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JRC Earth Observation Data and Processing Platform (JEODPP)

European Commission, Joint Research Centre
Directorate I Competences, Unit I.3 Text and Data Mining

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Visit of Jordan Academics, 27th June 2018, Ispra

Earth Observation in the Big Data Era

- The EU ***Copernicus*** Programme with the ***Sentinel*** fleet of satellites acts as a game changer by bringing EO into the Big Data era:
  - *expected 10TB/day of **free and open** data*
  - *requires new approaches for data handling and processing*
- Set-up of a collaborative platform at JRC for storing, processing, and analyzing Earth Observation data

Sentinel-1 (Credits: ESA/P. Carril)

Sentinel-2 (Credits: ESA/P. Carril)

Sentinel-3 (Credits: ESA/J. Huart)

JRC Earth Observation Data and Processing Platform (JEODPP)

Versatile platform bringing the users to the data and allowing for

- Running large scale batch processing of existing or new developed workflows
- Remote desktop capability for fast prototyping
- Interactive data mining and visualization with Jupyter

Current status of platform

Based on commodity hardware and open-source software stack:

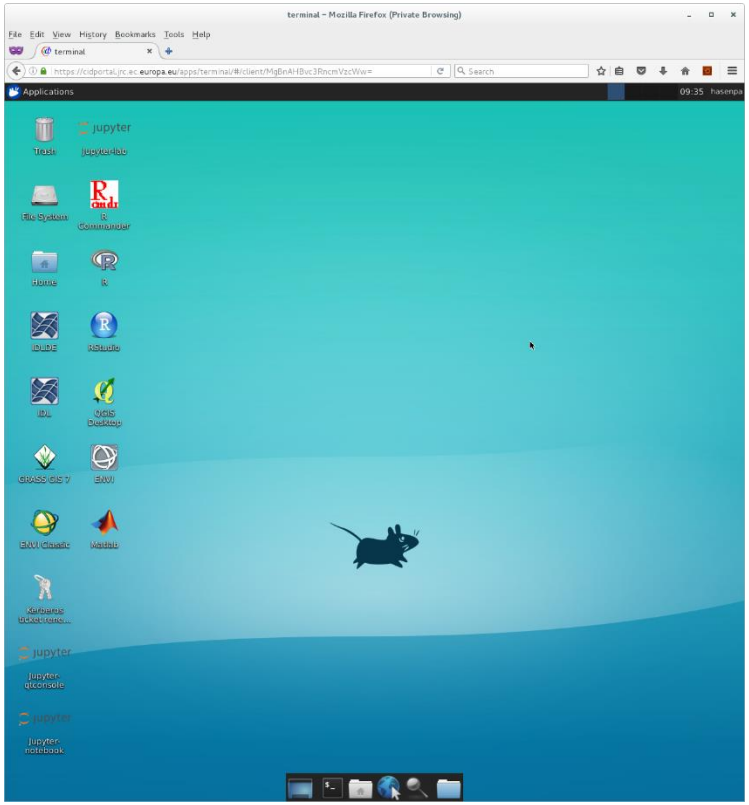
- Storage
  - ***CERN EOS*** *distributed file system,*
  - *Currently 2.4 PB net capacity*
  - *Extension to 7 PB net on the way*

- Processing servers (batch processing)
  - *1200 cores*
  - *further extension including GPU servers in 2018 planned*

Low-level batch processing

- **HTCondor** as workload manager for large-scale data processing
- **Docker** containers for flexible management of processing environments
  - *Custom builds for different requirements to support project-specific workflows*
  - *Facilitates upgrades and testing of processing environments (libraries, tools)*
- Use of OpenMPI in a virtual HPC cluster
- Testing of alternative solutions: MESOS, Spark

JEODPP Remote Desktop via Web



- A pool of Docker containers running next to the data
- Linux desktop environment
- Standard software installed
  - QGIS, GRASS
  - *IDL/ENVI, Matlab*
  - *R (R, R Commander, Rstudio)*
  - *Jupyter-lab, Jupyter-notebook*
  - *Python*
- Relies on HTML5 and runs in FF, IE, and Chrome
- For prototyping and ad hoc products' analysis/visualization

