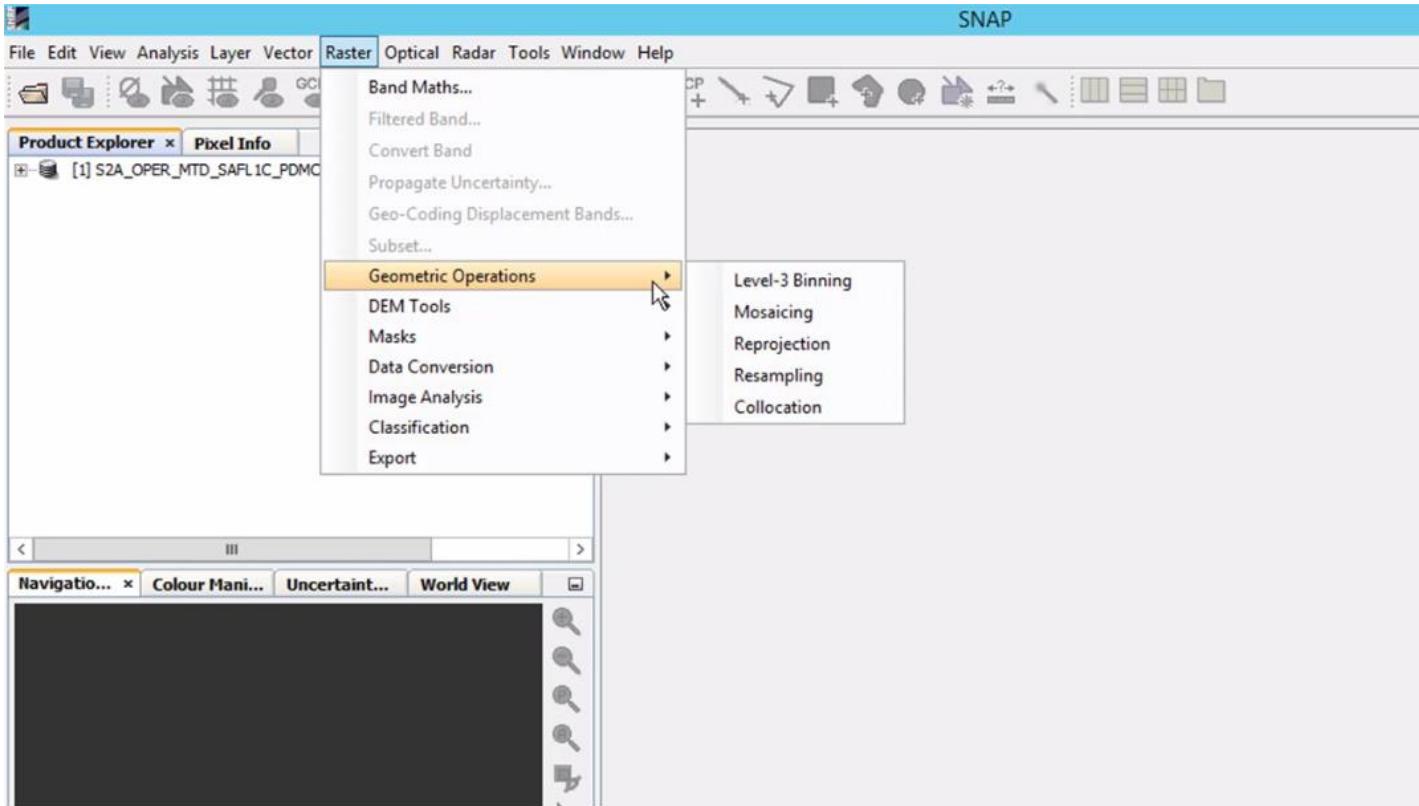
# Demonstration





# Demonstration

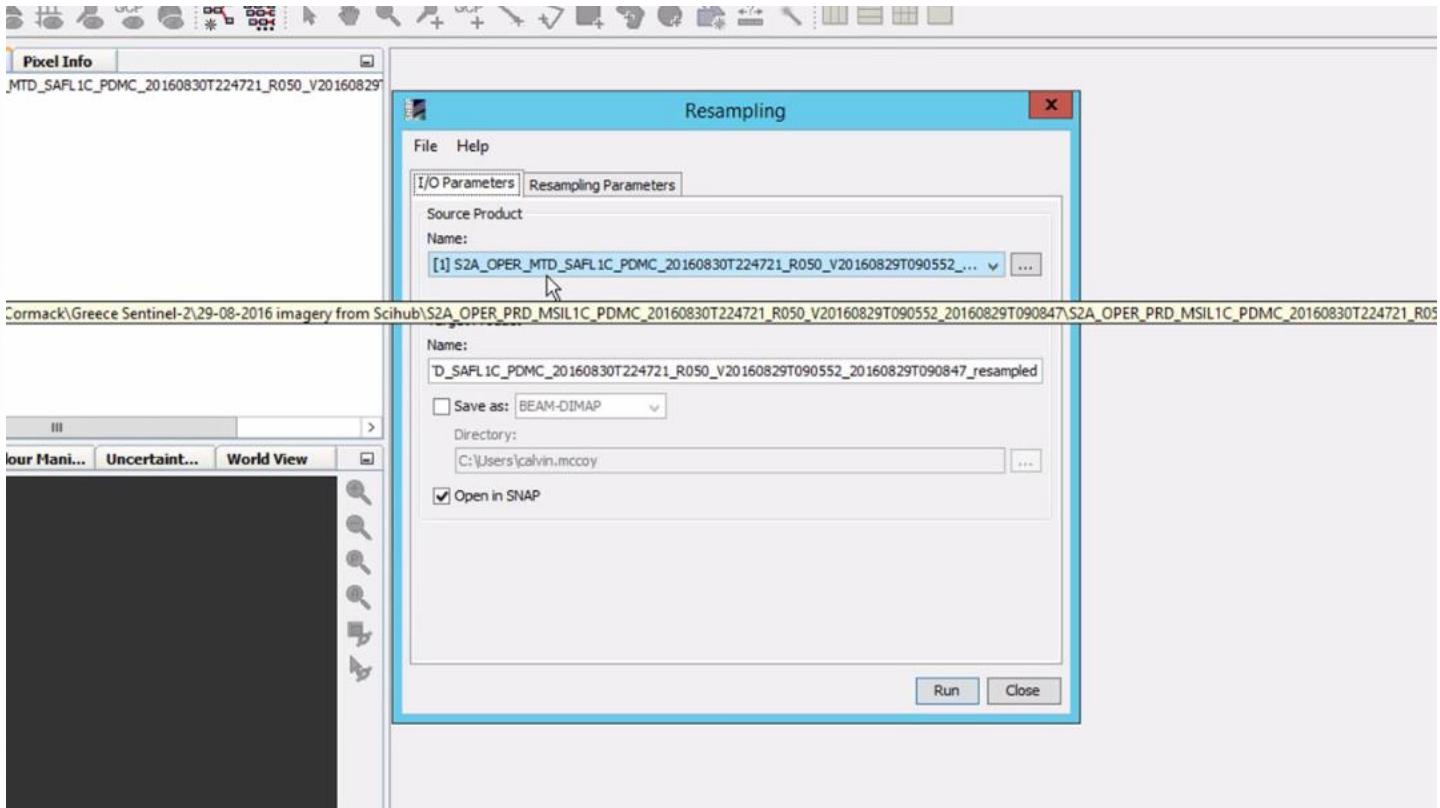
Copernicus





# Demonstration

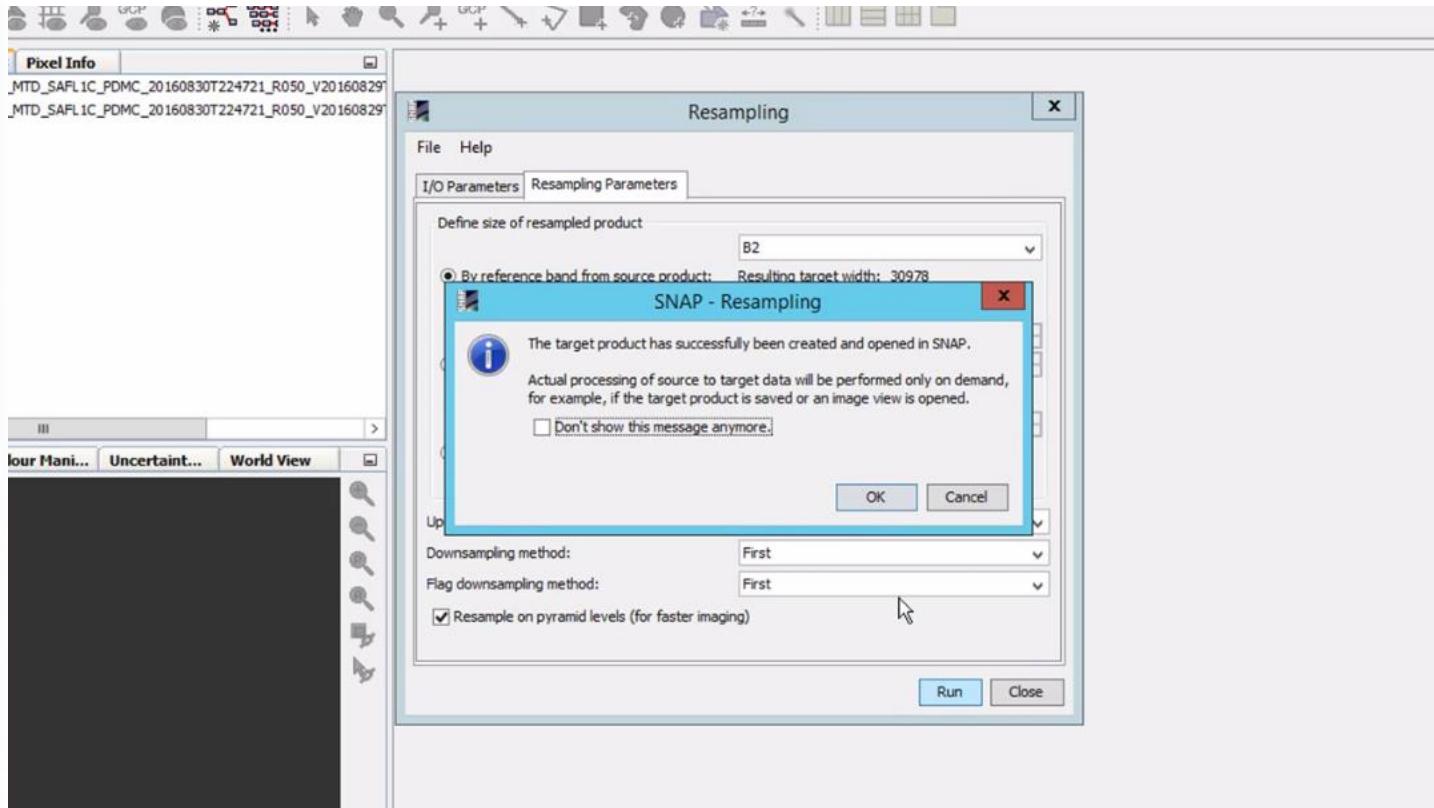
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# Demonstration

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# Demonstration

The screenshot shows the SNAP (Sentinel Application Platform) software interface. The main window displays a satellite image of a rural landscape with fields and a river. The top menu bar includes File, Edit, View, Analysis, Layer, Vector, Raster, Optical, Radar, Tools, Window, and Help. A toolbar with various icons is located above the main workspace. On the left, a 'Product Explorer' panel lists two items: [1] S2A\_OPER\_MTD\_SAFL1C\_PDMC\_20160830T224721\_R050\_V20160829T090552\_20160829T090847\_resampled - [not saved] - SNAP and [2] S2A\_OPER\_MTD\_SAPI1C\_PDMC\_20160830T224721\_R050\_V20160829T090552\_20160829T090847\_resampled - [not saved] - SNAP. Below the Product Explorer is a 'Navigation' panel with tabs for Colour Man..., Uncertain..., and World View. The main workspace is currently empty, showing a black area where the image would normally be displayed. The bottom right corner of the workspace has zoom controls: X -- Y --, Lat -- Lon --, and Zoom -- Level --.



# Demonstration

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The screenshot shows a geospatial analysis software interface. At the top, there is a menu bar with options: File, Edit, View, Analysis, Layer, Vector, Raster, Optical, Radar, Tools, Window, and Help. Below the menu bar is a toolbar with various icons for file operations, selection, measurement, and editing.

The main window is divided into several panels:

- Product Explorer**: A tree view showing two entries under [1] S2A\_OPER\_MTD\_SAFL1C\_PDMC\_20160830T224721\_R050\_V20160829:
  - [1] S2A\_OPER\_MTD\_SAFL1C\_PDMC\_20160830T224721\_R050\_V20160829
  - [2] S2A\_OPER\_MTD\_SAFL1C\_PDMC\_20160830T224721\_R050\_V20160829
    - Metadata
    - Vector Data
    - Bands (selected)
    - Masks
- Navigation**: A panel at the bottom left containing tabs for Colour Man..., Uncertain..., and World View. It includes a search bar and zoom controls.
- Map View**: The main area of the interface, showing a satellite map of a rural landscape with fields and roads.



# Demonstration

Copernicus

The screenshot shows a geospatial analysis software interface with the following components:

- Top Bar:** File, Edit, View, Analysis, Layer, Vector, Raster, Optical, Radar, Tools, Window, Help.
- Toolbar:** Includes icons for file operations (New, Open, Save, Print), selection tools (Select, Selection, Selection with Mask), measurement (Ruler, Distance, Area), and other functions (GCP, Vector Tools, Raster Tools, World View).
- Product Explorer:** A tree view showing the structure of the dataset:
  - Bands
    - sun
    - view
    - B1 (443 nm)
    - B2 (490 nm)
    - B3 (560 nm)
    - B4 (665 nm)
    - B5 (705 nm)
    - B6 (740 nm)
    - B7 (783 nm)
    - B8 (842 nm)
    - B8A (865 nm)
    - B9 (945 nm)
    - B10 (1375 nm)
    - B11 (1610 nm)
    - B12 (2190 nm)
- Navigation:** Includes tabs for Colour Mani..., Uncertain..., and World View, along with zoom and search tools.
- Background:** A satellite image of agricultural fields and roads.



# Demonstration



S2A\_OPER\_MTD\_SAFL1C\_PDMC\_20160830T224721\_R050\_V20160829T090552\_20160829T090847\_resampled - [not saved] - [B3] - SNAP

File Edit View Analysis Layer Vector Raster Optical Radar Tools Window Help

Product Explorer x Pixel Info

Bands

- sun
- view
- B1 (443 nm)
- B2 (490 nm)
- B3 (560 nm)**
- B4 (665 nm)
- B5 (705 nm)
- B6 (740 nm)
- B7 (783 nm)
- B8 (842 nm)
- B8A (865 nm)
- B9 (945 nm)
- B10 (1375 nm)
- B11 (1610 nm)
- R12 (2100 nm)

Navigation... x Colour Mani... Uncertain... World View

1: 521.51 0°

[2] B3

Product Library Layer Manager Mask Manager



# Demonstration

Copernicus

S2A\_OPER\_MTD\_SAFL1C\_PDMC\_20160830T224721\_R050\_V20160829T090552\_20160829T090847\_resampled - [not saved] - [B3] - SNAP

File Edit View Analysis Layer Vector Raster Optical Radar Tools Window Help

Product Explorer x Pixel Info

Bands

- sun
- view
- B1 (443 nm)
- B2 (490 nm)
- B3 (560 nm)
- B4 (665 nm)
- B5 (705 nm)
- B6 (740 nm)
- B7 (783 nm)
- B8 (842 nm)
- B8A (865 nm)
- B9 (945 nm)
- B10 (1375 nm)
- B11 (1610 nm)
- B12 (2190 nm)

Navigation x Colour Mani... Uncertain... World View

1 : 70.24 0°

+

X 6586 Y 30186 Lat 37°54'02"N Lon 24°20'12"E Zoom 1:70.2 Level 2

Product Library

Layer Manager

Mask Manager



# Demonstration

Copernicus

S2A\_OPER\_MTD\_SAFL1C\_PDMC\_20160830T224721\_R050\_V20160829T090552\_20160829T0908

File Edit View Analysis Layer Vector Raster Optical Radar Tools Window Help

Product Explorer x Pixel Info

Bands

- sun
- view
- B1 (443 nm)
- B2 (490 nm)
- B3 (560 nm)
- B4 (665 nm)
- B5 (705 nm)
- B6 (740 nm)
- B7 (783 nm)
- B8 (842 nm)
- B8A (865 nm)
- B9 (945 nm)
- B10 (1375 nm)
- B11 (1610 nm)
- B12 (2190 nm)

Raster

- Band Maths...
- Filtered Band...
- Convert Band
- Propagate Uncertainty...
- Geo-Coding Displacement Bands...
- Subset... **Selected**
- Geometric Operations
- DEM Tools
- Masks
- Data Conversion
- Image Analysis
- Classification
- Export

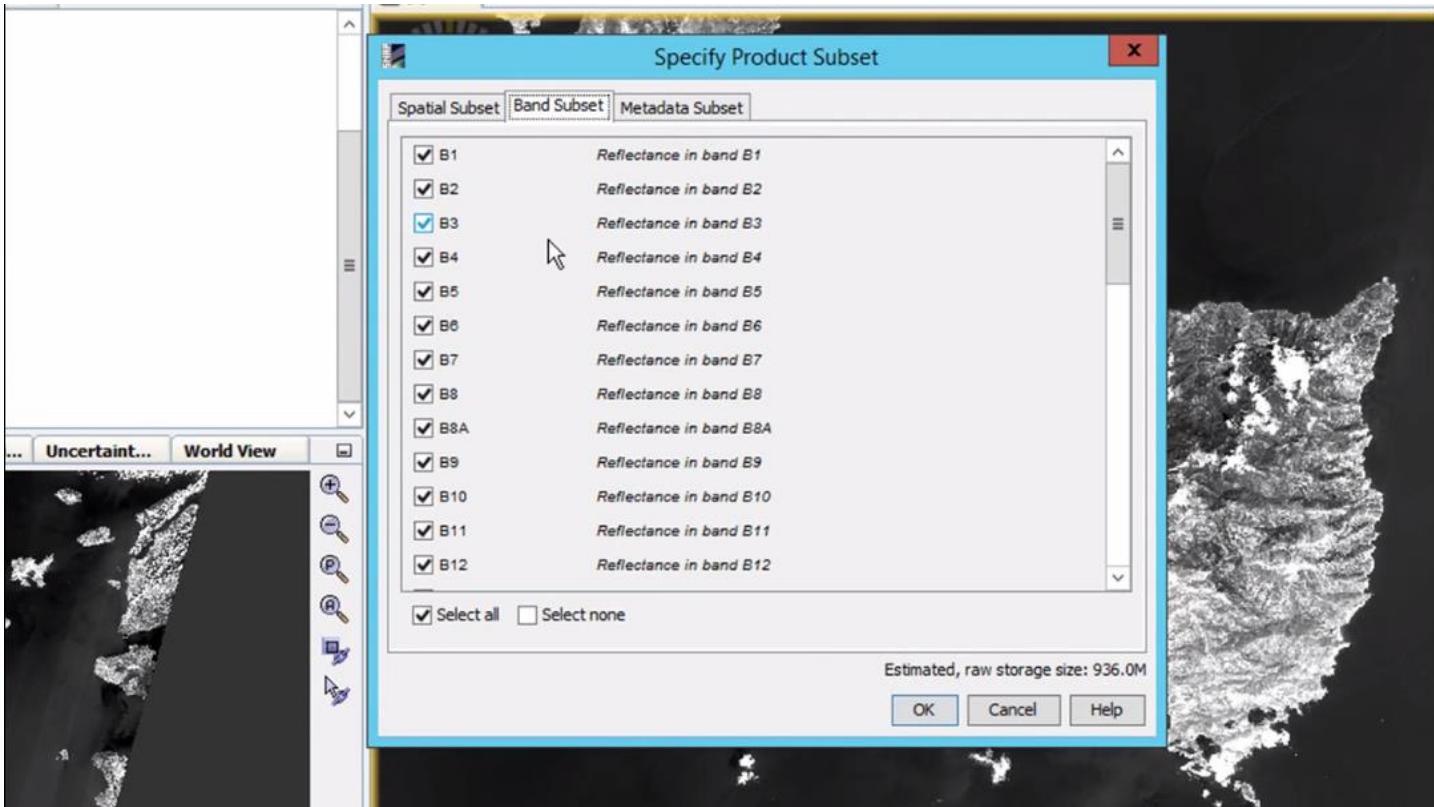
Navigation x Colour Management x Uncertainty x World View

The screenshot shows a software interface for processing satellite imagery. The main window displays a grayscale satellite image of a coastal area with complex terrain. A context menu is open over the image, specifically under the 'Raster' menu. The 'Subset...' option is highlighted with a yellow background and a cursor arrow pointing to it. The menu also includes other options like 'Band Maths...', 'Filtered Band...', 'Convert Band', 'Propagate Uncertainty...', 'Geo-Coding Displacement Bands...', 'Geometric Operations', 'DEM Tools', 'Masks', 'Data Conversion', 'Image Analysis', 'Classification', and 'Export'. The top bar of the software includes the file name 'S2A\_OPER\_MTD\_SAFL1C\_PDMC\_20160830T224721\_R050\_V20160829T090552\_20160829T0908', followed by standard menu items: File, Edit, View, Analysis, Layer, Vector, Raster, Optical, Radar, Tools, Window, and Help. Below the menu bar are several tool icons. On the left side, there's a 'Product Explorer' panel showing a tree view of bands and a 'Pixel Info' panel. At the bottom, there are tabs for 'Navigation', 'Colour Management', 'Uncertainty', and 'World View', along with some zoom and search tools.



