



The use of satellite data for oil spill detection in inland waters

Dr. Ioannis Lioumbas
Katerina Christodoulou



Division of Strategic Planning,
Hydraulic works & Development
Department of Research and Development

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Community of Practice

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aqua3S

Exposure of citizens to potential disasters has led to vulnerable societies that require risk reduction measures. Drinking water is one of the main risk sources when its safety and security are not ensured.

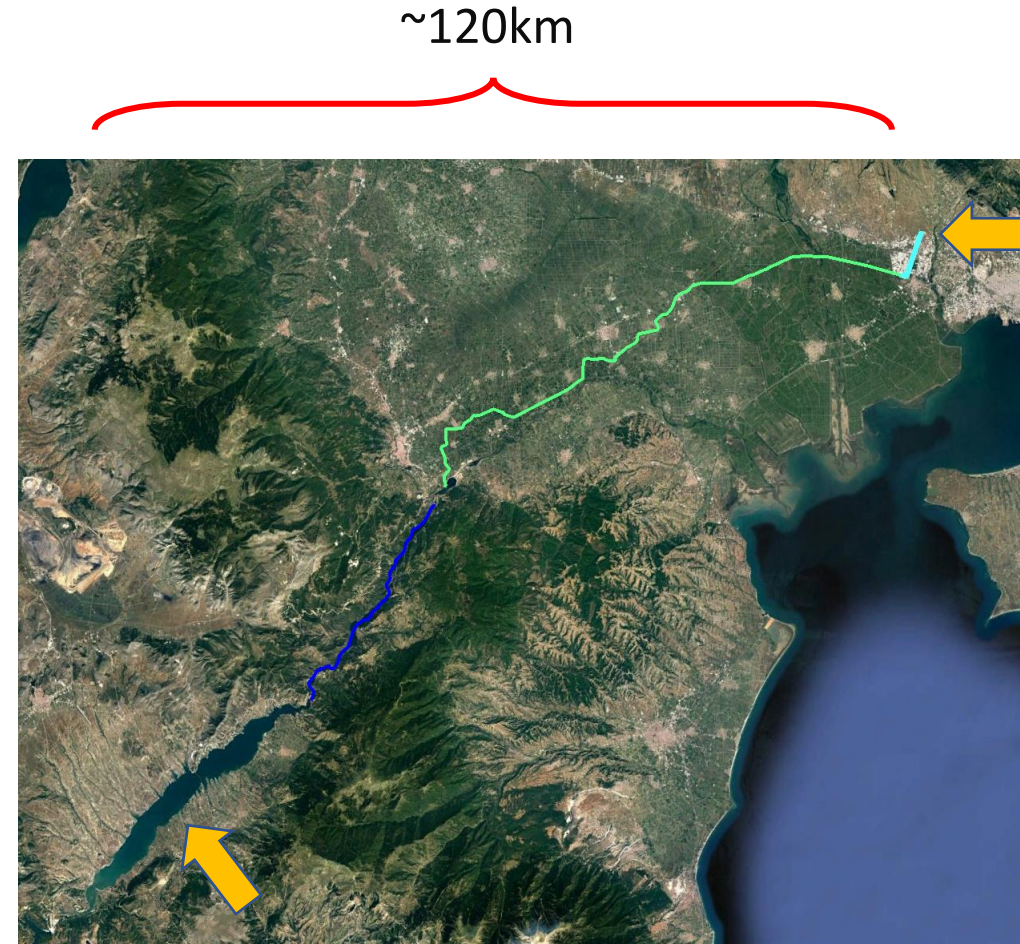
aqua3S project steps in to combine novel technologies in water safety and security, aiming to standardize existing sensor technologies complemented by state-of-the-art detection mechanisms.

Area of Interest

Polyphytos Artificial lake

This reservoir is the artificial lake of Polyphytos which is the main source of drinking water for Thessaloniki and provides drinking water for +1M citizens

- Has an area greater than 70km²
- Is related with a significant variety of anthropogenic actions
- Is located at a distance more than 120km from Thessaloniki Water Treatment Plant