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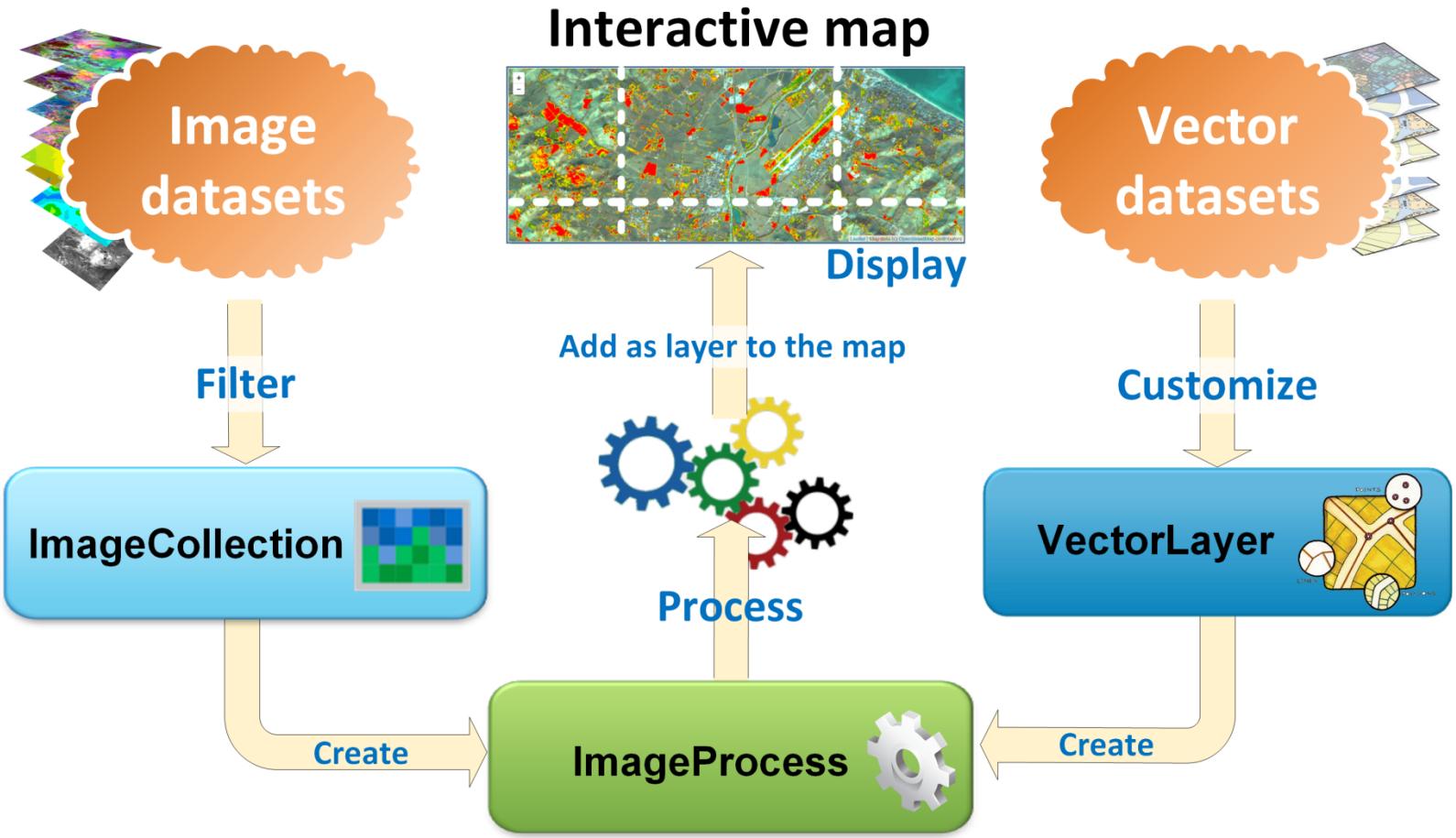
Interactive Visualization & Processing

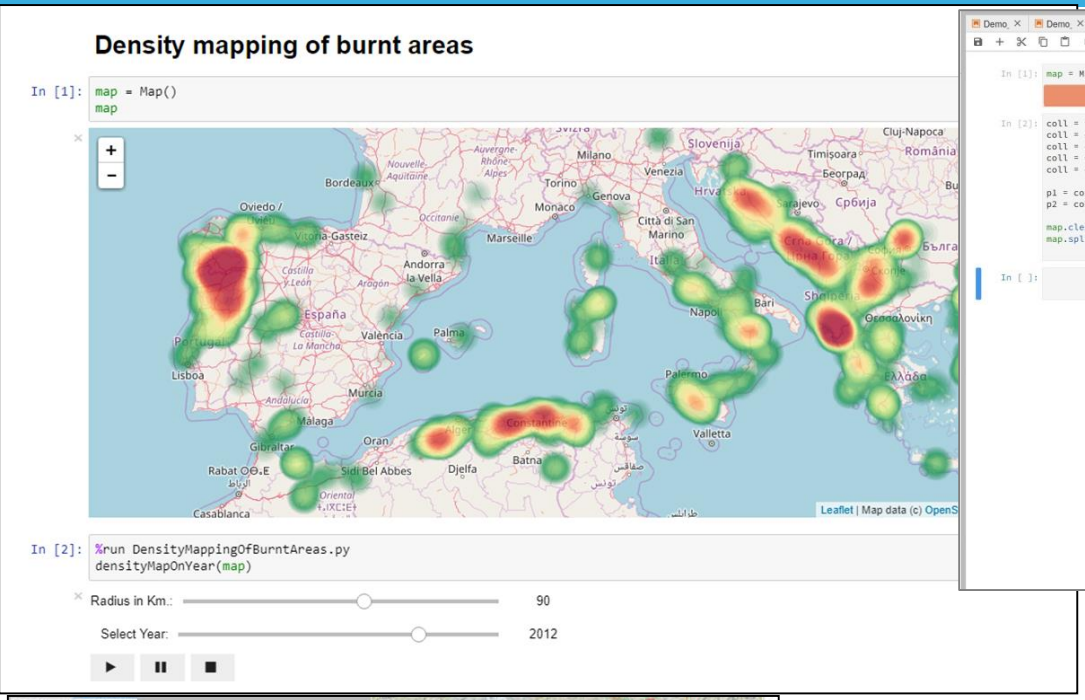
- Web user interface to server-based data processing
- Based on *Jupyter Notebook*
- Development of a data analysis and processing API
  - *Python as core with C/C++ modules + SWIG*
- Powerful data manipulation for programmers
- Easy interface building for use by non-programmers