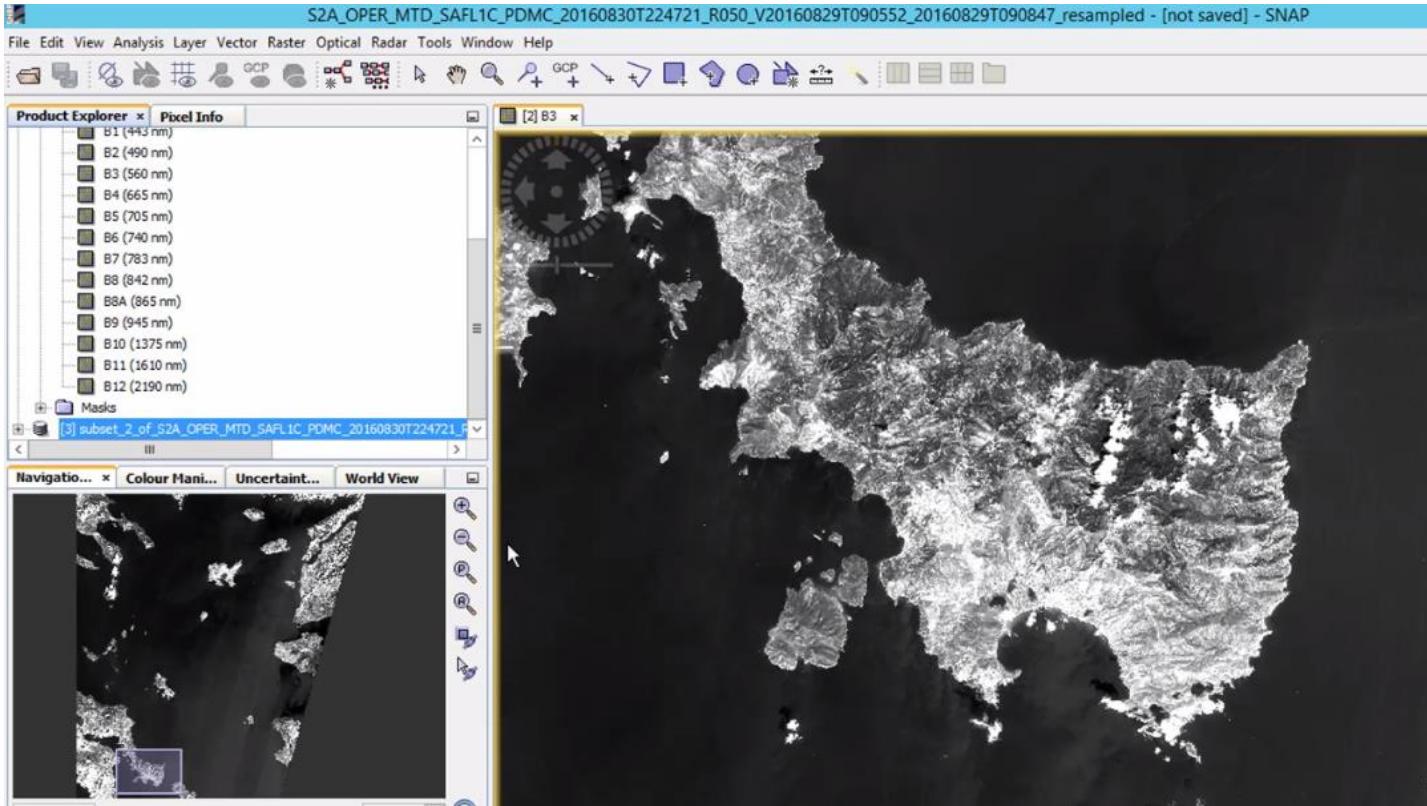
# Demonstration

Copernicus





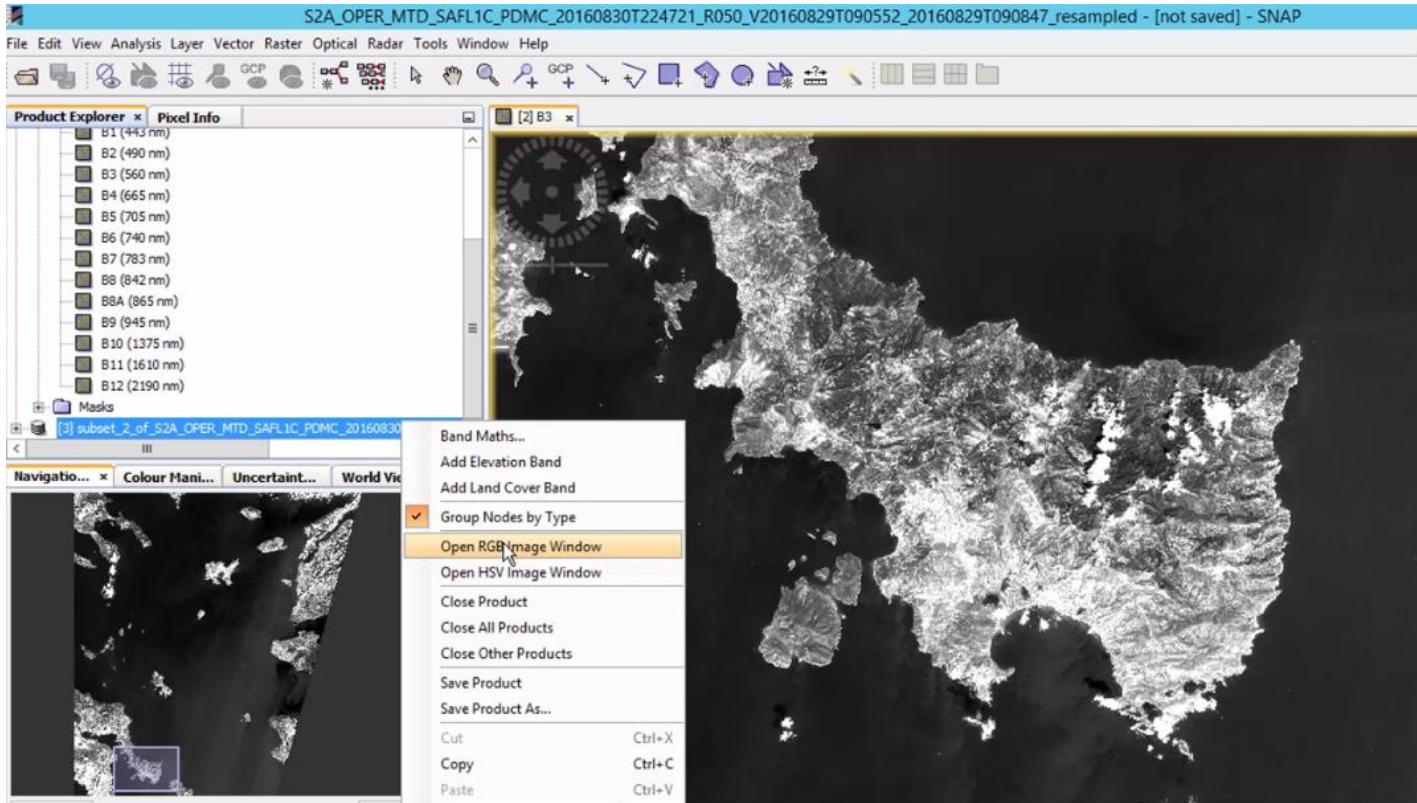
# Demonstration





# Demonstration

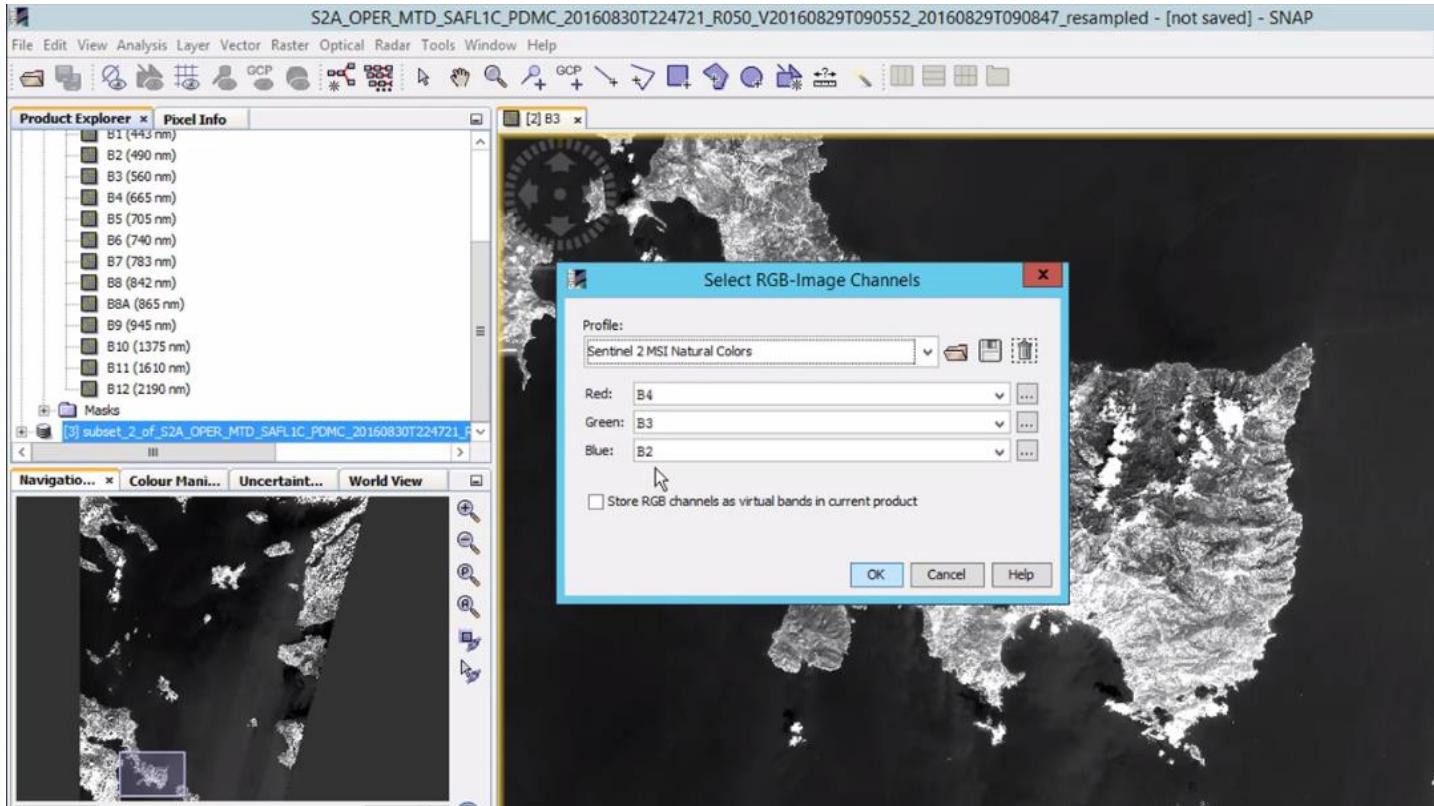
Copernicus





# Demonstration

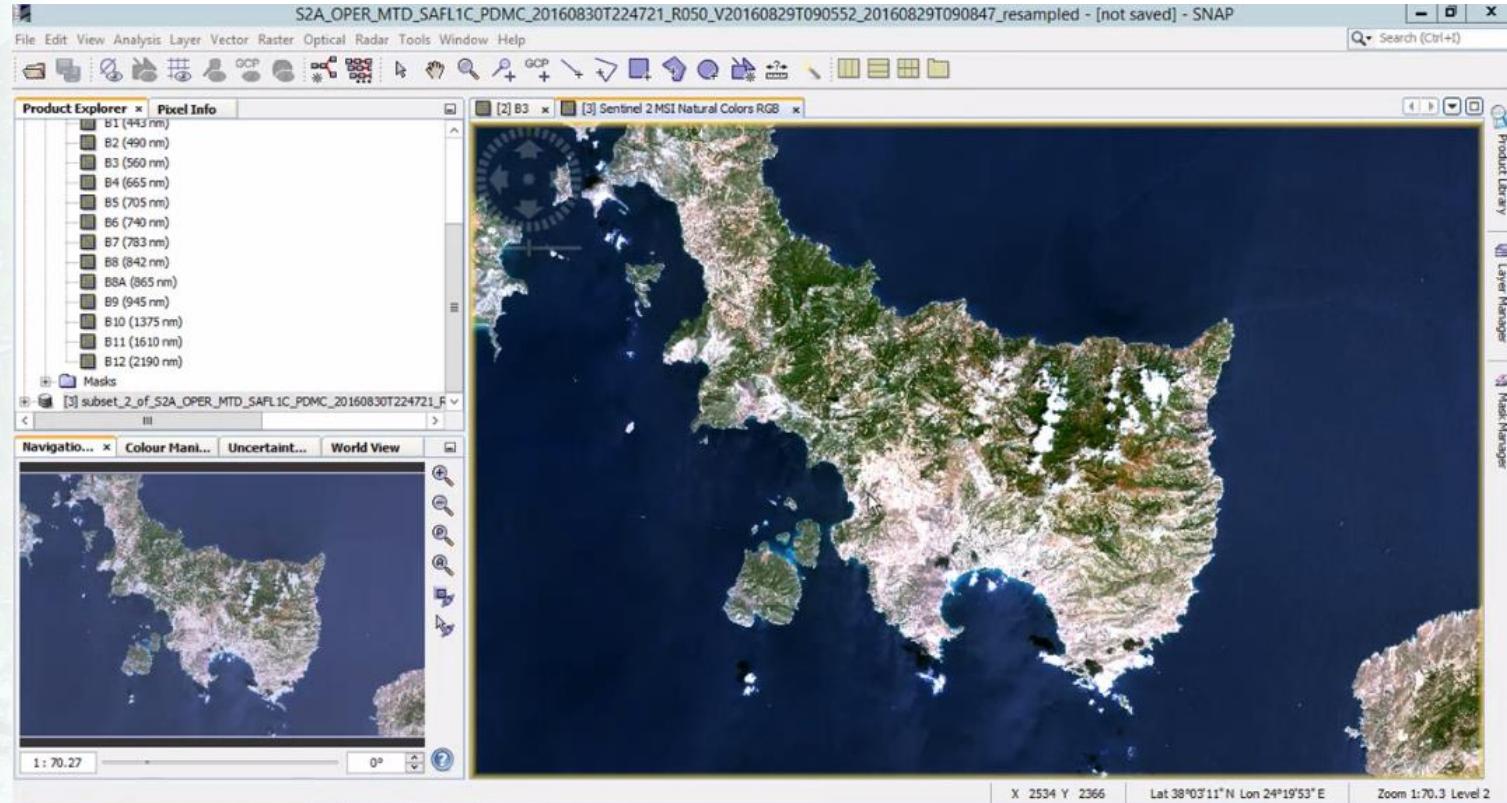
Copernicus





# Demonstration

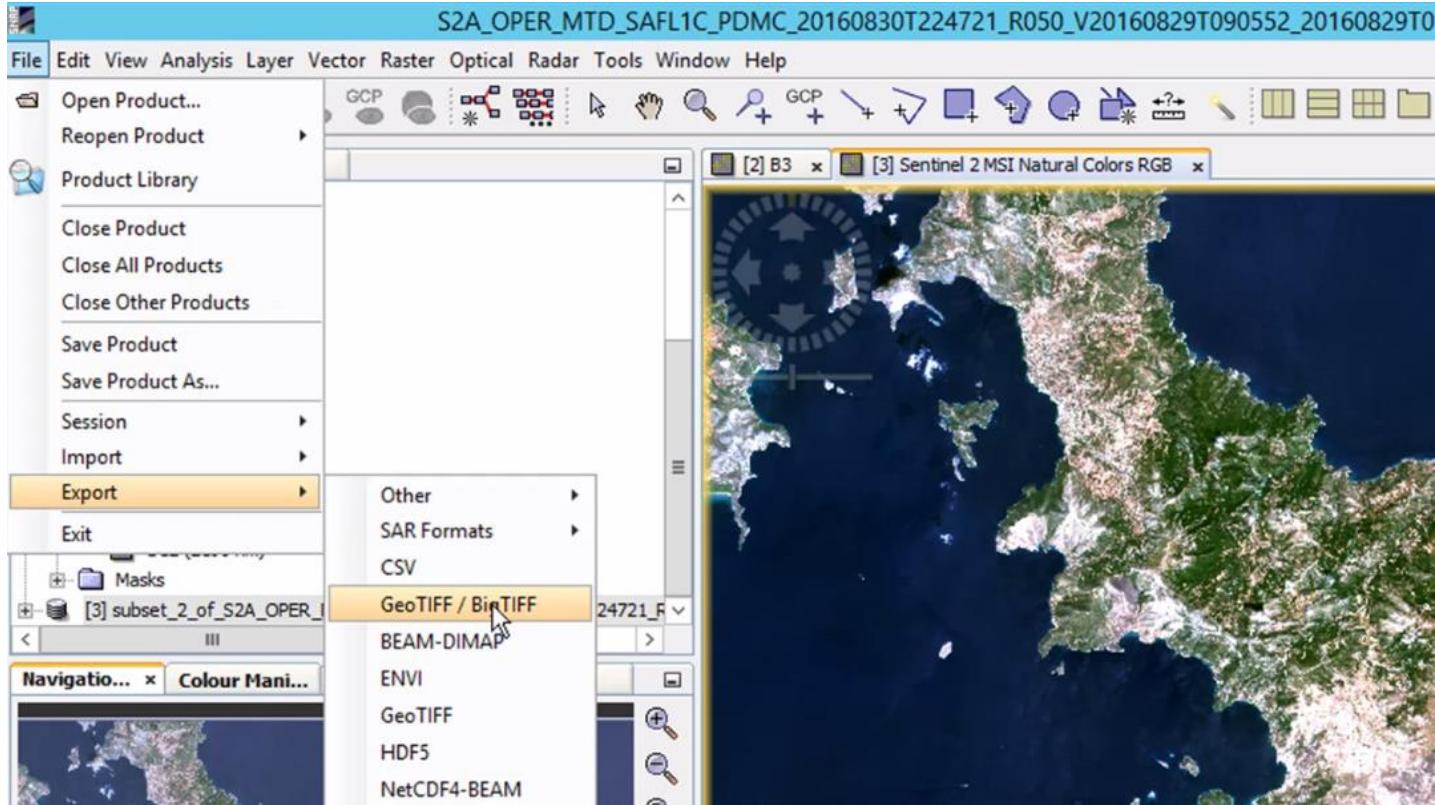
Copernicus





# Demonstration

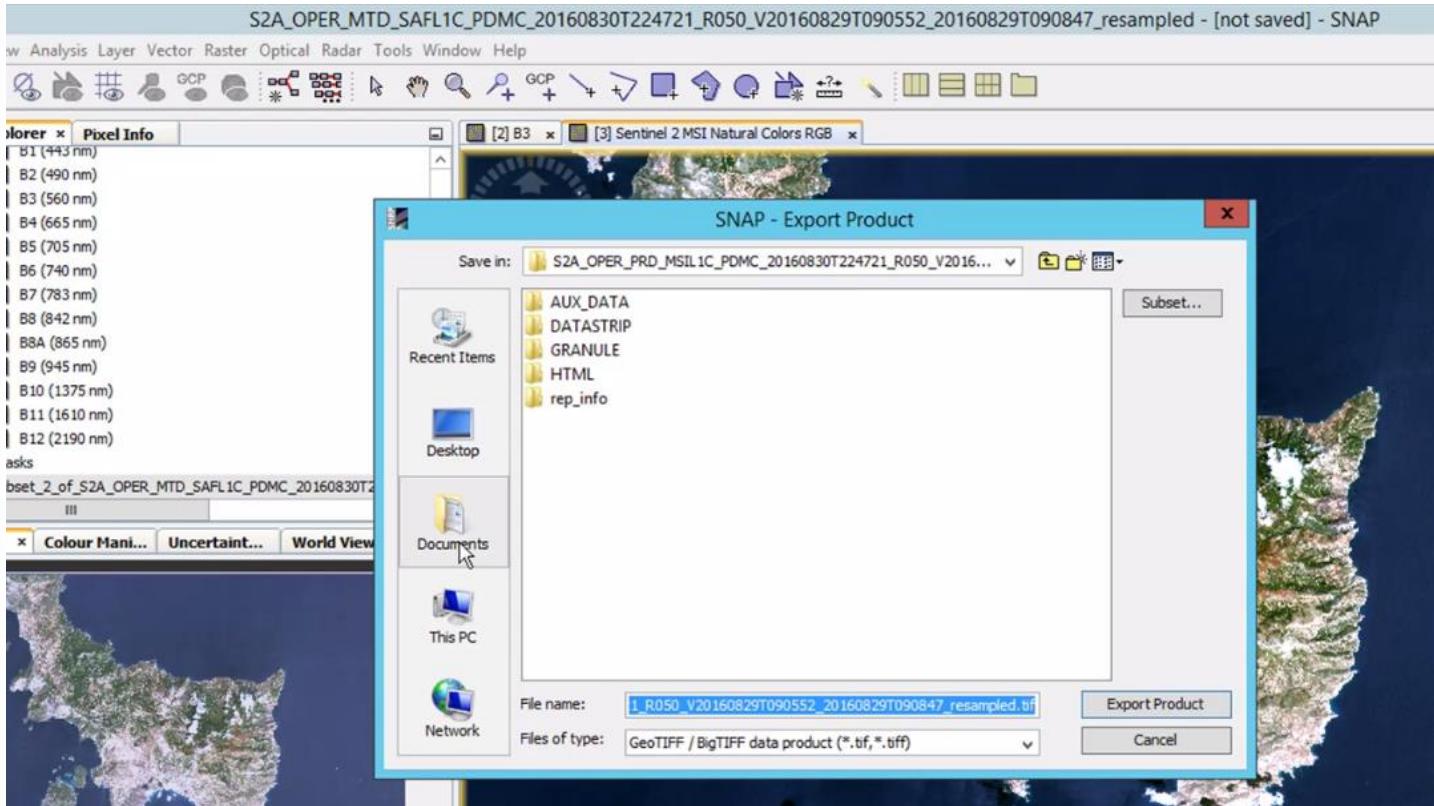
Copernicus





# Demonstration

Copernicus





Copernicus

# Demonstration

Sentinel-2 on AWS

Sentinel-2 data is available for anyone to use via Amazon S3.

