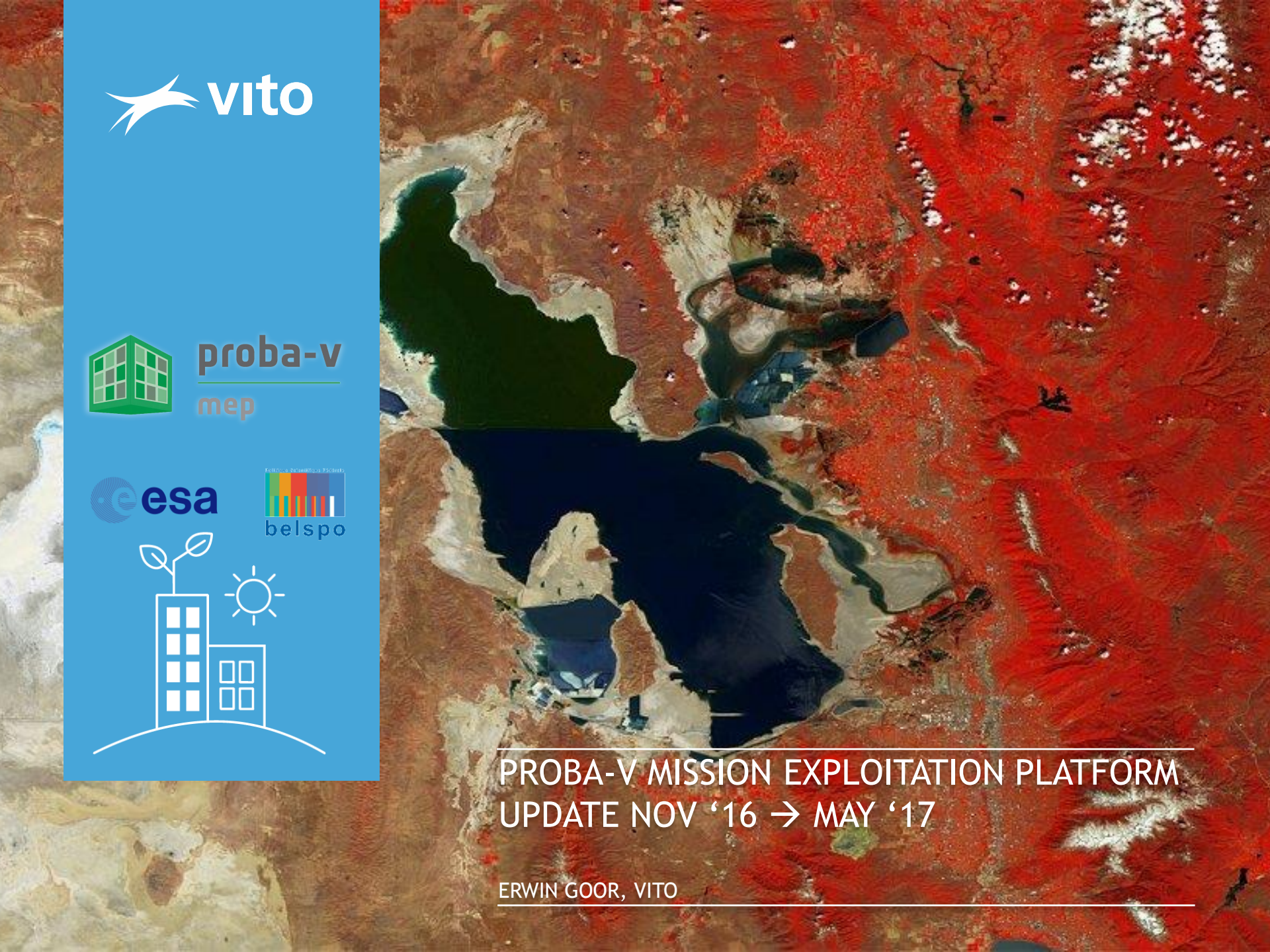


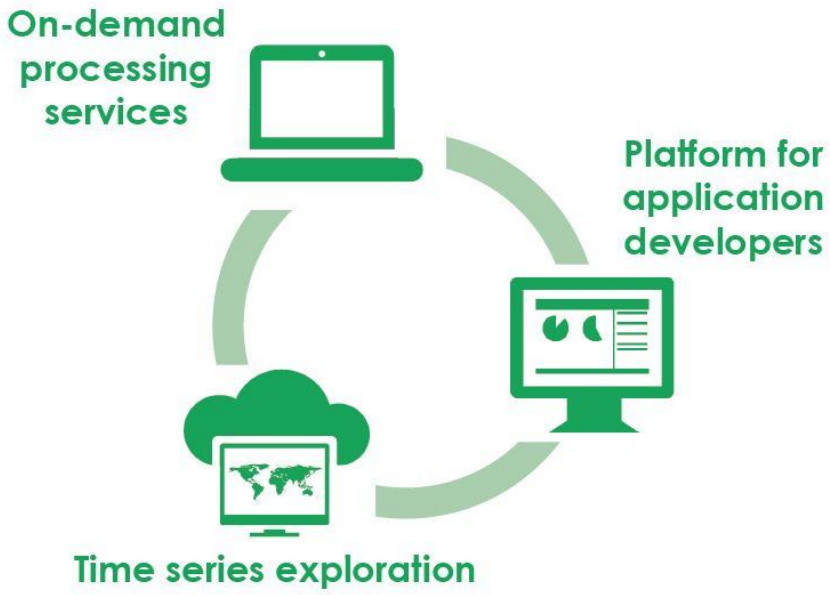
PROBA-V MISSION EXPLOITATION PLATFORM
UPDATE NOV ‘16 → MAY ‘17

ERWIN GOOR, VITO

PROBA-V MEP OVERVIEW

https://proba-v-mep.esa.int/

- Geo Viewer
- Time Series Viewer
- N-daily Compositor
- Request Virtual Machine
- Jupyter Notebooks



(*) only operations & EC funded – limited to viewers
(**) http://viewer.globalland.vgt.vito.be/viewer/
http://viewer.globalland.vgt.vito.be/tsviewer/

Copernicus Global Land (*) (**)	
SPOT-VEGETATION	Proba-V

Update needed after reprocessing!

openstack CLOUD SOFTWARE

Spark hadoop

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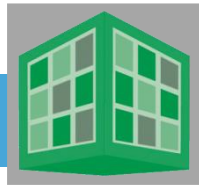
JUPYTER NOTEBOOKS



INTERACTIVE NOTEBOOKS

Interactive Data Analysis with python & R

Notebooks record & distribute ‘reproducible research

SnowDetectionNotebook.html

In [6]:
```
def parseTargets(statusmap, x, y):
    dataset = gdal.Open(statusmap)
    status = dataset.GetRasterBand(1)
    ret = status.ReadAsArray(x[0], y[0], x[1], y[1])
    del dataset
    return np.array(ret).flatten(order='F').tolist()

def parseFeatures( radiometry, x, y ):
    raster = gdal.Open(radiometry)
    raster_bands = [ raster.GetRasterBand(i).ReadAsArray(x[0], y[0], x[1], y[1]) for i in xrange(1, raster.RasterCount + 1) ]
    # 4 * Y * X

    del raster
    raster_bands = np.transpose(raster_bands)
    # Y * 4 * X

    raster_bands = raster_bands.reshape((len(raster_bands) * len(raster_bands[0]), len(raster_bands[0][0])))

    # Y * X * 4
    return raster_bands.tolist()

def parseChunk(chunk):
    return zip(
        parseTargets(chunk['statusmap'], chunk['x'], chunk['y']),
        parseFeatures(chunk['radiometry'], chunk['x'], chunk['y'])
    )

dataset = chunks.flatMap(parseChunk)
dataset.take(5)
```

Out[6]:
```
[(244, [764, 804, 874, 305]),
 (244, [767, 805, 876, 306]),
 (244, [768, 809, 879, 306]),
 (244, [775, 810, 880, 305]),
 (244, [773, 814, 879, 305])]
```

Some pixels contain invalid data. In such cases, one of the Reflectance value will be equal to -1. Since those pixels contain incomplete data, we might as well filter them out.

