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EOCap4Africa

8 Raster Processing

a) Data Acquisition, Cloud Handling & Mosaicing basics



Learning objectives



Learn which preprocessing steps matter in a remote sensing study

Understand the theoretical basics of cloud masking and mosaicing

Practice how to acquire Sentinel-2 data via Sentinel Hub



Why do we preprocess raster data?

Clouds and shadows obscure surface features

Processing raw data improves accuracy for analysis

Combining multiple images provides better coverage

Sentinel-2 tiles do not always align perfectly

Common preprocessing steps in GIS



1. **Cloud masking** – Remove unwanted cloud pixels
1. **Mosaicing** – Merge multiple Sentinel-2 tiles
1. **Clipping** – Focus on an area of interest
1. **Resampling** – Adjust pixel resolution
1. **Reprojection** – Align coordinate systems for consistency

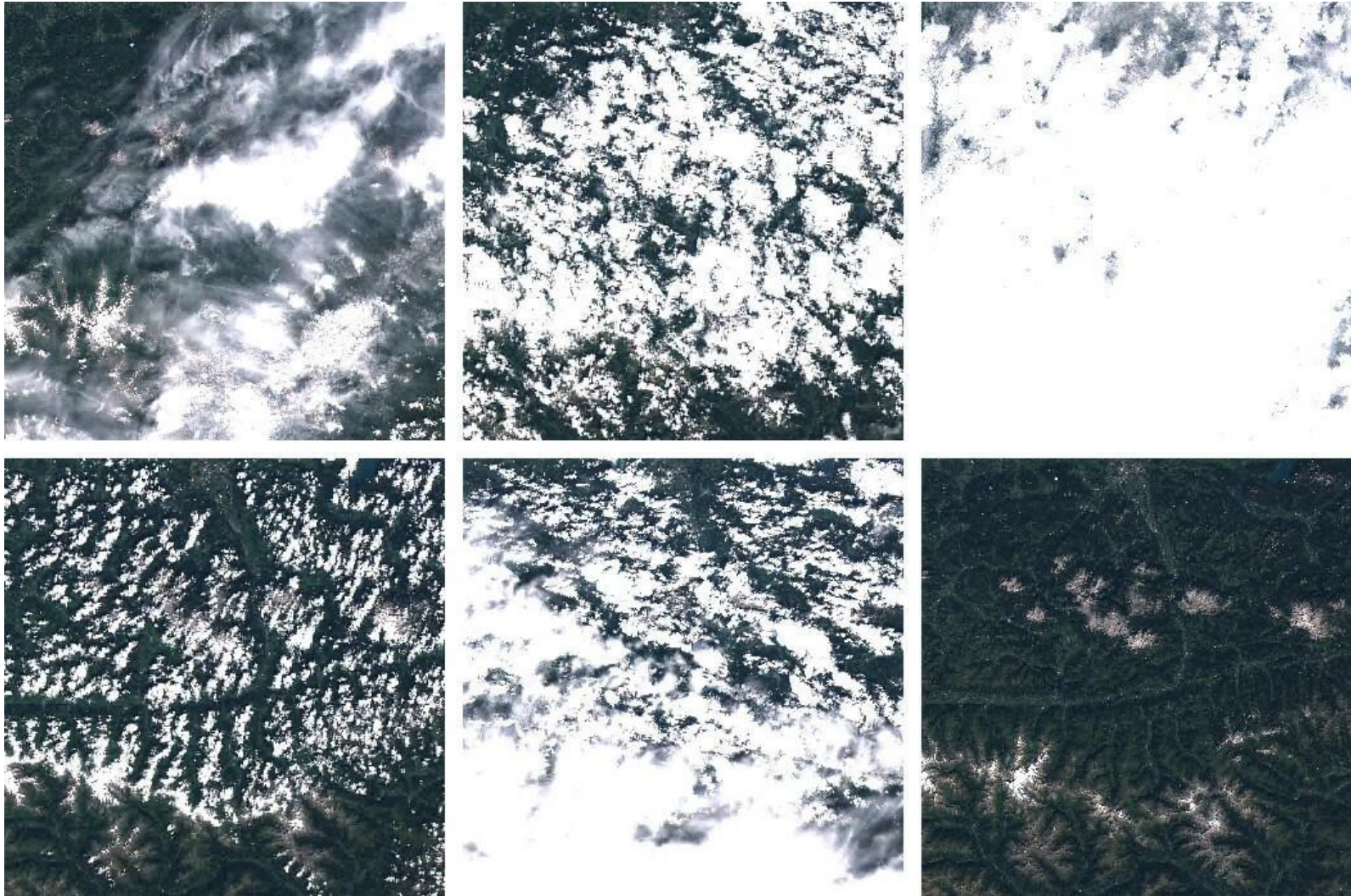


Order of preprocessing steps

- **Cloud masking first** prevents contaminated pixels from affecting the mosaic
- **Mosaicing before clipping** ensures a continuous dataset before selecting an AOI
- **Reprojection after clipping** reduces unnecessary transformations on large datasets
- **Resampling last** ensures final compatibility with the analysis requirements

QGIS offers great tools for all of these steps!