Thessaloniki Water Treatment Plant



Polyphytos Artificial lake ~70km²

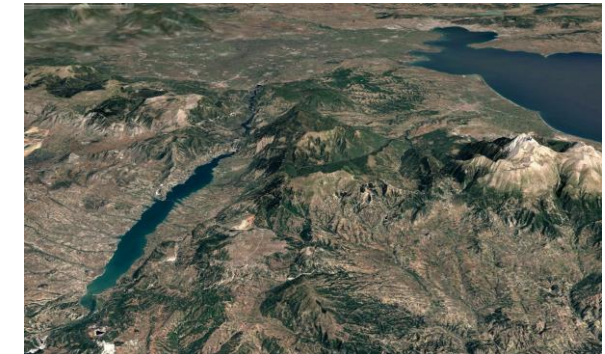
Google Earth®

Description of the situation

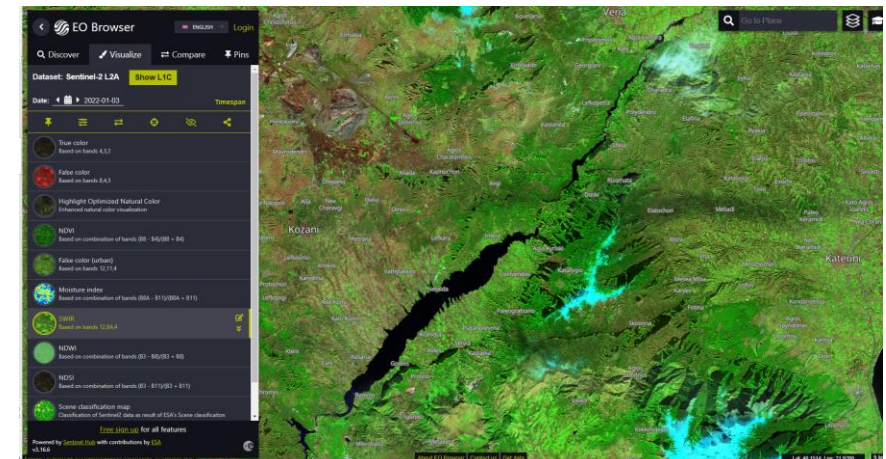
Periodical presence of hydrocarbons in the inflow of Thessaloniki Water Treatment Plant



Difficulty to locate the exact source of pollution



Preliminary exploration of the Copernicus products



Satellite tools

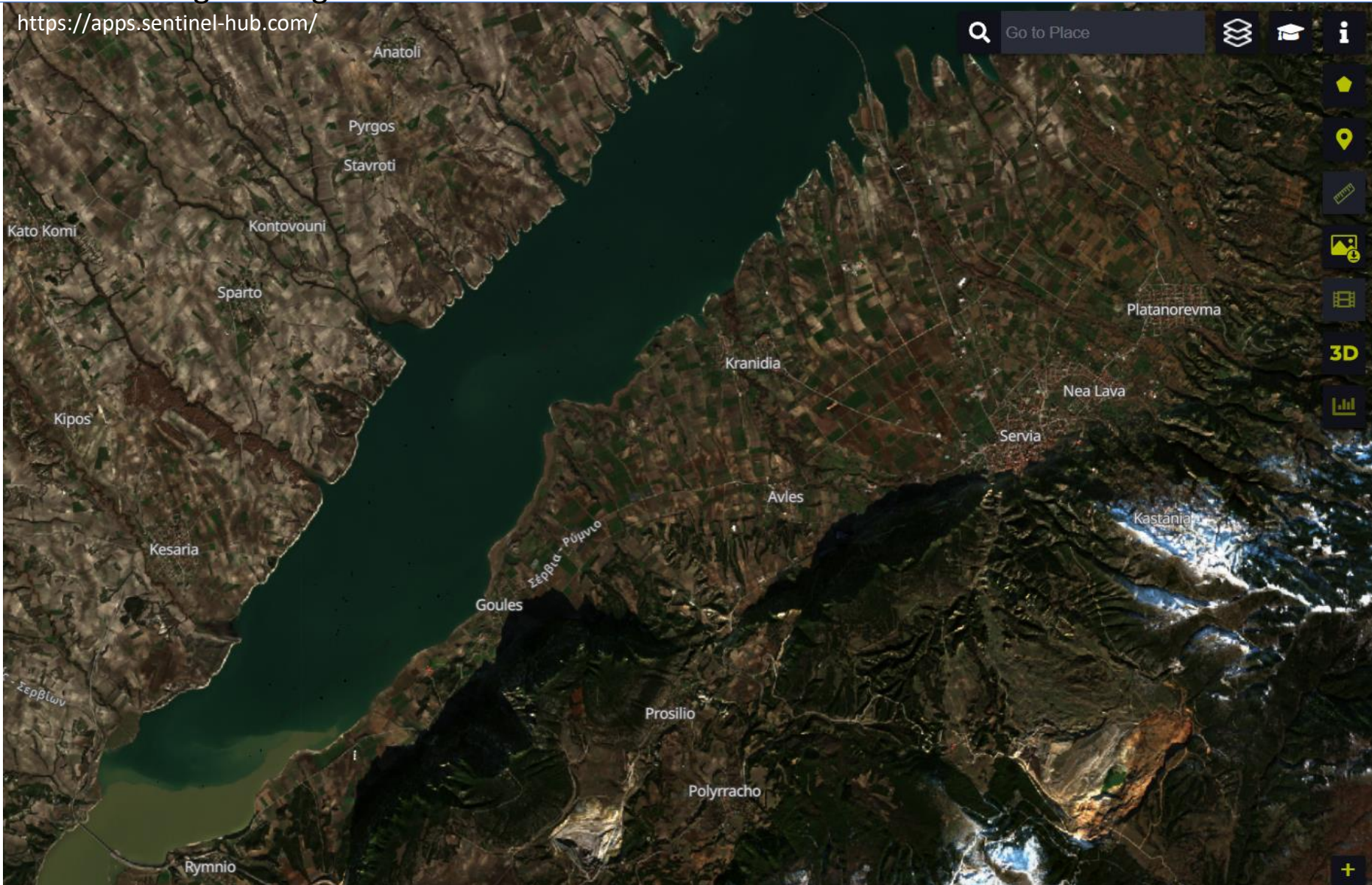
Satellite images along with filters have shown various formations

Typical case:
2021-12-24

Image analysis:

True color,

Based on bands 4, 3, 2



Sentinel 2 bands

Band	Central wavelength (nm)	Bandwidth (nm)	Spatial resolution (m)
1	443	20	60
2	490	65	10
3	560	35	10
4	665	30	10
5	705	15	20
6	740	15	20
7	783	20	20
8	842	115	10
8a	865	20	20
9	945	20	60
10	1375	30	60
11	1610	90	20
12	2190	180	20

<https://platform.pulchra-schools.eu/wp-content/uploads/2021/02/User-guide-for-the-Remote-Sensing-Tool.pdf>

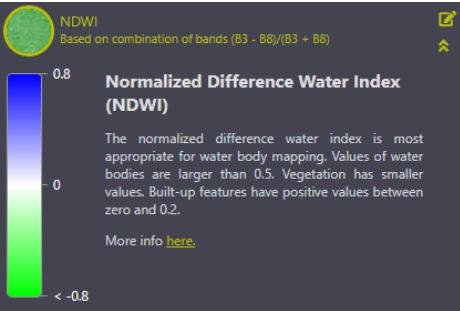
Satellite tools

Satellite images along with filters have shown various formations

Typical case:
2021-12-24

Image analysis:

NDWI



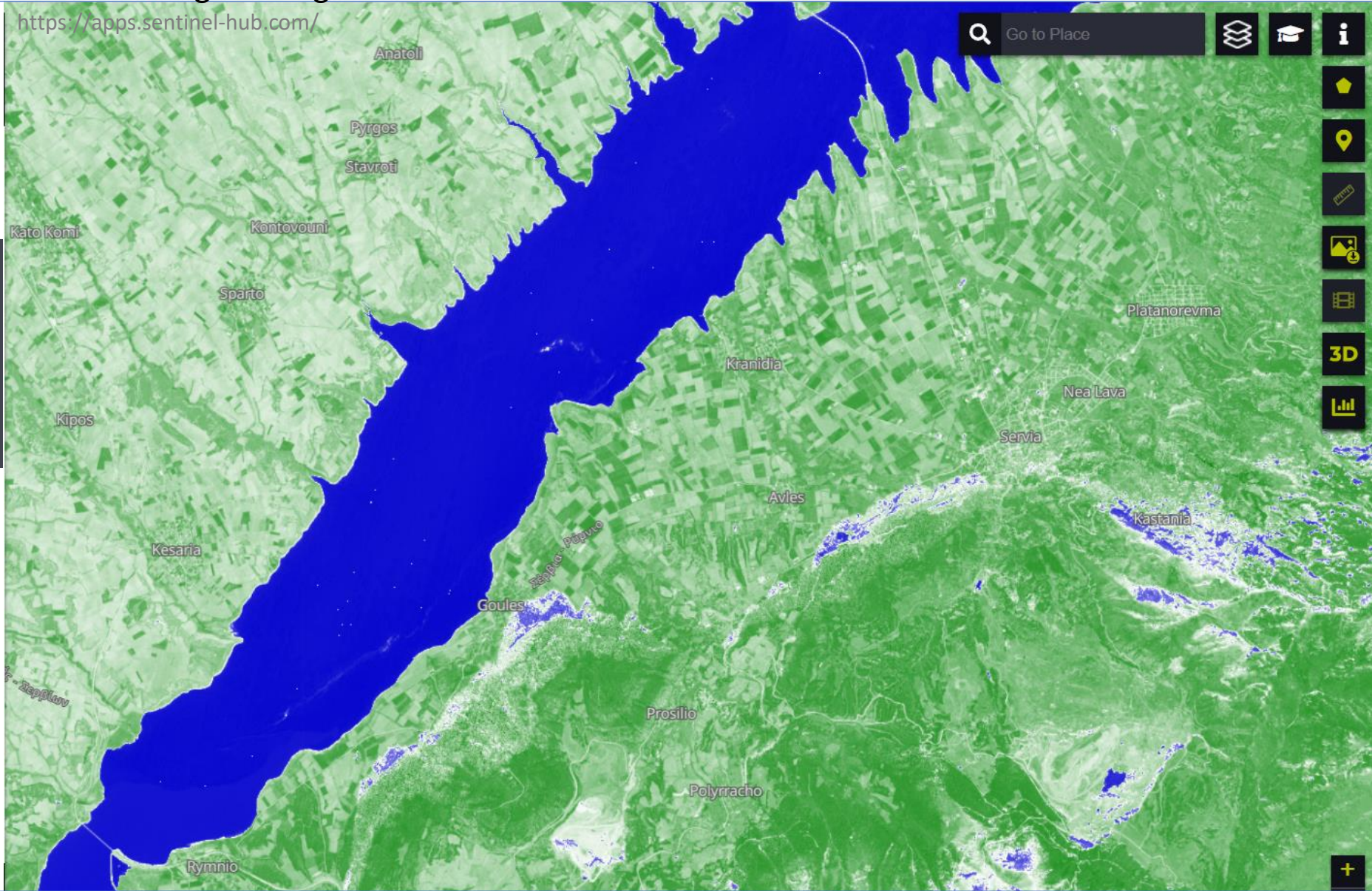
NDWI
Based on combination of bands (B3 - B8)/(B3 + B8)

0.8
0
-0.8

Normalized Difference Water Index (NDWI)

The normalized difference water index is most appropriate for water body mapping. Values of water bodies are larger than 0.5. Vegetation has smaller values. Built-up features have positive values between zero and 0.2.

More info [here](#).