In [7]:
```
def is_valid(row):
    for v in row[1]:
        if v == -1:
            return False
    return True

dataset = dataset.filter(is_valid).repartition(100)
dataset.take(5)
```

Out[7]:
```
[(123, [1418, 1482, 2055, 618]),
 (123, [1376, 1434, 1998, 586]),
 (251, [1331, 1395, 1403, 573]),
 (251, [1307, 1351, 1405, 578]),
 (251, [1318, 1355, 1406, 594])]
```

As mentioned earlier, the mask for Snow/Ice is 100. Since we are only interested in those, we can define a function to convert the complete bitmask into a single bit equal to 1 if the pixel is Snow/Ice and 0 otherwise.

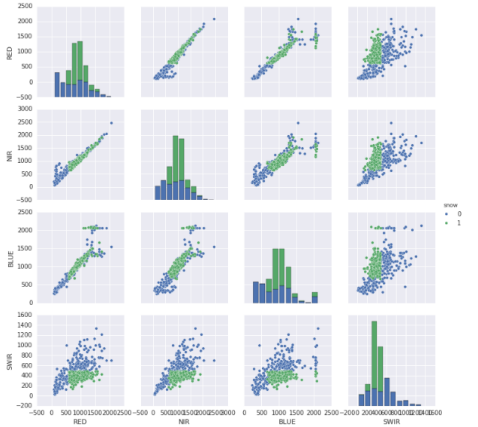
In [8]:
```
def is_snow(row):
    return (int(row[0] & 0b100 != 0) , row[1])

dataset = dataset.map(is_snow).cache()
dataset.take(5)
```

Out[8]:
```
[(1, [675, 695, 783, 304]),
 (1, [674, 694, 773, 300]),
 (1, [1456, 1593, 1490, 478]),
 (1, [1392, 1540, 1485, 460]),
```

In [12]:
```
sns.pairplot(df, hue='snow', vars=bands, hue_order=[0, 1])
```

Out[12]: <seaborn.axisgrid.PairGrid at 0x7f848fcf9910>



In [17]:
```
def is_snow_mask(mask):
    return (int(mask & 0b100 != 0))

def parseChunk(chunk):
    statusmap = map(is_snow_mask, parseTargets(chunk['statusmap'], chunk['x_range'], chunk['y_range']))
    features = parseFeatures(chunk['radiometry'], chunk['x_range'], chunk['y_range'])
    return (chunk['chunk'], map(parseSample, zip(statusmap, features)))

all_data = chunks.map(parseChunk)

def average_snow(data):
    return np.mean(map(lambda x: x.label, data))

averaged_by_chunk = all_data.map(lambda x: (x[0], average_snow(x[1]))).cache()
averaged_by_chunk.count()
```

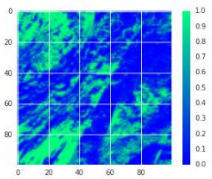
Out[17]: 10000

In [18]:
```
img_flat = averaged_by_chunk.collect()
```

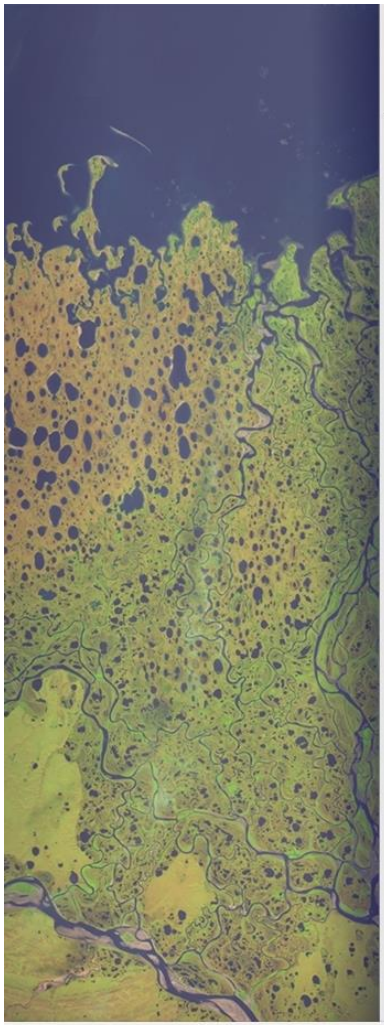
Here is how our original data looked like.

In [19]:
```
img = np.array(img_flat)[:, 1].reshape(100, 100, order='F').astype('float')
plt.imshow(img, cmap='winter')
plt.colorbar()
```

Out[19]: <matplotlib.colorbar.Colorbar at 0x7f848c46fad0>



SAMPLE NOTEBOO

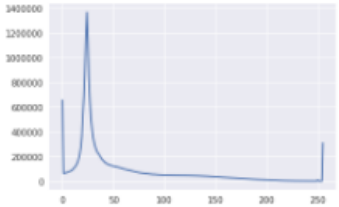


https://proba-v-mep.esa.int/applications/notebooks

Notebook sample gallery

Repository: https://bitbucket.org/vitotap/notebooks

Quick start sample

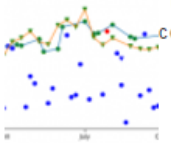


Finds PROBA-V products and computes a histogram using the processing cluster.

https://nbviewer.jupyter.org/urls/bitbucket.org/vitotap/notebooks/raw/master/QuickstartExample.ipynb

Keywords: catalog query, Spark, Python, histogram, matplotlib

Time series analysis (cal/val)



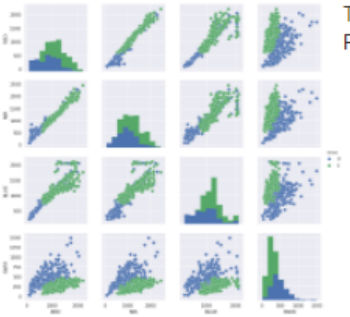
Uses MEP web services to retrieve time series from various products for a given point coordinate.

https://nbviewer.jupyter.org/urls/bitbucket.org/vitotap/notebooks/raw/master/CalVal%20WCS%20Timeseries.ipynb

https://nbviewer.jupyter.org/urls/bitbucket.org/vitotap/notebooks/raw/master/AERONET%20CalVal%20TSViewer.ipy

Keywords: Time series, REST, WCS, calibration, validation

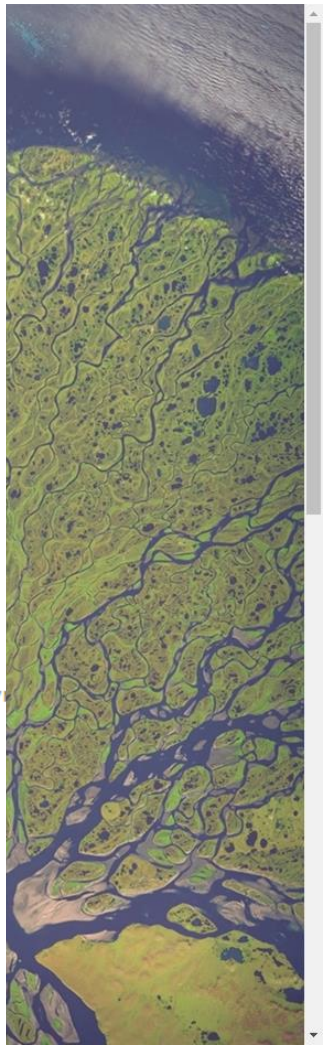
Snow classification



Trains a machine learning classifier to classify snow pixels based on PROBA-V radiometry.

