SENTINEL Hub

Sentinel Hub
Cloud Driver for EO Data

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Sinergise/Sentinel Hub

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The Earth Monitoring Competition
Copernicus masters
OVERALL WINNER
AZO

The Earth Monitoring Competition
Copernicus masters
WINNER 2016
T-SYSTEMS OPEN TELEKOM CLOUD CHALLENGE
AZO

EUROPEAN EO COMPANY OF THE YEAR 2018

EARSC

Sentinel-2

earth observation | satellite imagery | gis | natural resource | sustainability | disaster response

Description

The Sentinel-2 mission is a land monitoring constellation of two satellites that provide high resolution optical imagery and provide continuity for the current SPOT and Landsat missions. The mission provides a global coverage of the Earth's land surface every 5 days, making the data of great use in on-going studies. L1C data are available from June 2015 globally. L2A data are available from April 2017 over wider Europe region, planned to be expanded globally in July 2018.

Update Frequency

New Sentinel data are added regularly, usually within few hours after they are available on Copernicus OpenHub.

License

Access to Sentinel data is free, full and open for the broad Regional, National, European and International user community. View Terms and Conditions.

Documentation

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

Managed By

Sinergise

Contact

https://forum.sentinel-hub.com/c/aws-sentinel

Usage Examples

- EO Browser by Sinergise

Resources on AWS

Description
Level 1C scenes and metadata, in Requester Pays S3 bucket

Resource type
S3 Bucket

Amazon Resource Name (ARN)
`arn:aws:s3:::sentinel-s2-l1c`

AWS Region
`eu-central-1`

Description
S3 Inventory files for L1C

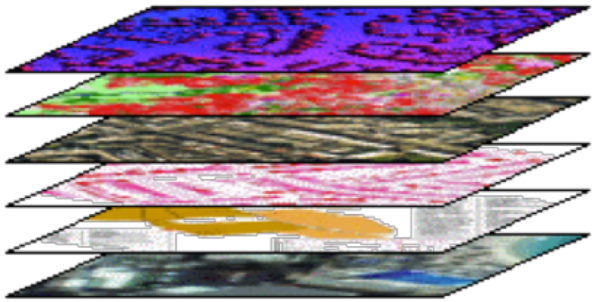
Resource type
S3 Bucket

Amazon Resource Name (ARN)
`arn:aws:s3:::sentinel-inventory/sentinel-s2-l1c`

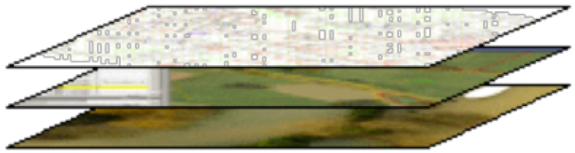
AWS Region
`eu-central-1`

Description
Level 2A scenes and metadata, in Requester Pays S3 bucket

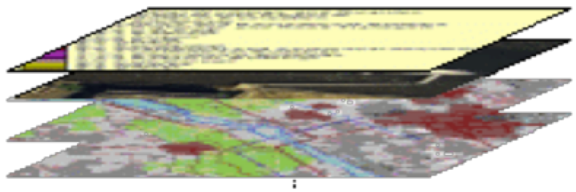
Copernicus - Sentinel-1, Sentinel-2



USGS – Landsat, MODIS



Digital elevation model



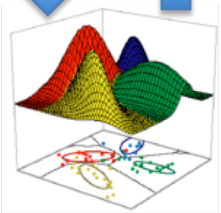
SENTINEL Hub

WMTS

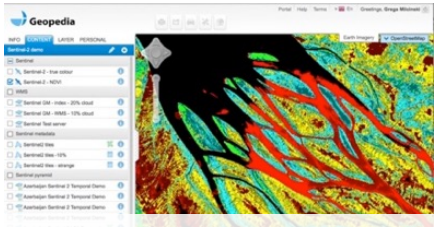
WMS

WCS

API

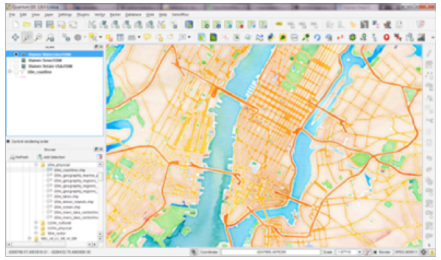


Machine learning



Cloud GIS

Web / Mobile apps



Desktop (QGIS, ArcGIS…)

Scripting (Python, R, ENVI…)

amazon web services

https://services.sentinel-hub.com/ogc/wcs/<INSTANCE>?SERVICE=WCS&REQUEST=GetCoverage
&COVERAGE=1_VV_ORTHORECTIFIED
&TIME=2018-07-17/2018-07-17
&BBOX=15.28815,107.07000,14.75496,106.09153
&RESX=20m&RESY=20m
&FORMAT=image/tiff&SRS=EPSG:4326

No worries about download, storage, decoding,
stitching scenes, reprojection, scaling, mosaicking,
meta-data parsing, backscatter calibration, orthorectification ...

SENTINEL Hub Playground 2018-05-28 20 %

Integrate Sentinel Hub in common web apps

Used parameters:

- one of the predefined visualizations - NDVI
- visualization using RGB bands
- with atmospheric correction
- without showing dates on tiles

Select the *maps* library and copy the code generated for the configured visualization.

- Leaflet v1.2.0
- Open Layers v3
- Google Maps API v3

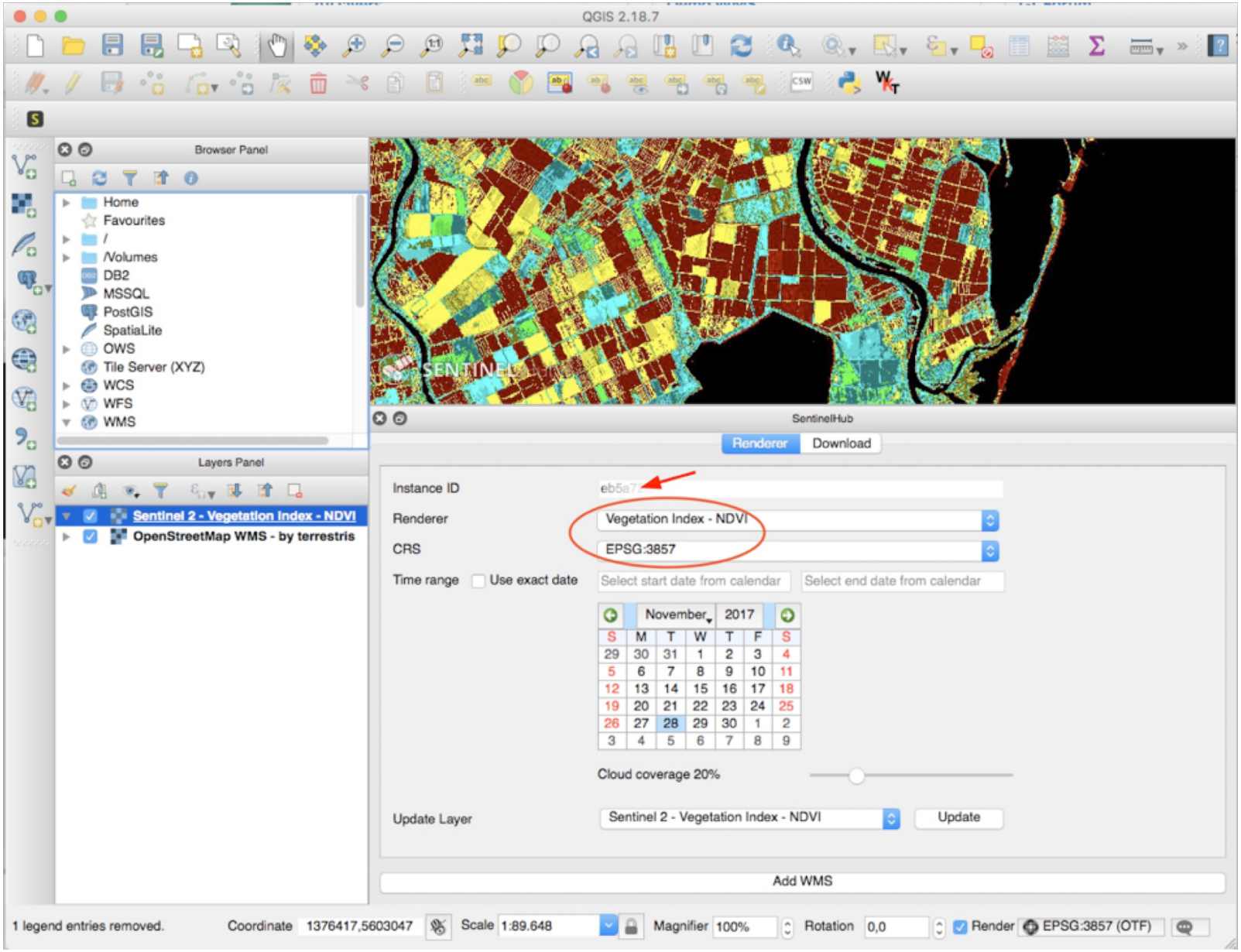
Your code using *Leaflet v1.2.0* library code preview download copy

```
<!DOCTYPE html>
<html lang="en">

<head>
    <meta charset="utf-8" />
    <meta http-equiv="x-ua-compatible" content="ie=edge, chrome=1" />
    <title>Sentinel Hub WMS services with Leaflet</title>
    <style>
        html,
        body {
            margin: 0;
            padding: 0;
            height: 100%;
            width: 100%;
        }

        #devTestingDemo {
            height: 100%;
            width: 100%;
        }
    </style>

<link rel="stylesheet" href="https://cdnjs.cloudflare.com/ajax/libs/leaflet/1.2.0/leaflet.css" />
<script src="https://cdnjs.cloudflare.com/ajax/libs/leaflet/1.2.0/leaflet.js"></script>

</head>

<body>
<div id="devTestingDemo"></div>
<script>

// OpenStreetMap
let osm = L.tileLayer('http://{s}.tile.osm.org/{z}/{x}/{y}.png', {
    attribution: '&copy; <a href="http://osm.org/copyright">OpenStreetMap</a> contributors'
});

// Sentinel Hub WMS service
// tiles generated using EPSG:3857 projection - Leaflet takes care of that
let baseUrl = "https://services.sentinel-hub.com/ogc/wms/bc56fb14-2c84-49fc-a826-6f4b5f7791c0";
let sentinelHub = L.tileLayer.wms(baseUrl, {
```