Cloud coverage on Sentinel-2 Data

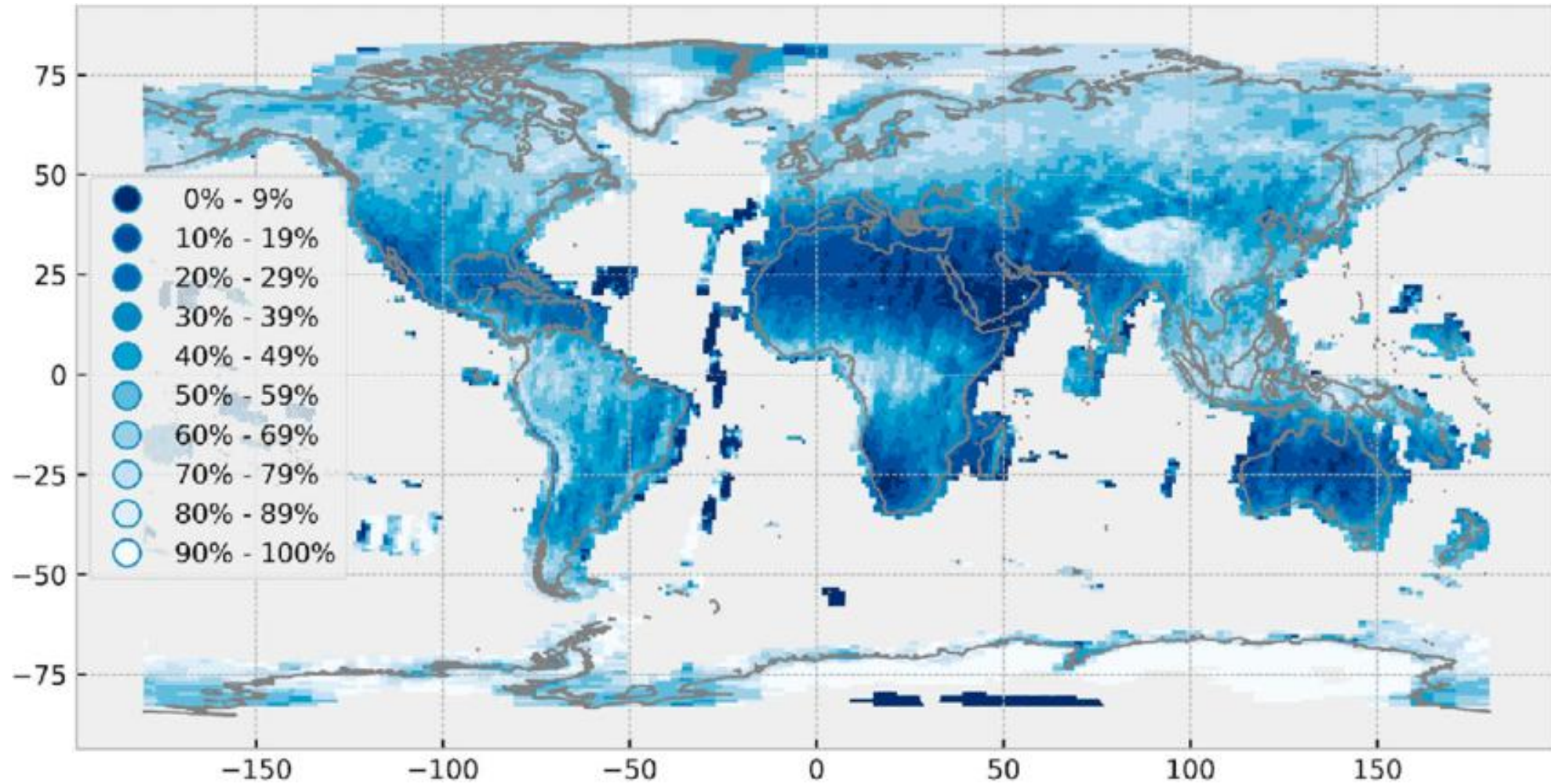


(Ungar 2017)



Cloud coverage on Sentinel-2 Data

Global spatial distribution of the average cloud cover of Sentinel-2



(Sudmanns et al. 2019)



What is mosaicing?

Mosaicing is the process of merging multiple raster tiles into a seamless image