About the data

Data structure

Browse through data

Accessing the Data

Featured uses

Contact us

Sentinel-2 data is available for anyone via Amazon S3, either over Internet or within AWS. All Sentinel-2 scenes are made available, often within hours of production.

Earth observation data provided by the [Sentinel-2](#) satellites are revolutionizing the market of space applications. Free, full and open access to data with very short revisit times, high spatial resolution, and good spectral resolution can benefit several sectors - agriculture, environmental and land-change monitoring, natural disaster response, insurance and others.

<http://sentinel-pds.s3-website.eu-central-1.amazonaws.com/>





Copernicus

# Demonstration



Sentinel-2 on AWS

sentinel-pds.s3-website.eu-central-1.amazonaws.com

About the data

Data structure

Browse through data

Accessing the Data

Featured uses

Contact us

Sentinel-2 delivers high-resolution optical images for land monitoring, emergency response and security services. The satellite carries a multispectral imager with a swath of 290 km. The imager provides a versatile set of 13 spectral bands spanning from the visible and near infrared to the shortwave infrared, featuring four spectral bands at 10 m, six bands at 20 m and three bands at 60 m spatial resolution.

Sentinel-2 is the result of close collaboration between ESA, the European Commission, industry, service providers and data users.

## About the data

Sentinel-2 data available on Amazon S3 allows anyone can use it to create new products on the AWS cloud without needing to worry about the cost of storing data or the time required to download it.

SOURCE	European Commission (Copernicus), ESA
CATEGORY	Satellite imagery
FORMAT	jp2, .txt
LICENSE	Access to Sentinel data is free, full and open for the broad Regional, National, European and International user community. View Terms and conditions.
STORAGE	Amazon S3



# Demonstration



Sentinel-2 on AWS

sentinel-pds.s3-website.eu-central-1.amazonaws.com

About the data

Data structure

Browse through data

Accessing the Data

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Contact us

0 10

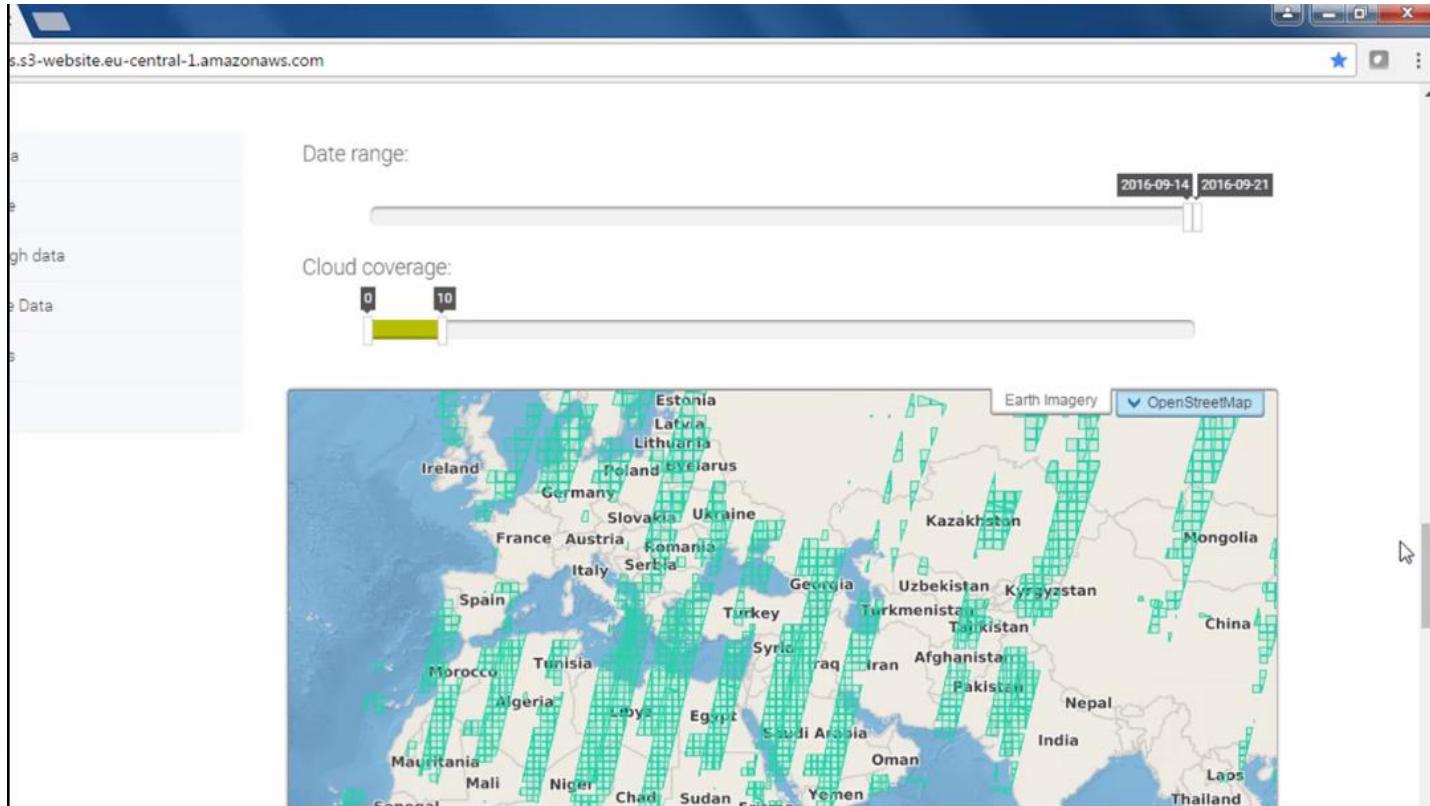
Earth Imagery OpenStreetMap

2500 km



# Demonstration

Copernicus





# Demonstration

Copernicus

Sentinel-2 on AWS

sentinel-pds.s3-website.eu-central-1.amazonaws.com

About the data

Data structure

Browse through data

Accessing the Data

Featured uses

Contact us

Date range:

2016-09-14 2016-09-21

Cloud coverage:

0 10

Earth Imagery OpenStreetMap



Copernicus

# Demonstration

The screenshot shows a web-based interface for Earth observation data. At the top, there is a header bar with a user icon, a search bar containing "ws.com", and standard browser controls (minimize, maximize, close). Below the header is a date range selector labeled "Date range:" with two input fields showing "2016-08-28" and "2016-09-03". A horizontal slider is positioned between these dates. Below the date range is a "Cloud coverage:" section with a slider scale from 0 to 10, where the value is set to 10. The main area features a map of the Greek mainland and surrounding islands. The map is overlaid with a green color gradient representing cloud coverage. Labels on the map include "Αχαρνές", "Άγιοι Ανάργυροι", "Αθήνα", and "Λειραίας". In the bottom right corner of the map area, there are two buttons: "Earth Imagery" and "OpenStreetMap". A vertical color bar on the far right indicates the scale for the cloud coverage gradient.



# Demonstration



Sentinel-2 on AWS

sentinel-pds.s3-website.eu-central-1.amazonaws.com

About the data

Data structure

Browse through data

Accessing the Data

Featured uses

Contact us

Earth Imagery OpenStreetMap

1 search result(s)

1 Sentinel2 tiles

35SKC - 2016-08-29

Cloud coverage [%] 2

Data coverage [%] 1

Sensing time 2016-08-29, 08:00

UTM zone 35N

Processing level Level-1C

Tile name 35SKC

Tile link [link to tile data](#)

Preview

The screenshot shows the 'Sentinel-2 on AWS' web application. On the left, a sidebar lists links: 'About the data', 'Data structure', 'Browse through data', 'Accessing the Data', 'Featured uses', and 'Contact us'. The main area features a map of Italy with a red rectangle highlighting a specific region. A legend at the bottom indicates a scale of '25 km'. To the right, a panel displays '1 search result(s)' for a 'Sentinel2 tiles' entry named '35SKC - 2016-08-29'. It provides details such as 'Cloud coverage [%] 2', 'Data coverage [%] 1', 'Sensing time 2016-08-29, 08:00', 'UTM zone 35N', 'Processing level Level-1C', 'Tile name 35SKC', and a 'Tile link' with a blue link icon. Below this is a 'Preview' section showing a detailed satellite image of the highlighted region.



Copernicus

# Demonstration

The screenshot shows a web browser window titled "Sentinel-2 on AWS" with the URL "sentinel-s2-l1c.s3-website.eu-central-1.amazonaws.com/#tiles/35/S/KC/2016/8/29/0/". The main content area is titled "Sentinel public image browser" and displays a hierarchical file structure for a specific tile. The path shown in the address bar is "sentinel-s2-l1c > tiles > 35 > S > KC > 2016 > 8 > 29 > 0". The file list includes:

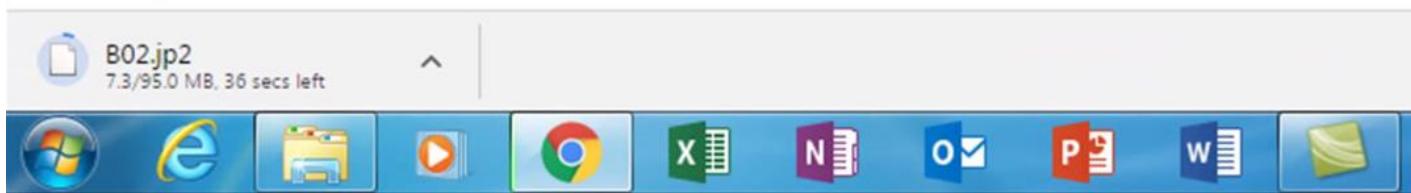
- [.. \(folder up\)](#)
- [auxiliary](#)
- [q1](#)
- [B01.jp2](#)
- [B02.jp2](#)
- [B03.jp2](#)
- [B04.jp2](#)
- [B05.jp2](#)
- [B06.jp2](#)
- [B07.jp2](#)
- [B08.jp2](#)
- [B09.jp2](#)
- [B10.jp2](#)
- [B11.jp2](#)
- [B12.jp2](#)
- [B8A.jp2](#)
- [metadata.xml](#)
- [preview.jp2](#)
- [preview.jpg](#)
- [productInfo.json](#)
- [tileInfo.json](#)



Copernicus

# Demonstration

[B02.jp2](#)  
[B08.jp2](#)  
[B09.jp2](#)  
[B10.jp2](#)  
[B11.jp2](#)  
[B12.jp2](#)  
[B8A.jp2](#)  
[metadata.xml](#)  
[preview.jp2](#)  
[preview.jpg](#)  
[productInfo.json](#)  
[tileInfo.json](#)





# Demonstration

Copernicus

The screenshot shows the QGIS 2.14.1-Essen interface. The main window displays a satellite image of a coastal region, characterized by dark water and various land cover types. A legend overlay is present, showing a grayscale gradient from black to white with numerical values: 002 (black), 088 (dark gray), 2793 (medium gray), 003 (dark gray), 577 (white), 2708 (white), 004 (white), 339 (white), 2915 (white), 008 (white), 192 (white), 3714 (white), 011 (white), 48 (white), 4225 (white), 012 (white), 30 (white), and 3081 (white). The QGIS toolbar at the top contains numerous icons for file operations, selection, measurement, and analysis. The bottom status bar shows coordinates (176073, 4256473), scale (1:833,158), rotation (0.0), and projection (EPSG:32635).



Copernicus

# Demonstration

The screenshot shows a geospatial analysis software interface. On the left, there is a 'Layers Panel' window listing several layers:

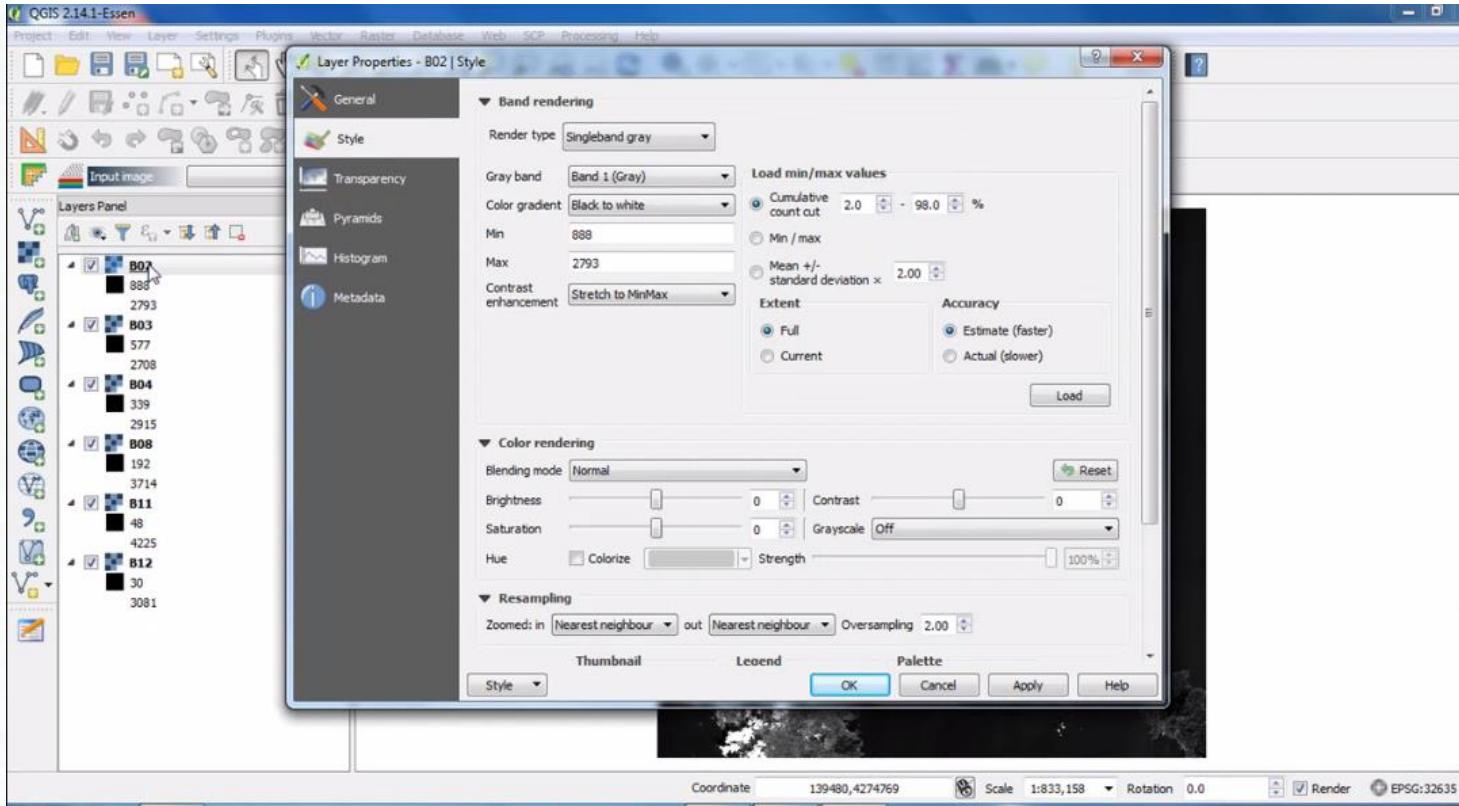
Layer	Count
B02	888
B03	2793
B03	577
B04	2708
B04	339
B08	2915
B08	192
B11	3714
B11	48
B12	4225
B12	30
B12	3821

The main workspace shows a grayscale map of a coastal area with various land cover types. A color-coded legend is visible on the far left, corresponding to the layers listed in the Layers Panel.



# Demonstration

Copernicus





# Demonstration

Copernicus

The screenshot shows the QGIS application interface. On the left, there is a map view displaying a satellite image of a rural area with fields and roads. The main window has a blue header bar with menu items: Settings, Plugins, Vector, Raster, Database, Web, SCP, Processing, and Help. Below the header is a toolbar with various icons. A large central dialog box is open, titled "Layer Properties - B02 | General". The dialog contains several sections:

- General**: Shows the layer name as "B02" and the source as "C:\Projects\Bruce McCormack\Greece\JP2 Images\B02.jp2". It also displays the dimensions as "Columns: 10980 Rows: 10980 No-Data Value: n/a".
- Style**: This section is currently selected, indicated by a dark gray background.
- Transparency**: This section is visible but not selected.
- Pyramids**: This section is visible but not selected.
- Histogram**: This section is visible but not selected.
- Metadata**: This section is visible but not selected.
- Layer info**: Contains the layer name and source information.
- Coordinate reference system**: Shows the selected CRS as "Selected CRS (EPSG:32635, WGS 84 / UTM zone 35N)".
- Scale dependent visibility**: Contains input fields for "Minimum (exclusive)" set to "1:100,000,000" and "Maximum (inclusive)" set to "1:0".



# Demonstration

Copernicus

QGIS 2.14.1-Essen

Project Edit View Layer Settings Plugins Vector Raster Database Web SCP Processing Help

Input image RGB Show

Layers Panel

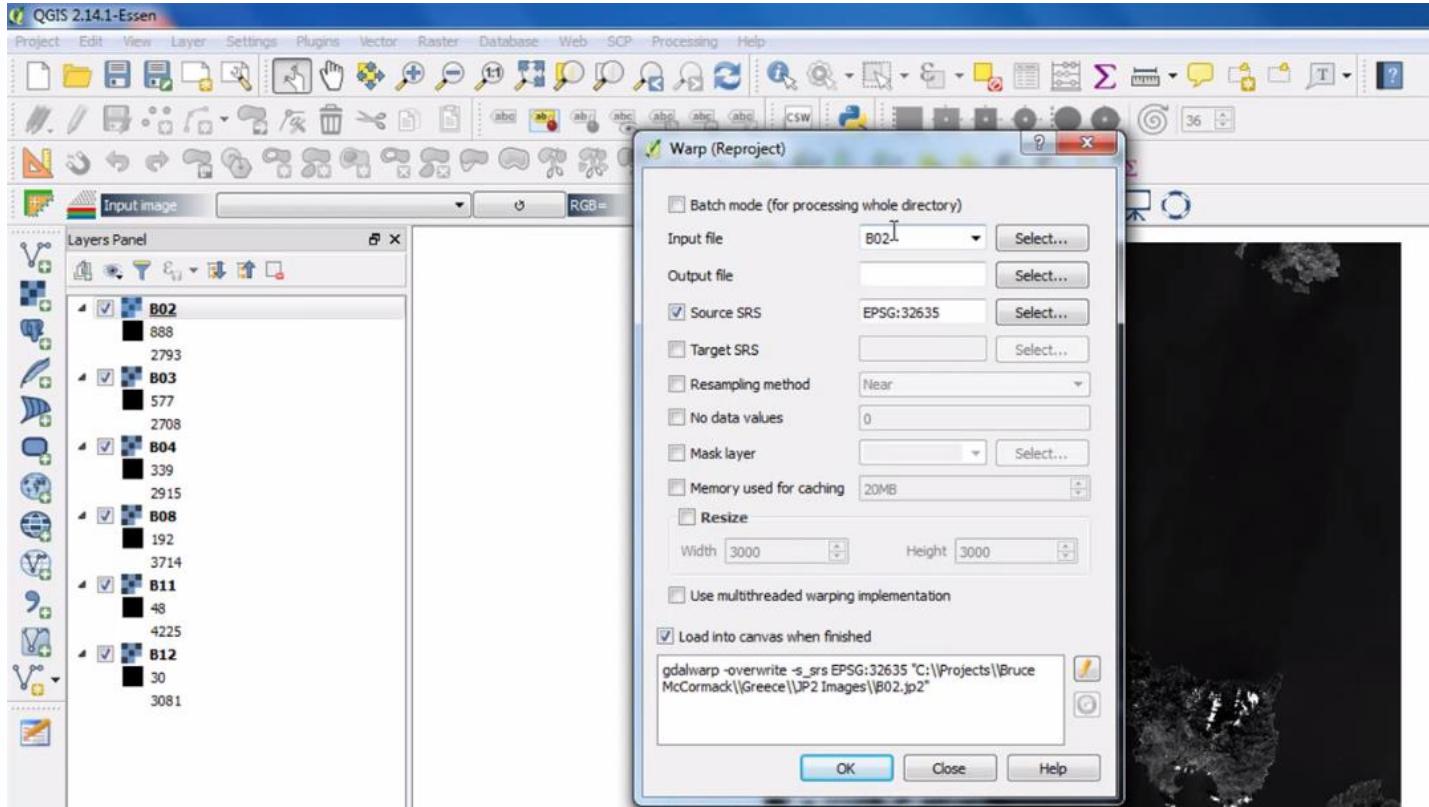
- B02  
888  
2793
- B03  
577  
2708
- B04  
339  
2915
- B08  
192  
3714
- B11  
48  
4225
- B12  
30  
3081

