

A New Way to Visualize and Download Sentinel-2 Images and Vegetation Index Maps Online for Free

Chenghai Yang
Research Agricultural Engineer

Color-infrared Image



Vegetation Index Map



USDA-ARS
Aerial Application Technology
Research Unit
College Station, TX

How Can I View & Download Images Online for Free?

- In my presentation last year, I demonstrated how to use QGIS software to download Sentinel-2 images and create different composite images such as true color images and color-infrared images.
- *Now, these composite images and various vegetation index maps can be easily viewed and downloaded directly from a newly launched Sentinel data space hub without using QGIS.*
- Before diving into *a step-by-step procedure on how to visualize and download these free images from the new data hub website*, I want to briefly talk about some terminology that will help you better understand different types of images you will be downloading from the hub.

What Do You Mean by Color-infrared Image?

- When talking about remote sensing images, you might encounter terms like *true color image*, *RGB image*, *color-infrared image*, *shortwave infrared image*, *far-infrared image*, *thermal image*, and more.
- These terms can be confusing for those who are not familiar with remote sensing. I will start by *giving a brief overview of different types of remote sensing images and clarifying the distinctions between these terms.*

True color



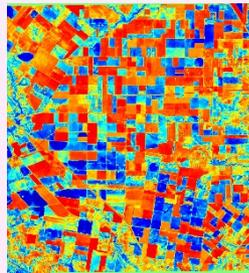
Color-infrared



NDVI



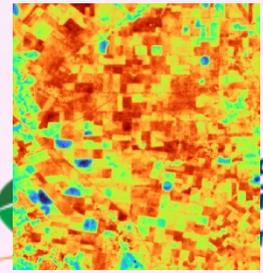
Moisture index



Shortwave infrared

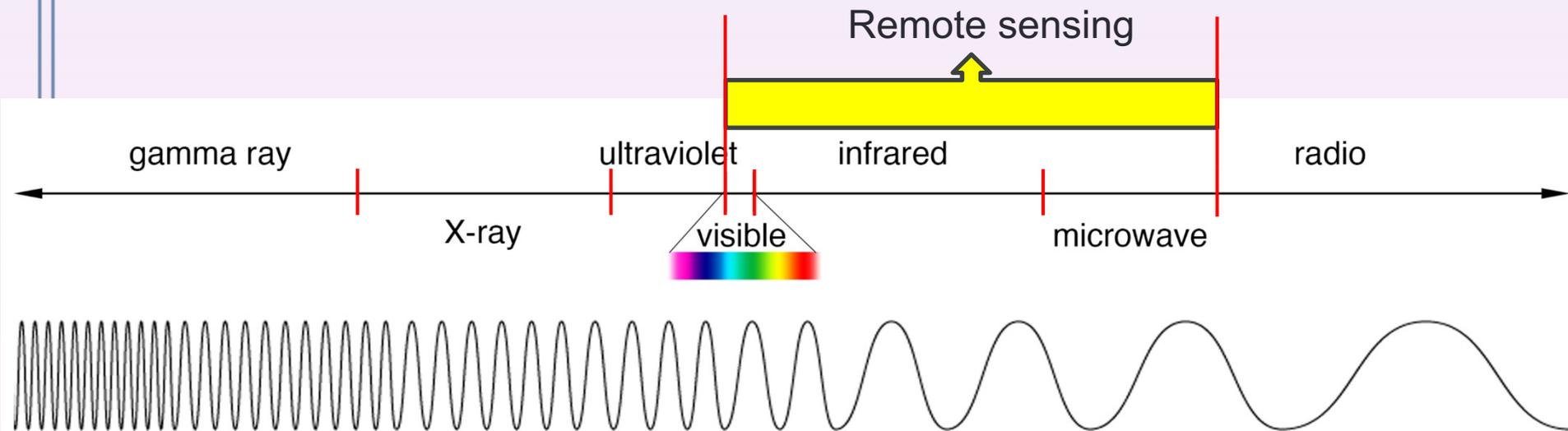


Thermal



The Electromagnetic Spectrum

- Remote sensing involves the detection of reflected and emitted radiation from objects on Earth's surface. *The most familiar form of the radiation is visible light*, which is perceptible to humans and constitutes only *a small portion of the full electromagnetic spectrum*. Remote sensing sensors typically *capture radiation in the visible, infrared and microwave portions of the spectrum*.
- Therefore, the terminology used for different types of images is directly related to the specific portions of the spectrum from which the images are acquired.

