GEE Time Series Explorer

Planetary-scale visualization and temporal profile sampling of EO imagery from the Earth Engine Data Catalog in QGIS and the EnMAP-Box

Andreas Janz

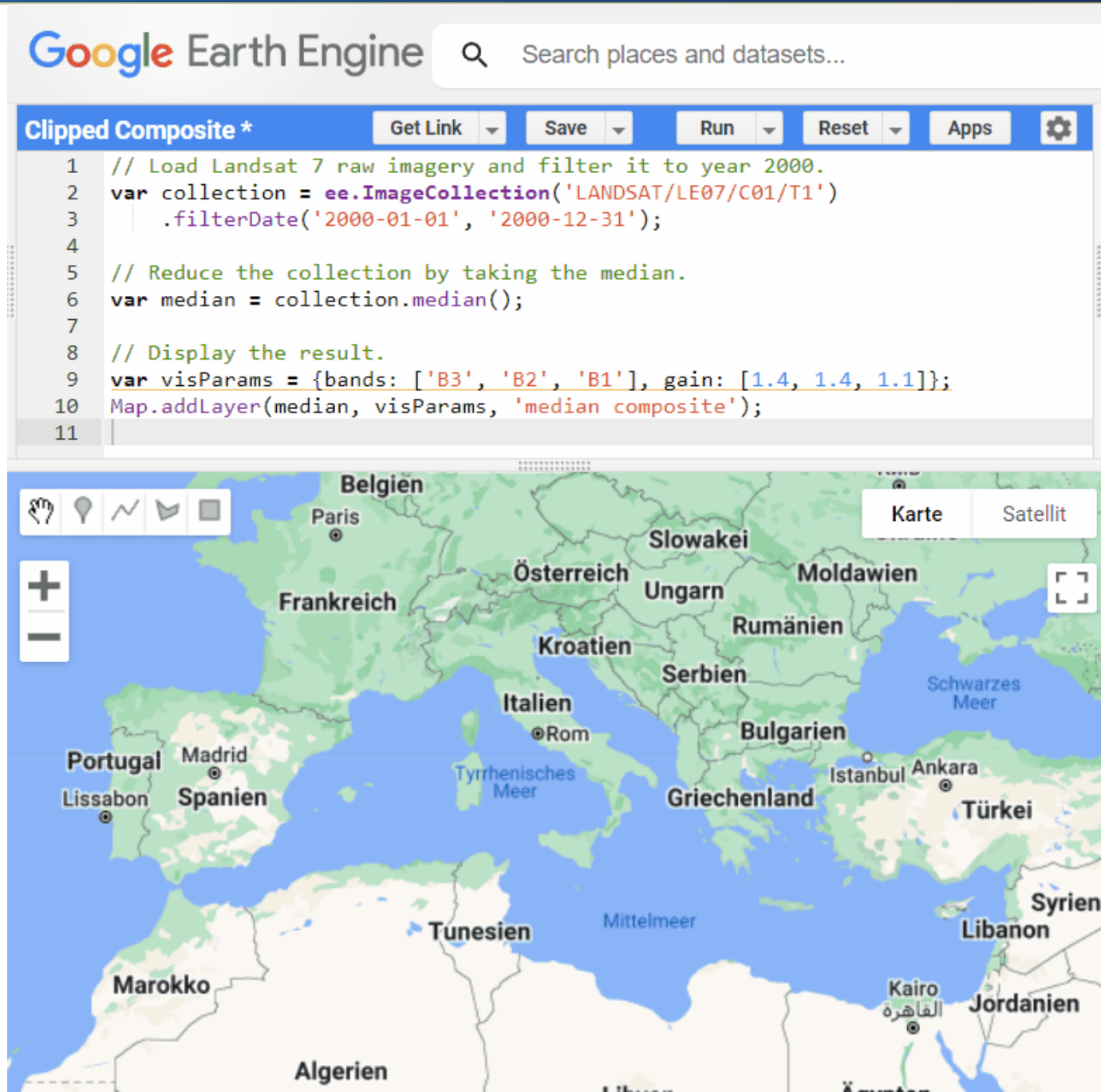
Philippe Rufin, Sebastian van der Linden, Patrick Hostert

GEE (*Google Earth Engine*) Time Series Explorer

- user-friendly, GUI-based integration of GEE into QGIS / EnMAP-Box
- access to multi-petabytes of EO imagery like Sentinel, Landsat and MODIS collections
- no programming skills required

Google Earth Engine

- web-based code editor
- interactive exploration of raw images and derived products
- easy to learn API
- but it takes some time to really learn all aspects of the API
- programming skills required



Google Earth Engine

- composite from >87k Landsat 7 scenes for the year 2000

Browsing

➢ a typical w

Google Earth Engine

Search places and datasets...

Clipped Composite * | Get Link | Save | Run | Reset | Apps

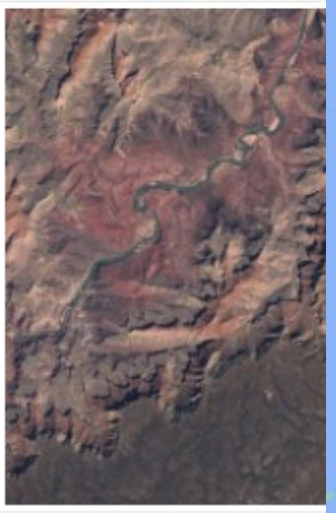
```
1  // Load Landsat 7 raw imagery and filter it to year 2000.
2  var collection = ee.ImageCollection('LANDSAT/LE07/C01/T1')
3      .filterDate('2000-01-01', '2000-12-31');
4
5  // Reduce the collection by taking the median.
6  var median = collection.median();
7
8  // Display the result.
9  var visParams = {bands: ['B3', 'B2', 'B1'], gain: [1.4, 1.4, 1.1]};
10 Map.addLayer(median, visParams, 'median composite');
11
```

developers.google.com/e

Earth Engine Data Cata

Home | View all datasets

USGS Lands



Google Earth Engine

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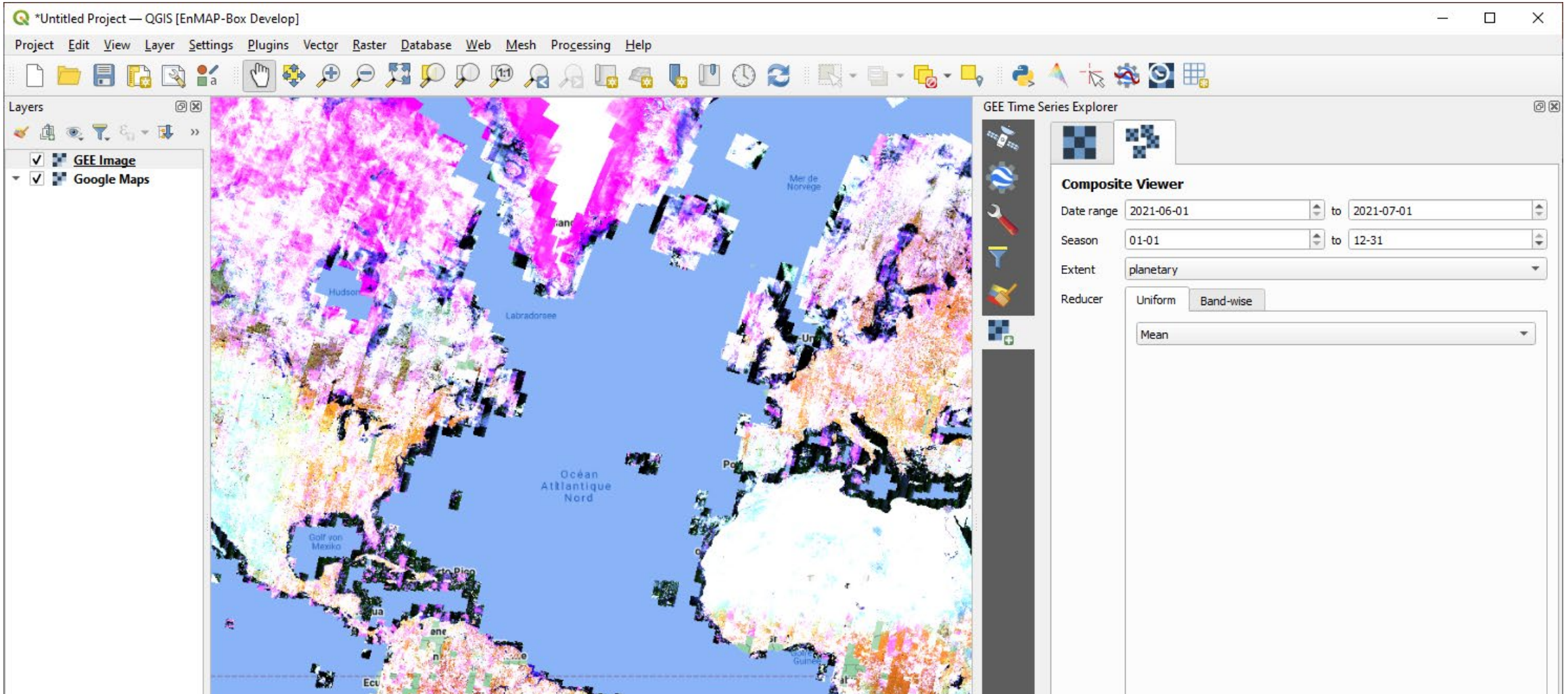
ot calculated.

00), -1 = not calculated.

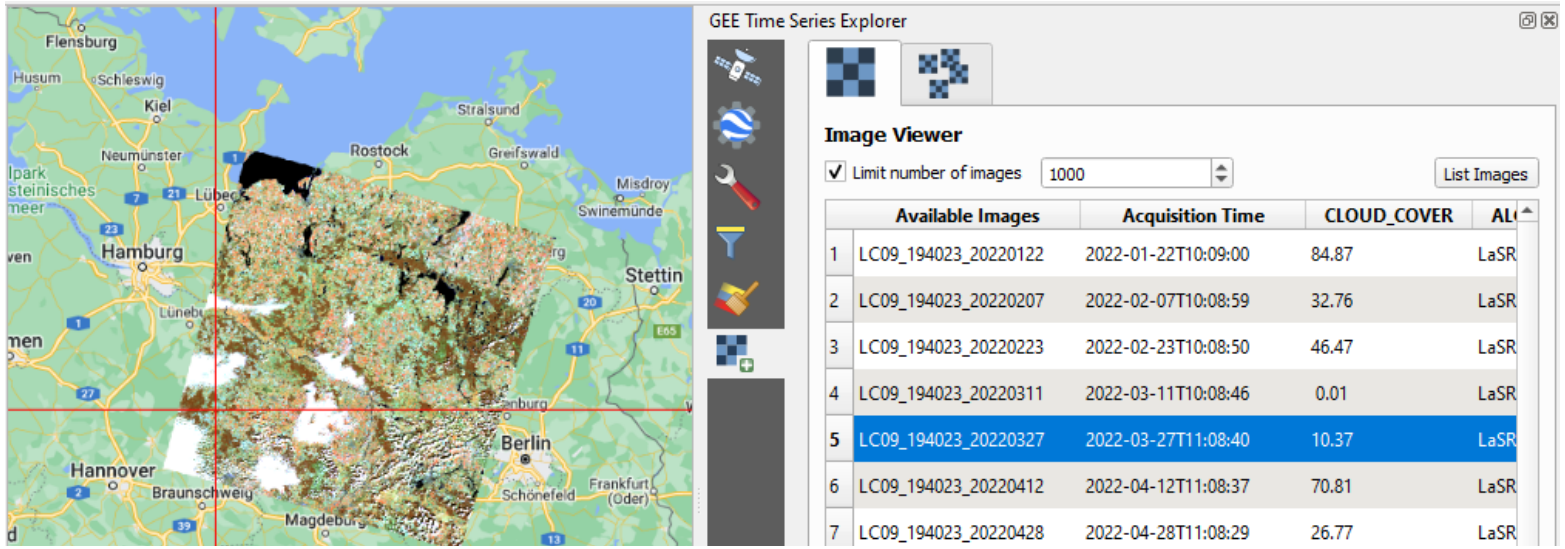
Browsing the *Earth Engine Data Catalog*

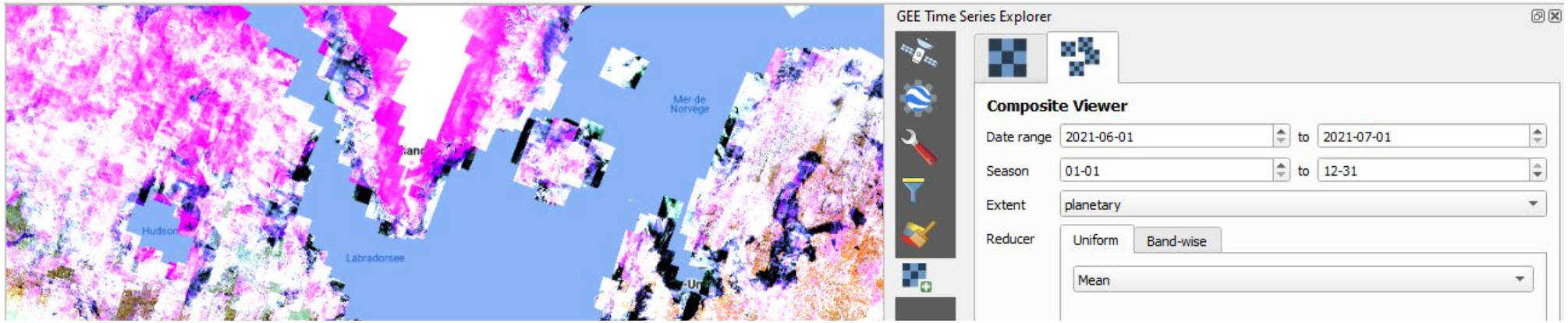
- using the GEE Time Series Explorer in QGIS



Main Features of the GEE Time Series Explorer

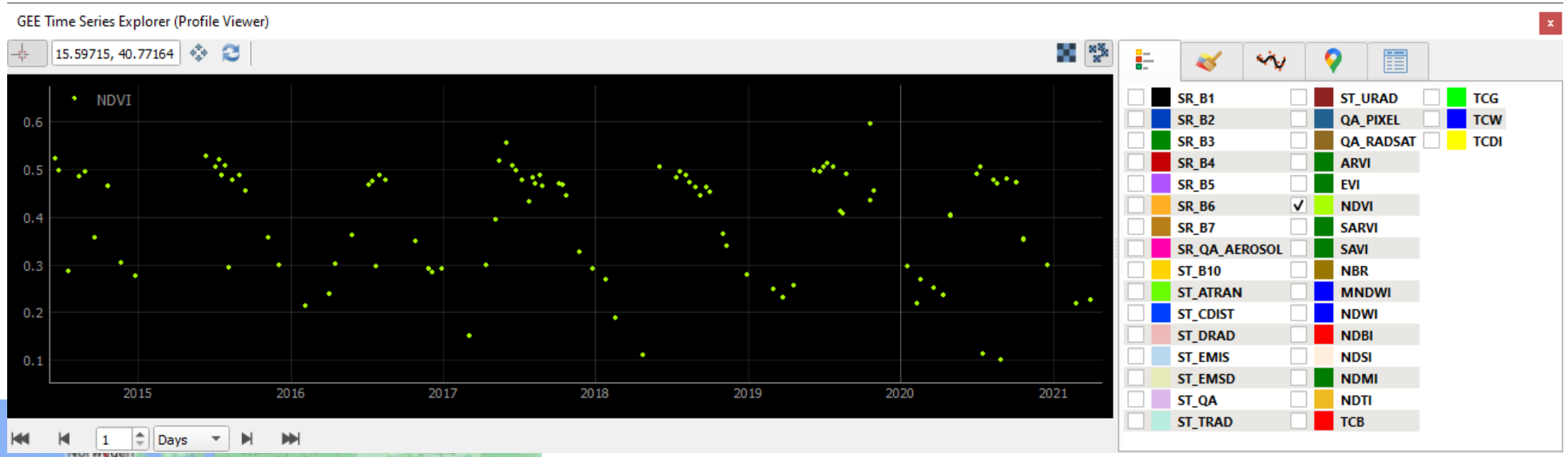
- browsing the EE Data Catalog (already shown)

