Remote Sensing

A key technology for a sustainable world*

**because we measure stuff*

vito
remote sensing

Steven Krekels - Unit Manager VITO Remote Sensing

vito
remote sensing

Agenda

- Intro VITO & VITO remote sensing
- Earth Observation the basics
- Generic Examples
- From global to local Agriculture

VITO &
VITO REMOTE SENSING


vito
remote sensing
ACCELERATING the transition
to a SUSTAINABLE world
Sustainable Energy Supply,
(Re)use Of Raw Materials,
Food Security,
Circular Economy,
Quality Of Life
We believe in the power of technology,
economic dynamics and the creativity of
people to leverage things.

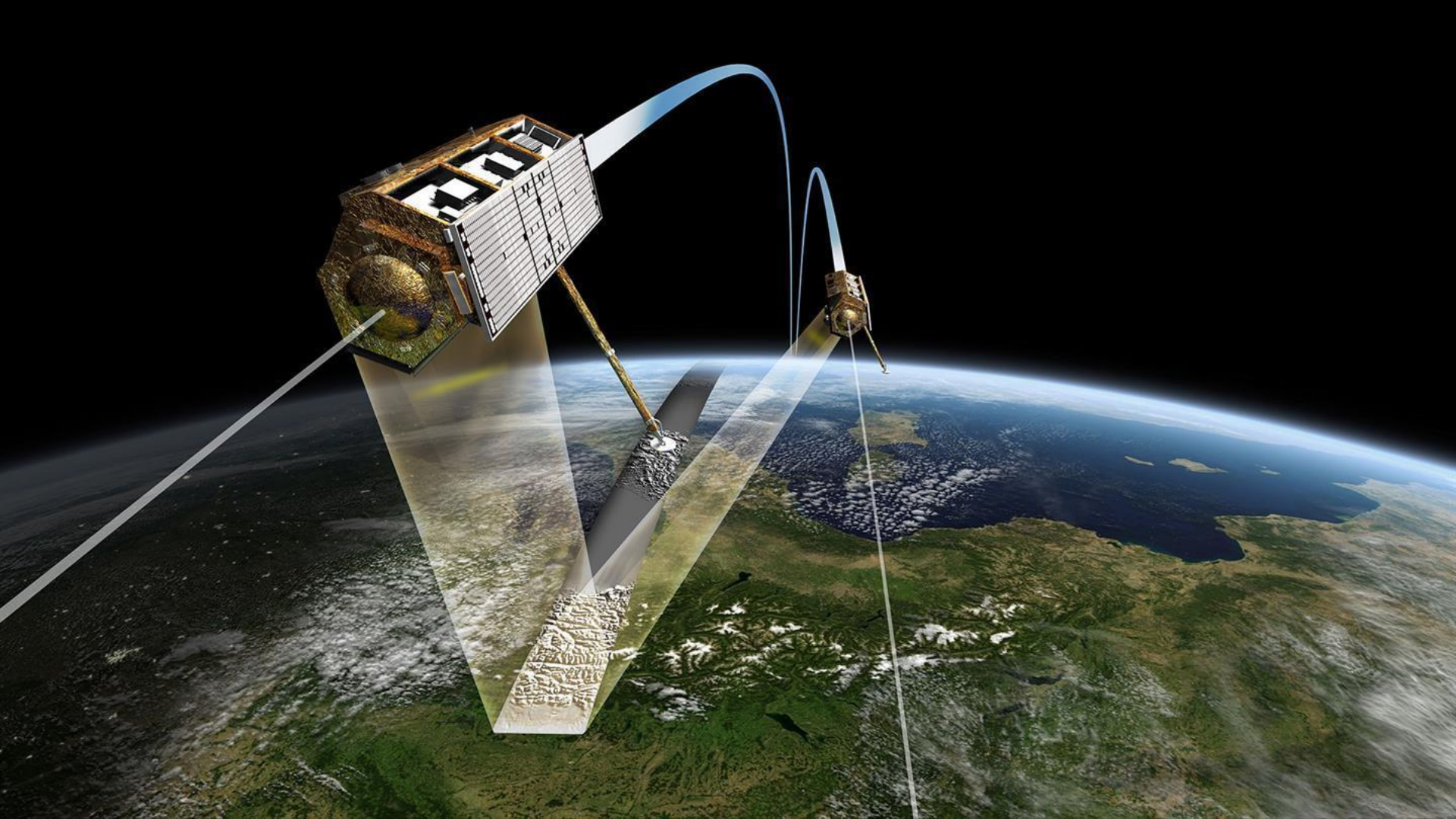

PEOPLE
PLANET
PROFIT


PEOPLE
PLANET
INNOVATION
vito
PROFIT

SPACE ECONOMY

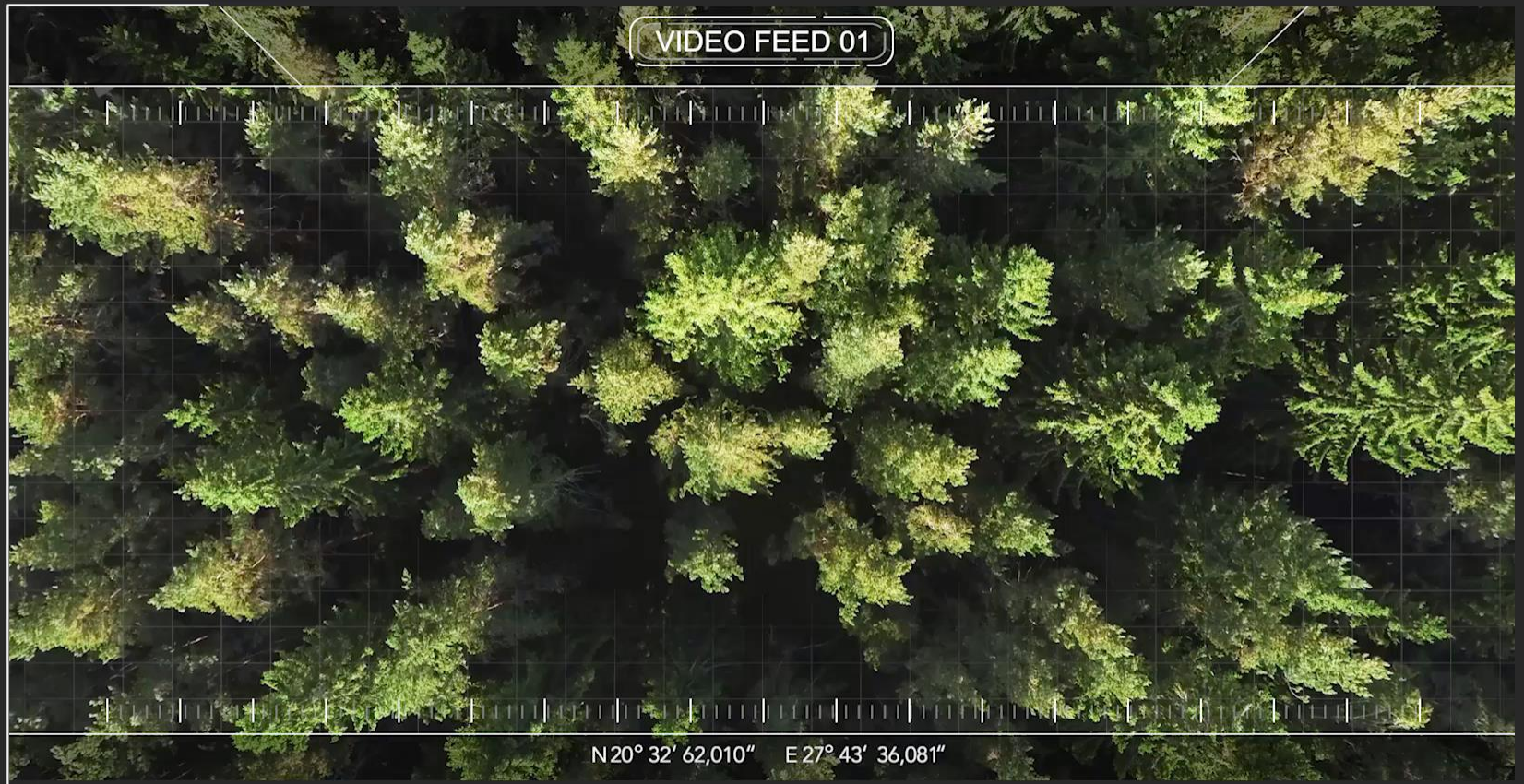
LOW ORBIT IS OPEN FOR BUSINESS

vito
remote sensing




QUANTUM COMPUTABILITY
VECTORS
QUANTUM ALGORITHMS
QUANTUM SUPREMACY
ENTANGLEMENT
SPACE-TIME
ERROR CORRECTION
ALGORITHMS
STOCHASTIC MATRICES
QUBITS
INTEGER FACTORIZATION
TWO STATES AT ONCE
STATES
OPTICAL LATTICES

Multi-disciplinary is the new technical


VIDEO FEED 01
N 20° 32’ 62,010” E 27° 43’ 36,081”

VITO Remote Sensing – Space Economy

Have a look at our introduction video with guest speaker astronaut Frank De Winne:

https://vimeo.com/vitovideo/space-economy

Platforms

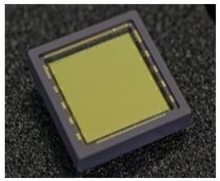

UAV

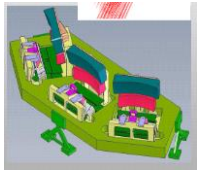

AIRBORN


HALE UAV


SATELLITE

Sensors





Value Added Services & Information Products

Markets


Agriculture


Landuse & Biodiversity


Climate


Water & Coast


Infrastructure


Security

vito remote sensing

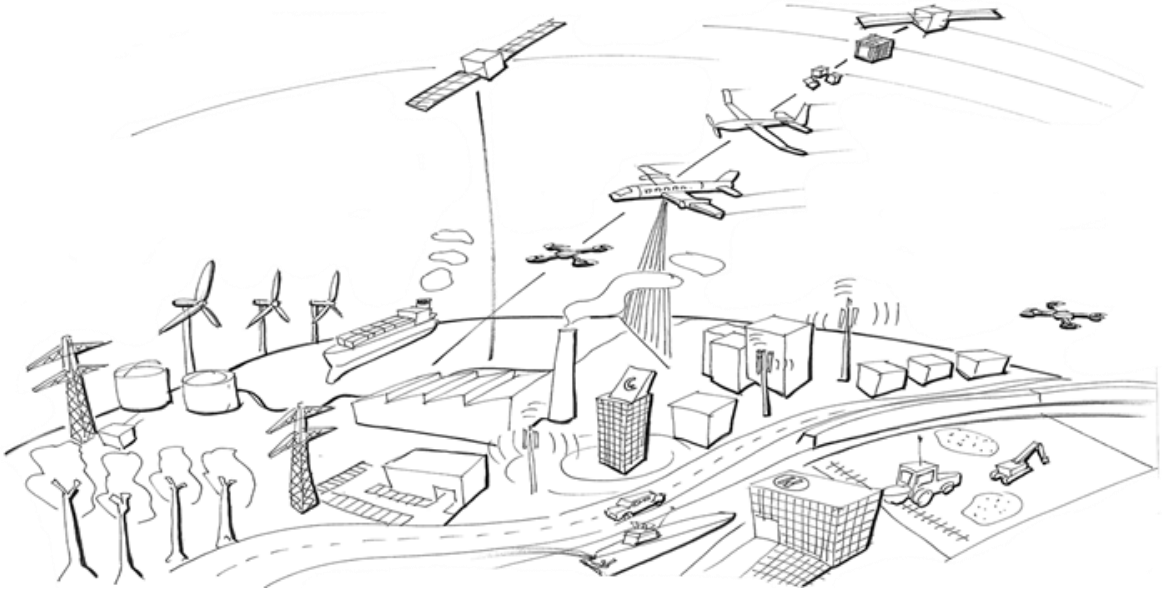
remotesensing.vito.be


OBJECTIFY
DATAFY
ANALYSE
vito
remote sensing

EARTH OBSERVATION BASICS

SEE THE BIGGER PICTURE

REMOTE SENSING: A TALE OF CHOICES



Spatial Resolution

- From km's
- Over m's
- To cm's
- And even(sub)mm's
- …

Temporary revisit

- Once a year / month / week / day
- Multiple times/day
- Continues & real time
- …

Data Type

- Optical
- SAR
- LiDAR
- Thermal
- Multi- & Hyper Spectral
- …

vito remote sensing


2019 @ 10 m
0
30 m

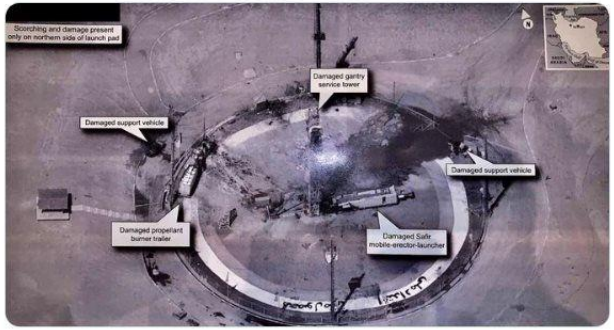

2019 @ 2 m


2019 @ 20 cm

How low can we go?

Donald J. Trump
@realDonaldTrump

The United States of America was not involved in the catastrophic accident during final launch preparations for the Safir SLV Launch at Semnan Launch Site One in Iran. I wish Iran best wishes and good luck in determining what happened at Site One.



6:44 pm · 30 Aug 2019 · Twitter for iPhone

Dr Marco Langbroek 💉 x2 #Vaccinate
@Marco_Langbroek

So the position of the satellite at 09:44:23 was taken, and in STK I let the viewq from the satellite point towards the launch platform. That yielded this. It is a very good match so there is no doubt in my mind that it is an image taken by USA 224.

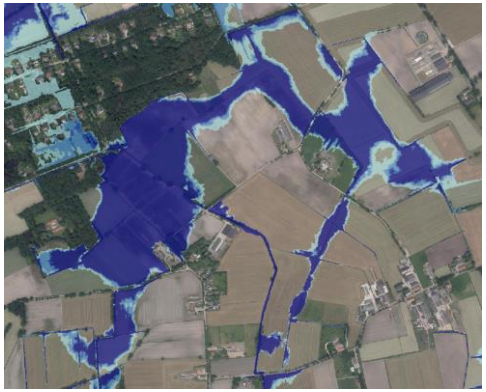
4:39 PM · Aug 31, 2019

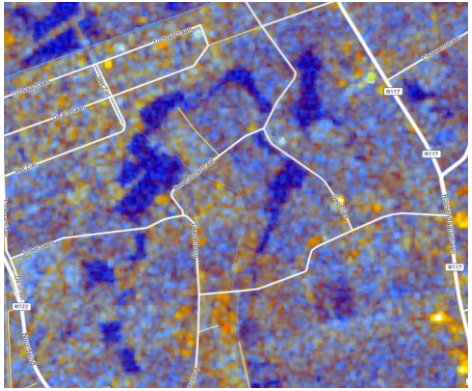
Cees Bassa
@cgbassa

Google Earth shows that the launch pad is about 60m in diameter, while the launch pad is about 600 pixels wide in the picture. That suggests a resolution of at least 10cm per pixel, as the original image could have had a higher resolution.

1:57 AM · Aug 31, 2019

OPTICAL – LIDAR - SAR





THE GOOD NEWS: (SOME OF) THE DATA IS OPEN & FREE!

