



**SENTINEL** Hub

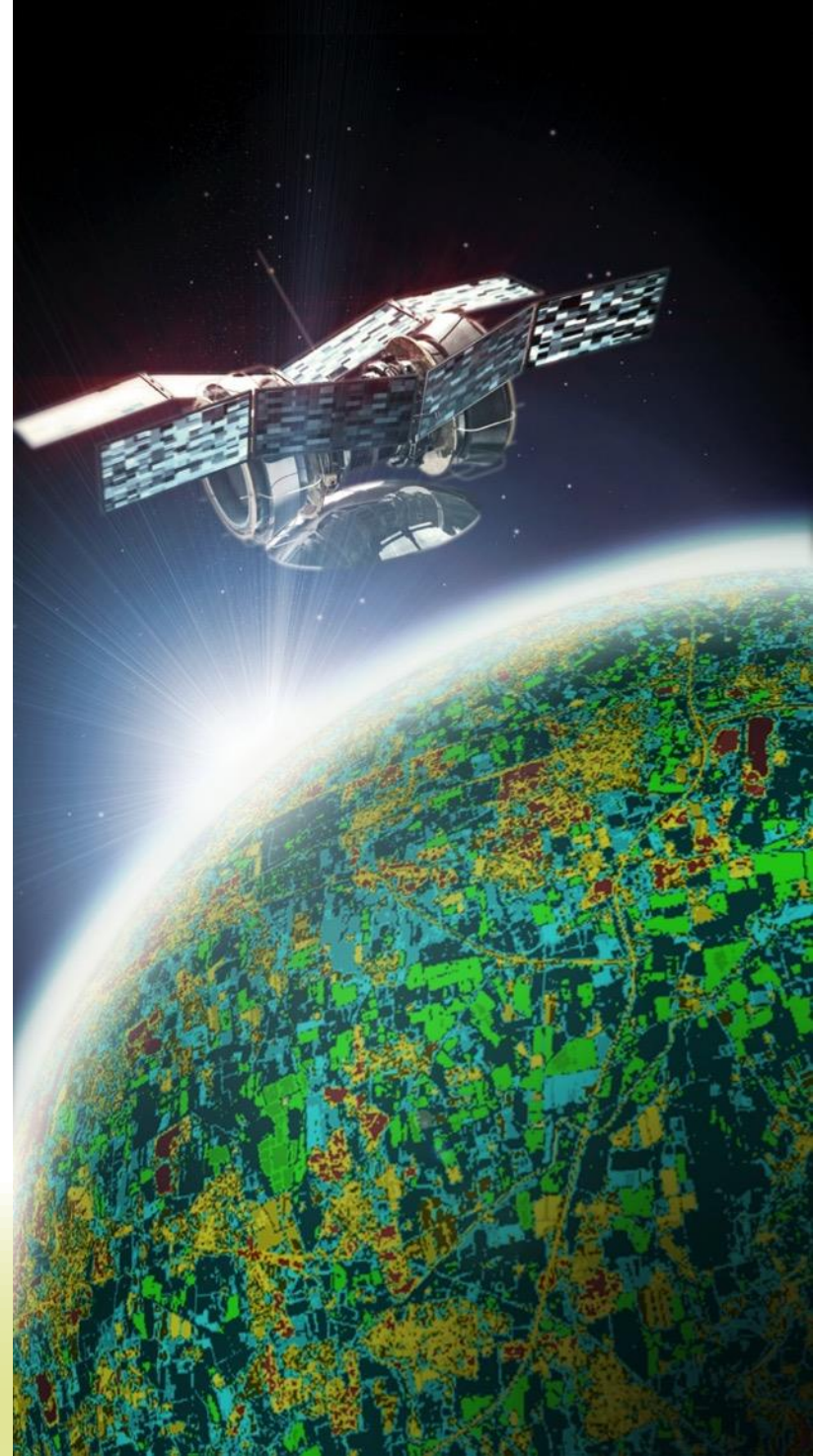


SINERGISE

# Sentinel Hub – cloud powered satellite imagery processing tools

**Grega Milcinski**

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# Plethora of EO data available – rapidly evolving

## COPERNICUS AND ITS SENTINELS

European Earth Observation Programme Capabilities: observing our planet for a safer world



proba-v

## NASA Earth Observatories



# Traditional ways of working with EO data

Kontrola 2.8.3 (izveštaj 1:7.5p (poslednja račica) - CwRS Skupina 20NES\_02\_FAZA1 Tip: FOTODIŠIFRIRANJA

Parčica koju ste izabrali uređite tako da kriterije Uprav. i površ. Kad završite s LPRS-om (u njegov status obično postavljen na 'Zaključen') Kad završite sve parčice, možete zaključiti kontrolu.

Izvor s SHP datoteke    Uvoz SHP datoteke

ID	Ime parčice	Uprav.	Površina	T	G	K	Z
070359	VRBAK	200	08 81 65	✓	✓	✓	✓
070365	OFUM	200	08 42 14	✓	✓	✓	✓
070374	KALJED	200	08 81 28	✓	✓	✓	✓
070417	SLATKAČA	422	08 19 86	✓	✓	✓	✓
070509	KOD GROBLJA	200	08 44 78	✓	✓	✓	✓
070581	KREKAJ	200	02 83 26	✓	✓	✓	✓
070602	REDAK	410	01 16 43	✓	✓	✓	✓
070652	VLAKA N.ŠVA	410	08 87 77	✓	✓	✓	✓
070070	VRBAK	200	08 42 06	✓	✓	✓	✓

ID	Uprava	Kultura	Površina
70000	200	04	0.92

Izveštaj o tolerancijama

ID	Uprav.	Kult.	Prijava	T	Uprav.	Uprav.	Toleran.
G	070374	200	0.82	✓	0.82	0.82	-0.11
F	070374	04	0.82	✓	0.82	0.82	-0.11

Pomoć    Zaključiti kontrolu

Rezultati pretraživanja za slij LPRS

Ime	Value
ID	12284
GRUP_ID	57852
TIP_ID	1
PARČA_ID	200
KRMOJ_SIFRA	
POVRŠINA_M2	9088
OPREMA	
NO_PRAVNA_NEBREDA	Nije osnovni status i DOP-a palyđen ARKOD.
GEOMETRIJA	izvode.sif STRUCT@5385de1T

U: nekodrup    500654.781, 5038446.845    0.0 in    1:2841    LPRS

# Volume of data going up

- Open-data - Sentinel, Landsat
- Several TB of data every day

The screenshot displays the Geopedia web application interface. The top navigation bar includes 'Portal', 'Help', 'Terms', a language selector set to 'En', and a user profile for 'Greetings, Grega Milcinski'. The main content area features a map of Europe with a dense green grid overlay, indicating satellite data coverage. The map includes labels for countries like Iceland, Sweden, and Russia, and a scale bar for 1000 km. The bottom of the map shows coordinates: E N: 4715858.897 2641663.698 23°4'47.03" N 42°21'47.81" E. The bottom right corner contains the copyright notice: © 2016 Sinergise d.o.o. | Data: terrestris GmbH.