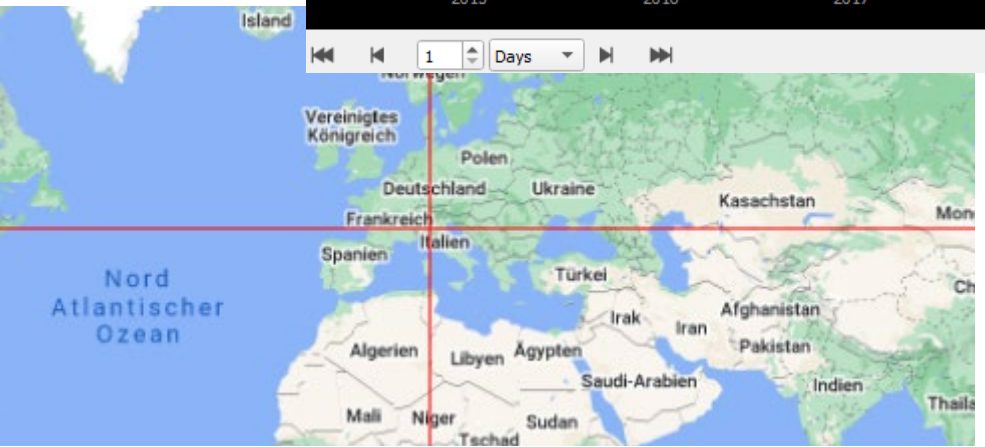




Main Features of the GEE Time Series Explorer

- temporal profile plotting





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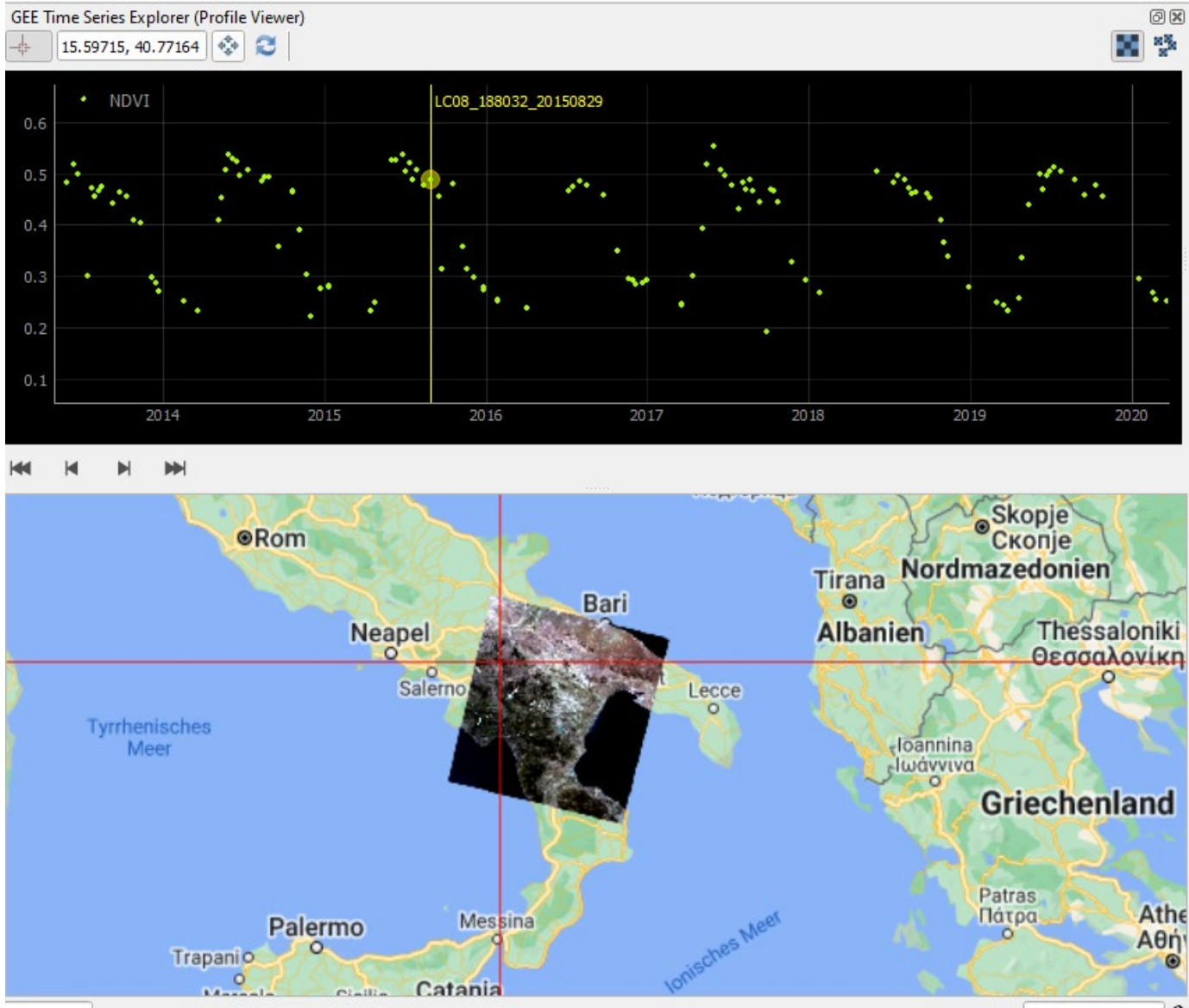

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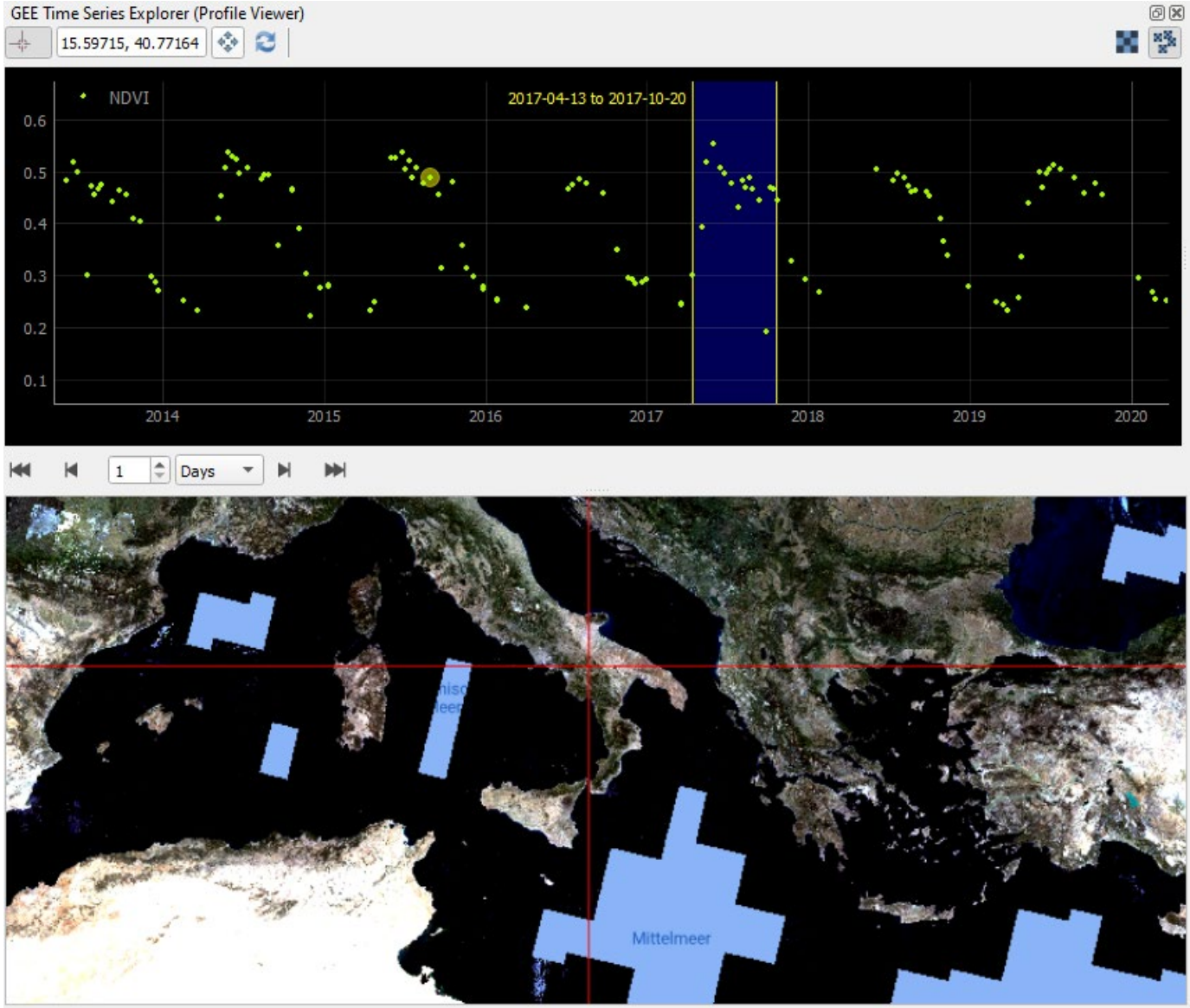

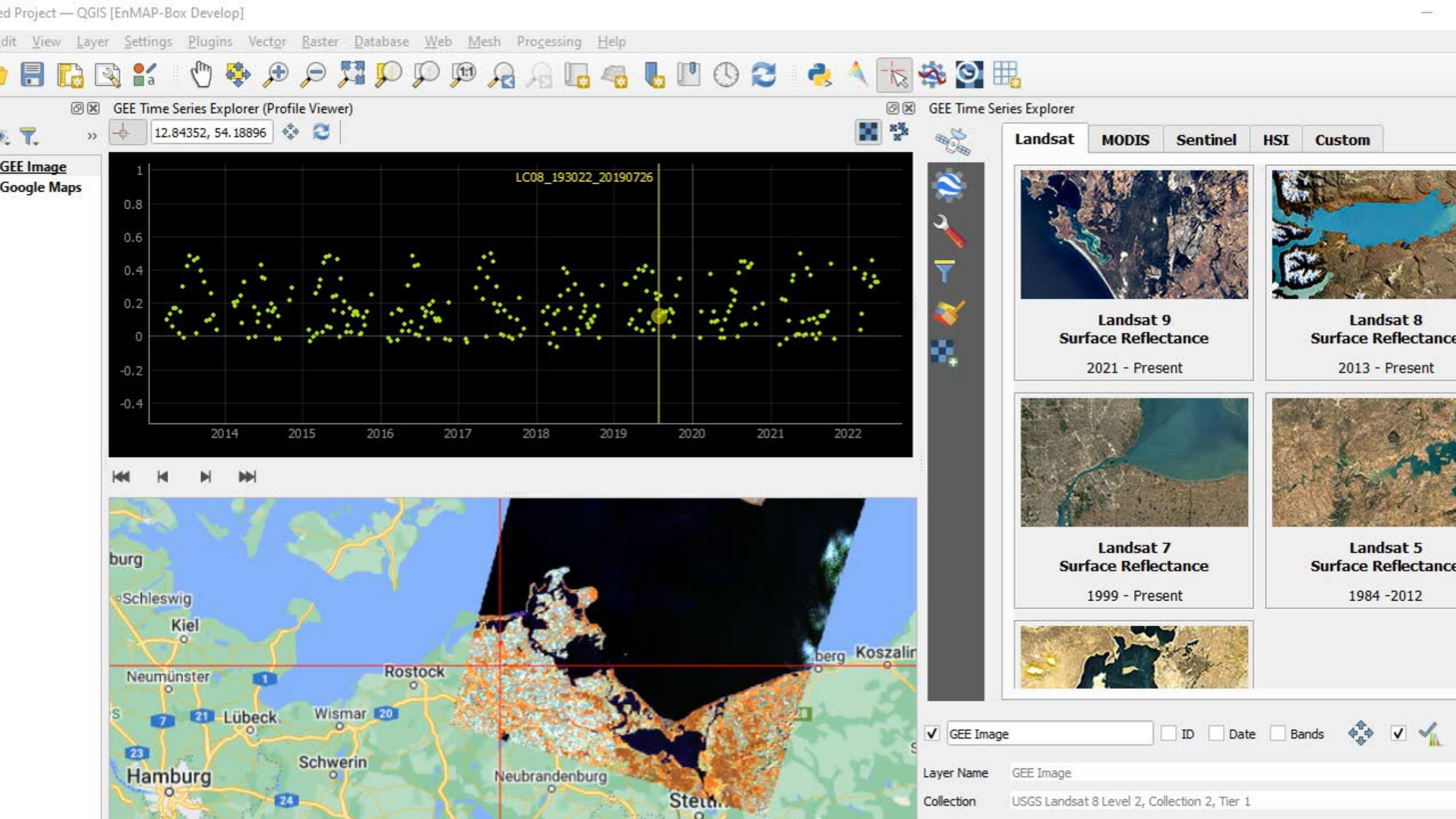
ed Project — QGIS [EnMAP-Box Develop]
dit View Layer Settings Plugins Vector Raster Database Web Mesh Processing Help
GEE Time Series Explorer (Profile Viewer)
12.84352, 54.18896
GEE Image
Google Maps
LC08_193022_20190726
1
0.8
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0.4
0.2
0
-0.2
-0.4
2014
2015
2016
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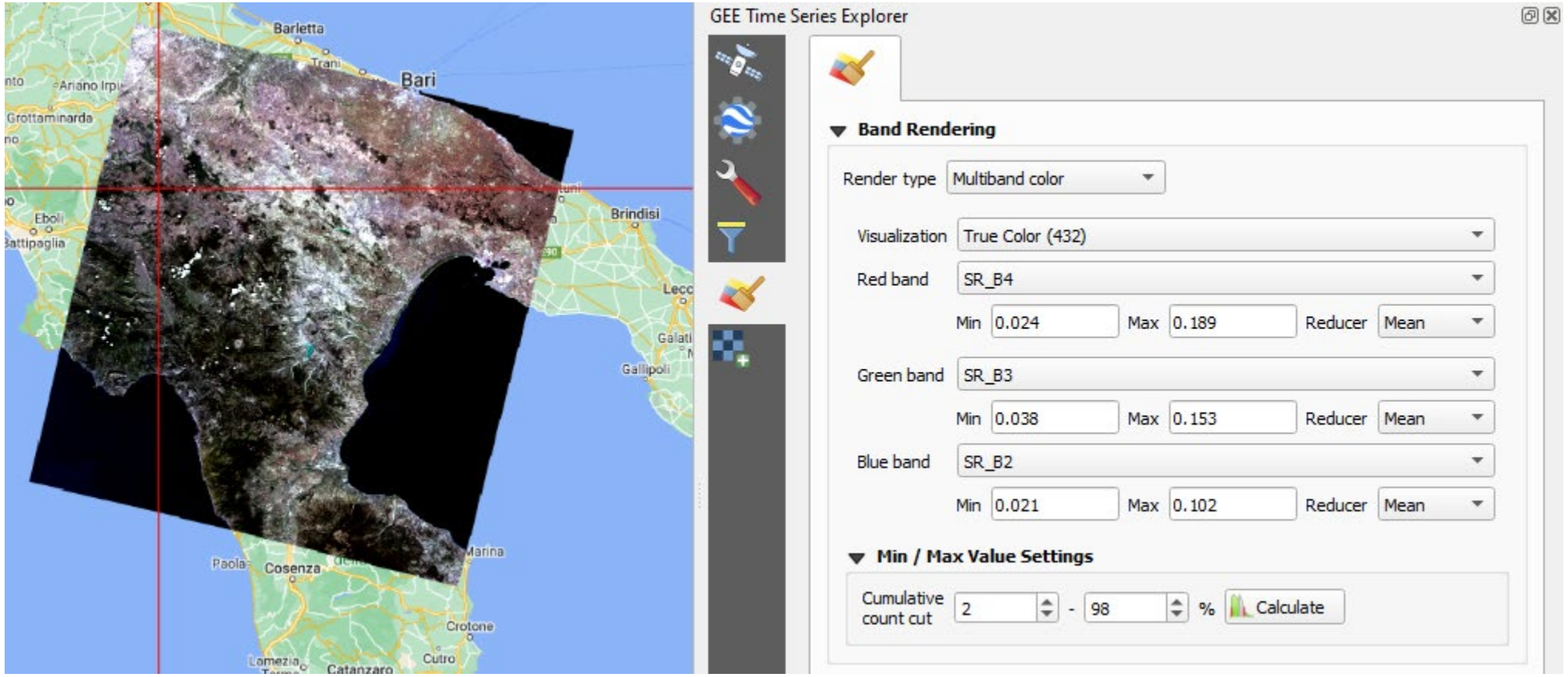
2018
2019
2020
2021
2022
burg
Schleswig
Kiel
Neumünster
Rostock
Lübeck
Wismar
Schwerin
Hamburg
Neubrandenburg
Koszalin
GEE Time Series Explorer
Landsat
MODIS
Sentinel
HSI
Custom
Landsat 9
Surface Reflectance
2021 - Present
Landsat 8
Surface Reflectance
2013 - Present
Landsat 7
Surface Reflectance
1999 - Present
Landsat 5
Surface Reflectance
1984 -2012
GEE Image
ID
Date
Bands
Layer Name
GEE Image
Collection
USGS Landsat 8 Level 2, Collection 2, Tier 1