Land

Marine

Atmosphere

Emergency

Security

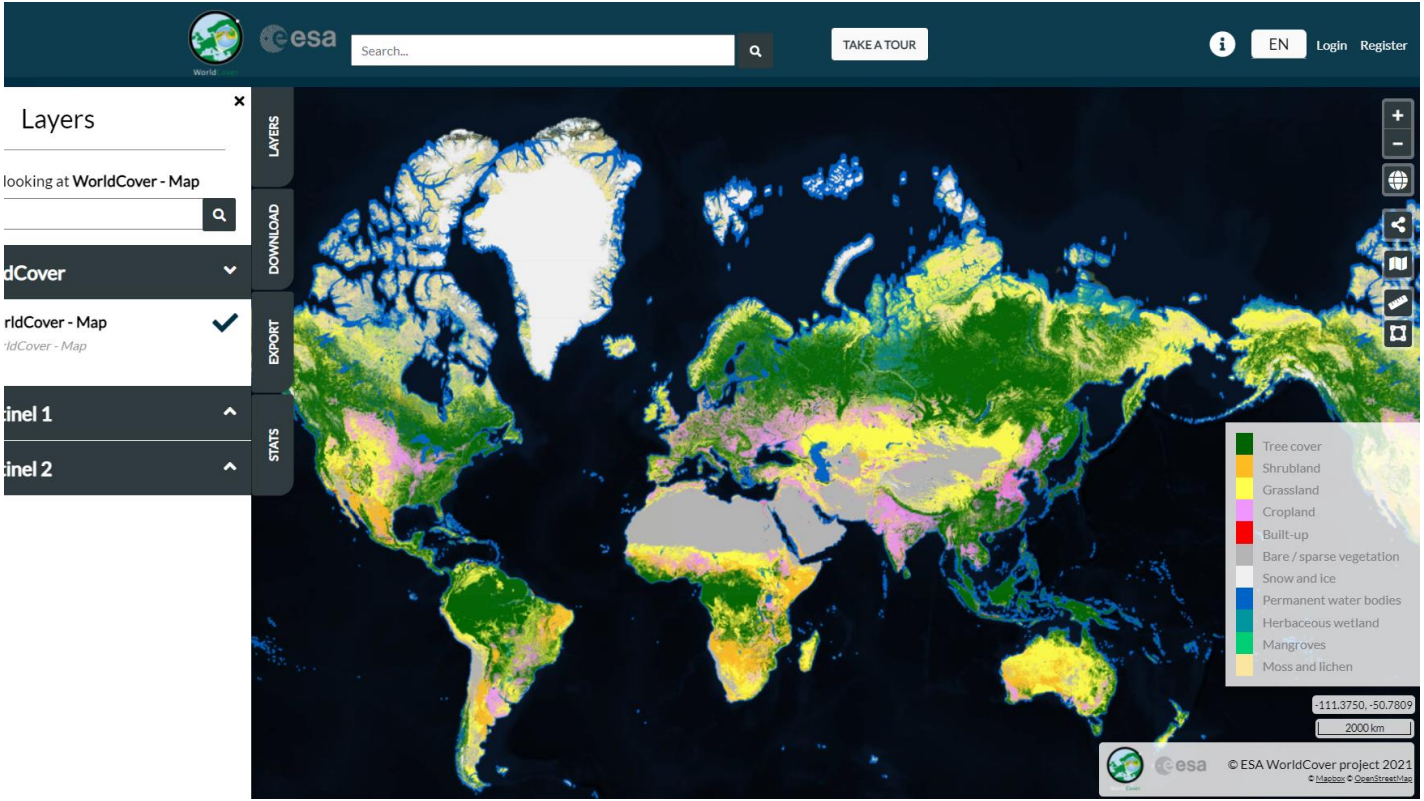
Climate Change

vito remote sensing

www.terrascope.be

remotesensing.vito.be

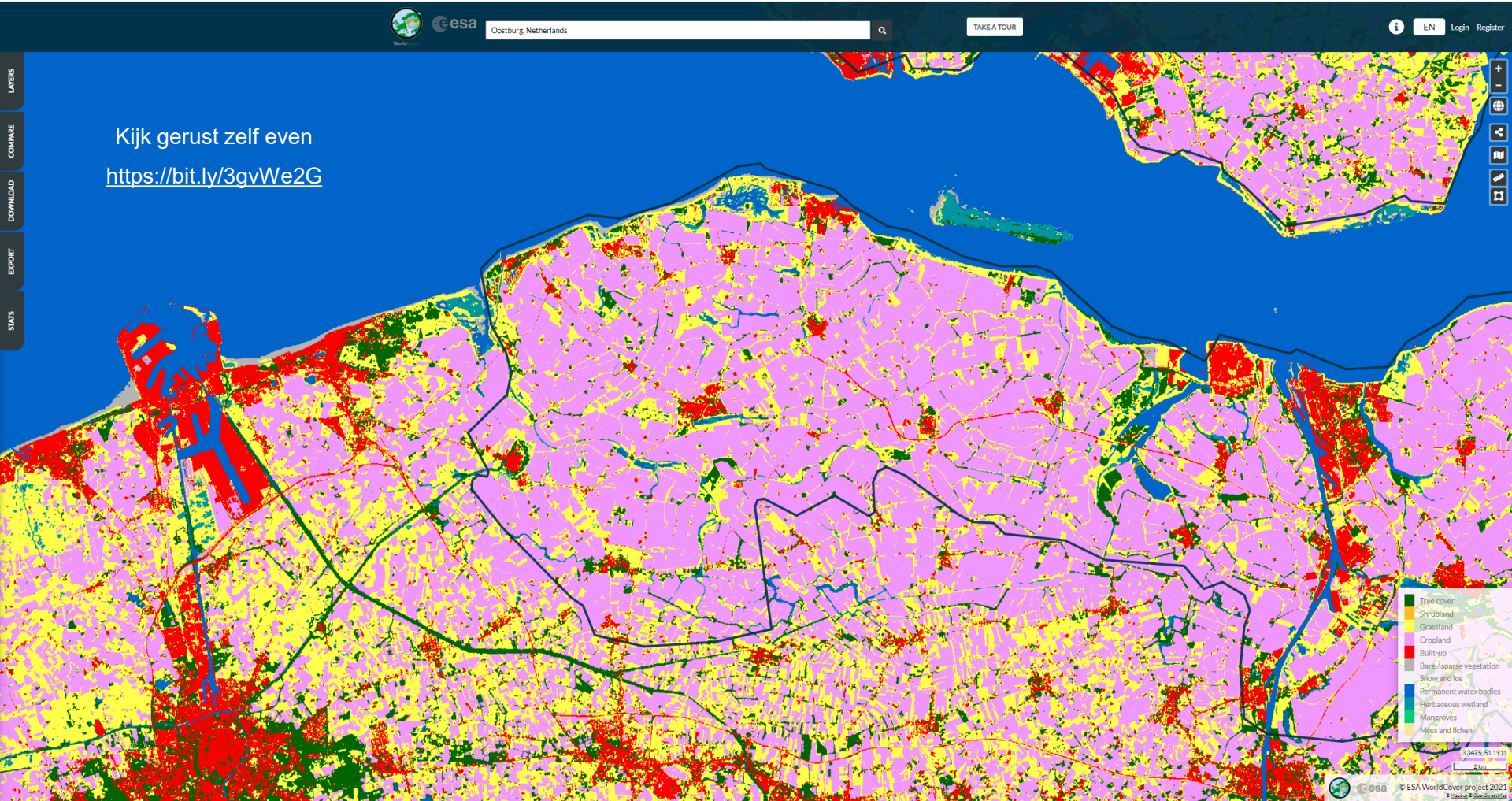
WORLDCOVER: FIRST GLOBAL LAND USE MAP AT 10M

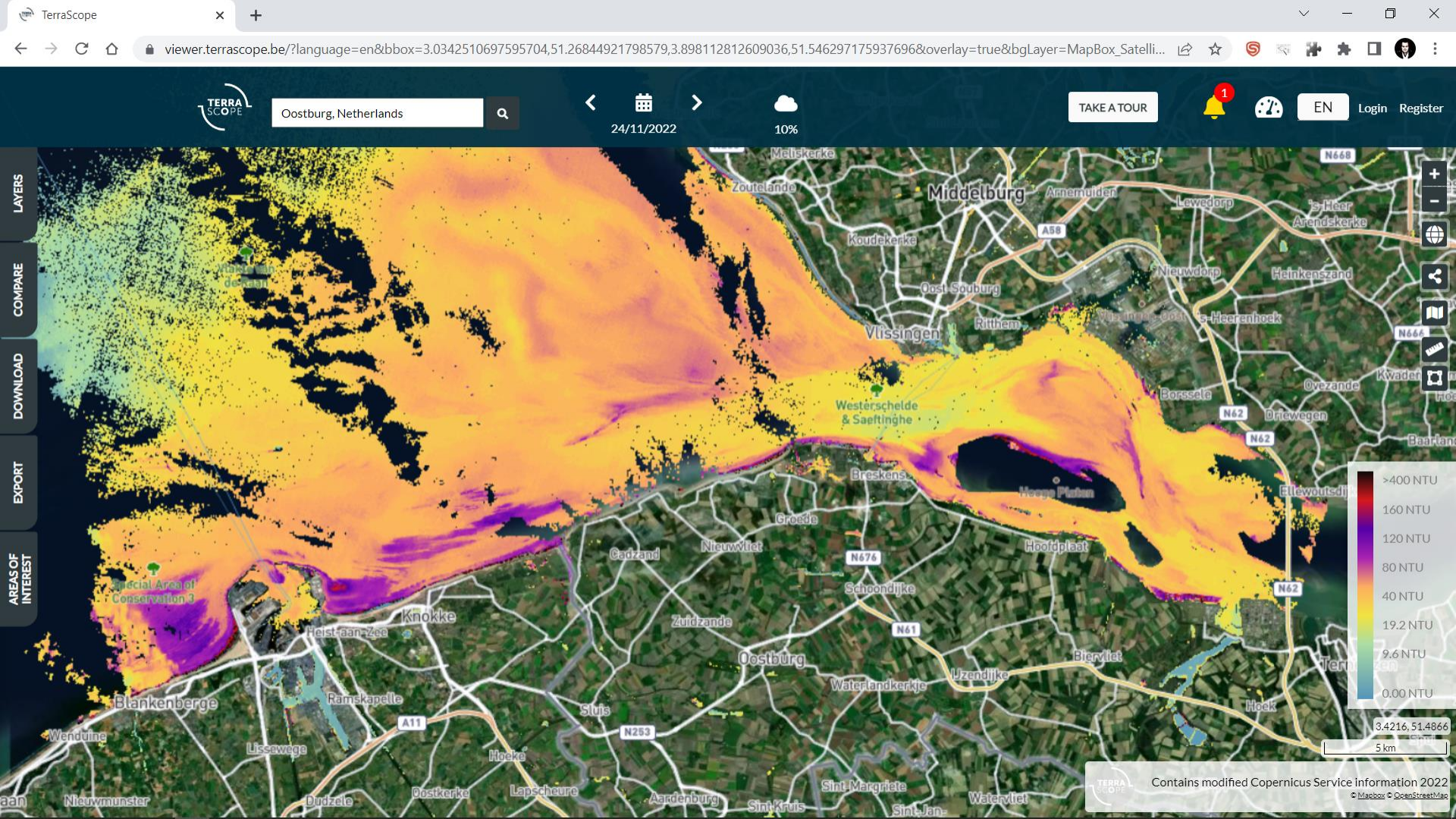


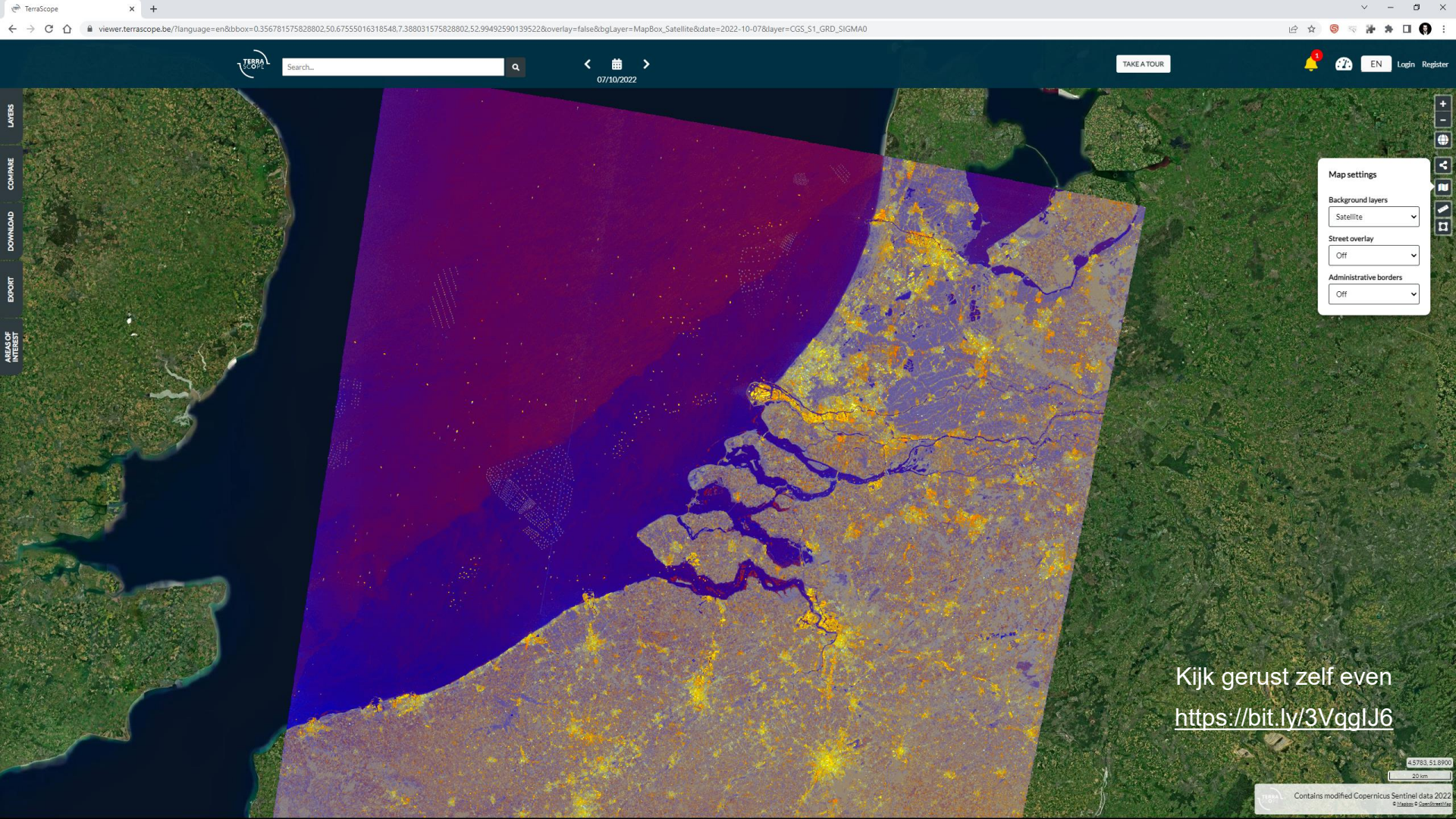
WorldCover 2020 & 2021 available for free at https://viewer.esa-worldcover.org/worldcover/