**Geopedia**

Portal Help Terms En Greetings, Grega Milcinski

INFO **CONTENT** PERSONAL

Sentinel GM

- WMS
- Sentinel GM - index - 20% cloud
- Sentinel GM - WMS - 20% cloud
- Sentinel Test server
- Sentinel metadata
- Sentinel2 tiles
- Sentinel2 tiles - 10%
- Sentinel2 tiles - strange
- Support
- Google maps: roadmap
- Google maps: satellite

Earth Imagery OpenStreetMap

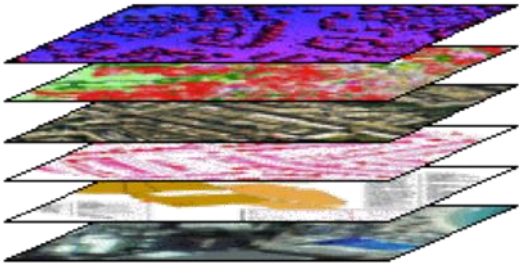
1000 km

E N: 4715858.897 2641663.698 23°4'47.03" N 42°21'47.81" E

© 2016 Sinergise d.o.o. | Data: terrestris GmbH

# Earth observation platform

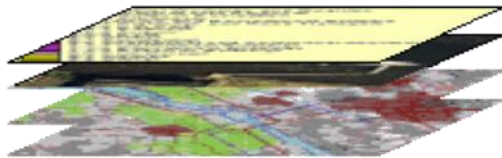
Open EO data - Sentinel-1, Sentinel-2, Landsat, etc.



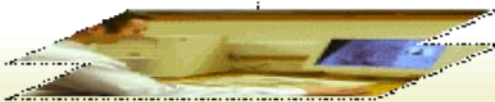
Commercial EO data – WorldWind, GeoEye,...



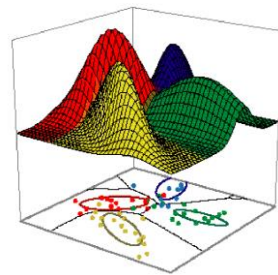
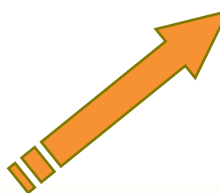
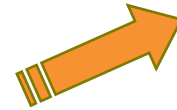
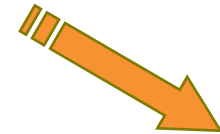
Aerial imagery (drone, plane)



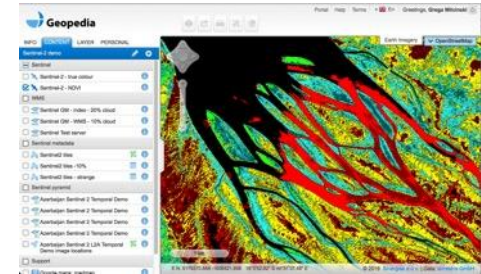
Other raster data



**SENTINEL** Hub



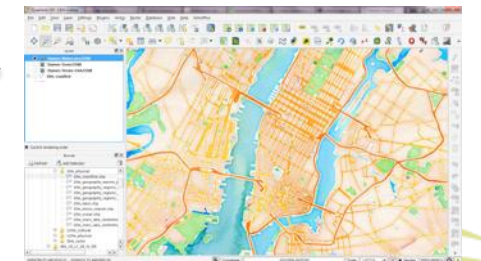
Machine learning



Cloud GIS



Web applications



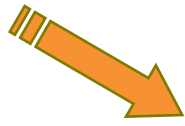
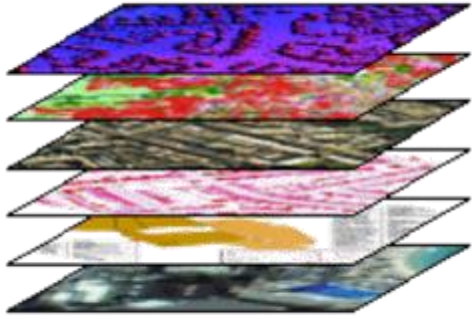
Open source GIS  
(QGIS, OpenJump,..)



Commercial GIS  
applications

# Earth observation platform

Open EO data - Sentinel-1, Sentinel-2, Landsat, etc.

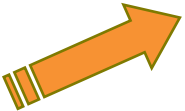


**SENTINEL** Hub

Commercial EO data – WorldWind, GeoEye,...



Aerial imagery (drone, plane)



Other raster data (DEM)