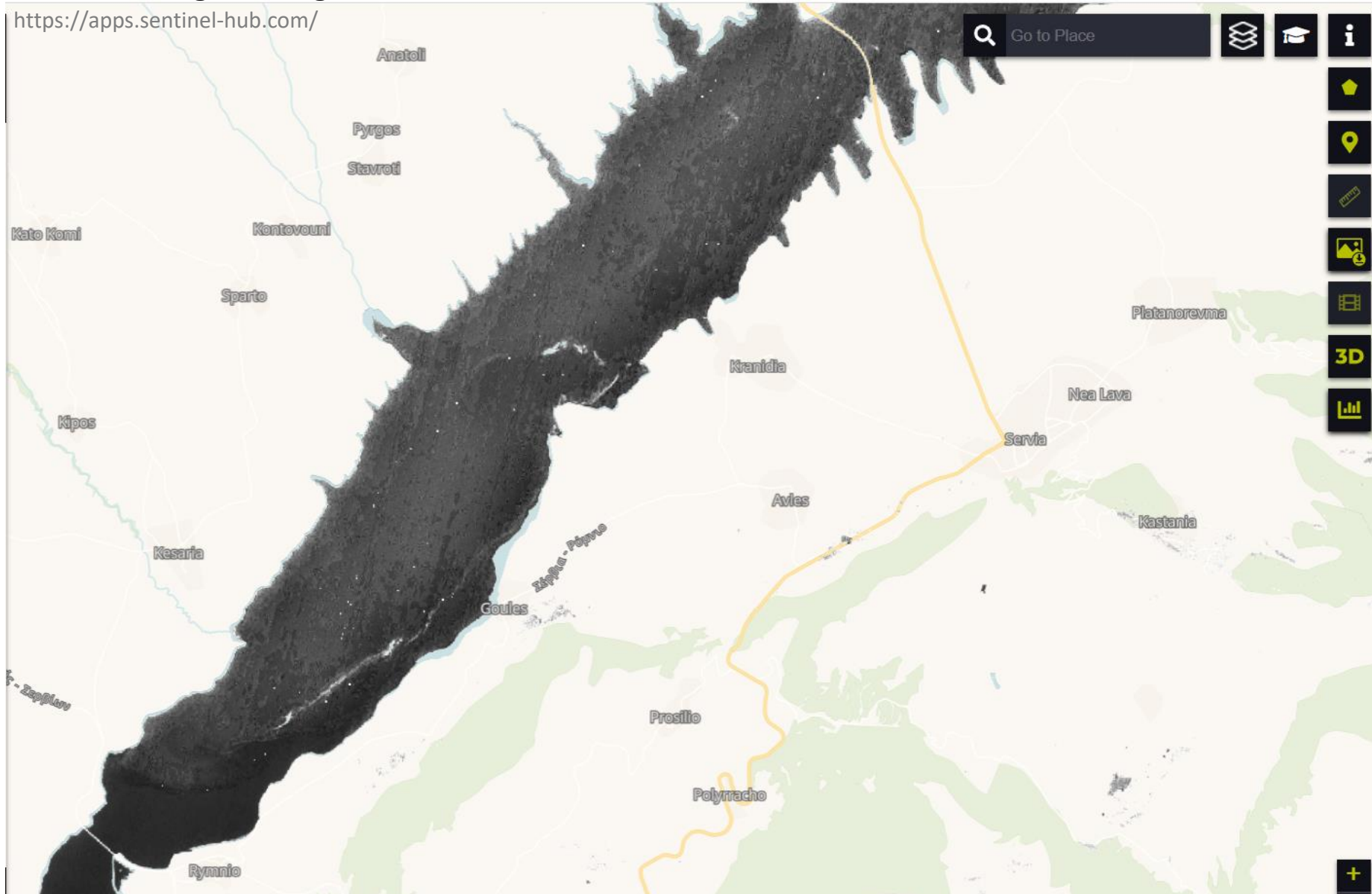
Satellite tools

Satellite images along with filters have shown various formations

Typical case:
2021-12-24

Image analysis:

B04/B08



Sentinel 2 bands

Band	Central wavelength (nm)	Bandwidth (nm)	Spatial resolution (m)
1	443	20	60
2	490	65	10
3	560	35	10
4	665	30	10
5	705	15	20
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Satellite tools