Coordinate 175632,4302545 Scale 1:833,158 Rotation 0.0 Render EPSG:32635



# Demonstration

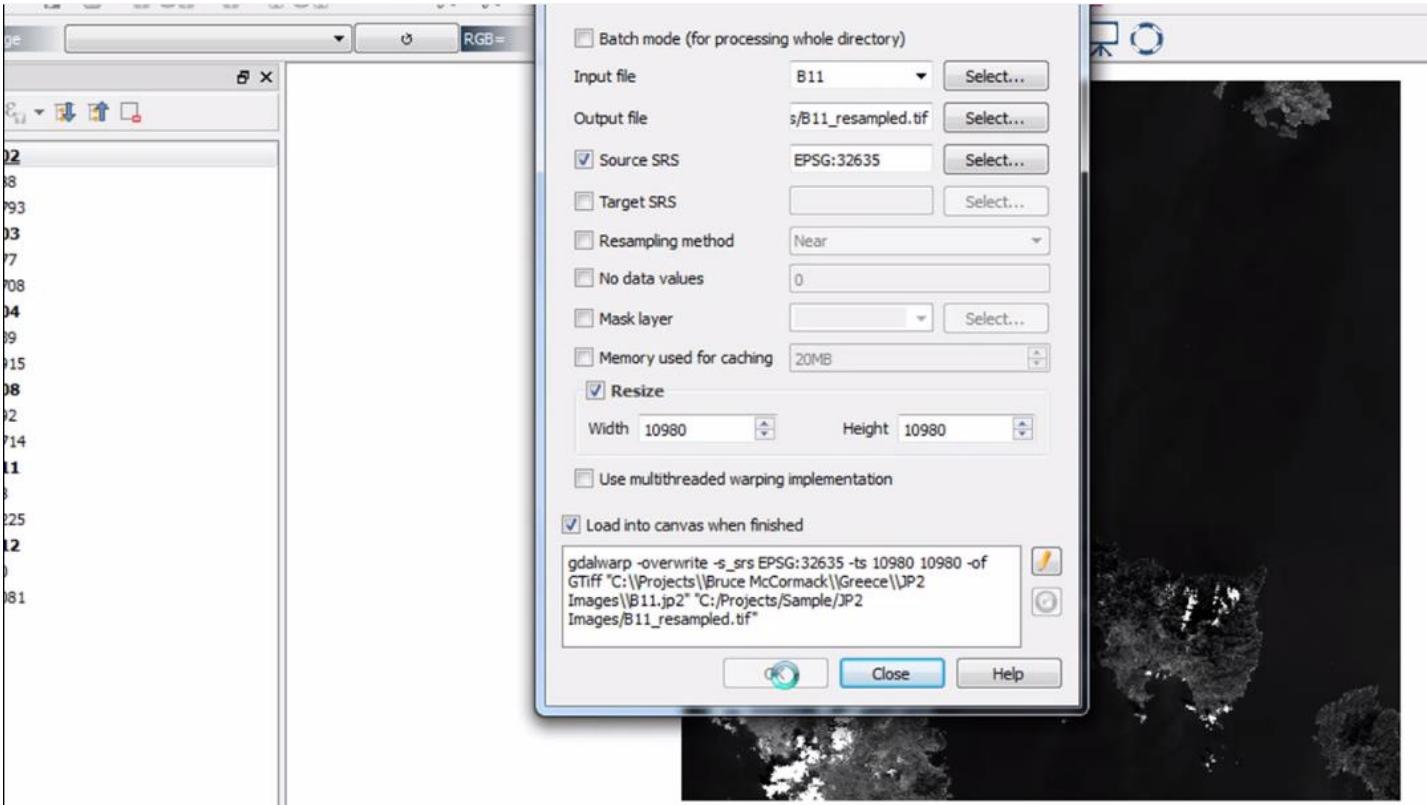
Copernicus





# Demonstration

Copernicus





# Demonstration

Copernicus

QGIS 2.14.1-Essen

Project Edit View Layer Settings Plugins Vector Raster Database Web SCP Processing Help

Raster Calculator... Align Rasters... Heatmap Zonal statistics Projections Conversion Extraction Analysis Miscellaneous GdalTools Settings...

Build Virtual Raster (Catalog)... Merge... Information... Build Overviews (Pyramids)... Tile Index...

Input image

Layers Panel

B02  
888  
2793

B03  
577  
2708

B04  
339  
2915

B08  
192  
3714

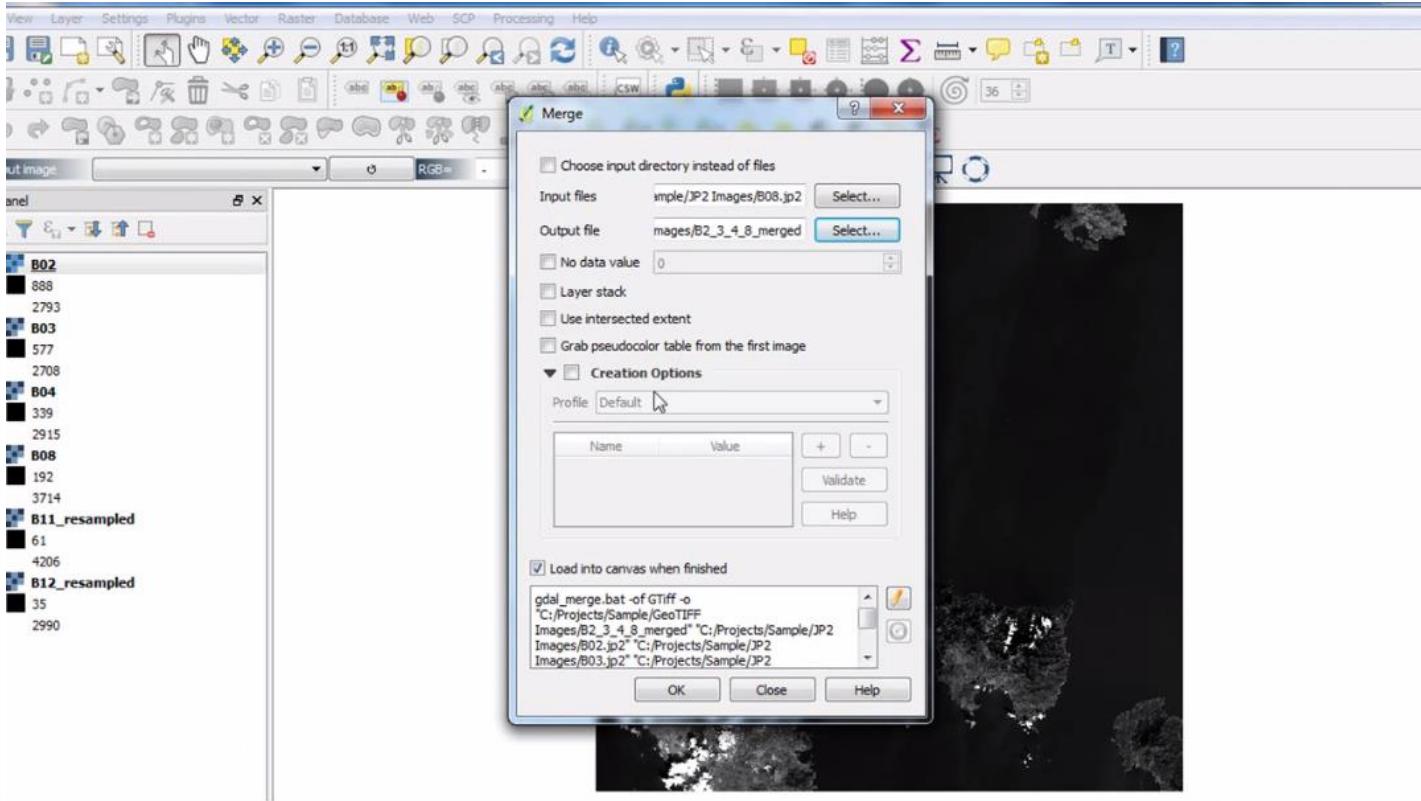
B11\_resampled  
61

A screenshot of the QGIS application interface. The title bar reads "QGIS 2.14.1-Essen". The menu bar includes "Project", "Edit", "View", "Layer", "Settings", "Plugins", "Vector", "Raster", "Database", "Web", "SCP", "Processing", and "Help". The "Raster" menu is currently open, showing options like "Raster Calculator...", "Align Rasters...", "Heatmap", "Zonal statistics", "Projections", "Conversion", "Extraction", "Analysis", "Miscellaneous", and "GdalTools Settings...". A sub-menu for "Miscellaneous" is open, showing "Build Virtual Raster (Catalog)...", "Merge...", "Information...", "Build Overviews (Pyramids)...", and "Tile Index...". On the left, the "Layers Panel" displays five layers: B02, B03, B04, B08, and B11\_resampled, each with its count (e.g., 888, 577, 339, 192, 61). The main canvas shows a satellite image of a landscape with various land cover types.



# Demonstration

Copernicus





Copernicus

# Demonstration

QGIS 2.14.1-Essen

Project Edit View Layer Settings Plugins Vector Raster Database Web SCP Processing Help

Input image RGB Show A A X F + ↗ ↘ T ?

Layers Panel

- B2\_3\_4\_8\_11\_12\_merged
- B02
  - 888
  - 2793
- B03
  - 577
  - 2708
- B04
  - 339
  - 2915
- B08
  - 192
  - 3714
- B11\_resampled
  - 61
  - 4206
- B12\_resampled
  - 35
  - 2990

Coordinate 167917,4275210 Scale 1:833,158 Rotation 0.0 Render EPSG:32635

1 legend entries removed.



Copernicus

# Demonstration

QGIS 2.14.1-Essen

Project Edit View Layer Settings Plugins Vector Raster Database Web SCP Processing Help

Input image RGB Show  A  A  F  +  R  G  B  T  ?

Layers Panel

- B2\_3\_4\_8\_11\_12\_merged
- B02
  - 888
  - 2793
- B03
  - 577
  - 2708
- B04
  - 339
  - 2915
- B08
  - 192
  - 3714
- B11\_resampled
  - 61
  - 4206
- B12\_resampled
  - 35
  - 2990

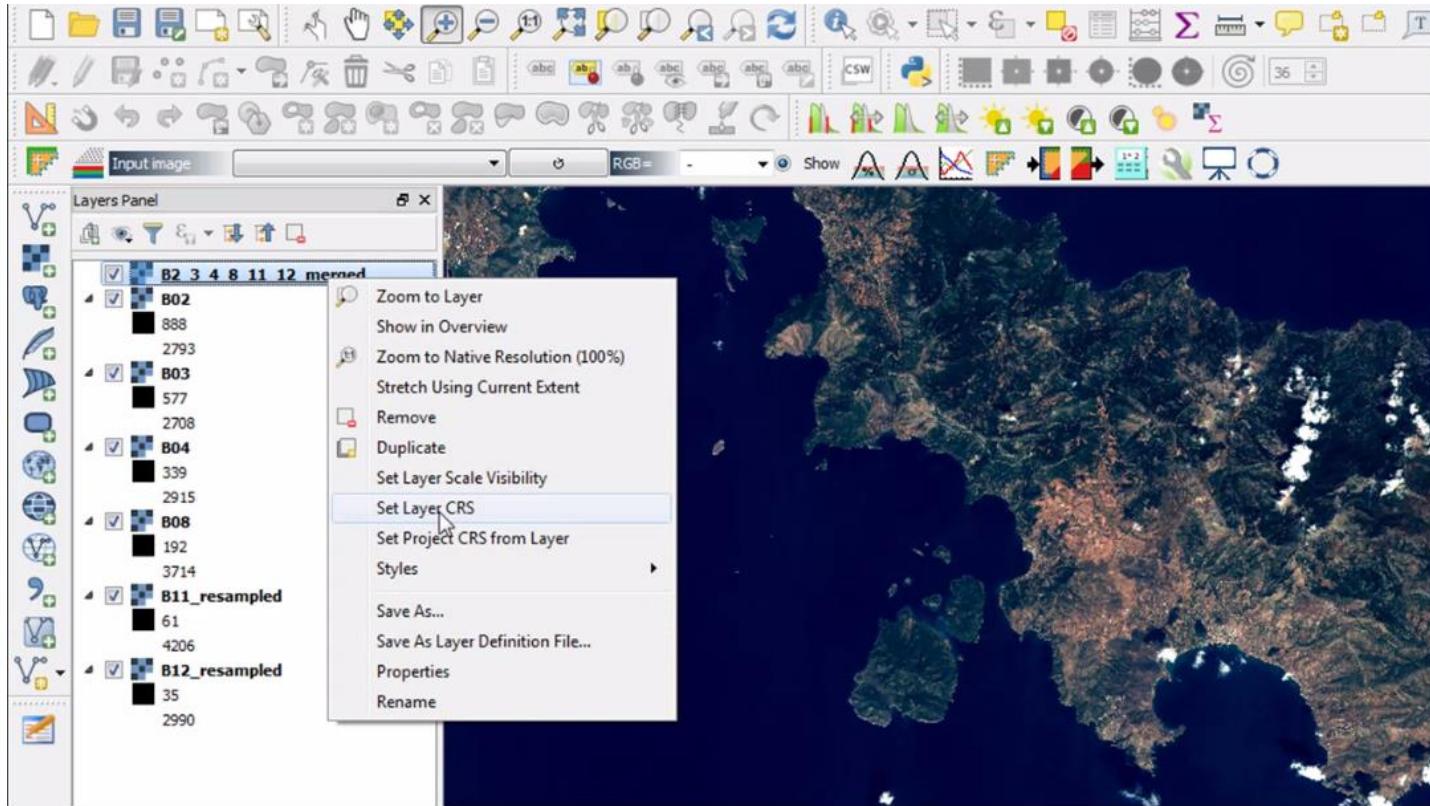
Coordinate 294228,4198717 Scale 1:833,158 Rotation 0.0 Render EPSG:32635

A satellite map of a coastal region, likely Spain, showing land cover classification. The map is dominated by dark blue oceans and green land areas. A legend in the bottom right corner shows various symbols for different land types. The QGIS interface is visible, with a toolbar at the top, a layers panel on the left listing the merged and resampled layers, and a map canvas on the right.



Copernicus

# Demonstration





Copernicus

# Demonstration

QGIS 2.14.1-Essen

Project Edit View Layer Settings Plugins Vector Raster Database Web SCP Processing Help

Layers Panel

- B2\_3\_4\_8\_11\_12\_merged
- B02
  - 888
  - 2793
- B03
  - 577
  - 2708
- B04
  - 339
  - 2915
- B08
  - 192
  - 3714
- B11\_resampled
  - 61
  - 4206
- B12\_resampled
  - 35
  - 2990

Save raster layer as...

Output mode  Raw data  Rendered image  Create VRT

Format GTiff Save as Karystos\_Subset

CRS Selected CRS (EPSG:32635, WGS 84 / UTM zone 35N)

Add saved file to map

Extent (current: map view)

North 4231122.07456979

West 238205.6069923114 East 303518.15973809006

South 4198496.9885277245

Resolution (current: layer)

Horizontal 10 Vertical 10

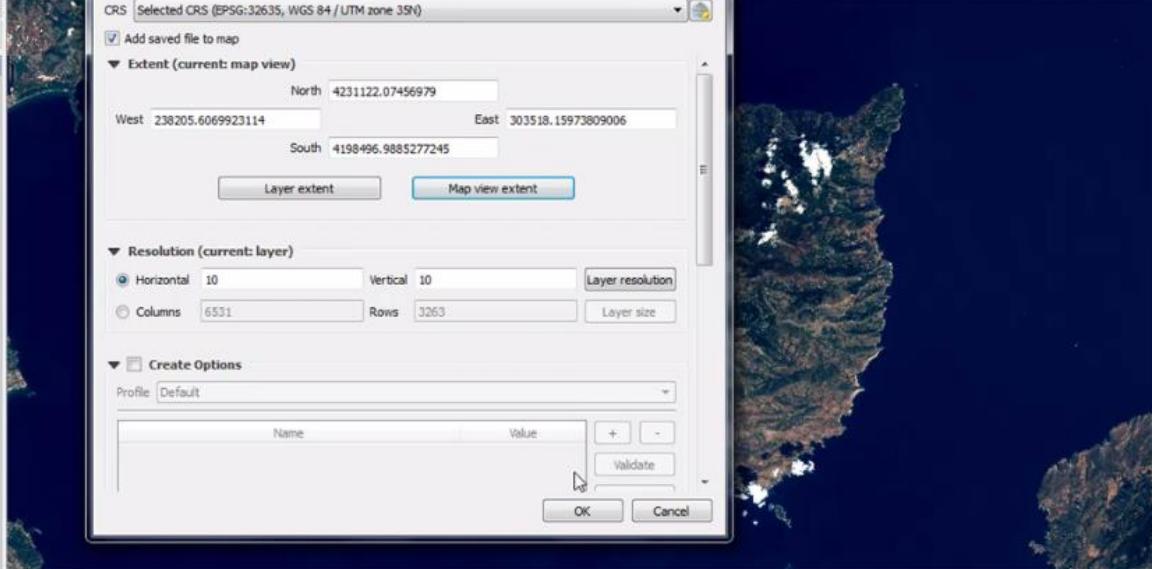
Columns 6531 Rows 3263

Create Options

Profile Default

Name	Value

Coordinate 238268,4224510 Scale 1:235,769 Rotation 0.0  Render EPSG:32635

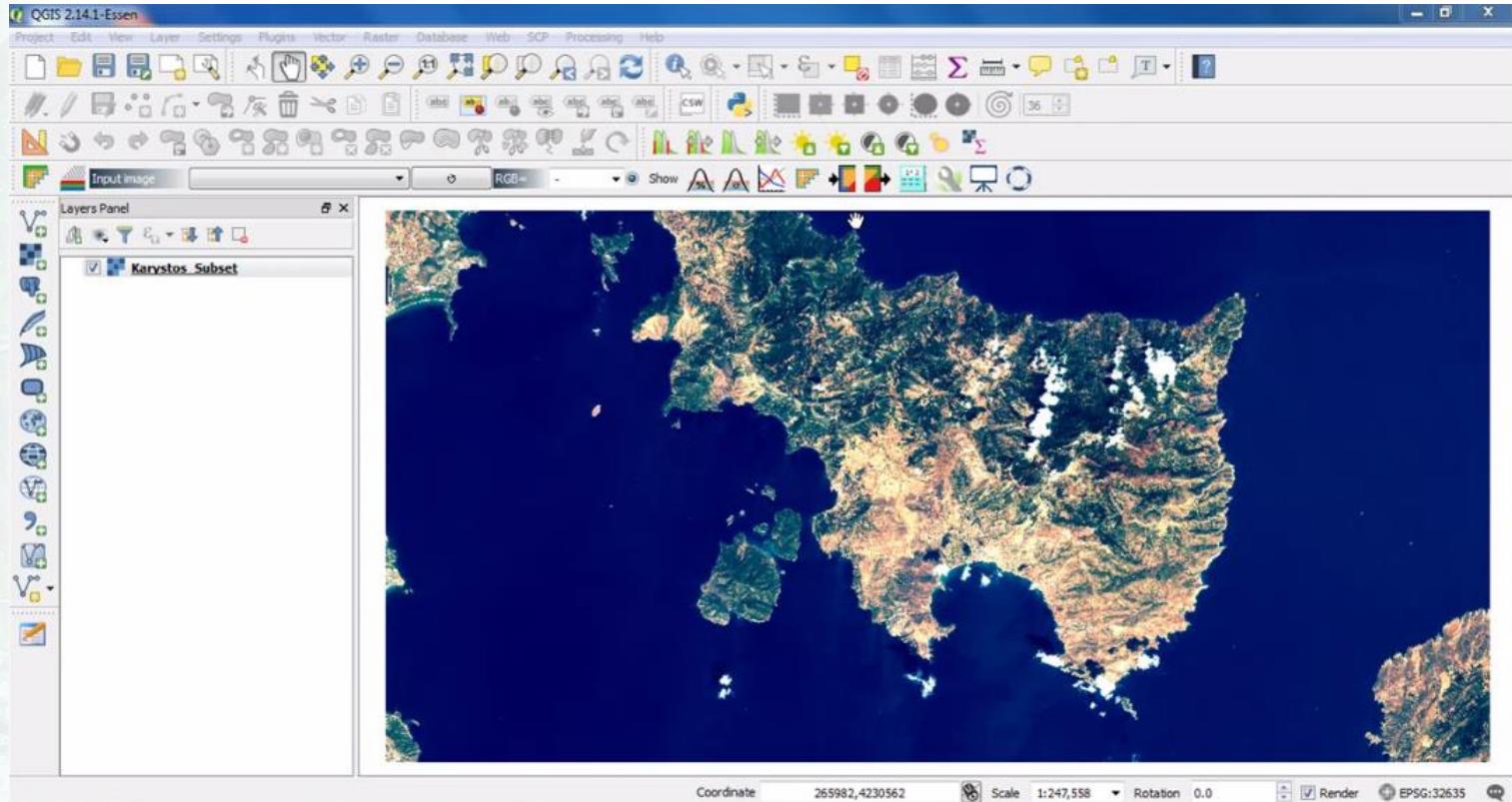


1 legend entries removed.