Cadastre

Disaster response

Agriculture

Defence

Insurance

Land Change

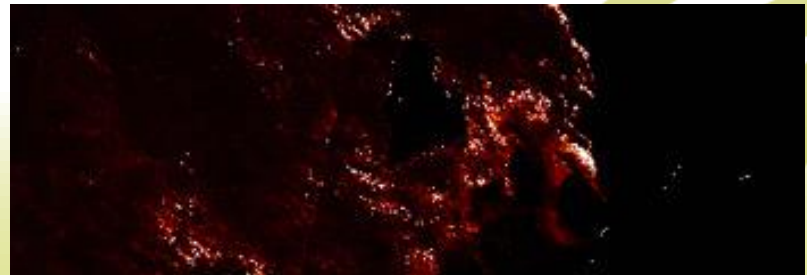
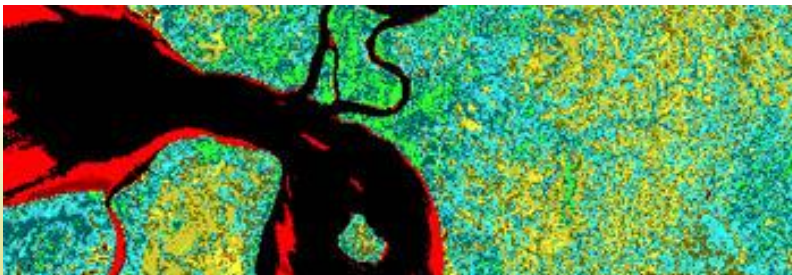
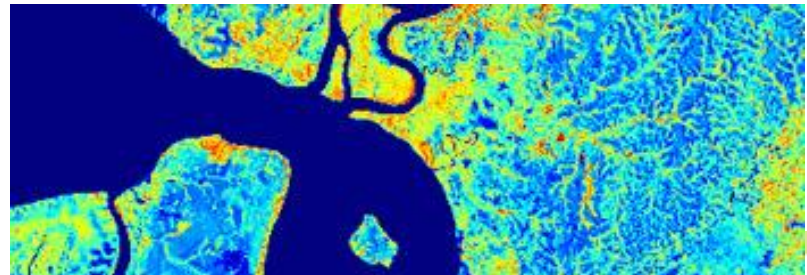
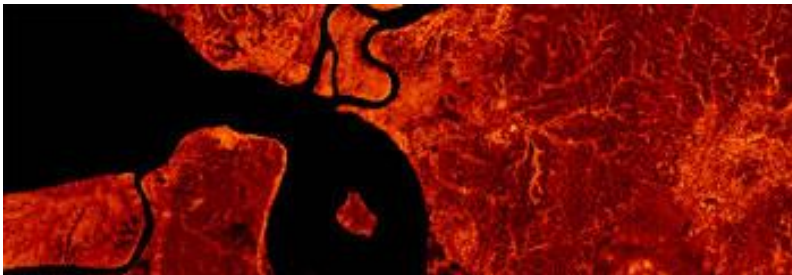
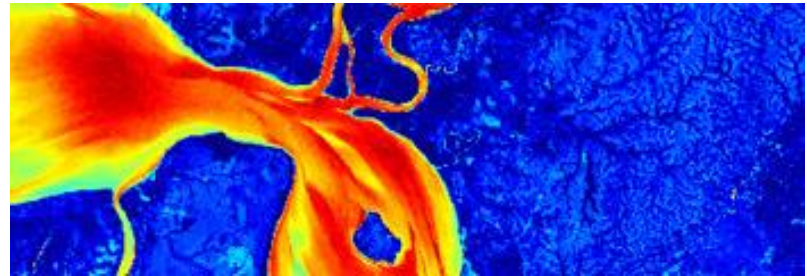
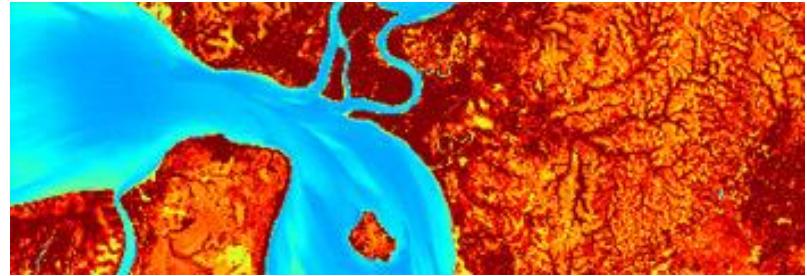
Drought monitoring

...

# With Sentinel Hub

The screenshot displays the ArcGIS web map viewer interface. The browser address bar shows the URL [www.arcgis.com/home/webmap/viewer.html](http://www.arcgis.com/home/webmap/viewer.html). The page title is "ArcGIS - My Map". The search bar contains the text "Istanbul, Istanbul, Turkey". The "Contents" panel on the left lists several layers, with "NDVI" selected and checked. The map itself shows a satellite-derived NDVI image of Istanbul, Turkey, with a color scale ranging from red (low vegetation) to blue (high vegetation). The interface includes various map controls such as zoom in (+), zoom out (-), home, and refresh buttons. The bottom of the map features logos for Geopedia, Terra Mapping the Globe Ltd, Esri, HERE, DeLorme, INCREMENT P, USGS, METI/NASA, and the Esri logo.

# Added value services – EO products





# Build your own EO product

The screenshot shows the Geopedia web interface. On the left, there is a sidebar with a list of layers including Sentinel-2 products (EVI2, CRI 1, CRI 2, PSRI, PSRI-NIR, ARI 1, ARI 2, SAVI, LAI\_SAVI, MSAVI2) and Slovenia maps (GURS orthophot, Topo 2014). The main area displays a map with a 'Set raster transform' dialog box open. The dialog box has a title bar with a close button and contains the following elements:

- Transform enabled
- Validate
- A code editor with the following text:

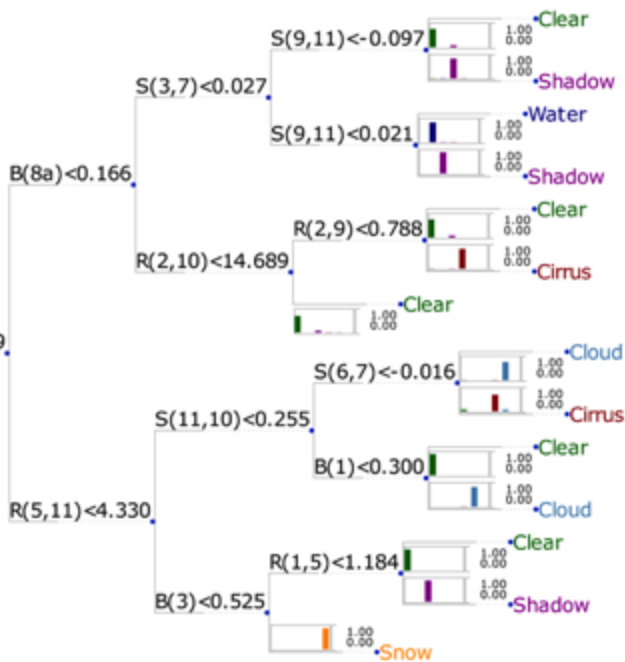
```
1 //MSAVI2 (Second Modified Soil Adjusted Vegetation Index) is
2 //self-adjusting and attempts to account for differences in soil
3 //background
4
5 var val = (2*(c4+1)-Math.sqrt(Math.pow(2*c4+1,2)-8*(c4-c2)))/2;
6
7
8 return [1,val,val,val];
9
```
- A button labeled 'Switch to simple editor' with a gear icon.
- Buttons for 'OK', 'Cancel', and 'Empty' at the bottom.

The background map shows a satellite view of a rural area with roads and fields. The top right corner of the interface includes 'Portal', 'Help', 'Terms', 'En', and 'Greetings, Grega Milcinski'. The bottom right corner shows the copyright '© 2015 Simgise d.o.o. | Data: terrestris GmbH'.