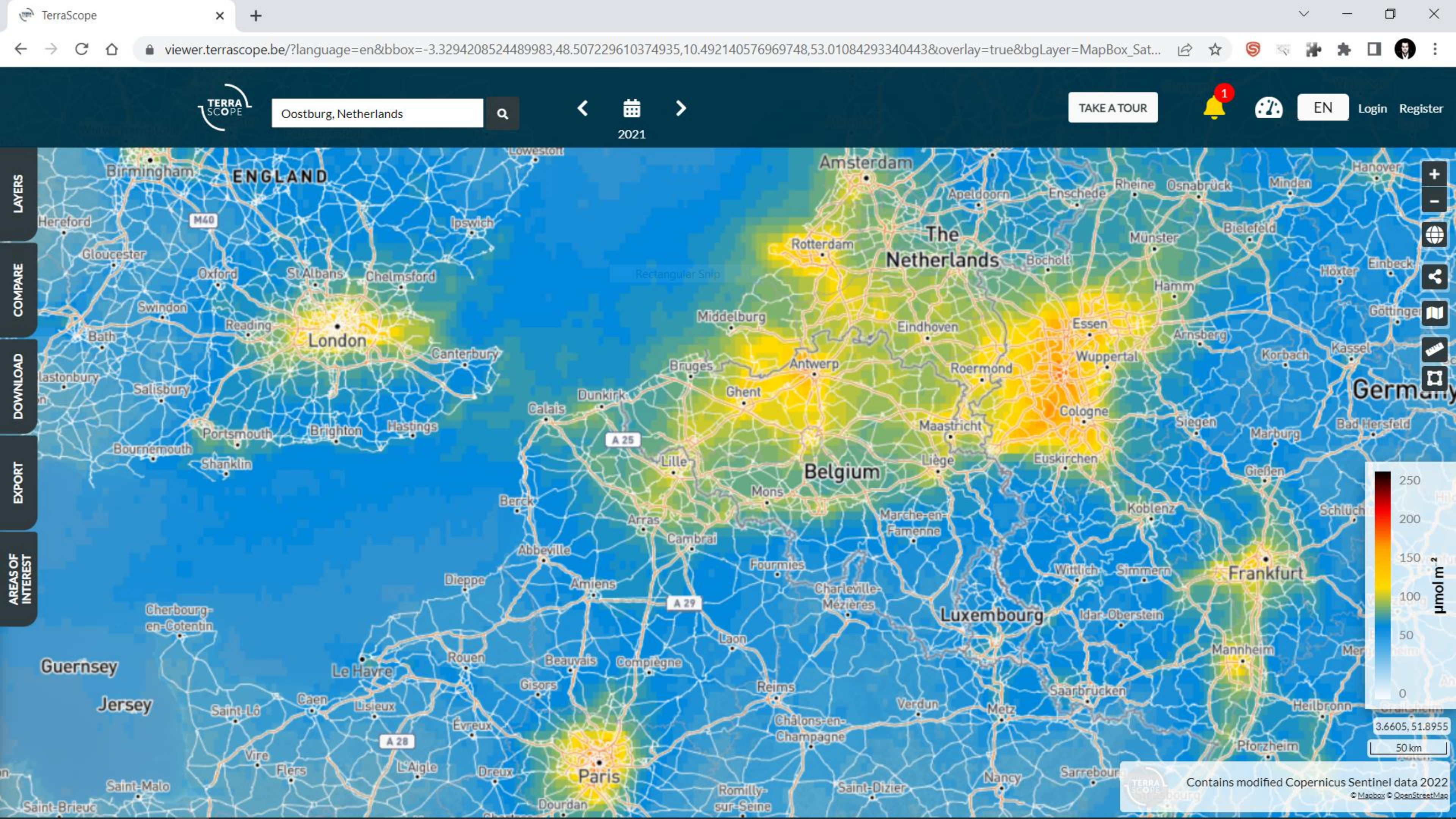
remotesensing.vito.be


WorldCover Viewer
viewer.esa-worldcover.org/worldcover/?language=en&bbox=-1.8606624237561793,50.023582591149534,12.441096226920 96,54.68255410301648 6&overlay=false&bgLayer=MapBox_Satellite&date=2022-11-24&layer=WORLDCOVER_2021_MAP
esa
Oostburg, Netherlands
TAKE A TOUR
EN
Login
Register
Statistics
2021
Netherlands
Netherlands
Tree cover
Shrubland
Grassland
Cropland
Built-up
Bare / sparse vegetation
Permanent water bodies
Herbaceous wetland
Mangroves
0
10
20
30
40
50
Percentage
Highcharts.com
LAYERS
COMPARE
DOWNLOAD
EXPORT
STATS
Tree cover
Shrubland
Grassland
Cropland
Built-up
Bare / sparse vegetation
Snow and ice
Permanent water bodies
Herbaceous wetland
Mangroves
Moss and lichen
1.8880, 50.1705
50 km
© ESA WorldCover project 2021


Oostburg, Netherlands
TAKE A TOUR
EN
Login
Register
LAYERS
COMPARE
DOWNLOAD
EXPORT
STATS
Kijk gerust zelf even
https://bit.ly/3gvWe2G
Tree cover
Shrubland
Grassland
Cropland
Built-up
Bare / sparse vegetation
Snow and ice
Permanent water bodies
Herbaceous wetland
Mangroves
Moss and lichen
© ESA WorldCover project 2021

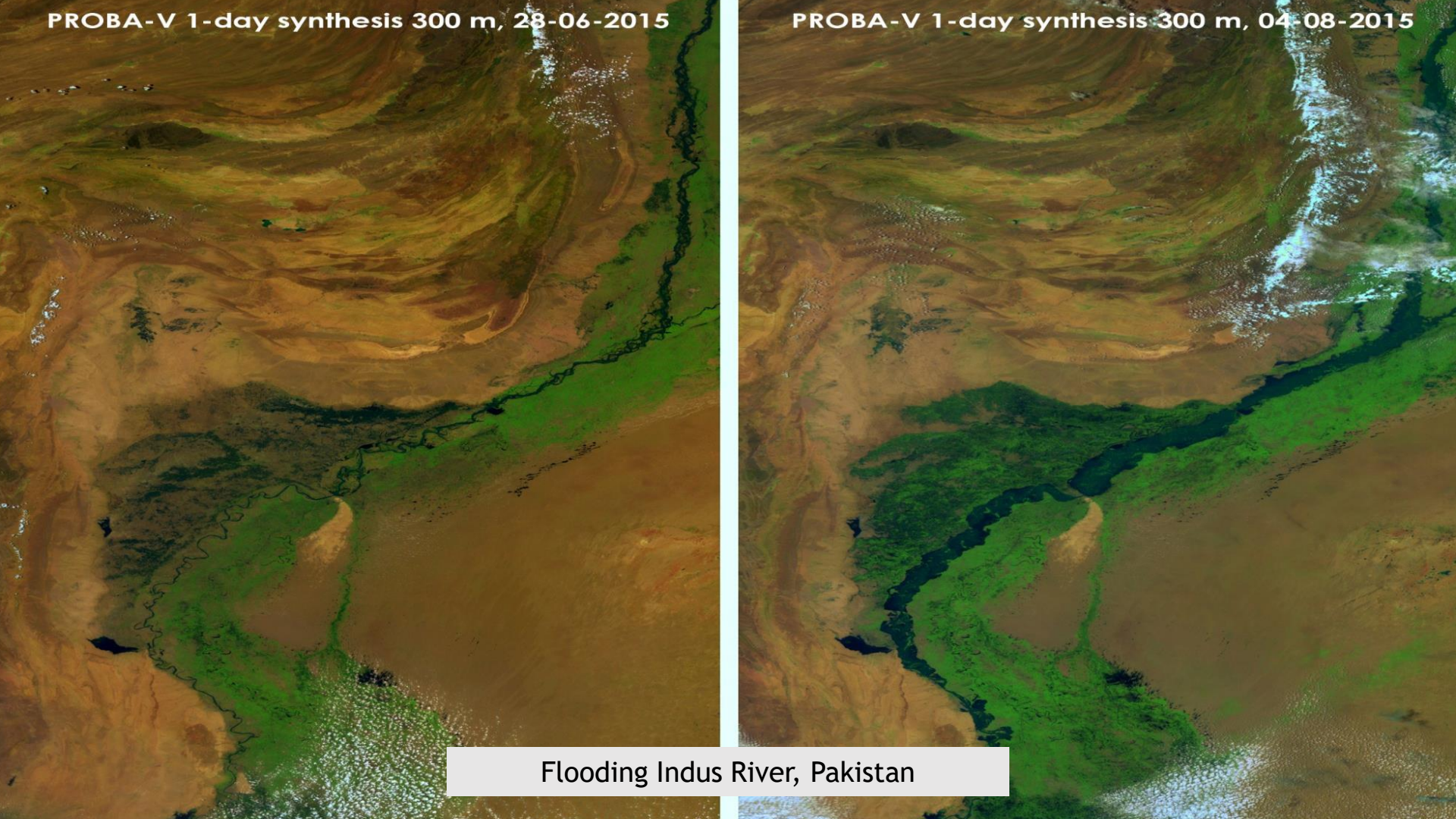

TerraScope
viewer.terrascope.be/?language=en&bbox=3.0342510697595704,51.26844921798579,3.898112812609036,51.546297175937696&overlay=true&bgLayer=MapBox_Satelli...
TERRA SCOPE
Oostburg, Netherlands
24/11/2022
10%
TAKE A TOUR
1
EN
Login
Register
LAYERS
COMPARE
DOWNLOAD
EXPORT
AREAS OF INTEREST
Middelburg
Vlissingen
Westerschelde & Saeftinghe
Knokke
Heist-aan-Zee
Blankenberge
Oostburg
Zuidzande
Cadzand
Nieuwvliet
Breskens
Hoofdplaat
Schoondijke
Biervliet
Uzendijke
Waterlandkerkje
Sluis
Ramskapelle
Wenduine
Lissewege
Nieuwmunster
Oostkerke
Lapscheure
Aardenburg
Sint-Kruis
Watervliet
Hoek
Special Area of Conservation 3
>400 NTU
160 NTU
120 NTU
80 NTU
40 NTU
19.2 NTU
9.6 NTU
0.00 NTU
3.4216, 51.4866
5 km
Contains modified Copernicus Service information 2022
© Mapbox © OpenStreetMap


TerraScope
viewer.terrascope.be/?language=en&bbox=0.356781575828802,50.675550163185 48,7.388031575828802,52.99492590139522&overlay=false&bgLayer=MapBox_Satellite&date=2022-10-07&layer=CGS_S1_GRD_SIGMA0
TERRASCOPE
Search...
07/10/2022
TAKE A TOUR
EN
Login
Register
LAYERS
COMPARE
DOWNLOAD
EXPORT
AREAS OF INTEREST
Map settings
Background layers
Satellite
Street overlay
Off
Administrative borders
Off
Kijk gerust zelf even
https://bit.ly/3VqgIJ6
4.5783, 51.8900
20 km
Contains modified Copernicus Sentinel data 2022


TerraScope
viewer.terrascope.be/?language=en&bbox=-3.3294208524489983,48.507229610374935,10.492140576969748,53.01084293340443&overlay=true&bgLayer=MapBox_Sat...
TERRA SCOPE
Oostburg, Netherlands
2021
TAKE A TOUR
1
EN
Login
Register
LAYERS
COMPARE
DOWNLOAD
EXPORT
AREAS OF INTEREST
ENGLAND
London
Birmingham
Amsterdam
Rotterdam
The Netherlands
Middelburg
Eindhoven
Antwerp
Bruges
Ghent
Essen
Wupppertal
Roermond
Cologne
Maastricht
Belgium
Lille
Dunkirk
Calais
Liège
Luxembourg
Frankfurt
Paris
Guernsey
Jersey
Germany
250
200
150
100
50
0
µmol m⁻²
3.6605, 51.8955
50 km
Contains modified Copernicus Sentinel data 2022
© Mapbox © OpenStreetMap