Why is it needed?

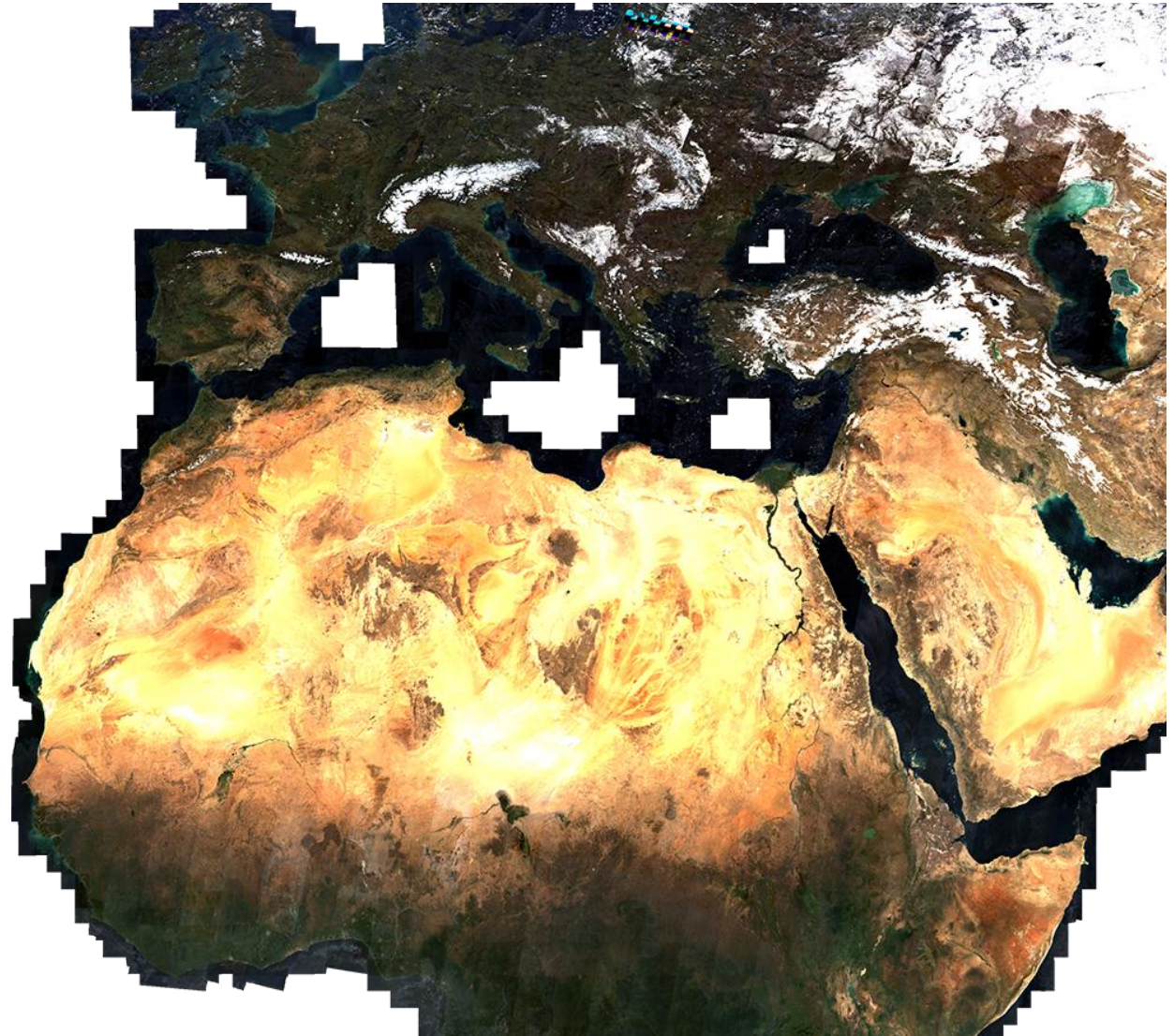
- Sentinel-2 and other satellite imagery come in separate tiles
- Large study areas require multiple images to cover the entire region
- Merging helps remove gaps and ensures spatial continuity

