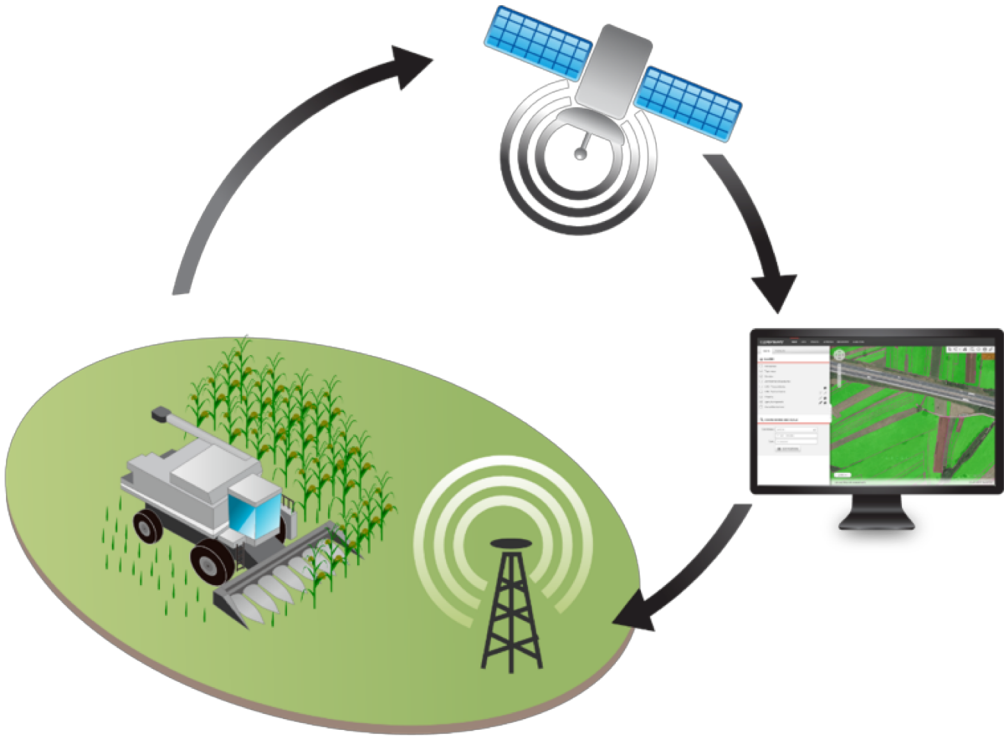
Introduction to Sentinel data

Grega Milcinski

Sinergise



Agenda

- Basic info about Sentinel
- Observing areas with EO Browser and other tools
- Towards area monitoring

Sentinel-2 - MSI

- Two satellites
  - June 2015
  - March 2017
- Revisit time 5 days
- 10 m resolution
- 13 spectral bands



Sentinel-1 - SAR

- Two satellites
  - April 2014
  - April 2016
- Revisit time 6 days
- 20 m resolution
- Sees through clouds