Get Sentinel and Landsat imagery in your GIS

2 km

OpenStreetMap © Sentinel Hub


QGIS 2.18.7
Browser Panel
Home
Favourites
/
/Volumes
DB2
MSSQL
PostGIS
SpatiaLite
OWS
Tile Server (XYZ)
WCS
WFS
WMS
Layers Panel
Sentinel 2 - Vegetation Index - NDVI
OpenStreetMap WMS - by terrestris
SentinelHub
Renderer
Download
Instance ID
eb5a7
Renderer
Vegetation Index - NDVI
CRS
EPSG:3857
Time range
Use exact date
Select start date from calendar
Select end date from calendar
November
2017
Cloud coverage 20%
Update Layer
Sentinel 2 - Vegetation Index - NDVI
Update
Add WMS
1 legend entries removed.
Coordinate
1376417,5603047
Scale
1:89.648
Magnifier
100%
Rotation
0,0
Render
EPSG:3857 (OTF)

Service: Process

SENTINEL Hub by SINERGISE

Search...

AUTHENTICATION

POST PROCESS

Process

HEADER PARAMETERS

Accept	string Enum: `"image/jpeg"` `"image/png"` `"image/tiff"` `"application/json"` `"application/tar"` `"multipart/mixed"`

REQUEST BODY SCHEMA: application/json

input required	object (Input)
bounds required	object (Bounds) Bounds object describing geometry of desired area.
bbox	Array of number <double> 4 items
geometry >	object (GeoJsonObject)
properties >	object
data > required	Array of object (BaseDataset) 1 items List of datasets.
evalscript required	string Block of JavaScript code.
output >	object (Output)

POST /api/v1/process

Request samples

Payload | Curl

application/json

Copy Expand all Collapse all

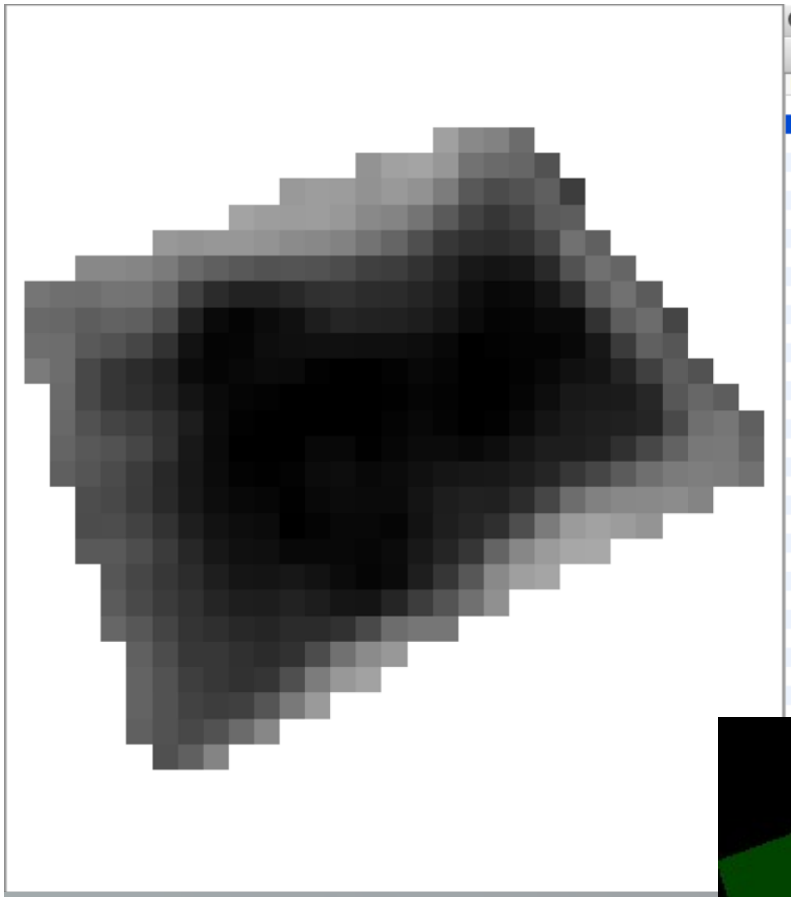
```
{
  - "input": {
      + "bounds": { … },
      + "data": [ … ]
    },
    "evalscript": "string",
  - "output": {
        "width": 1,
        "height": 1,
      + "responses": [ … ]
    }
}
```