How does it work?

- Overlapping areas are blended using pixel values
- NoData values are handled to avoid gaps
- The output is a single, continuous raster dataset

Sentinel-2 Mosaic

Showing southern Europe and
northern Africa



(Sentinel Hub n.d.)



Recap: Accessing Sentinel-2 data



<https://browser.dataspace.copernicus.eu>

General workflow:

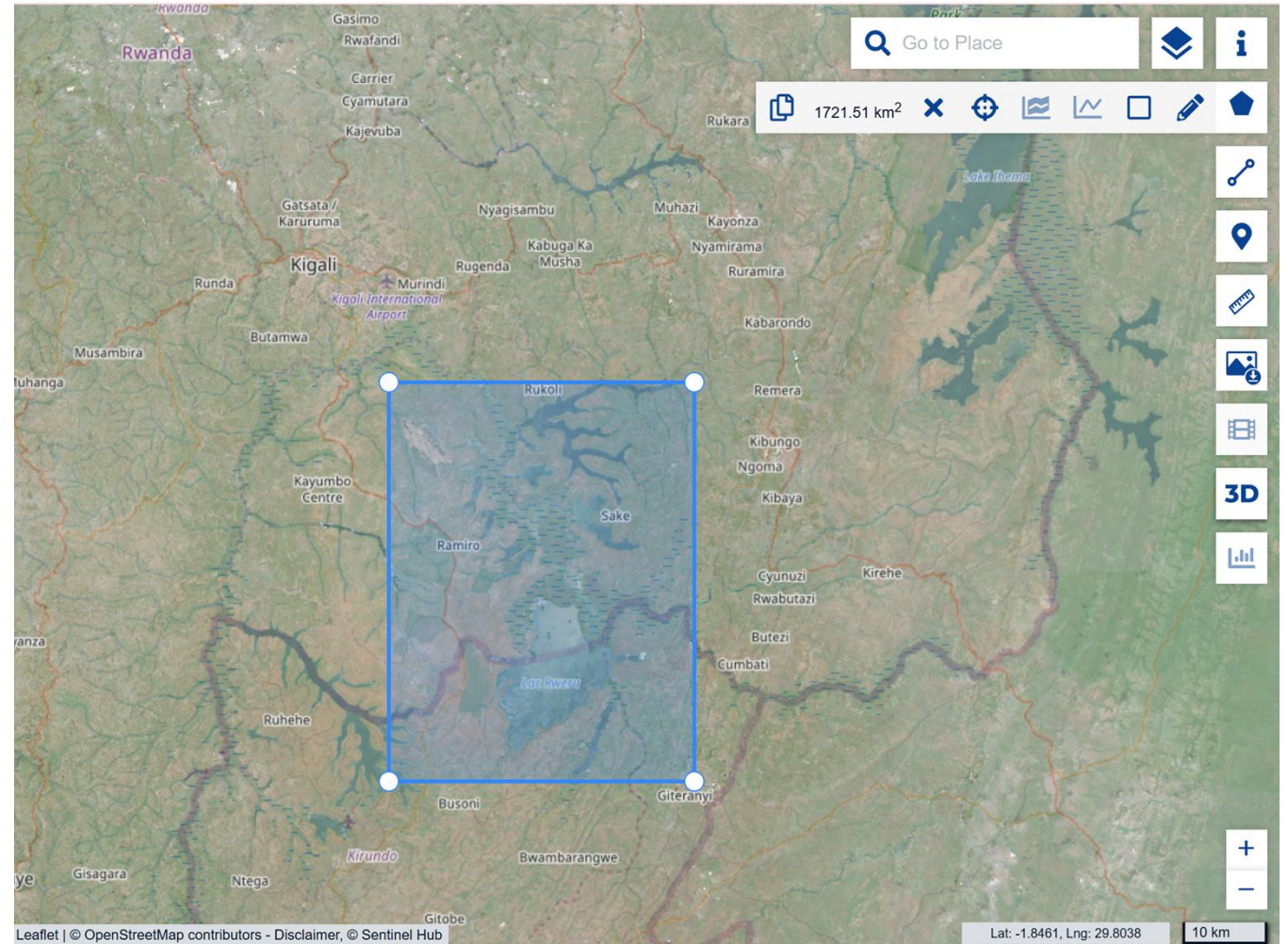
1. Visit the Sentinel Browser
2. Define **Area of Interest (AOI)** using a bounding box or shapefile
3. Choose **Sentinel-2 L2A** for atmospherically corrected data
4. Filter by **date range** and **cloud cover**
5. Download in **GeoTIFF format** for QGIS compatibility