EXAMPLES & EXAMPLES

vito
remote sensing

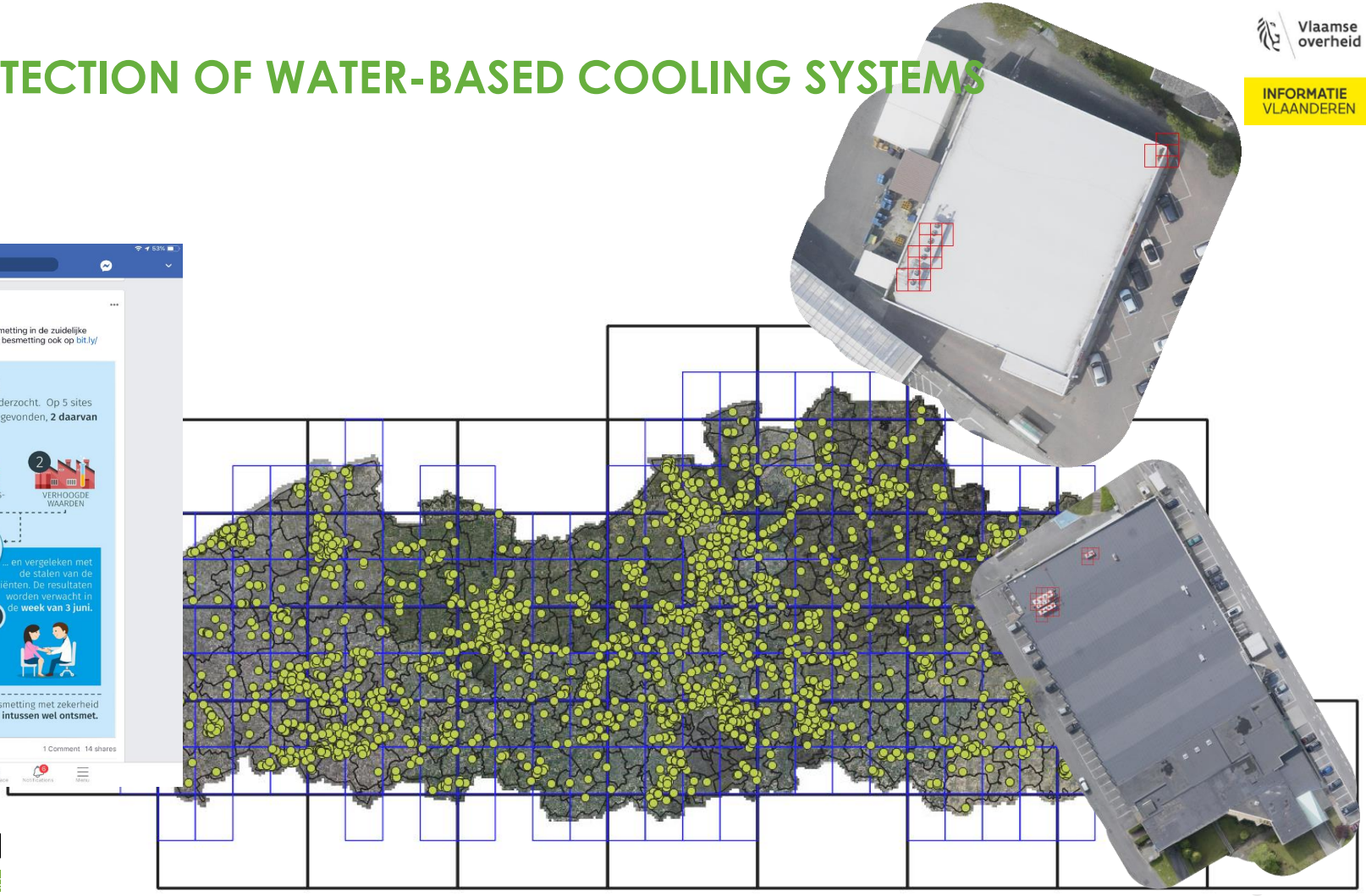


Flooding Indus River, Pakistan

DETECTION OF WATER-BASED COOLING SYSTEMS

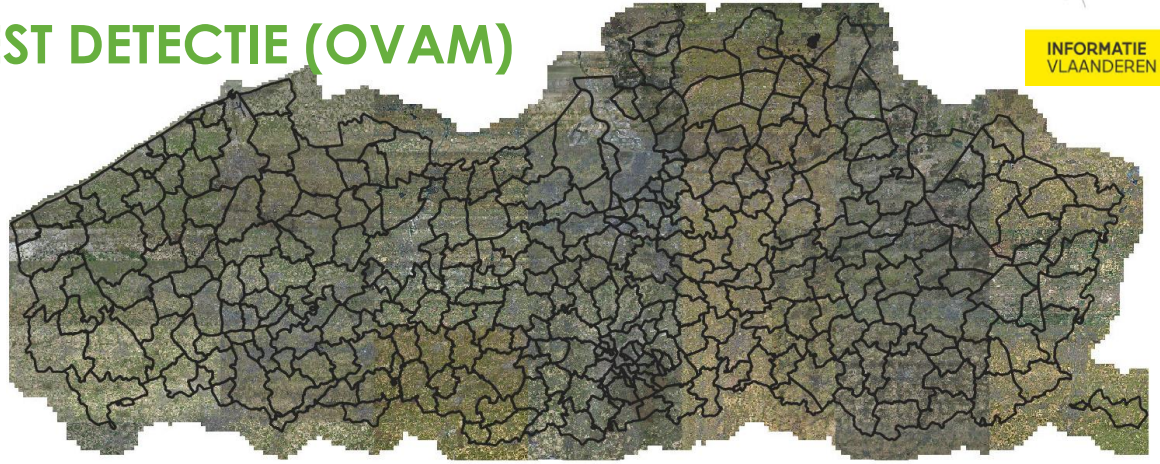
Vlaamse overheid

INFORMATIE VLAANDEREN

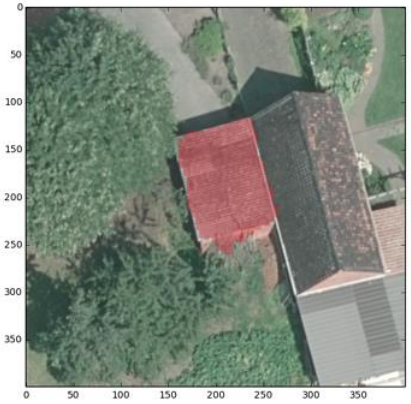


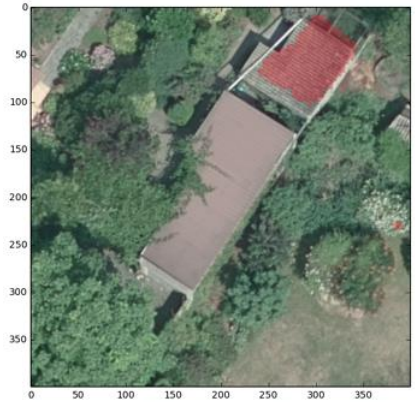
vito remote sensing

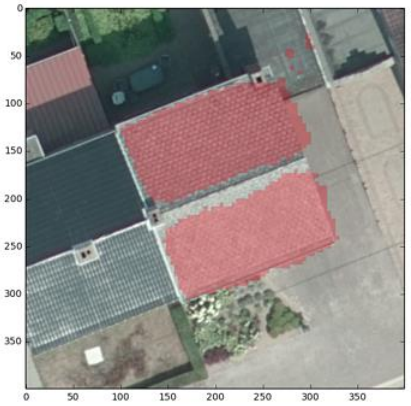
LUCHTBEELDEN ASBEST DETECTIE (OVAM)



AI – based detection of
Asbestos roof material



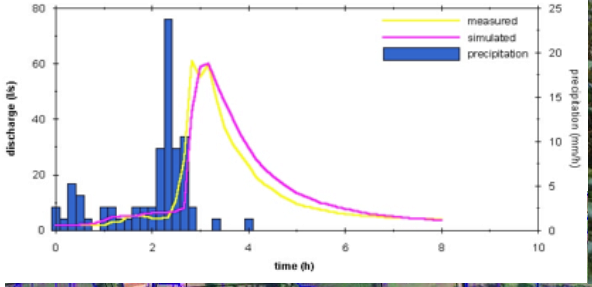


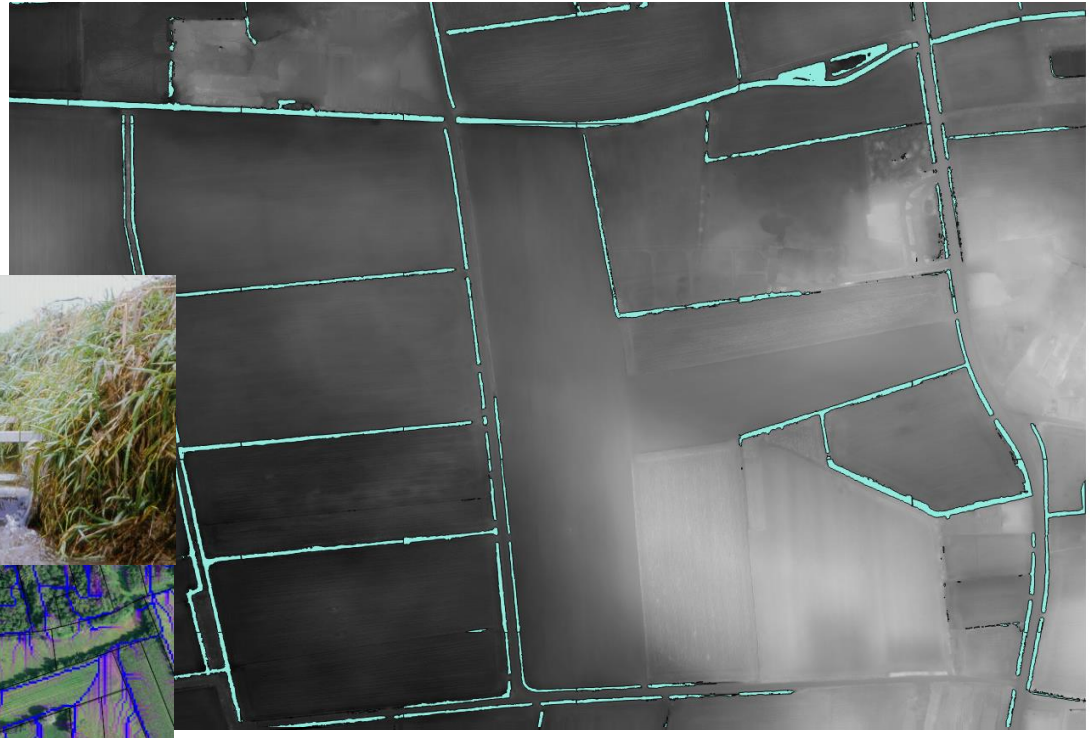


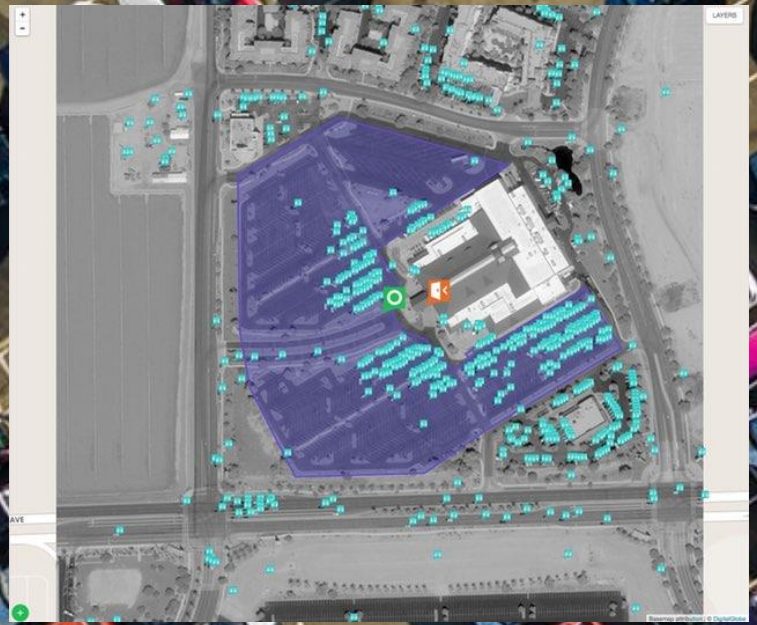
MAPPING OF SMALL DITCHES

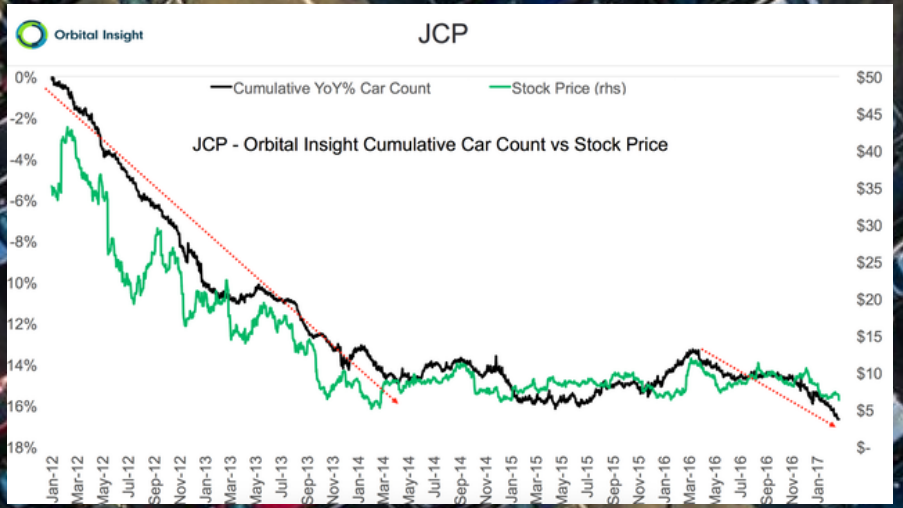
Vlaamse Milieu Maatschappij (VMM)

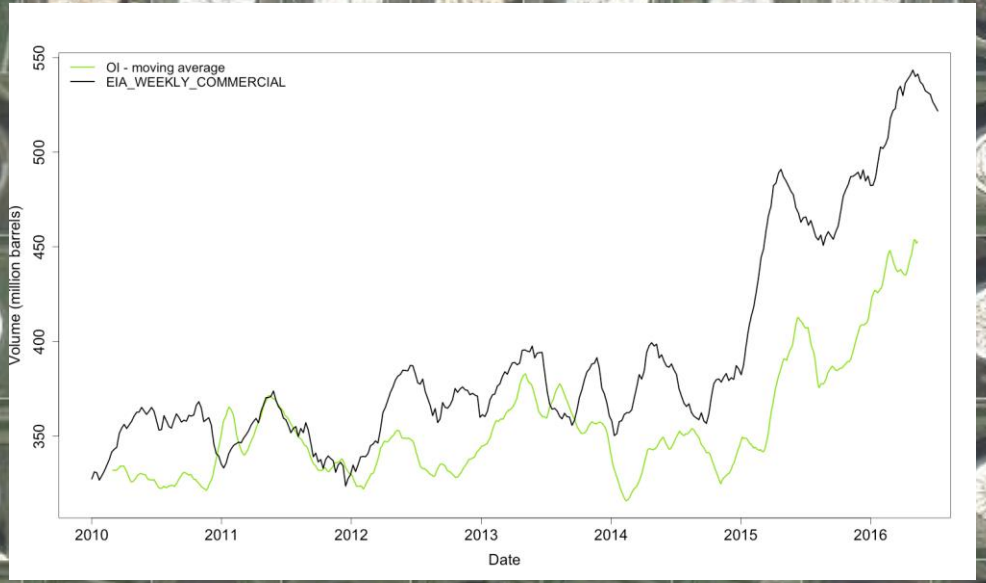
AI – based (semantic segmentation) mapping of small ditches ➔ hydrological modelling








Orbital Insight
JCP
Cumulative YoY% Car Count
Stock Price (rhs)
JCP - Orbital Insight Cumulative Car Count vs Stock Price
0%
-2%
-4%
-6%
-8%
10%
12%
14%
16%
18%
$50
$45
$40
$35
$30
$25
$20
$15
$10
$5
$-
Jan-12
Mar-12
May-12
Jul-12
Sep-12
Nov-12
Jan-13
Mar-13
May-13
Jul-13
Sep-13
Nov-13
Jan-14
Mar-14
May-14
Jul-14
Sep-14
Nov-14
Jan-15
Mar-15
May-15
Jul-15
Sep-15
Nov-15
Jan-16
Mar-16
May-16
Jul-16
Sep-16
Nov-16
Jan-17


OI - moving average
EIA_WEEKLY_COMMERCIAL
Volume (million barrels)
350
400
450
500
550
2010
2011
2012
2013
2014
2015
2016
Date

AGRICULTURE

REMOTE SENSING DRIVEN DATA SCIENCE 4 AGROFOOD

Genomic selection
Trait/product development

Breeding data

Seed production data

Farmers data
Market data
Competitor data
Agroclimat variables

Regional & Global trends
Agro climate variables

vito
remote sensing

remotesensing.vito.be

Key to more sustainable farming

Provide data driven advice

Understand GxE(xM)