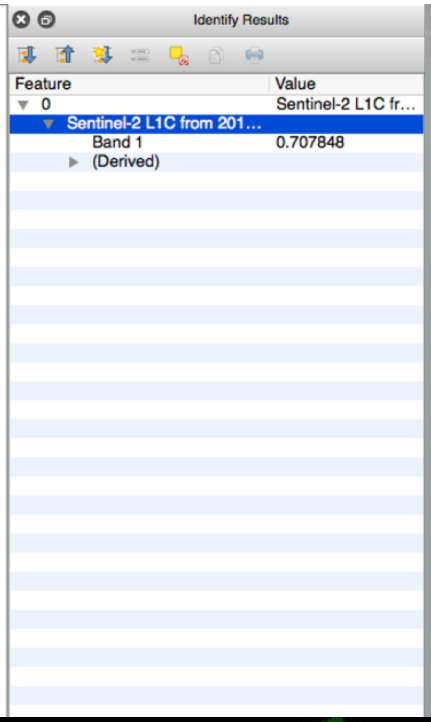
Response samples

200 | 400 | 500

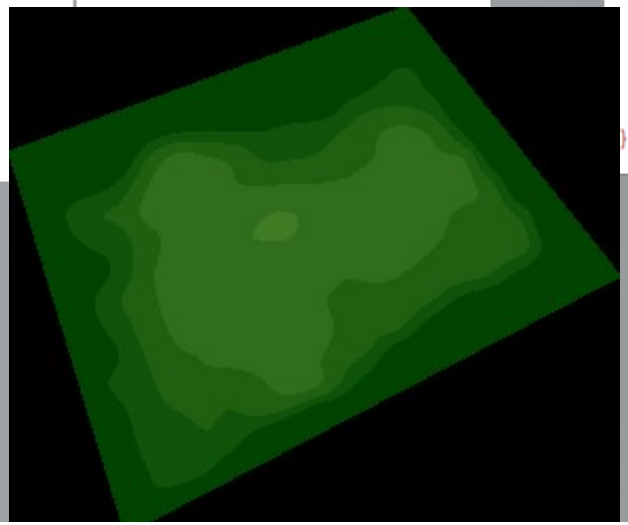
image/jpeg

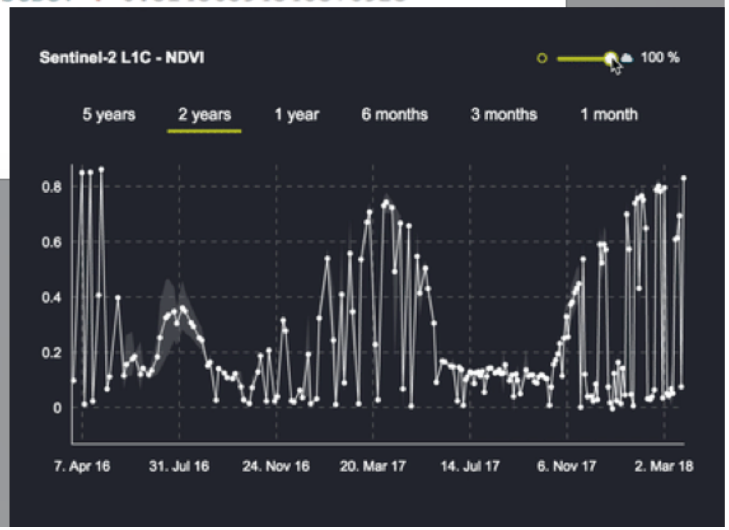
No sample






```
{
  "NDVI": [
    {
      "date": "2015-08-30",
      "basicStats": {
        "min": -0.5478424429893494,
        "max": 0.7815912365913391,
        "mean": 0.147320137875888,
        "stDev": 0.35443419609590726
      }
    },
    {
      "date": "2015-07-11",
      "basicStats": {
        "min": -0.5127978920936584,
        "max": 0.8115044236183167,
        "mean": 0.20168528533031557,
        "stDev": 0.31436594348376923
      }
    }
  ]
}
```



Custom processing script

- Pre-defined product (true color, false color, etc.)
- Custom band combination

```
return [B08, B04, B03];
```

- Various indices

```
var val = (B08-B04)/(B08+B04);
return [val];
```

- More complex algorithms
  - LAI, FAPAR – (basic) neural networks
  - https://github.com/sentinel-hub/custom-scripts/blob/master/sentinel-2/lai/script.js
- https://github.com/sentinel-hub/custom-scripts/

custom-scripts

A repository of custom scripts that can be used with Sentinel-Hub services.

View On GitHub

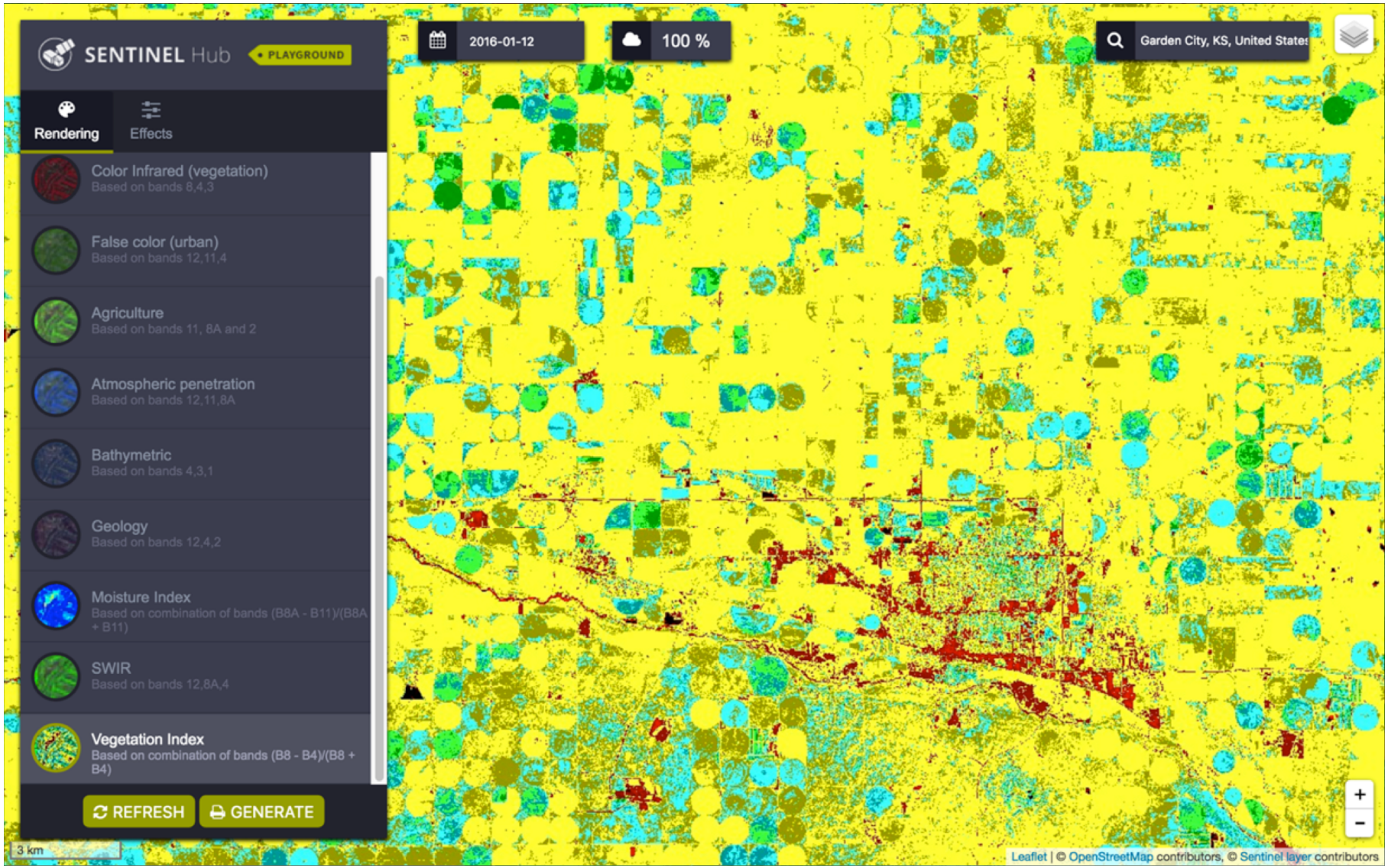
Wildfire visualization

Hide script or download it.

```
    // ***
// Visualizing (wild)fires in Sentinel-2 imagery
// For use in Sinergise EO Browser (http://apps.sentinel-hub.com/eo-browser)
// Pierre Markuse (@pierre_markuse)
// ***

// Functions
function A(a, b) {return a + b};
function stretch(val, min, max)  {
      return (val - min) / (max - min);
}

// Some basic colors
var BLACK = [0.0, 0.0, 0.0];
var WHITE = [1.0, 1.0, 1.0];
var RED = [0.9, 0.1, 0.1];
var YELLOW = [0.9, 0.9, 0.1];
var GREEN = [0.1, 0.9, 0.1];

// Band combinations
```

Sentinel-Hub by Sinergise

http://custom-scripts.sentinel-hub.com



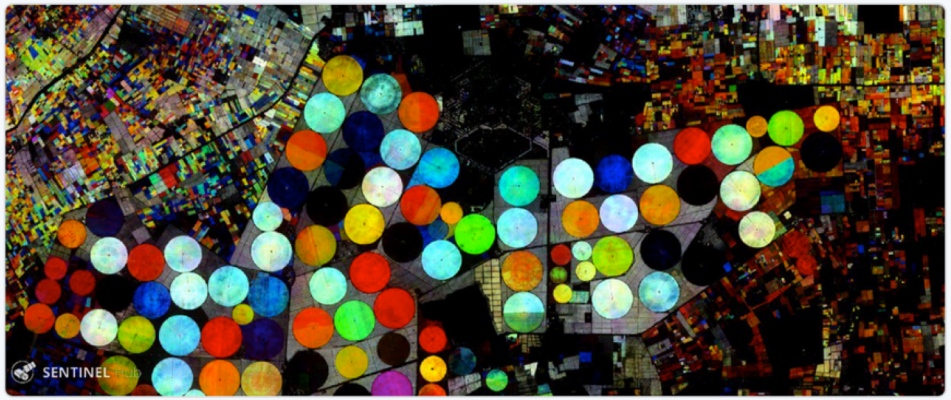
http://apps.sentinel-hub.com/sentinel-playground/