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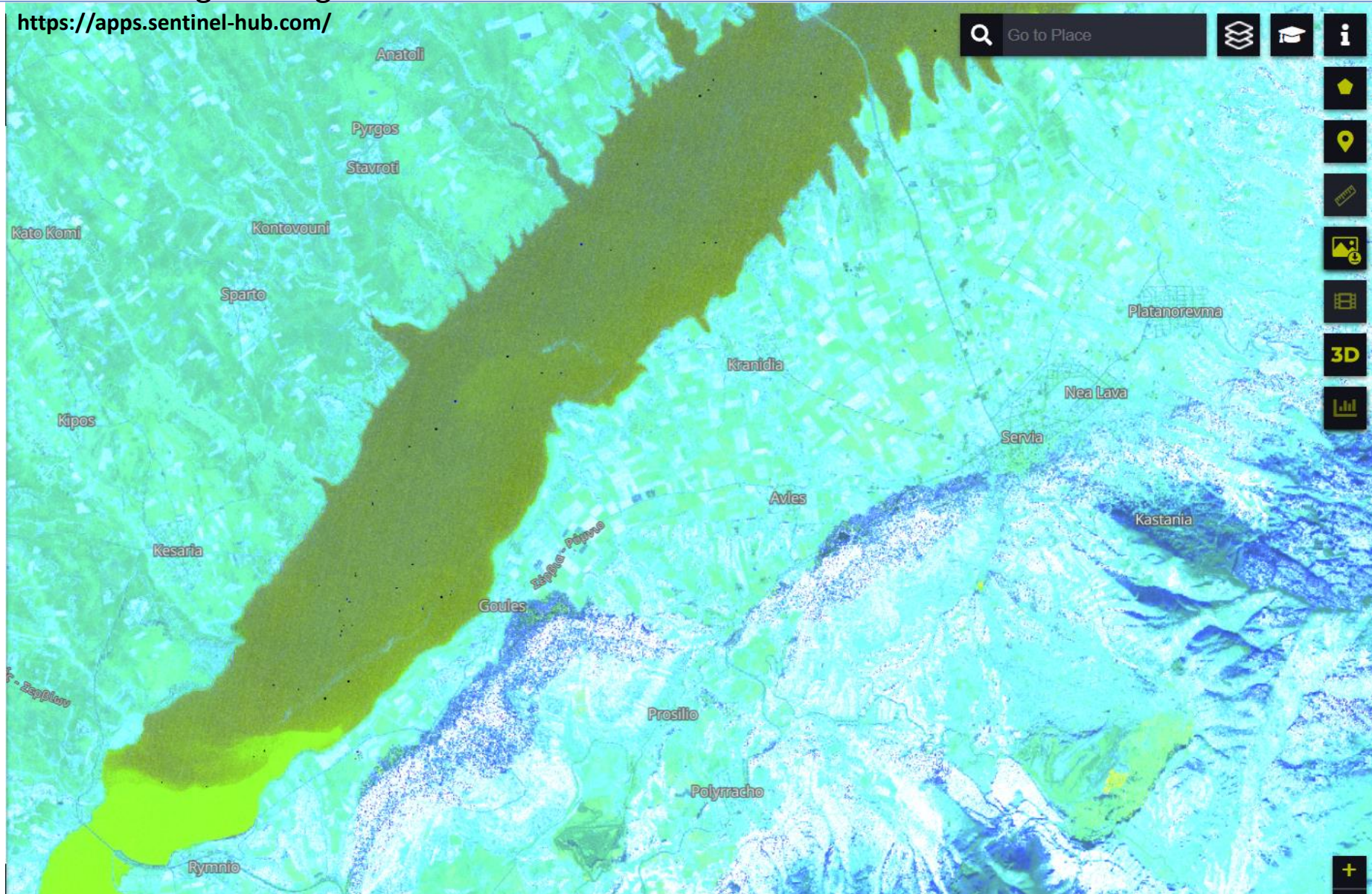
Typical case:
2021-12-24

Custom script:

Oil Spill detection

```
let R = (B03/B02)
let G = (B03+B04)/B02
let B = (B06+B07)/B05
return [R/3, G/3, B/3]
```

The OSI (Oil Spill Index) uses visible Sentinel-2 bands to display oil spills over water in the **costal/marine** environment.



Satellite tools

Satellite images along with filters have shown various formations

Typical case:
2021-12-24

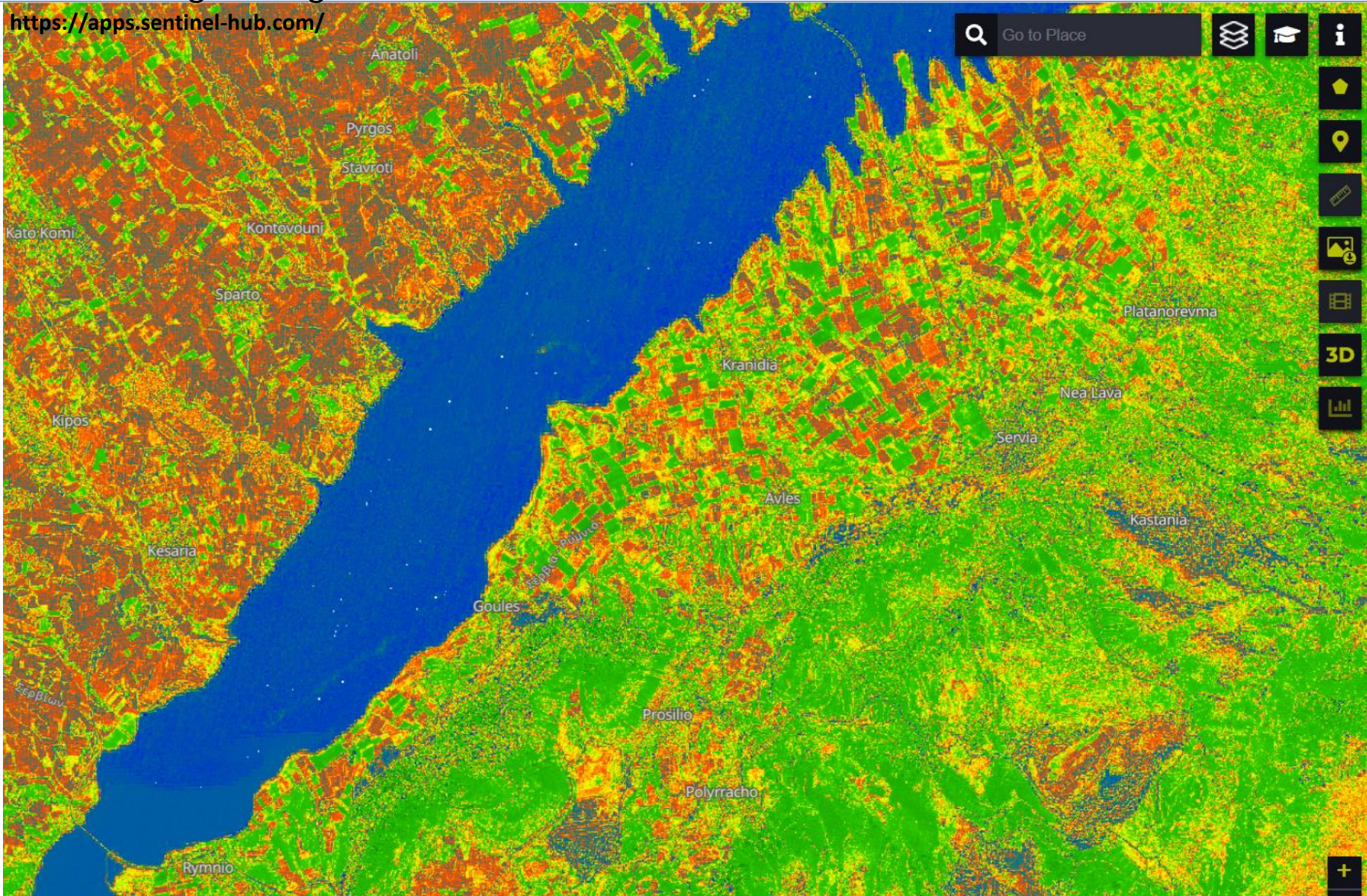
Image analysis:

Chlorophyl

```

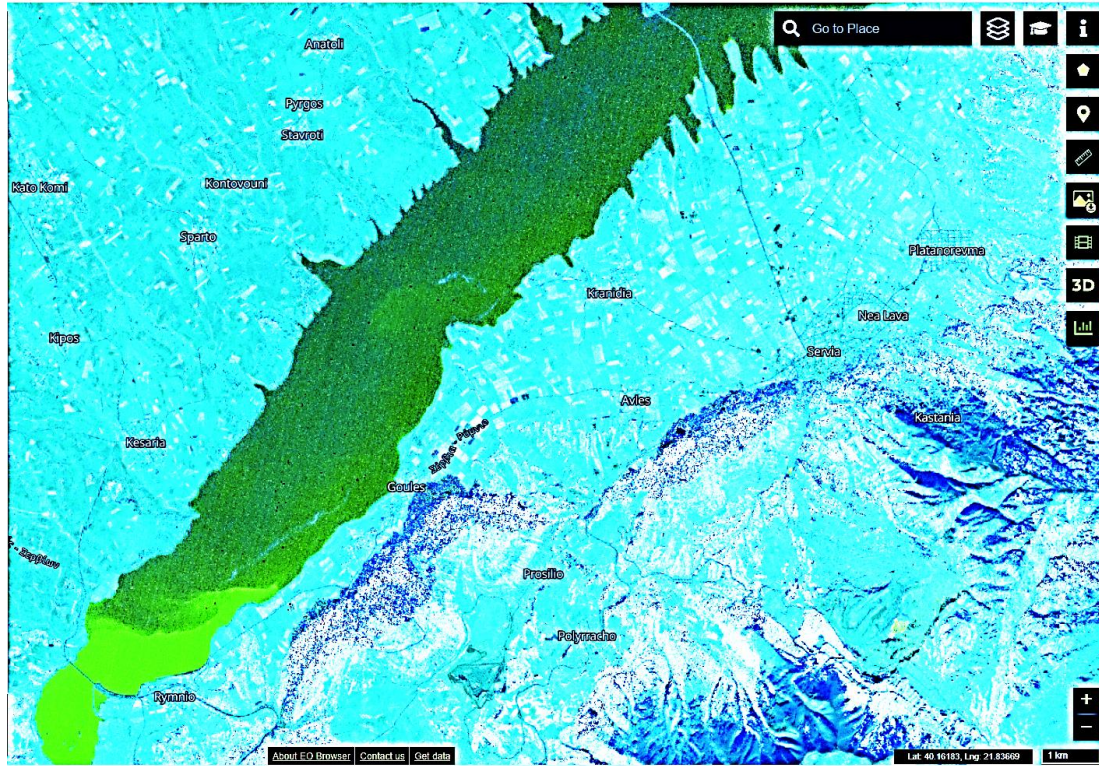
if ((B05+B04)==0){
  return [1,1,1]
};
var val = (B05-B04)/(B05+B04);

return colorBlend
(
  val,
  [-0.5,0,0.1,0.2,0.3,1],
  [
    [0,0,1],
    [0,0.5,0.5],
    [1,0.3,0],
    [1,1,0],
    [0.2,0.8,0],
    [0,0.5,0]
  ]
);
  
