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16/12/2015

An improved infrastructure for the exploitation of EO-data sources at VITO

Erwin Goor - VITO nv

Company Profile

VITO - Flemish Institute for Technological Research, Belgium

750 employees, 26 nationalities, 140 mio€ turnover in 2014

Remote Sensing unit: 80+ employees

Energy

Materials

Chemistry

Health

Land use

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VITO Remote Sensing Products and Solutions

Platforms

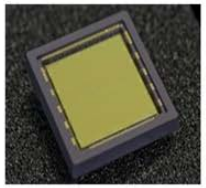
UAV

AIRBORN

HALE UAV

SATELLITE

Sensors



Value Added Services & Information Products

Markets

Vegetation

Agriculture

Water

Forest

Environment & Security

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PROBA-V User Segment (incl. SPOT-VEGETATION, METOP-AVHRR S10, …)

http://proba-v.vgt.vito.be/

http://www.vito-eodata.be/

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Global Land Service

Global Monitoring of Continental Surfaces

Describe the state, and the dynamics of vegetation, energy budget and water cycle

- ✓ User-driven service
- ✓ Sustainable system
- ✓ Reliable information

- ✓ Basic variables
- ✓ Validated products
- ✓ Near Real Time

Free and open access to products:
http://land.copernicus.eu/global/access

Supported by several R&D – operational - capacity building projects

Food security – Agriculture – Re-insurance – Biodiversity – Coastal zone management - …

SIGMA | Stimulating Innovation for Global Monitoring of Agriculture

FAO ASIS

highroc.eu

AGRICAB

Imagine

iPot industrial potato monitoring

SPIRITS Software for the Processing and Interpretation of Remotely sensed Image Time Series

The role of VITO in scientific exploitation of EO data

Grow towards

“Scalable R&D/Operations platform”

&

“Information dashboards/tools”

on non-co-located & heterogeneous

BIG DATA – Time series

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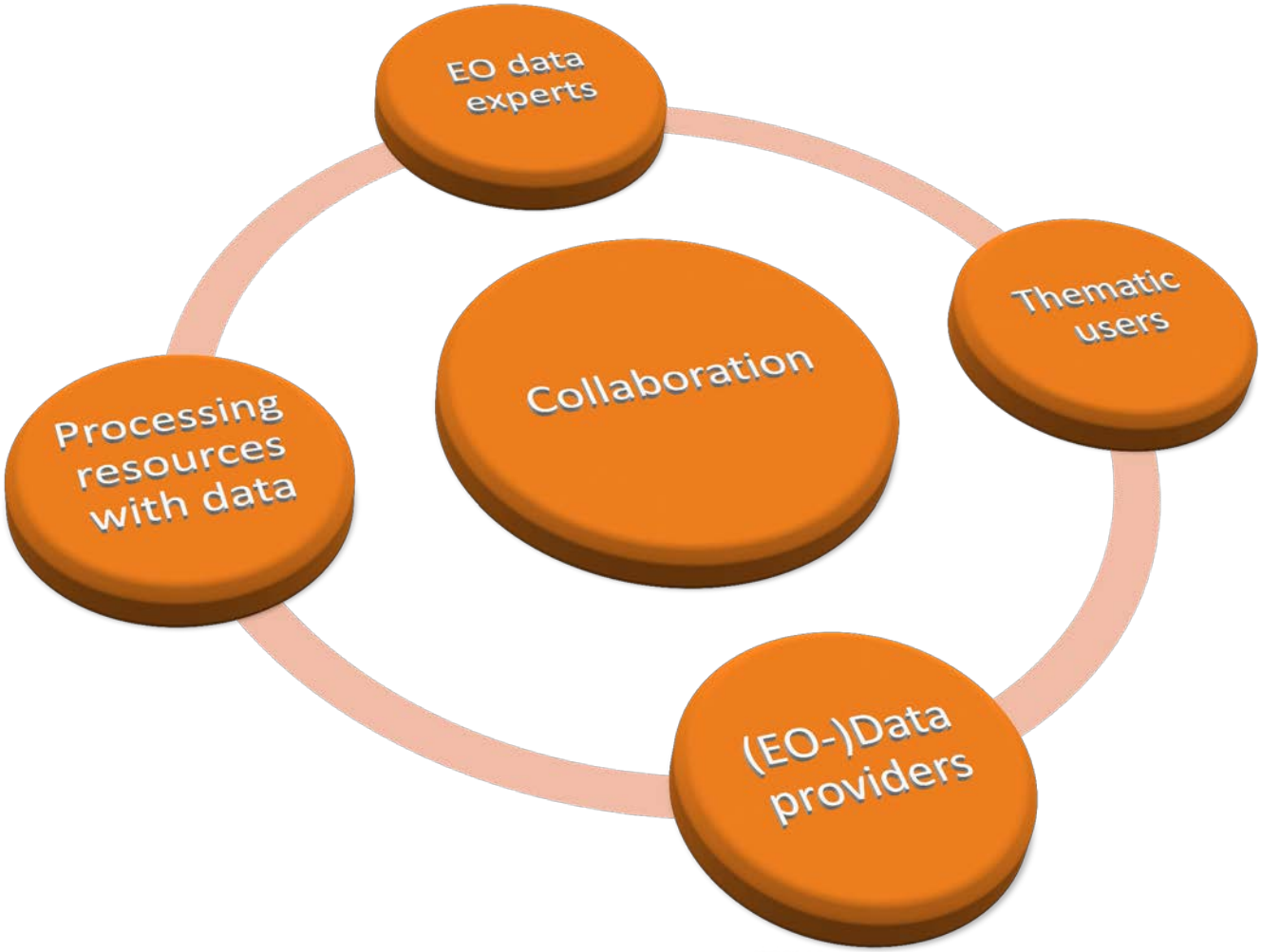