EO Browser
Search
Visualization
My pins
Satellite: SENTINEL-2 L1C
L2A
Date:
2018-03-26
Custom
Create custom rendering
True color
Based on bands 4,3,2
False color
Based on bands 8,4,3
False color (urban)
Based on bands 12,11,4
NDVI
Based on combination of bands (B8 - B4)/(B8 + B4)
Moisture index
Based on combination of bands (B8A - B11)/(B8A + B11)
SWIR
Based on bands 12,8A,4
NDWI
Based on combination of bands (B3 - B8)/(B3 + B8)
Analytical [?]
Powered by Sinergise with contributions from the European Space Agency
300 m
Sentinel-2 L1C - NDVI
100 %
5 years
2 years
1 year
6 months
3 months
1 month
0.8
0.6
0.4
0.2
0
7. Apr 16
31. Jul 16
24. Nov 16
20. Mar 17
14. Jul 17
6. Nov 17
2. Mar 18
Search places
0.26 km²
About EO Browser
Contact us
Get data
Lat: 42.06685, Lng: -5.53213
Carto © CC BY 3.0, OpenStreetMap © ODbL


2016-04-07
300 m
Copernicus
SENTINEL Hub

HD @HarelDan · 24 Oct 2017

Tip: Blue field growing, Green fields maturing, Yellow Fields ripe, Red fields reaped/drying. Same place, 3 days ago apps.sentinel-hub.com/sentinel-playg…



4 5 20

Stef Lhermitte
@StefLhermitte

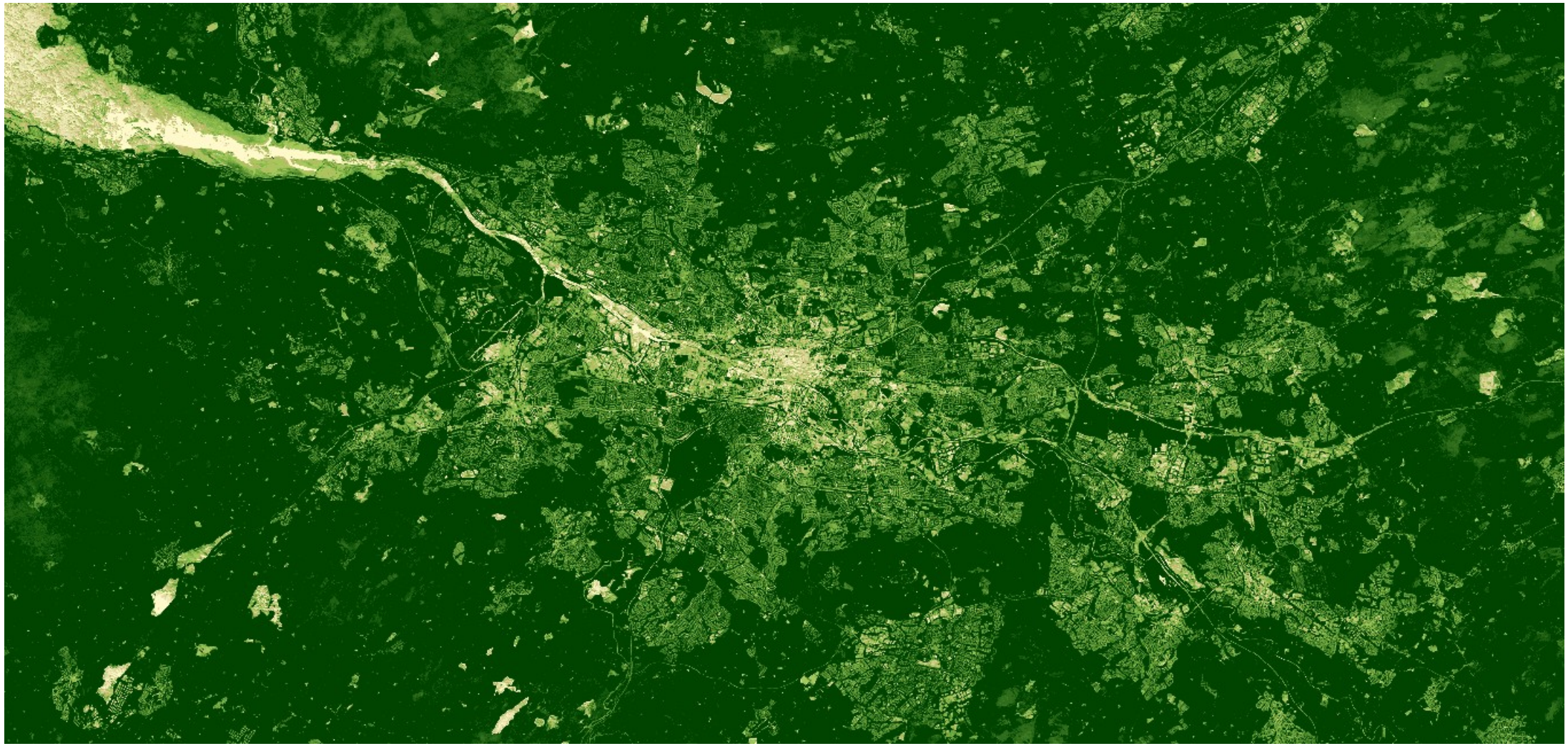
Following

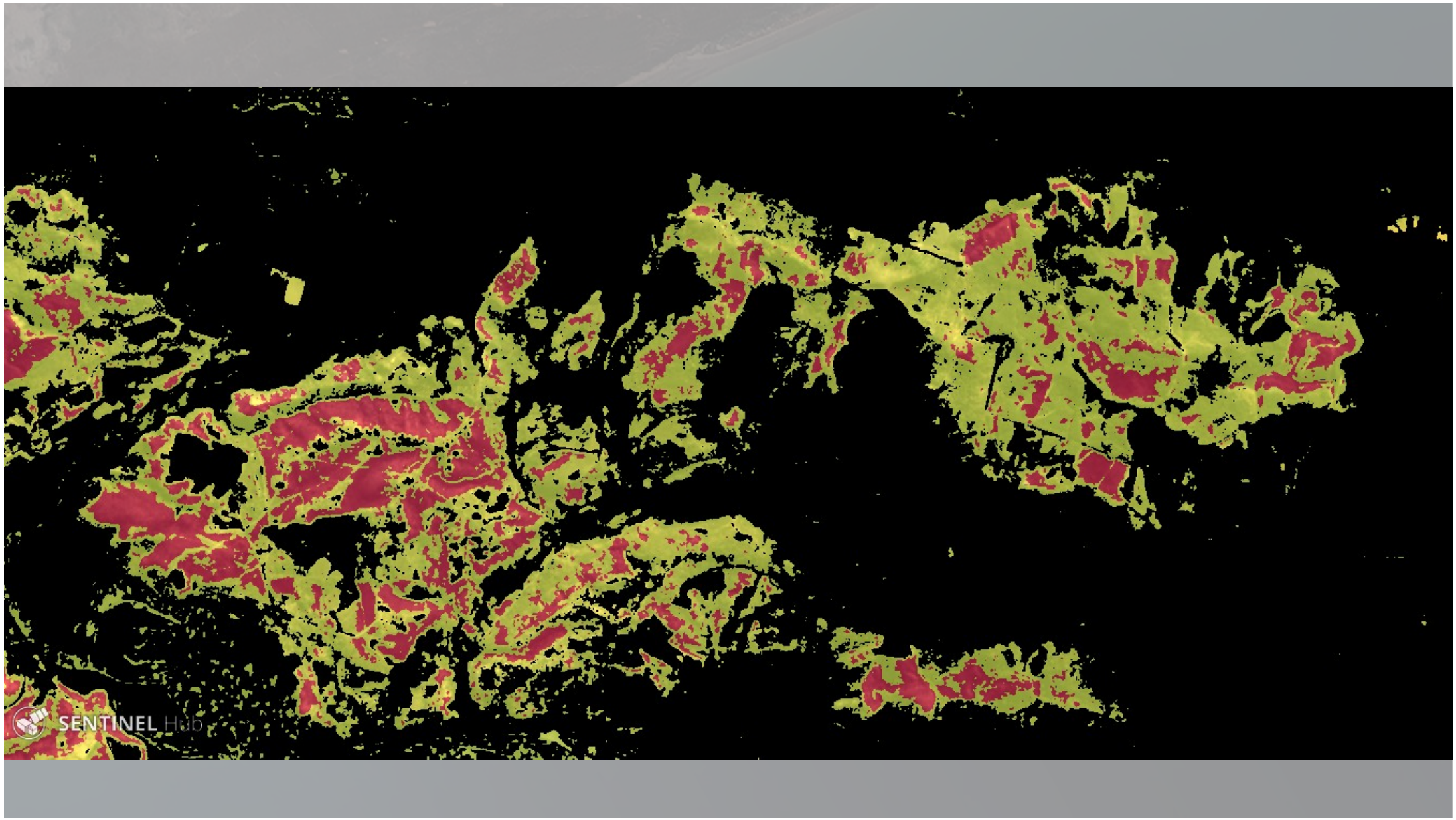
Replying to @HarelDan @sentinel_hub and 4 others