Main Features of the GEE Time Series Explorer

- QGIS-like styling of GEE WMS layer



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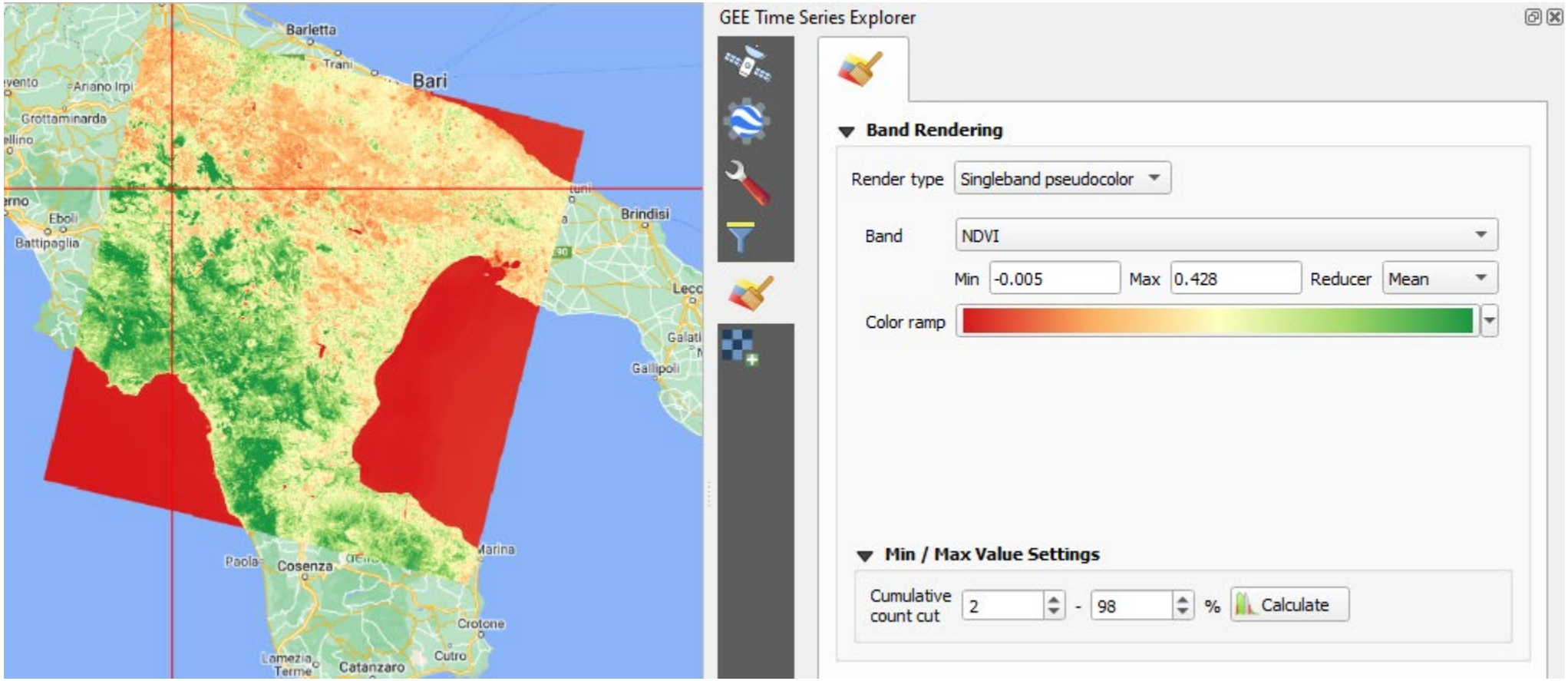
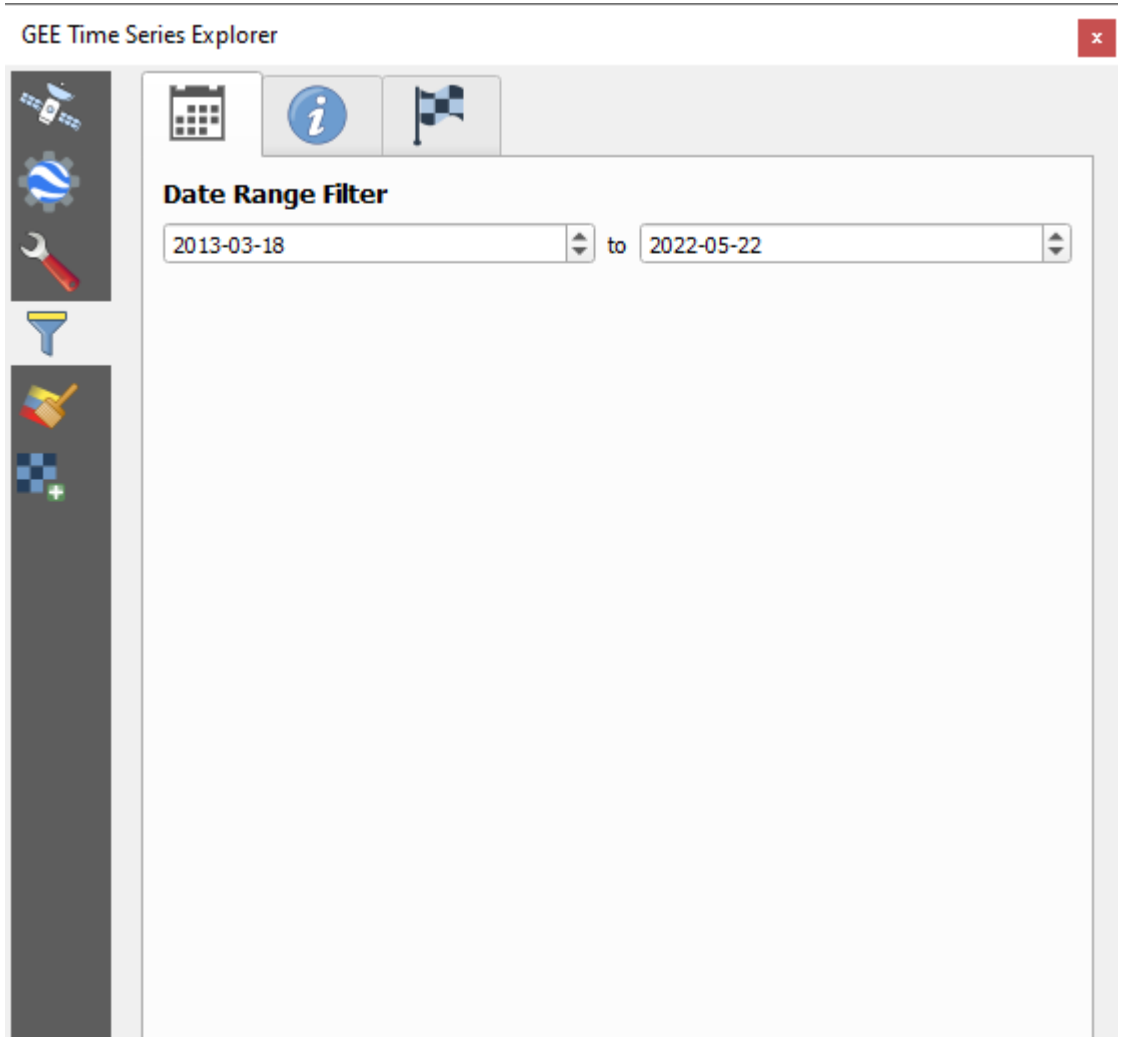


Main Features of the GEE Time Series Explorer

- image collection and pixel quality filtering



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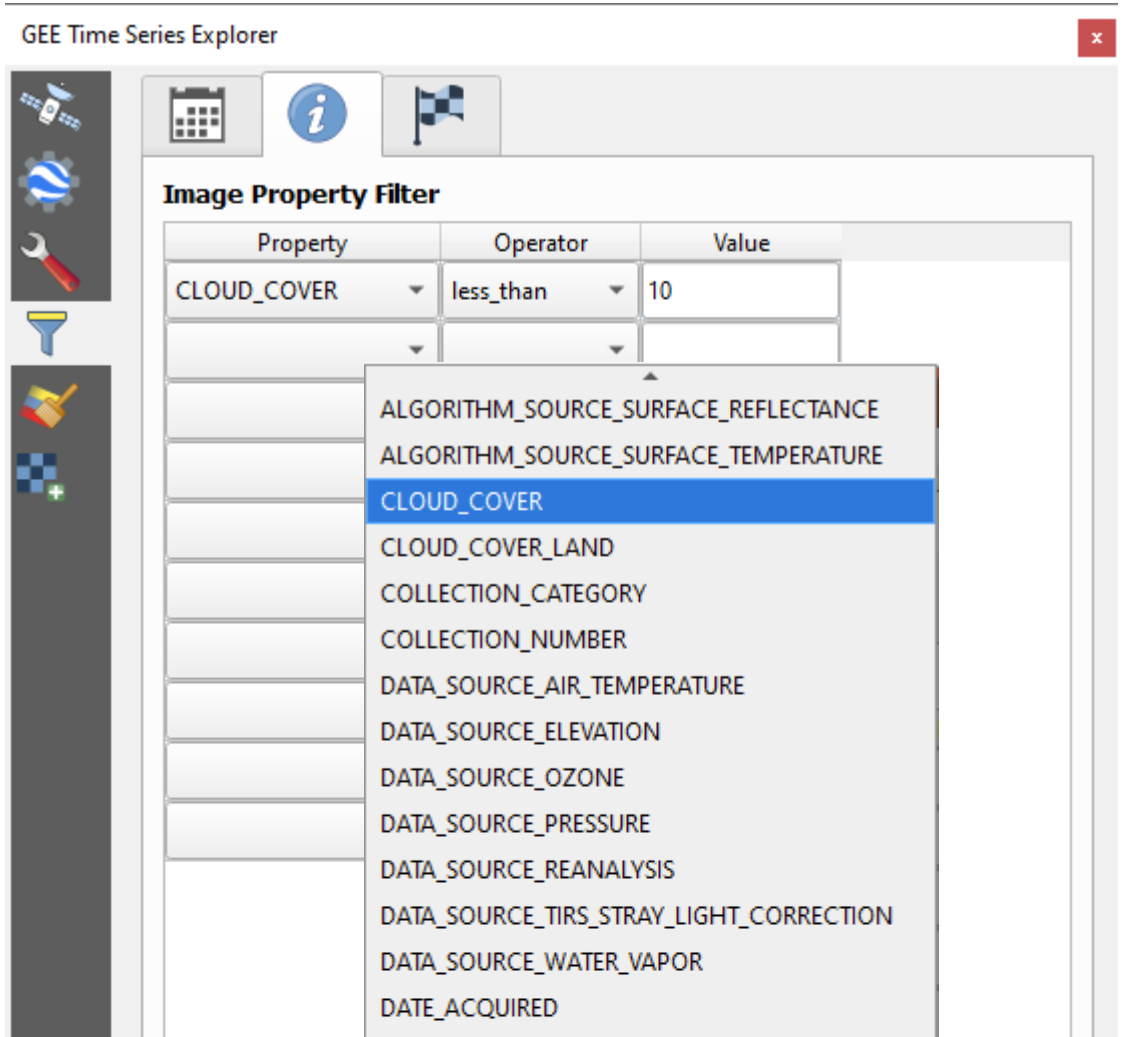

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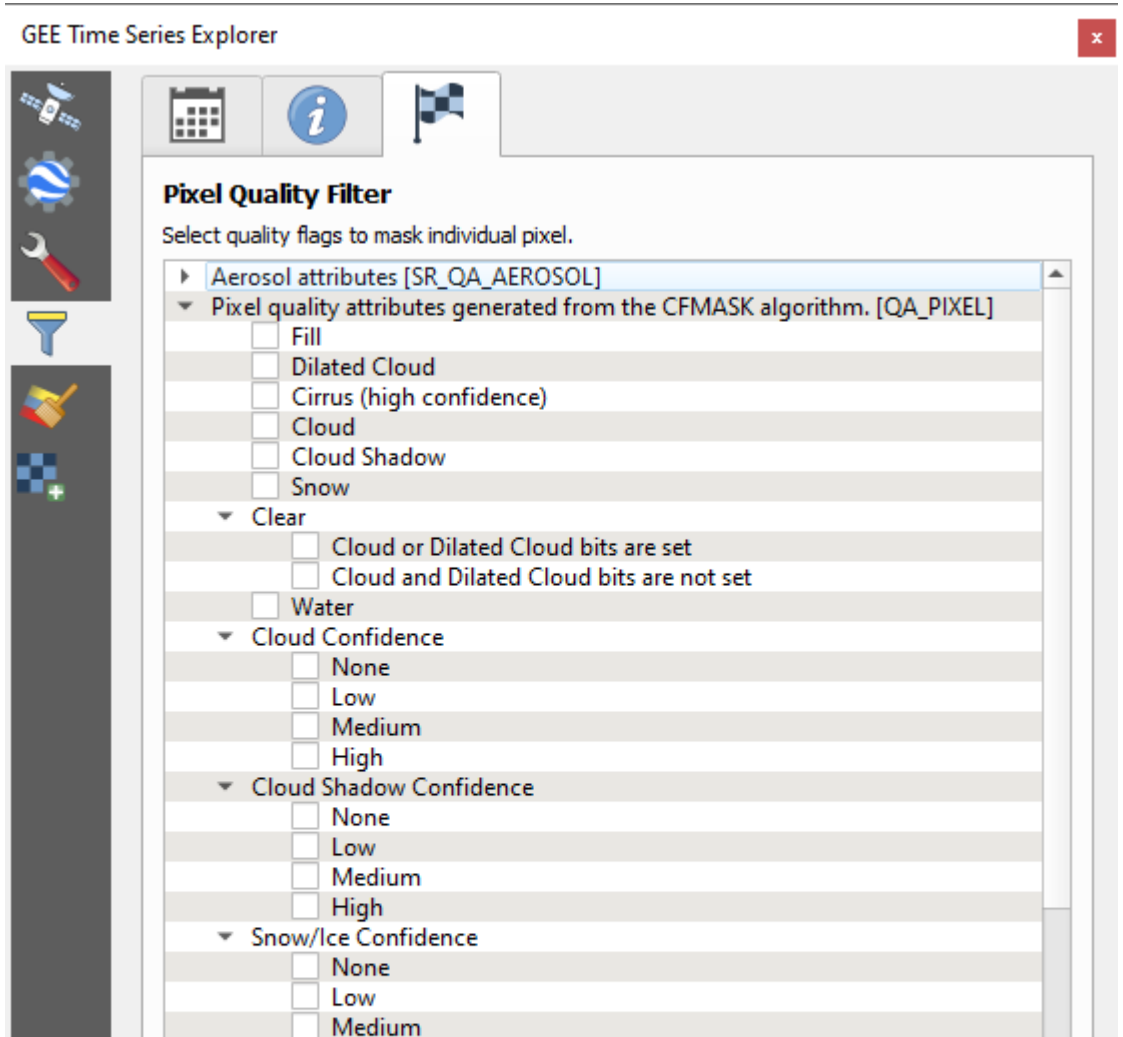

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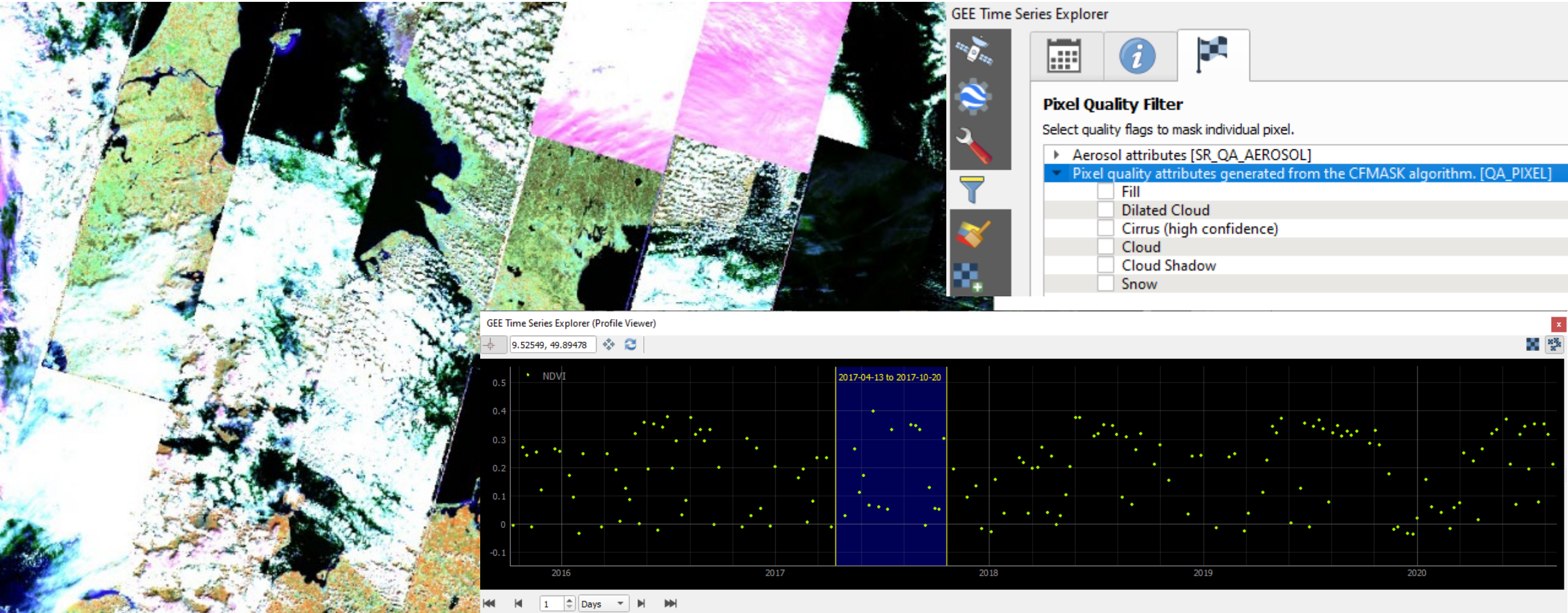