# EO classification example

Hollstein et al.: *Ready-to-Use Methods for the Detection of Clouds, Cirrus, Snow, Shadow, Water and Clear Sky Pixels in Sentinel-2 MSI Images*

<http://www.mdpi.com/2072-4292/8/8/666>



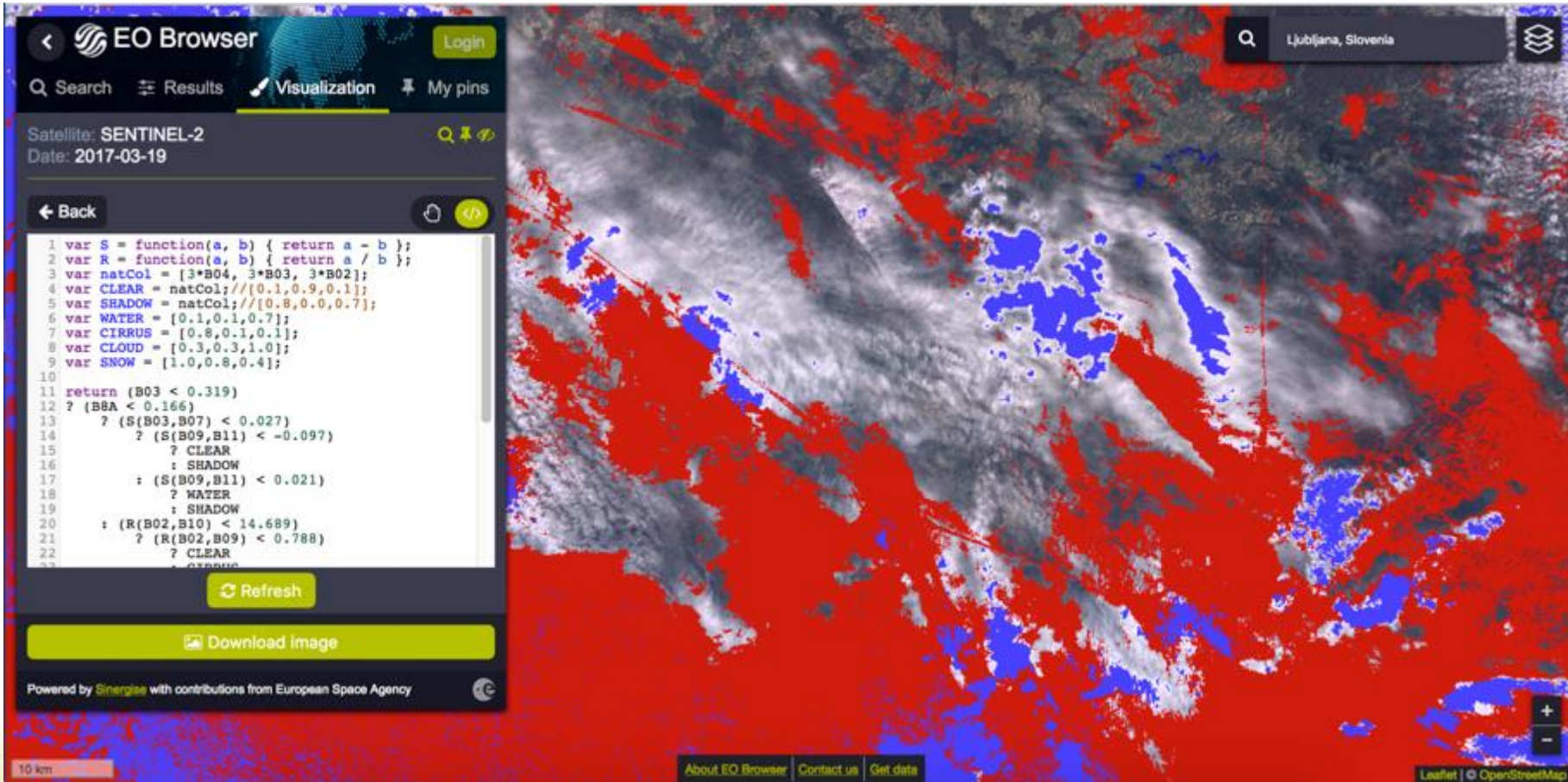
```
JavaScript
var S = function(a, b) { return a - b };
var R = function(a, b) { return a / b };
var natCol = [3*B04, 3*B03, 3*B02];
var CLEAR = natCol; //[0.1,0.9,0.1];
var SHADOW = natCol; //[0.8,0.0,0.7];
var WATER = [0.1,0.1,0.7];
var CIRRUS = [0.8,0.1,0.1];
var CLOUD = [0.3,0.3,1.0];
var SNOW = [1.0,0.8,0.4];

return (B03 < 0.319)
? (B8a < 0.166)
  ? (S(B03,B07) < 0.027)
    ? (S(B09,B11) < -0.097)
      ? CLEAR
      : SHADOW
    : (S(B09,B11) < 0.021)
      ? WATER
      : SHADOW
    : (R(B02,B10) < 14.689)
      ? (R(B02,B09) < 0.788)
        ? CLEAR
        : CIRRUS
      : CLEAR
  : (R(B05,B11) < 4.33)
    ? (S(B11, B10) < 0.255)
      ? (S(B06, B07) < -0.016)
        ? CLOUD
        : CIRRUS
      : (B01 < 0.3)
        ? CLEAR
        : CLOUD
    : (B03 < 0.525)
      ? (R(B01, B05) < 1.184)
        ? CLEAR
        : SHADOW
      : SNOW;
```

# EO classification example

The screenshot displays the EO Browser interface. The main view is a satellite image of a coastal area with a classification overlay in red and yellow. The interface includes a top navigation bar with a back arrow, the EO Browser logo, a 'Login' button, and a search bar labeled 'Search places'. Below the navigation bar are tabs for 'Search', 'Results', 'Visualization', and 'My pins'. A comparison panel on the left shows two layers: 'Sentinel-2: 4\_CLOUDS | 2017-03-14' and 'Sentinel-2: 1\_TRUE\_COLOR | 2017-03-14'. Each layer has a 'Split position' slider. The 'Split mode' is set to 'Split'. The bottom of the interface features a '10 km' scale bar, a 'Powered by Sinergise with contributions from European Space Agency' footer, and links for 'About EO Browser', 'Contact us', and 'Get data'. A zoom control is visible in the bottom right corner.

# EO classification example



The screenshot displays the EO Browser interface. The top navigation bar includes a search bar with the text "Ljubljana, Slovenia", a "Login" button, and menu options for "Search", "Results", "Visualization", and "My pins". The main content area shows a satellite image of Ljubljana, Slovenia, with a classification legend and a code editor. The legend is as follows:

- 1 var S = function(a, b) { return a - b };
- 2 var R = function(a, b) { return a / b };
- 3 var natCol = [3\*B04, 3\*B03, 3\*B02];
- 4 var CLEAR = natCol//[0.1,0.9,0.1];
- 5 var SHADOW = natCol//[0.8,0.0,0.7];
- 6 var WATER = [0.1,0.1,0.7];
- 7 var CIRRUS = [0.8,0.1,0.1];
- 8 var CLOUD = [0.3,0.3,1.0];
- 9 var SNOW = [1.0,0.8,0.4];

The code editor shows the following code:

```
10
11 return (B03 < 0.319)
12 ? (BBA < 0.166)
13   ? (S(B03,B07) < 0.027)
14     ? (S(B09,B11) < -0.097)
15       ? CLEAR
16         : SHADOW
17       : (S(B09,B11) < 0.021)
18         ? WATER
19         : SHADOW
20     : (R(B02,B10) < 14.689)
21       ? (R(B02,B09) < 0.788)
22         ? CLEAR
23         : CIRRUS
```

Below the code editor are buttons for "Refresh" and "Download image". The bottom of the interface includes a "10 km" scale bar, a "Powered by Sinergise with contributions from European Space Agency" notice, and a footer with "About EO Browser", "Contact us", "Get data", "Leaflet", and "OpenStreetMap" links.