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analysis services

download services

Processing services

SERVICES

On-demand raster data query

- ✓ On the fly statistical analysis
- ✓ Queries on user defined regions

openstack™ CLOUD SOFTWARE

On-demand processing

- ✓ Scalable distributed processing
- ✓ Deployed on cloud infrastructures with data locality

hadoop

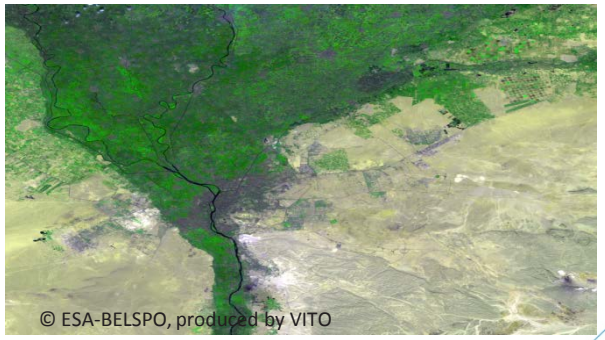
Systematic production & delivery of Earth Observation products

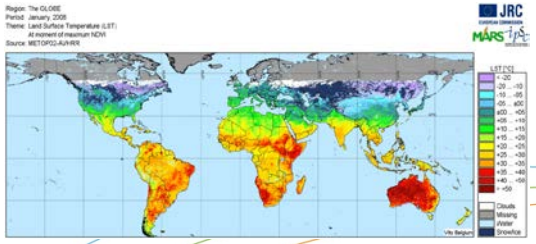
WWW.VITO-EODATA.BE

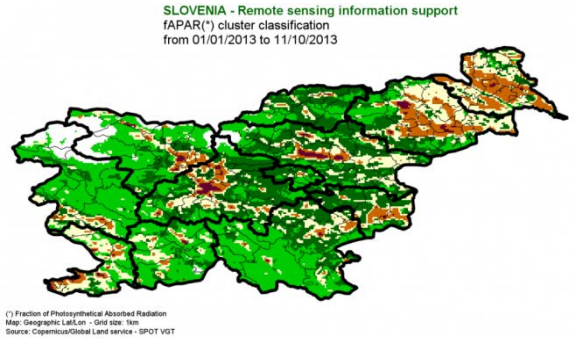
LAND.COPERNICUS.VGT.VITO.BE

esa

Copernicus The European Earth Observation Programme







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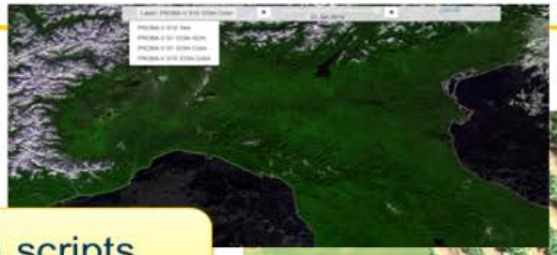
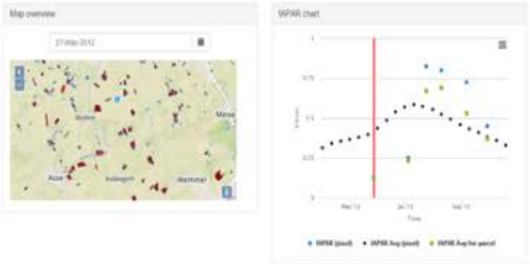
Web-based Applications



IDE's, Interactive scripts, on-demand processing, …



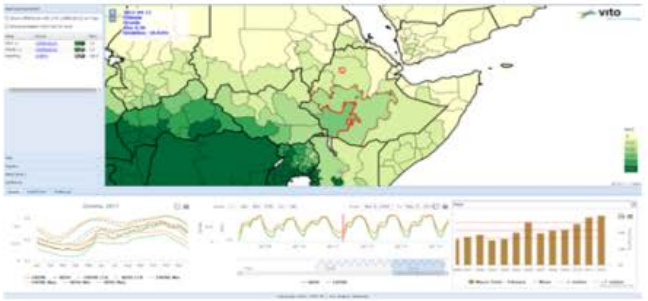
Dashboards - Info

- ✓ Self service
- ✓ highly customisable by users
- ✓ E-collaboration

Full-resolution viewing

Time Series viewer

- ✓ Near realtime updates
- ✓ Integrate data from various sources
- ✓ Powerful analysis