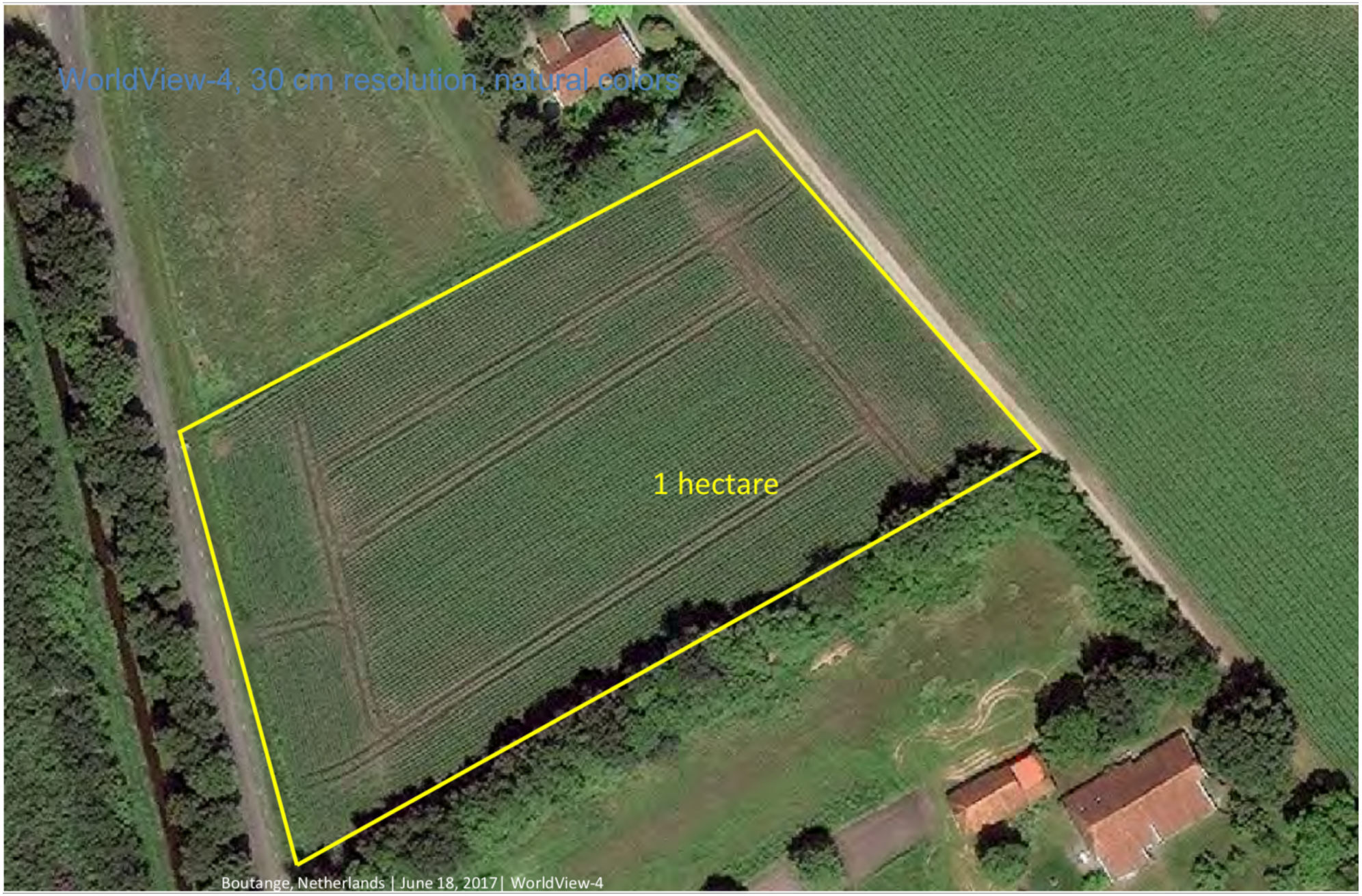


Sentinel-2 - MSI

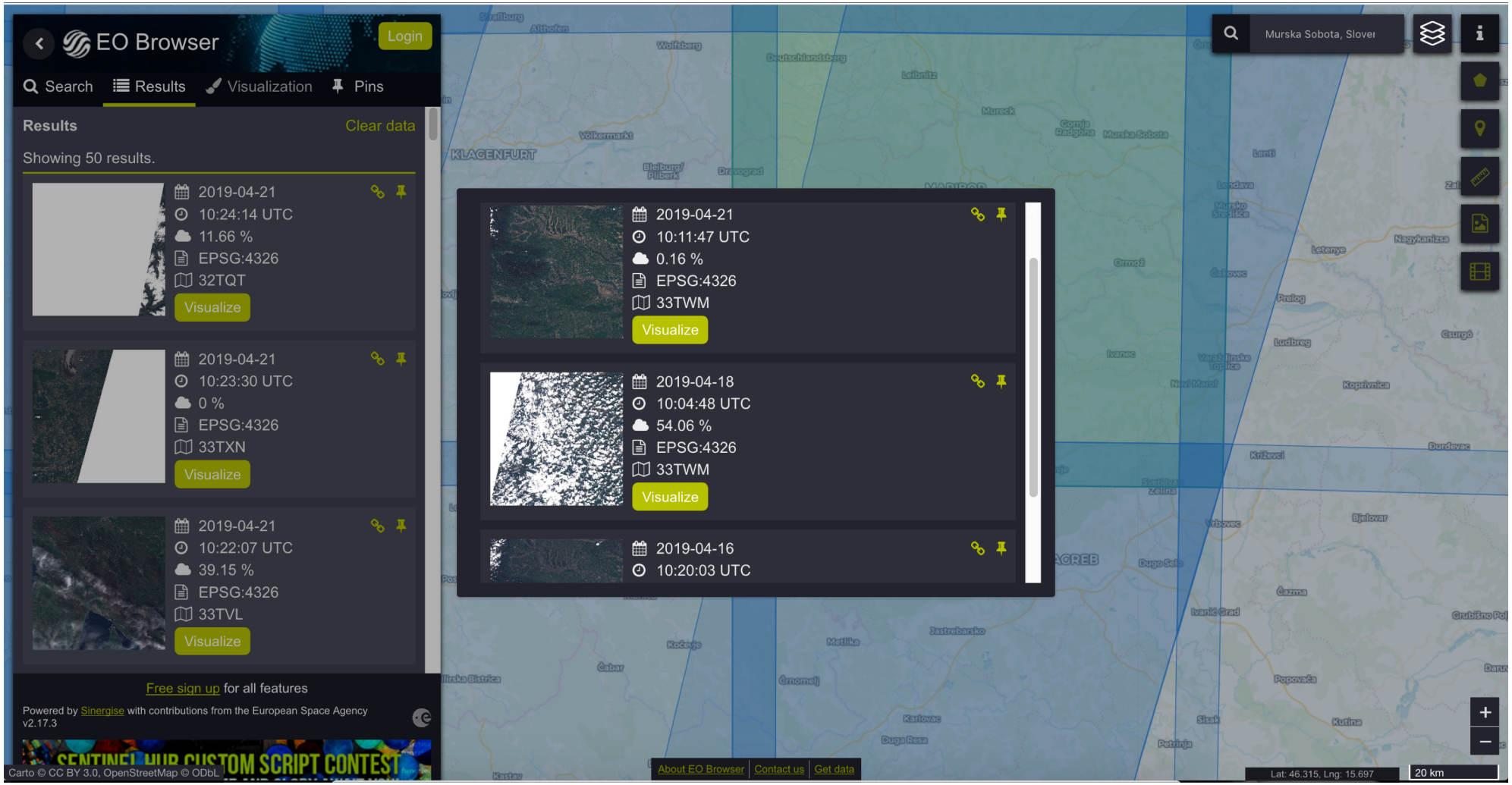
- Two satellites
  - June 2015
  - March 2017
- Revisit time 5 days
- 10 m resolution
- 13 spectral bands



Resolution


WorldView-4, 30 cm resolution, natural colors
1 hectare
Boutange, Netherlands | June 18, 2017| WorldView-4