Genomic selection
Trait/product development

Breeding data

Seed production data

Farmers data
Market data
Competitor data
Agroclimat variables

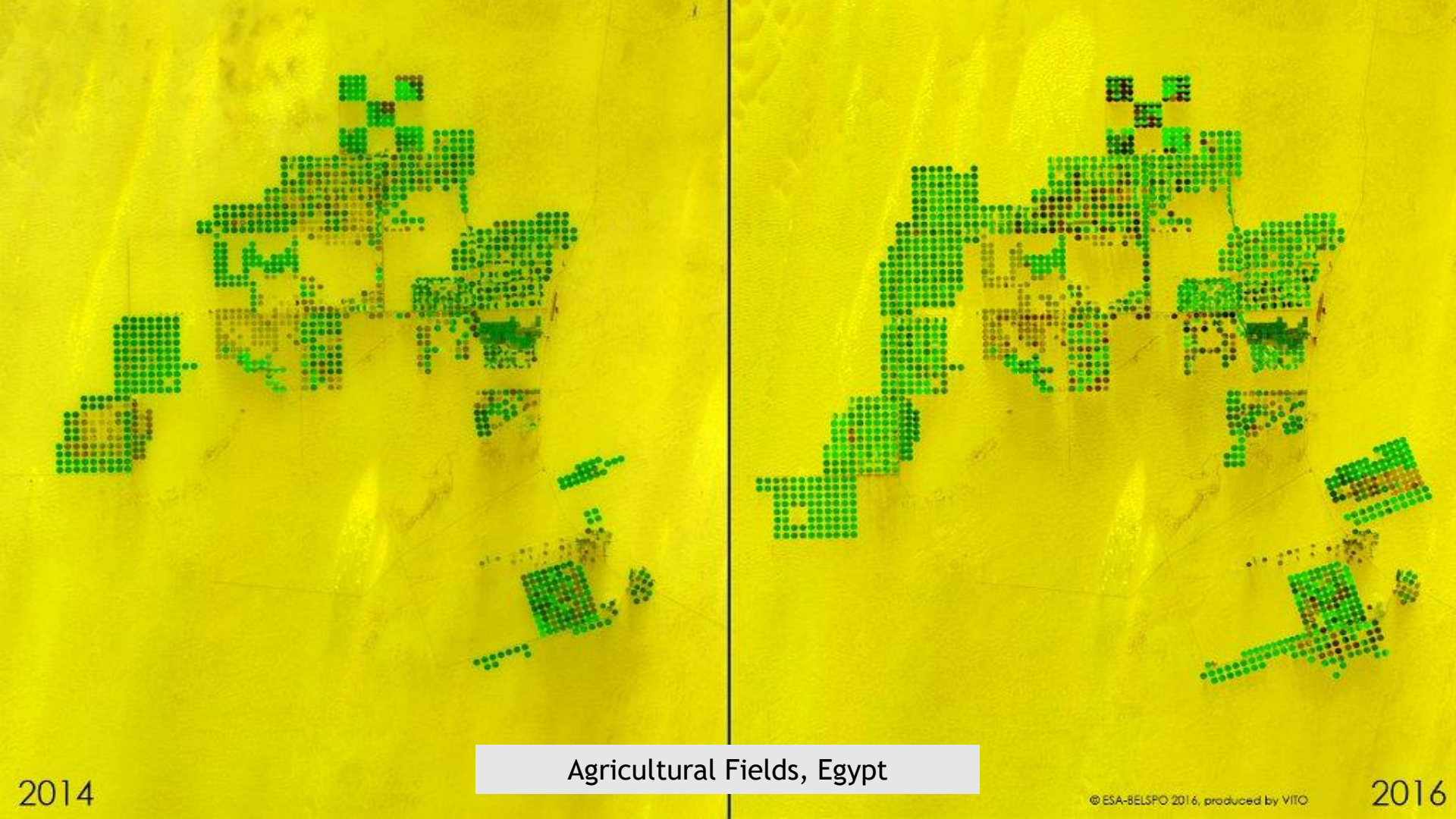
Regional & Global trends
Agroclimat variables

Improve product development

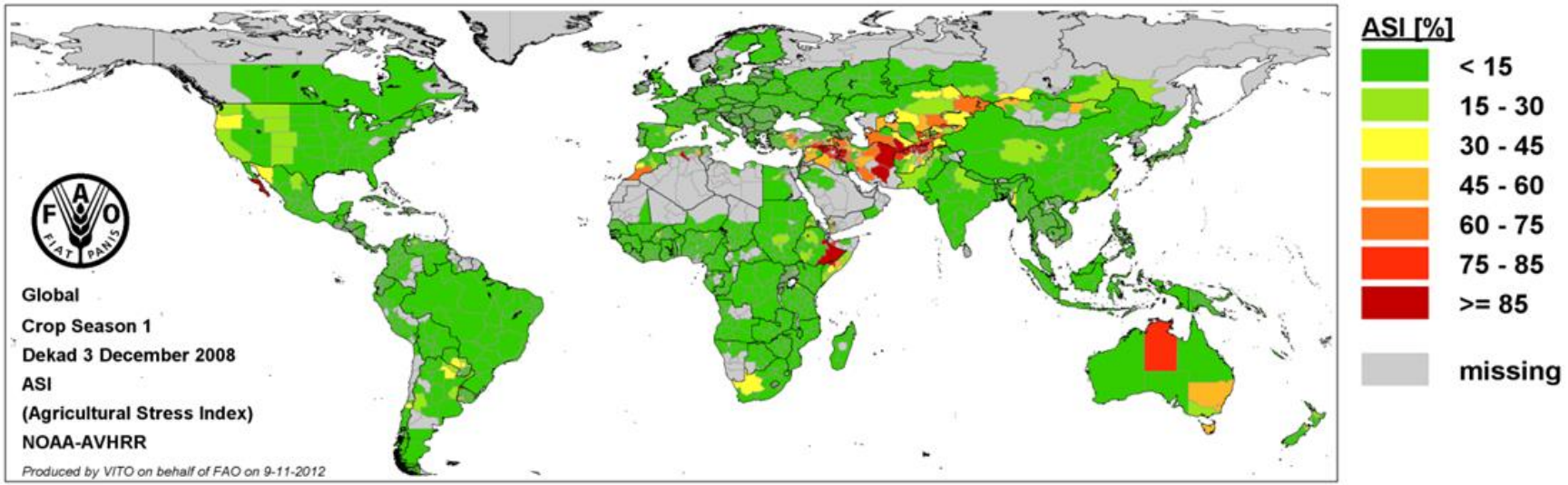
Understand how products/varieties ‘work’ at ops level

Key to develop climate adaptive products

vito
remote sensing


2014
Agricultural Fields, Egypt
© ESA-BELSPO 2016, produced by VITO
2016

FOOD SECURITY: AGRICULTURAL STRESS INDEX SYSTEM

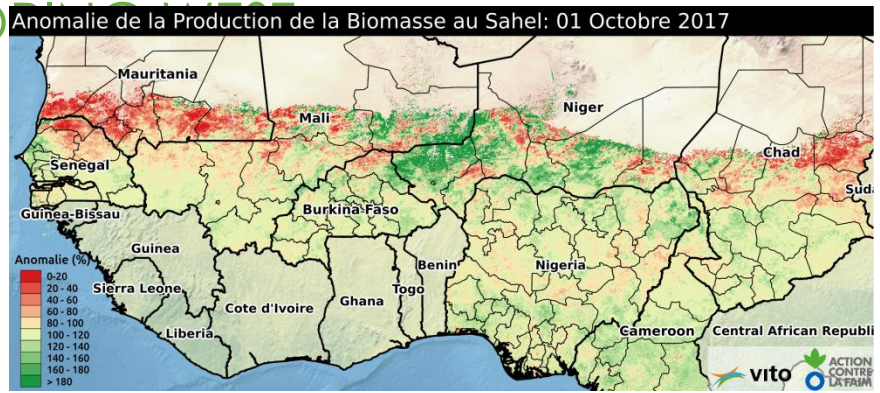


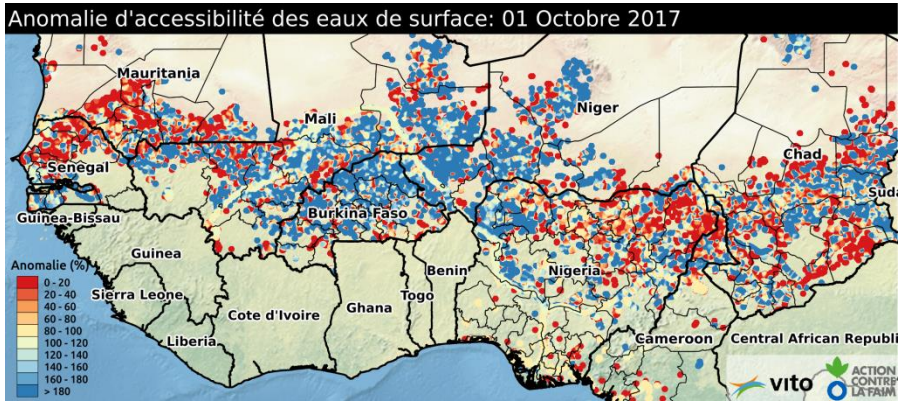
Agricultural stress index (ASI) at the end of 2008. The ASI is defined as the percentage of crop area within each administrative unit with a mean Vegetation Health Index (VHI) over the growing season below 35%.

vito remote sensing

remotesensing.vito.be

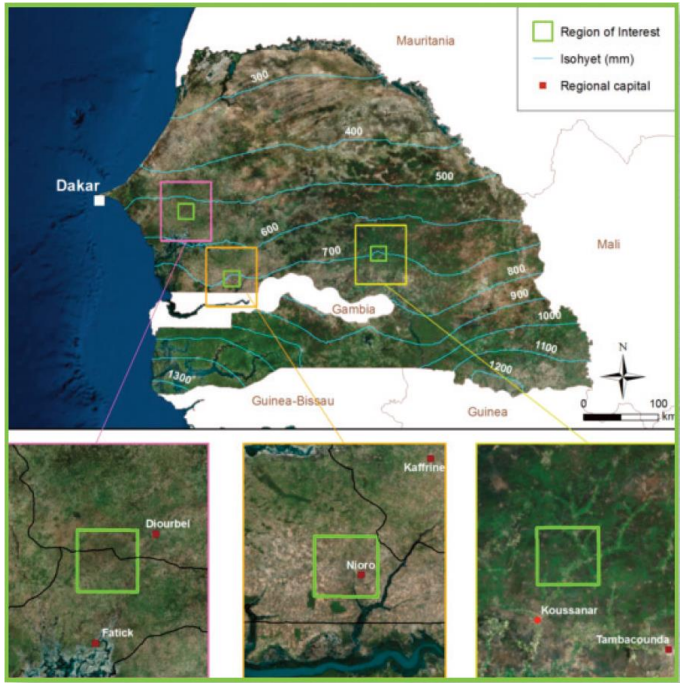
PROBA-V DATA FOR MONITORING AFRICAN CATTLE HERDERS

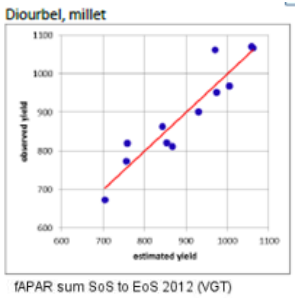


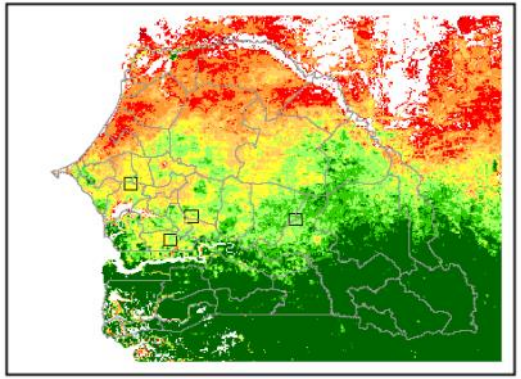


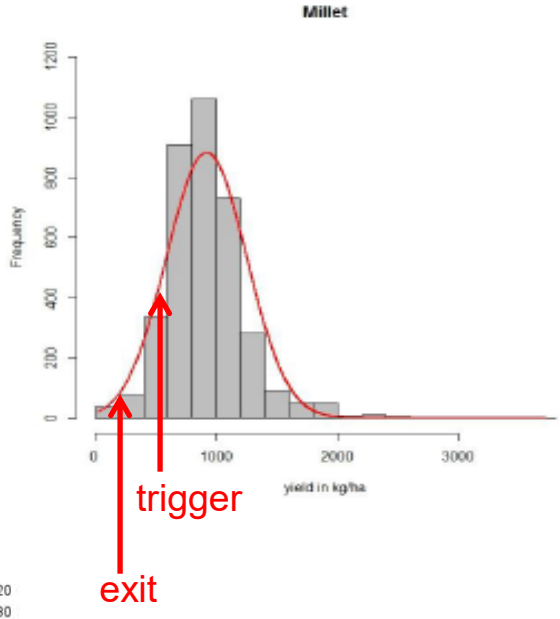
vito
remote sensing

INDEX BASED INSURANCES









IFAD
Investing in rural people

WFP

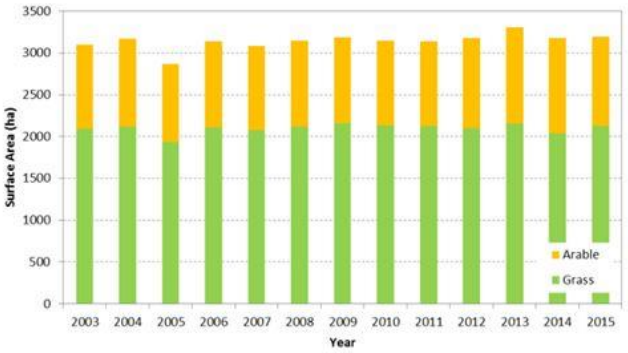
AFD
AGENCE FRANÇAISE DE DÉVELOPPEMENT

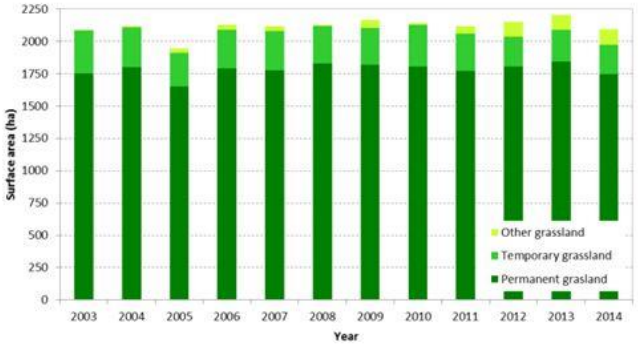
vito
remote sensing

remotesensing.vito.be

Supporting Agricultural Policy

Evidence of a changing farming landscape using remote sensing (left), while agricultural statistics for Voeren do not show large fluctuations in grassland area (right).