https://nbviewer.jupyter.org/urls/bitbucket.org/vitotap/notebooks/raw/master/SnowDetection.ipynb

Keywords: Spark, Machine learning, Python, Seaborn, graphs, plotting



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SUPPORT FOR CAL/VAL USERS – SAMPLE NOTEBOOKS

- *Use WCS to retrieve time series for pixel, including bitmasks*
- *Use RESTfull service to retreive time series (only Proba-V S10)*

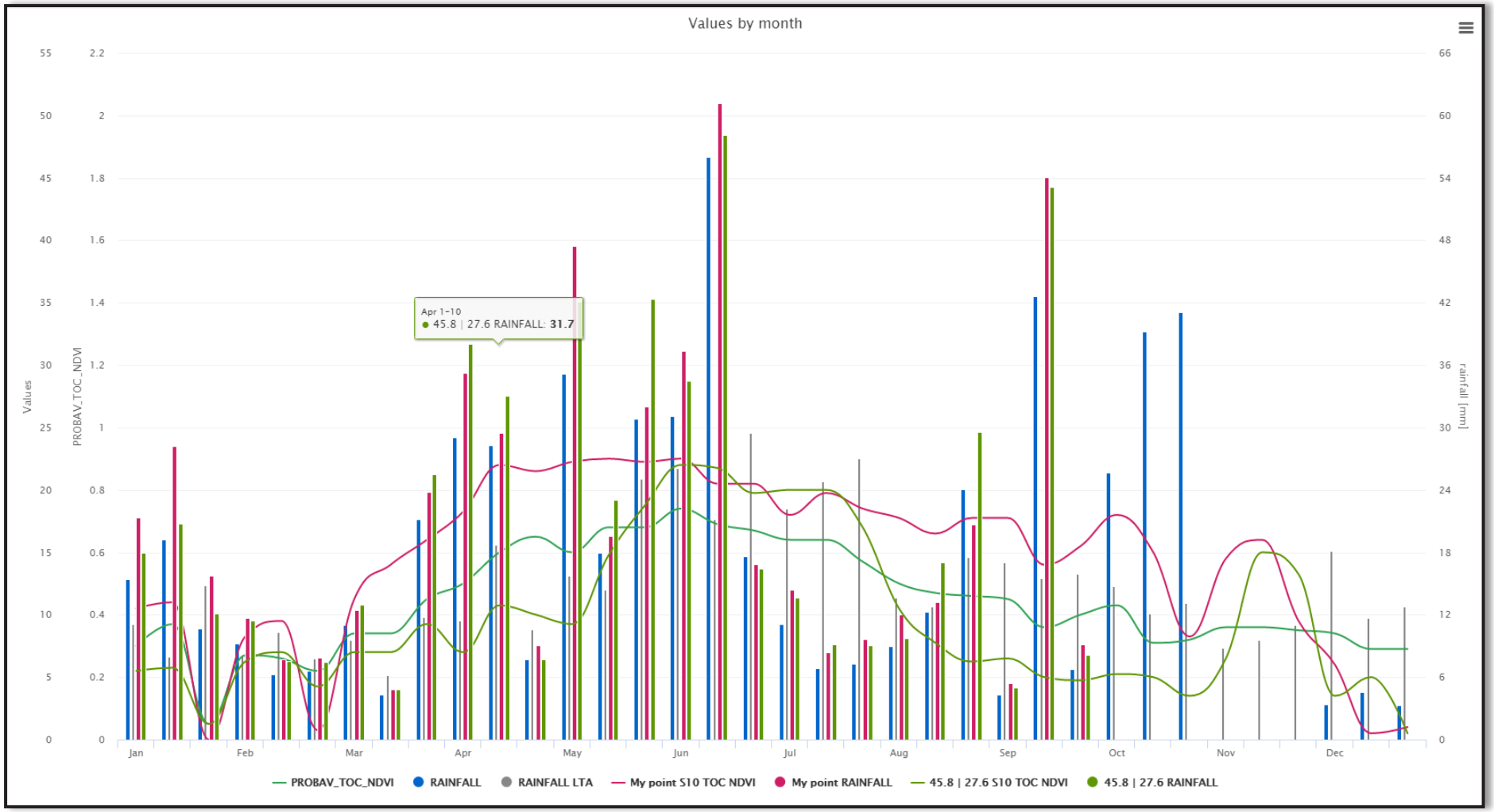
https://nbviewer.jupyter.org/urls/bitbucket.org/vitotap/notebooks/raw/master/CalVal%20WCS%20Timeseries.ipynb

» Filter out pixels which are flagged as cloud/no data

https://nbviewer.jupyter.org/urls/bitbucket.org/vitotap/notebooks/raw/master/AERONET%20CalVal%20TSViewer.ipynb