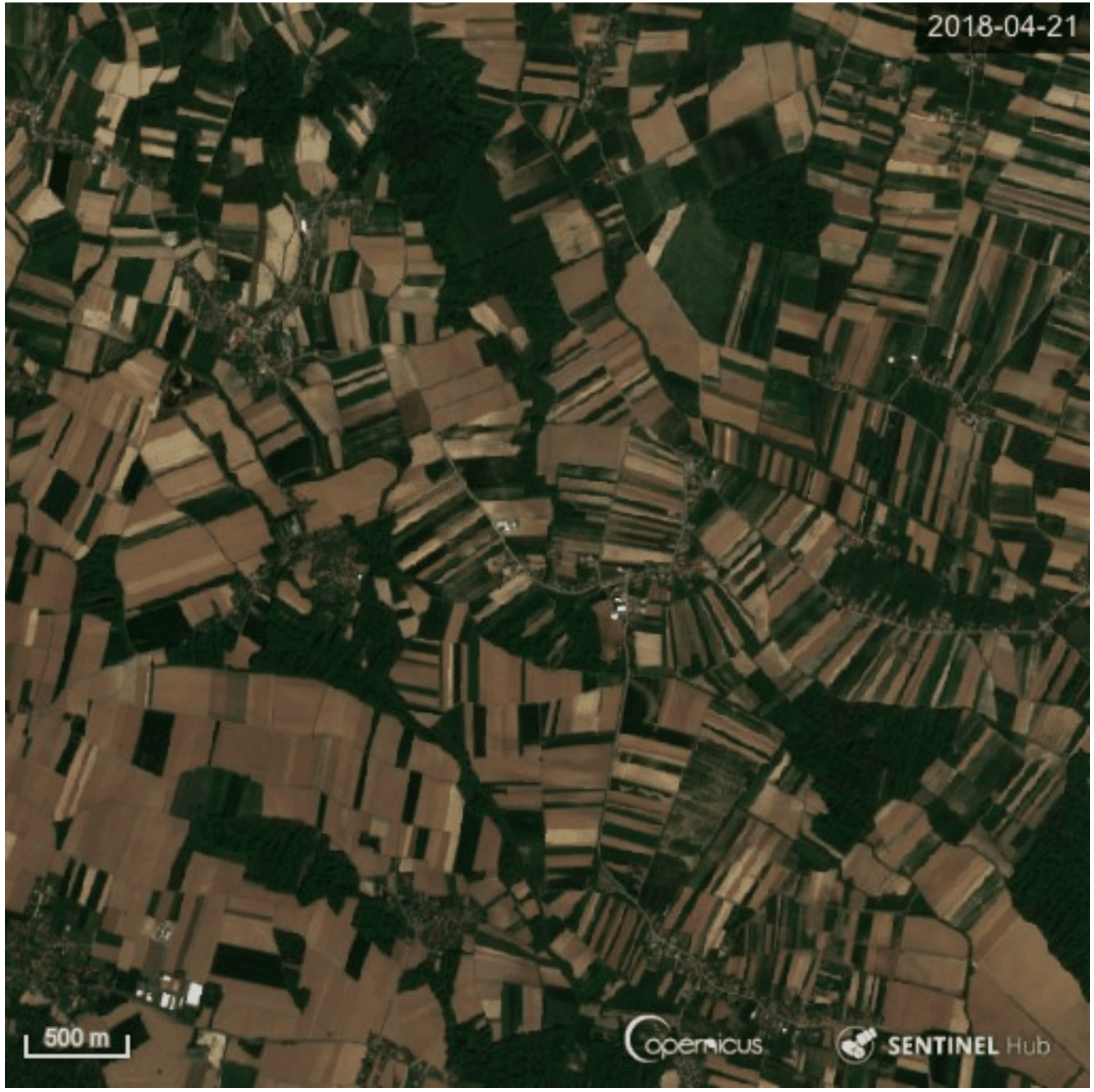
Revisit time



Revisit time – Ljubljanska kotlina



Revisit time - Prekmurje



Spectral bands

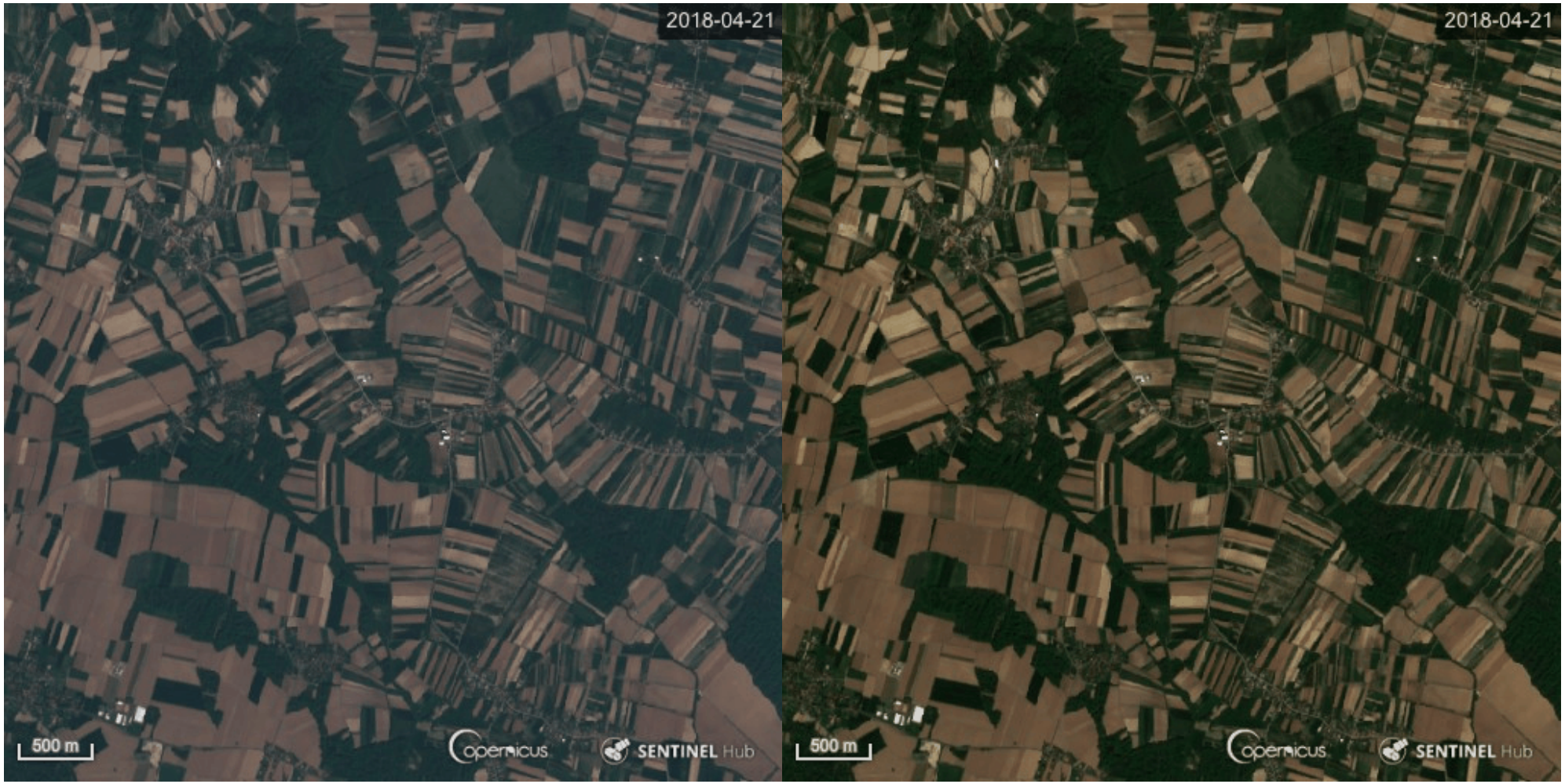
- True color
- False color
- NDVI
- NDWI
- Moisture index
- LAI
- ...

Sentinel-2 Bands	Central Wavelength (μm)	Resolution (m)
Band 1 - Coastal aerosol	0.443	60
Band 2 - Blue	0.490	10
Band 3 - Green	0.560	10
Band 4 - Red	0.665	10
Band 5 - Vegetation Red Edge	0.705	20
Band 6 - Vegetation Red Edge	0.740	20
Band 7 - Vegetation Red Edge	0.783	20
Band 8 - NIR	0.842	10
Band 8A - Vegetation Red Edge	0.865	20
Band 9 - Water vapour	0.945	60
Band 10 - SWIR - Cirrus	1.375	60
Band 11 - SWIR	1.610	20
Band 12 - SWIR	2.190	20

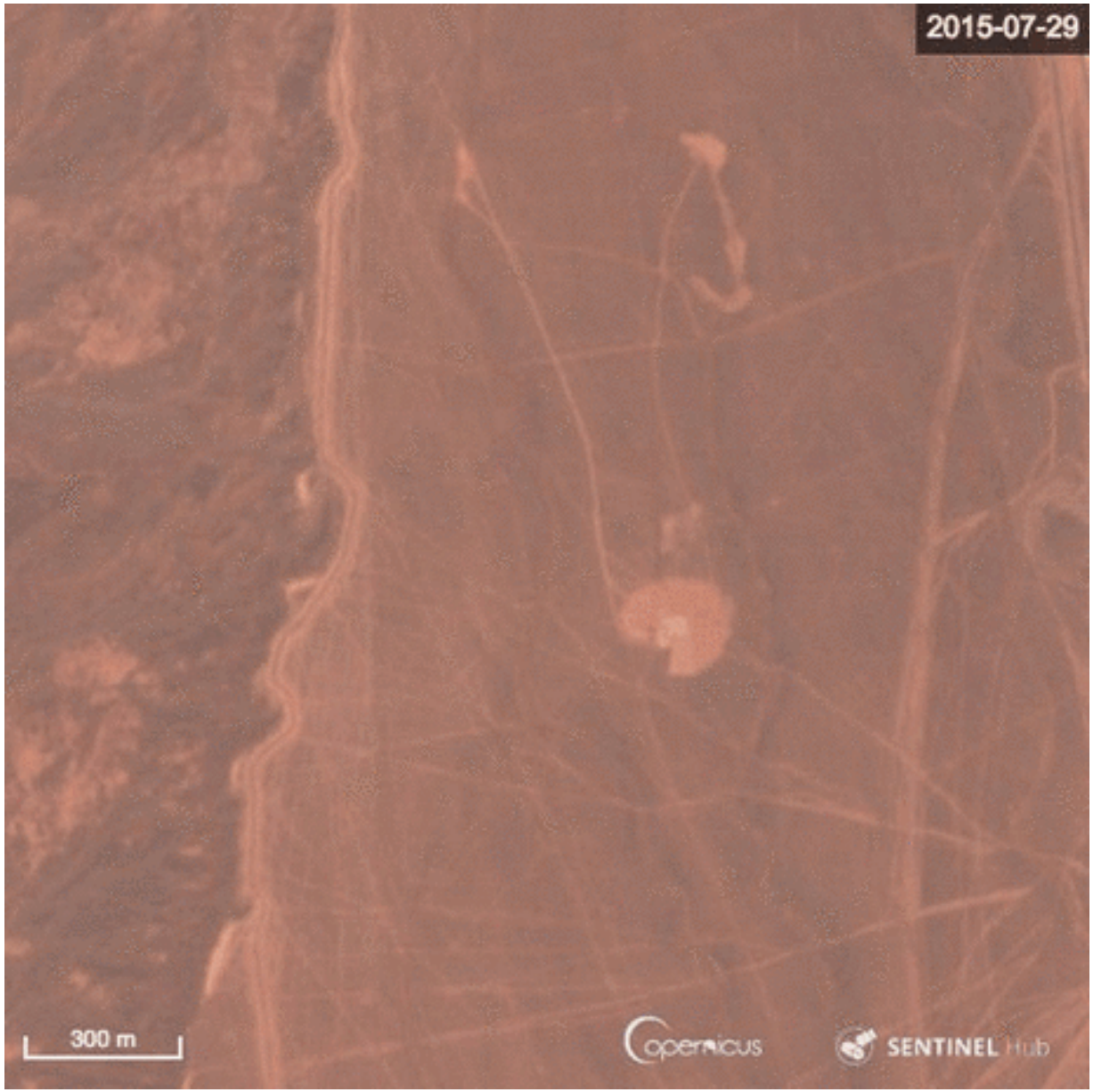
NDVI over time



L1C vs. L2A


2018-04-21
500 m
Copernicus
SENTINEL Hub
2018-04-21
500 m
Copernicus
SENTINEL Hub