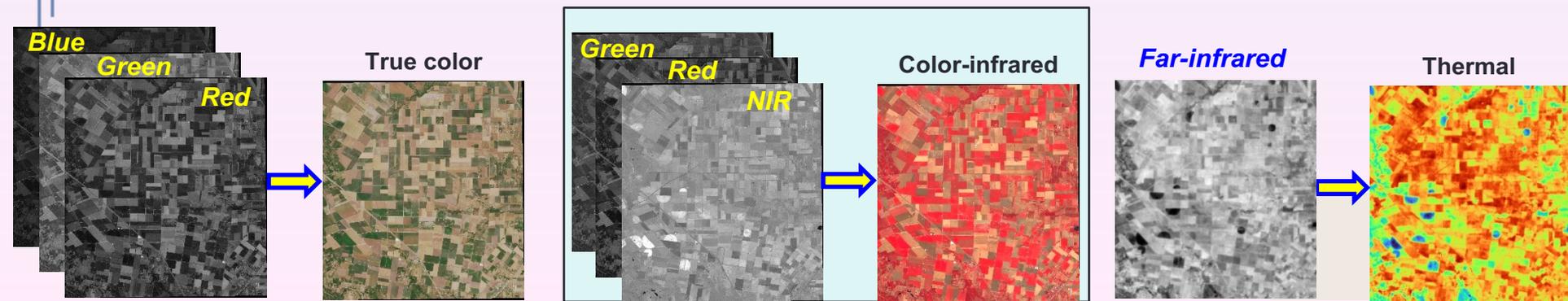


Sentinel-2 Specifications

Sentinel-2 band	Wavelength (nm)	Spatial resolution (m)	
Band 1 - Coastal aerosol	443±10	60	Visible
Band 2 - Blue	490±32.5	10	
Band 3 - Green	560±17.5	10	
Band 4 - Red	665±15	10	
Band 5 - Vegetation red edge	705±7.5	20	NIR
Band 6 - Vegetation red edge	740±7.5	20	
Band 7 - Vegetation red edge	783±10	20	
Band 8 - Near-infrared (NIR)	842±57.5	10	Short wave NIR
Band 8A - Vegetation red edge	865±10	20	
Band 9 - Water vapor	945±10	60	Short wave NIR
Band 10 – SWIR2-Cirrus	1375±15	60	
Band 11 - SWIR	1610±15	20	
Band 12 – SWIR	2190±90	20	

Types of Composite Images

- Each composite image is created from three individual band images.
- When the three visible bands are arranged in the order of *red, green & blue*, the resulting composite is commonly referred to as a *true color image, natural color image, or RGB image*.
- Any composite image that is not a true color image is called a *false color image*.
- The most popular false color composite, formed by the *NIR, red and green* bands, is known as a *color-infrared image, often simply referred to as a false color image*.
- However, a single-band image captured in the thermal region of the spectrum is termed either a *far-infrared image or a thermal image*.



Types of Vegetation Index Maps

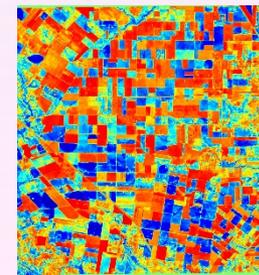
- A *vegetation index (VI)* is a *mathematical transformation of two or more image bands* designed to enhance the measurement of plant vigor and abundance.
- Various VIs find applications across diverse fields.
- The *normalized difference vegetation index (NDVI)* is the most commonly used VI in remote sensing.
- Another VI derived from the Sentinel-2 image is the *normalized difference moisture index (NDMI)*, specifically useful for assessing crop drought.