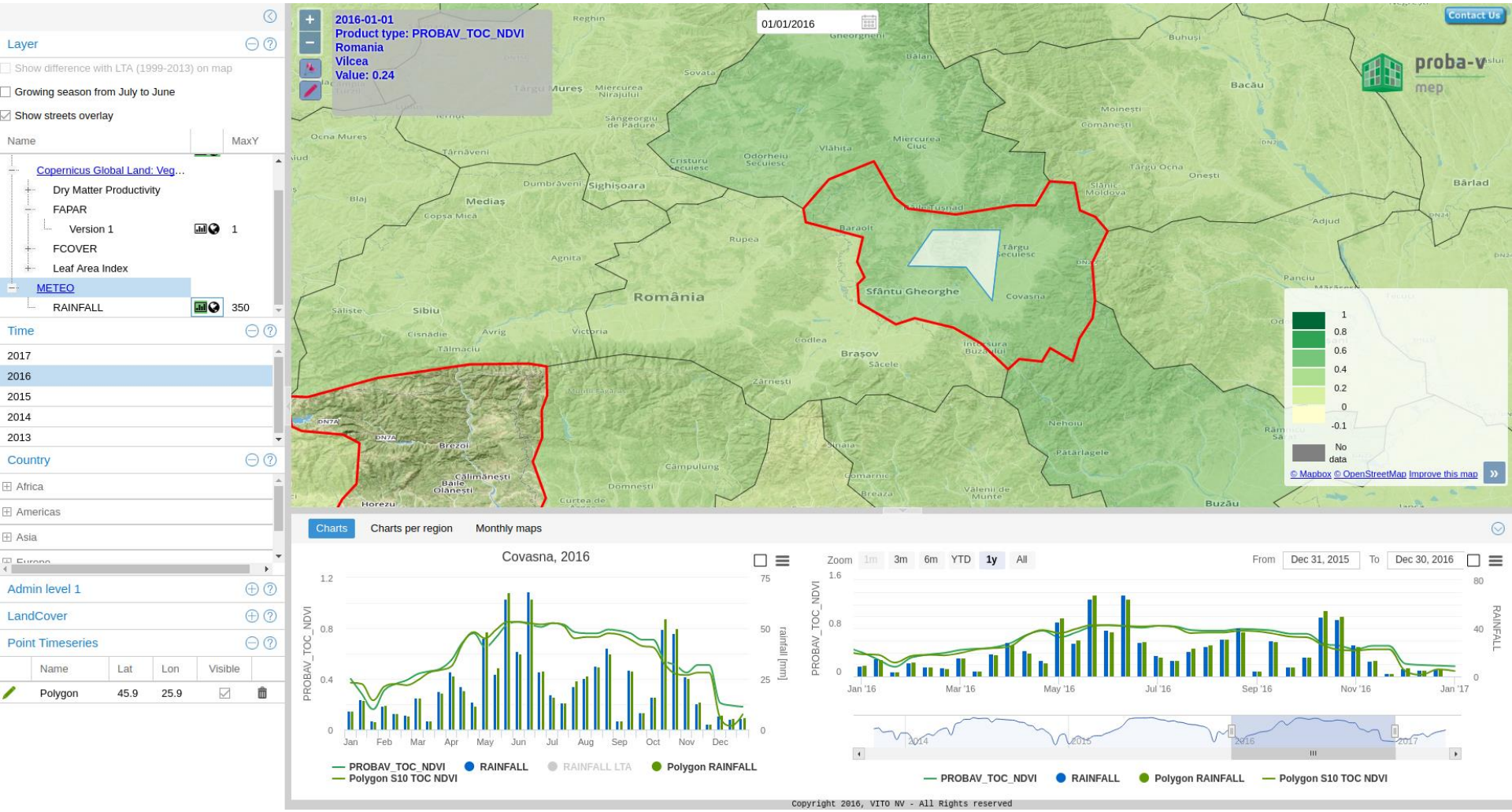
TIME SERIES VIEWER

- *Pixel support: released*
- *Polygon support: release on Web service, to be released on Web client*
- *SPOT-VEGETATION: to be released*



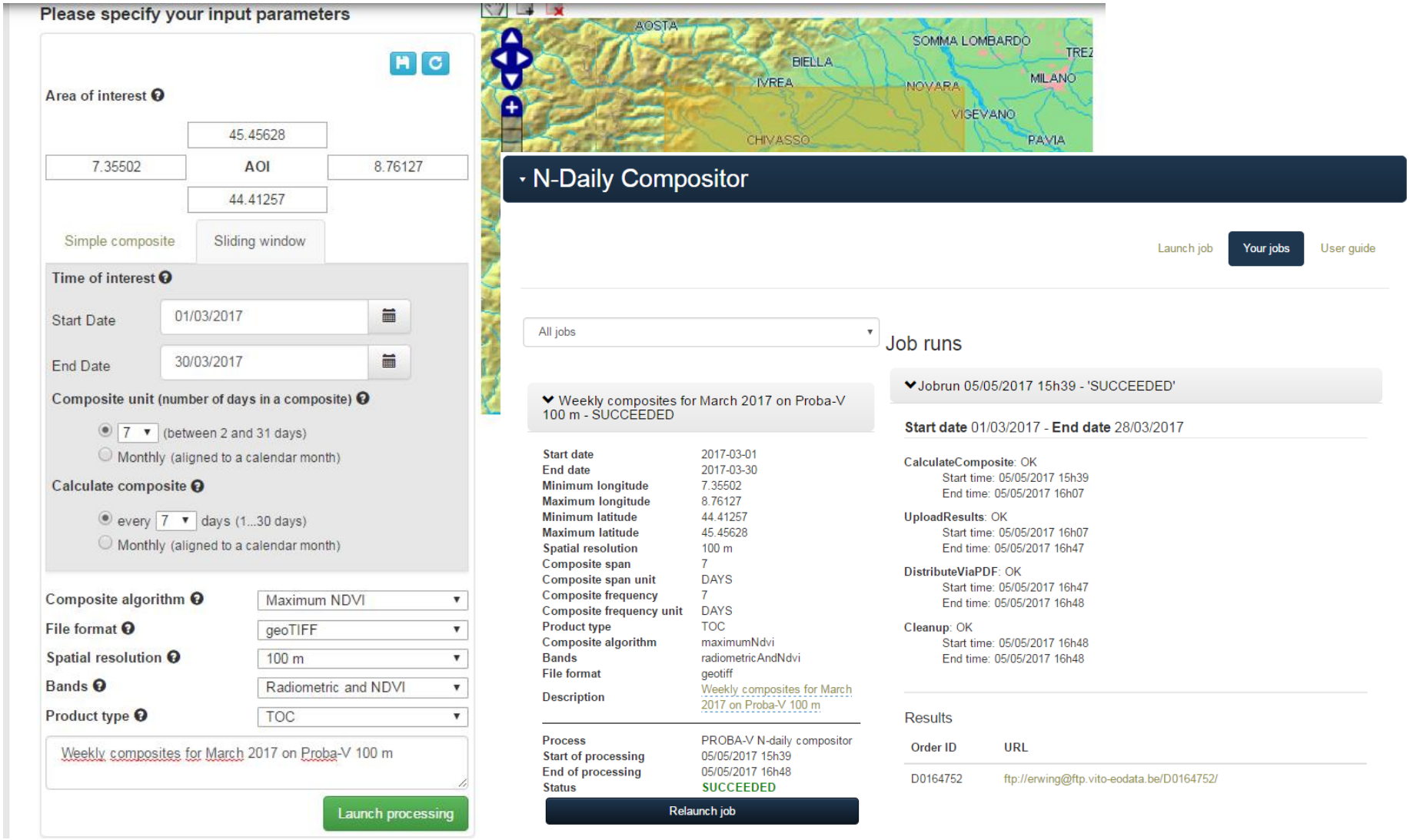
TIME SERIES VIEWER

Preview 'user-defined polygon' - not yet released!