Geopositional accuracy



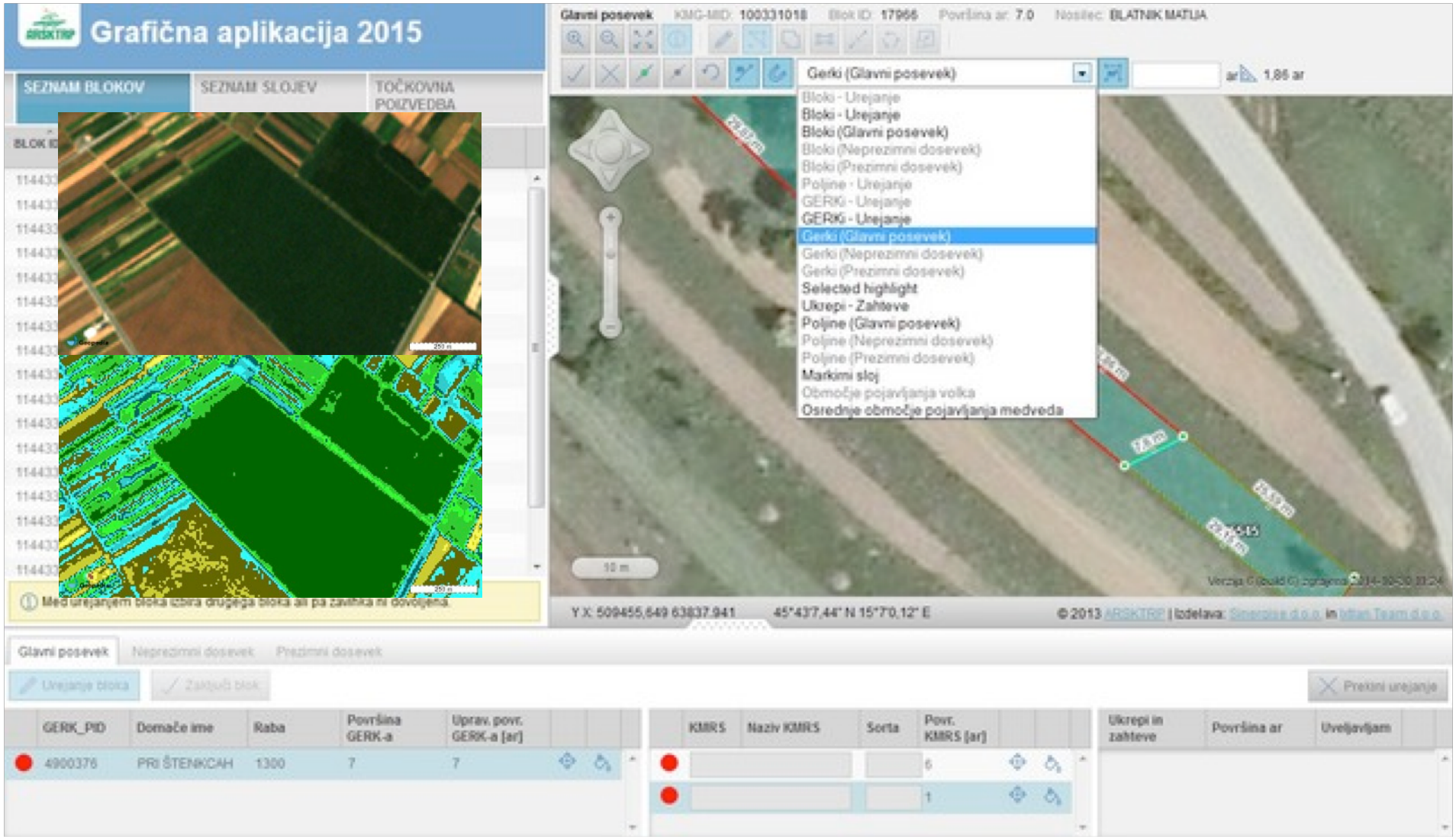
Sentinel-1

- Ascending/descending
- VV / VH
- SLC (Single Look Complex), GRD (Ground Range Detected)

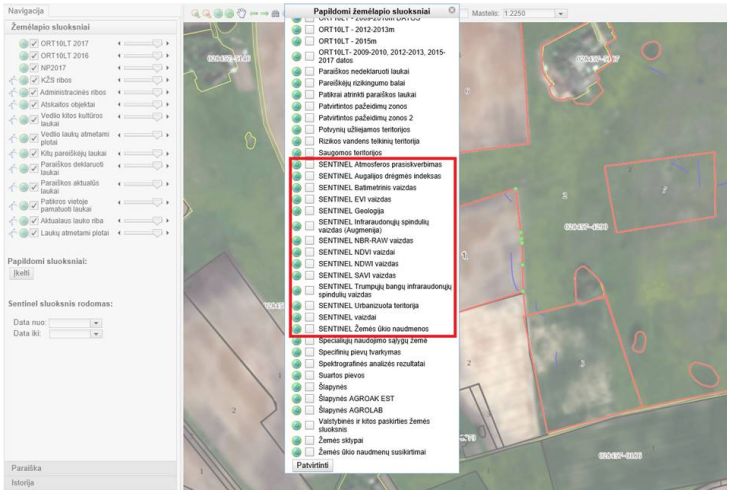
Exploring Sentinel data with EO Browser

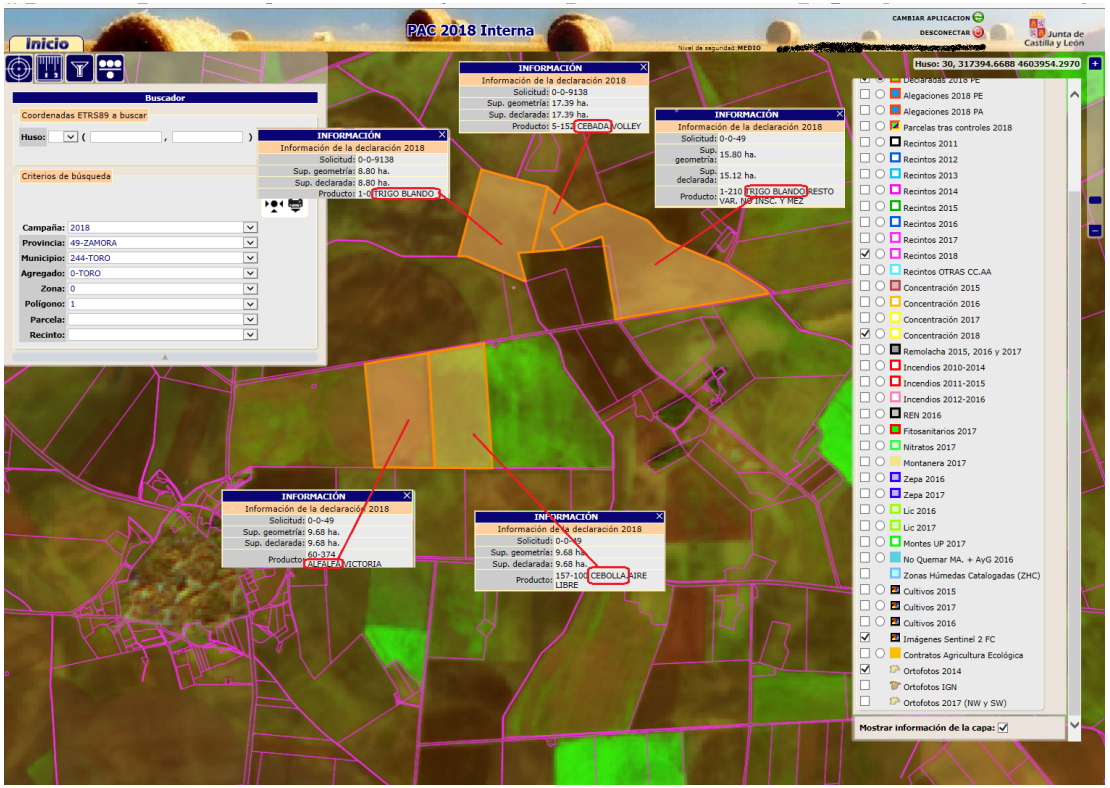
- Find area of interest
- Search for acqusitions
- Various indices
- Custom script
- Time-lapse
- NDVI chart
- Export GeoTiff