# Demonstration

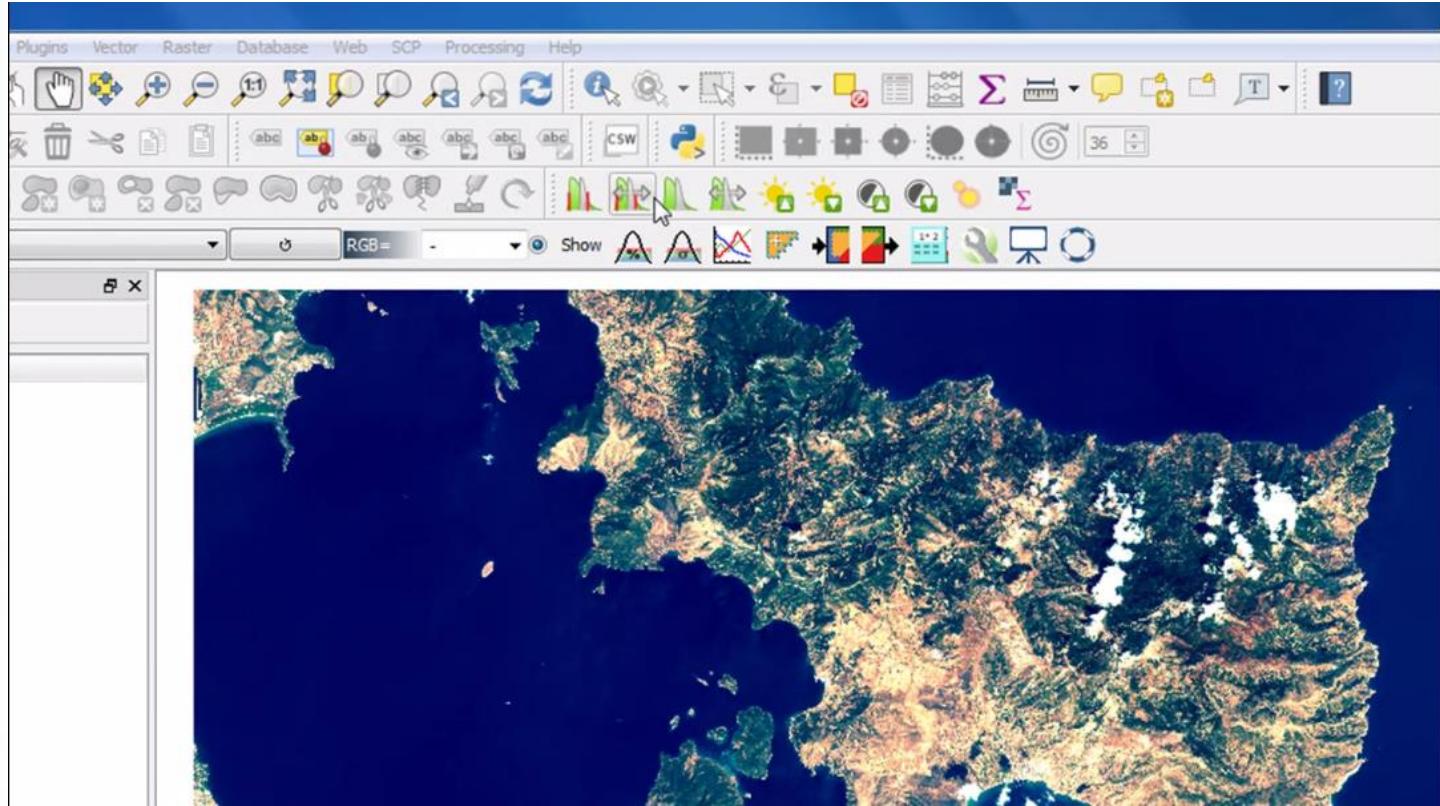
Copernicus





Copernicus

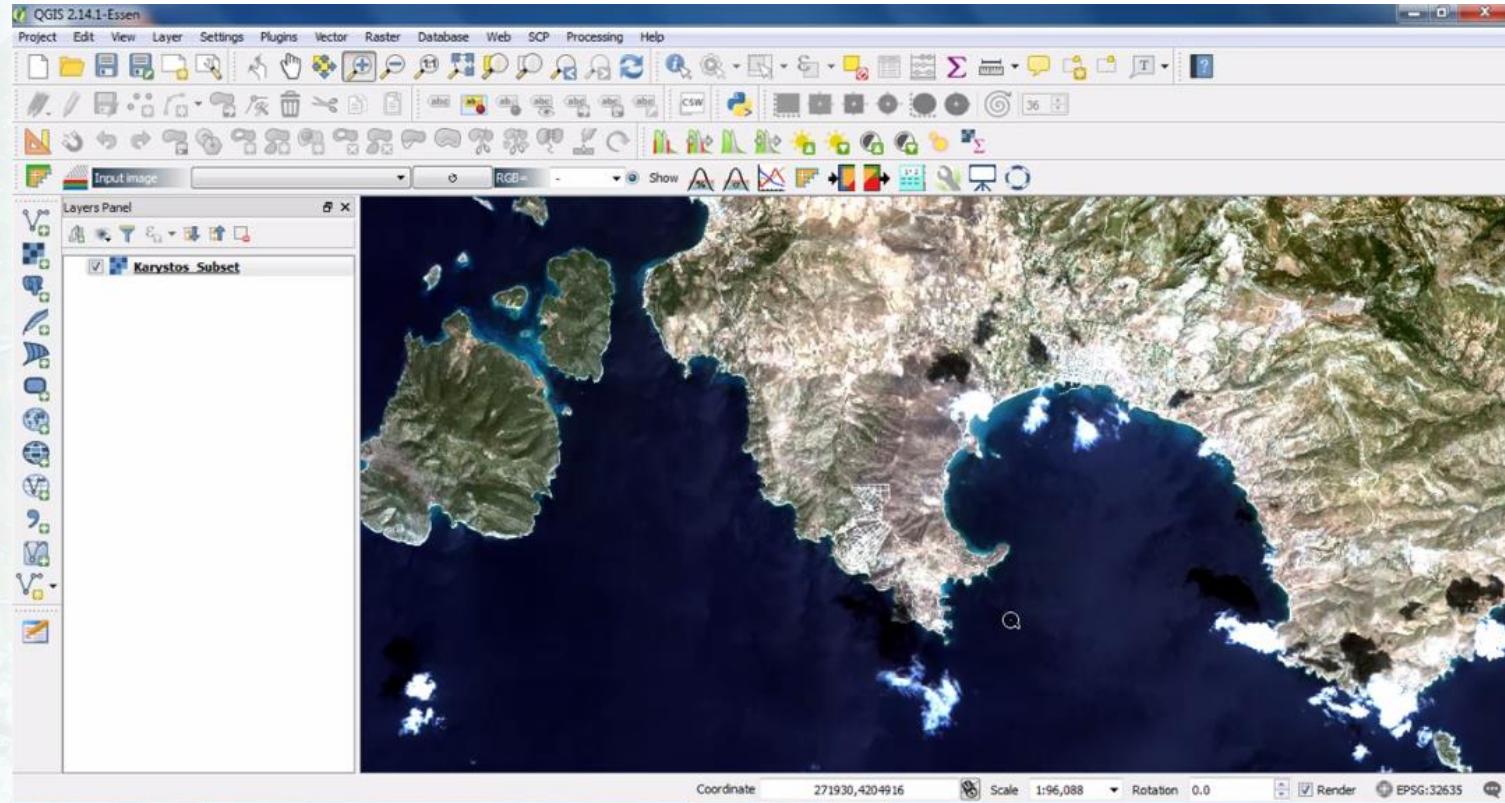
# Demonstration





Copernicus

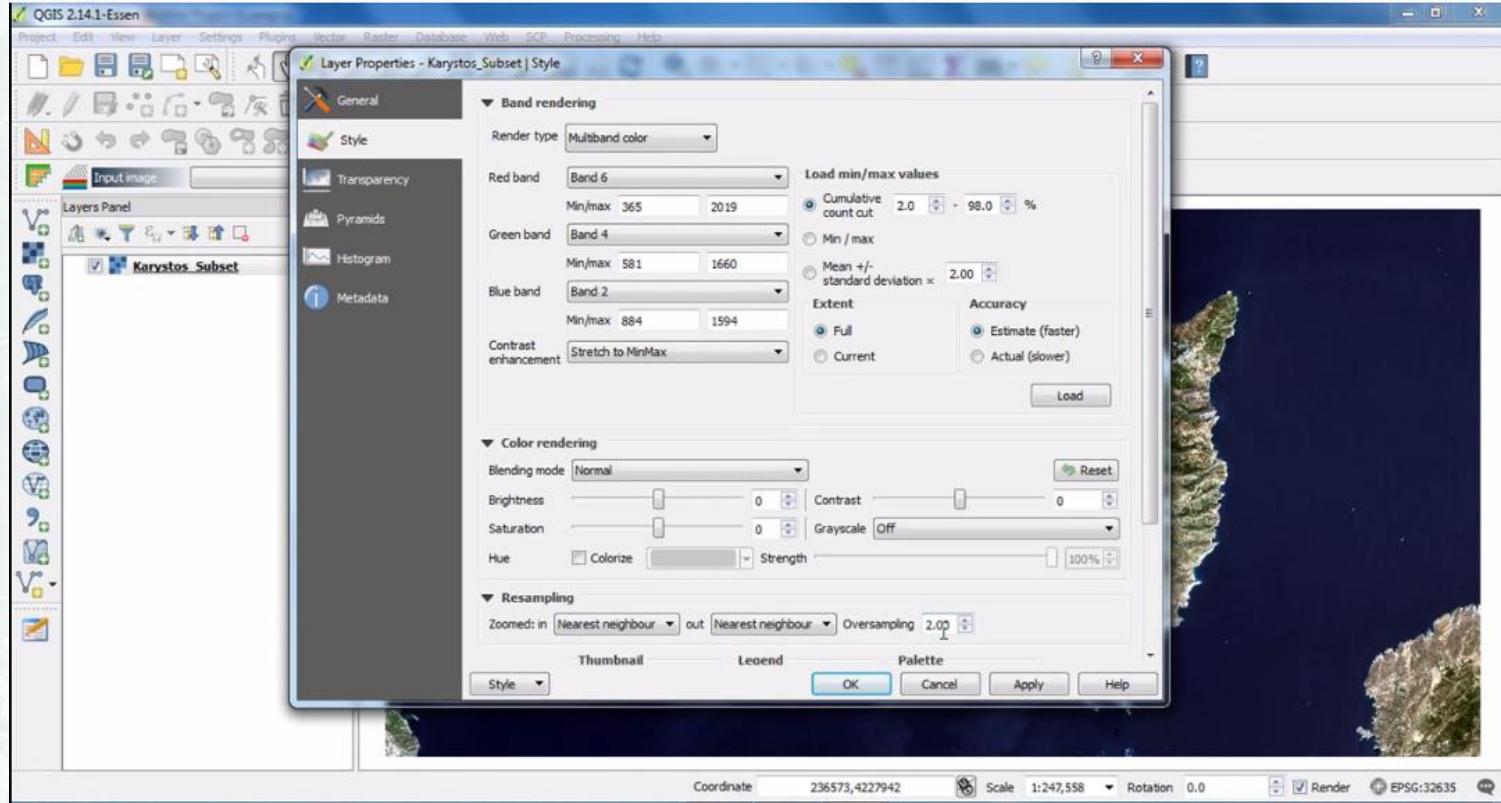
# Demonstration





# Demonstration

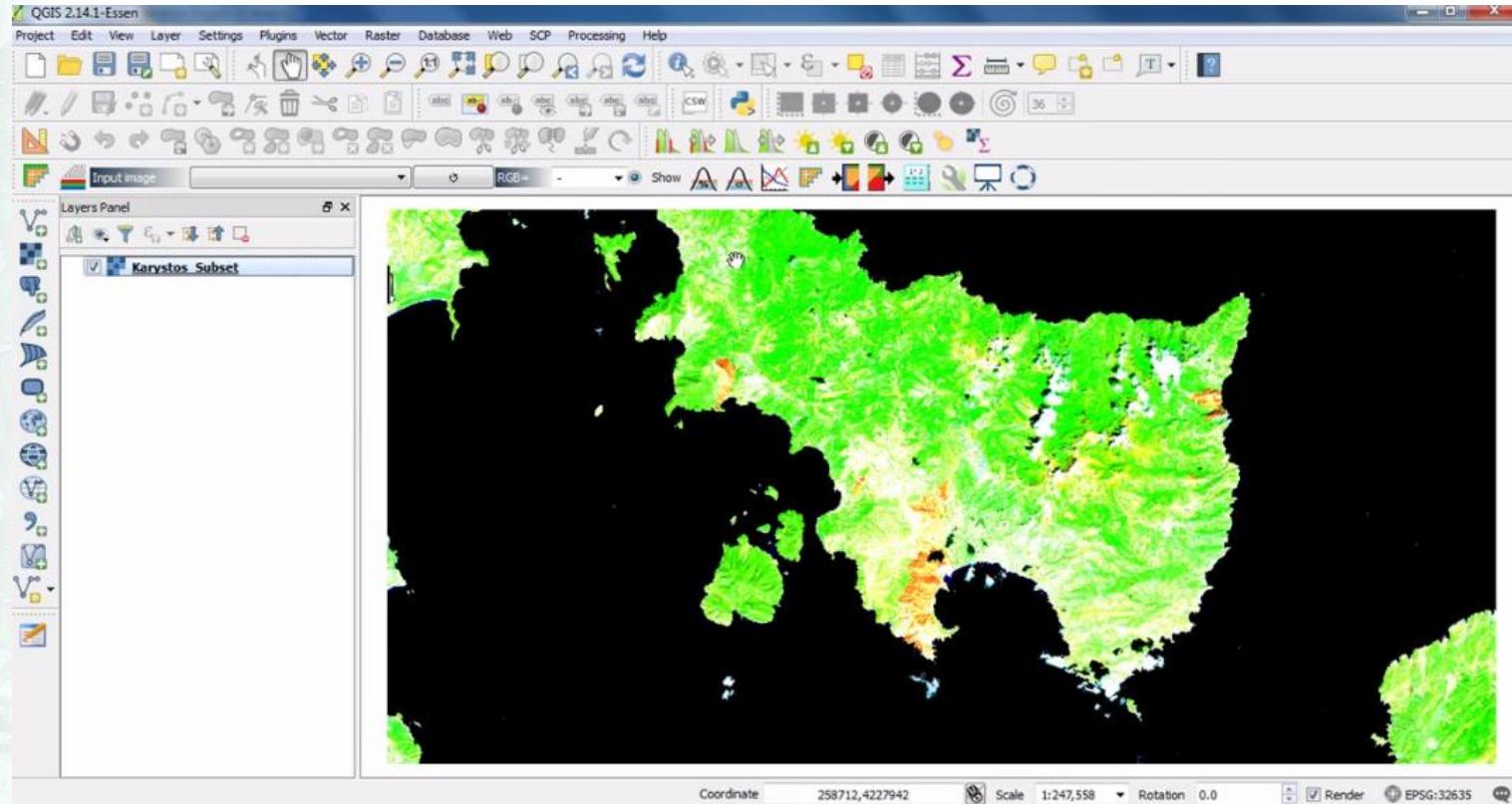
Copernicus





# Demonstration

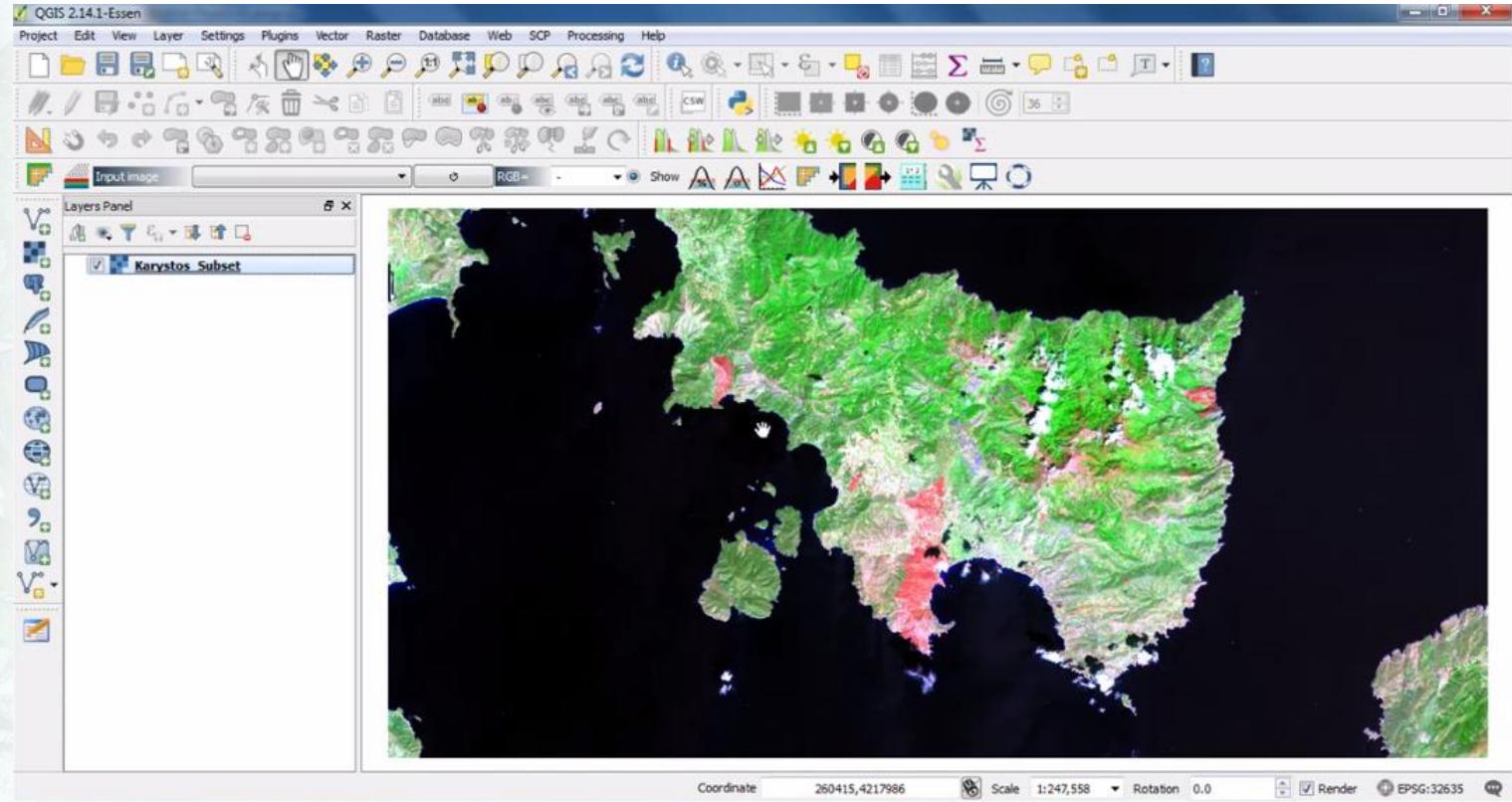
Copernicus





# Demonstration

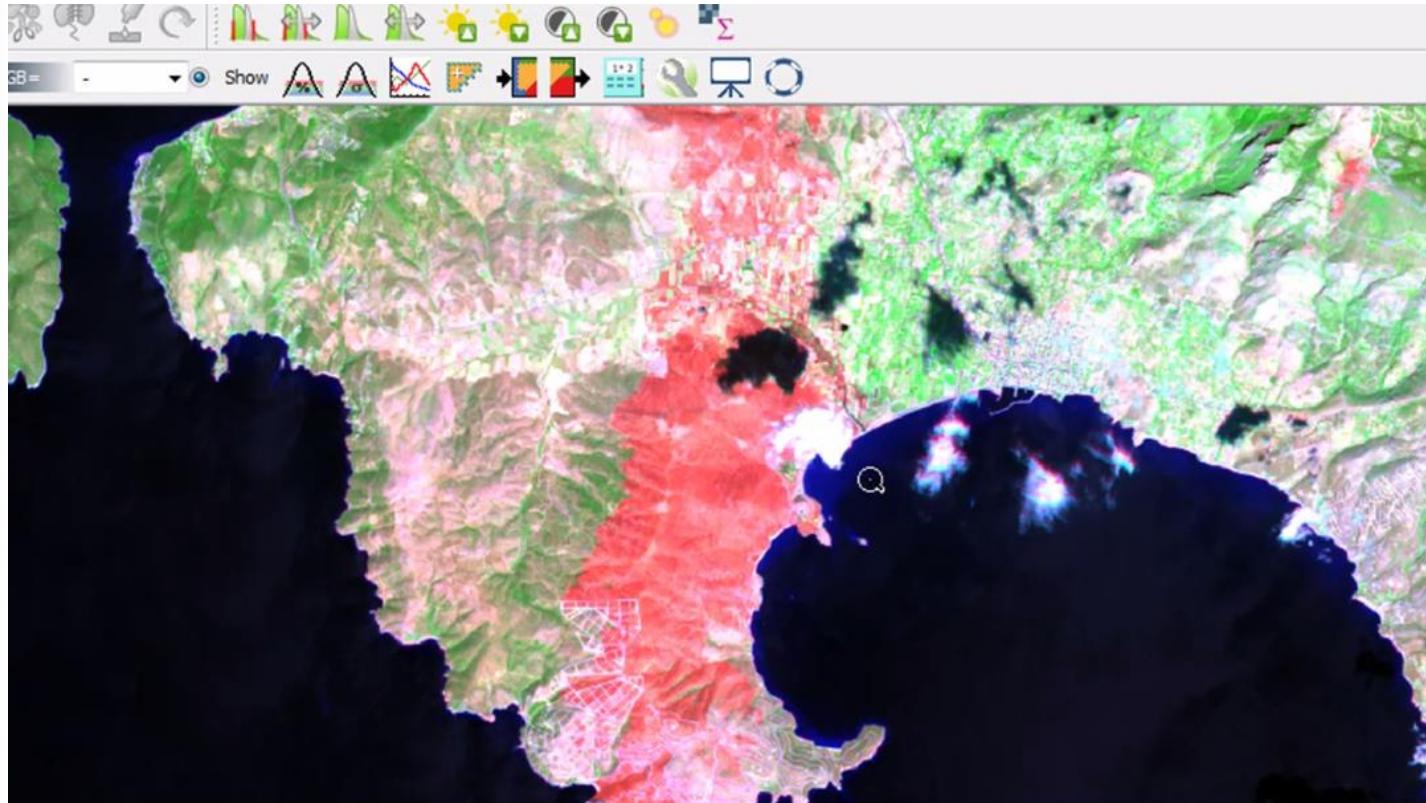
Copernicus





Copernicus

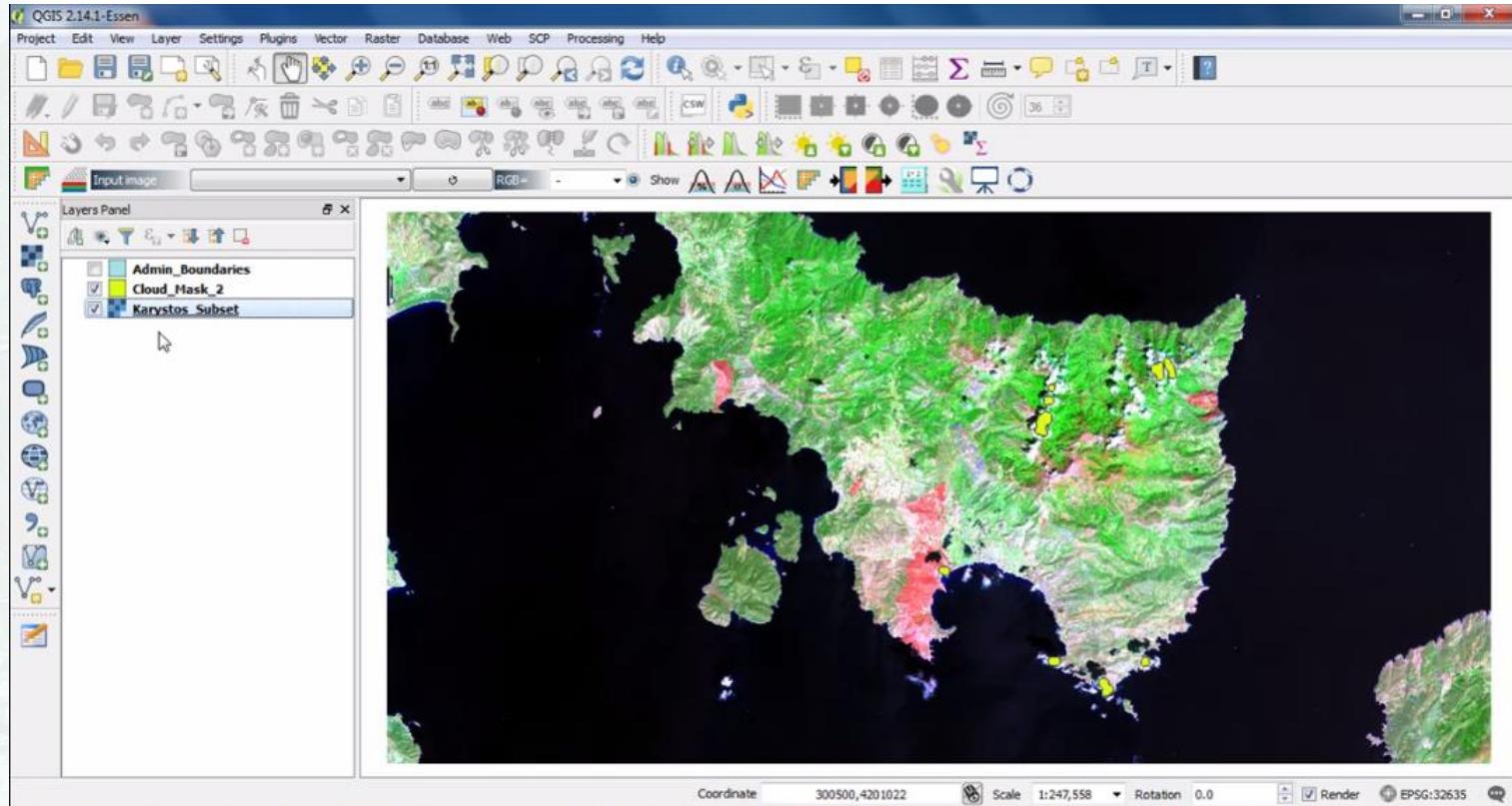
# Demonstration





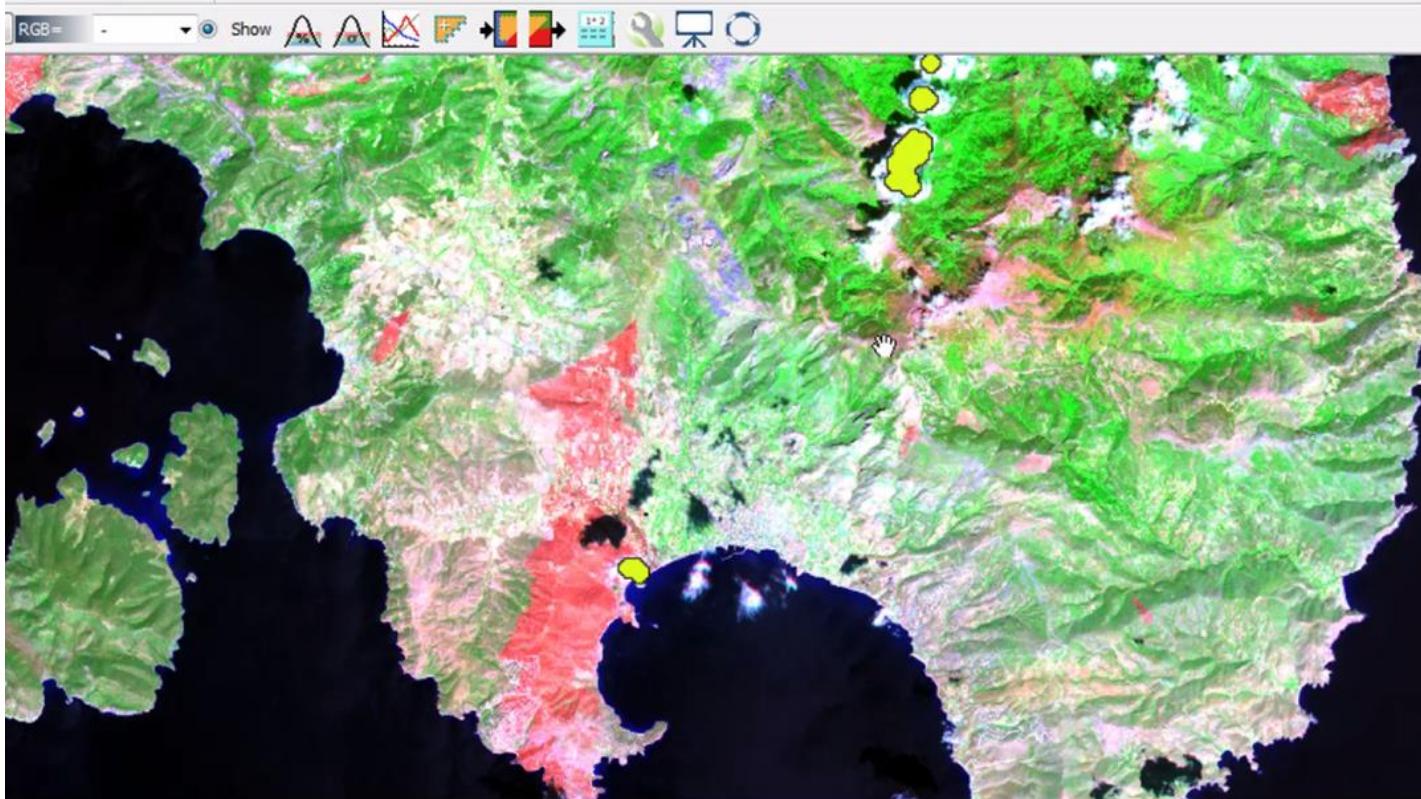