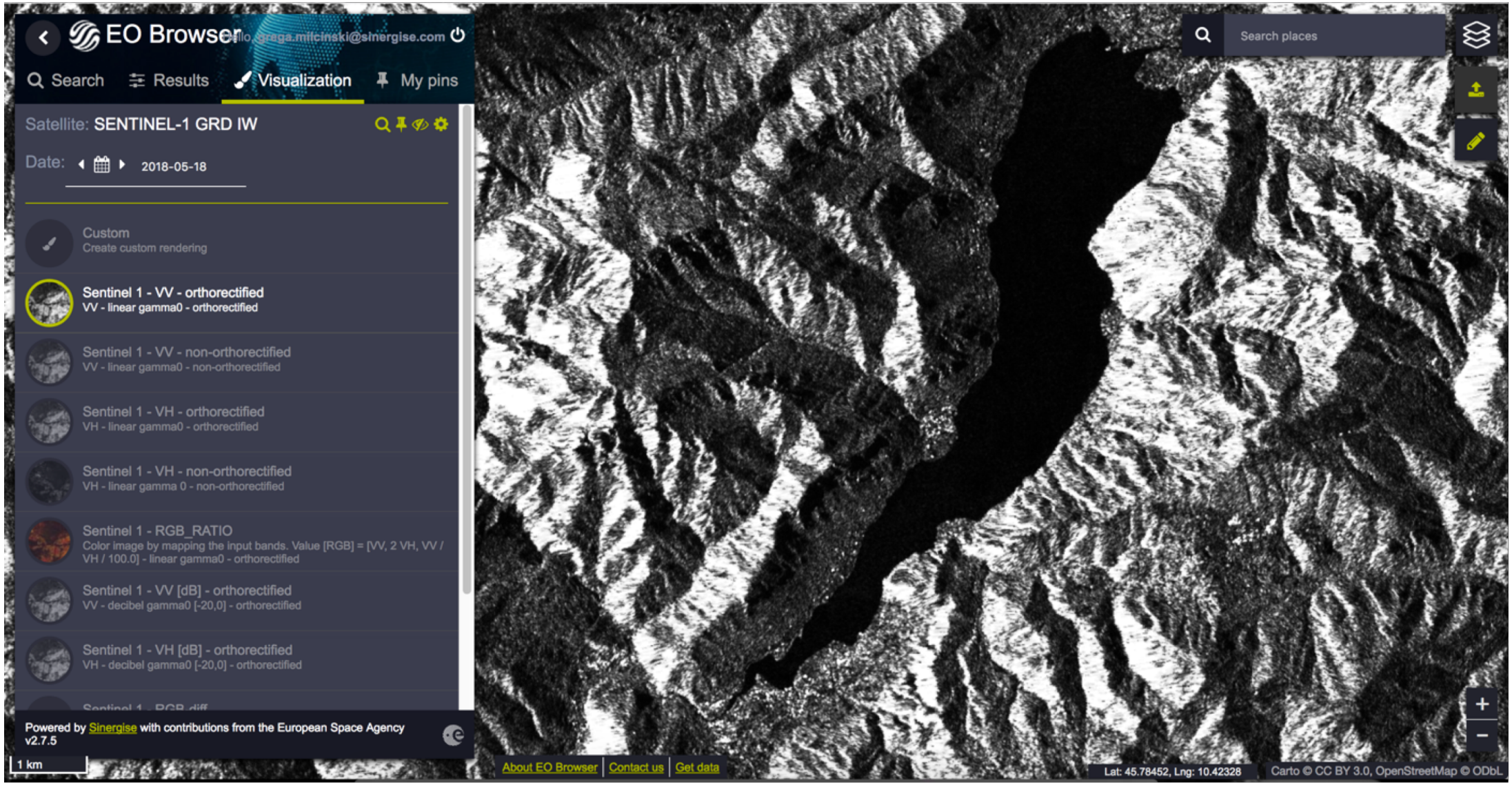
Wow! The moment even my mom can classify petabytes in seconds on her very old computer is getting closer. Just need to teach her Javascript

8:14 AM - 25 Oct 2017

1 Retweet **9** Likes




SENTINEL Hub


EO Browser
Search
Results
Visualization
My pins
Satellite: SENTINEL-1 GRD IW
Date: 2018-05-18
Custom
Create custom rendering
Sentinel 1 - VV - orthorectified
VV - linear gamma0 - orthorectified
Sentinel 1 - VV - non-orthorectified
VV - linear gamma0 - non-orthorectified
Sentinel 1 - VH - orthorectified
VH - linear gamma0 - orthorectified
Sentinel 1 - VH - non-orthorectified
VH - linear gamma 0 - non-orthorectified
Sentinel 1 - RGB_RATIO
Color image by mapping the input bands. Value [RGB] = [VV, 2 VH, VV / VH / 100.0] - linear gamma0 - orthorectified
Sentinel 1 - VV [dB] - orthorectified
VV - decibel gamma0 [-20,0] - orthorectified
Sentinel 1 - VH [dB] - orthorectified
VH - decibel gamma0 [-20,0] - orthorectified
Powered by Sinergise with contributions from the European Space Agency
v2.7.5
1 km
Search places
About EO Browser
Contact us
Get data
Lat: 45.78452, Lng: 10.42328
Carto © CC BY 3.0, OpenStreetMap © ODbL

Datasets

- Sentinel-1 GRD
- Sentinel-2 L1C and L2A
- Landsat-8
- MODIS
- DEM

- Adding more!