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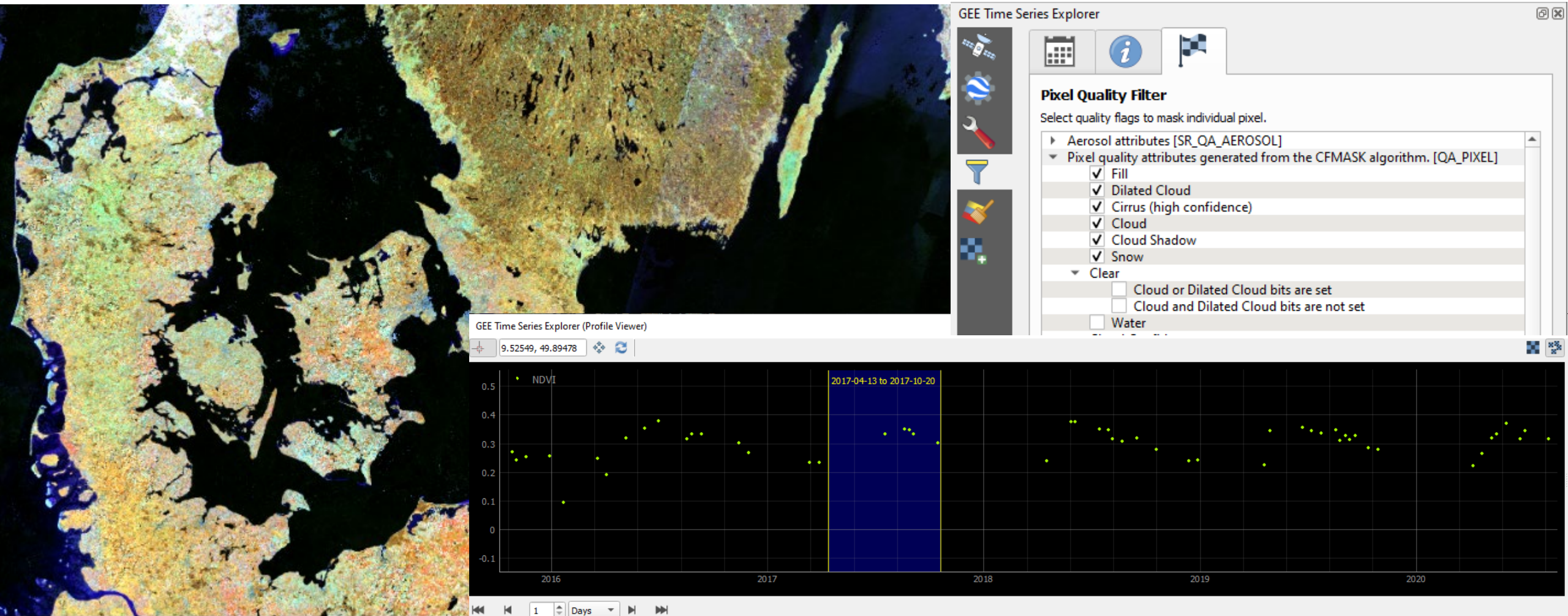
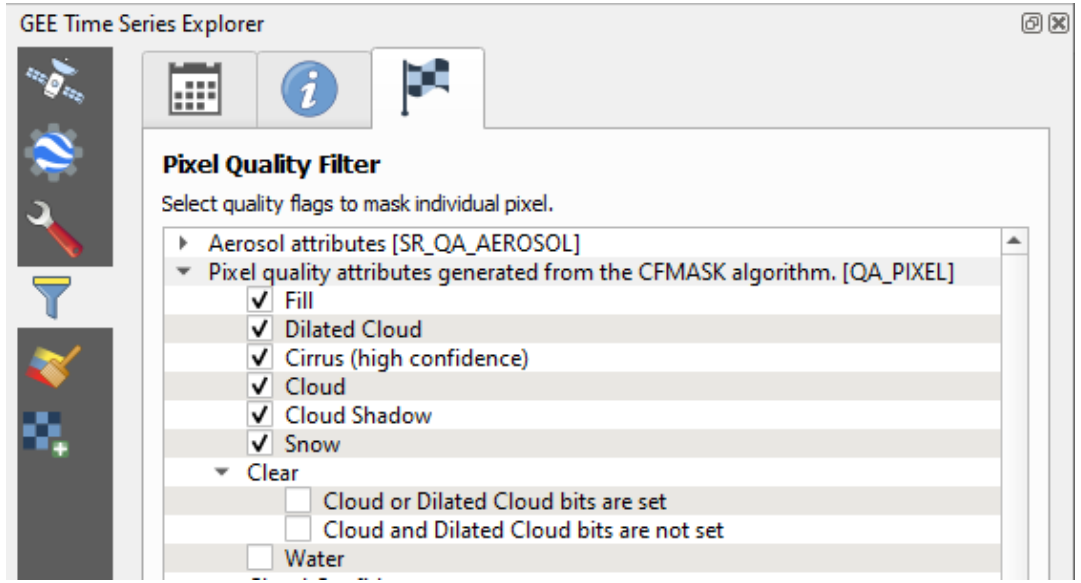
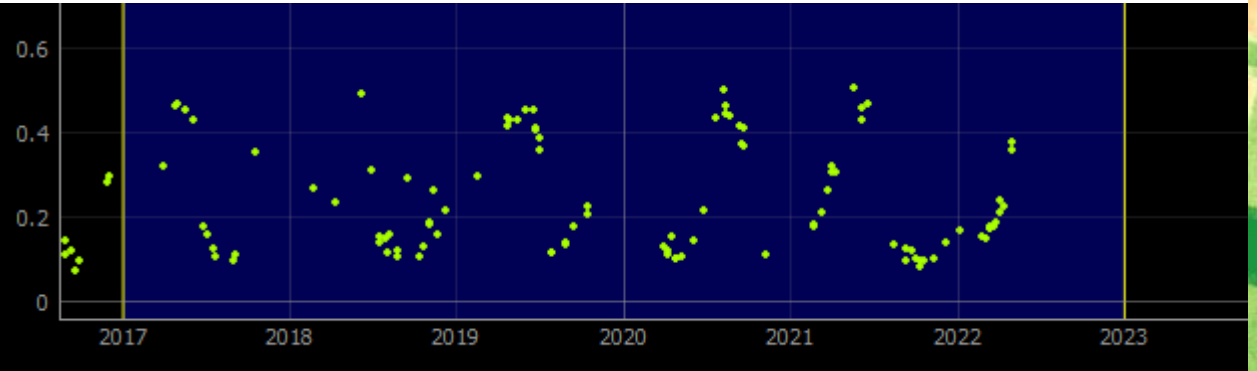
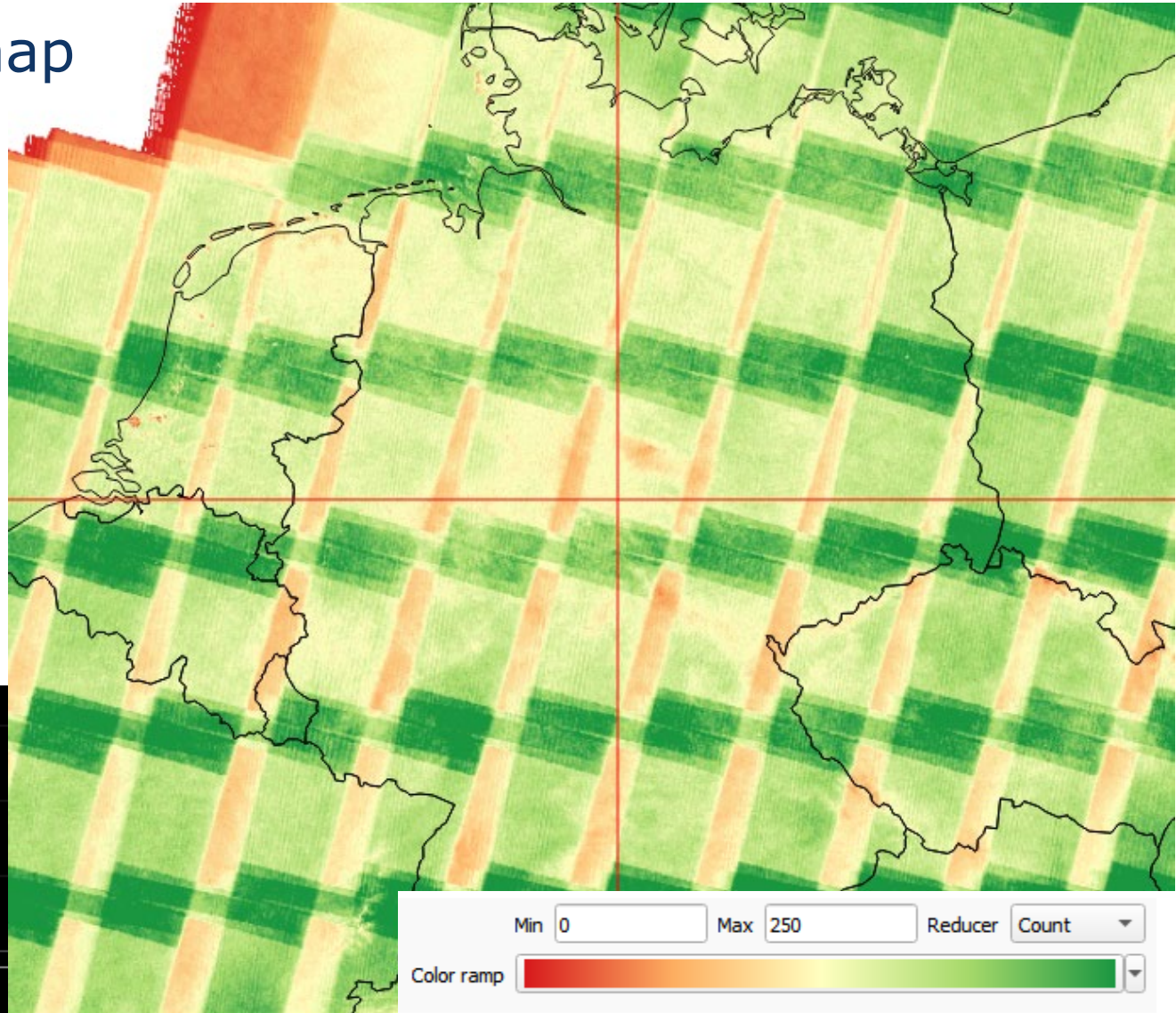


Main Features of the GEE Time Series Explorer

- clear-observation-counts heatmap







Main Features of the GEE Time Series Explorer

- capitalise on provided metadata

earthengine-stac.storage.googleapis.com/catalog/LANDSAT/LANDSAT_LC08_C02_T1_L2.json


```
},
"eo:bands": [
  {
    "center_wavelength": 0.443,
    "description": "Band 1 (ultra blue, coastal aerosol) surface reflectance",
    "gee:offset": -0.2,
    "gee:scale": 0.0000275,
    "gee:wavelength": "0.435-0.451 &mu;m",
    "name": "SR_B1"
  },
  {
    "center_wavelength": 0.482,
    "description": "Band 2 (blue) surface reflectance",
    "gee:offset": -0.2,
    "gee:scale": 0.0000275,
    "gee:wavelength": "0.452-0.512 &mu;m",
    "name": "SR_B2"
  },
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    "center_wavelength": 0.562
```
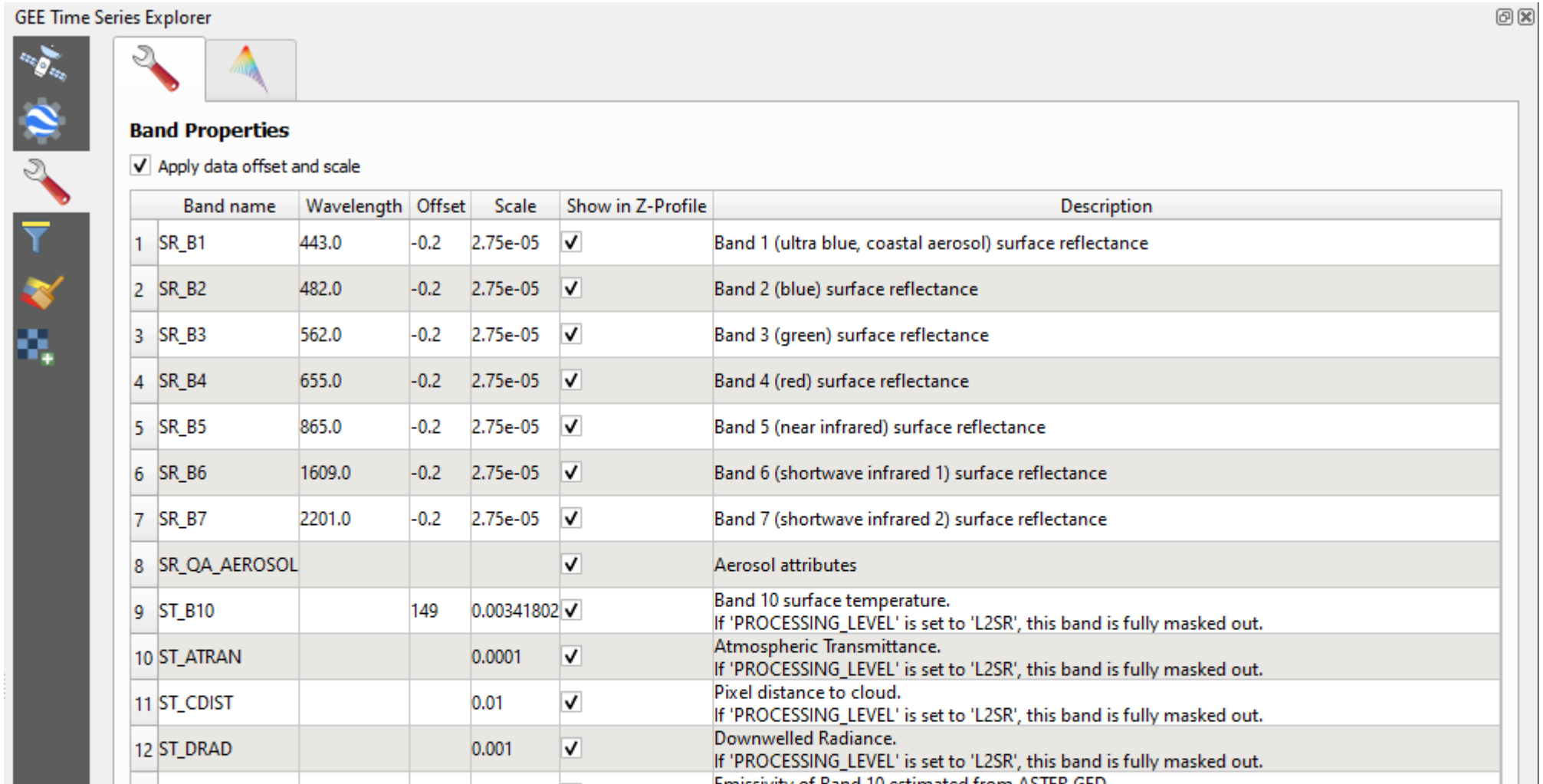

Main Features of the GEE Time Series Explorer

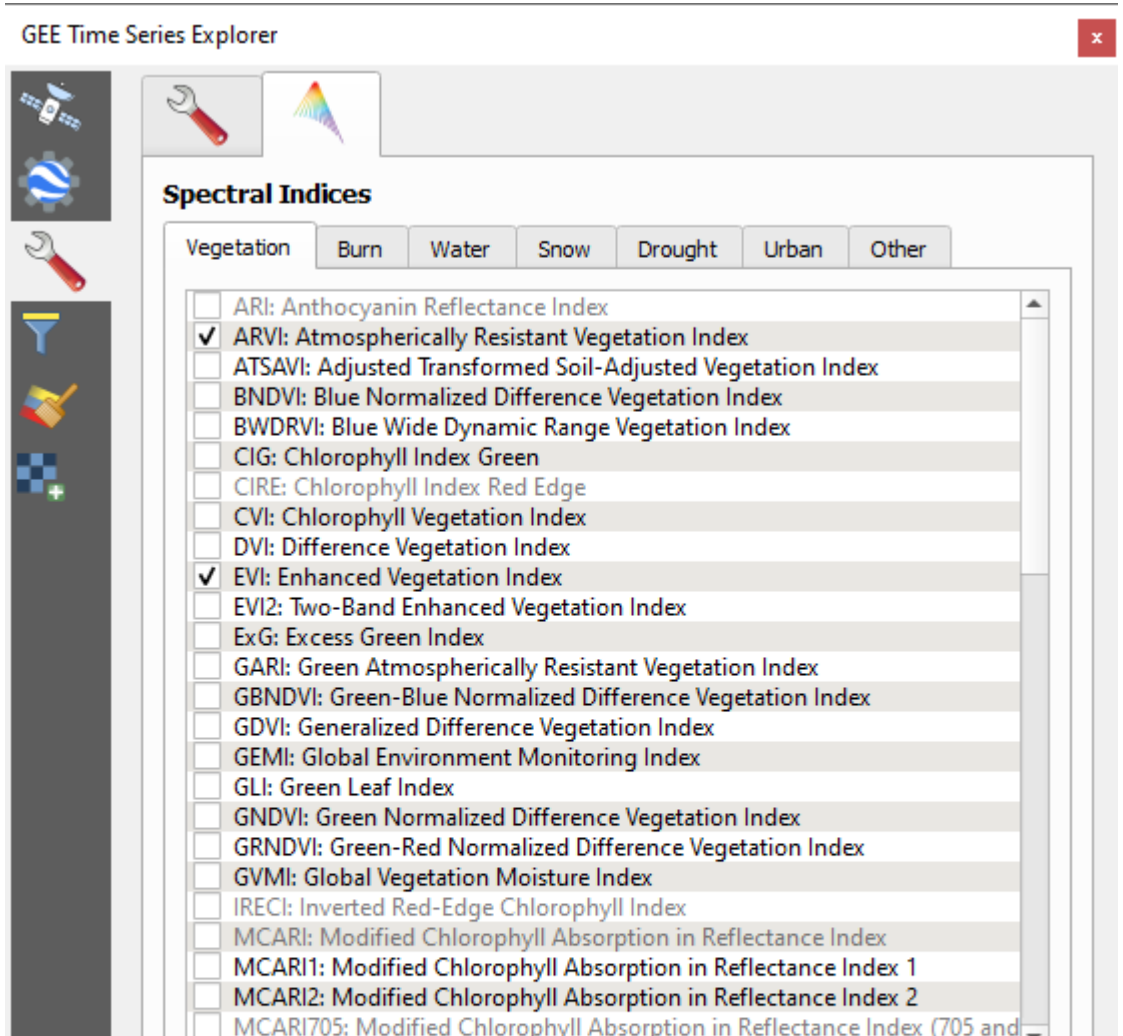
- capitalise on provided metadata: present information



	Band name	Wavelength	Offset	Scale	Show in Z-Profile	Description
1	SR_B1	443.0	-0.2	2.75e-05	✓	Band 1 (ultra blue, coastal aerosol) surface reflectance
2	SR_B2	482.0	-0.2	2.75e-05	✓	Band 2 (blue) surface reflectance
3	SR_B3	562.0	-0.2	2.75e-05	✓	Band 3 (green) surface reflectance
4	SR_B4	655.0	-0.2	2.75e-05	✓	Band 4 (red) surface reflectance
5	SR_B5	865.0	-0.2	2.75e-05	✓	Band 5 (near infrared) surface reflectance
6	SR_B6	1609.0	-0.2	2.75e-05	✓	Band 6 (shortwave infrared 1) surface reflectance
7	SR_B7	2201.0	-0.2	2.75e-05	✓	Band 7 (shortwave infrared 2) surface reflectance
8	SR_QA_AEROSOL				✓	Aerosol attributes
9	ST_B10		149	0.00341802	✓	Band 10 surface temperature. If 'PROCESSING_LEVEL' is set to 'L2SR', this band is fully masked out.
10	ST_ATRAN			0.0001	✓	Atmospheric Transmittance. If 'PROCESSING_LEVEL' is set to 'L2SR', this band is fully masked out.
11	ST_CDIST			0.01	✓	Pixel distance to cloud. If 'PROCESSING_LEVEL' is set to 'L2SR', this band is fully masked out.
12	ST_DRAD			0.001	✓	Downwelled Radiance. If 'PROCESSING_LEVEL' is set to 'L2SR', this band is fully masked out.

