

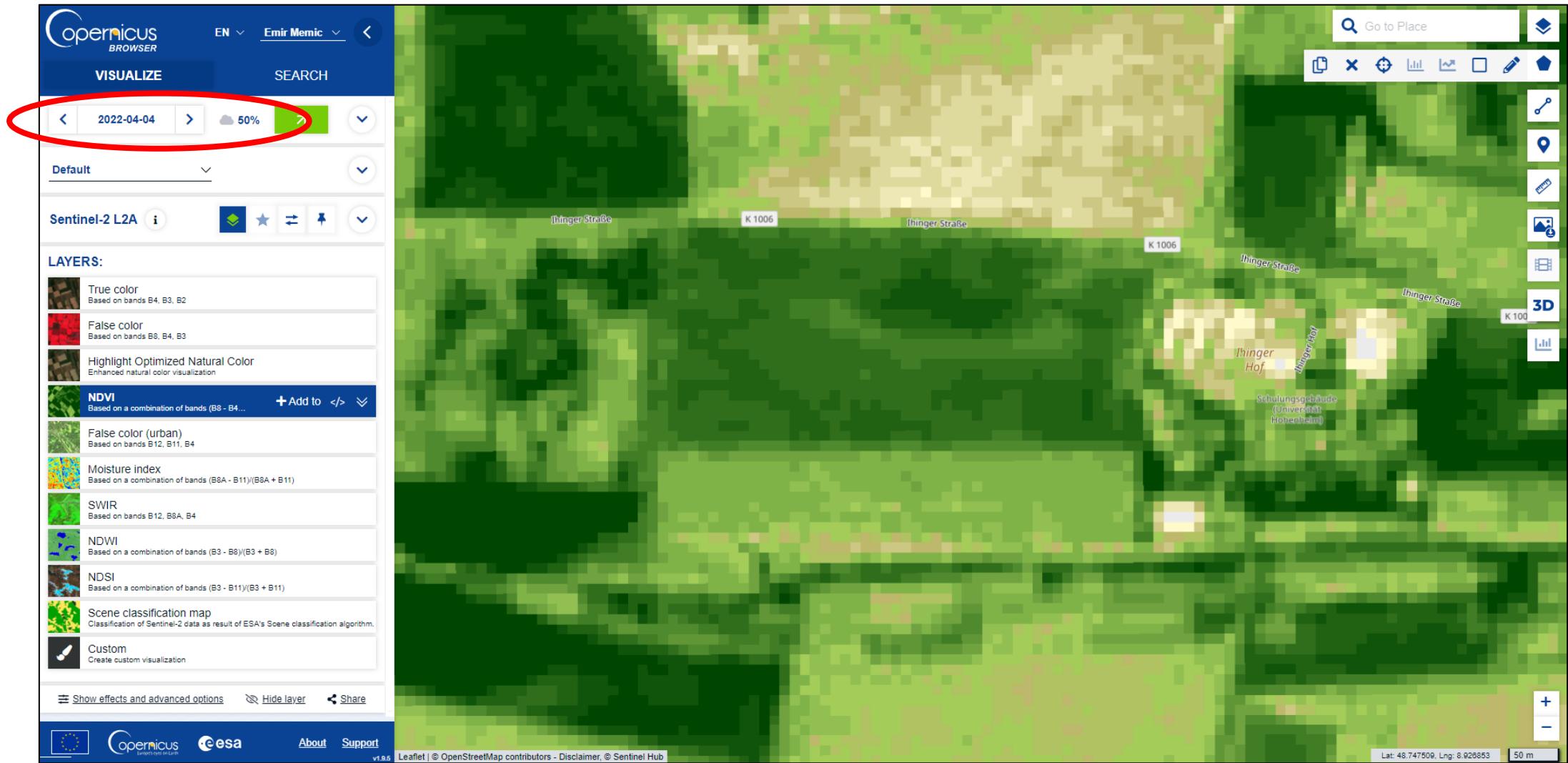
From NDVI to N application map (agriculture)

Lecture notes preparation - about conceptual framework
(Education purpose)

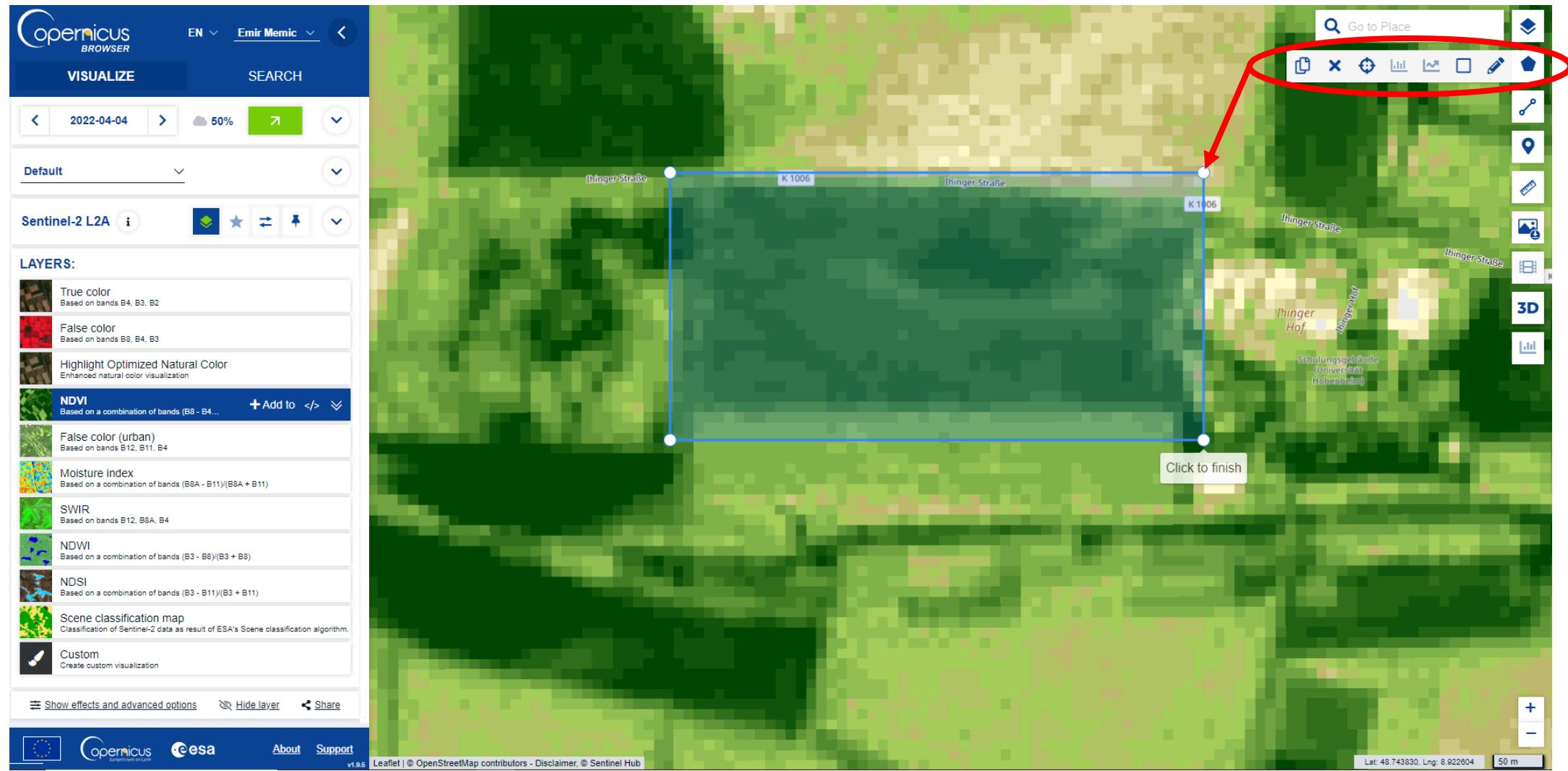
Emir Memic
(University of Hohenheim)
Feb 2024

Outline

- Satellite images download – Copernicus Browser
 - Copernicus Data Space Ecosystem (CDSE), Modified Copernicus Sentinel data 2024 processed in Copernicus Browser. <https://browser.dataspace.copernicus.eu/>
- QGIS-based NDVI analysis and N prescription map processing
 - QGIS 2024. QGIS.org, Geographic Information System. QGIS Association. <http://www.qgis.org>
- Discussion