Data feed towards 3rd-party applications

http://tsviewer.vito-eodata.be

analysis service

download services

processing services

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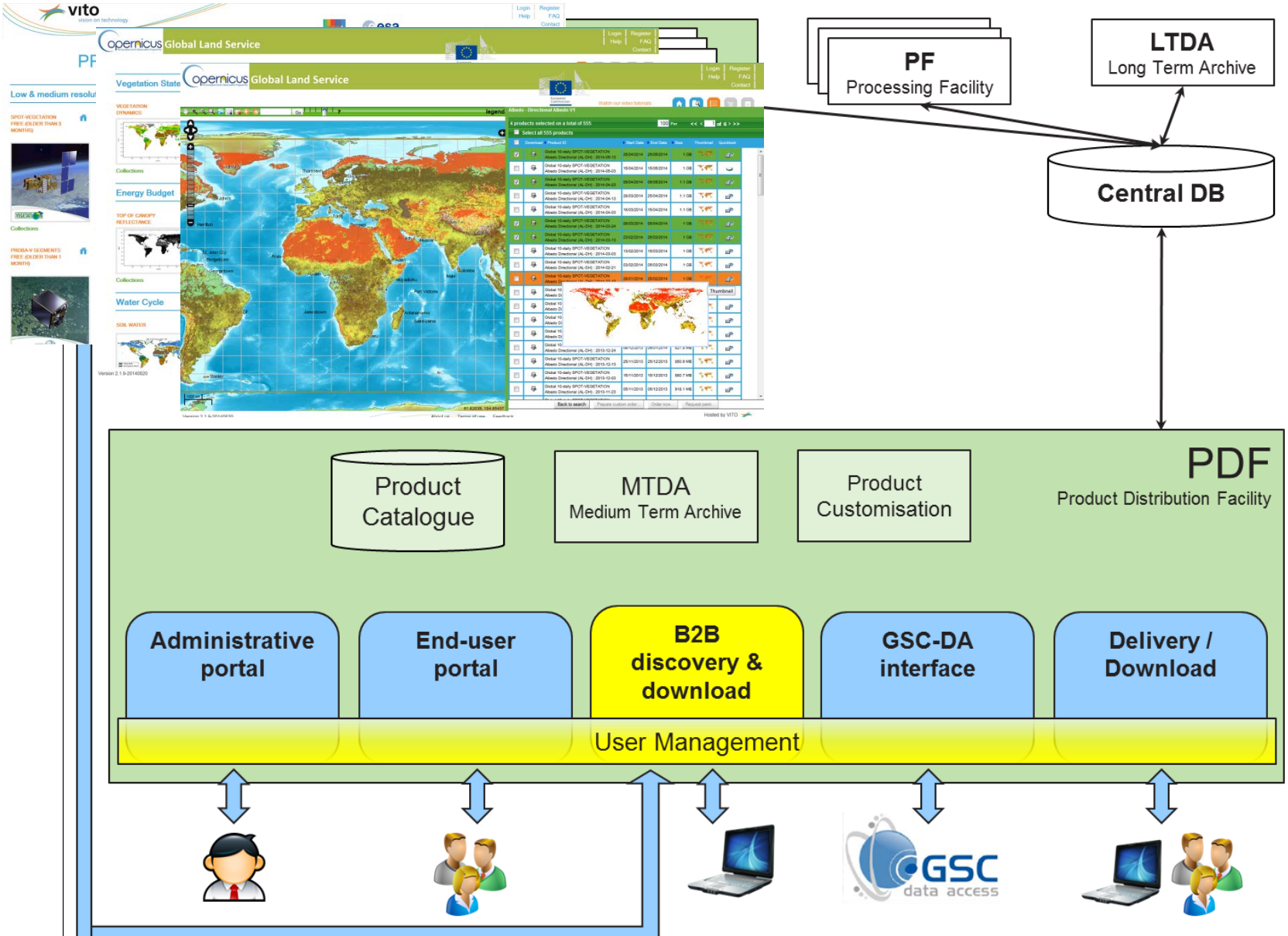
Product Distribution Facility: data distribution

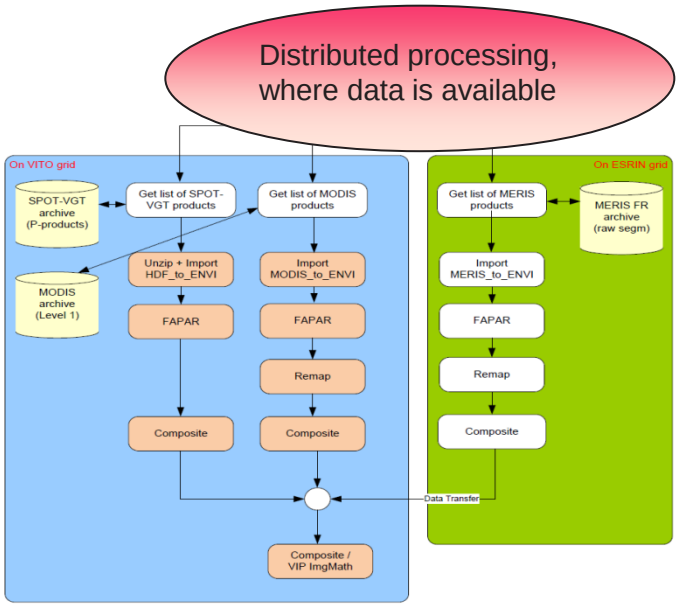
» Web based portal: http://www.vito-eodata.be & land.copernicus.eu/global/access