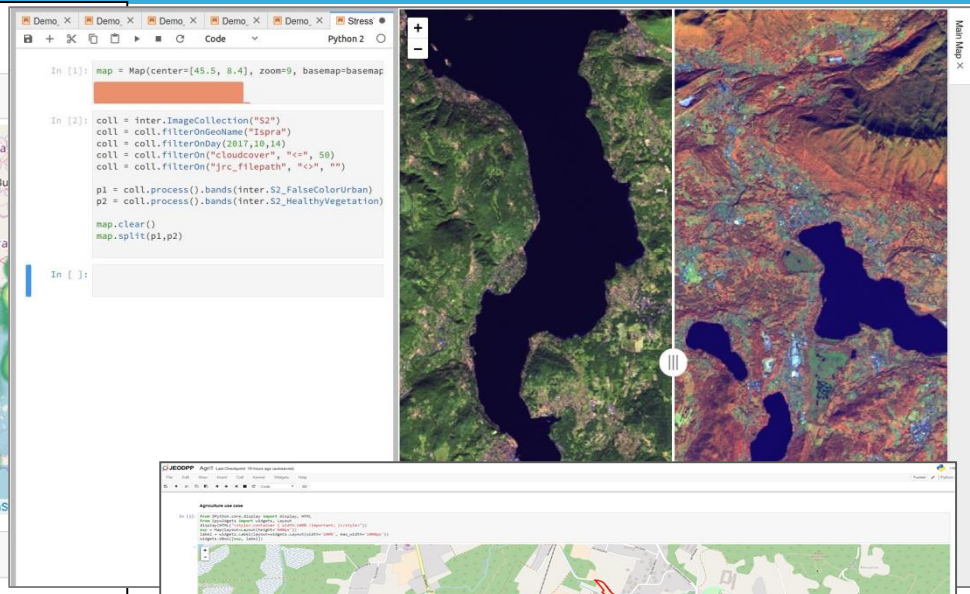
Interactive Visualization & Processing

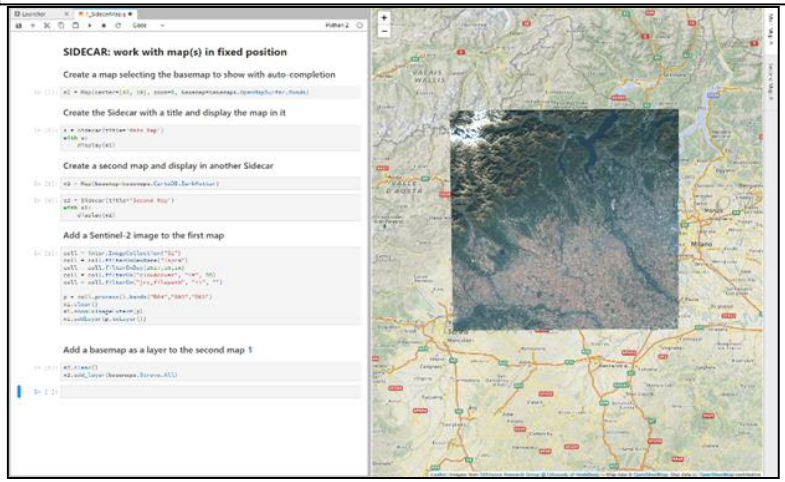


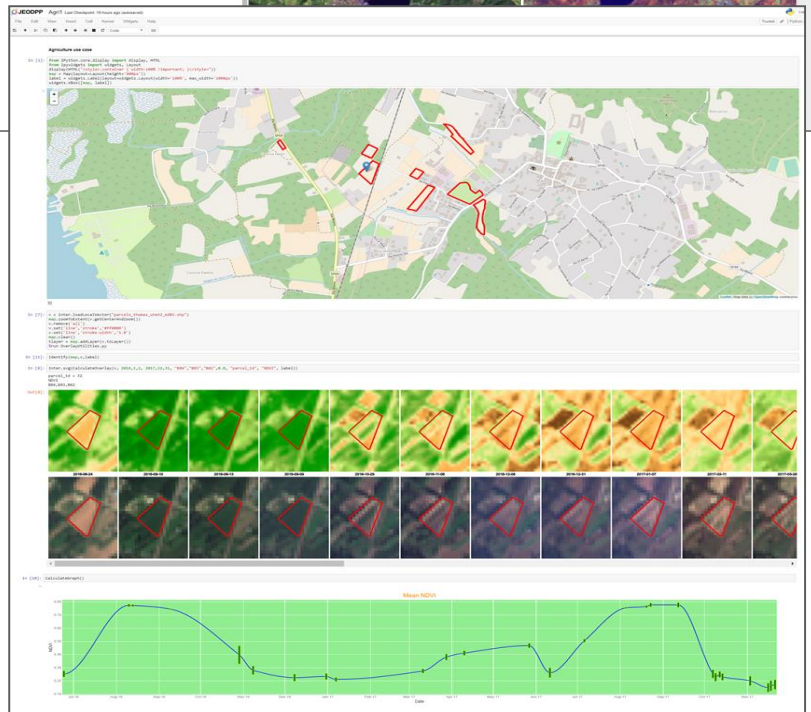
Source: Soille et al., FGCS, 2017 (submitted)