<http://apps.sentinel-hub.com/eo-browser/>

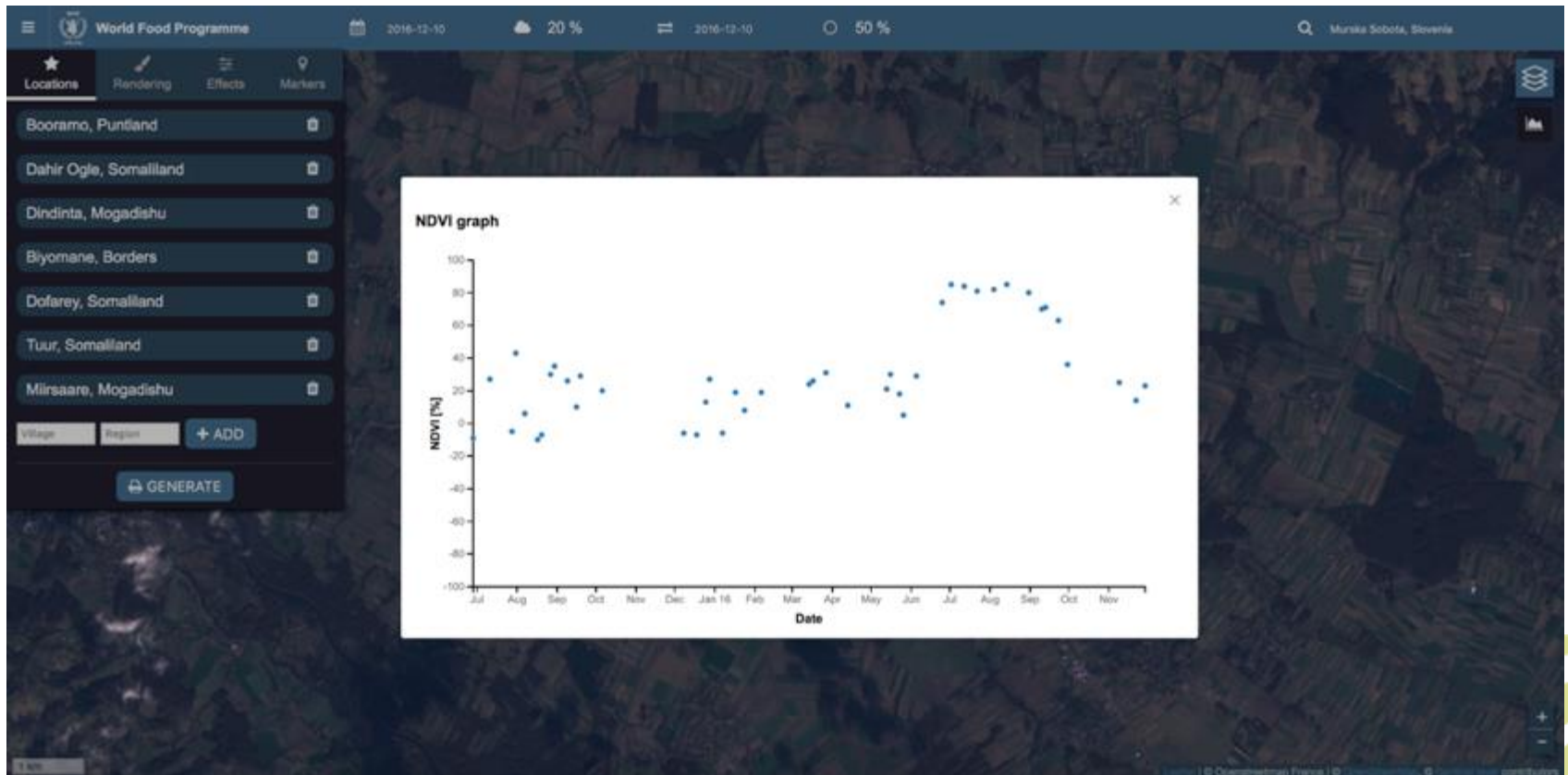
# Statistical API – time series

```
{
  "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
      }
    }
  ]
}
```

```
{
  "NDVI": [
    {
      "date": "2015-08-30",
      "basicStats": {
        "min": -0.5478424429893494,
        "max": 0.7815912365913391,
        "mean": 0.147320137875888,
        "stDev": 0.35443419609590726
      },
      "histogram": {
        "bins": [
          {
            "value": -0.23164855383139124,
            "count": 14377.0
          },
          {
            "value": 0.08134964140017291,
            "count": 1844.0
          },
          {
            "value": 0.23792375711536012,
            "count": 4692.0
          },
          {
            "value": 0.37365802377462387,
            "count": 4.0
          }
        ]
      }
    }
  ]
}
```

# Advanced functions

- Indices time series



# Data Sources

- Currently available

  - Sentinel-2 (full global archive)

  - Landsat-5, 7, 8 (ESA Archive)

  - Landsat-8 USGS (almost full global archive)

  - Sentinel-3 (full global archive)

  - Envisat MERIS (full global archive)

  - Sentinel-1 GRD

  - MODIS Terra and Aqua

  - SRTM

  - Planet and RapidEye

- Synced with SciHub and USGS

# Sentinel Playground

The image shows the Sentinel Playground web application interface. The main display is a satellite image of a river delta, likely the Shatt Al-Arab in Basrah, Iraq, with a color overlay. The interface includes a top navigation bar with the Sentinel Hub logo and a 'PLAYGROUND' tab. A date selector shows '2016-05-27' and a cloud cover indicator shows '30%'. A search bar contains the text 'Shatt Al-Arab, Basrah, Iraq'. On the left, there is a 'Rendering' panel with 'Effects' and 'Rendering' tabs. Below these, there is a section for picking different bands and dragging them into RGB fields. A grid of colored circles represents different bands: B01 (blue), B02 (light blue), B03 (green), B04 (orange), B05 (red), B06 (dark red), B07 (red), B08 (red), B09 (red), B10 (red), B11 (red), B12 (red), and B8A (red). Below this grid, the current RGB configuration is shown: R: B12, G: B11, B: B04. There are 'BACK', 'REFRESH', and 'GENERATE' buttons. A scale bar at the bottom left indicates '5 km'. At the bottom right, there are zoom in (+) and zoom out (-) buttons. The footer contains the text 'About Sentinel Hub', 'Leaflet | © OpenStreetMap, © Copernicus, Sinergise'.