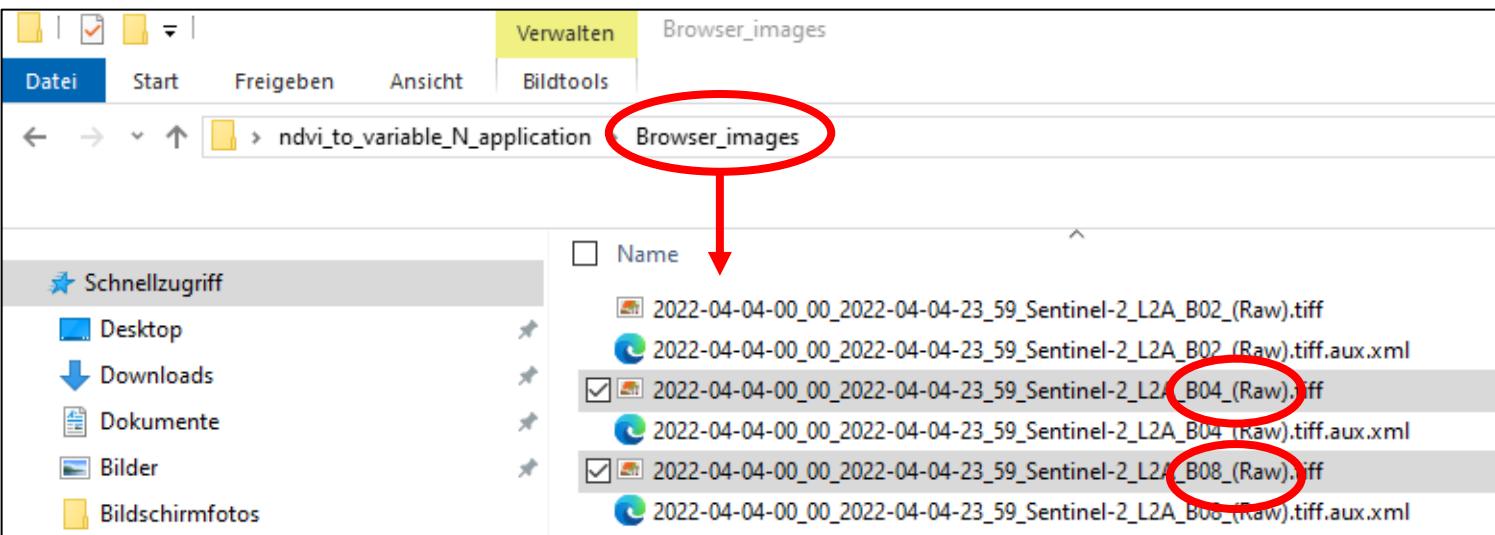


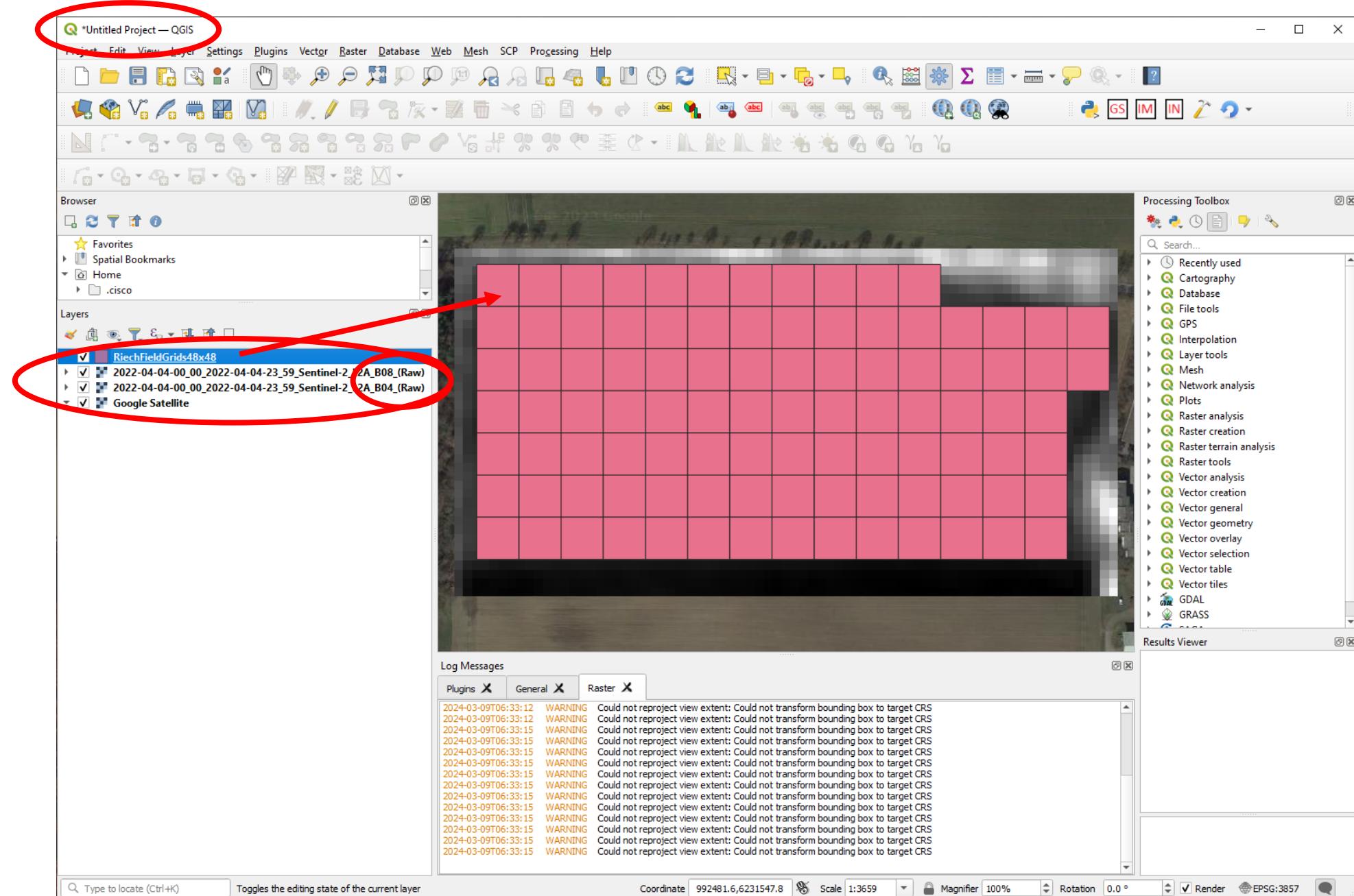
- Satellite images download – Copernicus Browser