Recap: Accessing Sentinel-2 data



Select the area of interest (AOI)

In this case, I choose wetlands in Rwanda



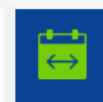



Recap: Accessing Sentinel-2 data



Select date of image acquisition, cloud cover and mosaicking order suitable to your study

DATE: TIME RANGE

From:


<
2025-01-01
>

hh 00 ◇ : mm 00 ◇

Until:

<
2025-02-26
>

hh 23 ◇ : mm 59 ◇

Max. cloud coverage:  **30%**

Mosaicking order: Layer default ∨

[Find products within selected time range](#)



Recap: Accessing Sentinel-2 data

Compare results and choose the image that best covers your AOI

Go to search

Showing 2 results

S2C_MSIL2A_20250225T080941_N0511_R078_T36MTC_20250225T113814.SAFE
Mission: SENTINEL-2 **Instrument:** MSI **Size:** 631MB
Sensing time: 2025-02-25T08:09:41.025000Z

Visualise

SENTINEL-2 MSI S2MSI2A

[i](#)
[+](#)
[+](#)
[+](#)

S2C_MSIL2A_20250225T080941_N0511_R078_T35MRT_20250225T113814.SAFE
Mission: SENTINEL-2 **Instrument:** MSI **Size:** 1135MB
Sensing time: 2025-02-25T08:09:41.025000Z

Visualise

SENTINEL-2 MSI S2MSI2A

[i](#)
[+](#)
[+](#)
[+](#)

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v1.14.8 Leaflet | © OpenStreetMap contributors - Disclaimer, © Sentinel Hub