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



# Sentinel Playground on GitHub

This screenshot shows the GitHub repository page for 'sinergise / SentinelPlayground'. The repository is described as a 'Simple application for using Sentinel-2 WMS service' with a link to <http://apps.sentinel-hub.com/sentinel...>. The repository statistics include 14 commits, 1 branch, 0 releases, and 6 contributors. The file list shows a directory structure with folders 'public' and 'src', and files '.gitignore', 'README.md', and 'package.json'. The 'README.md' file is currently selected and its content is partially visible at the bottom of the page.

This repository Search

Pull requests Issues Gist

sinergise / SentinelPlayground

Unwatch 11 Star 10 Fork 6

Code Issues 0 Pull requests 0 Projects 0 Wiki Pulse Graphs Settings

Simple application for using Sentinel-2 WMS service <http://apps.sentinel-hub.com/sentinel...> — Edit

14 commits 1 branch 0 releases 6 contributors

Branch: master New pull request Create new file Upload files Find file Clone or download

themre committed on GitHub Geocoding API explanation ... Latest commit caa298c 4 days ago

public	Geocoding API explanation	4 days ago
src	Fix WMS version	6 days ago
.gitignore	initial commit	2 months ago
README.md	Gitter badge	19 days ago
package.json	fix react version	7 days ago

README.md

# How do people use the data?



GIS and Beers

@GIS\_and\_Beers

Following



Ataque al corazón!! Heart attack in #Tokio using @sentinel\_hub #infrared #copernicus #sentinel

Translate from Spanish



3:25 PM - 4 Sep 2017

7 Retweets 15 Likes



# Agriculture applications

Copenhagen, Denmark

## Angiv filnavn

Nu kan du downloade et behovskort og en tildelingsfil. Har du GPS teknik på din traktor og en sprøjte, der kan håndtere positionsbestemt tildeling, kan du indlæse filen og graderet tildelingen henover marken. Har du ikke GPS i din traktor, kan du stadig se behovene på kortet forskellige steder i marken og bruge kortet manuelt.

Bemærk: Hvis "Gns. liter pr. ha" vurderes at være for høj eller lav, indtast da den rette mængde her. Niveauerne parallelforskydes op eller ned. Kontroller totalmængden.

Filnavn	Mark nr. (uden æv
Gennemsnit (kg N/ha)	39.68
% N i gødningen	100
Totale mængde	255

kg/ha

59.79  
40.14  
20.28  
0.21

Vælg det ønskede filformat

- Trimble Trimble-display
- JOHN DEERE JD-display
- Shape-fil
- JPG-billede
- Tekstfil