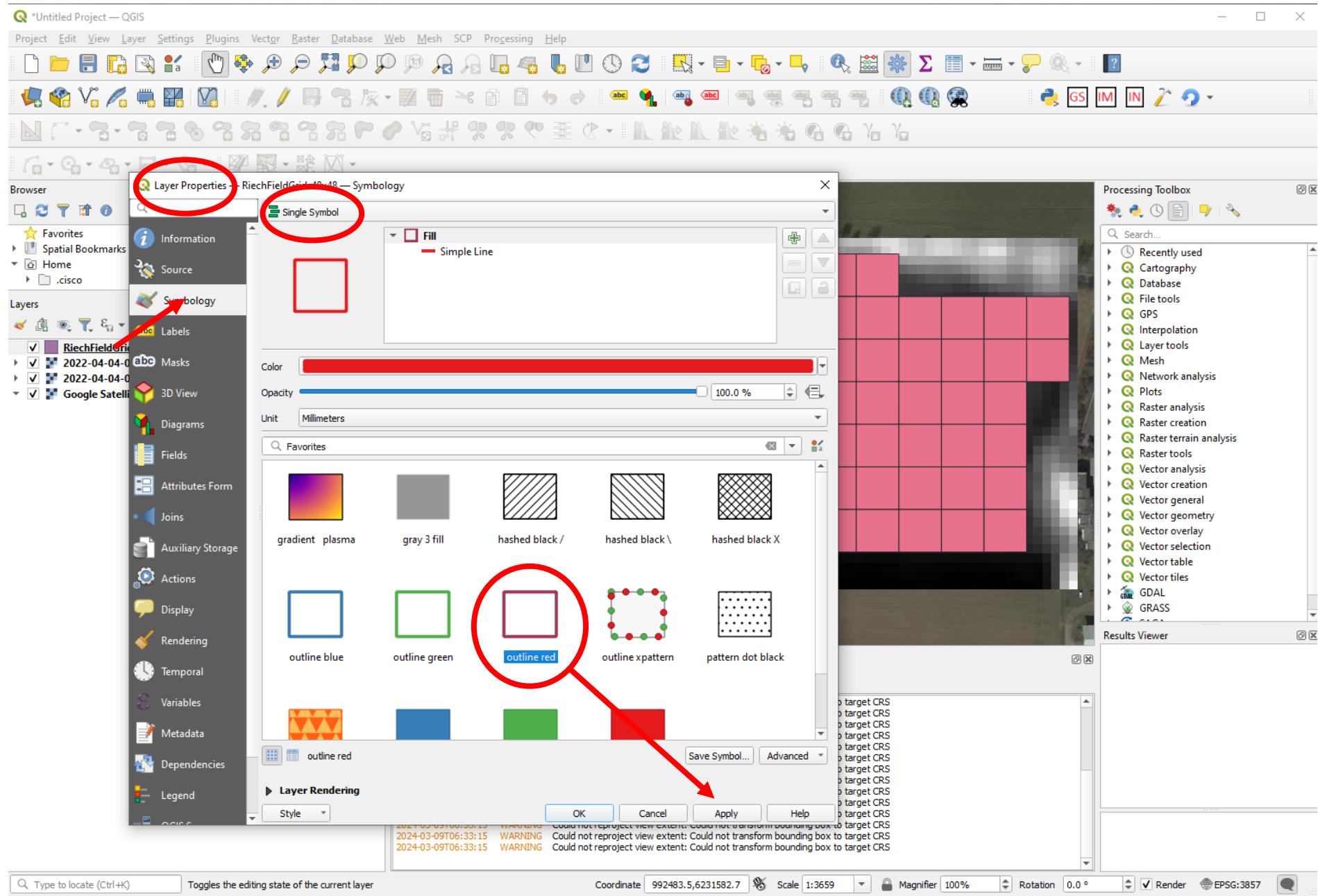


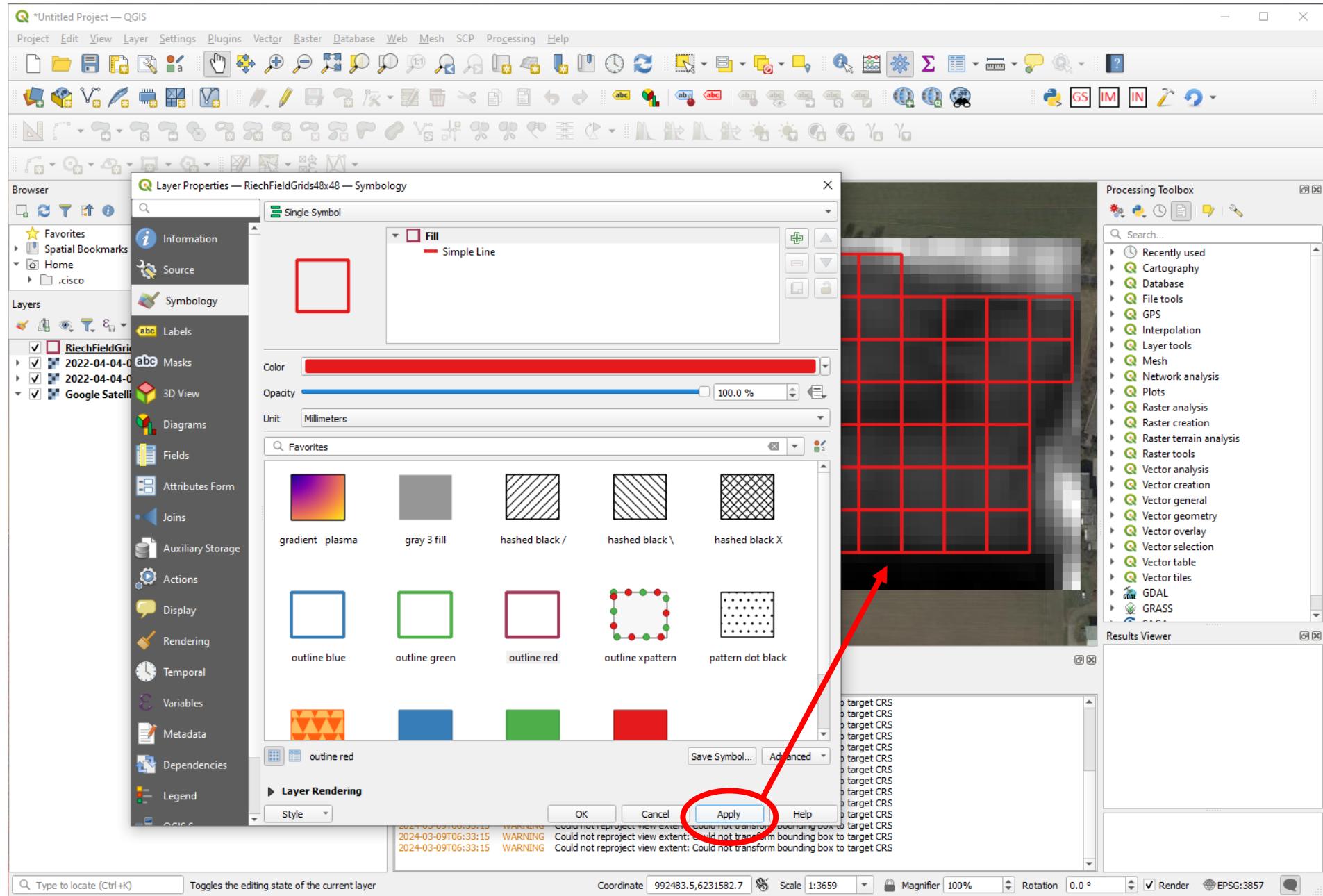
The screenshot shows the Copernicus Browser interface with the following details:

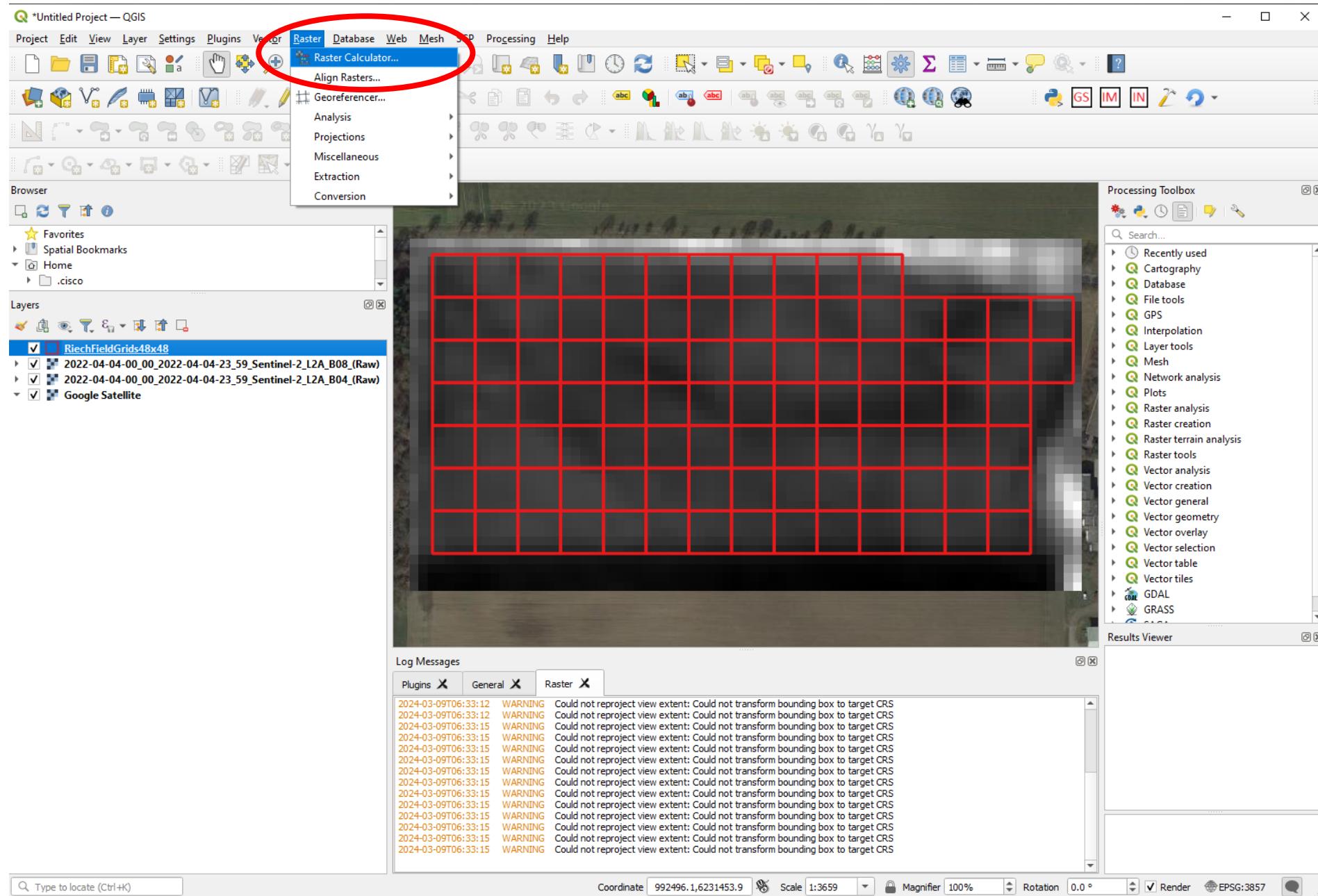
- Top Bar:** Shows "Copernicus BROWSER", "EN", "Emir Memic", and a search bar.
- Left Sidebar:** "VISUALIZE" tab is active. It displays a date range from "2022-04-04" to "2022-04-05", a zoom level of "50%", and a "Default" layer selection. Below this is a "LAYERs:" section listing various Sentinel-2 L2A products, including "True color", "False color", "Highlight Optimized Natural Color", "NDVI", "False color (urban)", "Moisture index", "SWIR", "NDWI", "NDSI", "Scene classification map", and "Custom".
- Central Map View:** A satellite map of a green landscape with buildings labeled "K1006", "Ihinger Hof", "Ihinger Straße", and "Schulungsgelände (Universität Hohenheim)". A blue polygon highlights an area of approximately 0.14 km².
- Right Panel:** Contains a "Go to Place" search bar, a toolbar with various icons (e.g., zoom, measure, draw), and a "3D" button.
- Modal Dialog:** Titled "Image download" (under the "Analytical" tab).
 - Image format:** Set to "TIFF (32-bit float)".
 - Image resolution:** Set to "HIGH" (79 x 40 px).
 - Coordinate system:** Set to "WGS 84 (EPSG:4326)".
 - Add dataMask band to raw layers:** A toggle switch is turned off.
 - Layers:** A list of bands:
 - Visualized:** B01, B02 (checked), B03, B04 (checked), B05, B06, B07, B08 (checked), B09, B10, B11, B12.
 - Raw:** True color, False color, Highlight Optimized Natural Color, NDVI, False color (urban), Moisture index, SWIR, NDWI, NDSI, Scene classification map.
 - Download:** A large green button with a download icon.