NDVI



$$\text{NDVI} = \frac{\text{NIR} - \text{Red}}{\text{NIR} + \text{Red}}$$

Moisture index



$$\text{NDMI} = \frac{\text{SWIR} - \text{Red}}{\text{SWIR} + \text{Red}}$$

Two Composites and Two VI Maps

True color



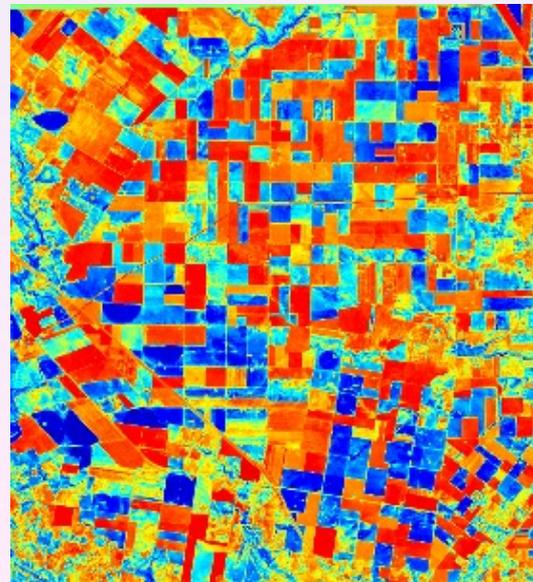
Color-infrared



NDVI



Moisture index



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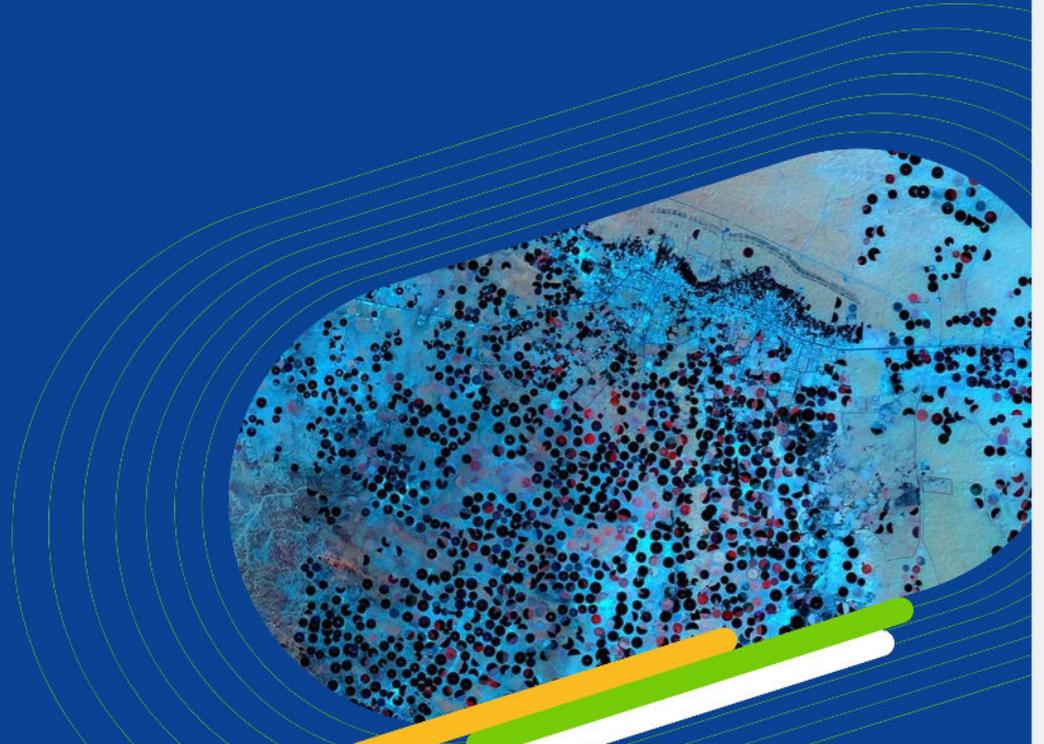
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Register form