Full resolution viewing

Hadoop based Processing Engine

- Use of Cloudera/Hortonworks Hadoop distribution for distributed EO-data processing: data locality
- WPS processes encapsulated in Oozie workflows
- Use of Spark for fast data extraction



WPS client (VITO or 3rd party)

Federated workflows

WPS server

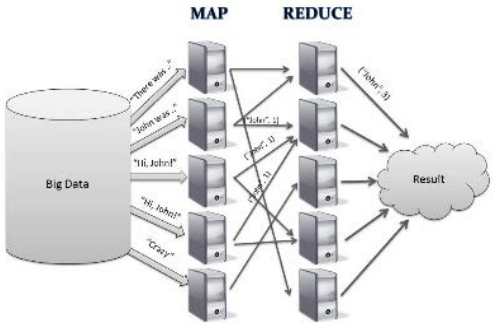
Workflows
Oozie

Distributed processing
mapReduce

Distributed storage
HDFS

Data Manager

Data Distribution Facilities



PROBA-V
LANDSAT
SENTINELs

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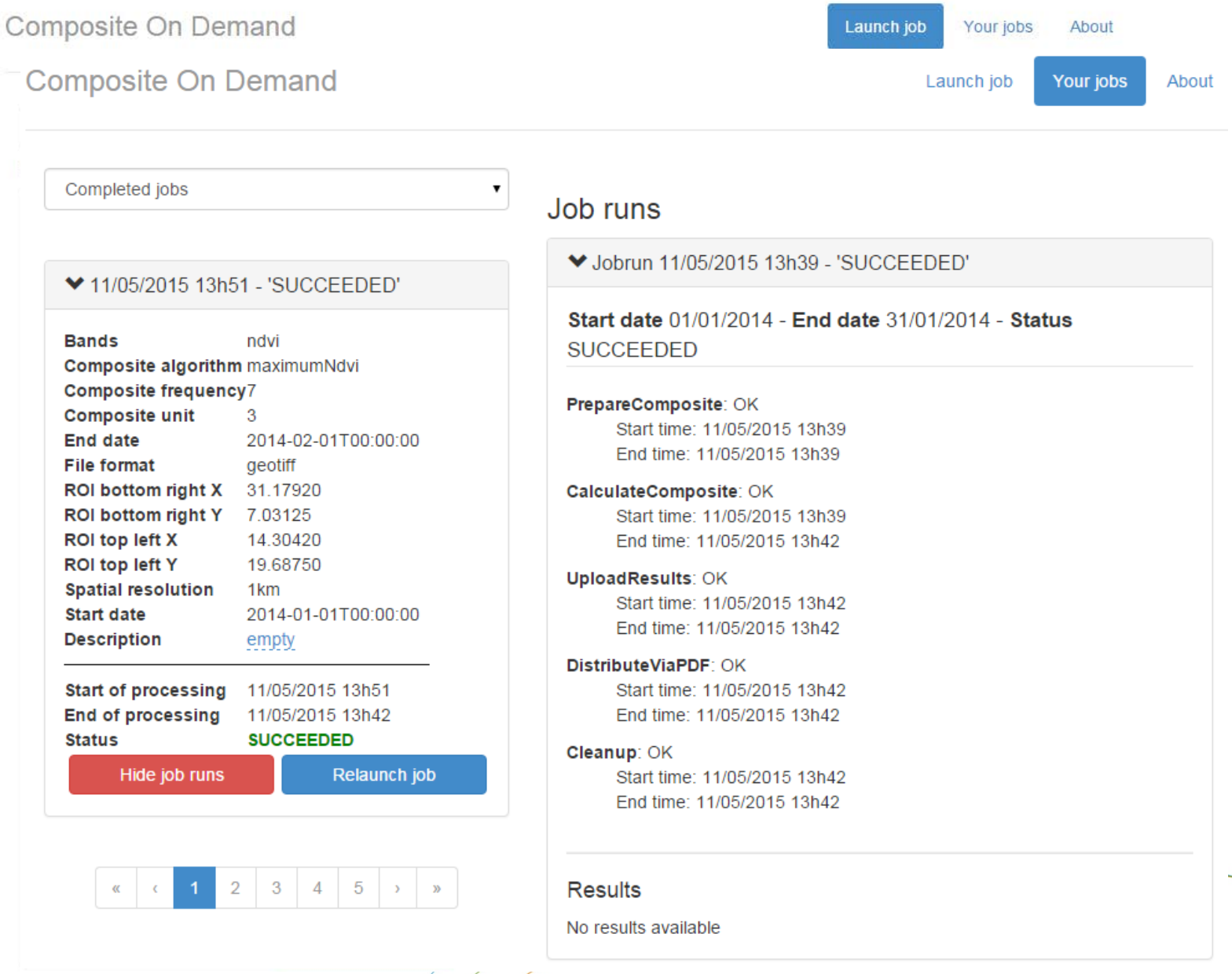
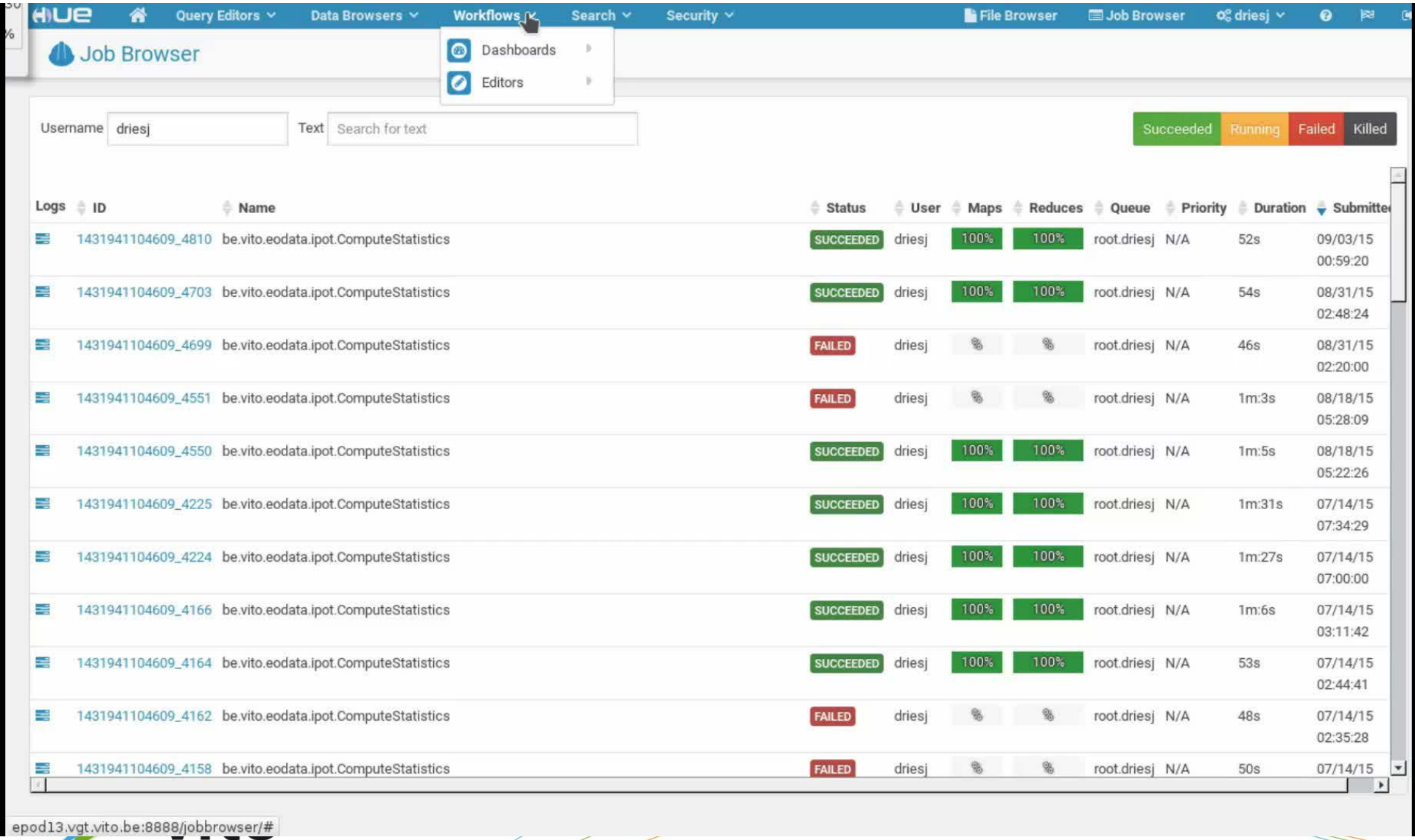
First ‘operational’ PoD service