Statistics – January 2019

SENTINEL Hub by SINERGISE

esa

Sentinel Hub

28 k
registered users

68 M
processed requests

5 PB
of satellite imagery

300 TB
added every month

4 Sentinel missions

3 Landsat missions

MODIS

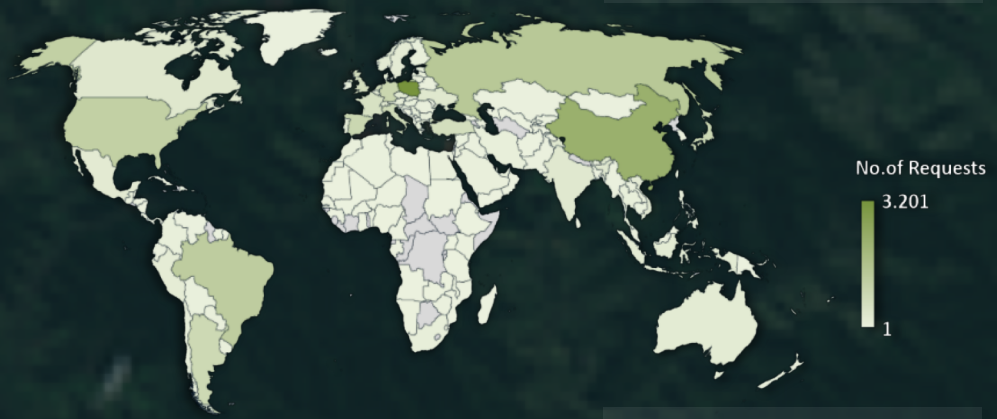
Envisat

EO Browser

24 k
monthly visitors

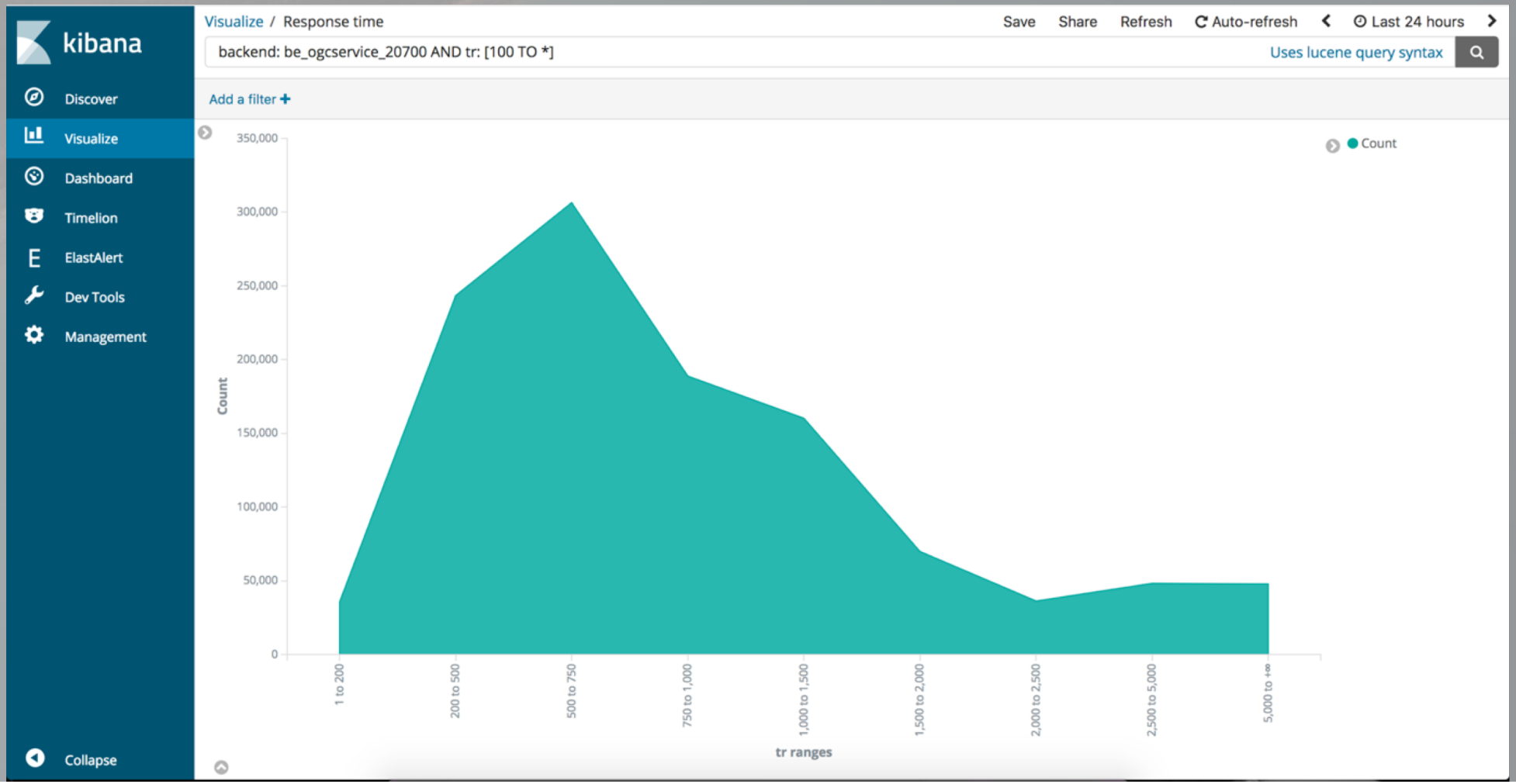
20 M
processed requests