Smart LPIS/GSAA



Sentinel Hub in LPIS





European Commission

Possible way forward

Land Parcel Identification System plus Geo-spatial aid application

Copernicus program (Sentinels data)

Size of the land =>
From measuring to confirming

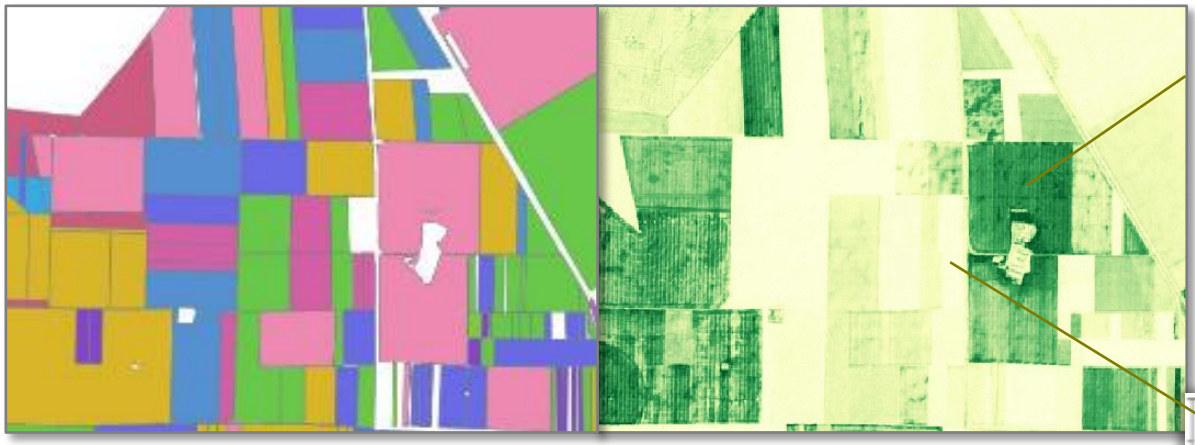
Activities on the land **=>**
through monitoring

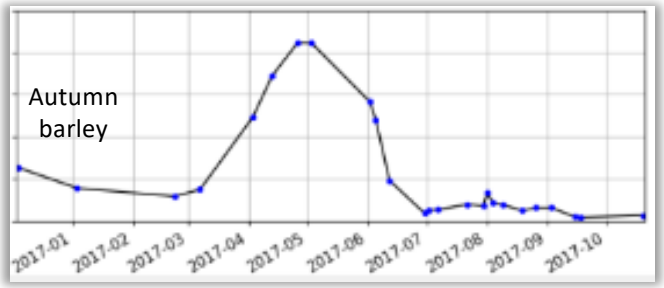
Introduction of a two tier approach in IACS

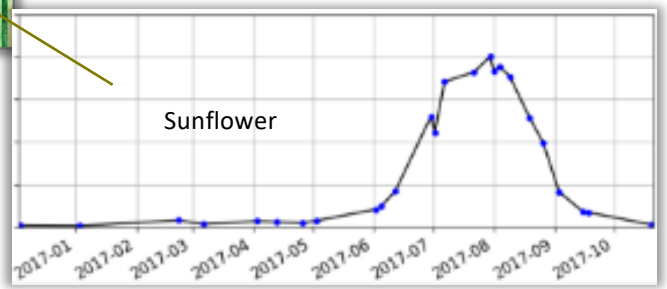
- towards a claimless system
- Less on-the-spot checks
- No multiple visits
- More compliance
- Performance based