Develop – debug – test – operate 'your' applications



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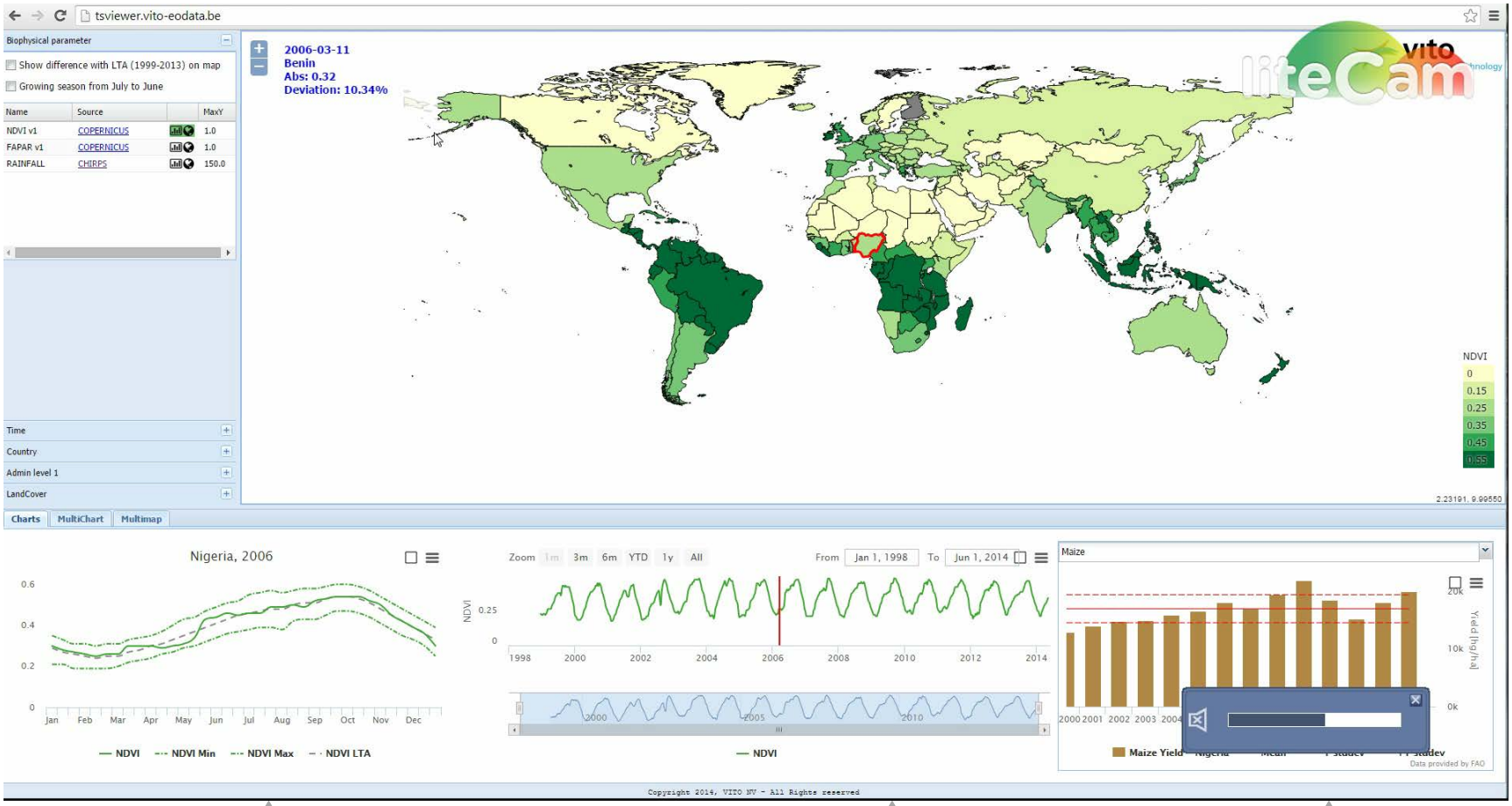
Global Satellite Time Series Viewer (prototype)

- http://tsviewer.vito-eodata.be
- Aim: quickly explore & review satellite time series and complementary indicators for agriculture and environmental monitoring



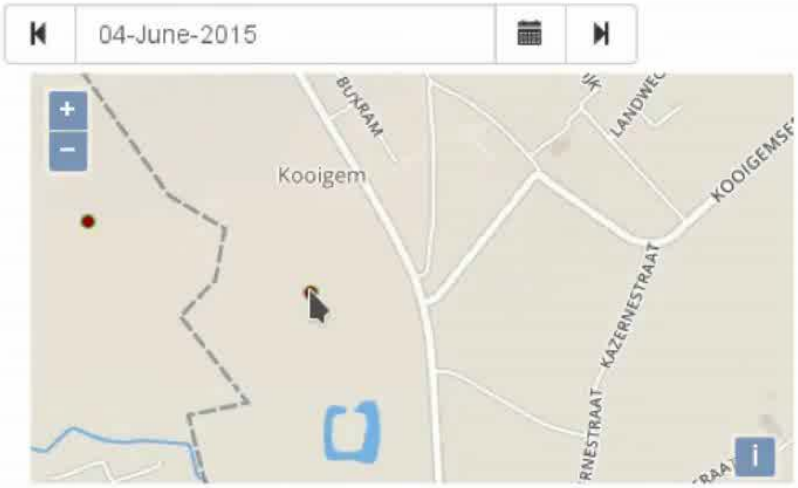
http://land.copernicus.eu/global/

http://www.vito-eodata.be

Fao.org

User-tailored dashboards

Map overview



DataViewer

Metadata

Field name	Community
AGT-03 Vremderhoeve	Broechem
Latitude	**Longitude**
51.1721	4.5659