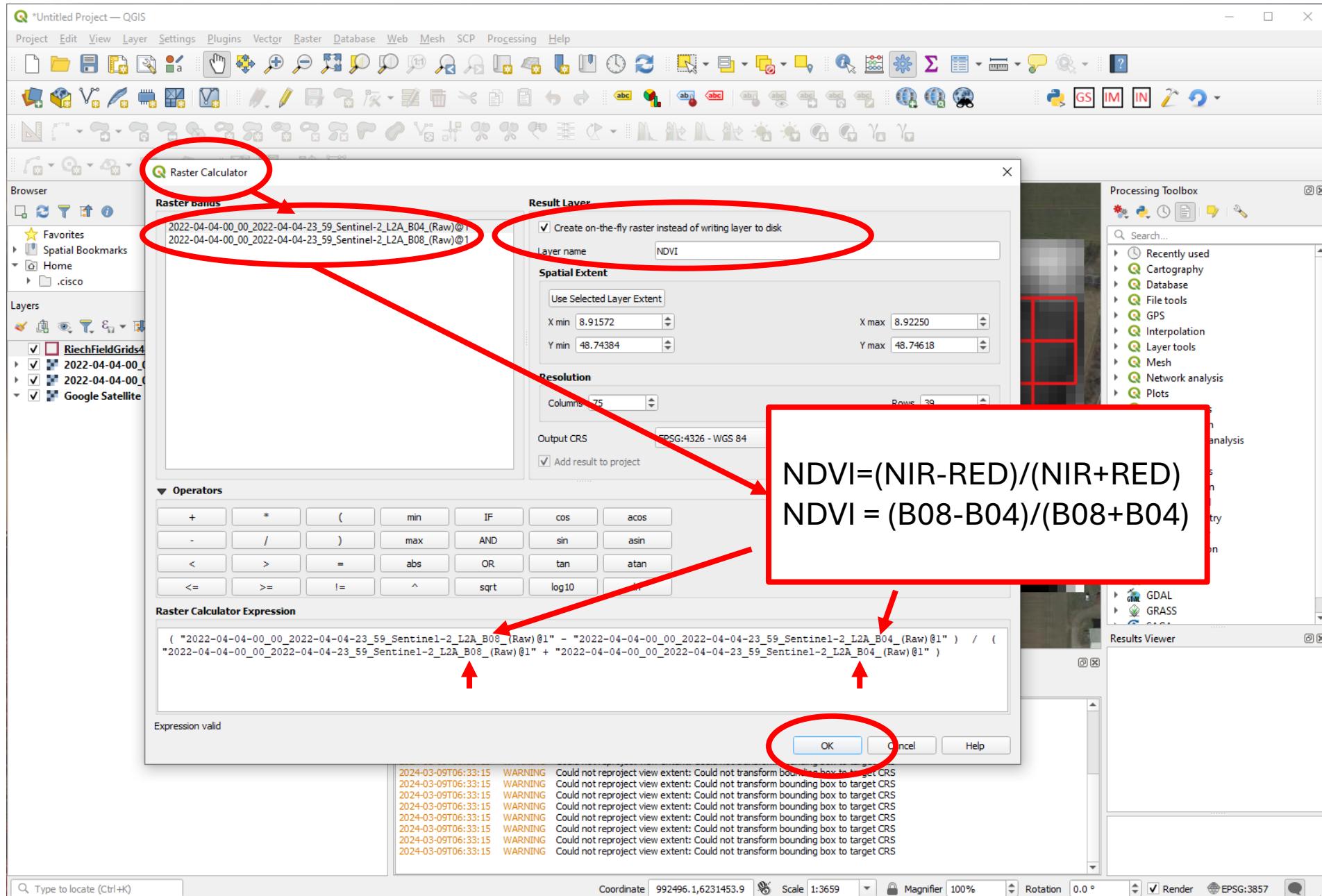


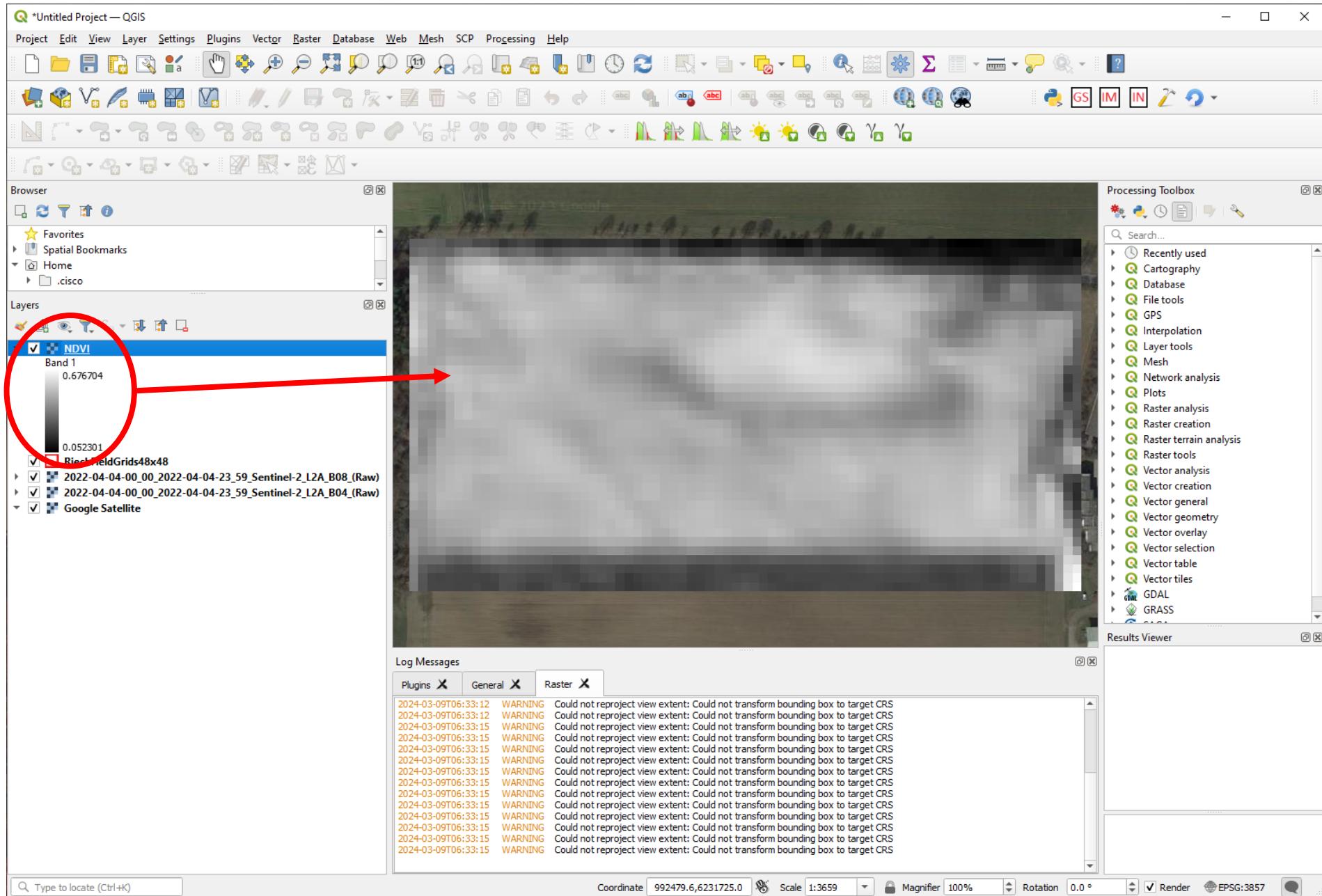


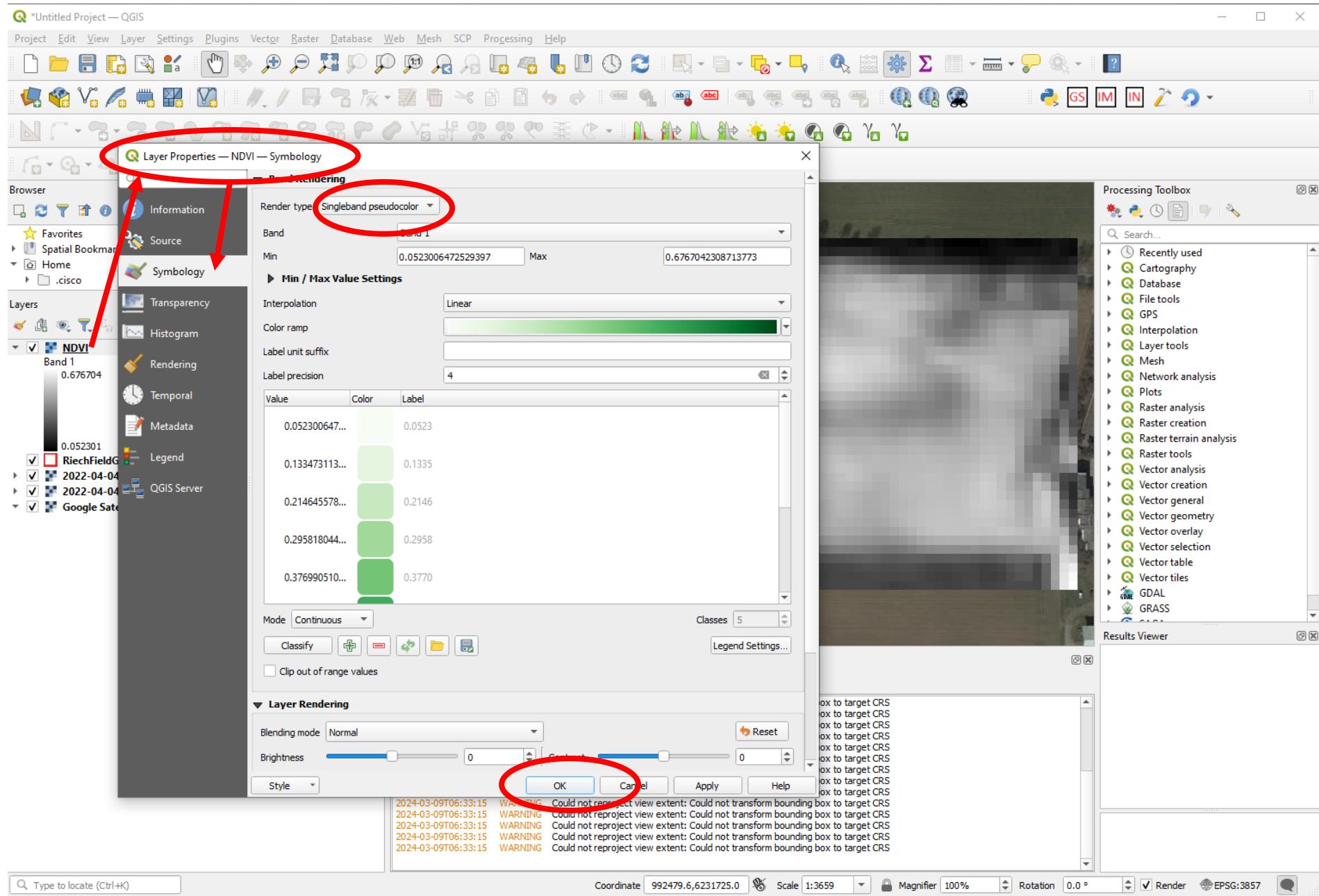


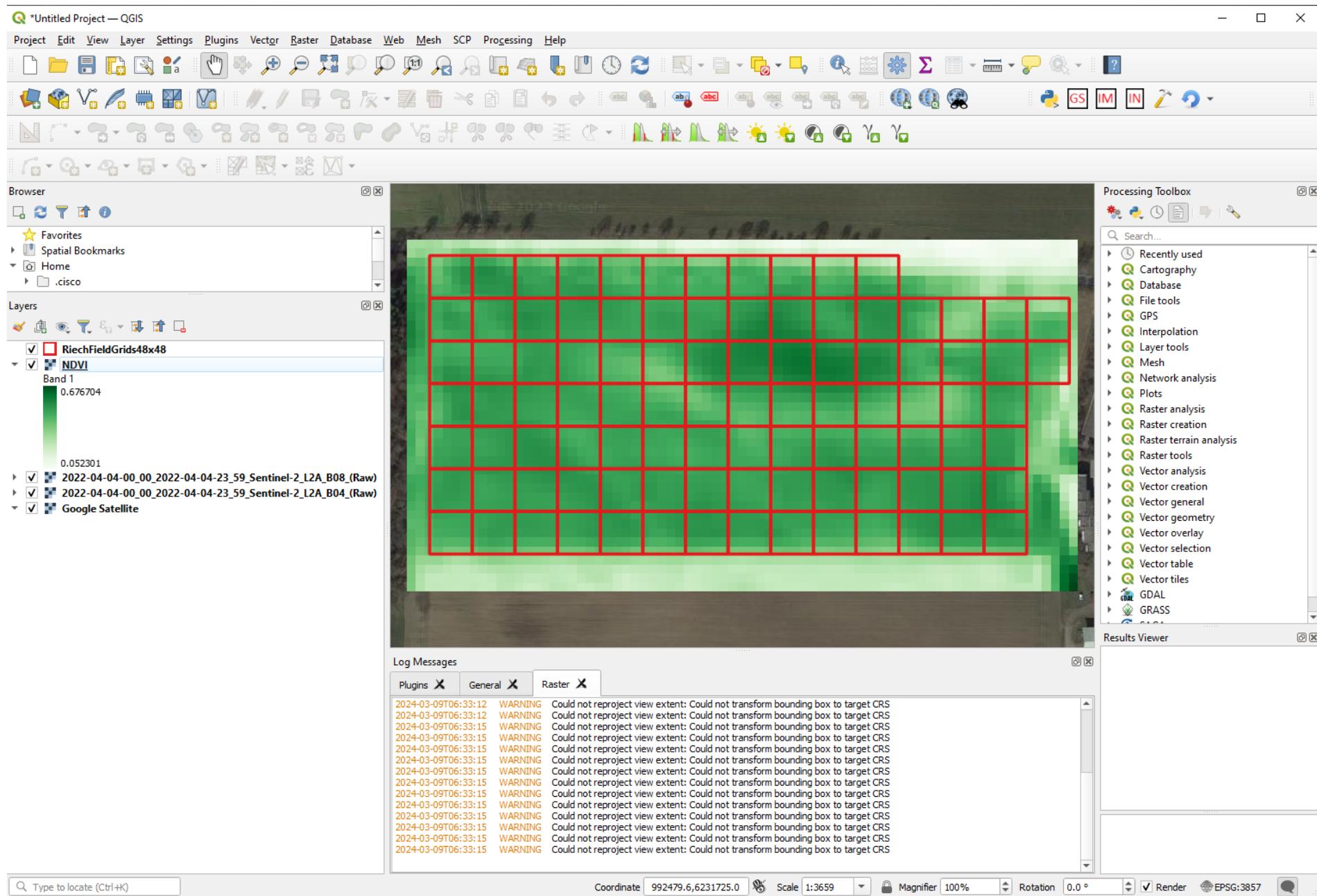


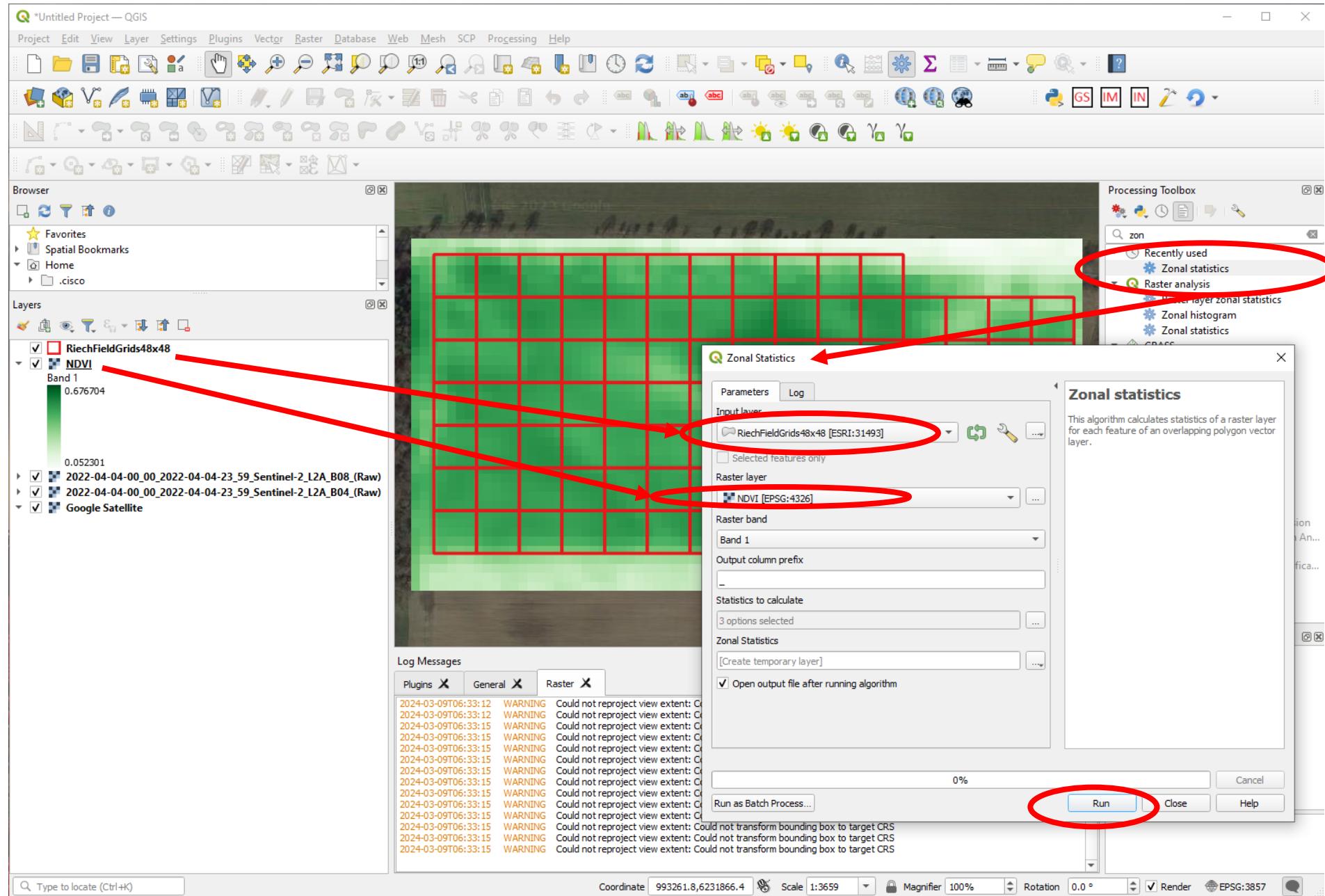


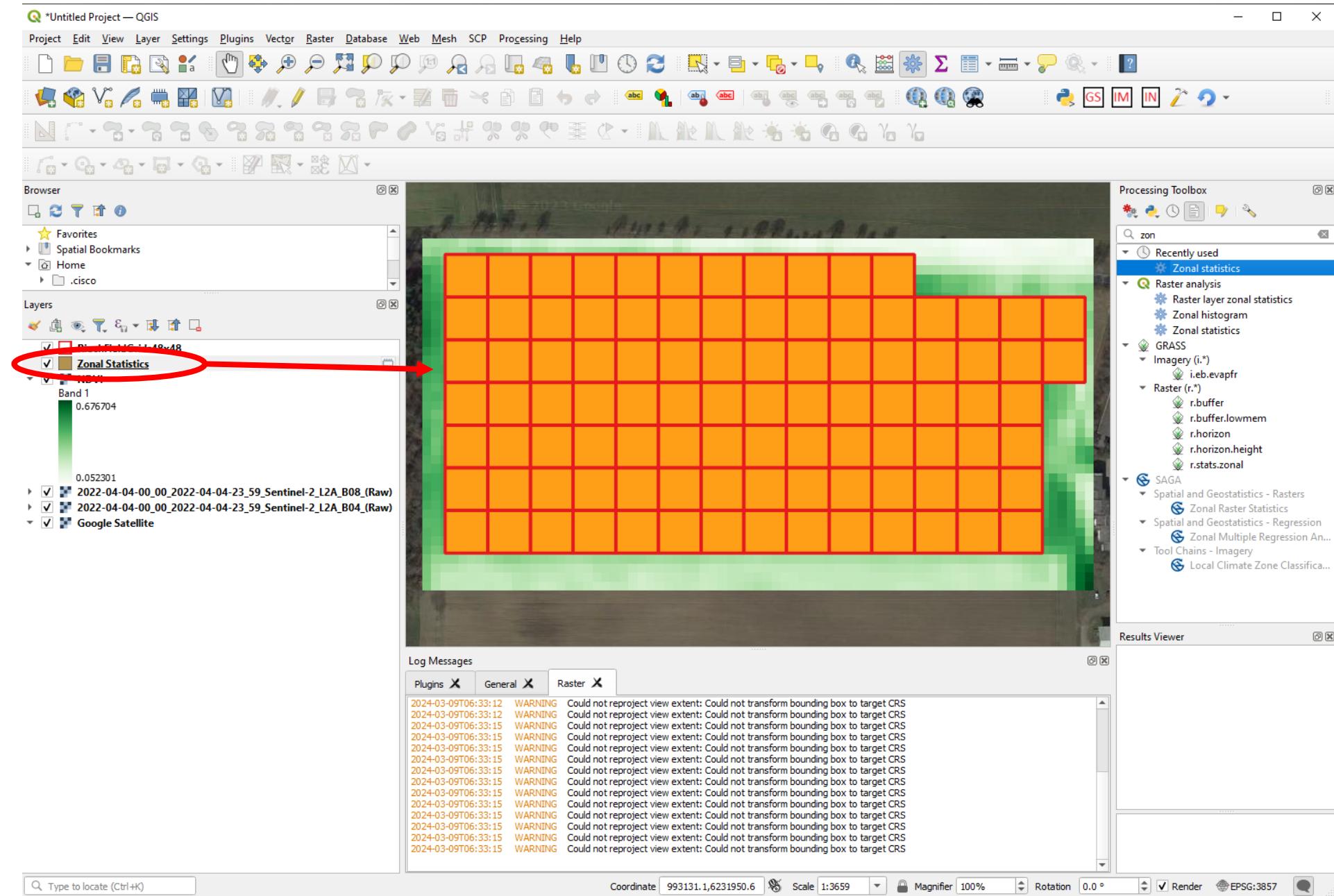


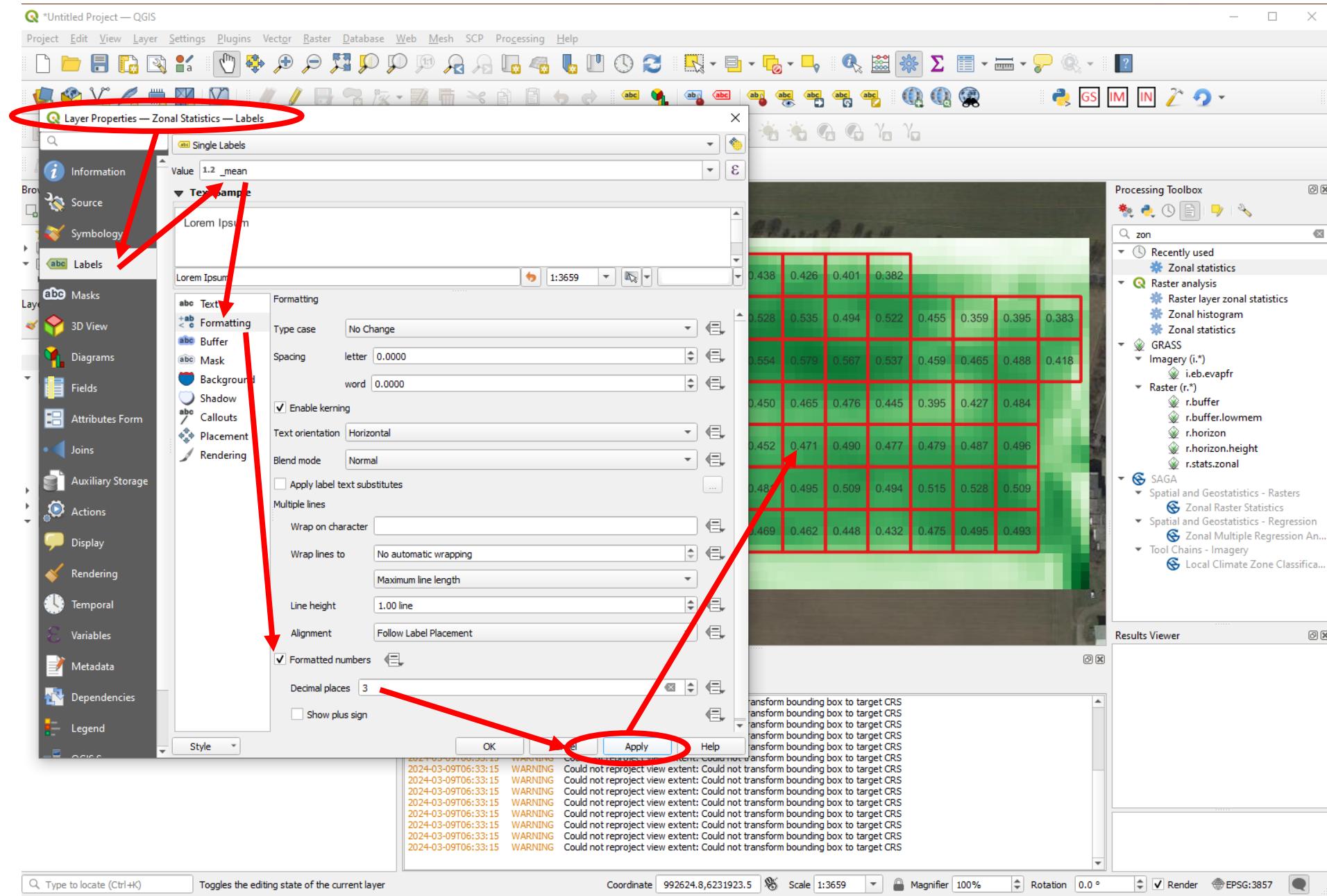


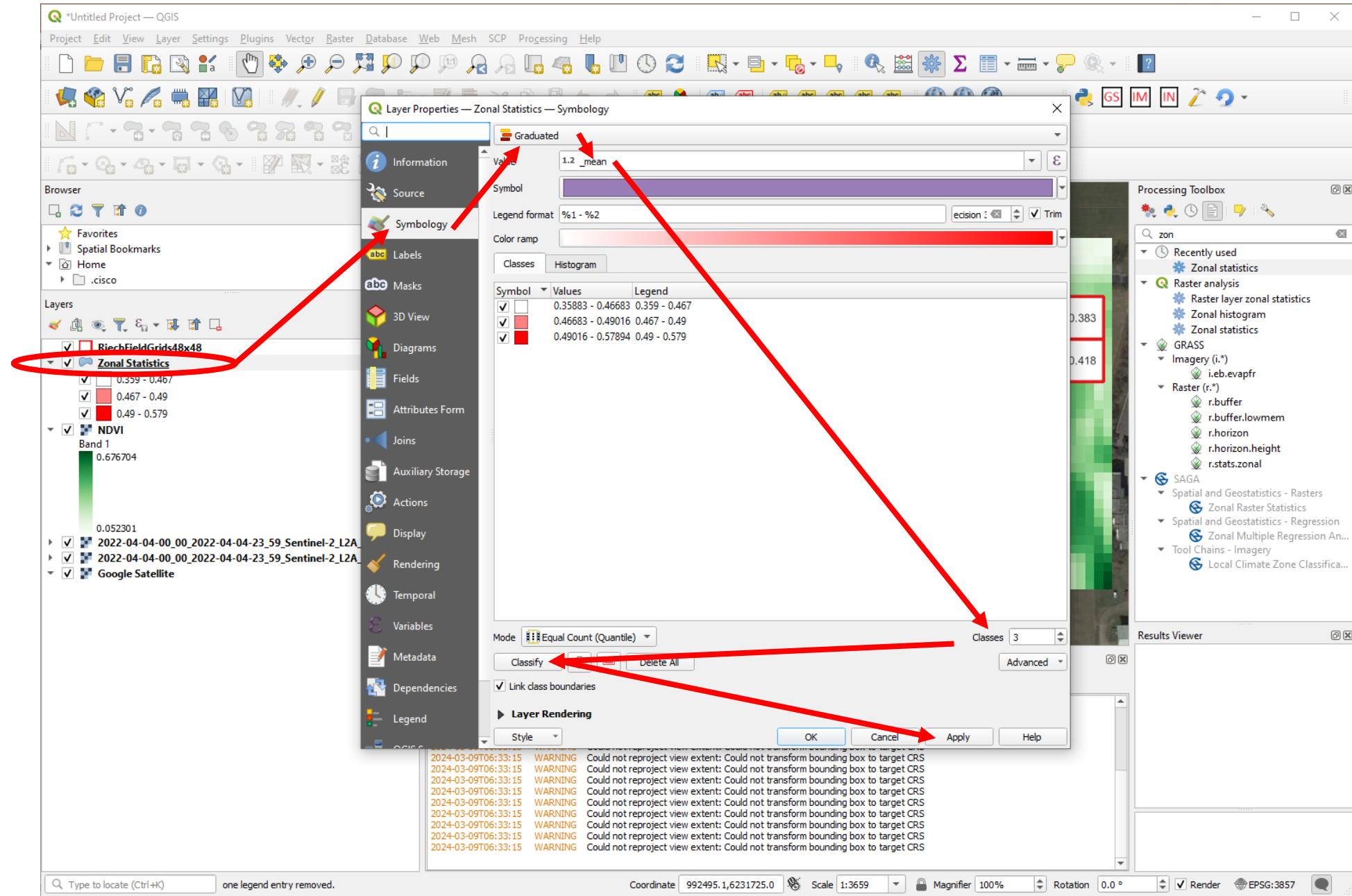


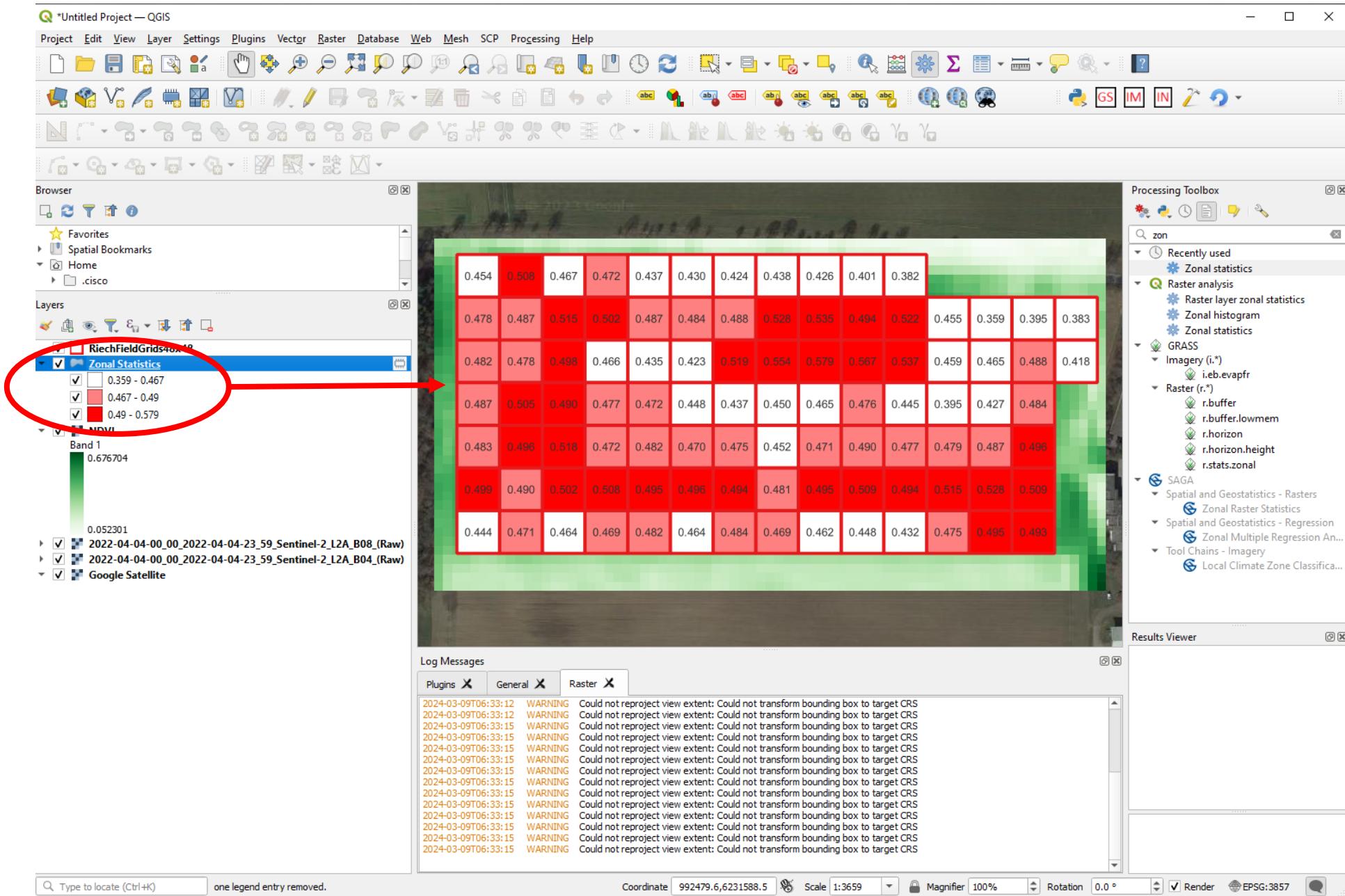












- This example was oversimplified with 3 NDVI categories (low, medium, high) and 3 N application amounts (low, medium, high)
- None defined category was result of non detailed setup of NDVI categories

Q *Untitled Project — QGIS