Agriculture and Rural Development

Automatic crop classification

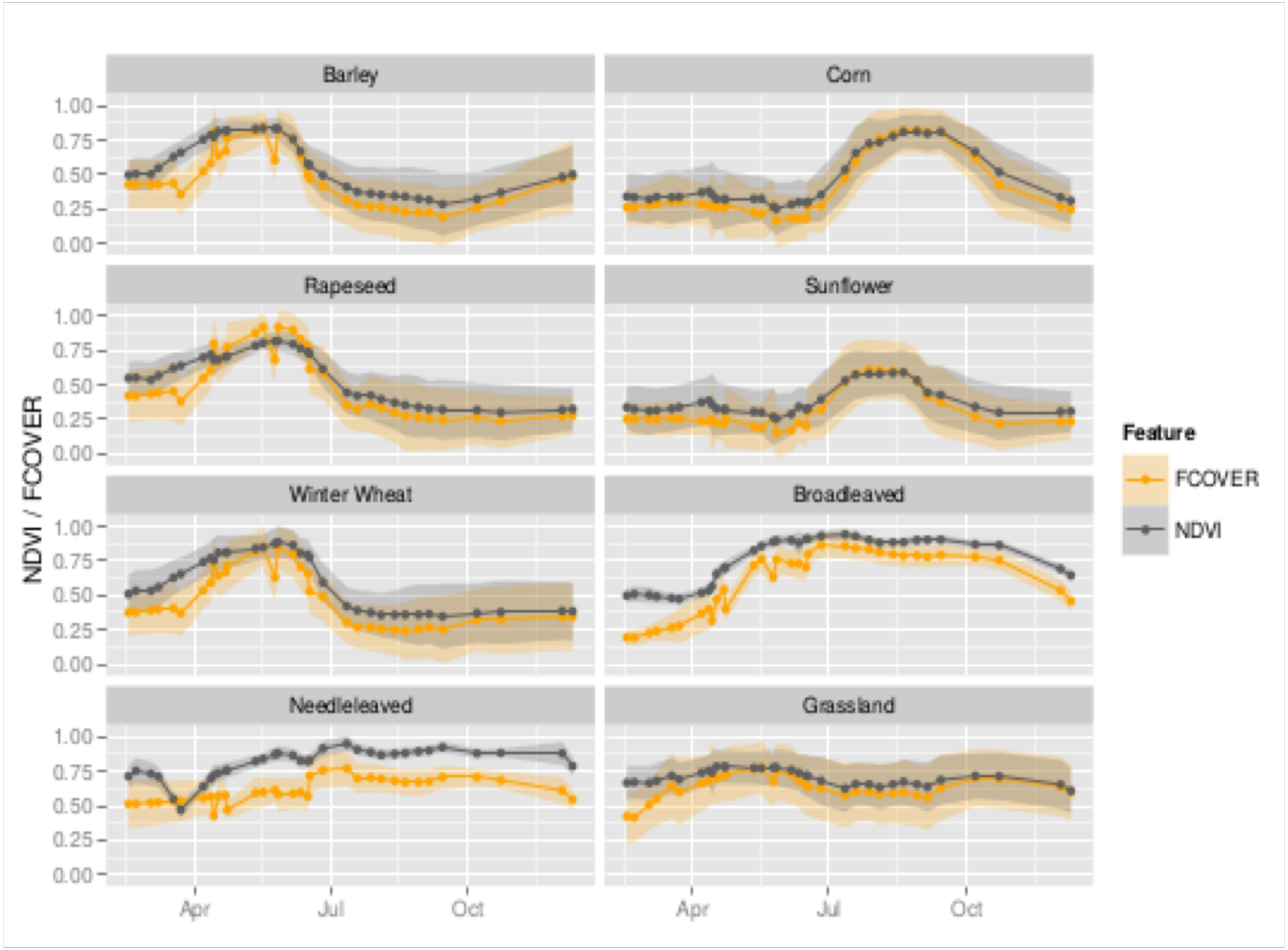






Crop type information & vegetation growing indicators

Automatic crop classification



Automatic crop classification





CT declared



Obs. confidence



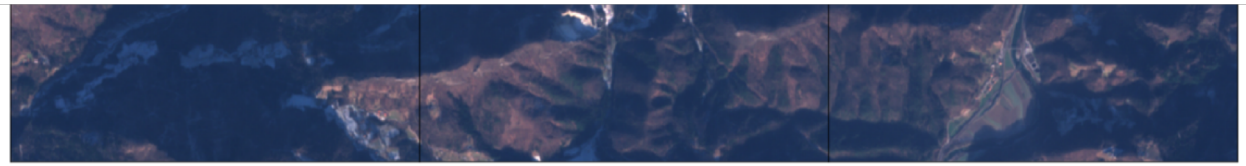
CT observed



Compliancy

GSAA_ID	AREA	CONF_IDX	CT_DECL	CT_PRED_1	CT_CONF_1	CT_PRED_2	CT_CONF_2	STATUS	C_INDIC
310000001733375000	14343	0	3000	3000	0,957	142	0,014	Assessed	Compliant
310000001733376000	6163	0	3000	3000	0,928	83	0,036	Assessed	Compliant
310000001733378000	16464	0	3000	3000	0,948	142	0,021	Assessed	Compliant
310000001726011000	8097	0	3000	3000	0,927	142	0,033	Assessed	Compliant

Land use / land cover example



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

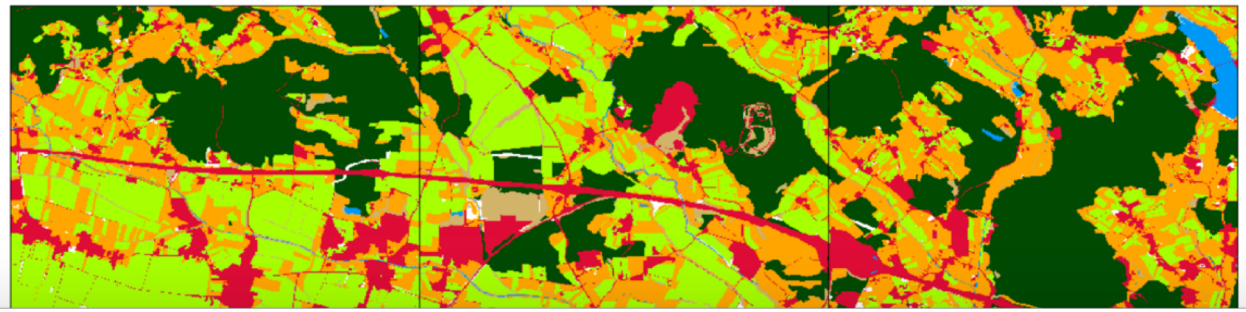
fig, axes = plt.subplots(figsize=(20,20*aspect_ratio), nrows=3, ncols=3)

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

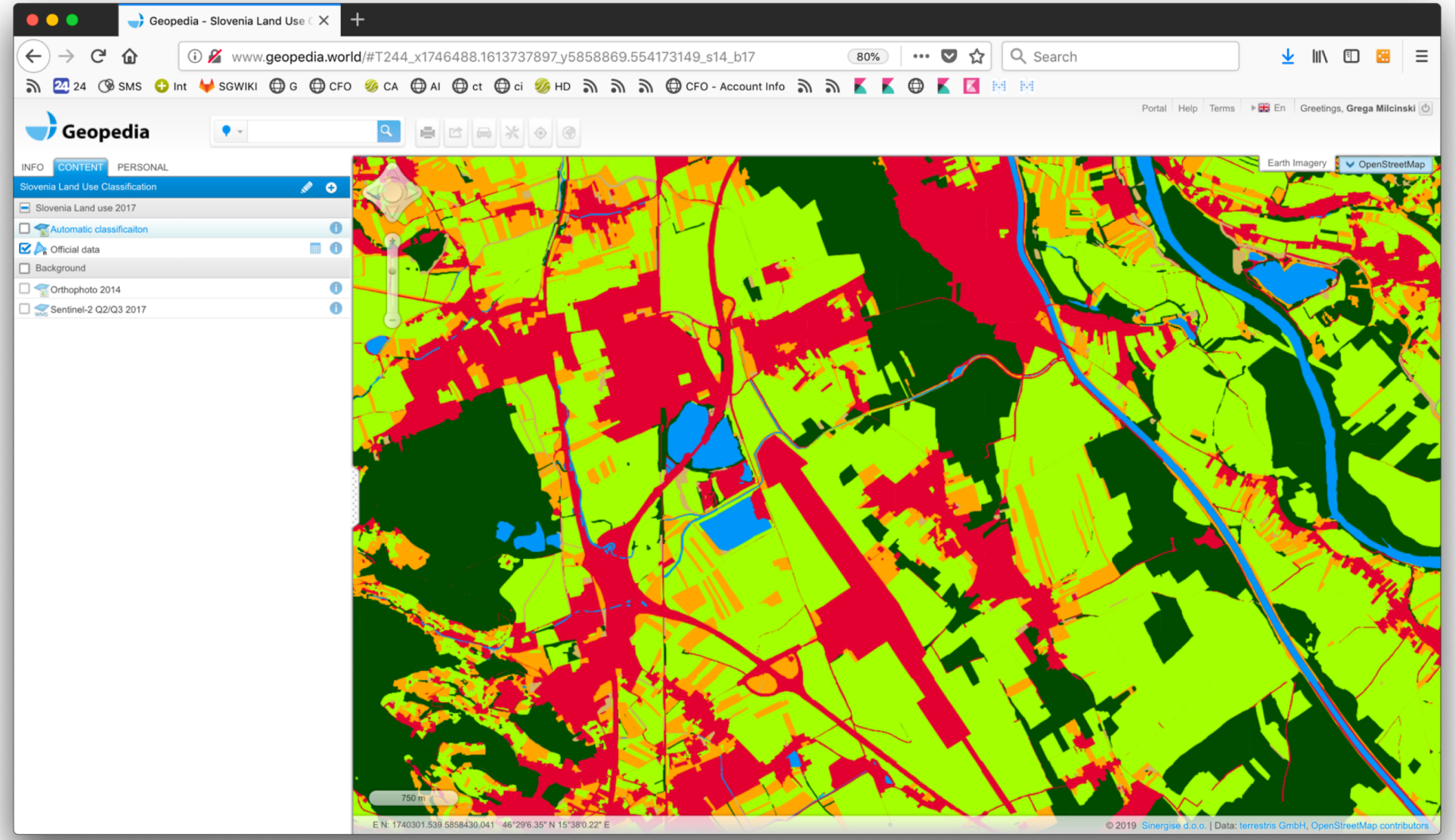
fig.subplots_adjust(wspace=0, hspace=0)