```

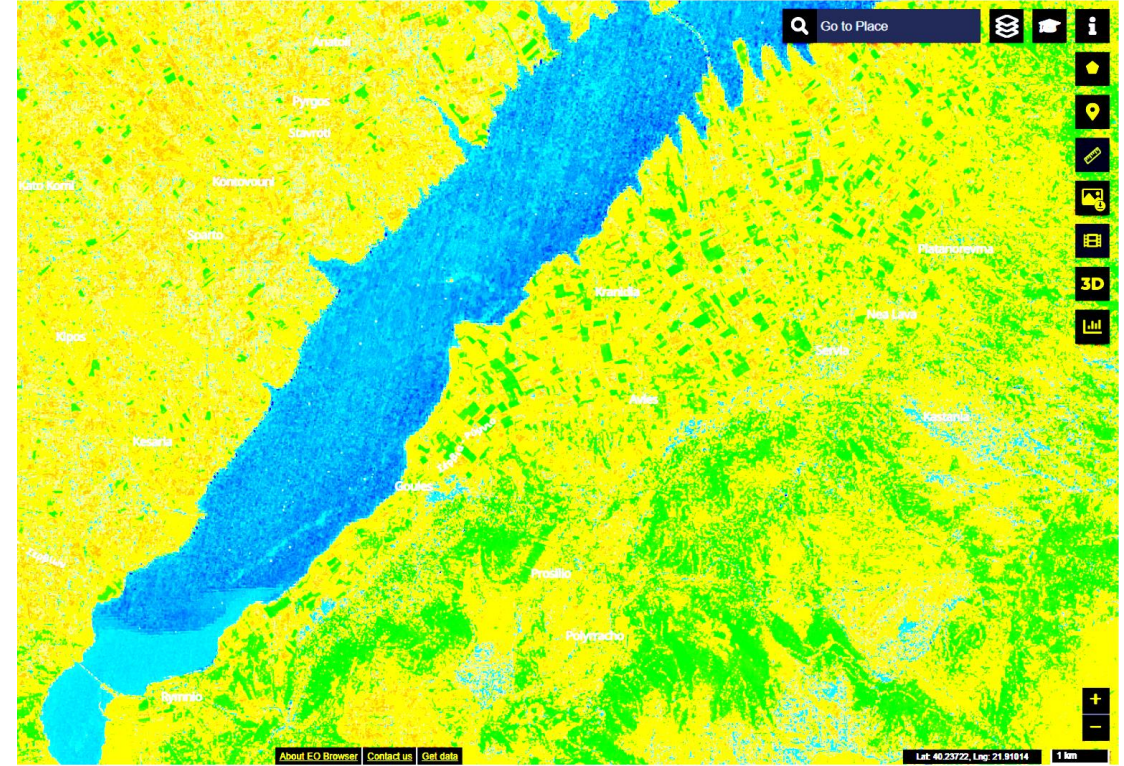


Operational application

Oil Spill detection



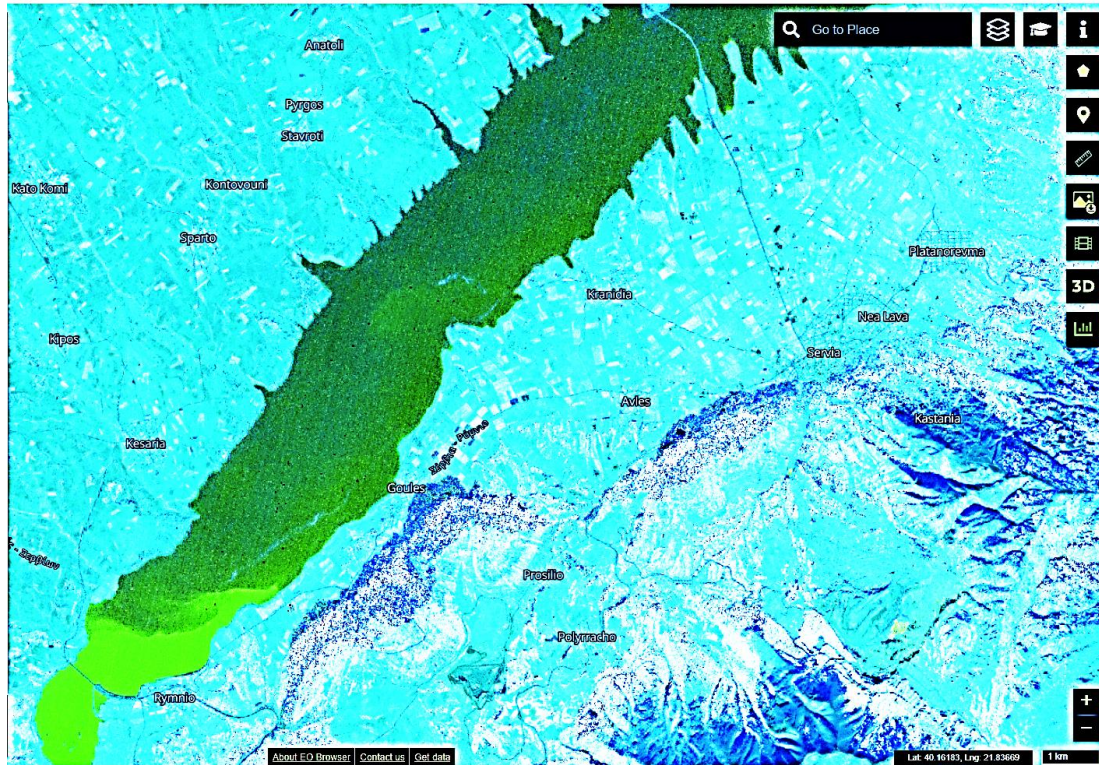
Chlorophyll



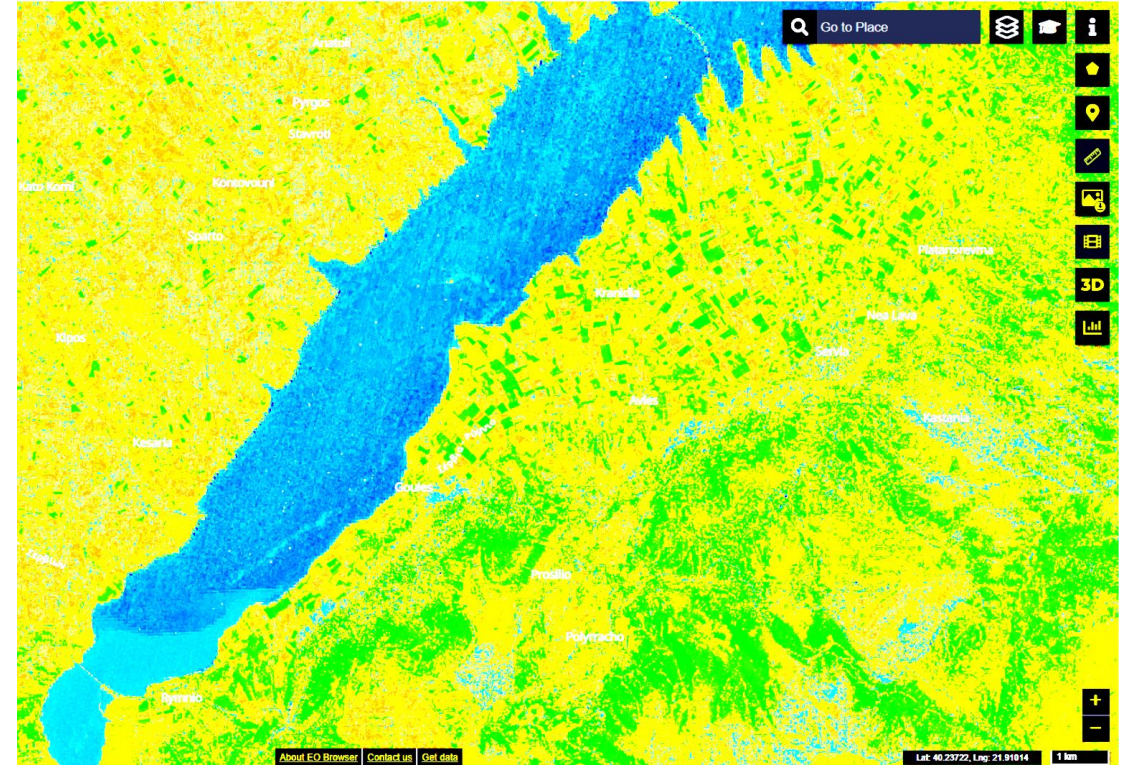
No clear answer on the type of the **formations-spills**

Operational application

Oil Spill detection



Chlorophyll



BUT

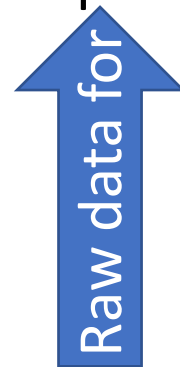
Good identification of the spill-formation spatial distribution
 Relatively frequent new images (one image per five days)

Operational application

3. Efficient vigilance for our company mitigation actions

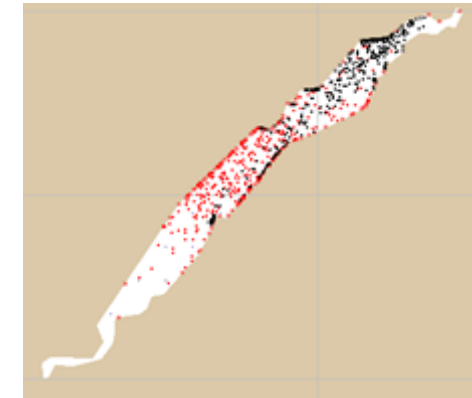
2. Optimize the sampling procedures

1. Oil spill diffusion model to locate possible sources' position and forecast the spill route in the lake



Good identification of the spill spatial distribution

Relatively frequent new images (one image per five days)



<https://response.restoration.noaa.gov/oil-and-chemical-spills/oil-spills/response-tools/gnome-suite-oil-spill-modeling.html>

BUT

3. Efficient vigilance for our company mitigation actions



Early warning system incorporated into our company procedures

Overall benefits

→Scientific:

- Novel methodology developed to detect irregular formations in inland waters
- Research initiated to offer methods to discriminate the type of formations observed on water surface

→Economic impact:

- Optimize the sources related to sampling procedures
- Avoid additional sources that are necessary for treating contaminated water in TWTP

→Societal impact:

- Further enhance the water safety procedures related to drinking water supply to +1M citizens

Desired future satellite-based features

1. More frequent satellite images
2. Better image analysis
3. SAR based tools in better analysis
4. Advances in qualitative discrimination



Thank you for your attention