* Required fields

First name *

Last name *

Email *

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Copernicus Browser
Data collections

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REGISTER ↗

• Select EXPLORE DATA->Copernicus Browser

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Zoom in or Define an Area of Interest

The screenshot shows the Copernicus Browser interface. The top navigation bar includes the Copernicus logo, language settings (EN), and a user profile (Chenghai Yang). The main interface is divided into a left sidebar and a right map area. The sidebar contains sections for 'VISUALIZE', 'SEARCH', 'DATE:', 'CONFIGURATIONS:', and 'DATA COLLECTIONS:'. The 'DATE:' section has a date input field (YYYY-MM-DD) and a 'Show latest date' button. The 'DATA COLLECTIONS:' section lists 'Sentinel-2 L1C' and 'Sentinel-2 L2A'. The map area shows a satellite view of Corpus Christi, Texas, with a blue polygon defining an area of interest. The map includes a search bar, a scale bar (1602.25 km²), and various map controls. A red box highlights the 'Area of Interest' (AOI) tools (rectangle, polygon, and circle) in the top right of the map area.

• Zoom in to the general area of interest.

• Further define the area by a box or polygon.

• Keep default configurations and click YYYY-MM-DD.

Select a Date to Visualize the Image

The screenshot displays the Copernicus Browser interface. The top navigation bar includes the Copernicus logo, language (EN), and location (Chenghai Yang). The main interface is split into a control panel on the left and a map on the right. The control panel features a 'VISUALIZE' button, a date selector (2023-07-15), a cloud coverage slider (30%), and a calendar. The calendar shows the month of July 2023, with the date 15 highlighted in a blue box. The map on the right shows a satellite view of a rural area with a blue bounding box around a specific region. The map includes a search bar, a scale bar (1405.70 km²), and various map controls like zoom, pan, and layers. The bottom of the control panel shows the selected layer 'Sentinel-2 L2A' and a 'LAYERS:' section.

2023-07-15

30%

Max. cloud coverage: 30%

July 2023

Su	Mo	Tu	We	Th	Fr	Sa
25	26	27	28	29	30	1
2	3	4	5	6	7	8
9	10	11	12	13	14	15
16	17	18	19	20	21	22
23	24	25	26	27	28	29
30	31	1	2	3	4	5