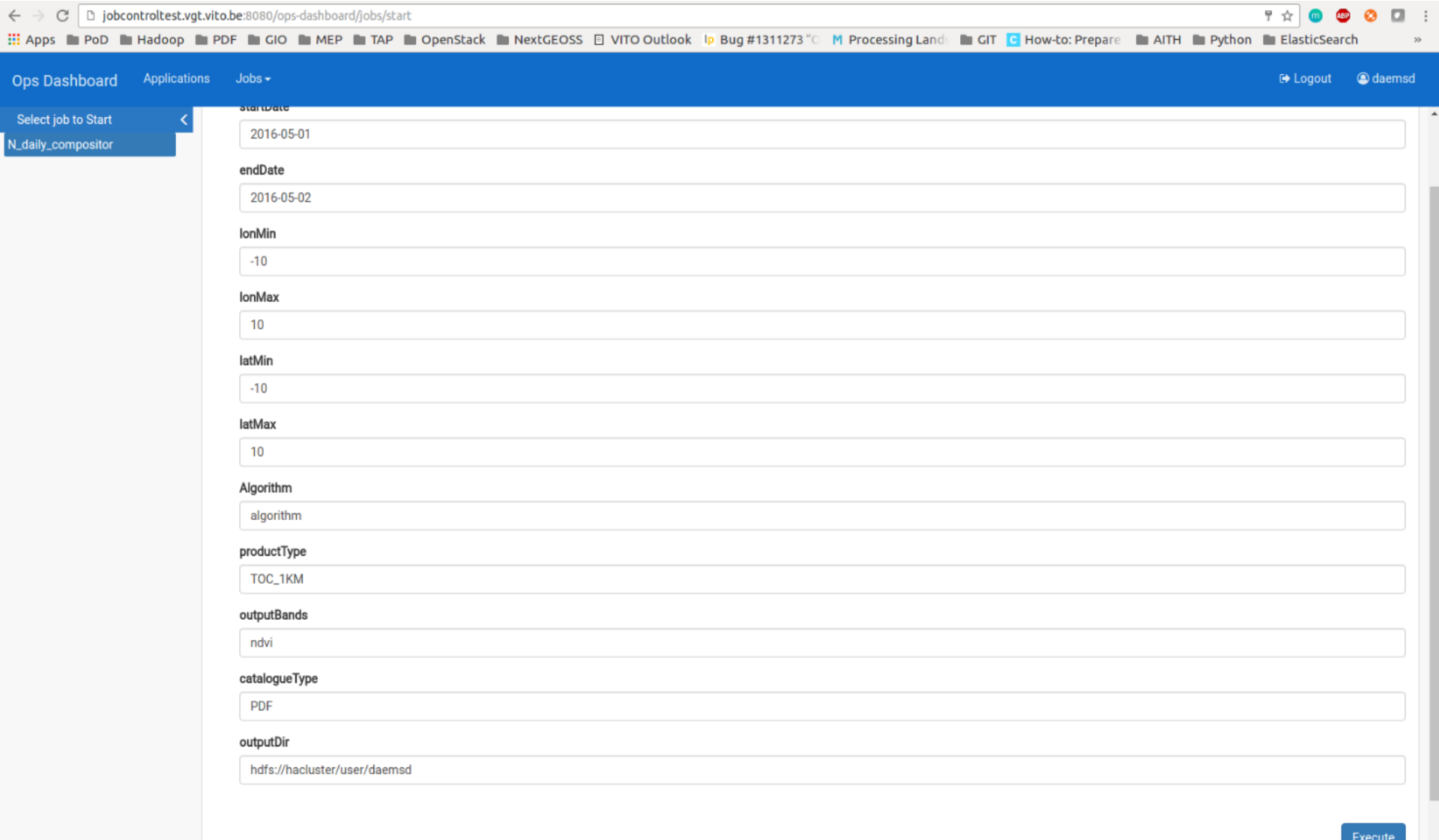
N-DAILY COMPOSITOR

Proba-V 100 m supported



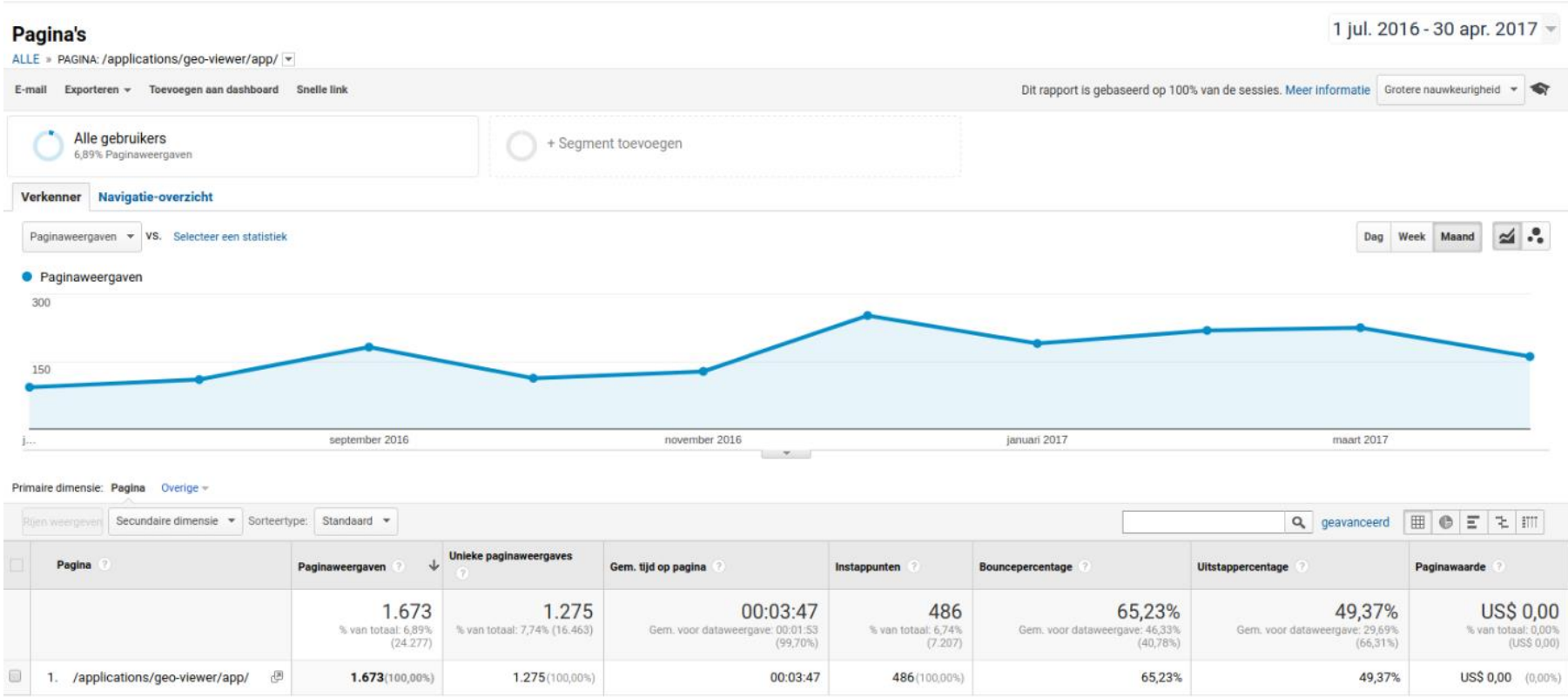
JOB MONITORING ON HADOOP CLUSTER

Implementation nearly finished → already used internally



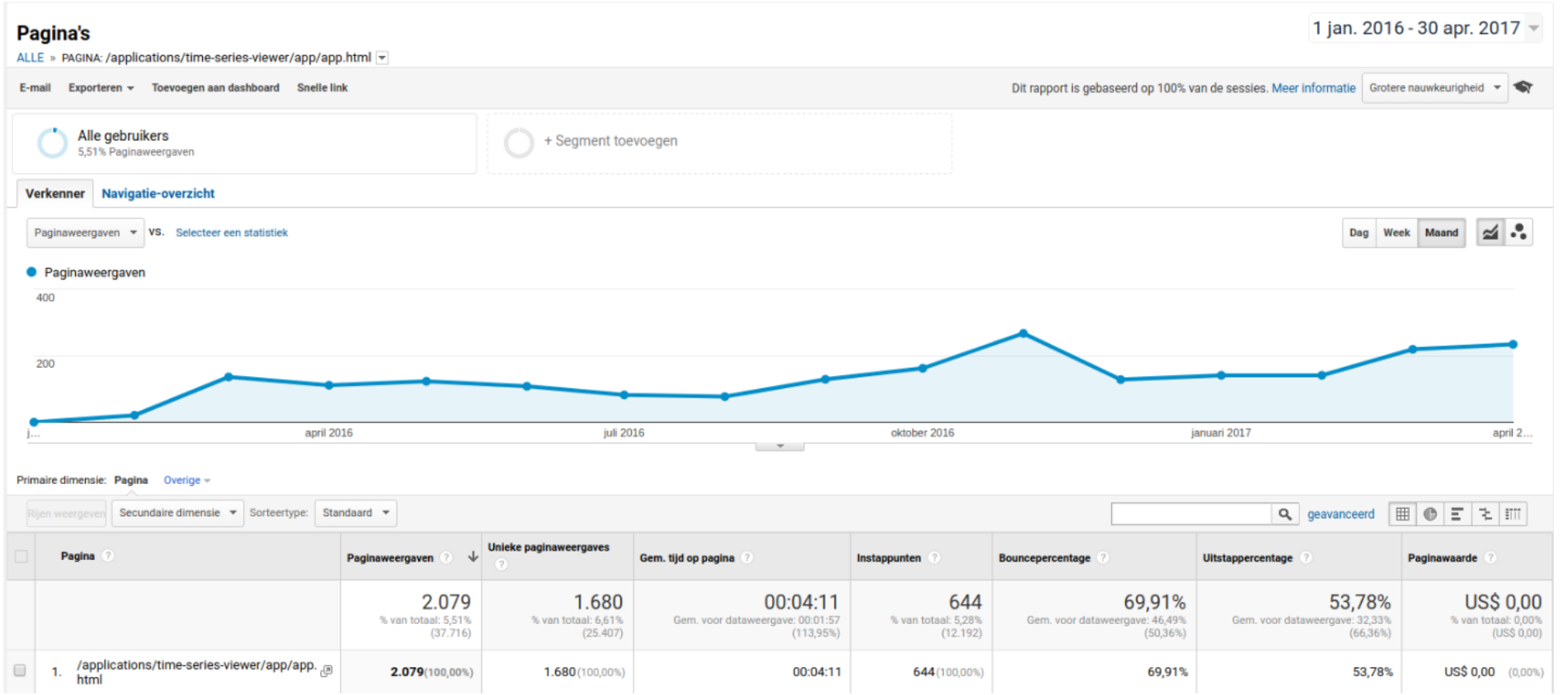
UPTAKE OF PROBA-V MEP APPLICATIONS – GEO VIEWER

!! Excluding the WMTS requests



UPTAKE OF PROBA-V MEP APPLICATIONS – TIME SERIES VIEWER

!! Excluding the Web services (only Web client)



UPTAKE OF PROBA-V MEP APPLICATIONS – VIRTUAL MACHINES

https://confluence.vgt.vito.be/pages/viewpage.action?spaceKey=EP&title=userVM+reporting

proba-v
mep

Live Training Session MEP:
Bring the User Closer to The Data

Dear,

Since November 2016, the PROBA-V Mission Exploitation Platform (MEP) is fully operational.
As a loyal user of PROBA-V, we invite you to one of our Webinars which we will organise in April – May and June 2017.