Main Features of the GEE Time Series Explorer

- capitalise on provided metadata: prepare spectral indices



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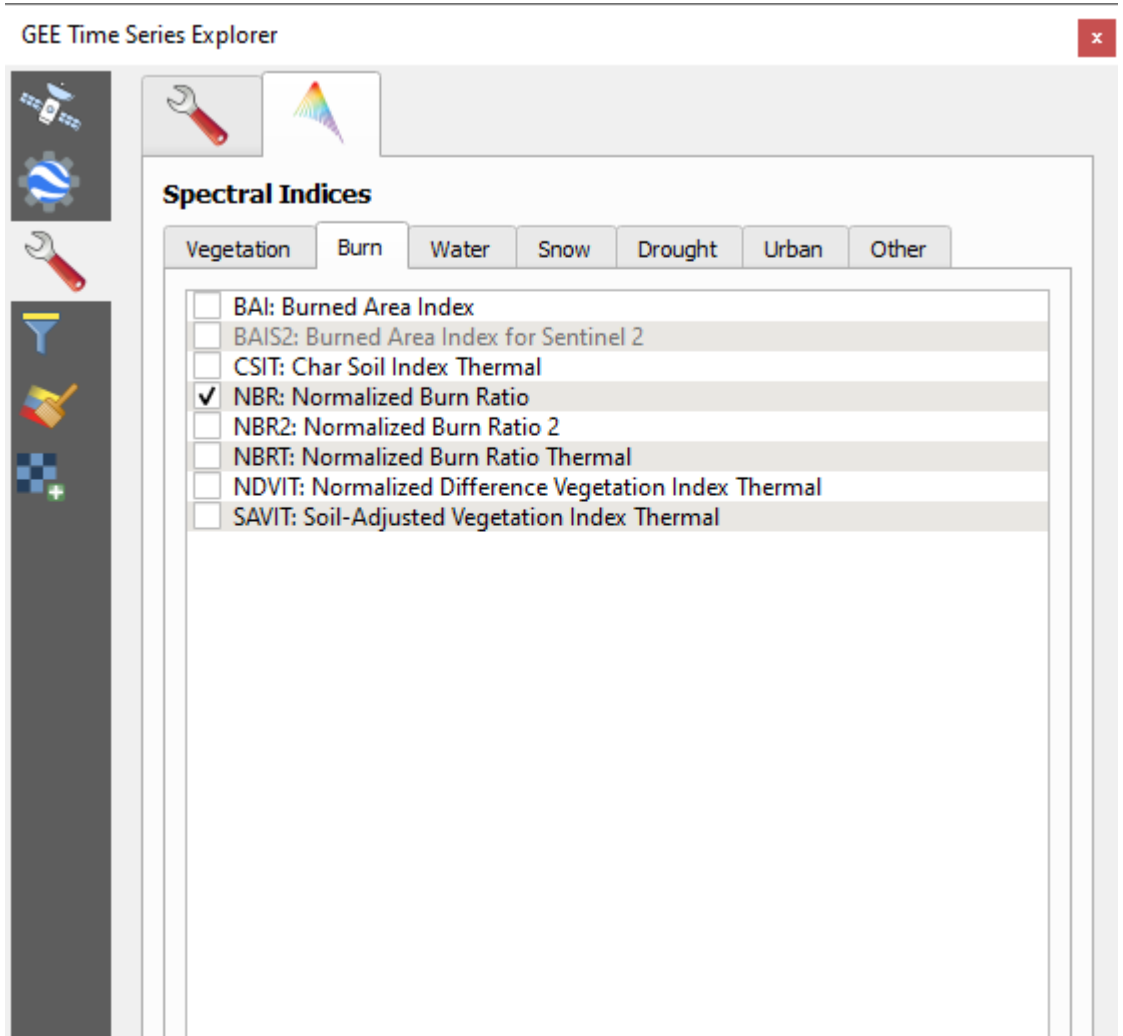

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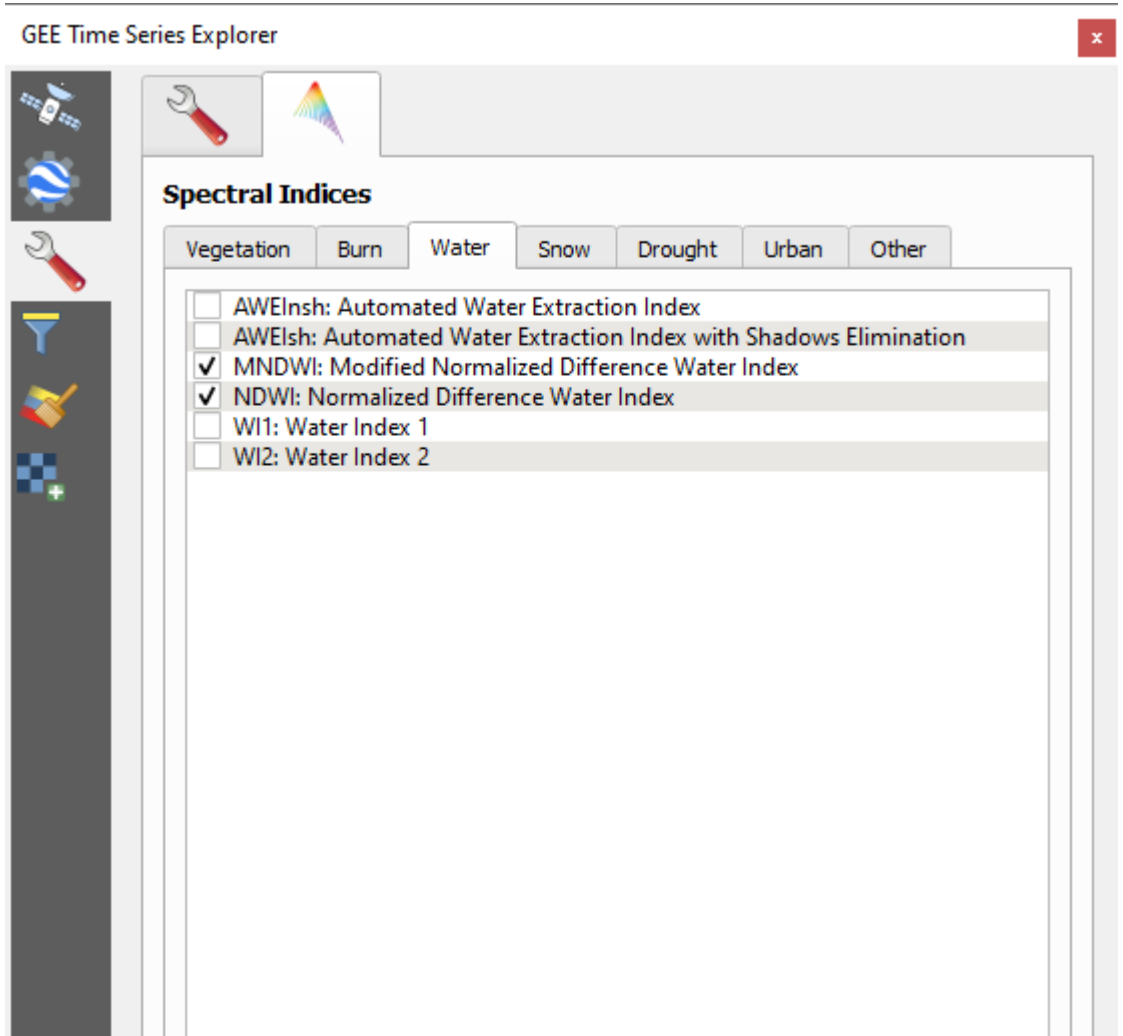

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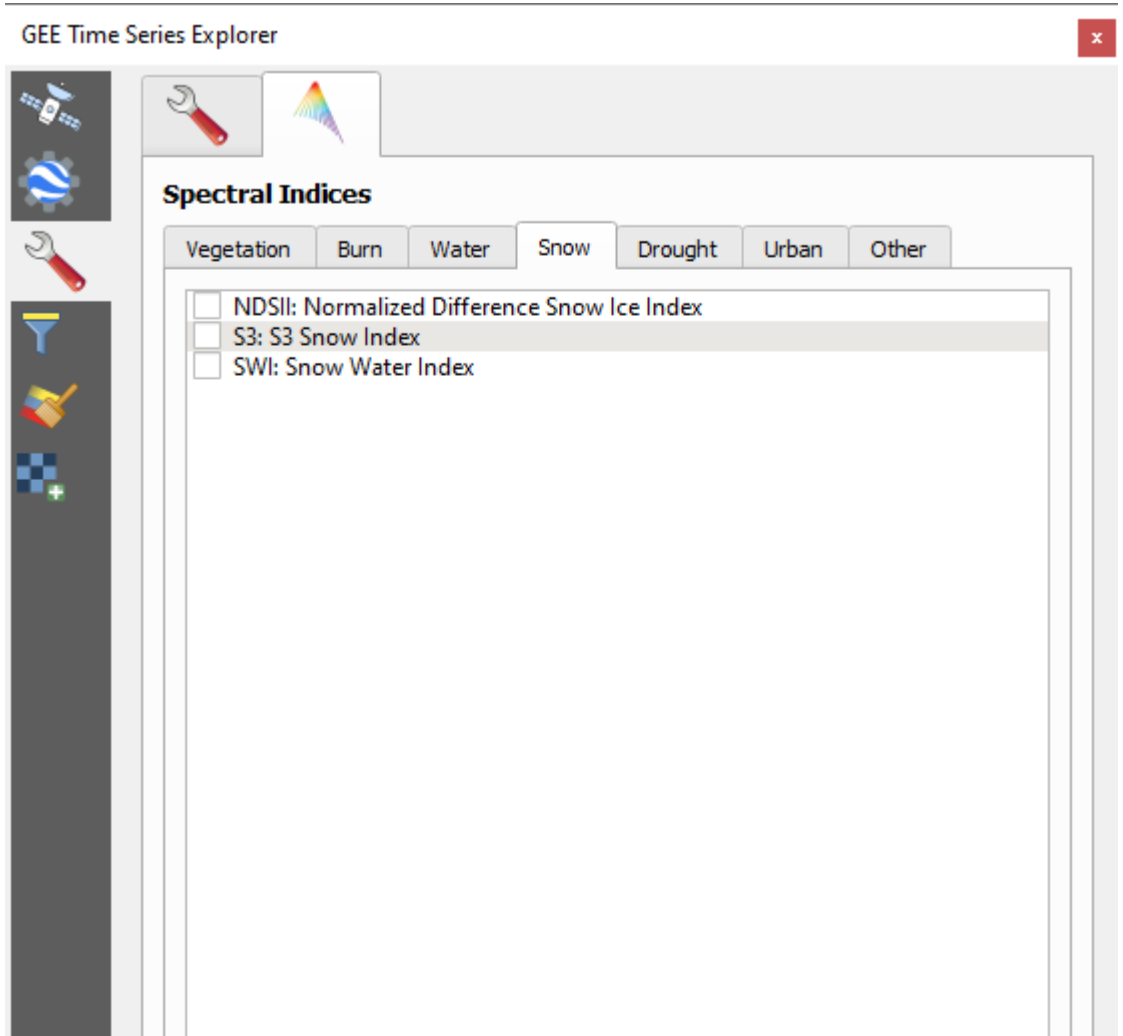

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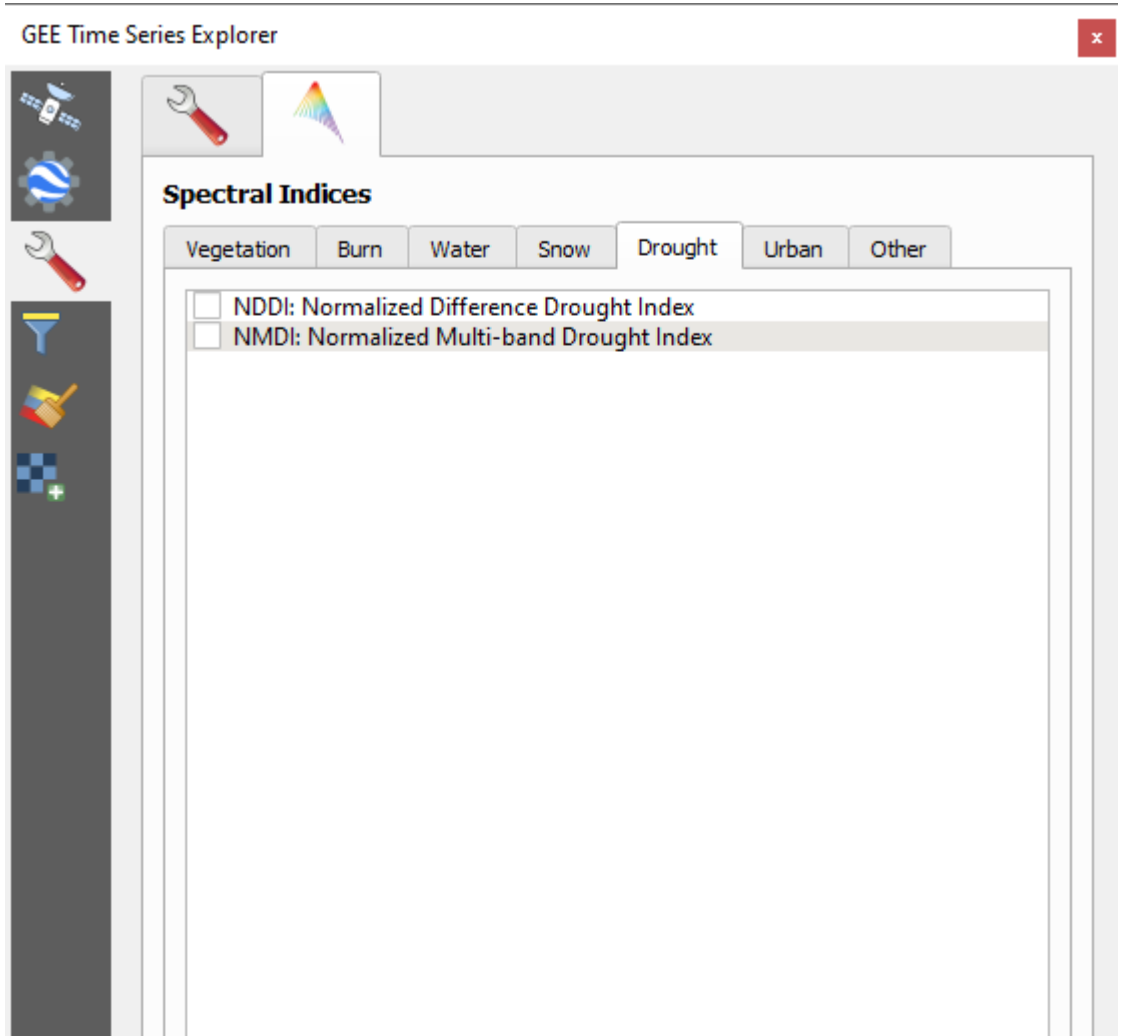