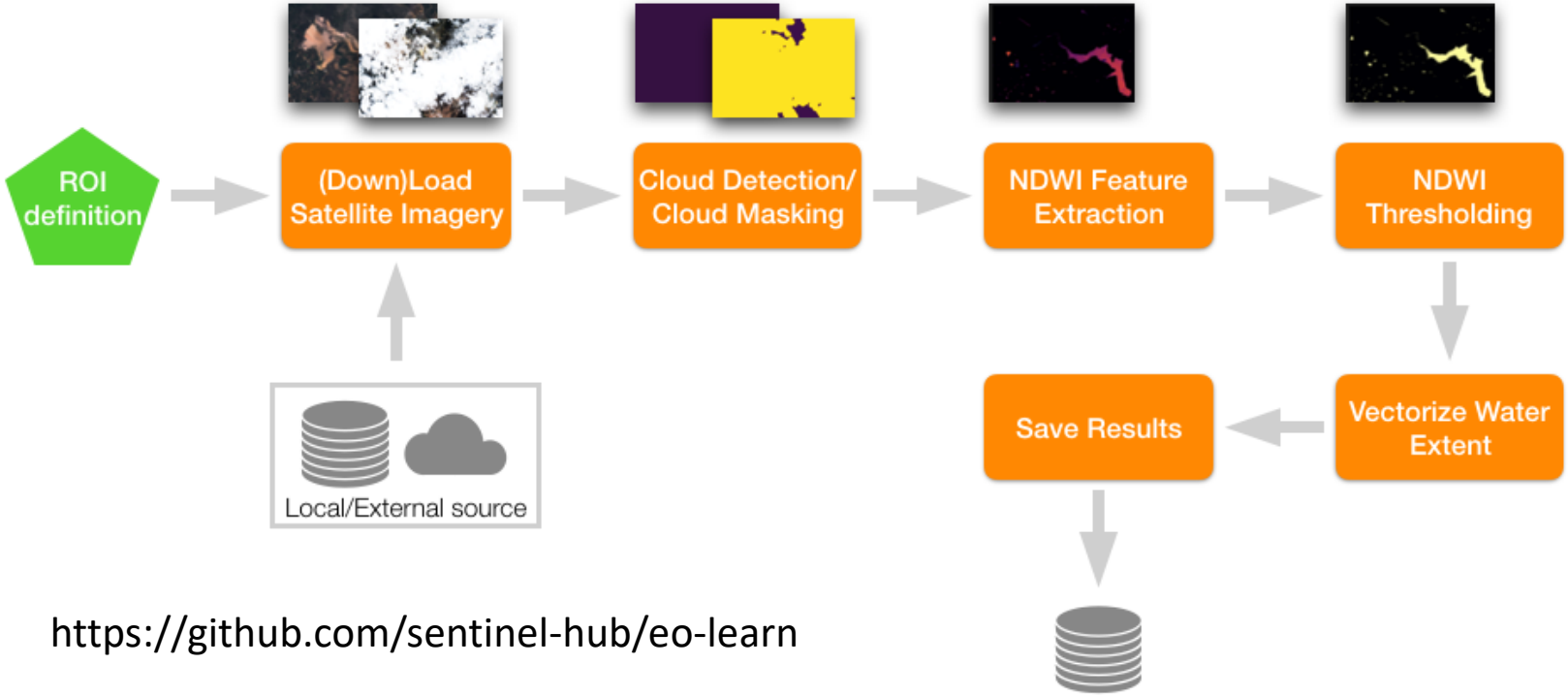
Open-source and free to use



Visitors from 159 countries

Performance



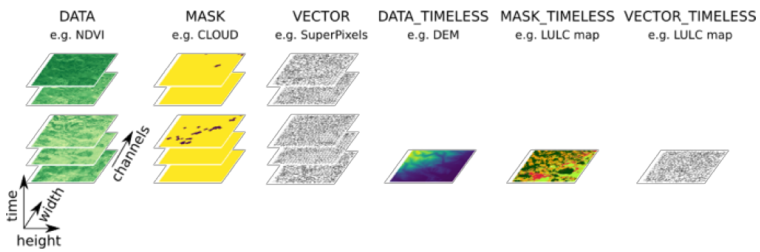


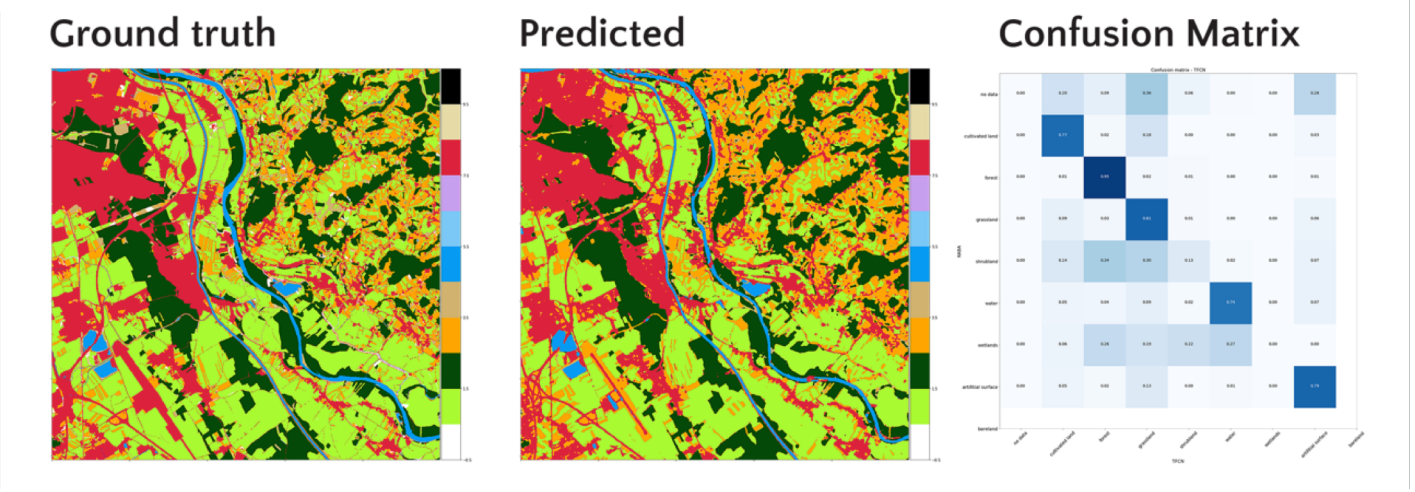
Φ-lab

eo-learn

Funded by the H2020 Framework Programme of the European Union

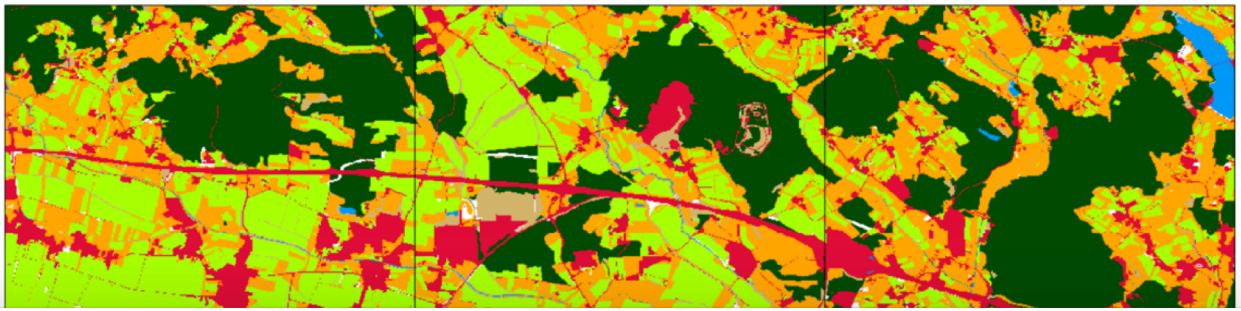
https://github.com/sentinel-hub/eo-learn