Recap: Accessing Sentinel-2 data

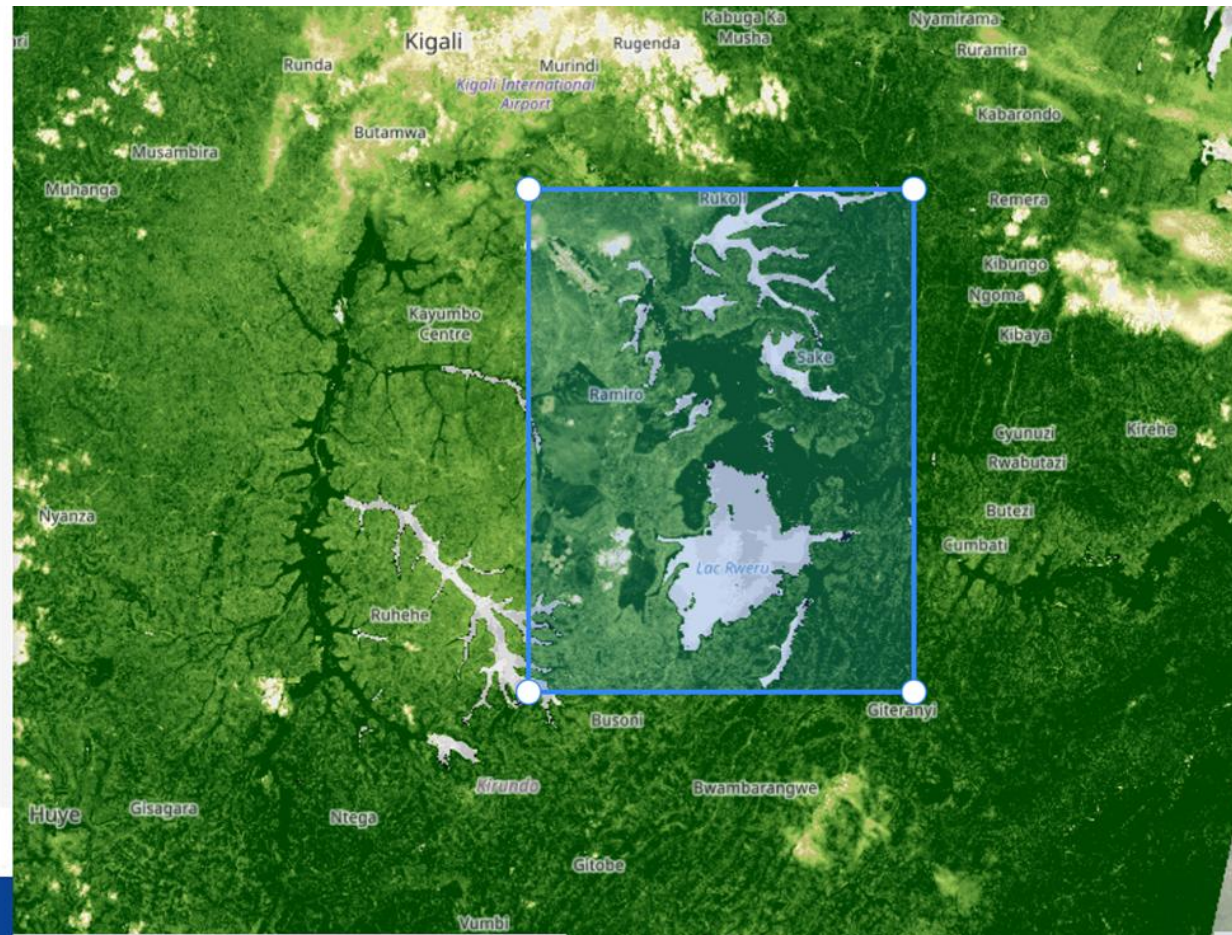
In the layers tab you can either choose the RGB Image or finalised analysis products such as the NDVI

LAYERS:

- True color
Based on bands B4, B3, B2
- False color
Based on bands B8, B4, B3
- Highlight Optimized Natural Color
Enhanced natural color visualisation
- NDVI**
Based on a combination of bands (B8 - B4...)
[+ Add to](#) [</>](#) [v](#)
- 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 - B8)/(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.

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Recap: Accessing Sentinel-2 data

Finally, if you are logged in to your account, you can download the scene.

Download a Sentinel-2 scene of your liking by following the steps outlined before.

Think of a study in which this Scene might be useful.

Summary & key takeaways



Sentinel-2 data is easily accessible via **Copernicus Browser**

Cloud cover is essential for optical satellite imagery

Mosaicing combines multiple tiles for seamless analysis

QGIS provides **user-friendly tools** for raster preprocessing

Sources



Sudmanns, M., Tiede, D., Augustin, H., & Lang, S. (2019). Assessing global Sentinel-2 coverage dynamics and data availability for operational Earth observation (EO) applications using the EO-Compass. *International Journal of Digital Earth*, 13(7), 1-17. <https://doi.org/10.1080/17538947.2019.1572799>

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Thank you for your attention!

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