# Wildfire monitoring

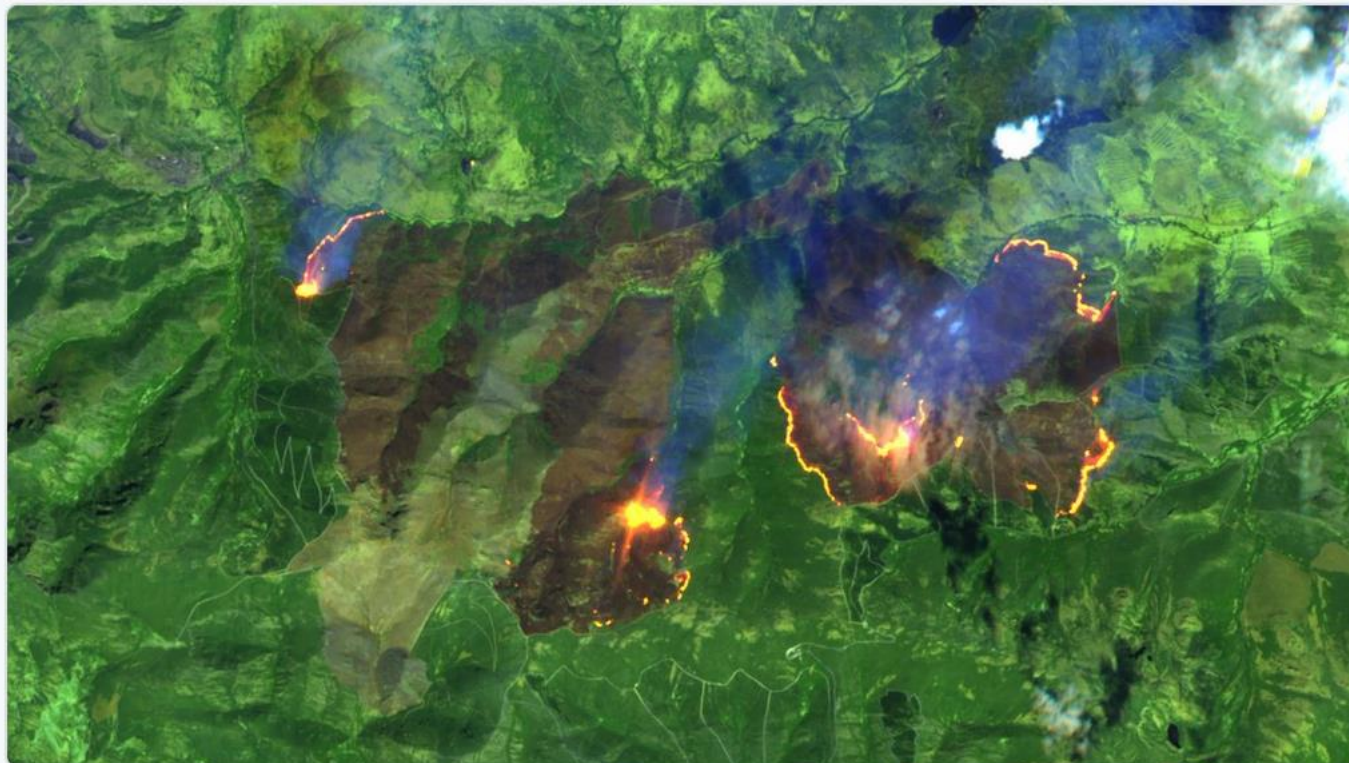


**GIS and Beers** @GIS\_and\_Beers · Aug 25

Sigue el 🔥 incendio de #Cabrera 😞😞😞

Seguimos esperando las últimas imágenes de #sentinel 🕶️

🌐 Translate from Spanish



You and Copernicus Land

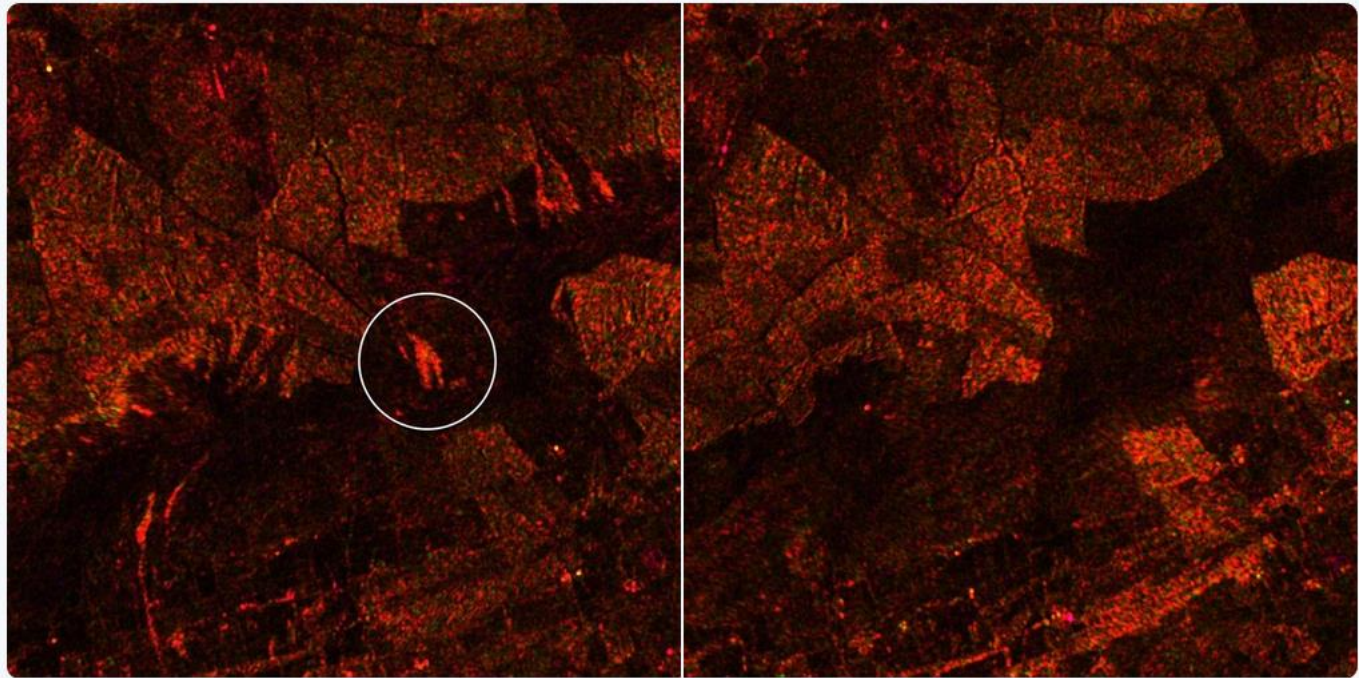


# Landslides



**DonegalMaps** @DonegalMaps · Aug 29

Landslide at Grainne's Gap [#Donegal](#) [#Inishowen](#) captured from Space [#Sentinel1](#) 22nd & 26th August 2017 SAR RGB Image



You, DonegalCountyCouncil, OEP and 4 others



1



12



22



# Floods

↻ You Retweeted



**Simon Gascoin** @sgascoin · Aug 30

Flooded areas near Highway 90 and Dayton TX (July 24 vs. Aug 29)

[#Sentinel1](#) [#HarveyFlood](#)



💬 2

↻ 44

❤️ 41



# Drought

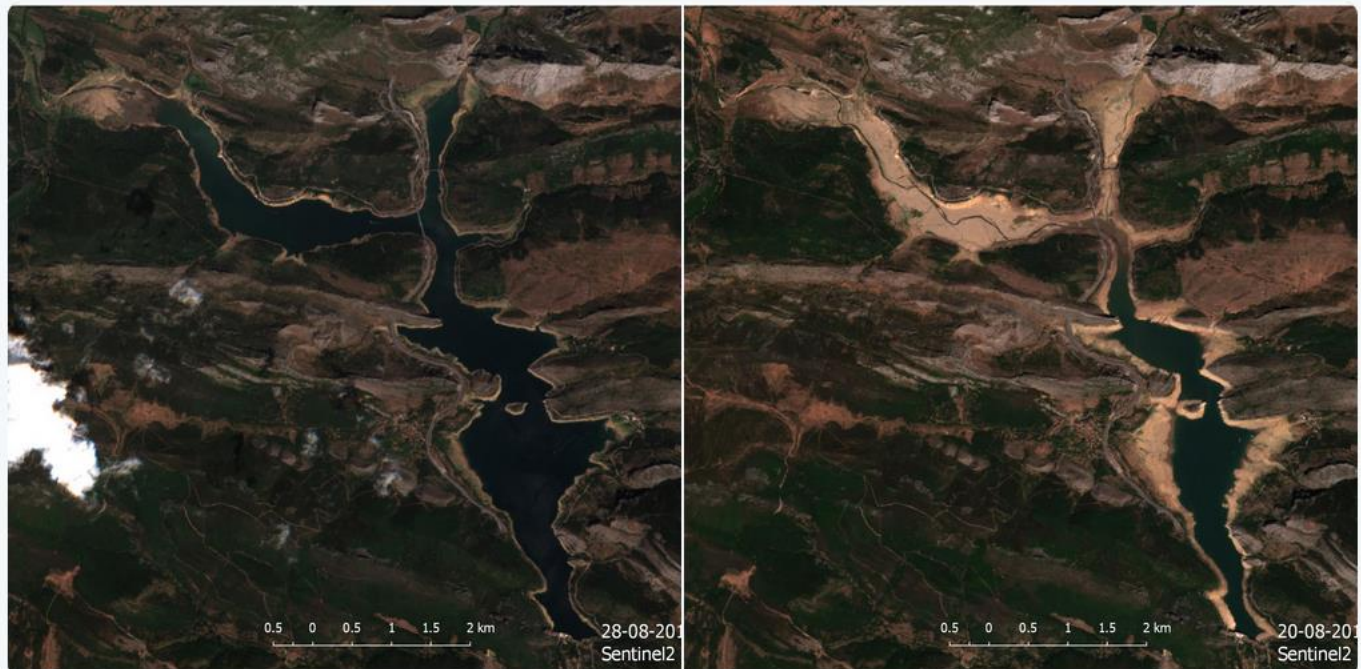


**Toño Fdez-Cañadas** @TFCanadas · 18h

Replying to @srvillalba @Divulgameteo @JostoMaffeo

Así se ve el embalse desde #Sentinel2 . A finales de agosto de este año y del año pasado @sentinel\_hub