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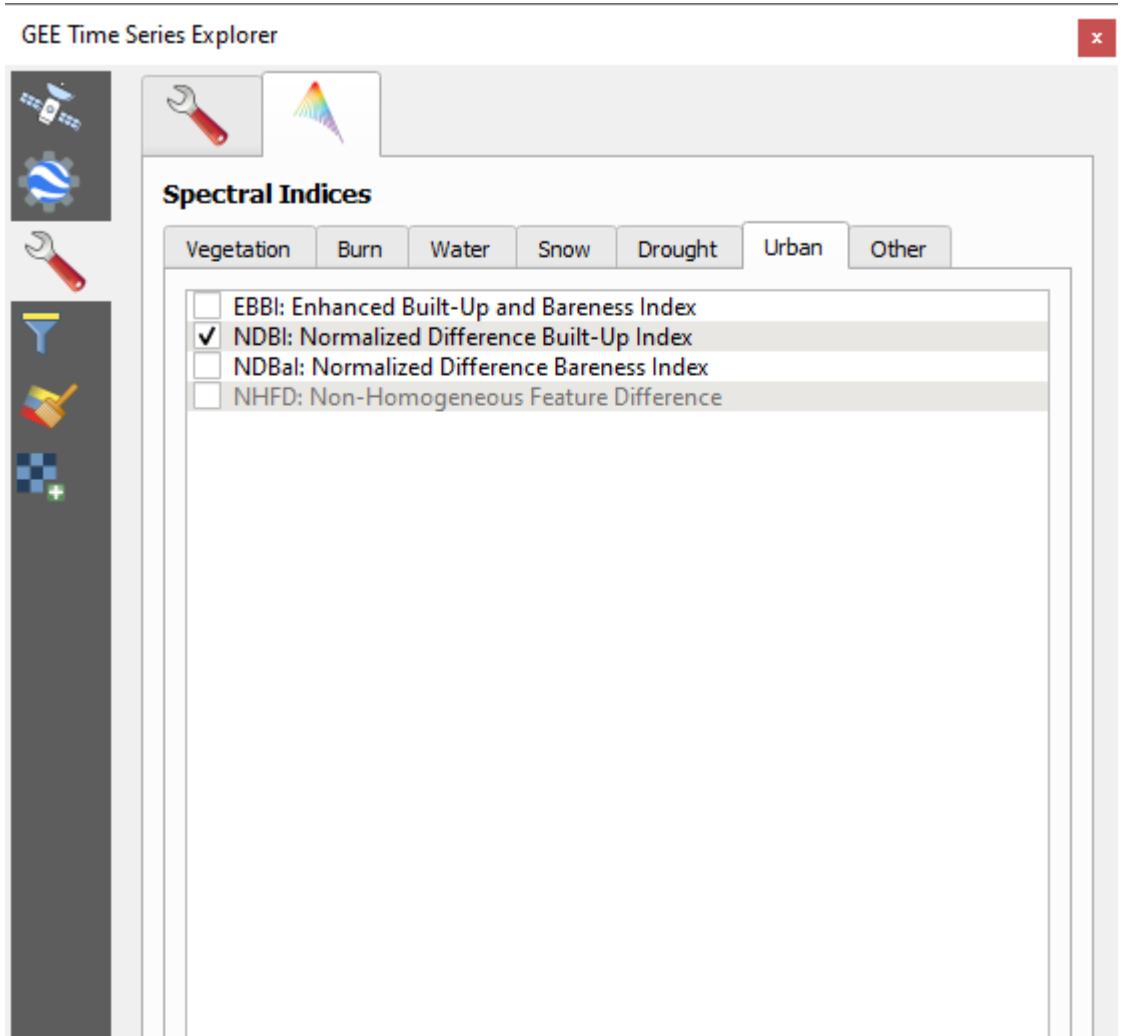

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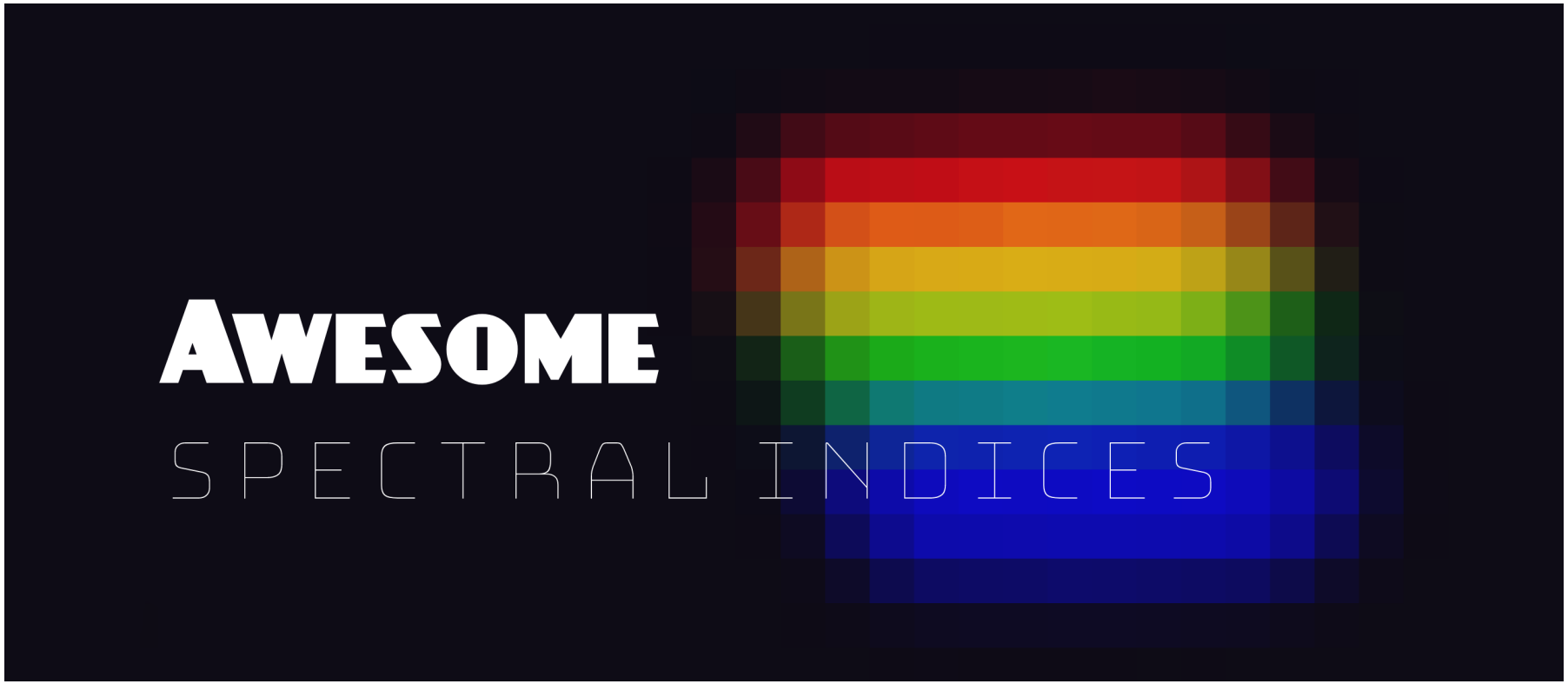
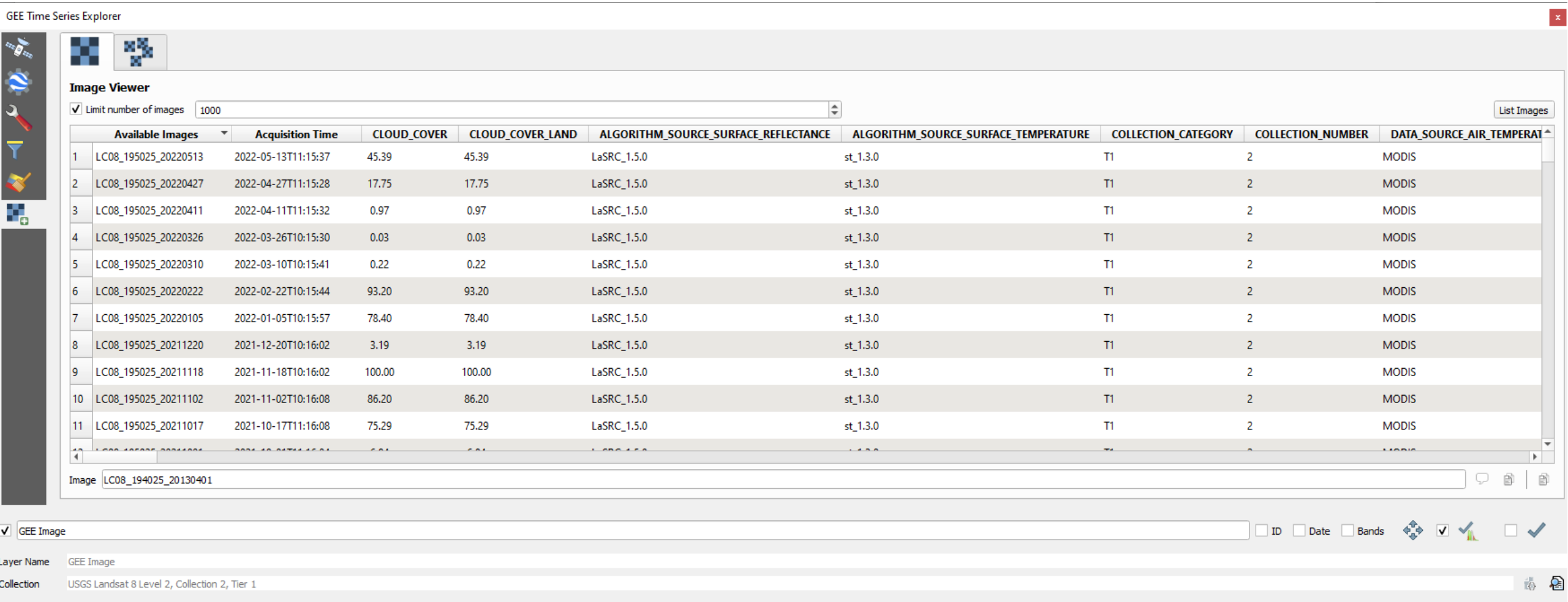
  https://awesome-ee-spectral-indices.readthedocs.io



Main Features of the GEE Time Series Explorer

- capitalise on provided metadata: sort images by properties



	Available Images	Acquisition Time	CLOUD_COVER	CLOUD_COVER_LAND	ALGORITHM_SOURCE_SURFACE_REFLECTANCE	ALGORITHM_SOURCE_SURFACE_TEMPERATURE	COLLECTION_CATEGORY	COLLECTION_NUMBER	DATA_SOURCE_AIR_TEMPERAT
1	LC08_195025_20220513	2022-05-13T11:15:37	45.39	45.39	LaSRC_1.5.0	st_1.3.0	T1	2	MODIS
2	LC08_195025_20220427	2022-04-27T11:15:28	17.75	17.75	LaSRC_1.5.0	st_1.3.0	T1	2	MODIS
3	LC08_195025_20220411	2022-04-11T11:15:32	0.97	0.97	LaSRC_1.5.0	st_1.3.0	T1	2	MODIS
4	LC08_195025_20220326	2022-03-26T10:15:30	0.03	0.03	LaSRC_1.5.0	st_1.3.0	T1	2	MODIS
5	LC08_195025_20220310	2022-03-10T10:15:41	0.22	0.22	LaSRC_1.5.0	st_1.3.0	T1	2	MODIS
6	LC08_195025_20220222	2022-02-22T10:15:44	93.20	93.20	LaSRC_1.5.0	st_1.3.0	T1	2	MODIS
7	LC08_195025_20220105	2022-01-05T10:15:57	78.40	78.40	LaSRC_1.5.0	st_1.3.0	T1	2	MODIS
8	LC08_195025_20211220	2021-12-20T10:16:02	3.19	3.19	LaSRC_1.5.0	st_1.3.0	T1	2	MODIS
9	LC08_195025_20211118	2021-11-18T10:16:02	100.00	100.00	LaSRC_1.5.0	st_1.3.0	T1	2	MODIS
10	LC08_195025_20211102	2021-11-02T10:16:08	86.20	86.20	LaSRC_1.5.0	st_1.3.0	T1	2	MODIS
11	LC08_195025_20211017	2021-10-17T11:16:08	75.29	75.29	LaSRC_1.5.0	st_1.3.0	T1	2	MODIS

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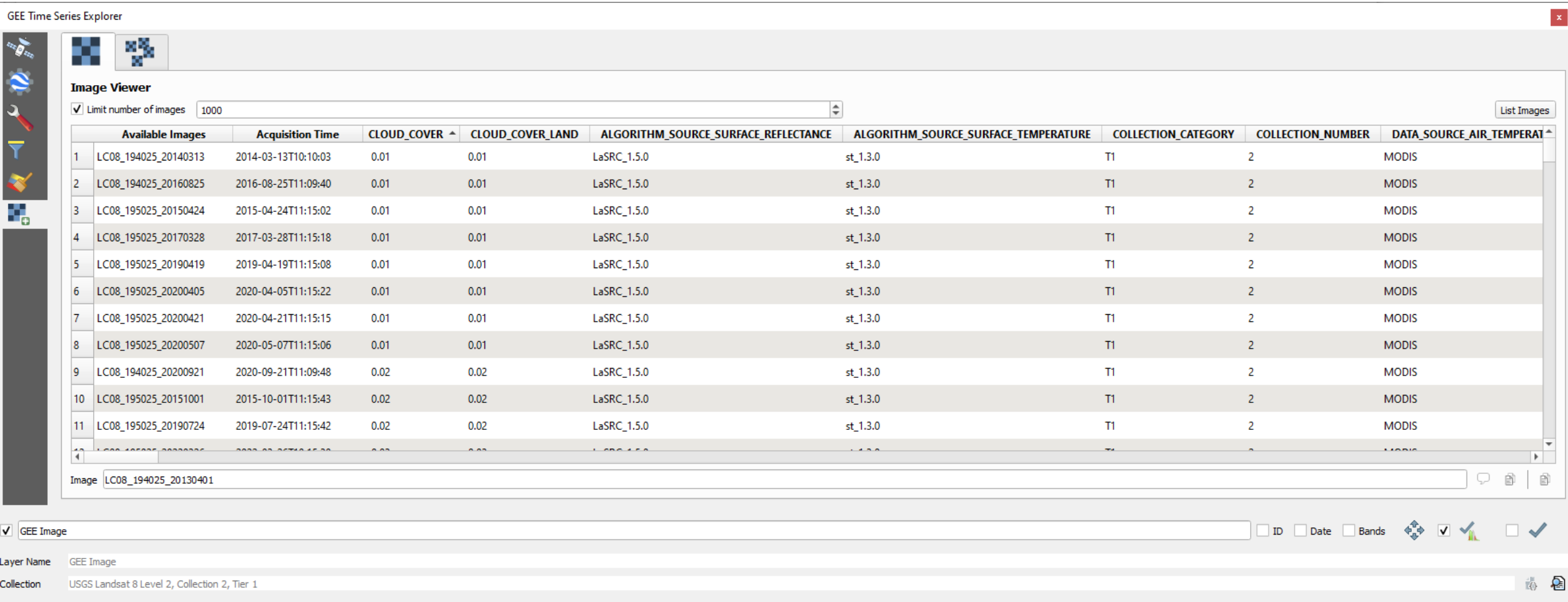

	Available Images	Acquisition Time	CLOUD_COVER	CLOUD_COVER_LAND	ALGORITHM_SOURCE_SURFACE_REFLECTANCE	ALGORITHM_SOURCE_SURFACE_TEMPERATURE	COLLECTION_CATEGORY	COLLECTION_NUMBER	DATA_SOURCE_AIR_TEMPERAT
1	LC08_194025_20140313	2014-03-13T10:10:03	0.01	0.01	LaSRC_1.5.0	st_1.3.0	T1	2	MODIS
2	LC08_194025_20160825	2016-08-25T11:09:40	0.01	0.01	LaSRC_1.5.0	st_1.3.0	T1	2	MODIS
3	LC08_195025_20150424	2015-04-24T11:15:02	0.01	0.01	LaSRC_1.5.0	st_1.3.0	T1	2	MODIS
4	LC08_195025_20170328	2017-03-28T11:15:18	0.01	0.01	LaSRC_1.5.0	st_1.3.0	T1	2	MODIS
5	LC08_195025_20190419	2019-04-19T11:15:08	0.01	0.01	LaSRC_1.5.0	st_1.3.0	T1	2	MODIS
6	LC08_195025_20200405	2020-04-05T11:15:22	0.01	0.01	LaSRC_1.5.0	st_1.3.0	T1	2	MODIS
7	LC08_195025_20200421	2020-04-21T11:15:15	0.01	0.01	LaSRC_1.5.0	st_1.3.0	T1	2	MODIS
8	LC08_195025_20200507	2020-05-07T11:15:06	0.01	0.01	LaSRC_1.5.0	st_1.3.0	T1	2	MODIS
9	LC08_194025_20200921	2020-09-21T11:09:48	0.02	0.02	LaSRC_1.5.0	st_1.3.0	T1	2	MODIS
10	LC08_195025_20151001	2015-10-01T11:15:43	0.02	0.02	LaSRC_1.5.0	st_1.3.0	T1	2	MODIS
11	LC08_195025_20190724	2019-07-24T11:15:42	0.02	0.02	LaSRC_1.5.0	st_1.3.0	T1	2	MODIS

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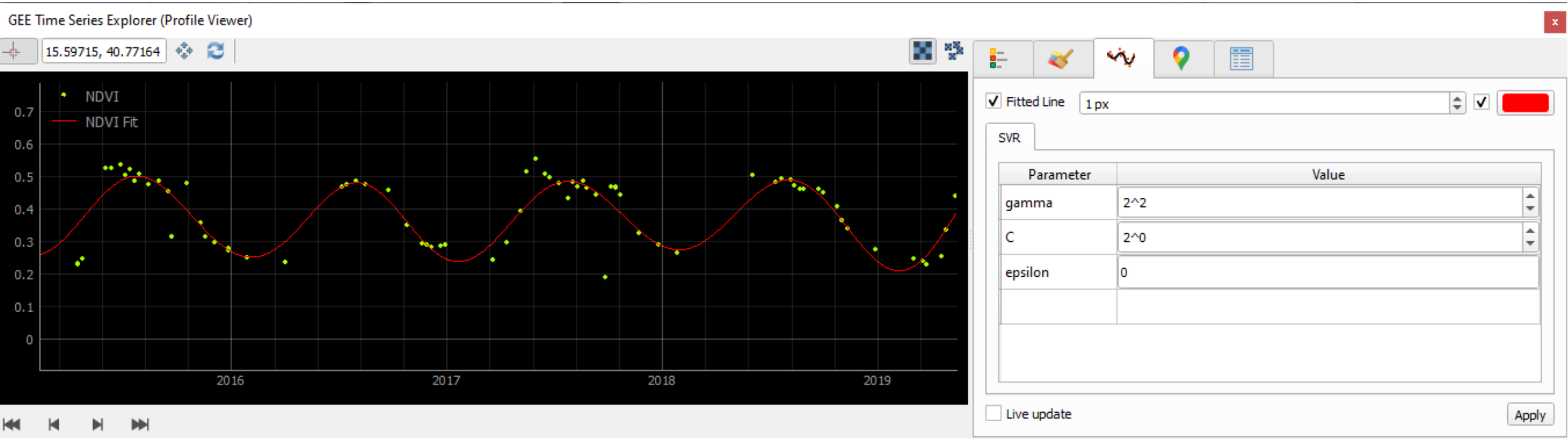
- profile fitting