Interactive Visualization & Processing









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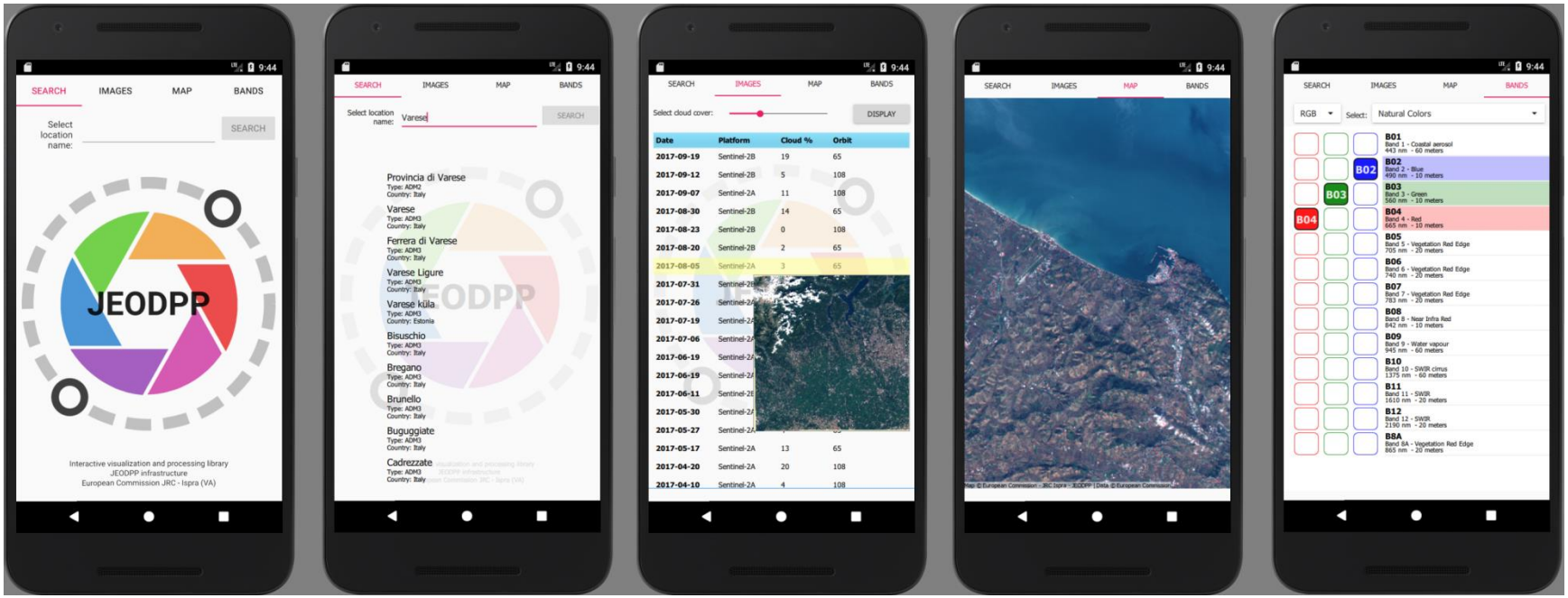
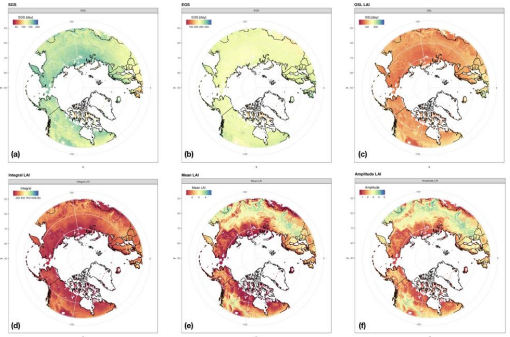
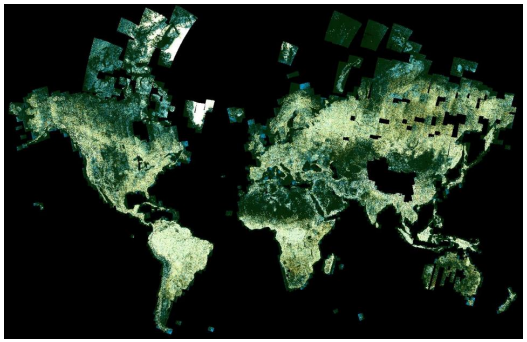
Mobile app – proof of concept
Sentinel-2 explorer

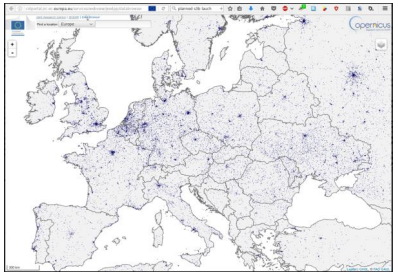


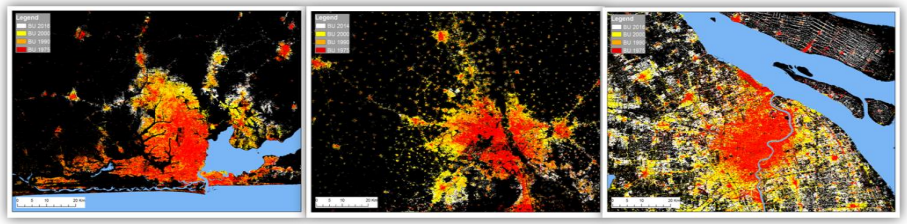
Gallery of data processing on the JEODPP

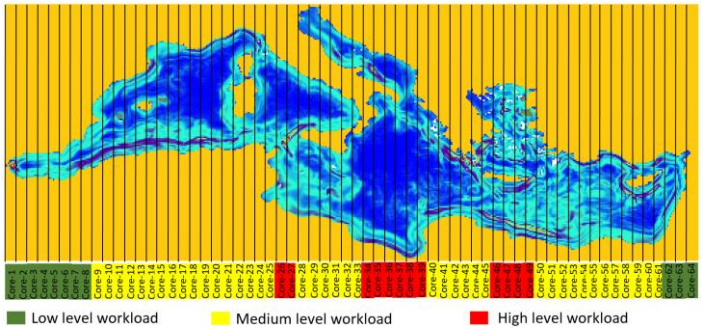
JEODPP
JRC Earth Observation Data and Processing Platform