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

Browser

Layers

- RiechfieldGrids40_10
- Zonal Statistics** (highlighted with a red circle)
- NDVI
- Band 1
- 0.676704
- 0.052301
- 2022-04-04_00_00_2022-04
- 2022-04-04_00_00_2022-04
- Google Satellite

Zonal Statistics — Features Total: 97, Filtered: 97, Selected: 0

	id	_count	_sum	_mean
	1	16	7.26533224302356	0.454083265188...
	2	20	9.561190362974...	0.478059518148...
	3	20	9.64982833645304	0.482491416822...
	4	20	9.7433026494669	0.487165132473...
	5	16	7.729688096652...	0.483105506040...
	6	20	9.987119150445...	0.499355957522...
	7	20	8.885069083774...	0.444253454188...
	8	20	10.16147149656...	0.508073574828...
	9	10	12.18572898793...	0.487429159517...
	10	25	11.96224975064...	0.47848999025...
	11	25	12.63730946743...	0.505492378697...
	12	20	9.914615602144...	0.495730780107...
	13	25	12.25410090718...	0.490164036287...
	14	25	11.77746172654...	0.471098469061...
	15	20	9.336695751450...	0.466834787572...
	16	25	12.86960526978...	0.514784210791...
	17	19	12.45027138085...	0.498010855234...
	18	25	12.25743391055...	0.490297356422...
	19	21	10.36852047105...	0.518426023552...
	20	25	12.53953562042...	0.501581424816...

Show All Features

2024-03-09T06:33:15 WARNING Could not reproject view extent: Could not transform bounding box to target CRS

Coordinate 993264.7, 6231471.4 Scale 1:3659 Magnifier 100% Rotation 0.0° Render EPSG:3857

Processing Toolbox

zon

- Recently used
 - Zonal statistics
- Raster analysis
 - Raster layer zonal statistics
 - Zonal histogram
 - Zonal statistics
- GRASS
 - Imagery (i.*)
 - i.eb.evapfr
 - Raster (r.*)
 - r.buffer
 - r.buffer.lowmem
 - r.horizon
 - r.horizon.height
 - r.stats.zonal
- SAGA
 - Spatial and Geostatistics - Rasters
 - Zonal Raster Statistics
 - Spatial and Geostatistics - Regression
 - Zonal Multiple Regression An...
 - Tool Chains - Imagery
 - Local Climate Zone Classifica...