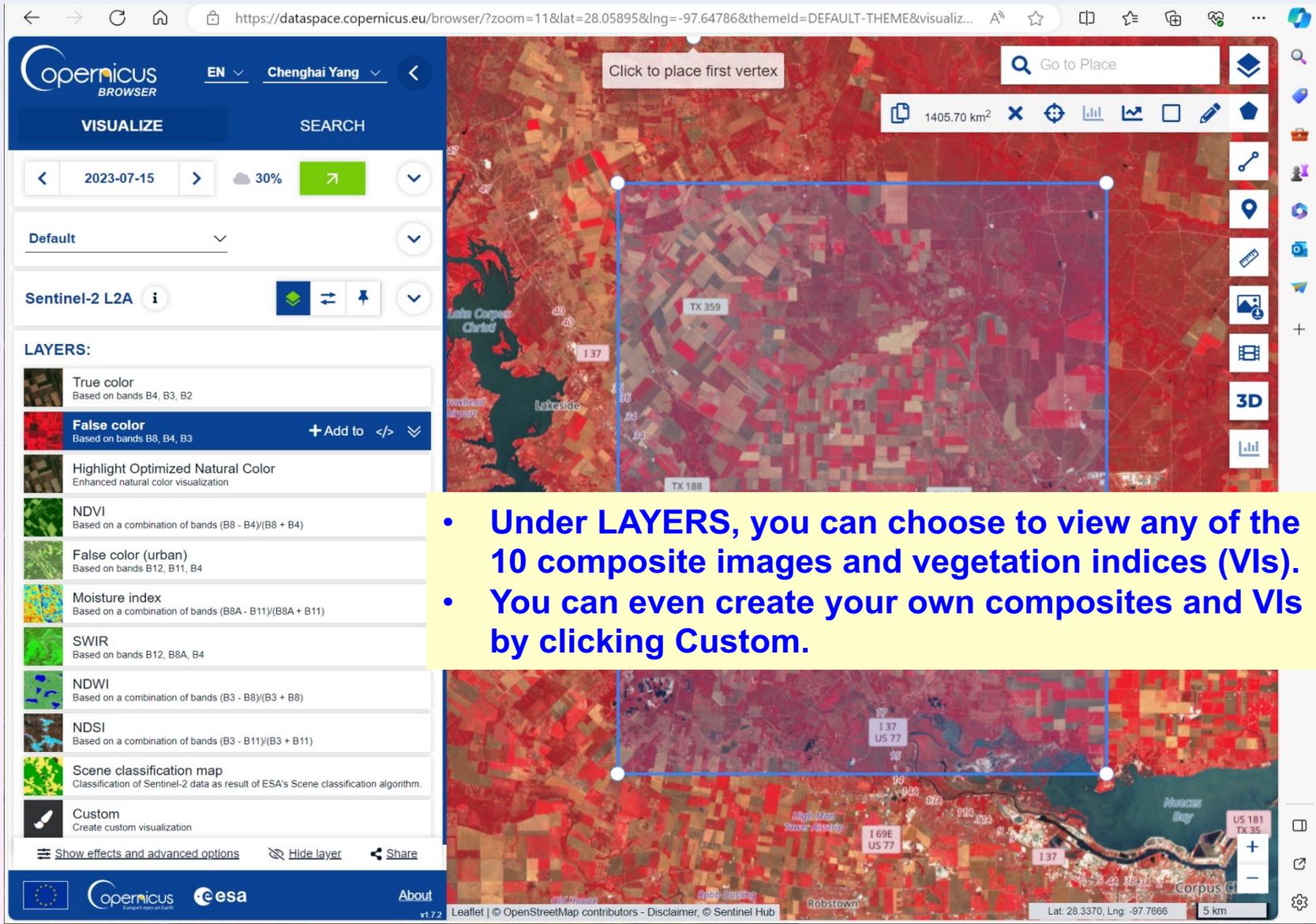
Default

Sentinel-2 L2A

LAYERS:

- Adjust Max. cloud coverage as necessary and select a boxed date
- Click VISUALIZE to view the true color image for the selected date.

Select False Color to Visualize



Click to place first vertex

Go to Place

1405.70 km²

2023-07-15 30%

Default

Sentinel-2 L2A

LAYERS:

- True color
Based on bands B4, B3, B2
- False color**
Based on bands B8, B4, B3 + Add to </>
- Highlight Optimized Natural Color
Enhanced natural color visualization
- NDVI
Based on a combination of bands (B8 - B4)/(B8 + B4)
- False color (urban)
Based on bands B12, B11, B4
- Moisture index
Based on a combination of bands (B8A - B11)/(B8A + B11)
- SWIR
Based on bands B12, B8A, B4
- NDWI
Based on a combination of bands (B3 - B9)/(B3 + B9)
- NDSI
Based on a combination of bands (B3 - B11)/(B3 + B11)
- Scene classification map
Classification of Sentinel-2 data as result of ESA's Scene classification algorithm.
- Custom
Create custom visualization

Show effects and advanced options Hide layer Share

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Lat. 28.3370, Lng. -97.7666 5 km

- Under **LAYERS**, you can choose to view any of the 10 composite images and vegetation indices (VIs).
- You can even create your own composites and VIs by clicking **Custom**.

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nology

Select NDVI to Visualize

https://dataspace.copernicus.eu/browser/?zoom=11&lat=28.05895&lng=-97.64786&themelid=DEFAULT-THEME&visualiz...