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='')))
```

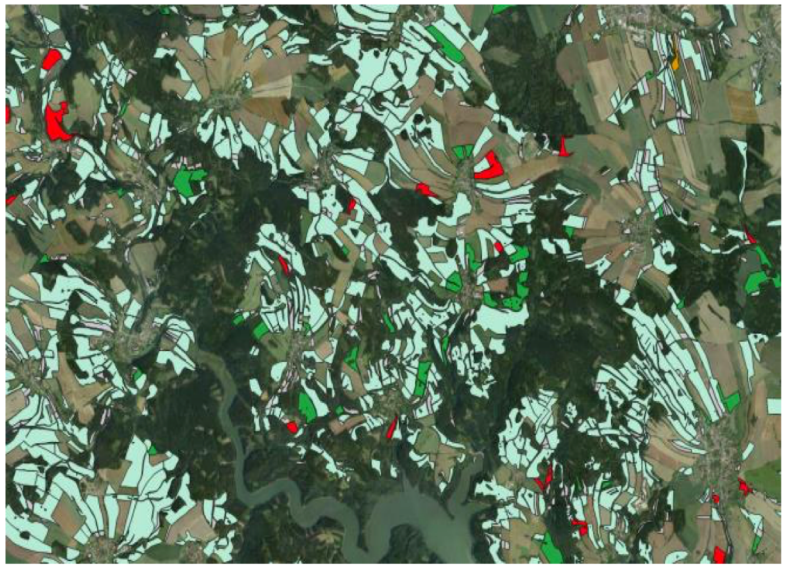


Land use / land cover example

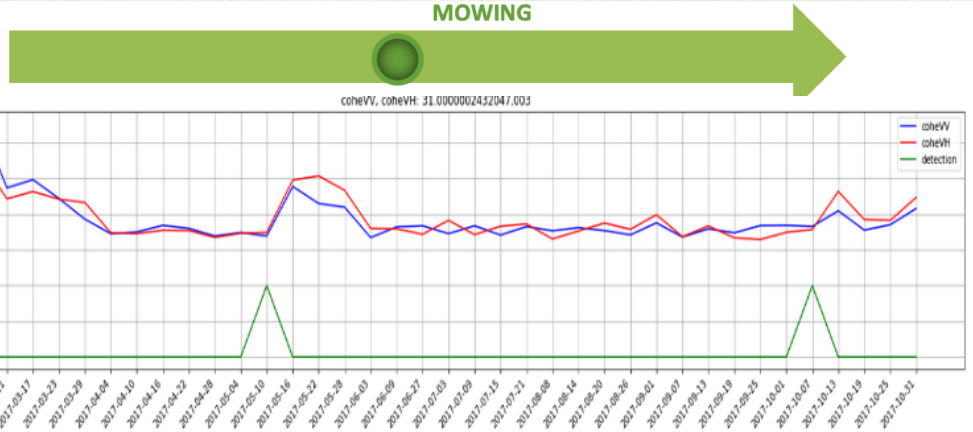


Mowing detection

Grassland mowing detection from S1 & S2
Czech Republic

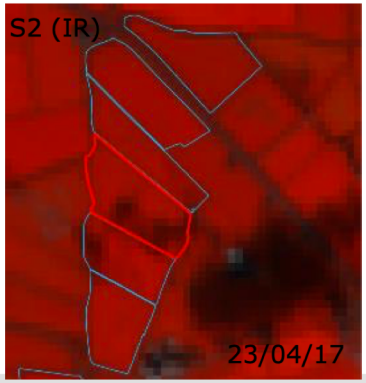


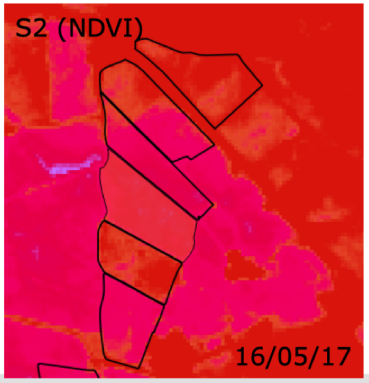
Not assessed
Agreement (mowing in the period)
No agreement (no mowing)
Agreement (mowing in the period + other)
No agreement (mowing outside the period)

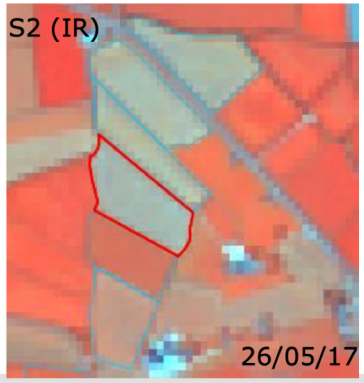


Coherence during the mowing

Coherence after the mowing

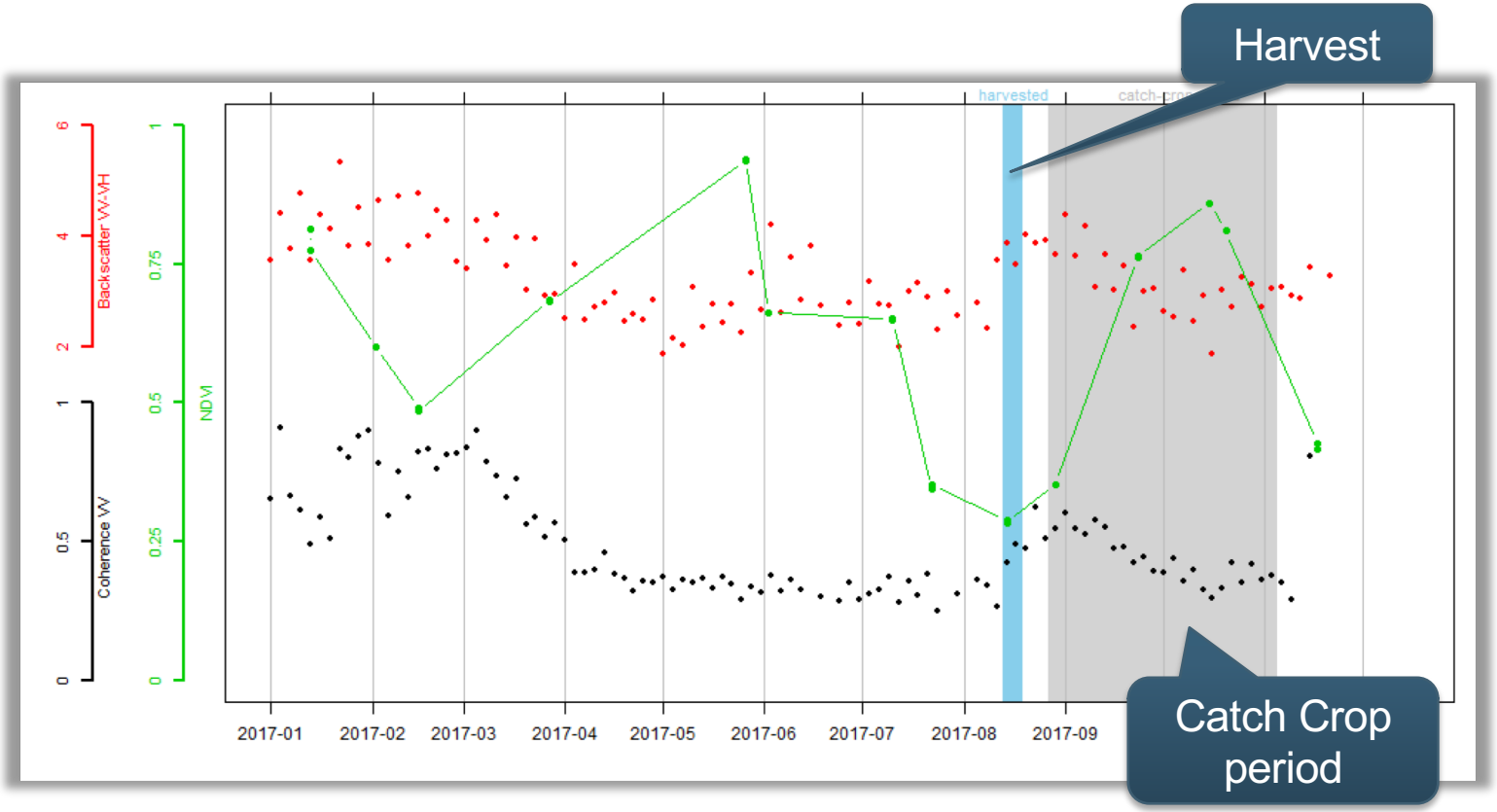






ESA UNCLASSIFIED - For Official Use

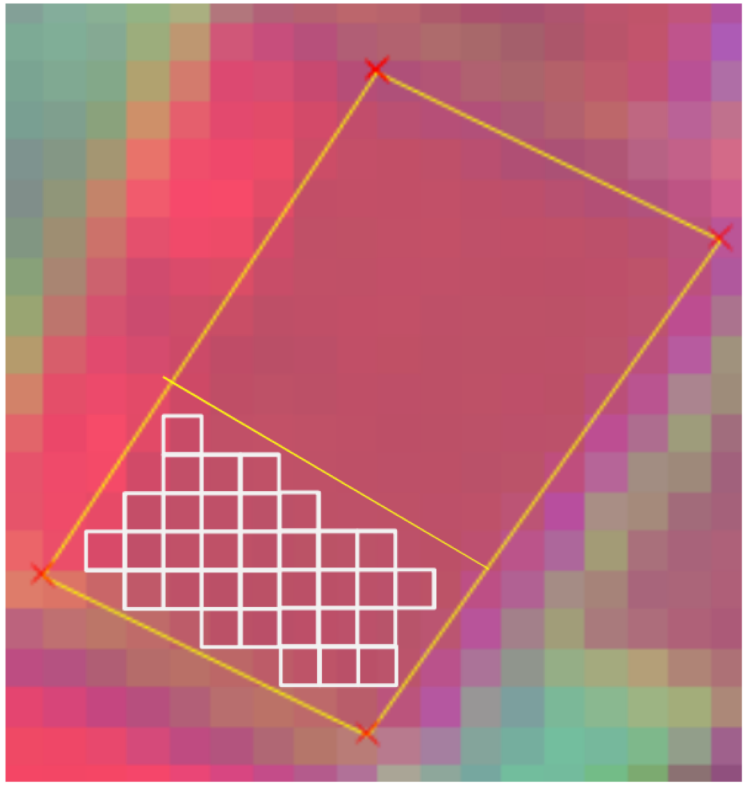
Agricultural practices



Physical markers to monitor EFA agricultural practices

Minimum area

Sentinel-2 geometric resolution vs parcel size



- Parcel area: 0.5 ha
- Full internal pixels: 33 (0.33 ha)

- Thematic information all the year long can be retrieved by Sentinel-2 data on parcels with area of 0.5 ha and even less

e-geos
AN ASI / TELESPAZIO COMPANY

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Ground truth data

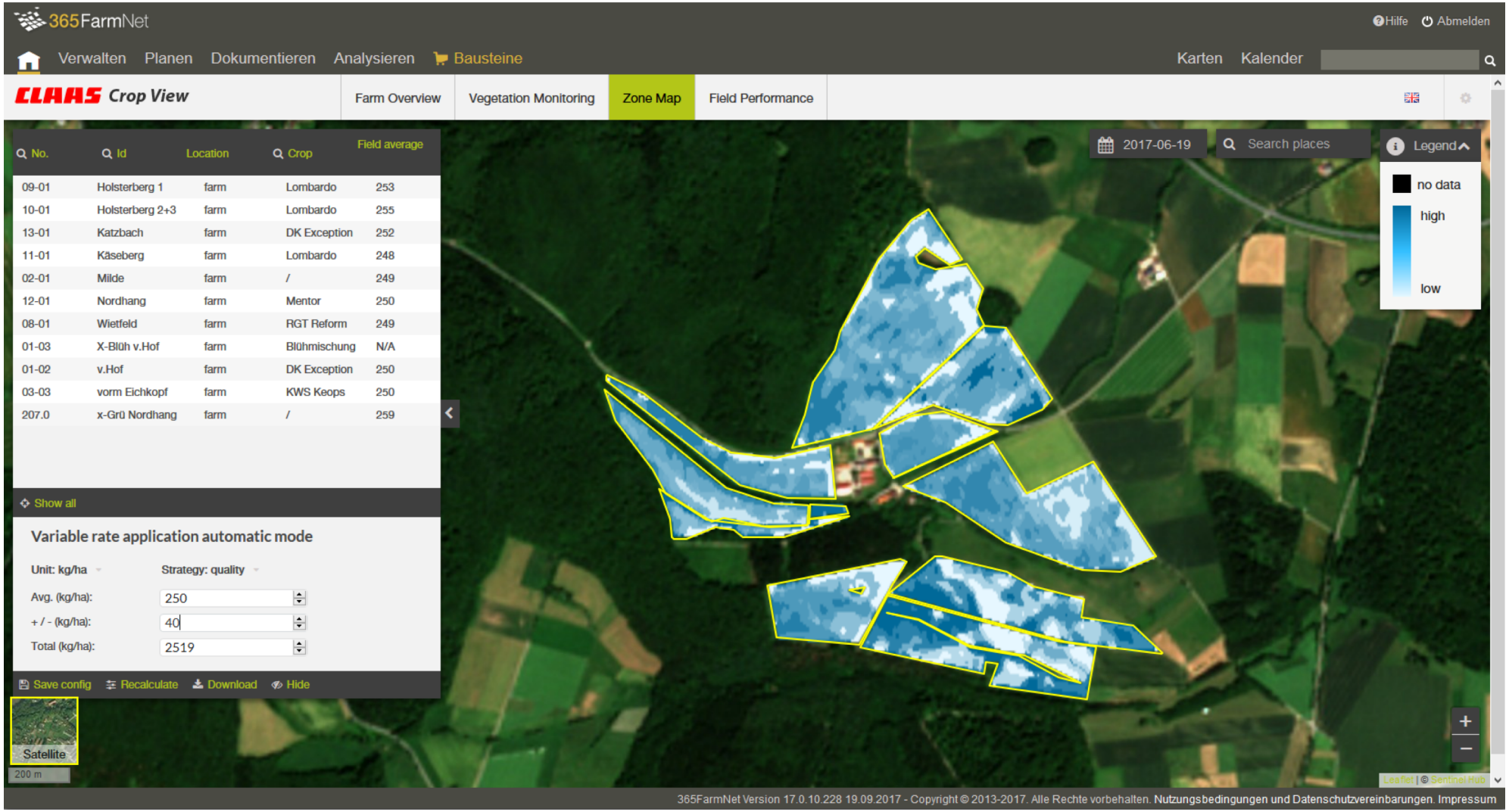
- Check by monitoring -> finding outliers
- Claimless system – proper ground truthing