 Translate from Spanish

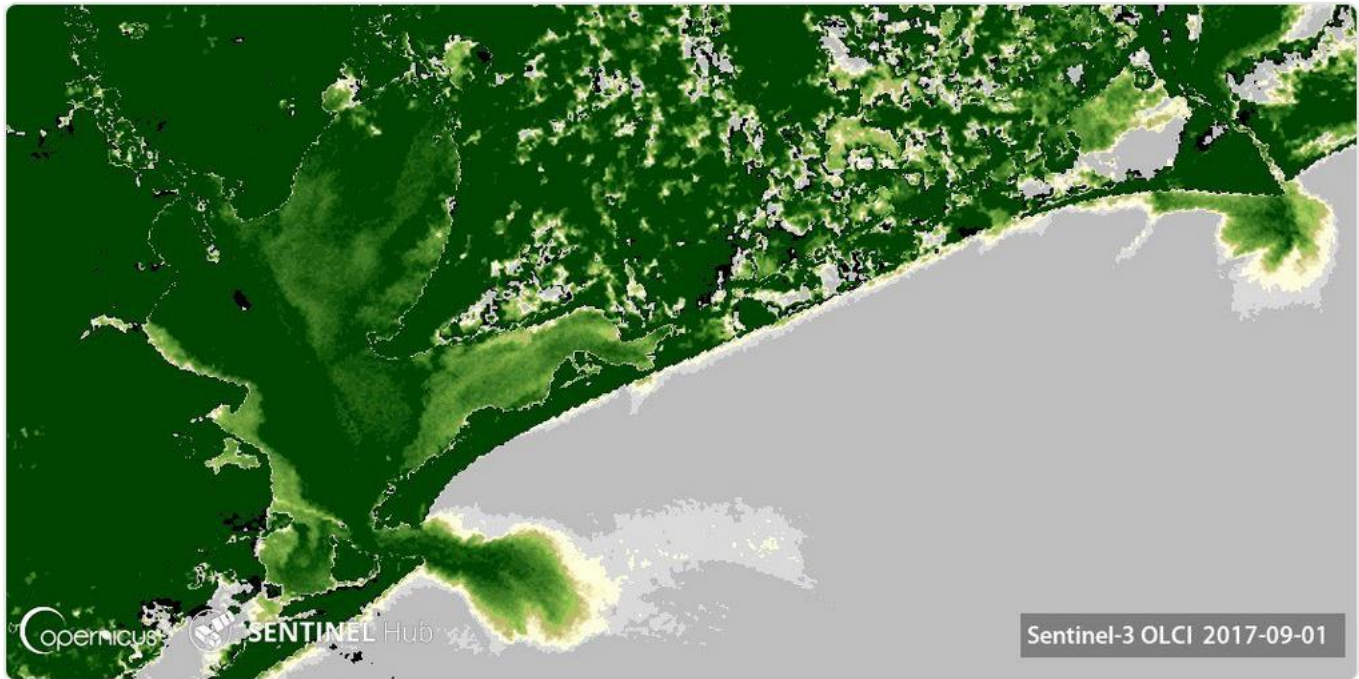


# Environmental monitoring



**Zack Labe**  @ZLabe · Sep 2

Satellites are an indispensable tool for monitoring the Earth system. Today's Sentinel-3 terrestrial-chlorophyll-band over Galveston Bay, TX





# Giving power to the people

**Veeteede Amet**  
February 13 at 4:35pm · 🌐

Like Page

Selline pilt avaneb siis Eesti merealast ja jääoludest 800 km kõrguselt, otse Sentinel-2 pardalt. Siit on ka hästi näha, kus jää juba paksem ja kus see veel õrnem on. Surfa ise ka sateliitpiltidel siit: [http://sentinel-pds.s3-website.eu-central-1.amazonaws.com/...](http://sentinel-pds.s3-website.eu-central-1.amazonaws.com/)

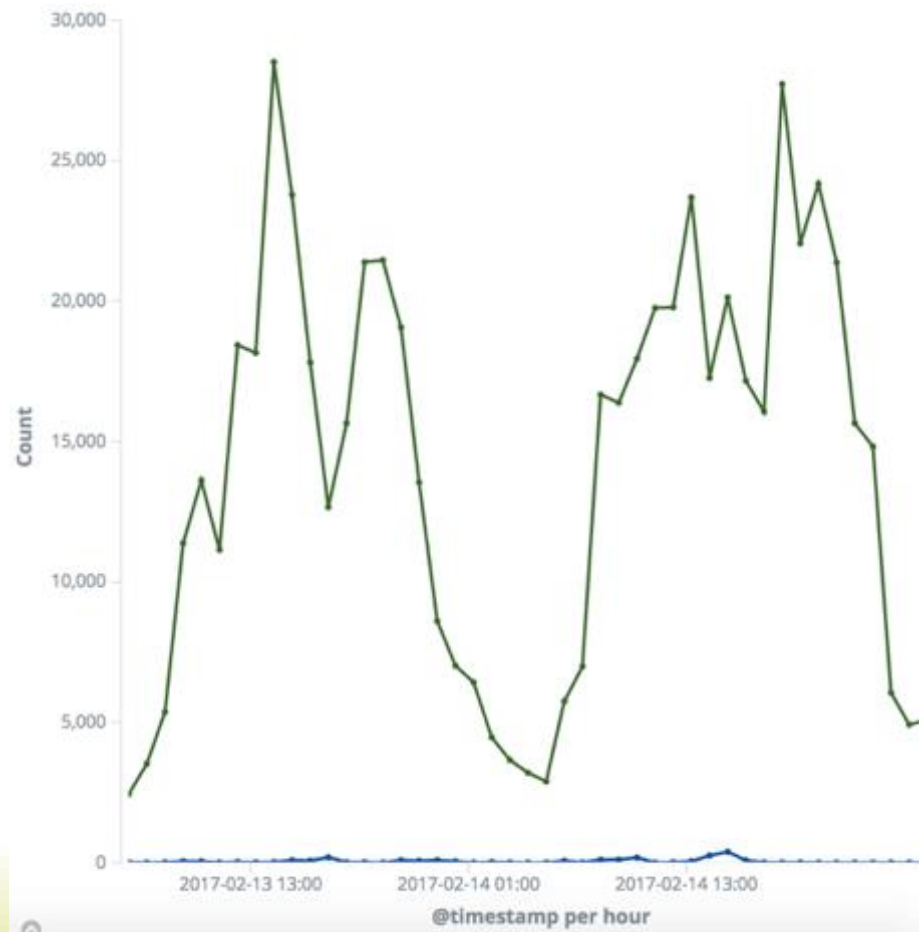
Aga täna teatas Maanteeamet meile, et nad on alustanud ettevalmistusi jäätee rajamiseks Vormsile. Niisiis otsustasimegi meie peatada seal alates 20. veebruarist laevaliiklus. Laevaliiklus pannakse seega seisma kavan...

See More  
See Translation



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# Conclusion

- Real-time processing of data
  - cost efficient, flexible
- Operational
- Try it out
- More info
  - <http://www.sentinel-hub.com/>
  - <http://apps.sentinel-hub.com/sentinel-playground>
  - <http://apps.sentinel-hub.com/eo-browser/>



# Sentinel Hub references