# Demonstration

Copernicus



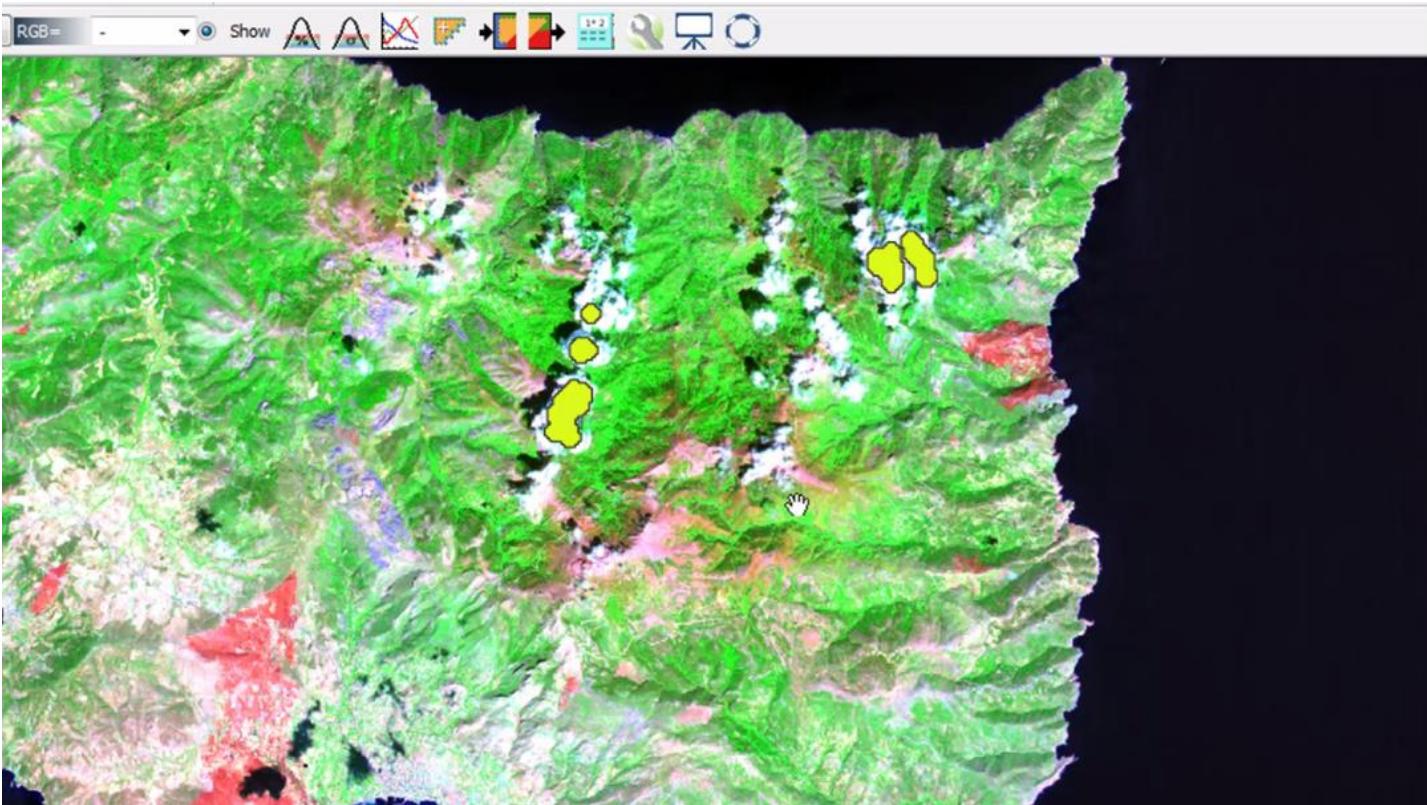


# Demonstration





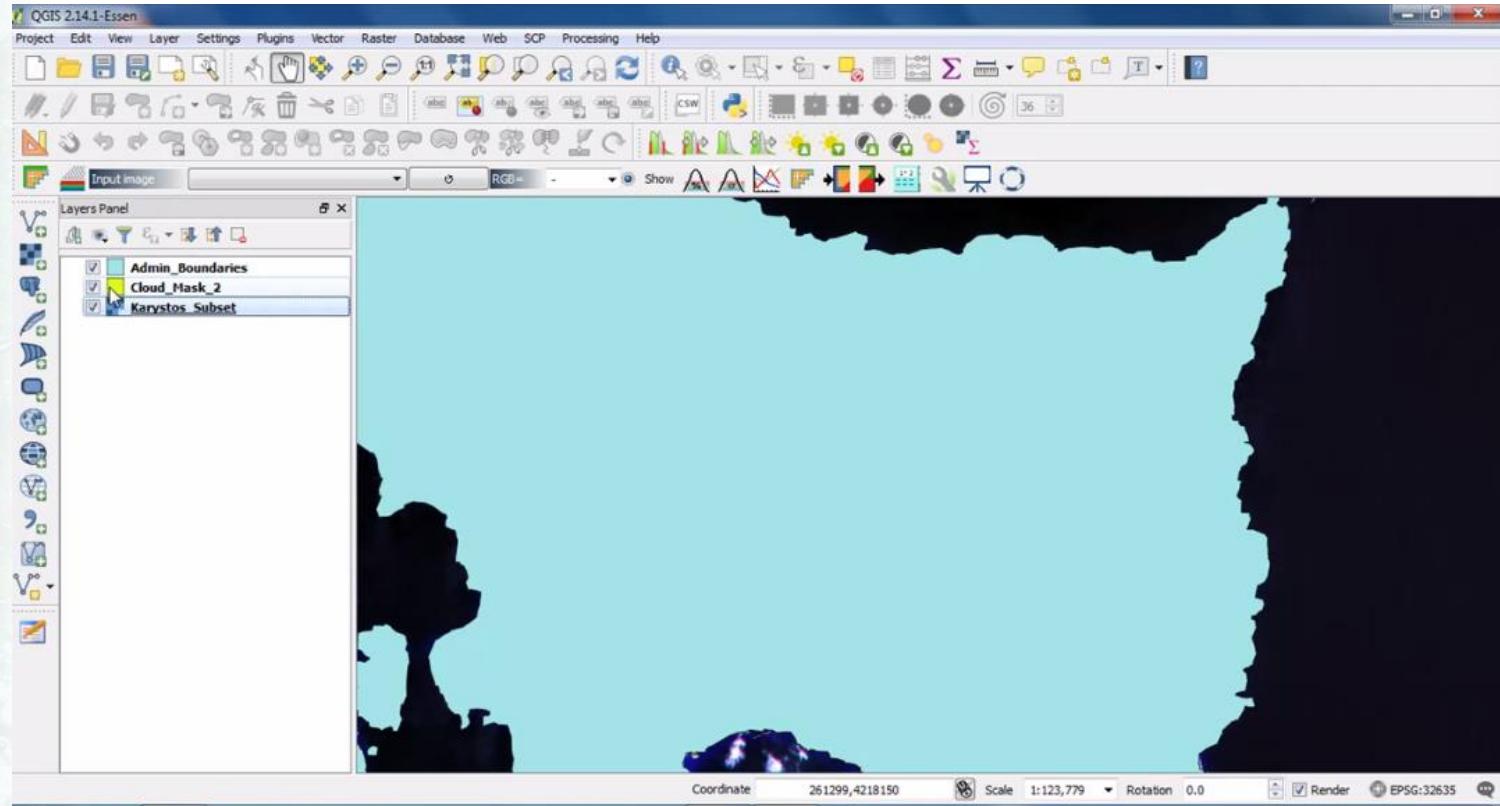
# Demonstration





Copernicus

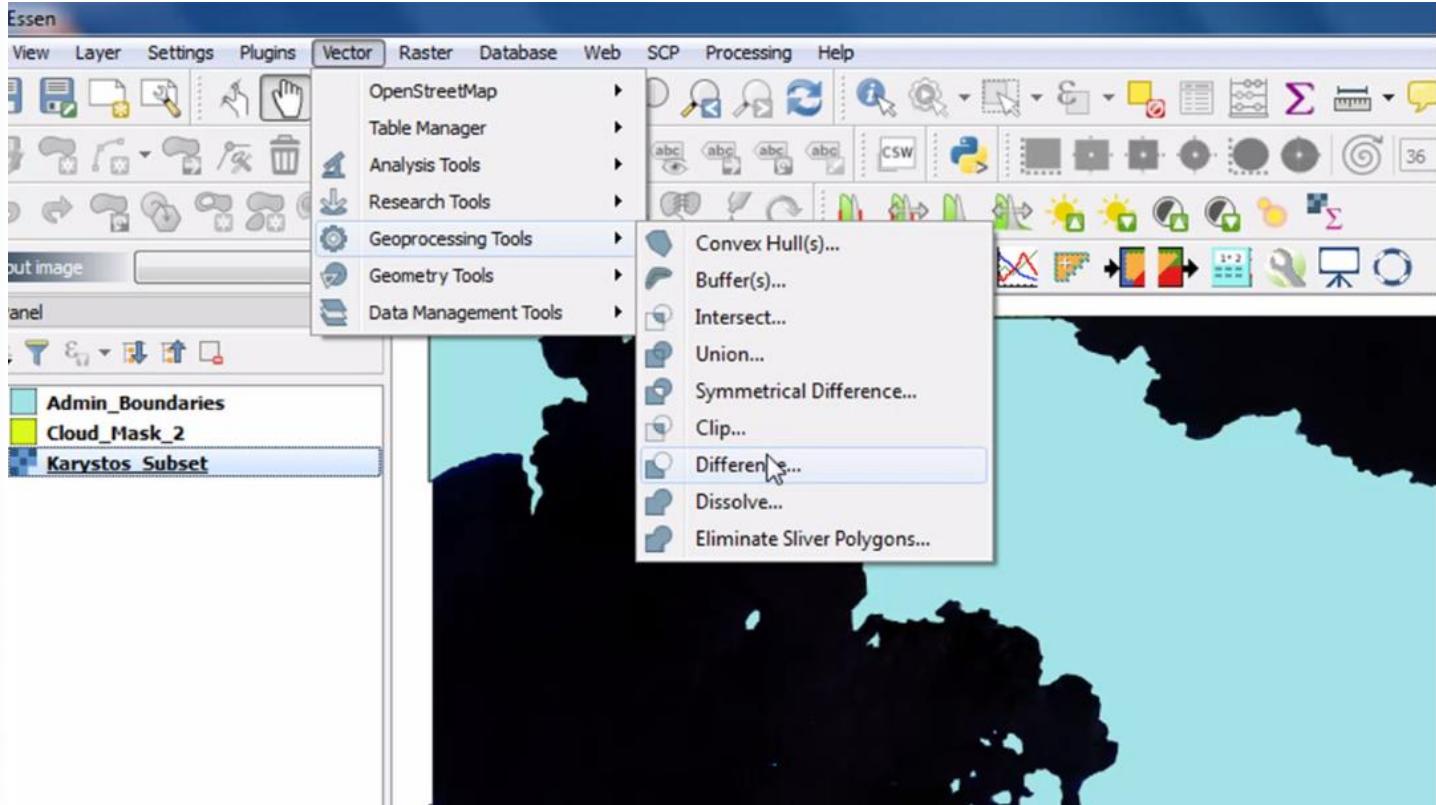
# Demonstration





# Demonstration

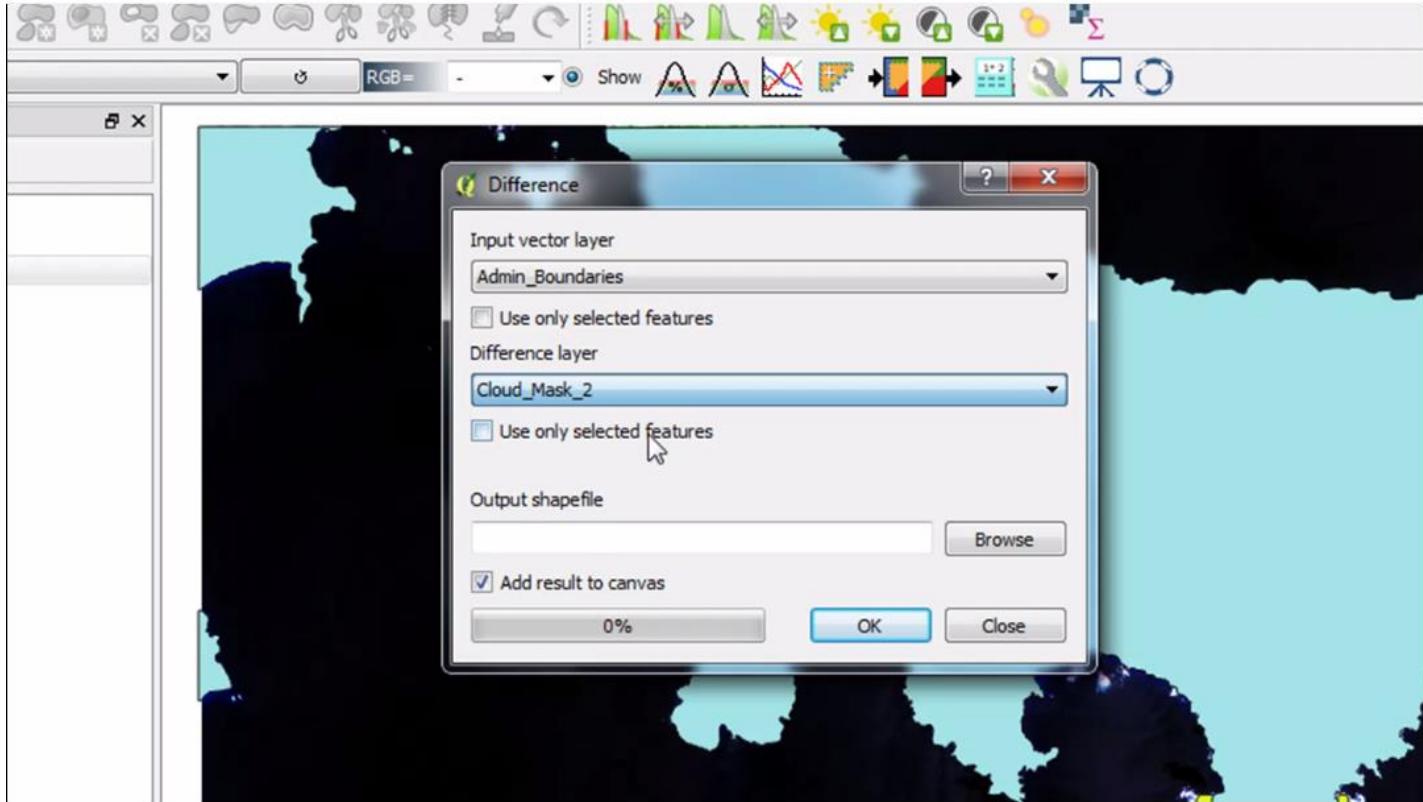
Copernicus





# Demonstration

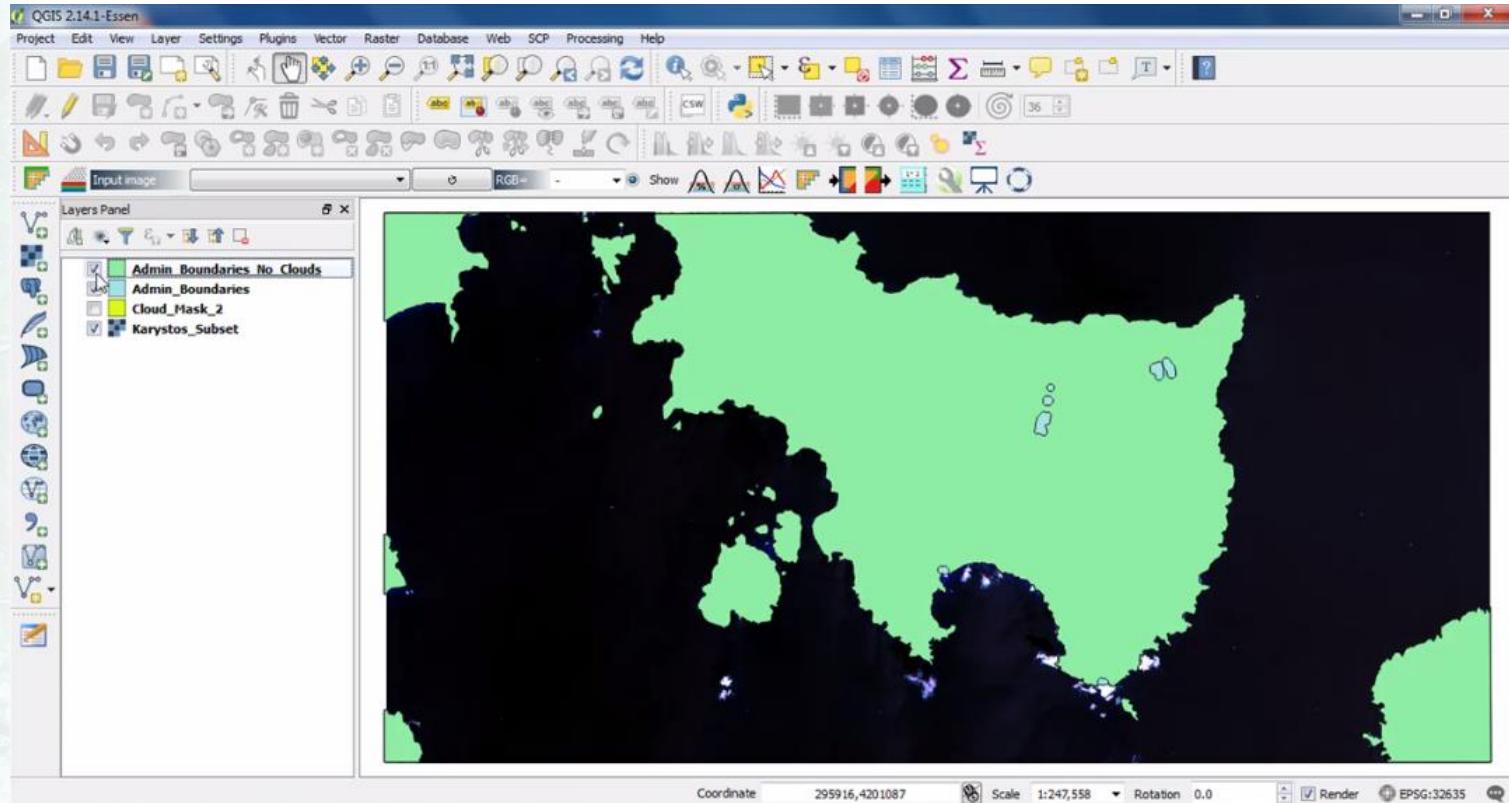
Copernicus





# Demonstration

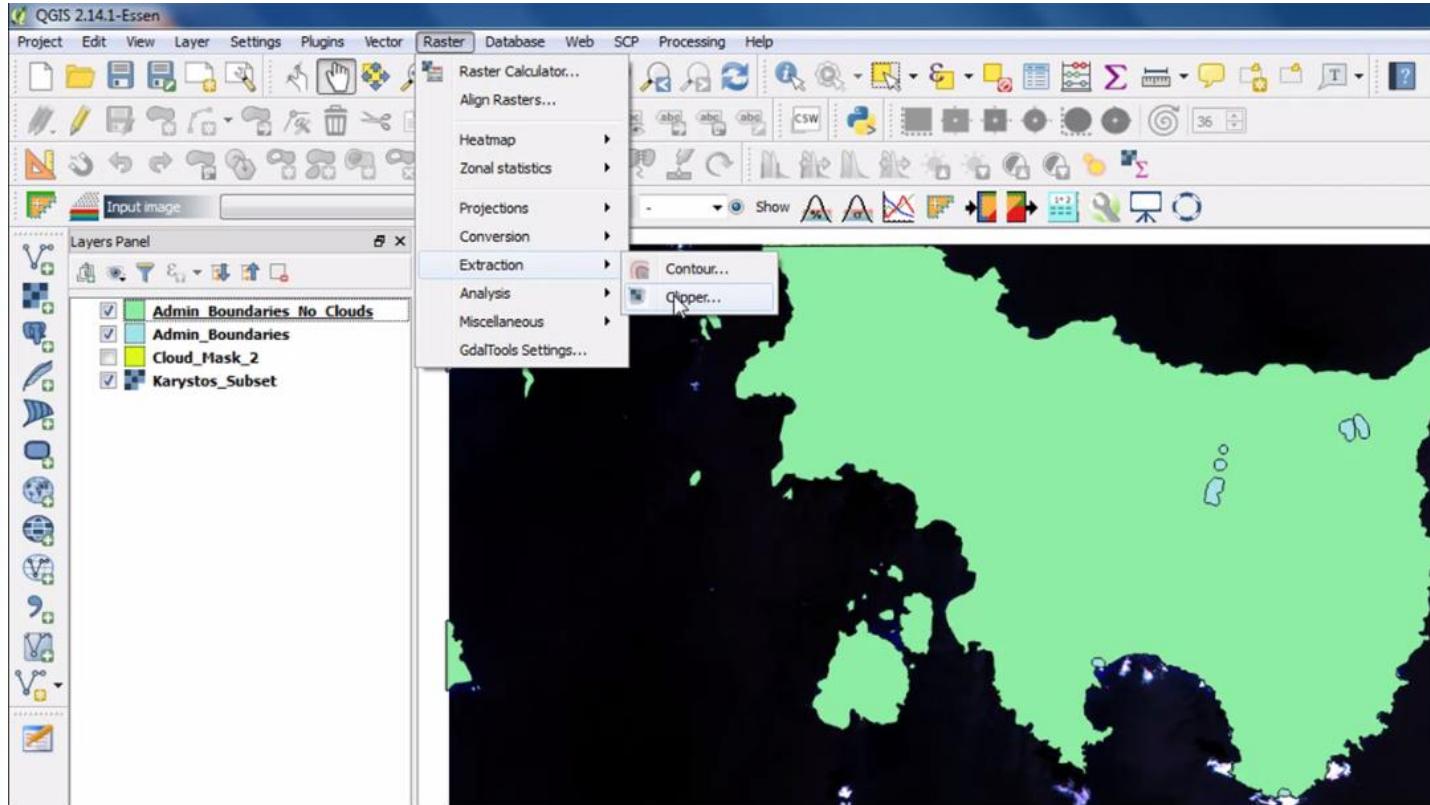
Copernicus





Copernicus

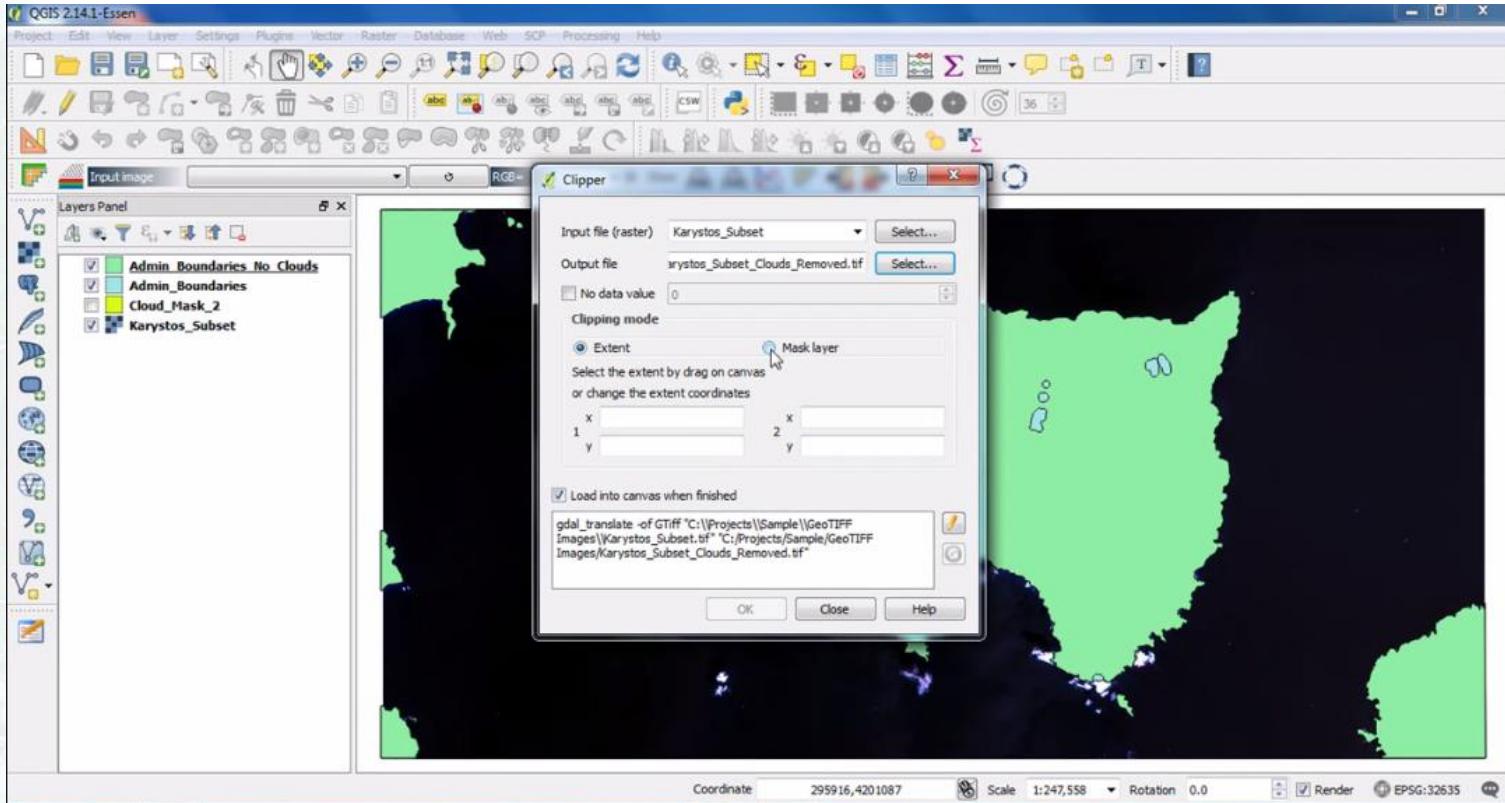
# Demonstration





# Demonstration

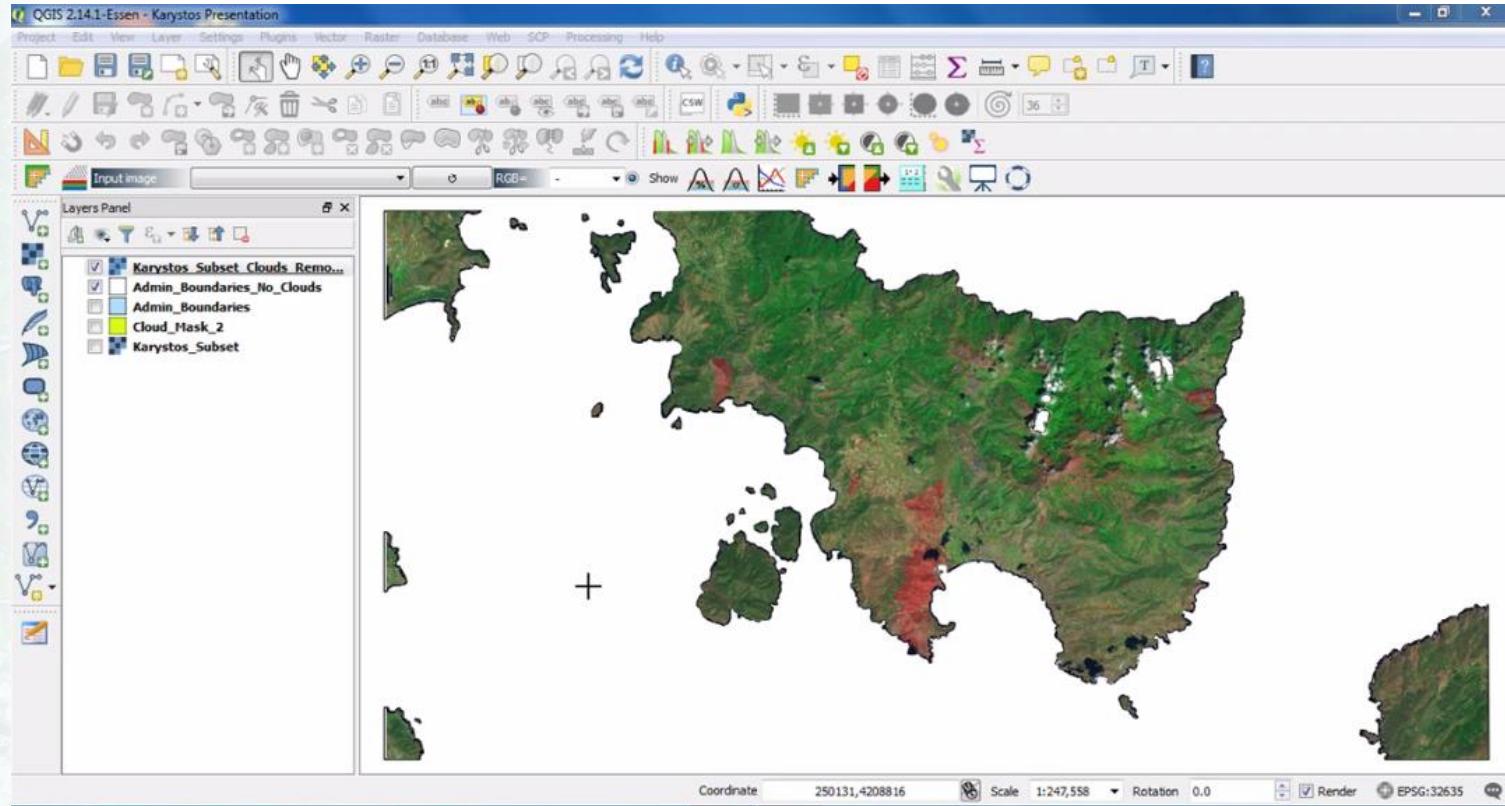
Copernicus





Copernicus

# Demonstration





# Demonstration

Copernicus

in - Karytos Presentation

Layer Settings Plugins Vector Raster

image

Karytos\_Subset\_Clouds\_Removed@1  
Karytos\_Subset@2  
Karytos\_Subset@3  
Karytos\_Subset@4  
Karytos\_Subset@5  
Karytos\_Subset@6  
Karytos\_Subset\_Clouds\_Removed@1  
Karytos\_Subset\_Clouds\_Removed@2  
Karytos\_Subset\_Clouds\_Removed@3  
Karytos\_Subset\_Clouds\_Removed@4  
Karytos\_Subset\_Clouds\_Removed@5  
Karytos\_Subset\_Clouds\_Removed@6

Raster bands

Result layer

Output layer  ...