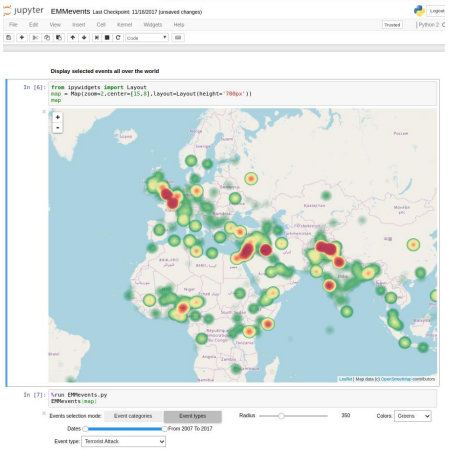


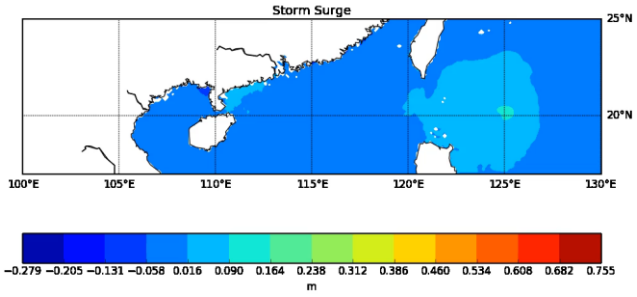












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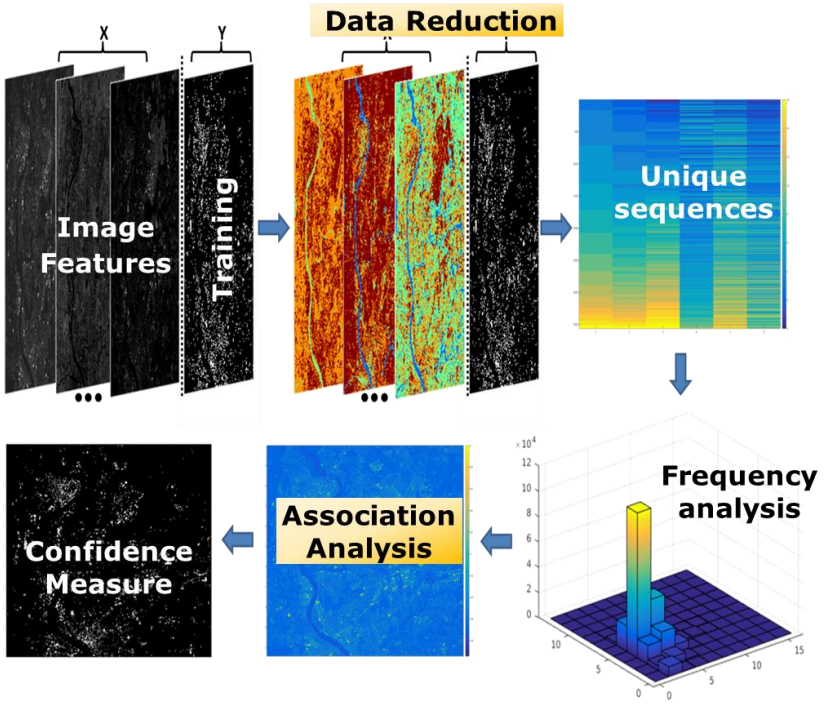
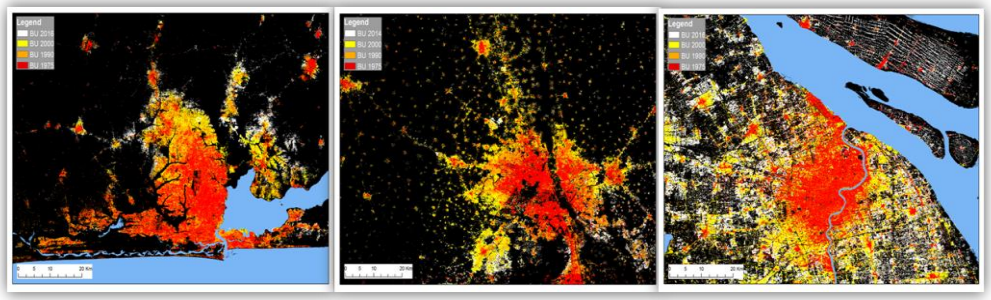
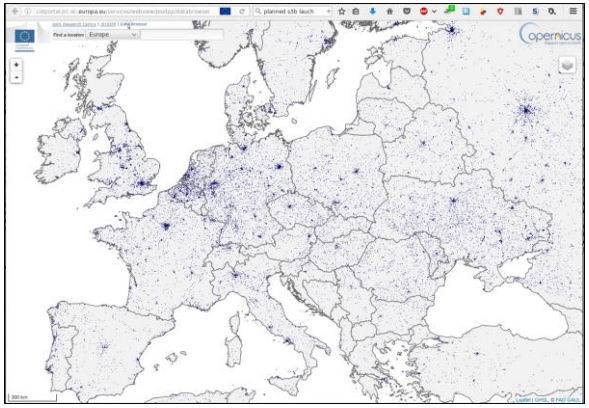
Global human settlement detection