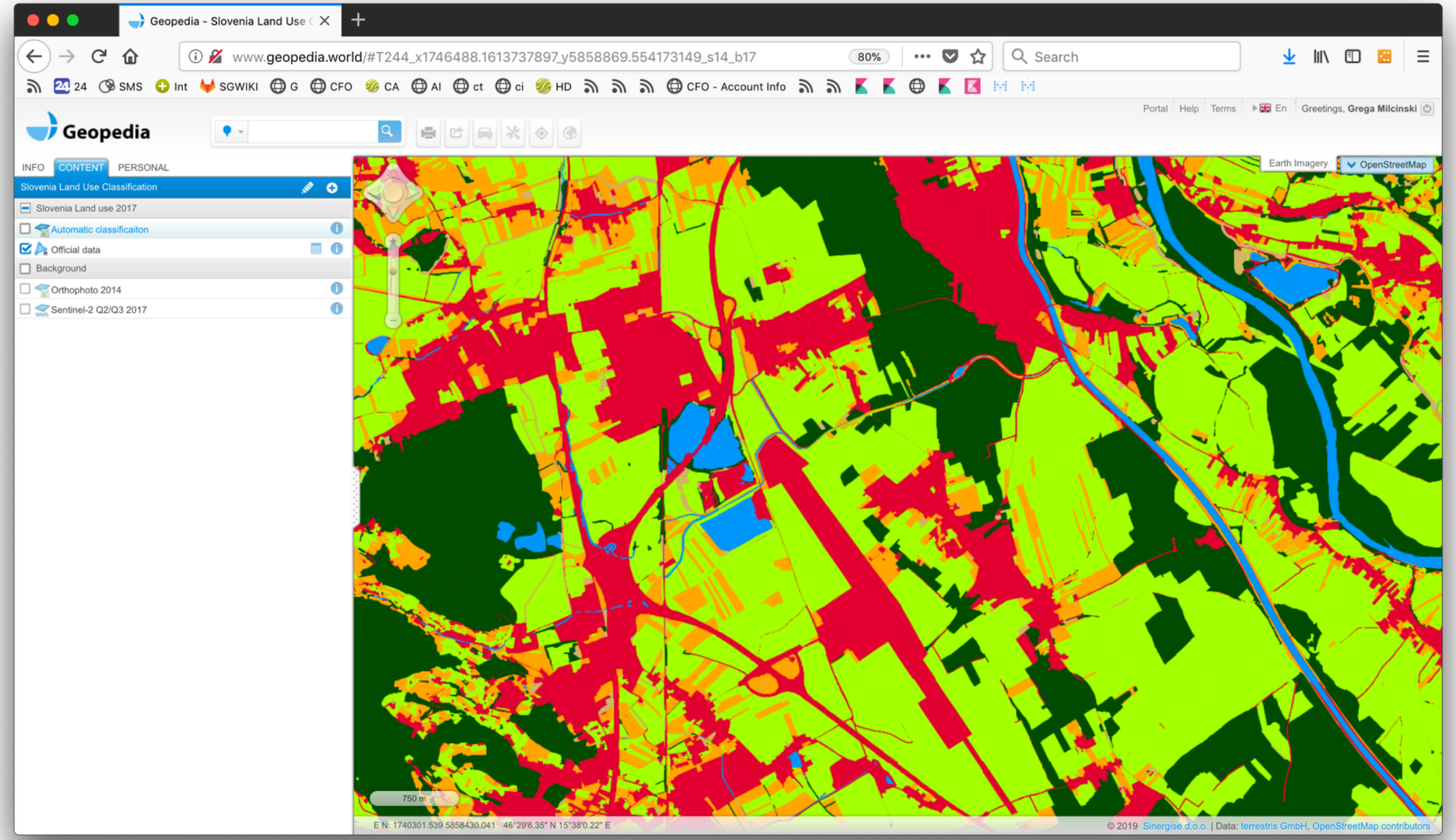


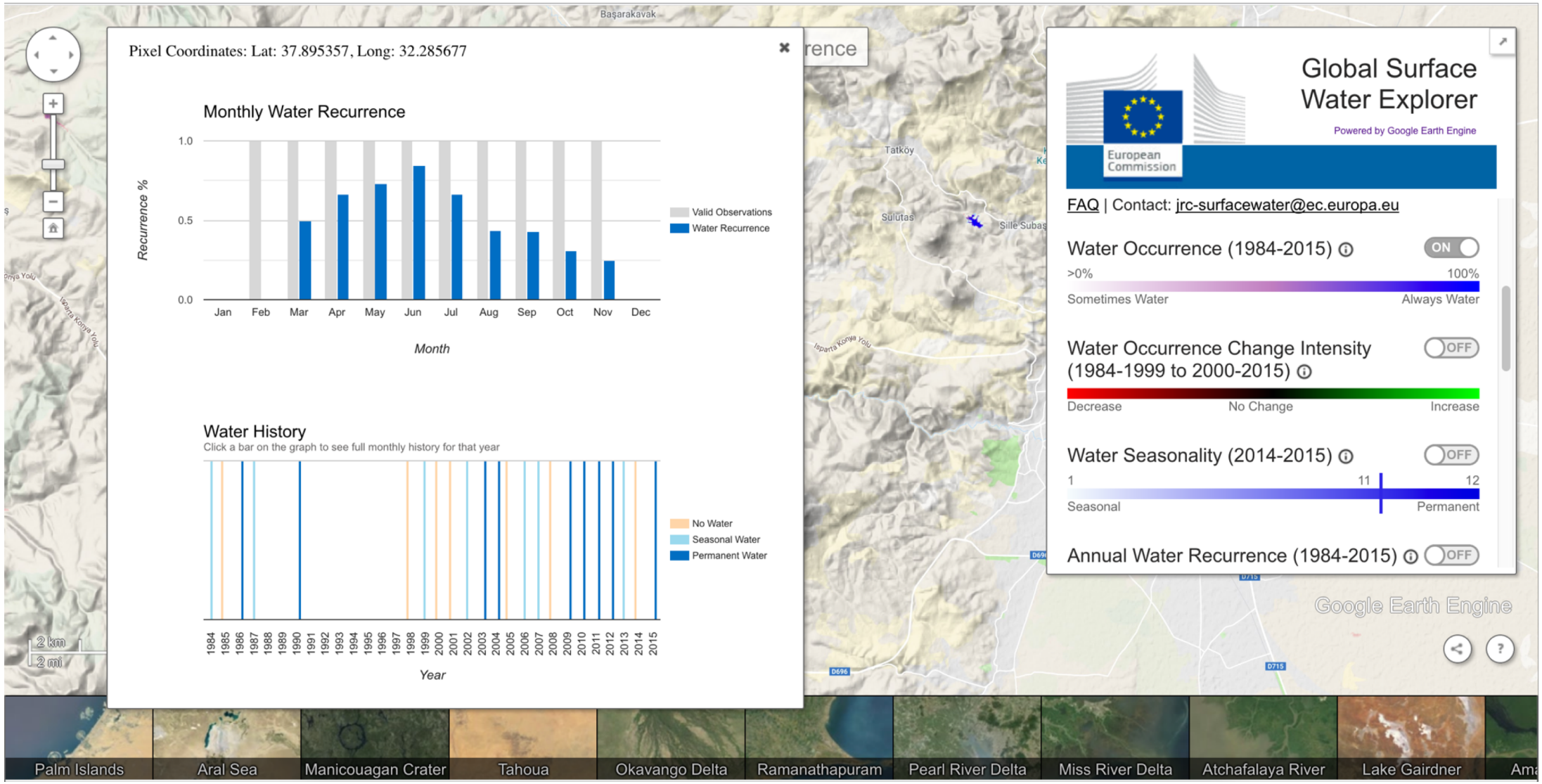


In [12]:
```
path_out = './eopatches_small/' if use_smaller_patches else './eopatches_large/'

# Reference colormap
sys.path.append('../../example_data/')
from lulc_cmap import lulc_cmap, lulc_norm
from lulc_classes import lulc_classes

fig, axes = plt.subplots(figsize=(20,20*aspect_ratio), nrows=3, ncols=3)

pbar = tqdm(total=9)
for i, ax in enumerate(axes.flat):
    eopatch = EOPatch.load('{}/eopatch_{}'.format(path_out, i)) if save_choice else eopatches[i]
    im = ax.imshow(eopatch.mask_timeless['LULC'].squeeze(), cmap=lulc_cmap, norm=lulc_norm)
    ax.set_xticks([])
    ax.set_yticks([])
    ax.set_aspect("auto")
    pbar.update(1)
    del eopatch

fig.subplots_adjust(wspace=0, hspace=0)

cb = fig.colorbar(im, ax=axes.ravel().tolist(), orientation='horizontal', pad = 0.01, aspect=100)
cb.ax.tick_params(labelsize=20)
cb.set_ticks(np.array(list(lulc_classes.values())))
cb.ax.set_xticklabels(list(lulc_classes.keys()),rotation=45,fontsize=15)
plt.show()
```

```
HBox(children=(IntProgress(value=0, max=9), HTML(value='')))
```




Geopedia - Slovenia Land Use
www.geopedia.world/#T244_x1746488.1613737897_y5858869.554173149_s14_b17
80%
Search
24
SMS
Int
SGWIKI
G
CFO
CA
AI
ct
ci
HD
CFO - Account Info
Portal
Help
Terms
En
Greetings, Grega Milcinski
Geopedia
INFO
CONTENT
PERSONAL
Slovenia Land Use Classification
Slovenia Land use 2017
Automatic classificaiton
Official data
Background
Orthophoto 2014
Sentinel-2 Q2/Q3 2017
Earth Imagery
OpenStreetMap
750 m
E N: 1740301.539 5858430.041 46°29'6.35" N 15°38'0.22" E
© 2019 Sinergise d.o.o. | Data: terrestris GmbH, OpenStreetMap contributors


Pixel Coordinates: Lat: 37.895357, Long: 32.285677
Monthly Water Recurrence
Recurrence %
1.0
0.5
0.0
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
Month
Valid Observations
Water Recurrence
Water History
Click a bar on the graph to see full monthly history for that year
1984 1985 1986 1987 1988 1989 1990 1991 1992 1993 1994 1995 1996 1997 1998 1999 2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014 2015
Year
No Water
Seasonal Water
Permanent Water
Global Surface Water Explorer
Powered by Google Earth Engine
European Commission
FAQ | Contact: jrc-surfacewater@ec.europa.eu
Water Occurrence (1984-2015)
ON
>0%
100%
Sometimes Water
Always Water
Water Occurrence Change Intensity (1984-1999 to 2000-2015)
OFF
Decrease
No Change
Increase
Water Seasonality (2014-2015)
OFF
1
11
12
Seasonal
Permanent
Annual Water Recurrence (1984-2015)
OFF
Google Earth Engine
Palm Islands
Aral Sea
Manicouagan Crater
Tahoua
Okavango Delta
Ramanathapuram
Pearl River Delta
Miss River Delta
Atchafalaya River
Lake Gairdner

BLUEDOT

WATER OBSERVATORY

Search water bodies

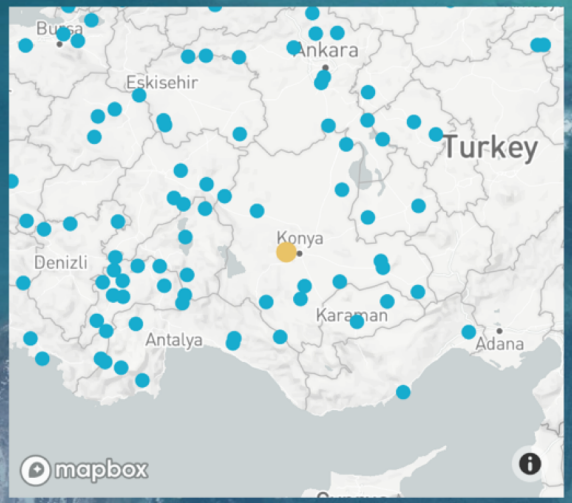
Type name or country

Altinapa (Turkey)
water body

2018-09-19
observation date

38%
surface area

82
total observations



Summary

It was never never easier to get and exploit mass amount of EO data.

Test it with a free trial account.

Mark your need for Sentinel Hub in the AWS-GEO application.

Make use of open-source tools.

More info

- http://sentinel-hub.com/
- http://apps.sentinel-hub.com/eo-browser/
- https://sentinel-hub.github.io/custom-scripts/
- https://github.com/sentinel-hub/eo-learn
- https://education.sentinel-hub.com

Thanks

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