Results Viewer

Q *Untitled Project — QGIS

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

Browser

Zonal Statistics — Features Total: 97, Filtered: 97, Selected: 0

	id	_count	_sum	_mean				
1	1	16	7.26533224302356	0.45408326588...	0.438	0.426	0.401	0.382
2	2	20	9.561190362974...	0.478039518148...	0.528	0.535	0.494	0.522
3	3	20	9.64982833645304	0.482491416822...	0.554	0.579	0.567	0.537
4	4	20	9.743302649...	0.487165132473...	0.450	0.465	0.476	0.445
5	5				0.452	0.471	0.490	0.477
6	6				0.481	0.495	0.509	0.494
7	7				0.469	0.462	0.448	0.432
8	9				0.490	0.455	0.359	0.395
9	10				0.459	0.465	0.427	0.484
10	11				0.479	0.487	0.496	
11	12				0.515	0.528	0.509	
12	13				0.475	0.495	0.493	
13	14	25	12.25410090718...	0.490164036287...	0.490	0.481	0.472	0.463
14	15	25	11.77746172654...	0.471098469061...	0.482	0.473	0.464	0.455
15	17	20	9.336695751450...	0.466834787572...	0.494	0.485	0.476	0.467
16	18	25	12.86960526978...	0.514784210791...	0.496	0.487	0.478	0.469
17	19	25	12.45027138085...	0.498010855234...	0.498	0.489	0.480	0.471
18	20	25	12.25743391055...	0.490297356422...	0.499	0.490	0.481	0.472
19	21	20	10.36852047105...	0.518426023552...	0.500	0.491	0.482	0.473

Show All Features

2024-03-09T06:33:15 WARNING Could not reproject view extent: Could not transform bounding box to target CRS

Add Field

Name: agrYieldMax

Type: Whole number (integer)

Provider type: integer

Length: 10

OK Cancel

Raster

Processing Toolbox

Results Viewer

Q *Untitled Project — QGIS

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

Browser

Zonal Statistics — Features Total: 97, Filtered: 97, Selected: 0

Layers

- RiechFieldGrids48x48
- Zonal Statistics
 - 0.359 - 0.467
 - 0.467 - 0.49
 - 0.49 - 0.579
- NDVI
 - Band 1 0.676704
 - 0.052301
- 2022-04-04_00_00_2022-04
- 2022-04-04_00_00_2022-04
- Google Satellite

Processing Toolbox

zon

- Recently used
 - Zonal statistics
- Raster analysis
 - Raster layer zonal statistics
 - Zonal histogram
 - Zonal statistics
- GRASS
 - Imagery (i.*)
 - i.eb.evapfr
 - Raster (r.*)
 - r.buffer
 - r.buffer.lowmem
 - r.horizon
 - r.horizon.height
 - r.stats.zonal
- SAGA
 - Spatial and Geostatistics - Rasters
 - Zonal Raster Statistics
 - Spatial and Geostatistics - Regression
 - Zonal Multiple Regression An...
 - Tool Chains - Imagery
 - Local Climate Zone Classifica...

Results Viewer

agrYieldMax

id	_count	_sum	_mean	agrYieldMax
1	1	16	0.454083265188...	0.426
2	2	20	0.478059518148...	0.401
3	3	20	0.482491416822...	0.382
4	4	20	0.487165132473...	0.535
5	5	16	0.483105506040...	0.494
6	6	20	0.499355957522...	0.522
7	7	20	0.444253454188...	0.455
8	9	20	0.508073574828...	0.359
9	10	25	0.487429159517...	0.395
10	11	25	0.478489990025...	0.465
11	12	25	0.505492378697...	0.466
12	13	20	0.495730780107...	0.476
13	14	25	0.490164036287...	0.445
14	15	25	0.471098469061...	0.445
15	17	20	0.466834787572...	0.494
16	18	25	0.514784210791...	0.515
17	19	25	0.498010855234...	0.528
18	20	25	0.490297356422...	0.509
19	21	20	0.518426023552...	0.462
				0.448
				0.432
				0.475
				0.495
				0.493

Show All Features

2024-03-09T06:33:15 WARNING Could not reproject view extent: Could not transform bounding box to target CRS

Type to locate (Ctrl+K)

Coordinate 993264.7, 6231471.4 Scale 1:3659 Magnifier 100% Rotation 0.0° Render EPSG:3857

Untitled Project — QGIS

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

Zonal Statistics — Features Total: 97, Filtered: 97, Selected: 0

Processing Toolbox

zon

- Recently used
 - Zonal statistics
- Raster analysis
 - Raster layer zonal statistics
 - Zonal histogram

Field Calculator

Only update 0 selected features

Create a new field

Update existing field

Output field name: agrYieldMax

Output field type: Whole number (integer)

Output field length: 10 Precision: 3

Expression:

```
CASE
  WHEN "_mean" >= 0.359 and "_mean" < 0.467 THEN 50
  WHEN "_mean" >= 0.467 and "_mean" < 0.490 THEN 70
  WHEN "_mean" >= 0.490 and "_mean" <= 0.579 THEN 90
END
```

Feature: 1 Preview: 50

OK Cancel Help

The screenshot shows the QGIS interface with the Field Calculator open. A red arrow points from the 'Update existing field' checkbox in the Field Calculator settings to the 'agrYieldMax' field in the Zonal Statistics table. Another red arrow points from the 'CASE' expression in the Field Calculator to a callout box containing the detailed CASE expression. A green arrow points from the 'Output field name' field in the Field Calculator to the 'agrYieldMax' field in the table. The Zonal Statistics table displays five rows of data with columns: id, _count, _sum, _mean, and agrYieldMax. The agrYieldMax column contains NULL values. The Processing Toolbox on the right shows the 'zon' category with 'Zonal statistics' selected.

CASE

WHEN "_mean" >= 0.359 and "_mean" < 0.467 THEN 50

WHEN "_mean" >= 0.467 and "_mean" < 0.490 THEN 70

WHEN "_mean" >= 0.490 and "_mean" <= 0.579 THEN 90

END

Q *Untitled Project — QGIS

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

Zonal Statistics — Features Total: 97, Filtered: 97, Selected: 0

1.2 id = 1.2

	id	_count	_sum	_mean	agrYieldMax
1	1	16	7.26533224302356	0.454083265188...	50
2	2	20	9.561190362974...	0.478059518148...	70
3	3	20	9.64982833645304	0.482491416822...	70
4	4	20	9.7433026494669	0.487165132473...	70
5	5	16	7.729688096652...	0.483105506040...	70
6	6	20	9.987119150445...	0.499355957522...	90
7	7	20	8.885069083774...	0.444253454188...	50
8	9	20	10.16147149656...	0.508073574828...	90
9	10	25	12.18572898793...	0.487429159517...	70
10	11	25	11.96224975064...	0.478489990025...	70
11	12	25	12.63730946743...	0.505492378697...	90
12	13	20	9.914615602144...	0.495730780107...	90
13	14	25	12.25410090718...	0.490164036287...	90
14	15	25	11.77746172654...	0.471098469061...	70
15	17	20	9.336695751450...	0.466834787572...	50
16	18	25	12.86960526978...	0.514784210791...	90
17	19	25	12.45027138085...	0.498010855234...	90
18	20	25	12.25743391055...	0.490297356422...	90
19	21	20	10.36852047105...	0.518426023552...	90

Show All Features

2024-03-09T06:33:12 WARNING Could not reproject view extent: Could not transform bounding box to target CRS
2024-03-09T06:33:15 WARNING Could not reproject view extent: Could not transform bounding box to target CRS
2024-03-09T06:33:15 WARNING Could not reproject view extent: Could not transform bounding box to target CRS
2024-03-09T06:33:15 WARNING Could not reproject view extent: Could not transform bounding box to target CRS
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Type to locate (Ctrl+K)

Coordinate 992596.8,6231915.7 Scale 1:3659 Magnifier 100% Rotation 0.0° Render EPSG:3857

Zonal Statistics

Raster layer zonal statistics

Zonal histogram

Zonal statistics

GRASS

Imagery (i.*)

i.eb.evapfr

Raster (r.*)

r.buffer

r.buffer.lowmem

r.horizon

r.horizon.height

r.stats.zonal

SAGA

Spatial and Geostatistics - Rasters

Zonal Raster Statistics

Spatial and Geostatistics - Regression

Zonal Multiple Regression An...

Tool Chains - Imagery

Local Climate Zone Classifica...

Results Viewer

*Untitled Project — QGIS

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

Zonal Statistics — Features Total: 97, Filtered: 97, Selected: 0

1.2 id = 1.2 Update All Update Selected

id	_count	_sum	_mean	agrYieldMax
1	1	16	7.26533224302356	0.454083265188...
2	2	20	9.561190362974...	0.478059518148...
3	3	20	9.64982833645304	0.482491416822...
4	4	20	9.7433026494669	0.487165132473...
5	5	16	7.729688096652...	0.483105506040...
6	6	20	9.987119150445...	0.499355957522...
7	7	20	8.885069083774...	0.444253454188...
8	9	20	10.16147149656...	0.508073574828...
9	10	25	12.18	0.359 - 0.467
10	11	25	11.96	0.467 - 0.49
11	12	25	12.63	0.49 - 0.579
12	13	20	9.914	NDVI Band 1 0.676704
13	14	25	12.2541090718...	0.490164036287...
14	15	25	11.77746172654...	0.471098469061...
15	17	20	9.336695751450...	0.466834787572...
16	18	25	12.86960526978...	0.514784210791...
17	19	25	12.45027138085...	0.498010855234...
18	20	25	12.25743391055...	0.490297356422...
19	21	20	10.36852047105...	0.518426023552...

Stop Editing

Do you want to save the changes to layer Zonal Statistics?

RiechFieldGrids48

NDVI Band 1 0.676704

0.052301

2022-04-04-00_00

2022-04-04-00_00

Google Satellite

Coordinate 992864.0,6231881.8 Scale 1:3659 Magnifier 100% Rotation 0.0° Render EPSG:3857

Processing Toolbox

zon

- Recently used
 - Zonal statistics
- Raster analysis
 - Raster layer zonal statistics
 - Zonal histogram
 - Zonal statistics
- GRASS
 - Imagery (i.*)
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 - Raster (r.*)
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 - r.horizon.height
 - r.stats.zonal
- SAGA
 - Spatial and Geostatistics - Rasters
 - Zonal Raster Statistics
 - Spatial and Geostatistics - Regression
 - Zonal Multiple Regression An...
 - Tool Chains - Imagery
 - Local Climate Zone Classifica...

Results Viewer