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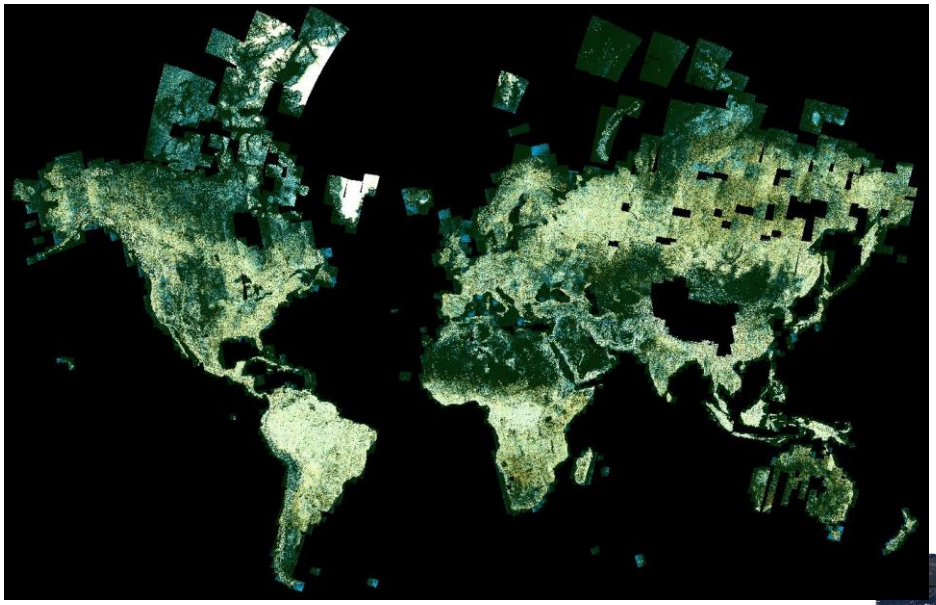
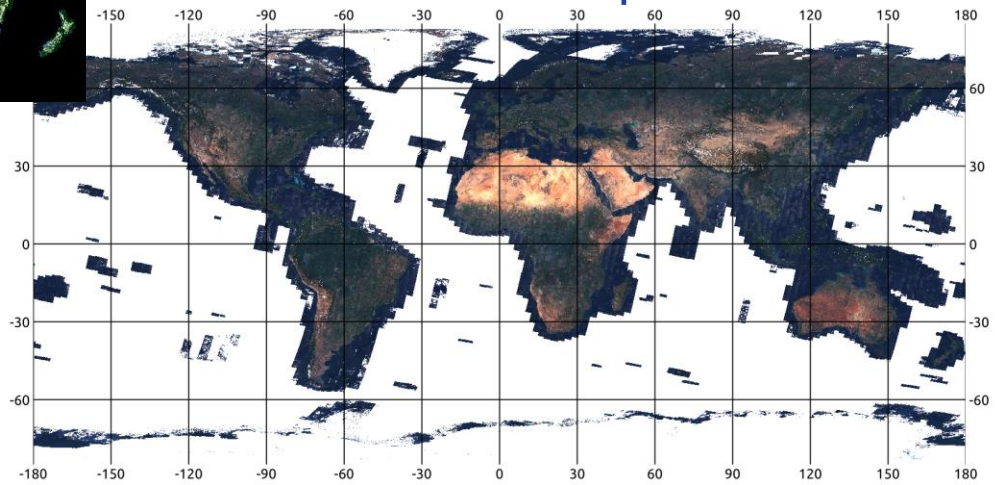
Creation of global satellite seamless mosaics



Sentinel-1 – Radar (SAR)

Sentinel-2 – Optical



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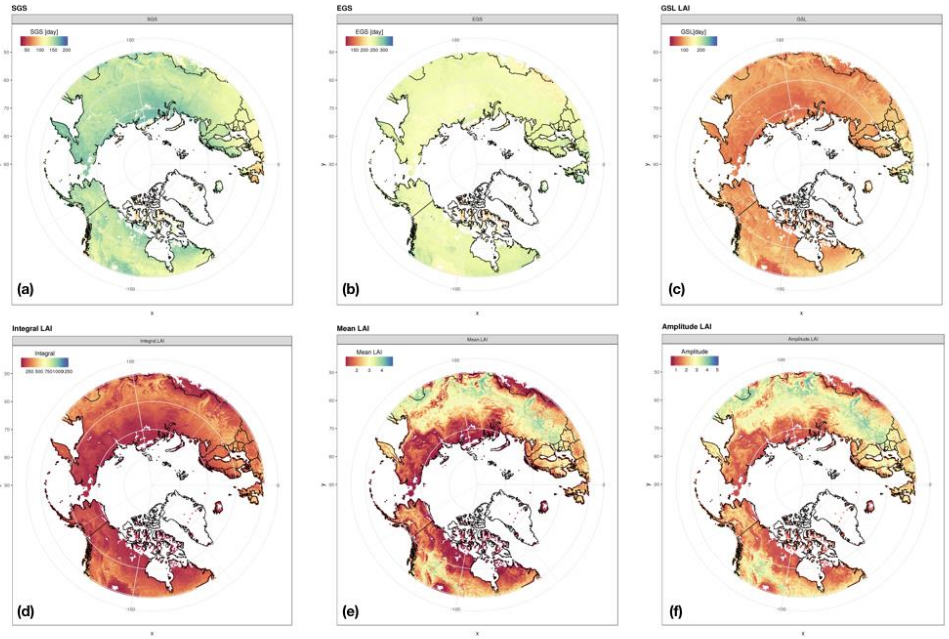
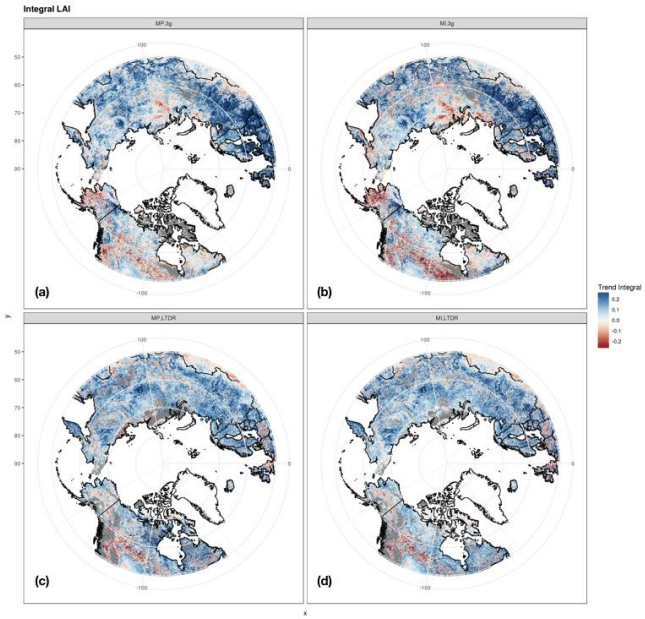
Monitoring vegetation phenology