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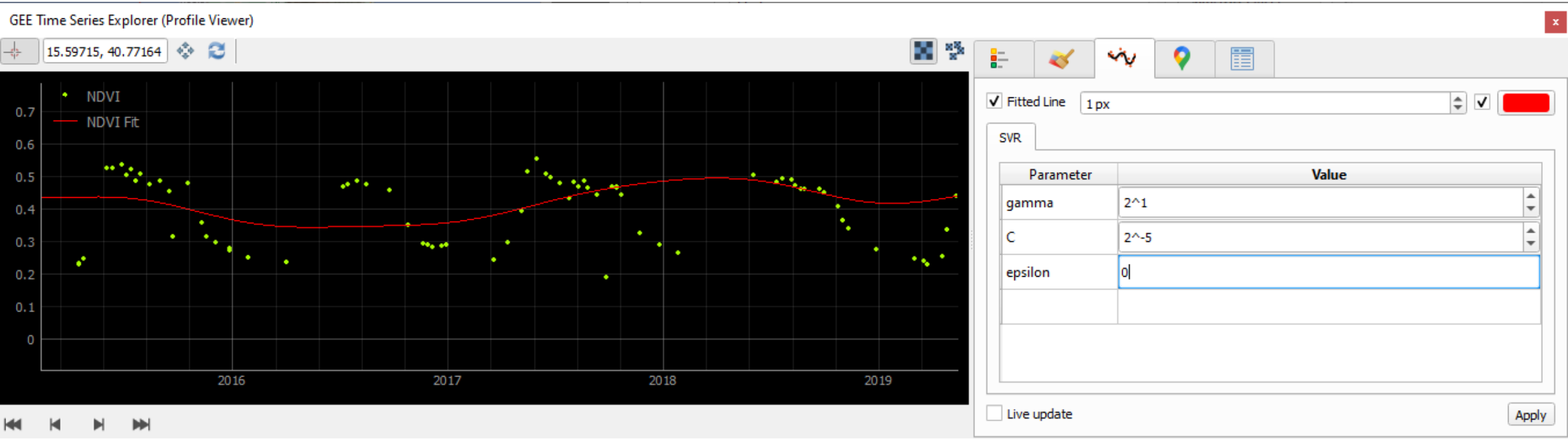

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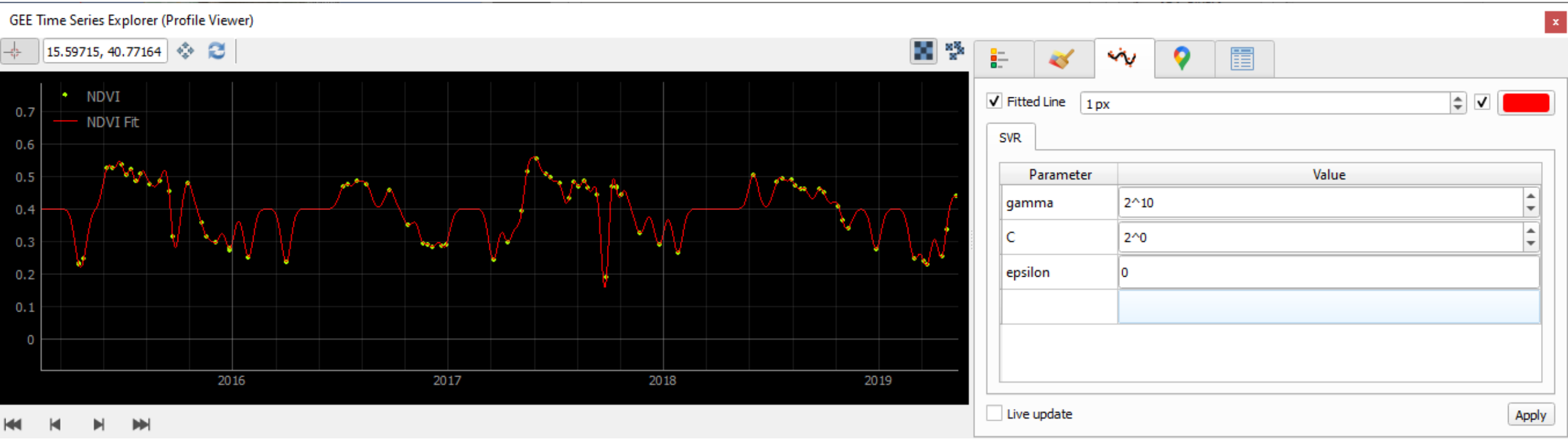

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- sample-based analysis via the location browser

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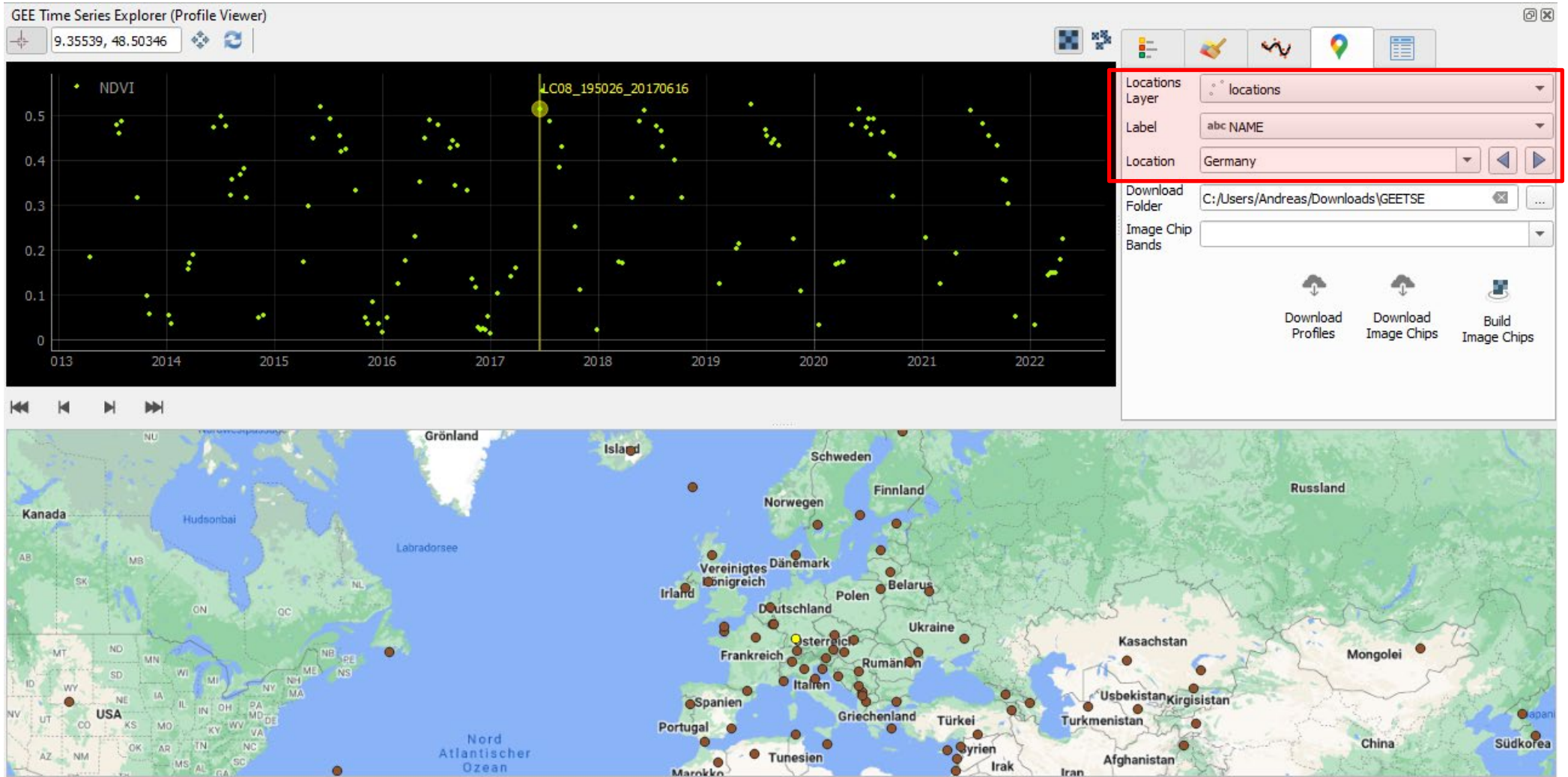

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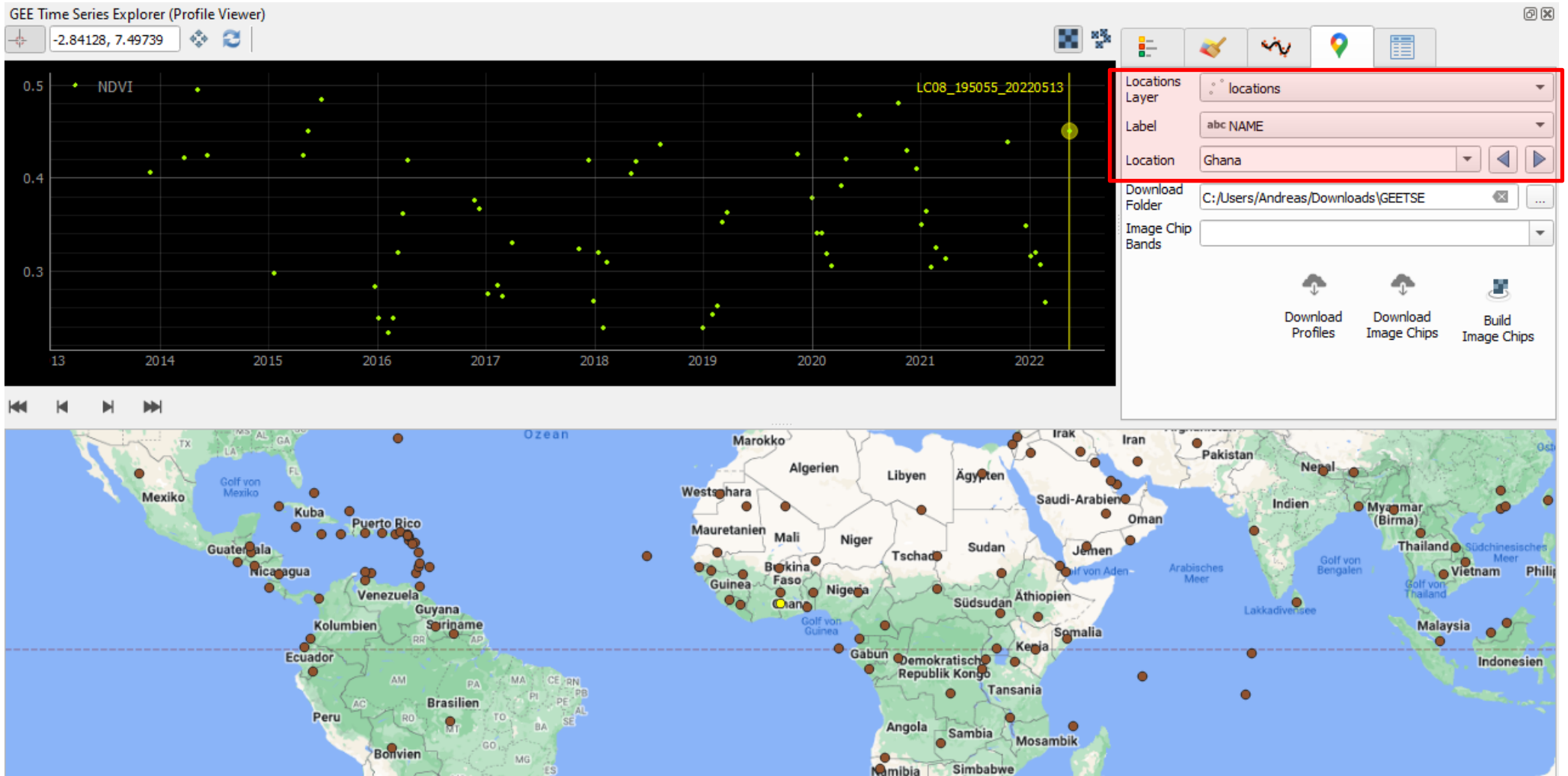
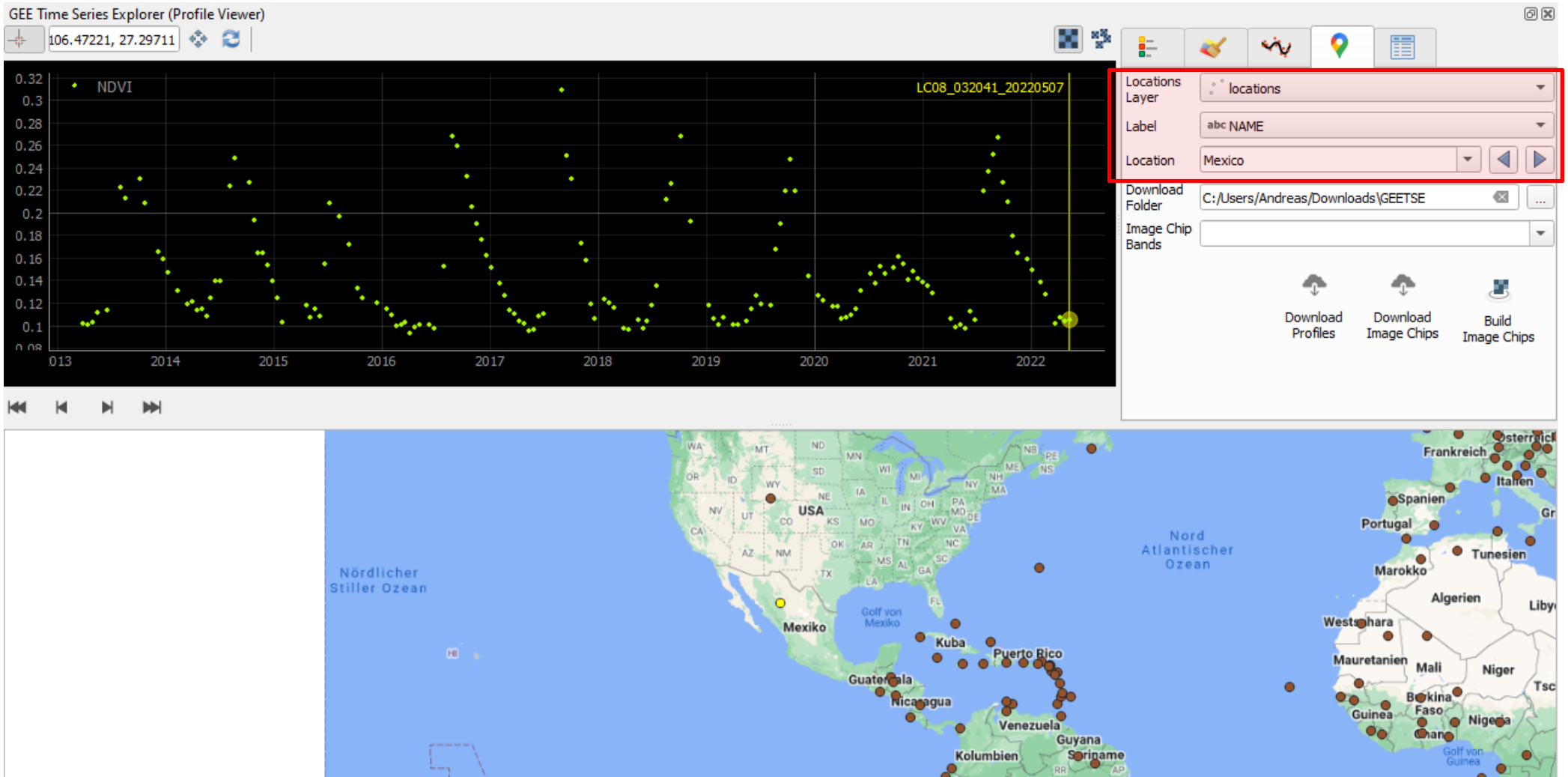


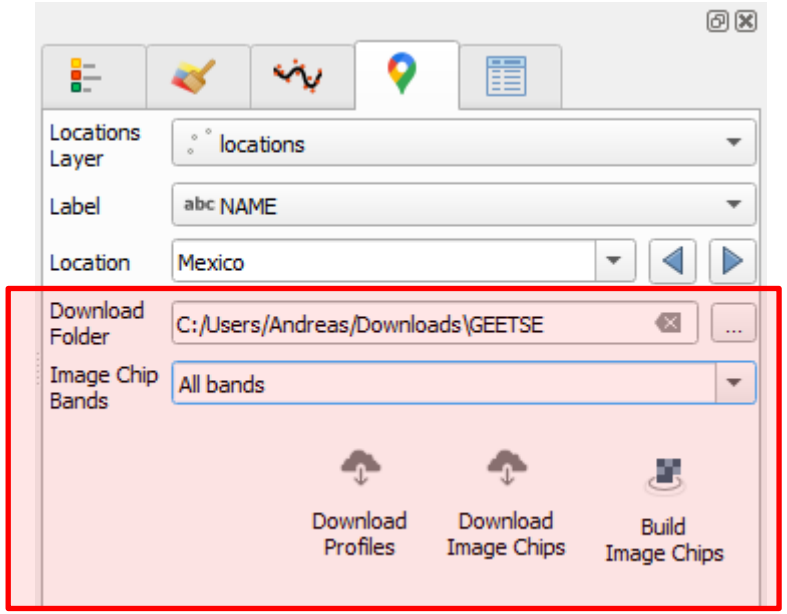
Main Features of the GEE Time Series Explorer