Go to Place

Click to place first vertex

1405.70 km²

2023-07-15 30%

Default

Sentinel-2 L2A

LAYERS:

- True color
Based on bands B4, B3, B2
- False color
Based on bands B8, B4, B3
- Highlight Optimized Natural Color
Enhanced natural color visualization
- NDVI**
Based on a combination of bands (B8 - B4...)
- False color (urban)
Based on bands B12, B11, B4
- Moisture index
Based on a combination of bands (B8A - B11)/(B8A + B11)
- SWIR
Based on bands B12, B8A, B4
- NDWI
Based on a combination of bands (B3 - B9)/(B3 + B8)
- NDSI
Based on a combination of bands (B3 - B11)/(B3 + B11)
- Scene classification map
Classification of Sentinel-2 data as result of ESA's Scene classification algorithm.
- Custom
Create custom visualization

- Under **LAYERS**, you can choose to view any of the 10 composite images or vegetation indices (VIs).
- You can even create your own composites and VIs by clicking **Custom**.

137 US 77

169E US 77

137 TX 35

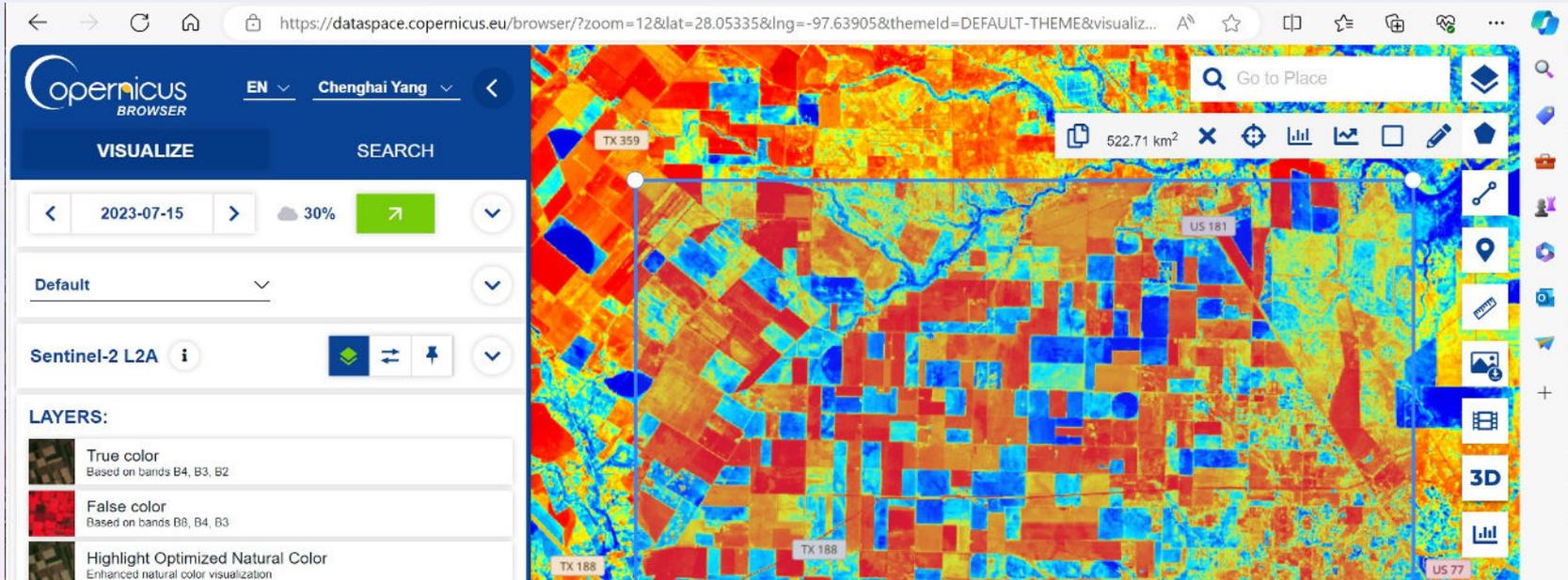
181 TX 35

137

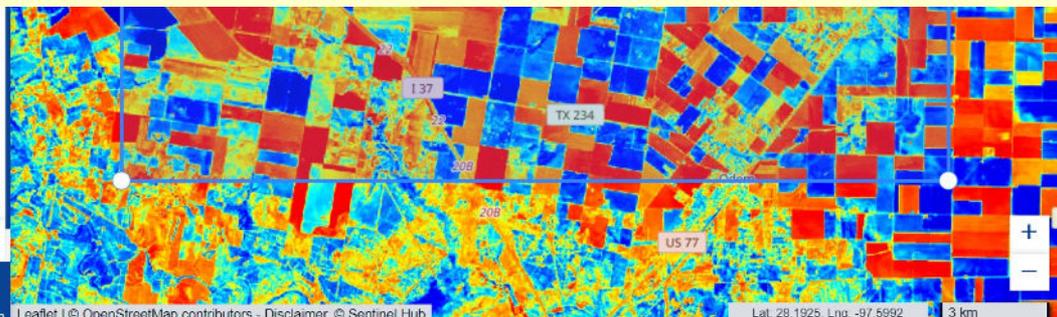
5 km

Lat. 28.3310, Lng. -97.6458

Select Moisture Index to Visualize



- Under **LAYERS**, you can choose to view any of the 10 composite images or vegetation indices (VIs).
- You can even create your own composites and VIs by clicking **Custom**.



Select Moisture Index to Visualize

The screenshot shows the Copernicus Browser interface. The 'Analytical' tab is selected and highlighted with a red box. The 'Moisture index' layer is selected in the 'LAYERS' panel. On the right sidebar, the 'Download Image' icon is highlighted with a red box and labeled 'Download Image' with a red arrow. Below the 'Image format' dropdown, a 'Preview' section shows a color-coded map of the moisture index, with a 'Download' button highlighted in a red box and labeled 'Download' with a red arrow.

- Click the **Download Image** icon on the right side.
- A preview of the selected image or VI will be displayed.
- Click **Download** at the bottom to save it as a JPG file.

Download Selected Images and VIs