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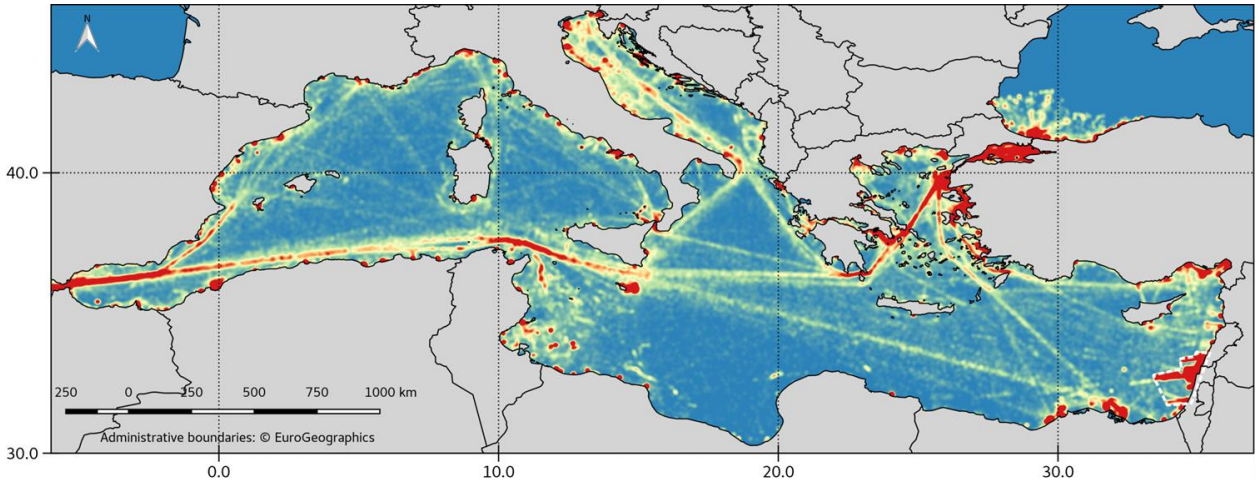
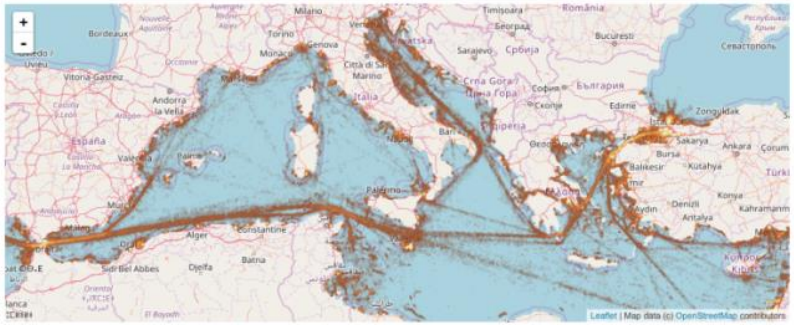
Ship detection and visualization




```
In [1]: map = Map()
        map
```



Load ships data and display in heatmap mode selecting a color scheme:

```
In [2]: v = inter.VectorLayer("ships").heatmap(2000.0,"inv_nimages",0,0.05).opacity(190)
        v.colorScheme("YlOrBr_mixed_exp")
        map.clear()
        map.addLayer(v.toLayer())
```

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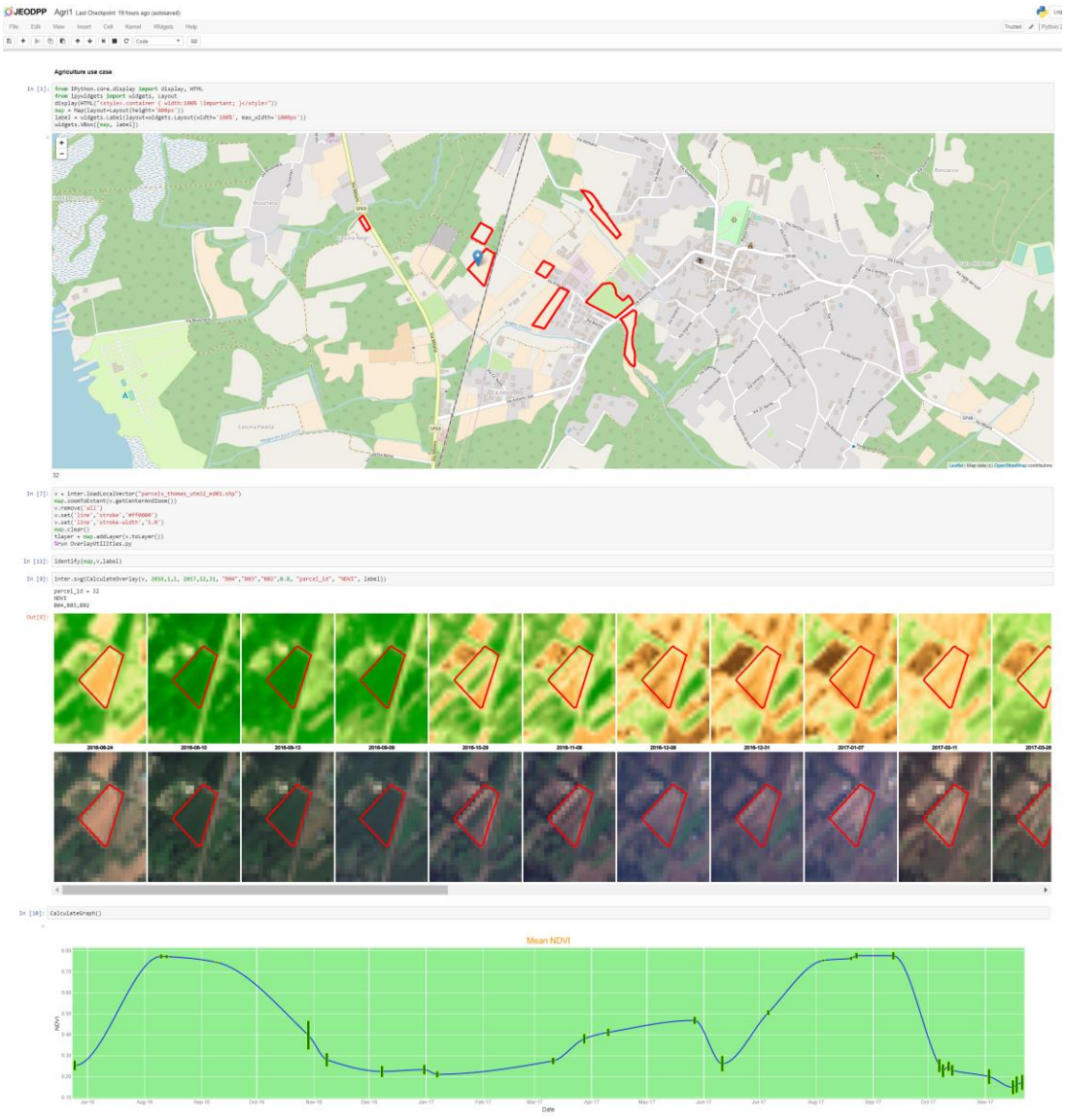
Agriculture controls & monitoring