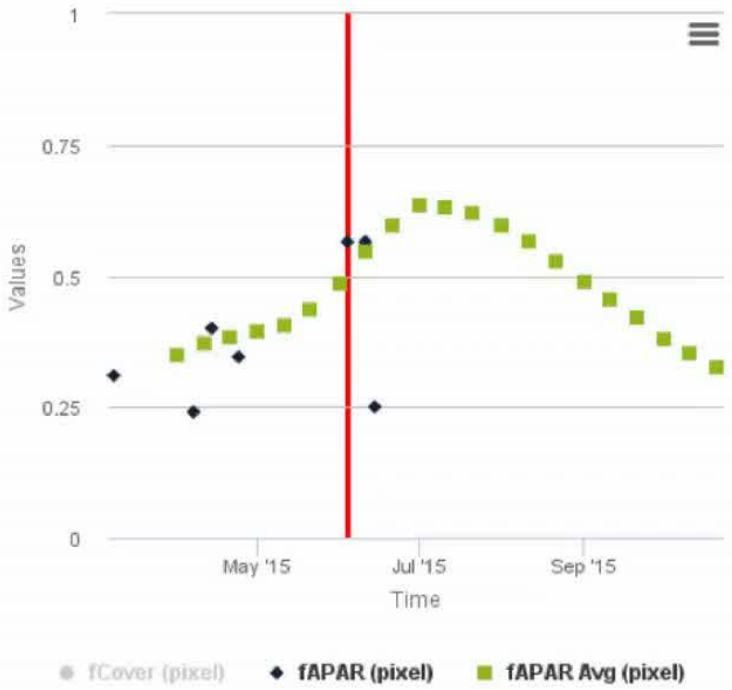
General parameters

Planting date	Harvest date
2015-04-19	
Plant separation	**Row distance**
35	75

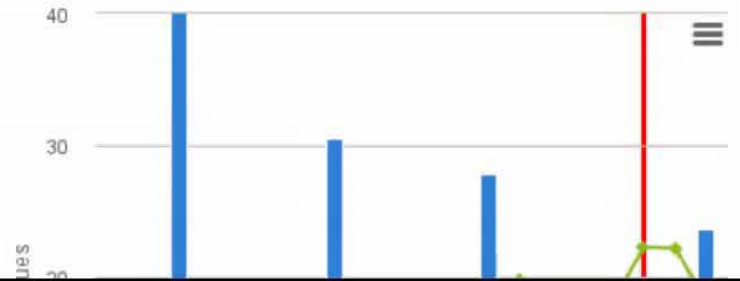
Fenologies

Type	Date	Remarks

fCover/fAPAR



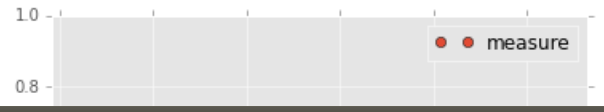
Highchart



Support of Python and R on the data/timeseries

```
In [1]: import matplotlib.pyplot as plt
        import matplotlib
        %matplotlib inline

        from elasticsearchapi import ElasticsearchAPI

        matplotlib.style.use('ggplot')

        username = "ddaems"
        password =

        es = ElasticsearchAPI(username, password)
```

```
In [3]: df = es.search("pcfruit_nutrieten", "measure", "spectrum:0", 1000)
        df.plot(x='wavelength', y='measure', style='o', ylim=(0,1))

Out[3]: <matplotlib.axes._subplots.AxesSubplot at 0x7f5c8ed4c490>
```



RStudio

File Edit Code View Plots Session Build Debug Tools Help

sample.R* | es_api.R

Source on Save | Run | Source

```
1  library(httr)
2  library(jsonlite)
3
4  library(elasticsearchapi)
5
6  auth <- es_authenticate("ddaems", "ddaems")
7  max_temp_by_year <- es_time_series(auth, "meteo", "measure", "TIMESTAMPCODEBEGIN", "TM_MX_C", "1y", "avg")
8  plot(max_temp_by_year, type='l')
9
10 resp <- es_search(auth, "pcfruit_nutrieten", "measure", "tree:1", 1000)
11 tree1 <- resp[ resp$tree == "1", ]
12
13 plot(tree1$wavelength, tree1$measure, ylim=c(0,1))
14
```

8:33 (Top Level) R Script

Console

Environment | History

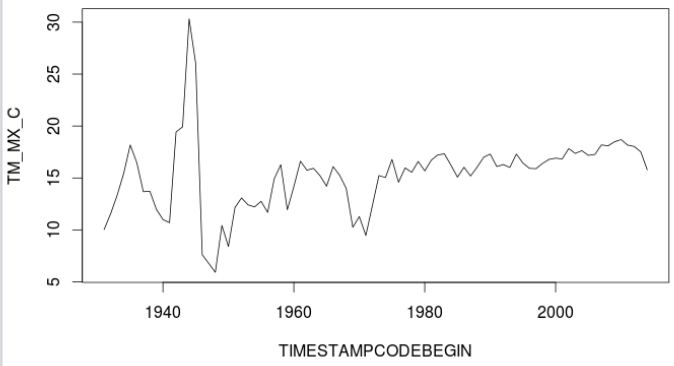
Import Dataset | Clear | List

Global Environment

Data	
max_temp_by_year	82 obs. of 2 variables
resp	1000 obs. of 6 variables
tree1	1000 obs. of 6 variables
Values	
auth	
Functions	
es_authenticate	function (username, password)
es_search	function (auth, index, type, q, size)
es_time_series	function (auth, index, type, time_field, value_field, interval, aggr…

Files | Plots | Packages | Help | Viewer

Zoom | Export | Clear All



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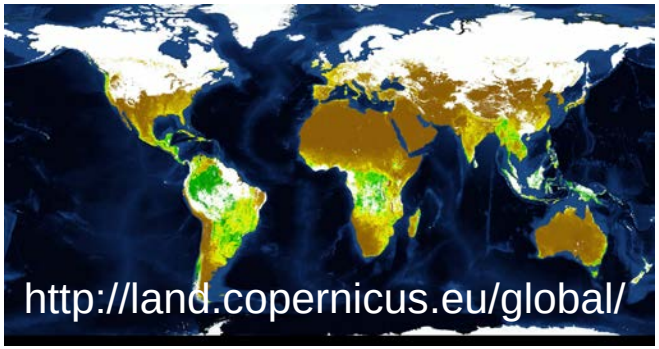
Roadmap