The screenshot shows the Copernicus Browser interface. At the top, the 'Analytical' view is selected. The 'Image download' panel is open, showing settings for image format (TIFF), resolution (CUSTOM), and coordinate system (UTM). A 'Download' button is highlighted at the bottom. A red arrow points to the 'Download Image' icon in the right-hand toolbar.

- Click **Analytical** at the top.
- Select the image layers and other image settings as shown.
- Click **Download** at the bottom to save selected images and VIs.

Selected Images Are Saved in Your PC

- The images are saved in **C:\Users\Chenghai.Yang\Downloads\Browser_images.zip**.
- Use **7-Zip** or any unzip software to **extract the files**.
- The extracted files are saved at **C:\Users\Chenghai.Yang\Downloads\Browser_images**.

The screenshot displays a Windows File Explorer window with the following details:

- Navigation pane:** Shows 'This PC' and 'Downloads' selected. Other locations include Desktop, Documents, Pictures, This PC, and various folders like '061022_FM50_D850' and 'Browser_images_all'.
- Address bar:** Shows the path 'This PC > Downloads > Browser_images'.
- Content area:** Displays four satellite images in a 2x2 grid:
 - Top-left: **2023-07-15-00_00_2023-07-15-23_59_Sentinel-2_L2A_False_col_or.tiff** (False-color composite)
 - Top-right: **2023-07-15-00_00_2023-07-15-23_59_Sentinel-2_L2A_Moisture_index.tiff** (Moisture index map)
 - Bottom-left: **2023-07-15-00_00_2023-07-15-23_59_Sentinel-2_L2A_NDVI.tiff** (NDVI map)
 - Bottom-right: **2023-07-15-00_00_2023-07-15-23_59_Sentinel-2_L2A_True_col_or.tiff** (True-color composite)
- Right pane:** Shows '4 items' and a folder icon.
- Bottom-left corner:** Shows '4 items'.

Summary and Expectations

- We have discussed several types of remote sensing images. *The expectation is that you can distinguish between these commonly used terms (e.g., true color, RGB, near-infrared, color-infrared, and far-infrared).*
- We have demonstrated a step-by-step procedure on how to visualize and download free Sentinel-2 images. *The expectation is that you can register on the website and obtain different image products (e.g., true color, color-infrared, and NDVI) for any area of your choice.*

Questions?

Thank You!

chenghai.yang@usda.gov