vito remote sensing

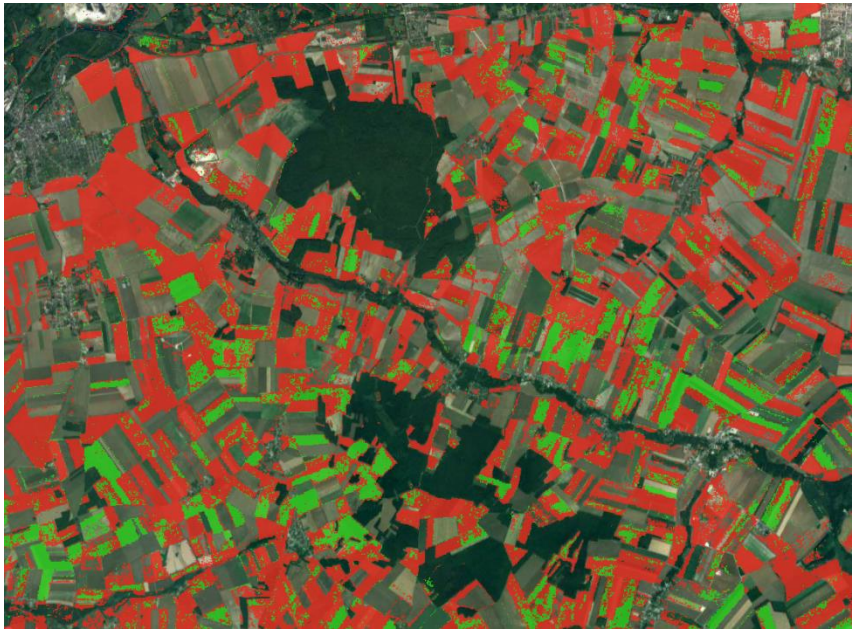
remotesensing.vito.be

Early area estimation of different crops

Few fields with known crop type

Training a satellite-based automatic crop detection procedure

Region-wide area estimation, months before harvesting



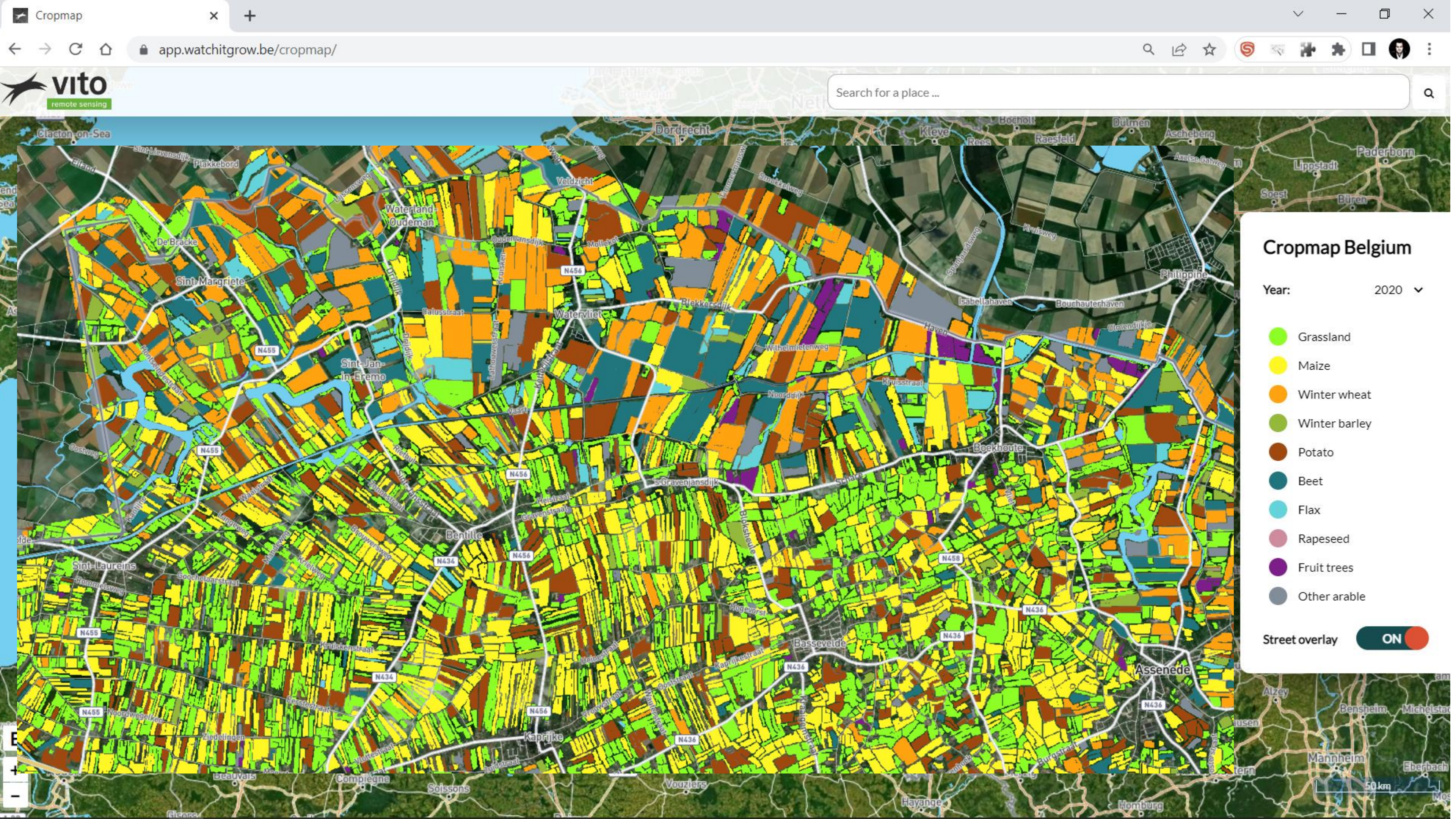
Crop classification in the Champagne region

Winter wheat

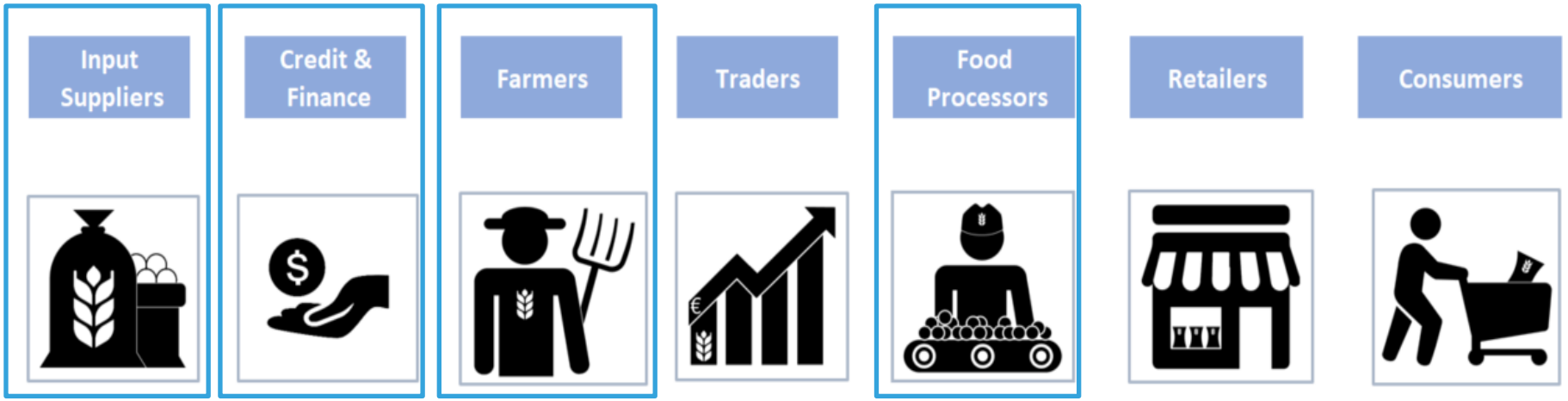
Winter barley

vito remote sensing

remotesensing.vito.be


Cropmap
app.watchitgrow.be/cropmap/
vito
remote sensing
Search for a place ...
Cropmap Belgium
Year:
2020
Grassland
Maize
Winter wheat
Winter barley
Potato
Beet
Flax
Rapeseed
Fruit trees
Other arable
Street overlay
ON
Sint-Margriete
Sint-Jan-in-Eremo
Watervliet
Waterland-Oudeman
Bentille
Sint-Laureins
Boekhoute
Bassevelde
Assenede
Kaprijke
Philippine
Dordrecht
Kleve
Paderborn
Mannheim
50 km

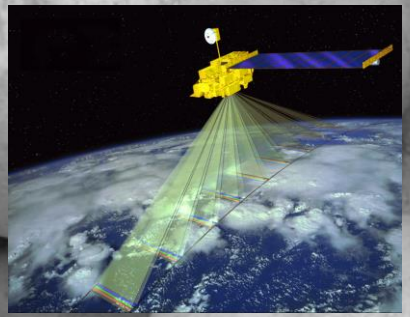
Remote Sensing as **Enabler** for further **Digitization** of the **Potato Value Chain**

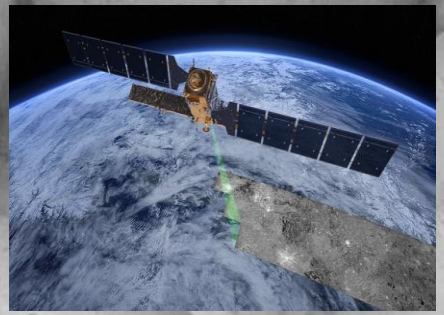


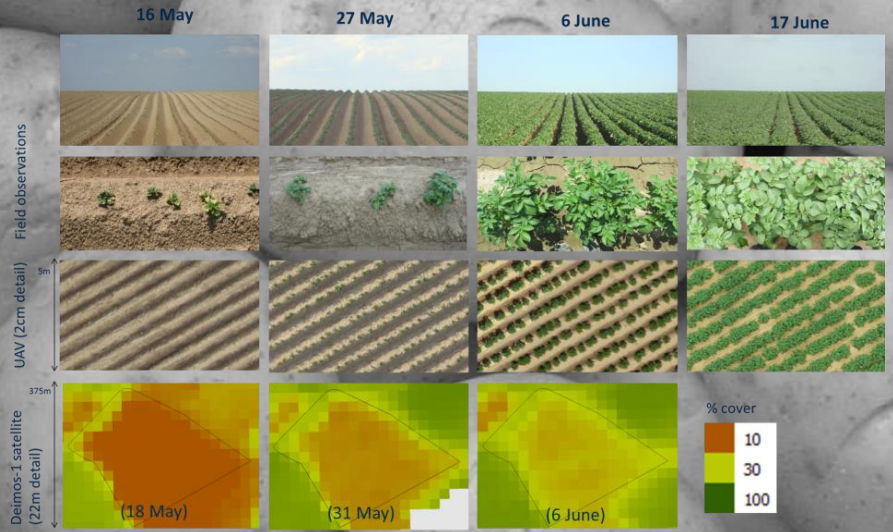
vito remote sensing

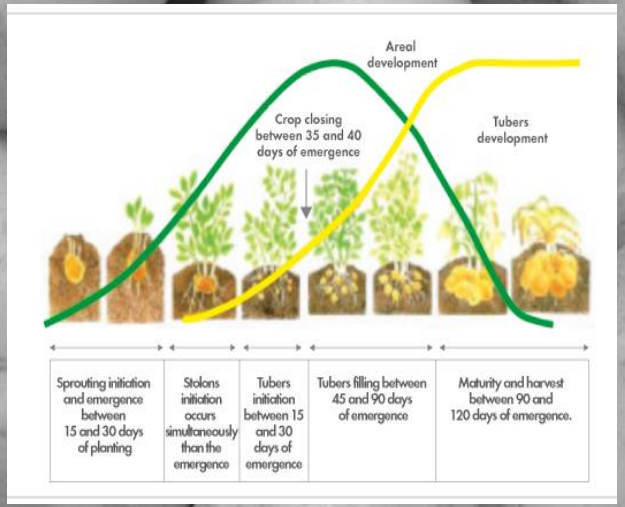
remotesensing.vito.be

BELGIAN POTATOES ARE MONITORED FROM SPACE!