- sample-based analysis via the location browser

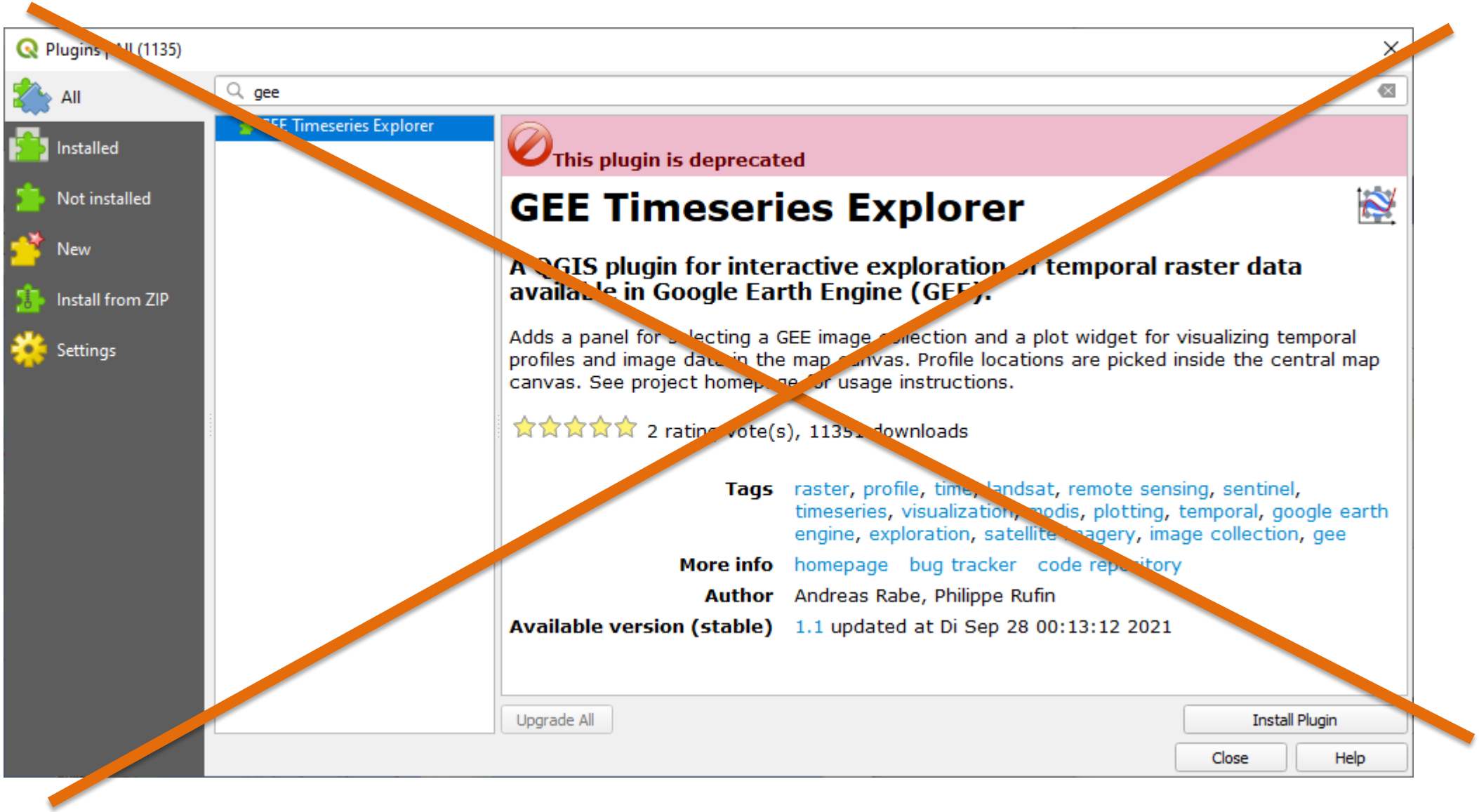


Main Features of the GEE Time Series Explorer

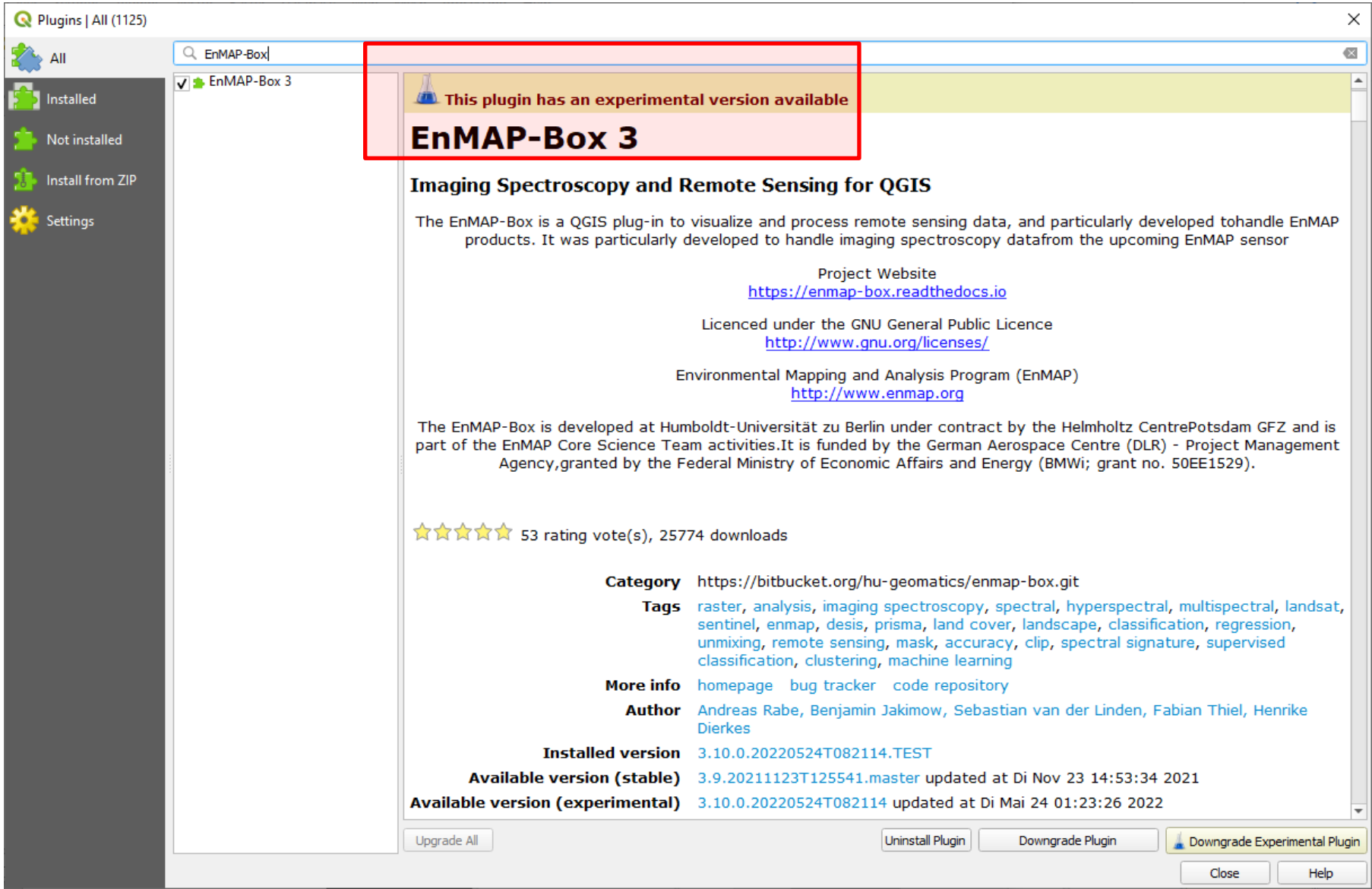
- sample-based analysis via the location browser
  - download profiles for each location
  - download image chips (500x500 px) for each data point



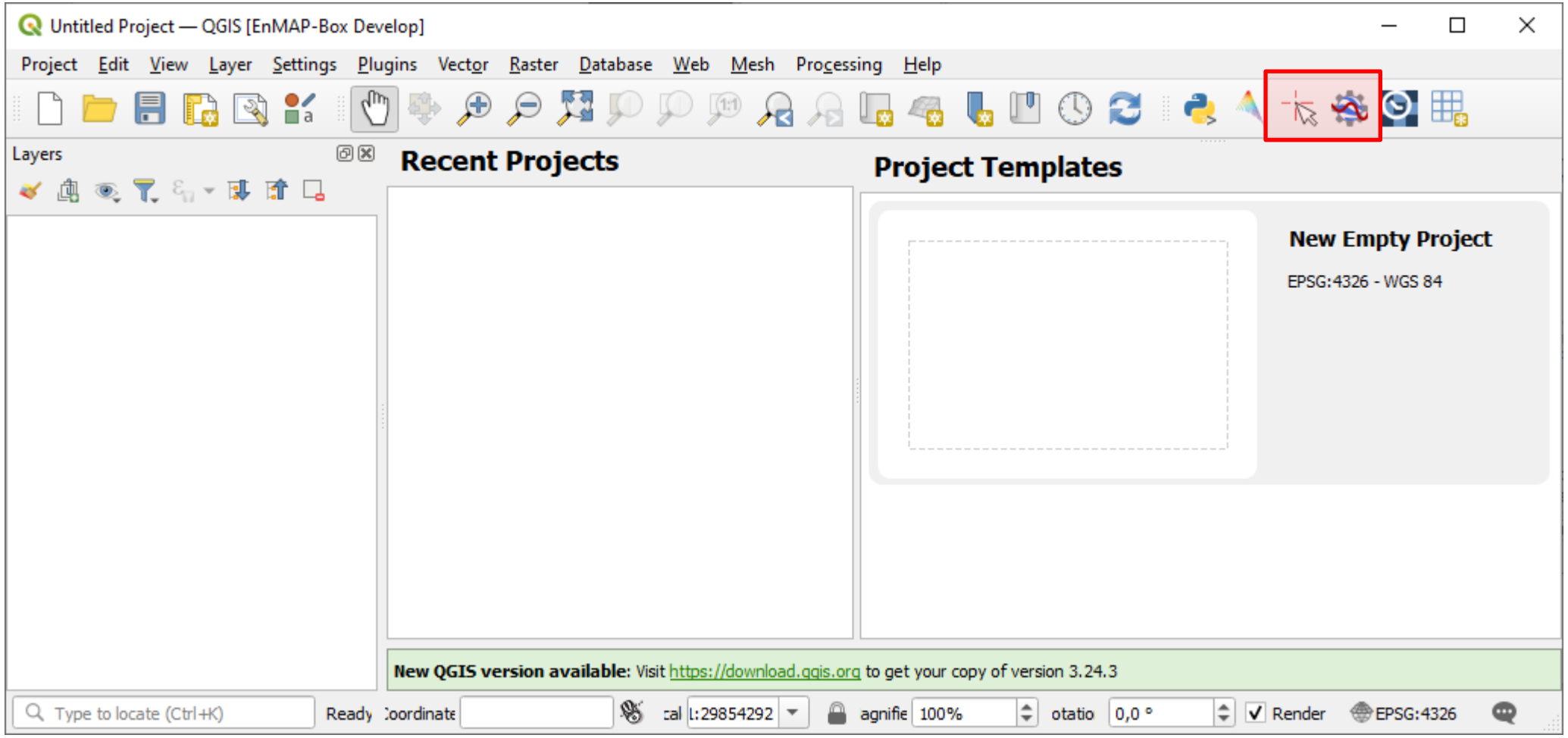
Installation

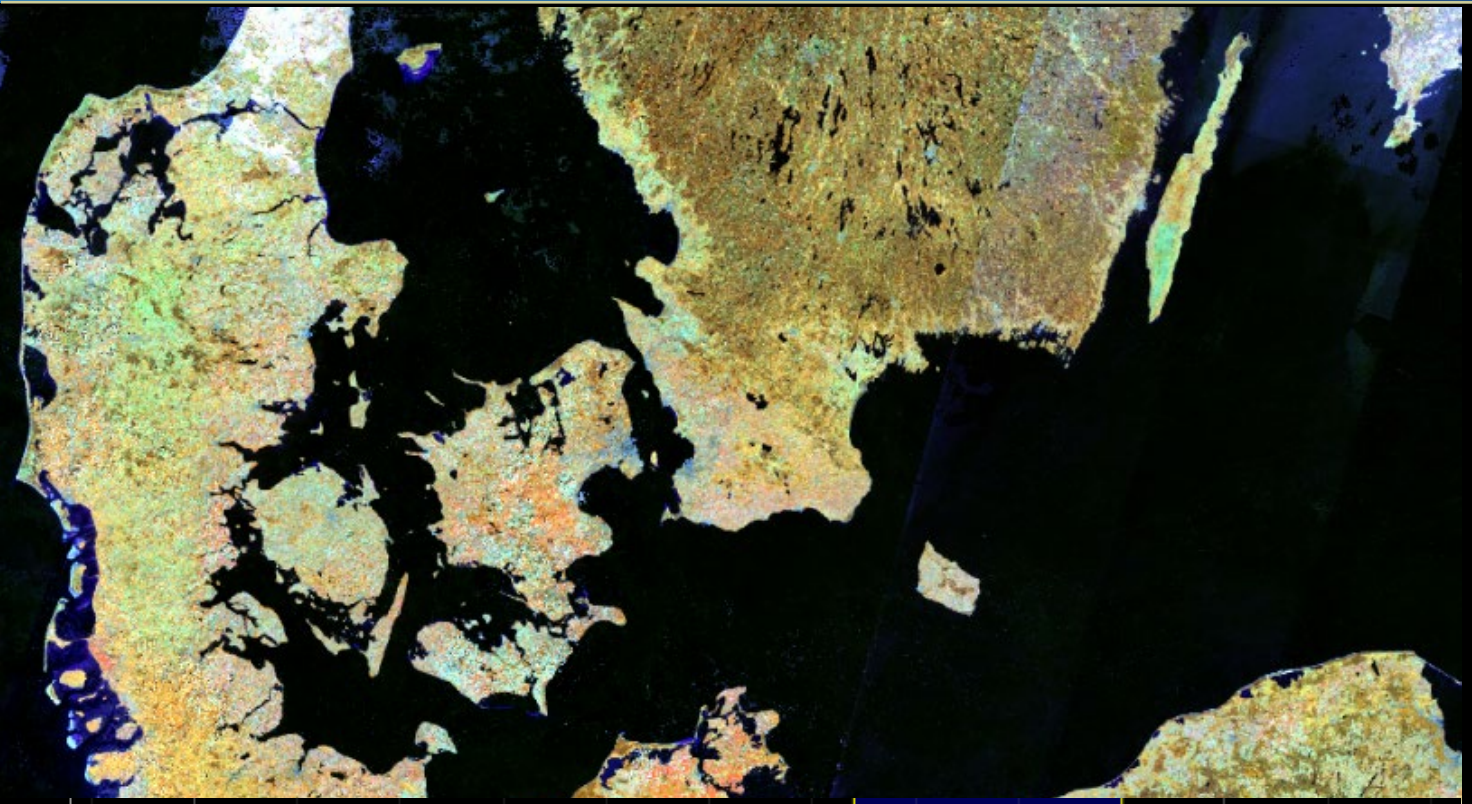


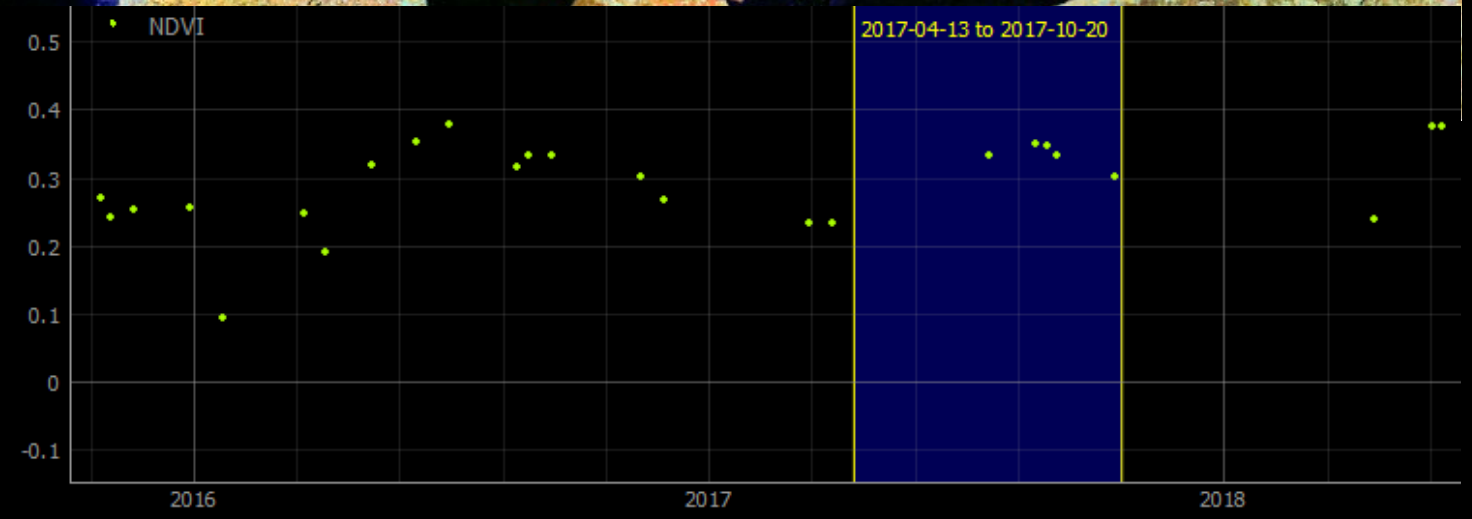
Installation



Installation







Thank you for listening!

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