Learn from our experts about:
- Virtual Research Environment: working with PROBA-V data without downloading any data;
- Powerful Hadoop/Spark cluster for scalable EO-processing workflows;
- Data analytics: extract time series in real-time for any pixel or polygon;
- Interactive analytics with Notebooks technology.

After this interactive session, we will support you further in your first activities on the platform, where you can ***get free resources*** to start experimenting.

Let us know whether you are interested to attend the Webinar (~1 hour) and we will contact you to provide you with the necessary information.

April 2017

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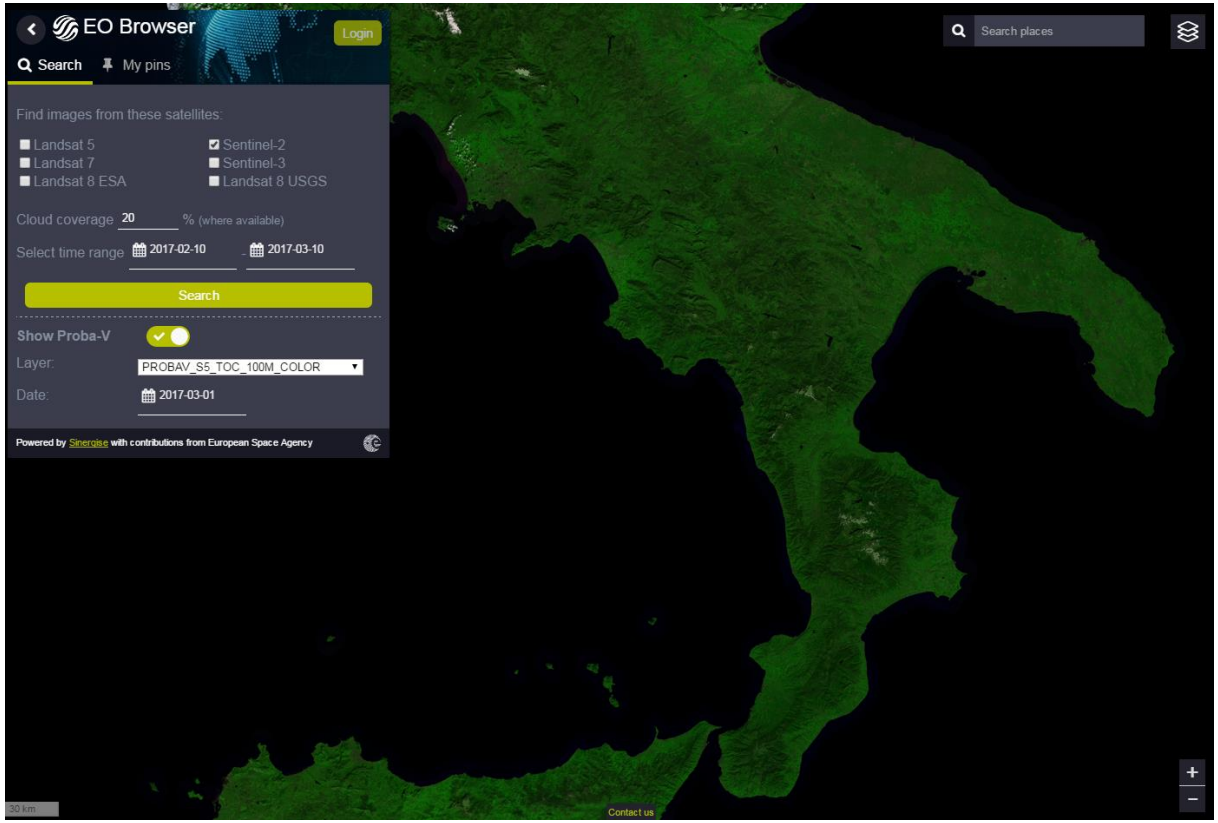
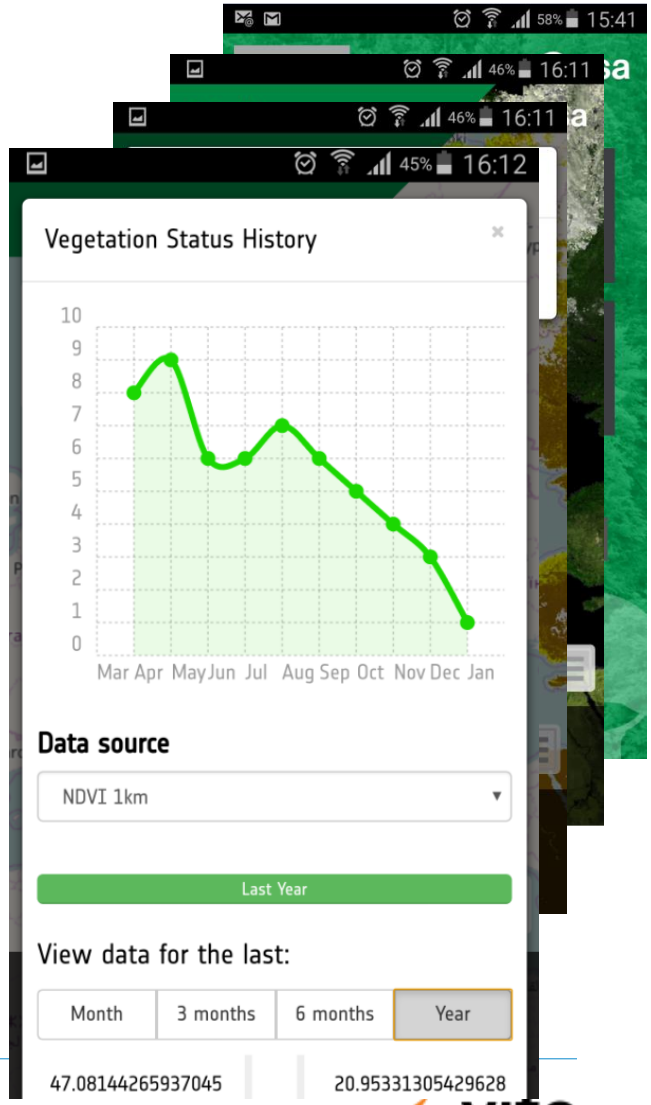
UPTAKE OF PROBA-V MEP APPLICATIONS – AS A NODE WITHIN A FEDERATION