Time series SPOT-VGT → PROBA-V

Daily global coverage of land since 1998

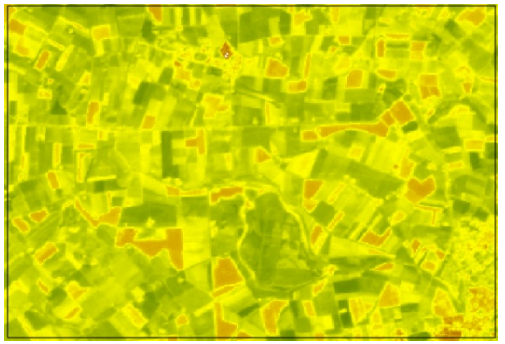
1 km → 333 m → 100 m resolution



Time series Copernicus Global Land

Global coverage since 1998

1 km → 333 m resolution



Bio-geophysical parameters

at high resolution

On-demand service

- **R&D ESA project 'ESE' → Acceptance July 2015 → Support of pilots**
- **Operational 'PROBA-V Mission Exploitation Platform' → First release Jan 2016**
  - Time series viewer - full-res. Viewer - pre-defined PoD services – ESA Cloud Toolbox
  - Virtual Research Environment on scalable platform with access full archive
  - E-collaboration – Cal/Val - access to similar EO missions – Software - Documentation

esa

European Space Agency

→ You can be involved

as external bèta user!

as partner infrastructure in a federation

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Belgian Science Policy Office

belspo

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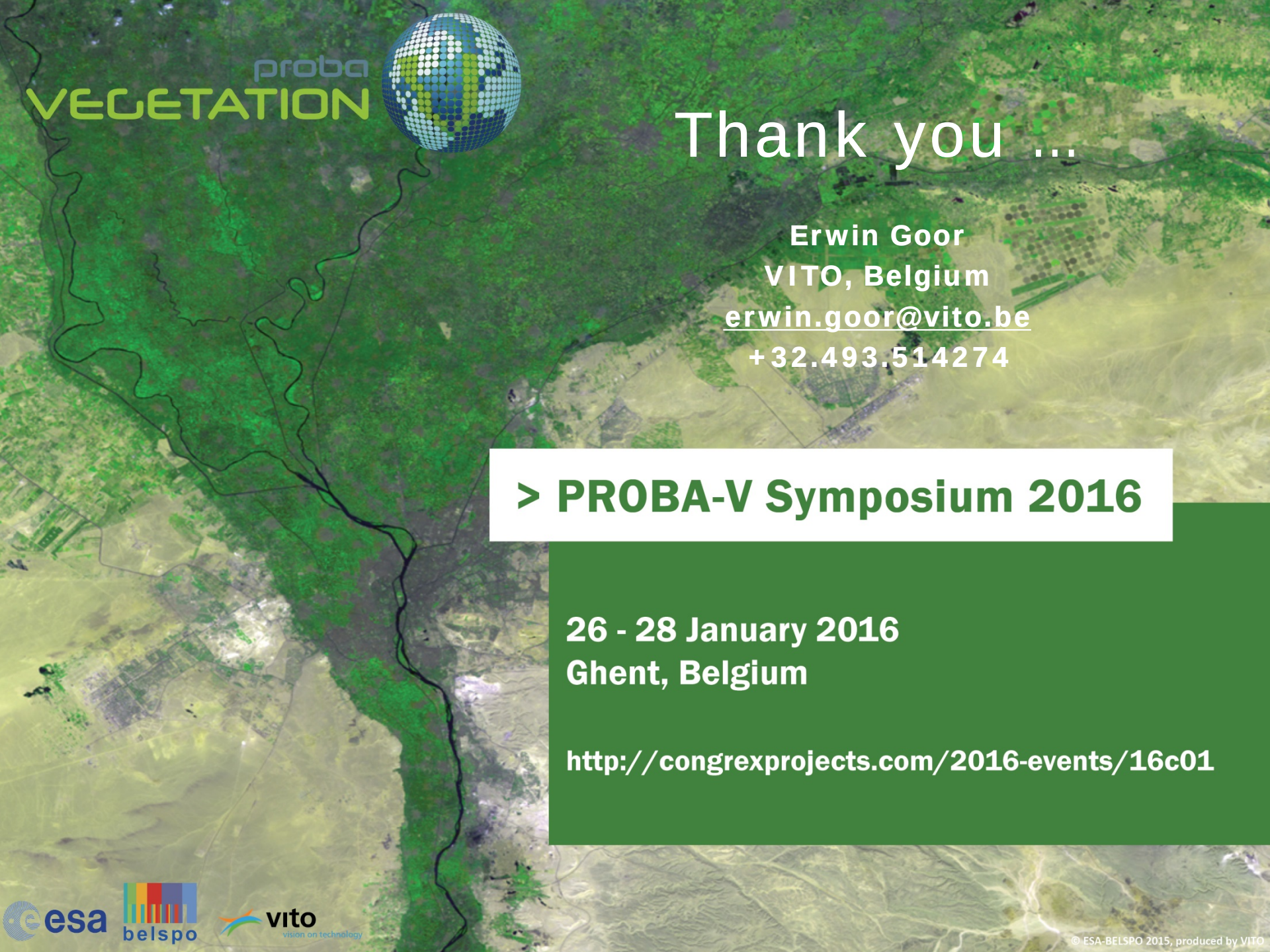

Thank you …

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> PROBA-V Symposium 2016

26 - 28 January 2016
Ghent, Belgium

http://congrexprojects.com/2016-events/16c01

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