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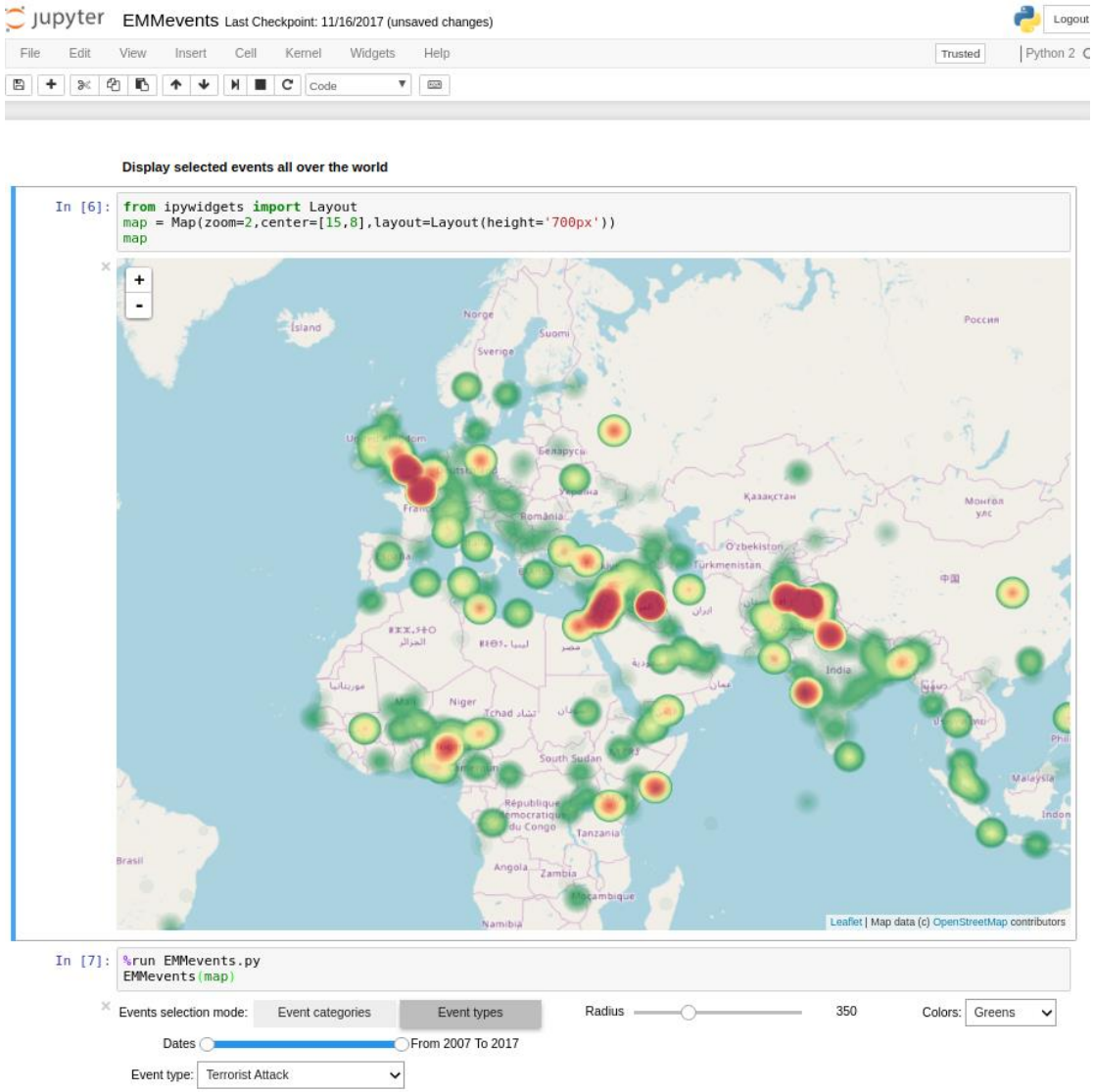
European media monitoring – visualization of events



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Platform evolution and outlook

JEODPP
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- >20 JRC projects actively using the JEODPP
- More projects expressed interest in usage
- Extension towards new data domains
- Intensified usage of machine learning

Thank you for your attention!

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Future Generation Computer Systems

Volume 81, April 2018, Pages 30-40

A versatile data-intensive computing platform for information retrieval from big geospatial data

P. Soille, A. Burger, D. De Marchi, P. Kempeneers, D. Rodriguez, V. Syrris, V. Vasilev

https://doi.org/10.1016/j.future.2017.11.007

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