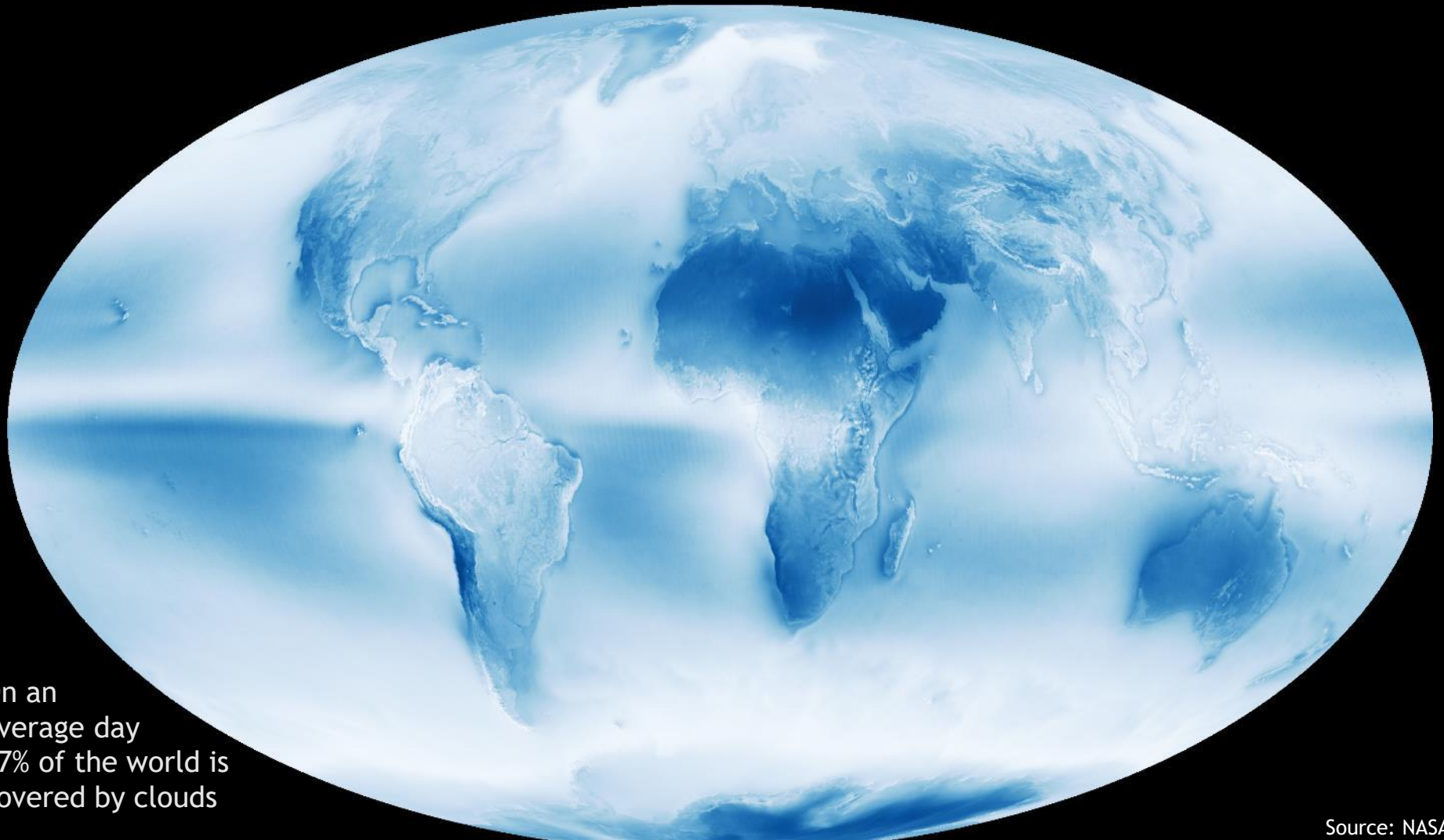








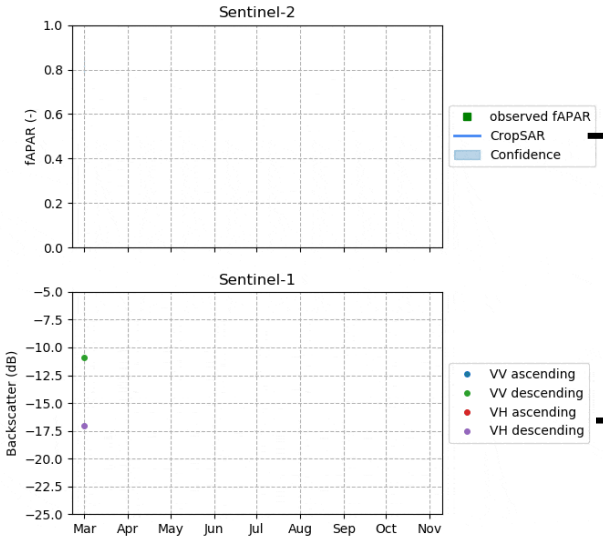
More info on watchitgrow.be



On an
average day
67% of the world is
covered by clouds

Source: NASA

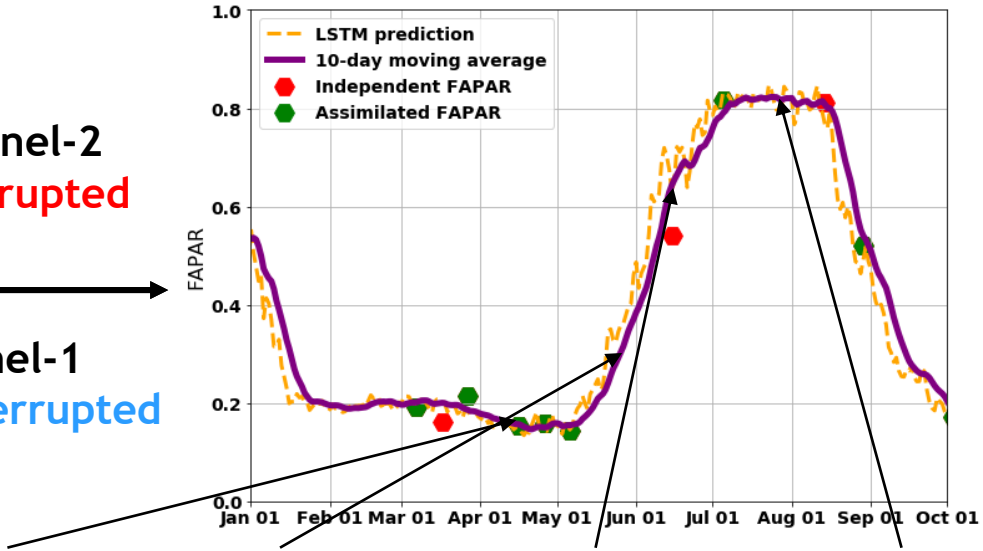
LOOKING THROUGH THE CLOUDS WITH CROPSAR



Sentinel-2 interrupted

Sentinel-1 uninterrupted

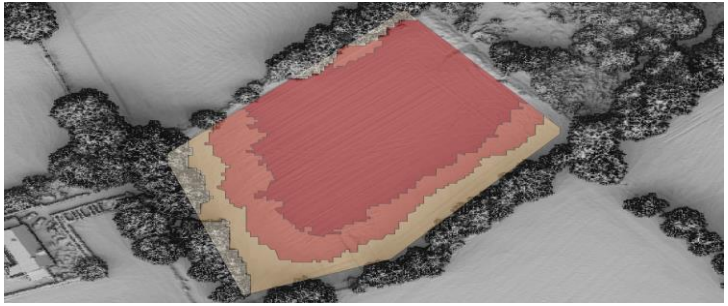
Sentinel-2 uninterrupted



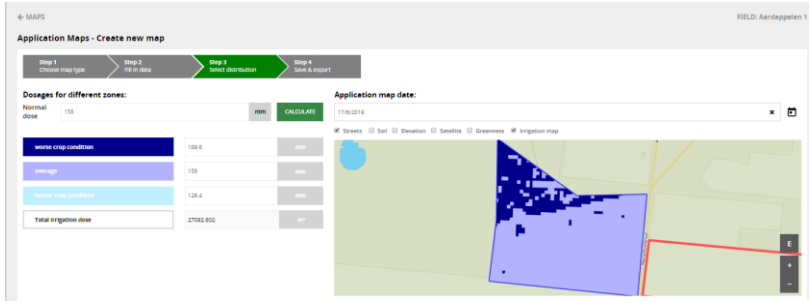
https://blog.vito.be/remotesensing/cropsar2019

HELPING THE FARMER MANAGER ON HIS WAY TO SUSTA
PRACTICES

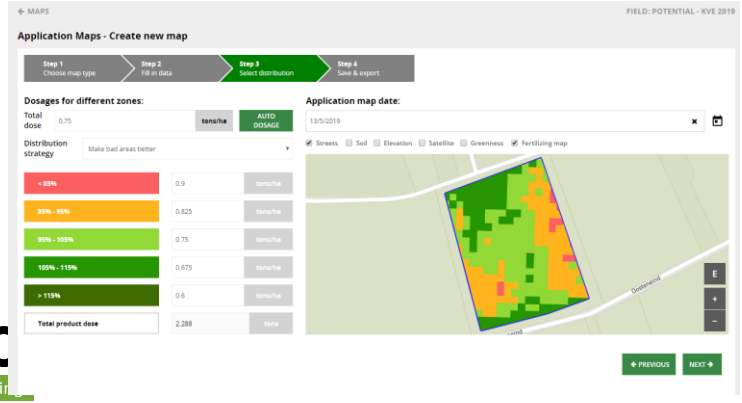
Planting



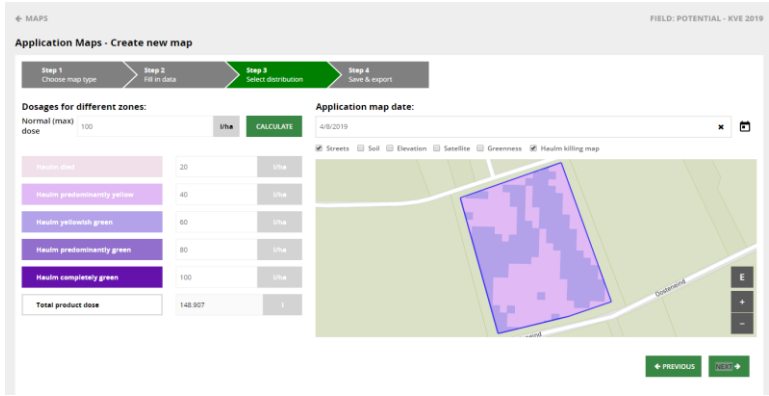
Irrigation



Fertilisation



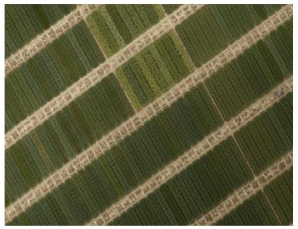
Haulm Killing



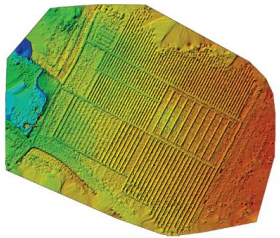
remote sensing

MAPEO – CROPMONITORING

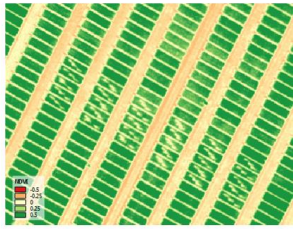
Orthomosaic



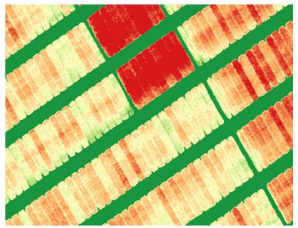
DEM



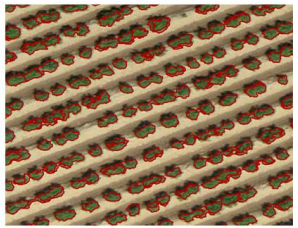
NDVI



Crop height



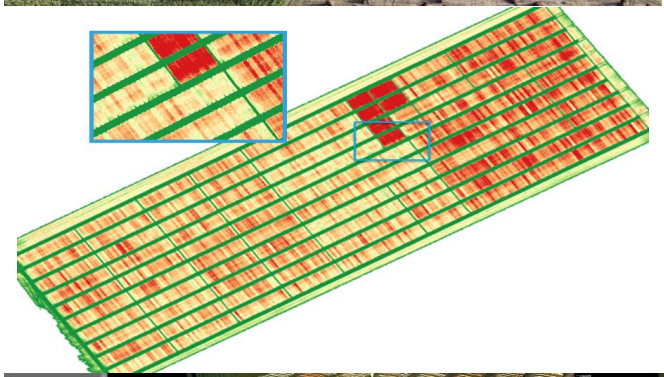
Crop count



Crop cover

vito
remote sensing

https://remotesensing.vito.be/case/mapeo

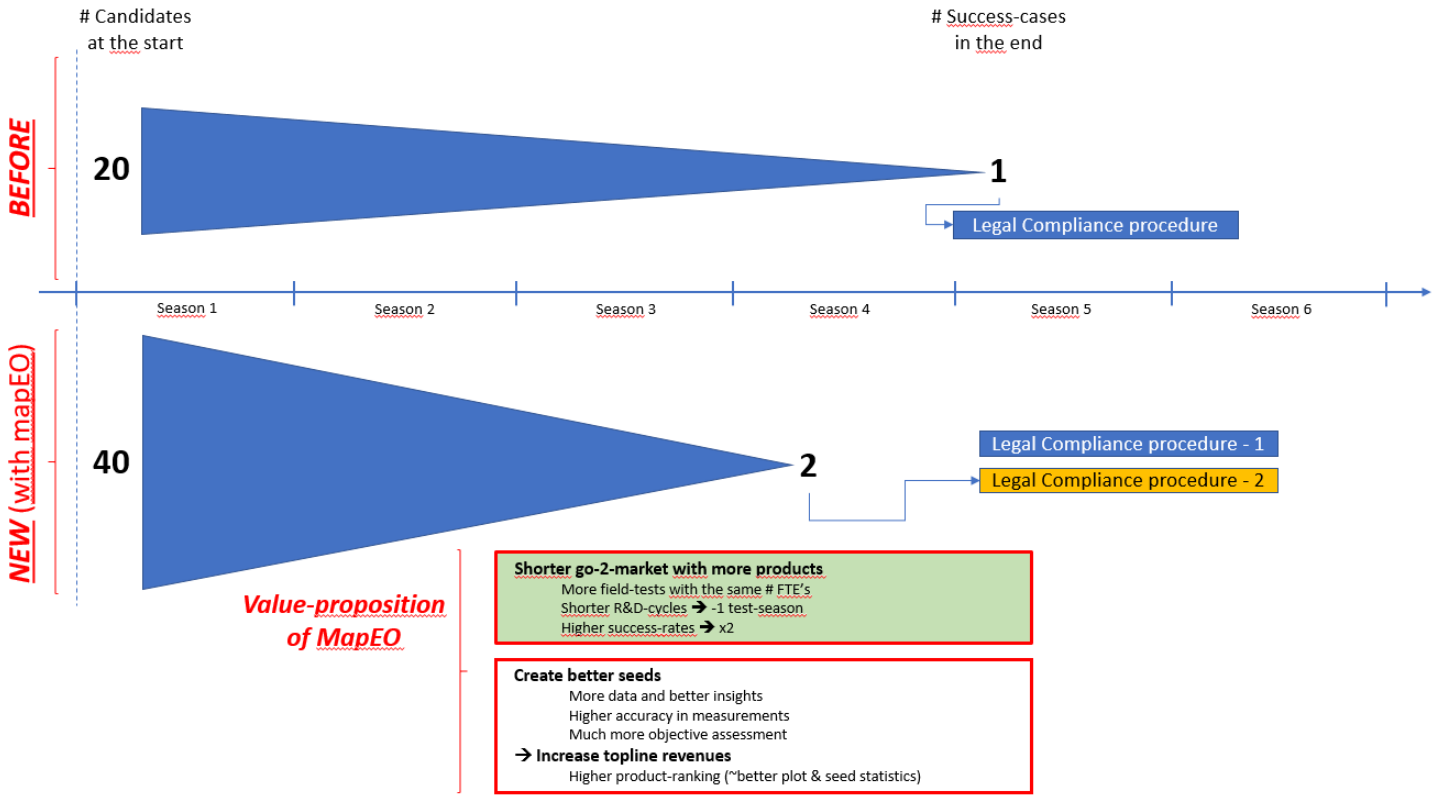


Drone based phenotyping – Why?

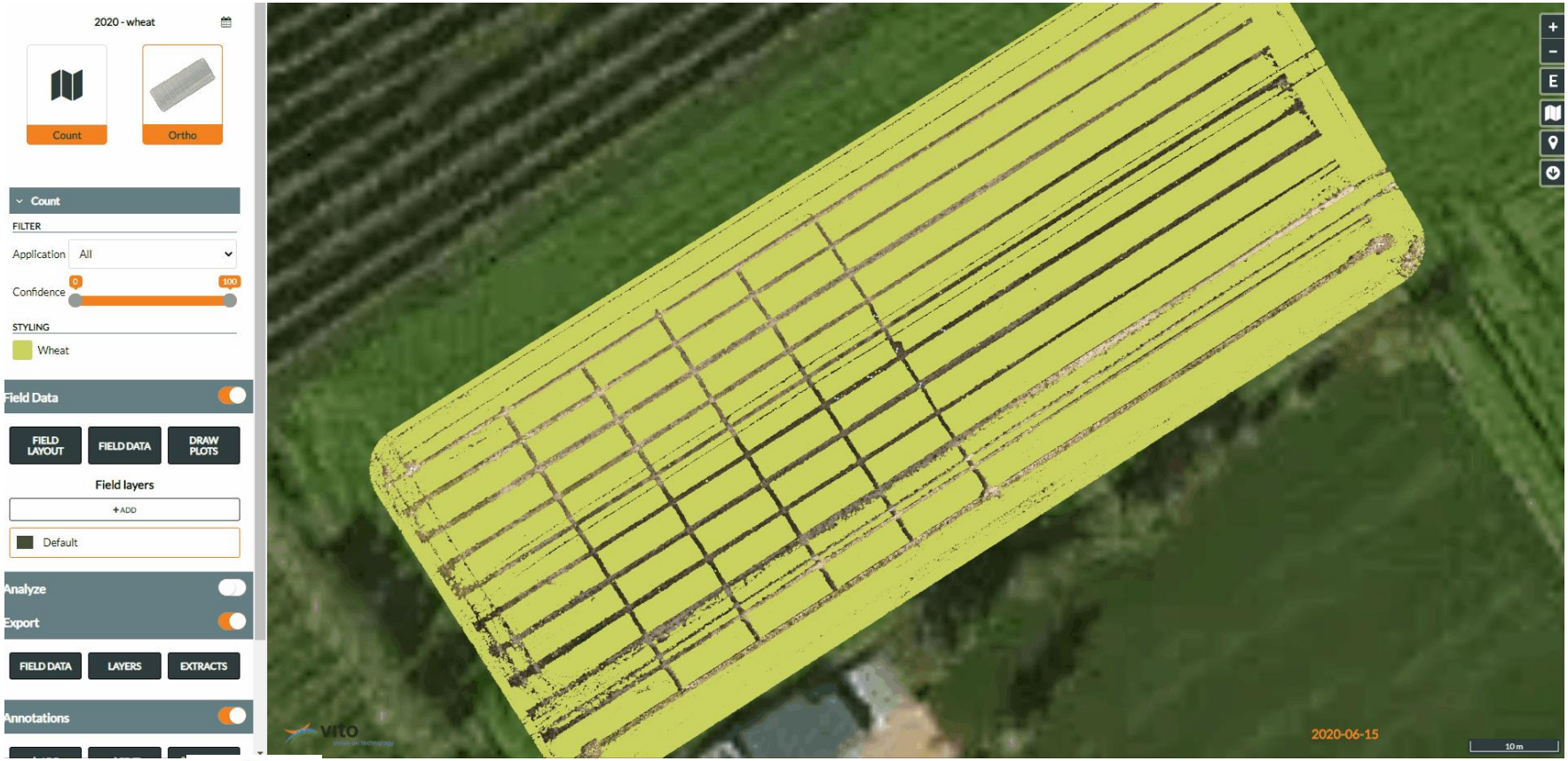
- **Speed up phenotyping work**
  - Shorten time to market
  - Reduced cost of breeding/test line through reduced testing-periods
  - Higher breeding success rate