Other data sources

- VHR commercial imagery
- Drone imagery
- Planet data

Planet data




365FarmNet
Hilfe
Abmelden
Verwalten
Planen
Dokumentieren
Analysieren
Bausteine
Karten
Kalender
CLAAS Crop View
Farm Overview
Vegetation Monitoring
Zone Map
Field Performance
No.
Id
Location
Crop
Field average
09-01 Holsterberg 1 farm Lombardo 253
10-01 Holsterberg 2+3 farm Lombardo 255
13-01 Katzbach farm DK Exception 252
11-01 Käseberg farm Lombardo 248
02-01 Milde farm / 249
12-01 Nordhang farm Mentor 250
08-01 Wietfeld farm RGT Reform 249
01-03 X-Blüh v.Hof farm Blühmischung N/A
01-02 v.Hof farm DK Exception 250
03-03 vorm Eichkopf farm KWS Keops 250
207.0 x-Grü Nordhang farm / 259
Show all
Variable rate application automatic mode
Unit: kg/ha
Strategy: quality
Avg. (kg/ha): 250
+ / - (kg/ha): 40
Total (kg/ha): 2519
Save config
Recalculate
Download
Hide
Satellite
200 m
2017-06-19
Search places
Legend
no data
high
low
Leaflet | © Sentinel Hub
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Farm sustainability tool

- Article 12.3: “Member States shall establish a system for providing the Farm Sustainability Tool for Nutrients referred to in Annex III, with the minimum content and functionalities defined therein, to beneficiaries, who shall use the Tool.