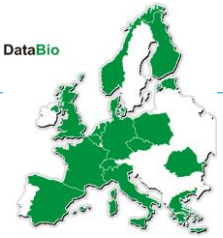




NEXTGEOSS
Contributing to the Vision of GEO

food security tep

DataBio



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UPTAKE OF PROBA-V MEP – USER FEEDBACK AT WORLD COVER 2017

- *Copernicus Global Land (VITO) - The dynamic Global Land Cover layer at 100 m resolution*

MEP platform

- Mission Exploitation Platform (MEP) PROBA-V is a virtual research environment
- Backbone of your automated processing chain
- Example: metrics extraction needs **5588** CPU-hours for whole Africa
  → MEP platform allows use to use 2 TB memory and 460 executers
  ➔ processing time cut to 41 hours = **99.2 % time saving**

- *WUR - Large area land cover monitoring using satellite image time series*

Objective

- Case studies for land cover monitoring
  - Semi-arid Sahel region
    - Land cover
    - Forest cover
  - Boreal region
    - Land cover fraction
- Big EO data challenge ~ Cloud-based processing platforms
  - ESA Cloud Toolbox
  - Proba-Mission Exploitation Platform (MEP)

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PLANNING

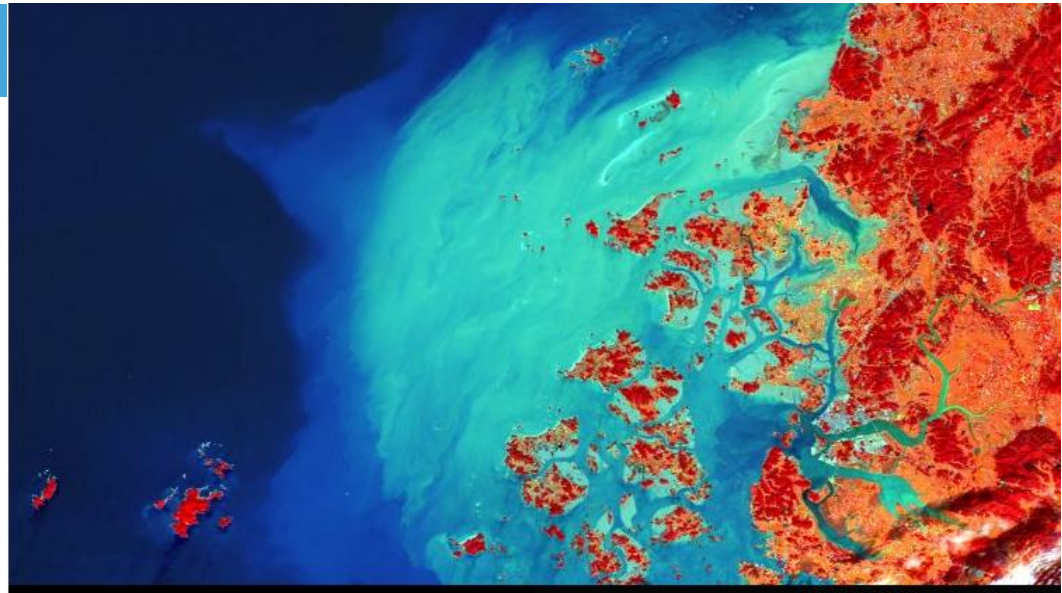
- **Iteration 2**
  - FAT (excl. Data Mgr) – 30 June 2017
  - AR (excl. Data Mgr) – 2 October 2017
  - ORR (excl. Data Mgr) – 31 October 2017

  - PDR (Data Mgr - Spacebel) – 30 June 2017
  - FAT (Data Mgr - Spacebel) – 31 October 2017
  - AR (Data Mgr - Spacebel) – 22 December 2017
  - ORR (Data Mgr - Spacebel) – 30 March 2018
- **Iteration 3 → limited new developments!**
  - KO – September 2017
- **Operations** will be extended (CCN needed) till end of 2019

PROMOTION ACTIVITIES

PROBA-V WEEKLY MAILING

Link to the Image of the Week in geoviewer



ESA-BELSPO 2017, produced by VITO

Mokpo, South Korea

Mokpo is a mid-size city (~250,000 inhabitants) in the southwest of South Korea and is part of the South Jeolla Province. It is a main gate to the country's largest granary at the Honam Plain and has been a naval base during the Choson Dynasty (1392 – 1910).
Further, it was the hometown of late South Korean president and Nobel Peace Prize 2000 recipient Kim Dae-Jung.

The city is surrounded outside the coast by more than 1,400 islands, which provide fishing grounds and also protect the area from large typhoon and tsunami impacts.