- **Create better seeds**
  - More data and better insights
  - Higher accuracy in measurements
  - Much more objective assessment

Value Proposition MapEO

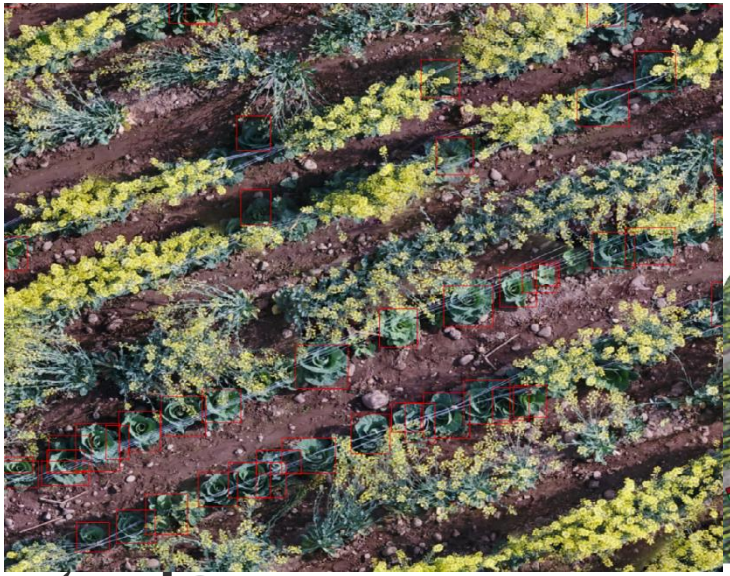


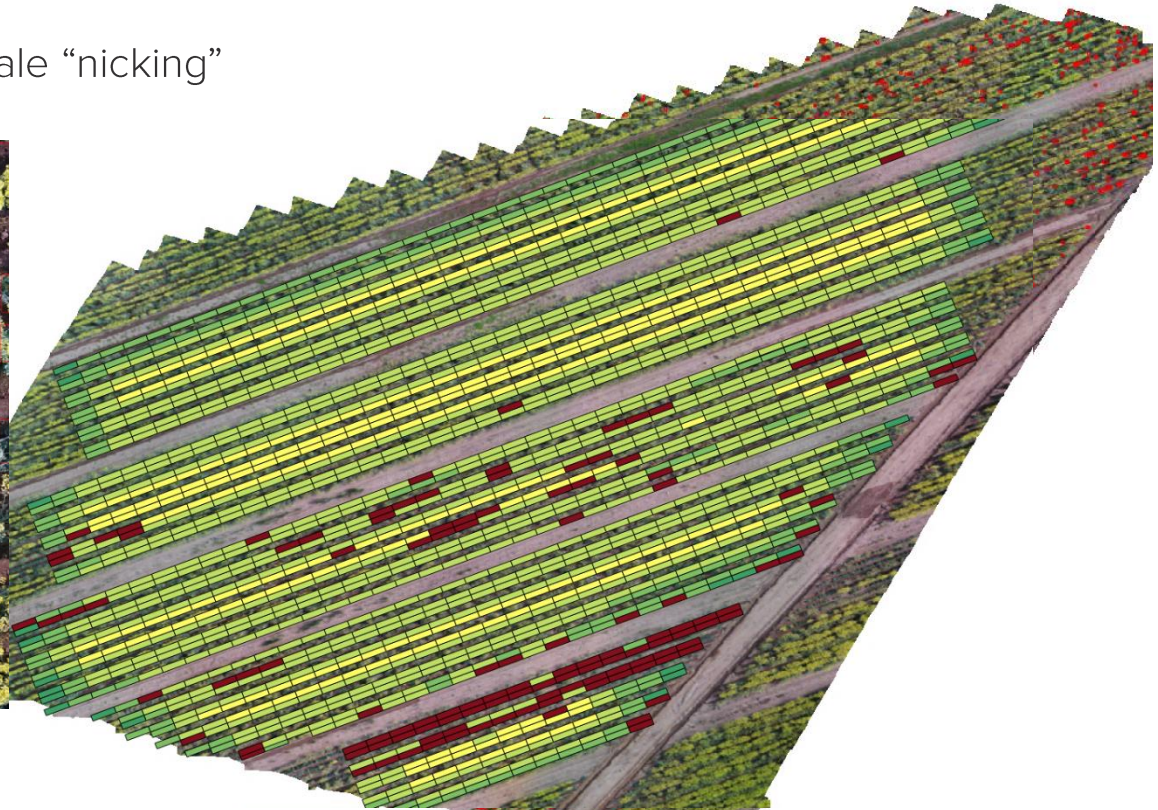
EXAMPLE : WHEAT – SPIKE COUNT



Example: nicking index in Brassica

Cabbage flower counting for male/female “nicking”





vito
remote sensing

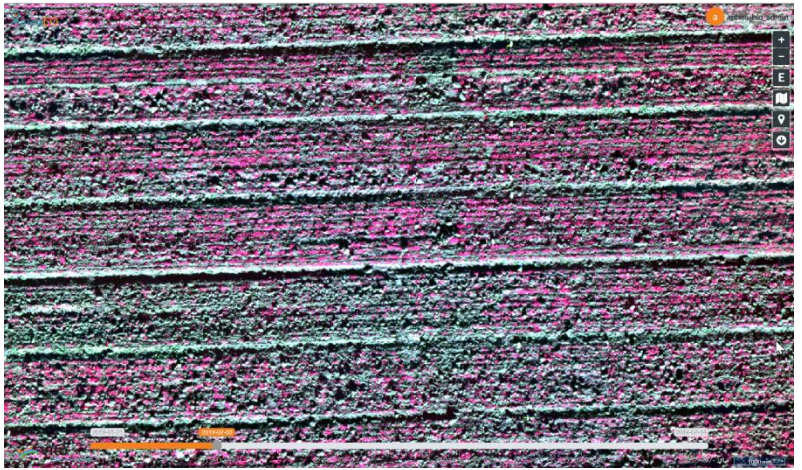
Some examples – traits

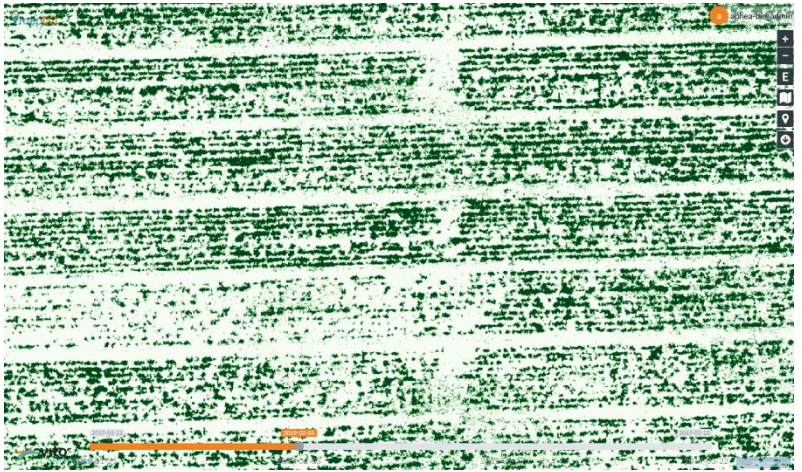
Canopy coverage

“Canopy coverage is an interesting trait to study the **effects of biostimulant** products on early **plant growth”**

Marcelo Labra – Aphea.bio

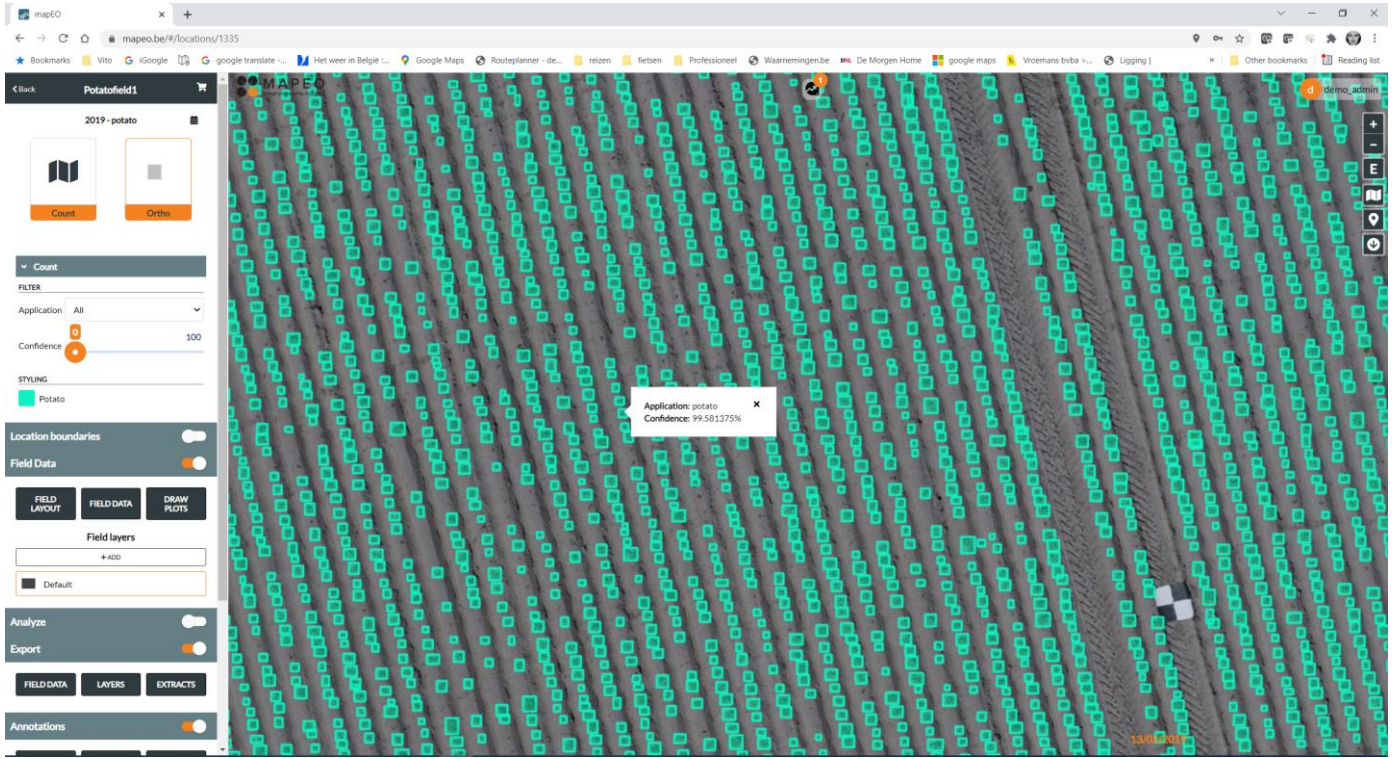
Field view





vito
remote sensing

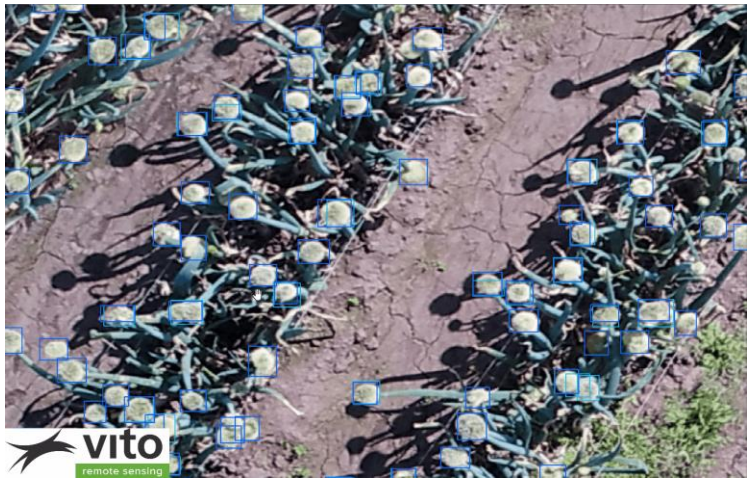
Emergence count potato

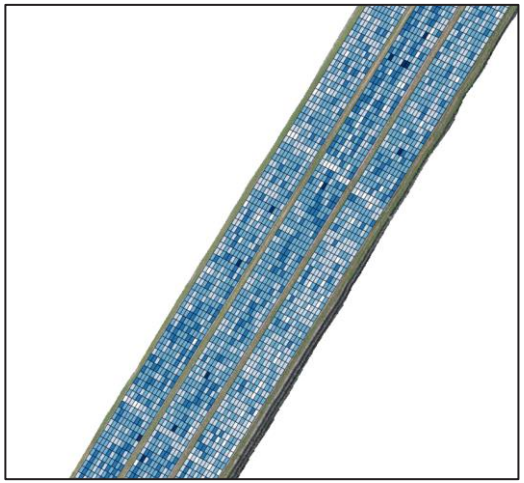


vito
remote sensing

remotesensing.vito.be

Seed production fields





Onion flower counting based on deep CNN

- Regions of low seed quantity
- Optimal harvest time

PROBA-V DATA FOR TIMELY LIVESTOCK MANAGEMENT IN NAMIBIA

Cornelis van der Waal 06.09.2018
PROBA-V, cattle management, Agriculture, land cover

WHEN THE HEAT GETS TOUGH ...

Bart Deronde 06.08.2018
EO Data, Agriculture, Crop monitoring, WatchITgrow®, Terrascope

A SENTINEL SHAKE FOR EARLY CROP MAPPING

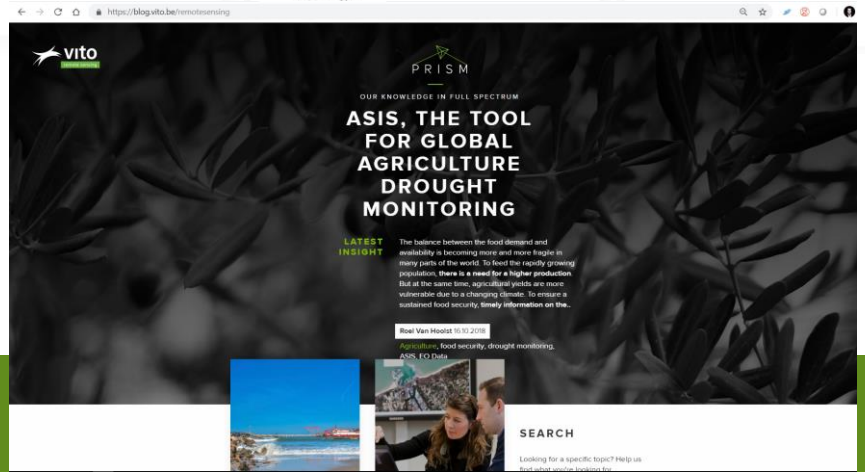
Kristof Van Tricht 17.07.2018
Agriculture, Sentinel, deep learning, Multitemporal image analysis, radar, optical, food

WEATHER IMPACTS ON AGRICULTURE

Anne Gobin 06.11.2017
Climate, Agriculture, smart farming, EO Data

IMAGE ANALYTICS FOR OBJECTIVE PLANT VARIETY ASSESSMENT

Esther Monard 20.06.2018
MAPEO, phenotyping, plant breeding, Agriculture, drones



Keep an eye on our **blog** for more!

https://blog.vito.be/remotesensing

Steven Krekels
M steven.krekels@vito.be
T @stevenkrekels