Output format **GeoTIFF**

Current layer extent

X min 238205.60699 XMax 303518.15974

Y min 4198496.98853 Y max 4231122.07457

Columns 6531 Rows 3263

Output CRS Selected CRS (EPSG:32635, WGS 84 / UTM zone 35N)

Add result to project

Operators

+ = sqrt cos sin tan log10 (

- / ^ acos asin atan ln )

< > = != <= >= AND OR

Raster calculator expression

```
( "Karytos_Subset_Clouds_Removed@4" - "Karytos_Subset_Clouds_Removed@6" ) / ( "Karytos_Subset_Clouds_Removed@4" + "Karytos_Subset_Clouds_Removed@6"
```

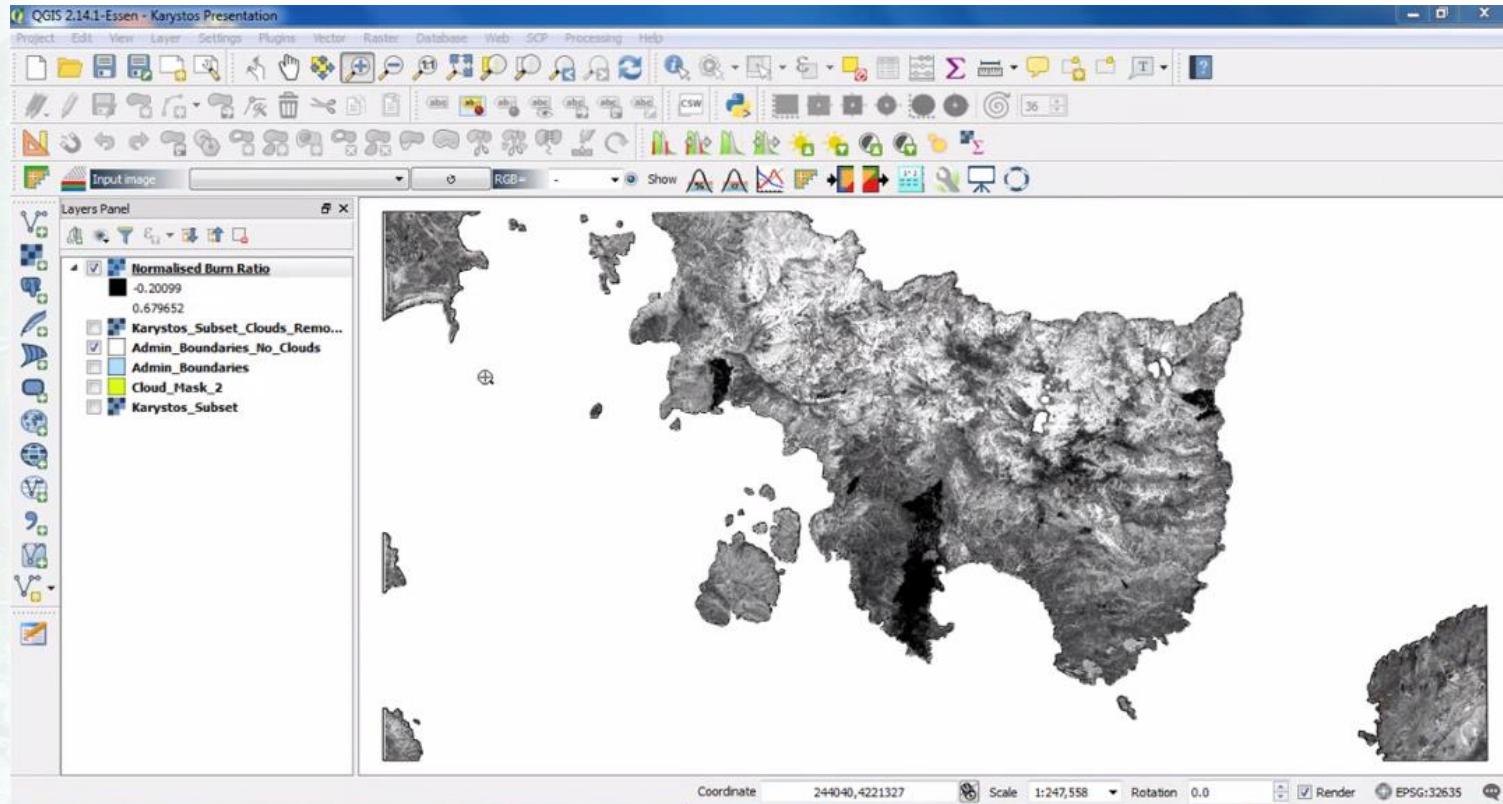
Expression invalid

Cancel OK



Copernicus

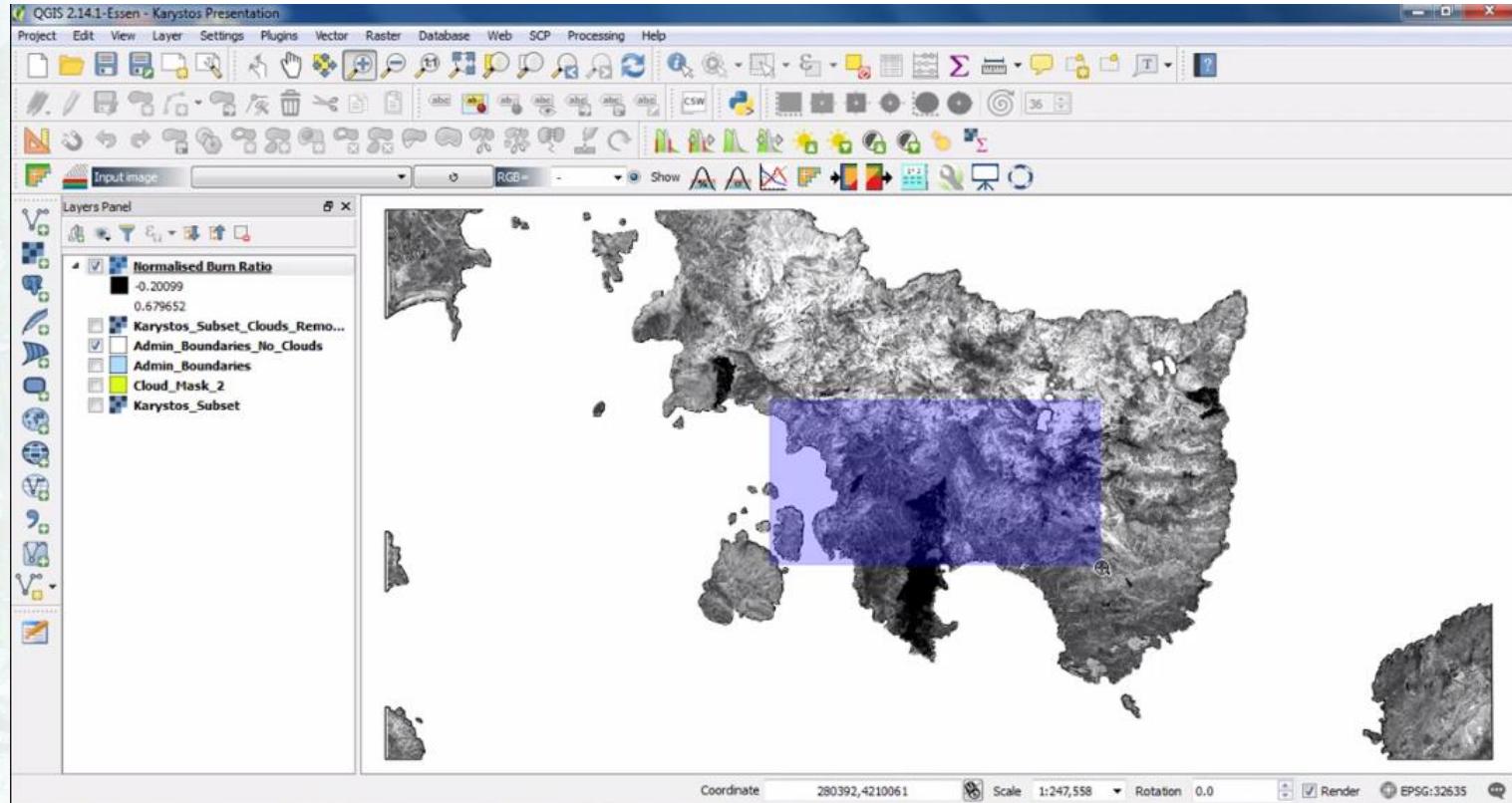
# Demonstration





# Demonstration

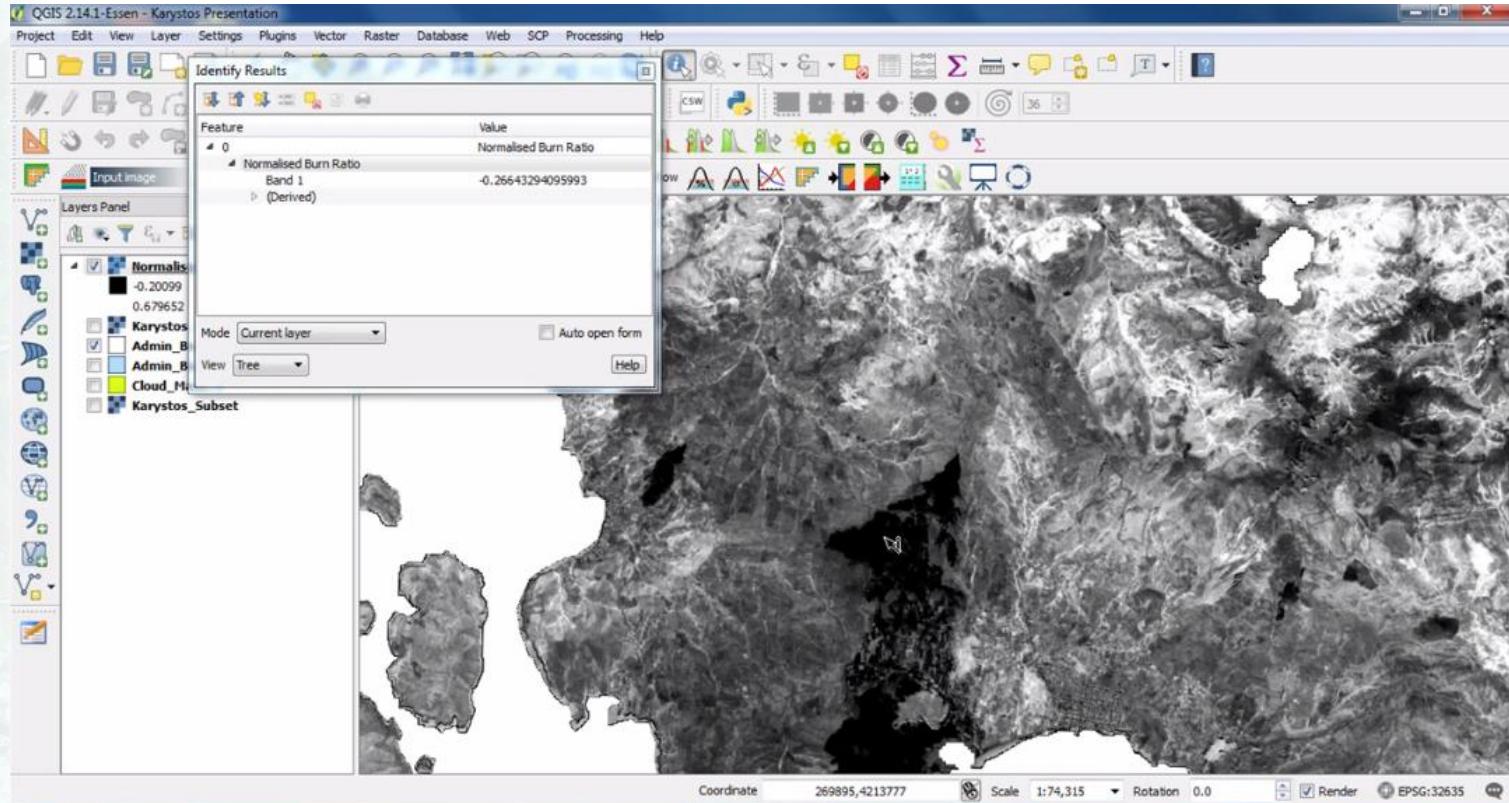
Copernicus





# Demonstration

Copernicus





# Demonstration

Copernicus

QGIS 2.14.1-Essen - Karystos Presentation

Layer Properties - Normalised Burn Ratio | Style

General

Style

Transparency

Pyramids

Histogram

Metadata

Normalis  
-0.20099  
0.679652

Karystos

Admin\_B

Admin\_B

Cloud\_M

Karystos

Band rendering

Render type: Singleband pseudocolor

Band: Band 1 (Gray)

Color interpolation: Linear

Generate new color map

RdYlGn

Edit

Invert

Mode: Continuous

Classes: 5

Min: -0.20099

Max: 0.679652

Classify

Min / max origin: Estimated cumulative cut of full extent.

Load min/max values

Cumulative count cut: 2.0 - 98.0 %

Min / max

Mean +/- standard deviation  $\times$  2.00

Extent

Accuracy

Full

Estimate (faster)

Current

Actual (slower)

Clip

Color rendering

Style

OK Cancel Apply Help

Coordinate: 279471, 4210553

Scale: 1:74,315

Rotation: 0.0

Render

EPSG:32i

1 legend entries removed.



# Demonstration

Copernicus

QGIS 2.14.1-Essen - Karytos.Presentation

Layer Properties - Normalised Burn Ratio | Style

General

Style

Transparency

Pyramids

Histogram

Metadata

Layers Panel

- Normalis [-0.20099 0.679652]
- Karytos
  - Admin\_B
  - Admin\_B
  - Cloud\_M
  - Karytos

Band rendering

Render type: Singleband pseudocolor

Band: Band 1 (Gray)

Color interpolation: Linear

Generate new color map

RdYlGn

Mode: Continuous

Classes: 5

Min: -0.20099 Max: 0.679652

Classify

Min / max origin: Estimated cumulative cut of full extent.

Load min/max values

Cumulative count cut: 2.0 - 98.0 %

Min / max

Mean +/- standard deviation x: 2.00

Extent

Accuracy

Full

Estimate (faster)

Current

Actual (slower)

OK Cancel Apply Help

Clip

Color rendering

Style

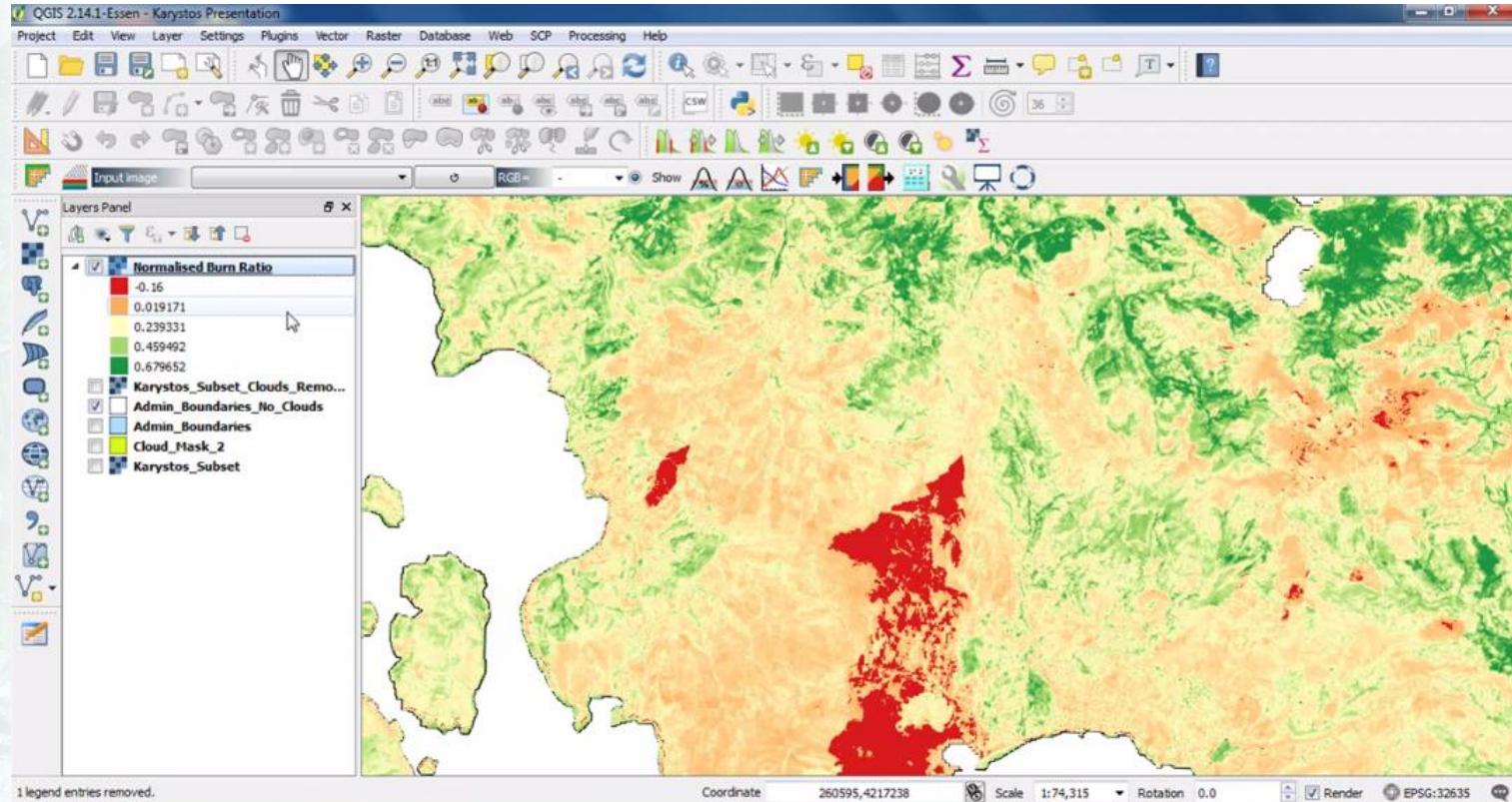
Coordinate: 279471,4210553 Scale: 1:74,315 Rotation: 0.0 Render: EPSG:326

1 legend entries removed.



# Demonstration

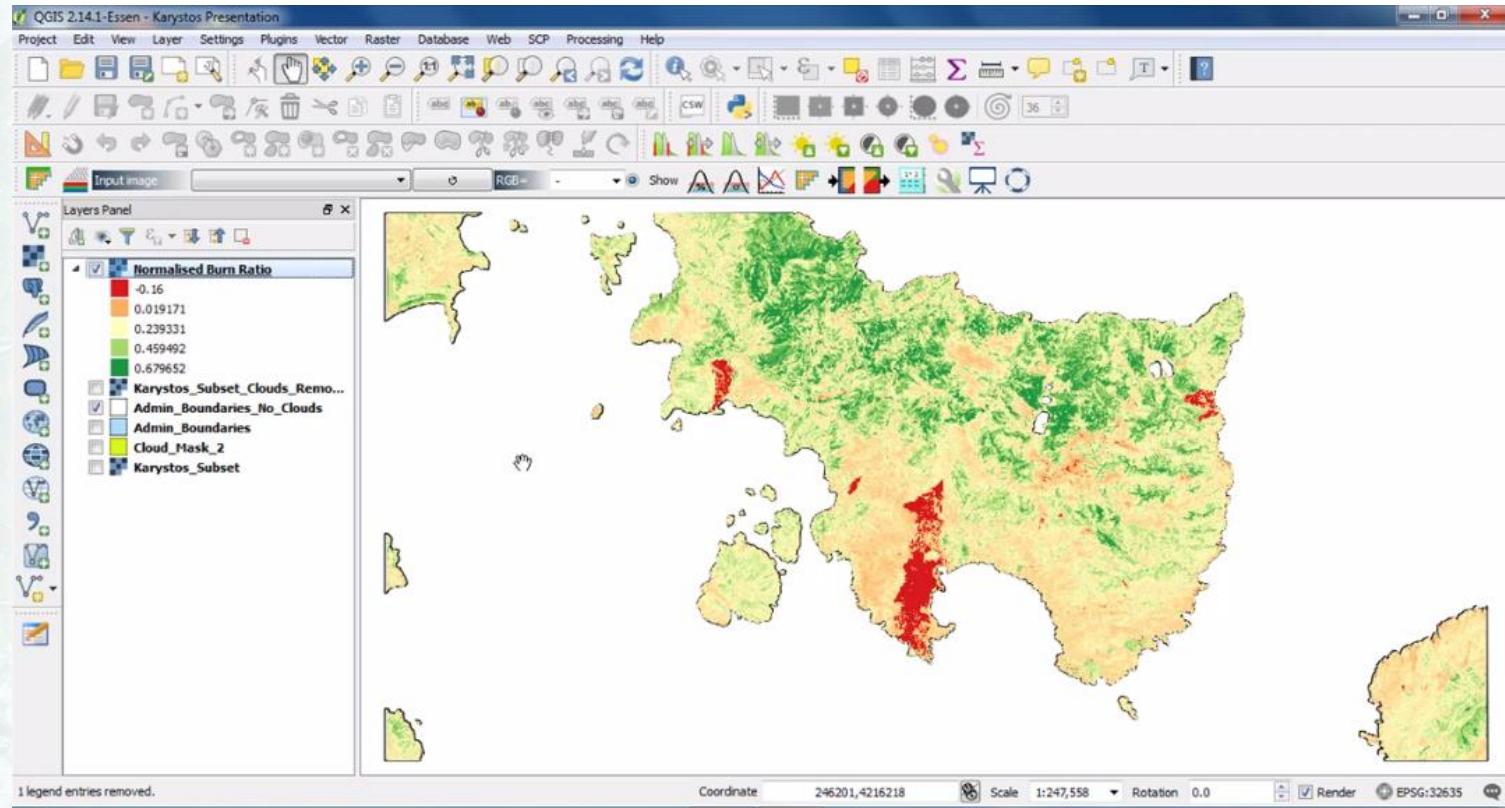
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# Demonstration



# Demonstration



Copernicus

The screenshot shows the Planet Explorer Beta interface. At the top, there's a search bar with the placeholder "Search for a location..." and a "Save search" button. Below it, a sidebar lists "My data usage details" and "Daily Imagery - Aggregate of Usage Locations". The main area displays a satellite mosaic of Sicily, Italy, with a bounding box of 23.622, 36.091, 23.262, 39.396. A legend on the right identifies various land cover types. A timeline at the bottom shows dates from May 11 to June 12, 2017, with a "Daily Imagery" button.

[https://www.planet.com/explorer/#/interval/1%20day/types/Sentinel2L1C/mosaic/global\\_monthly\\_2017\\_09\\_mosaic/center/23.682,59.091/zoom/10/geometry/POLYGON\(\(23.2621+58.8499,24.6519+58.8499,24.6519+59.3968,23.2621+59.3968,23.2621+58.8499\)\)/items/Sentinel2L1C%3AS2A\\_MSIL1C\\_20170528T095031\\_N0205\\_R079\\_T35VLF\\_20170528T095032,Sentinel2L1C%3AS2A\\_MSIL1C\\_20170528T095031\\_N0205\\_R079\\_T34VFL\\_20170528T095032](https://www.planet.com/explorer/#/interval/1%20day/types/Sentinel2L1C/mosaic/global_monthly_2017_09_mosaic/center/23.682,59.091/zoom/10/geometry/POLYGON((23.2621+58.8499,24.6519+58.8499,24.6519+59.3968,23.2621+59.3968,23.2621+58.8499))/items/Sentinel2L1C%3AS2A_MSIL1C_20170528T095031_N0205_R079_T35VLF_20170528T095032,Sentinel2L1C%3AS2A_MSIL1C_20170528T095031_N0205_R079_T34VFL_20170528T095032)



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# Thank you!

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