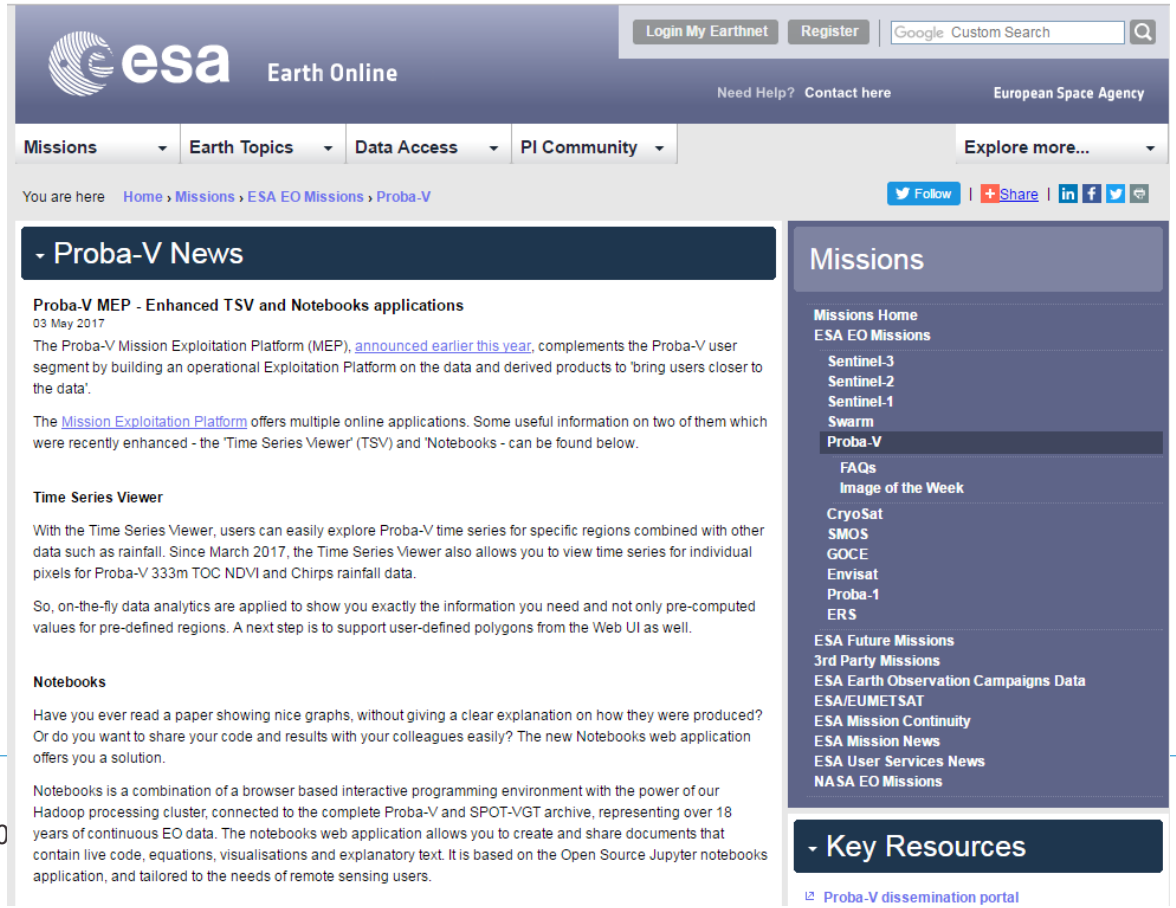
The 100 m image of 6 October 2016 shows Mokpo in the lower-right image part as a blue-grey area located at the Yeonsang River estuary. Furthermore, the image shows the scattered smaller and larger islands outside the coast, while an extensive area with large sediment concentrations extents further into the Yellow Sea in a bow shape.

Launch Geoviewer

PROBA-V products comprise segment data (Level 1C and Level 2A) and daily and 10-daily synthesis files (S1 and S10), including NDVI data. More information on the PROBA-V product suite is available at the Product Distribution Portal and the Product User Manual.

SPECIFIC PROBA-V MEP MAILINGS

» http://www.flexmail.eu/m-f303452c581b6919c7b9113182a667abb4d05073d690e445



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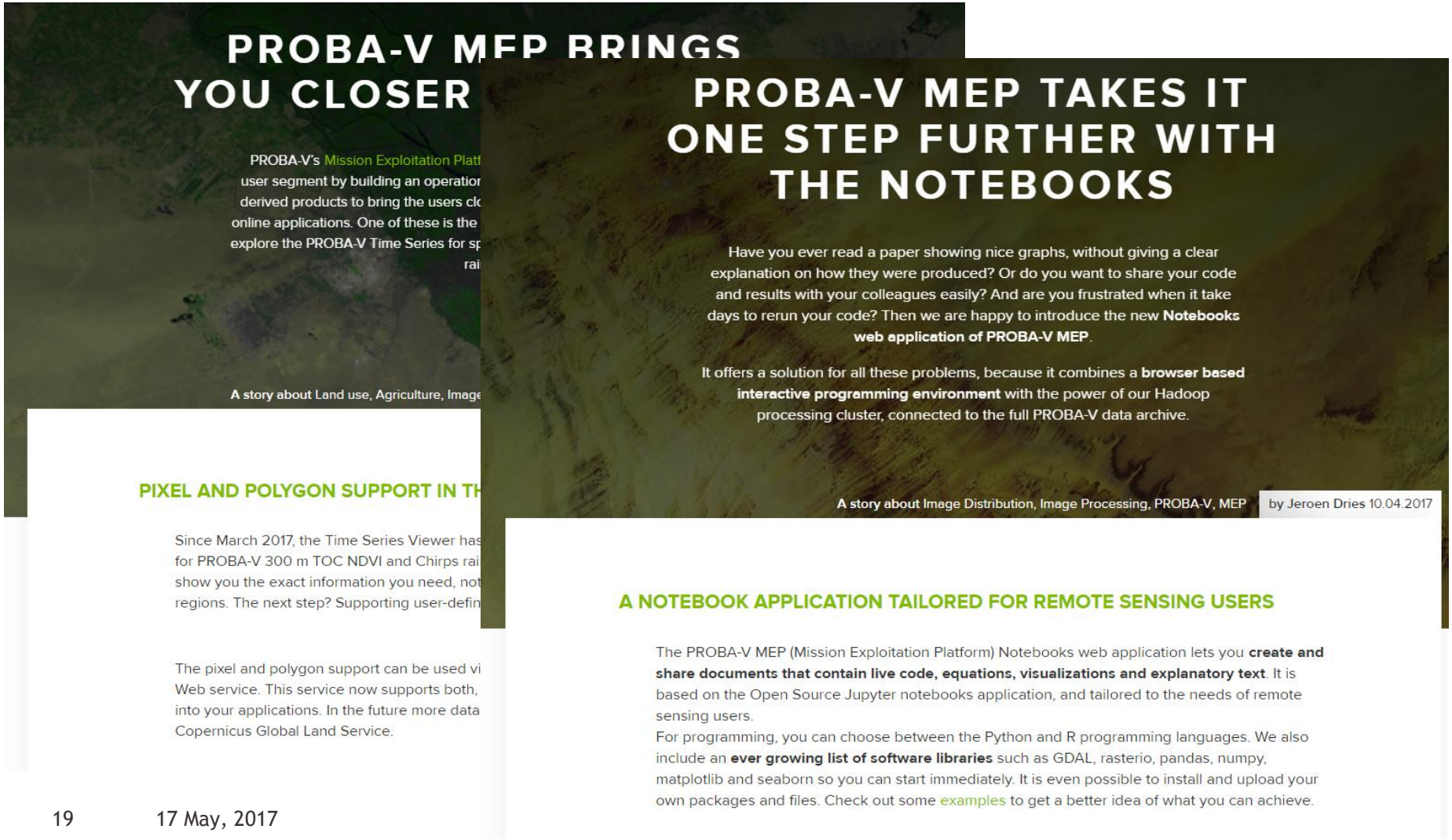
VITO REMOTE SENSING BLOG

https://blog.vito.be/remotesensing



PROBA-V MEP LEAFLET FOR DEVELOPERS

Being developed …

PRESENTATIONS & DEMO'S AT VARIOUS EVENTS

- BEGEO day 2017, Brussels (March) – demonstrations
- ESA WorldCover 2017 (March), ESRIN - presentation
- EGU 2017, Vienna (April) – poster
- EODC forum 2017 (May), Vienna – presentation & demonstrations
- Multitemp (June), Bruges – demonstrations
- BIDS conference 2017 (November), Toulouse – Abstract submitted
- Datacube conference 2017 (October), ESRIN - ???

MEP evolutions / R&D to be discussed with ESA – EC – Belspo … after DIAS consortia are granted

!! DIAS is a clear opportunity for MEP as "Support for 3rd-party services integration"
→ fusion Proba-V with Sentinel-2, …

http://proba-v-mep.esa.int/

Thank you …

Erwin Goor – VITO - Belgium
erwin.goor@vito.be