Automated Earth Observation data discovery and access using open source web frameworks

Main objectives:

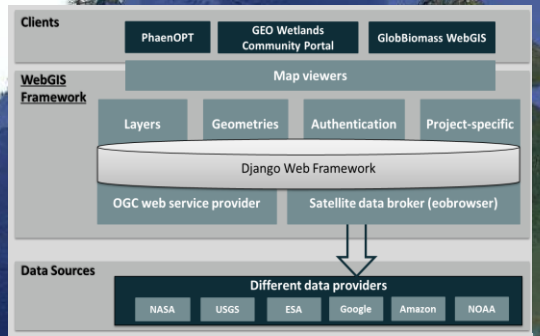
- Develop a generic framework to set up web-based geoportals using existing open source web frameworks
- Publish independent map viewers with centralized data management
- Provide ability to automatize the discovery of multi-source Earth Observation data for individual regions

Software:

- Django Web Framework (Python)
- OpenLayers
- AngularJS

Tools:

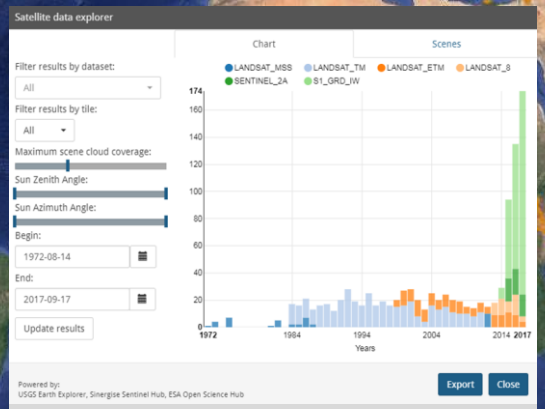
- Satellite scene explorer
- ISO-compliant metadata management
- Interactive visualization of geospatial data based on OGC services



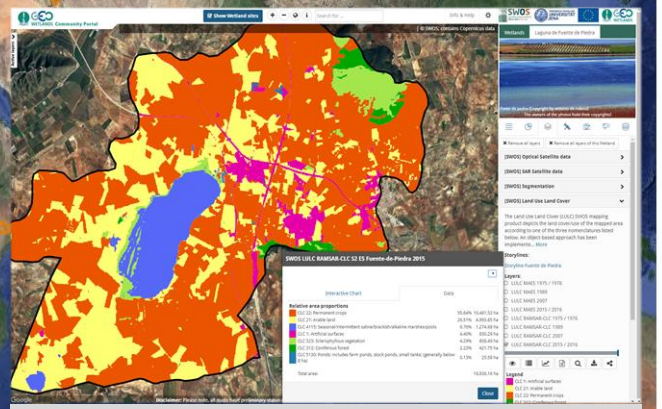
Concept

```
from pyEOM import SatelliteBroker
# Register brokering services (ESA Science Hub, USGS Earth Explorer, Sinergis
broker_all = SatelliteBroker(
    esa_scihub=('*username*', '*password*', ['S1*_IW_GRD*']),
    usgs=('*username*', '*password*', ['LANDSAT_MSS', 'LANDSAT_TM_C1', 'LANDS
    sentinelhub=('http://services.eocloud.sentinel-hub.com/v1/wfs/*APIKEY*',
)

# Search for all scenes based on given geometry (geom_wkt)
scenes = broker_all.search(geom_wkt)

# Optionally do some automated post processing
scenes_meta = broker_all.post_process_results(scenes, min_overlap=0.7) #filte
scenes_meta = broker_all.retrieve_metadata(scenes_meta) #retrieve external me
scenes_meta = broker_all.add_sentinelhub_wms_url(scenes_meta) #add sentinel h

# Export data to GeoJSON file
broker_all.export_results(scenes_meta, 'test_all10.json')
```

Python library



Satellite data broker



Example use cases

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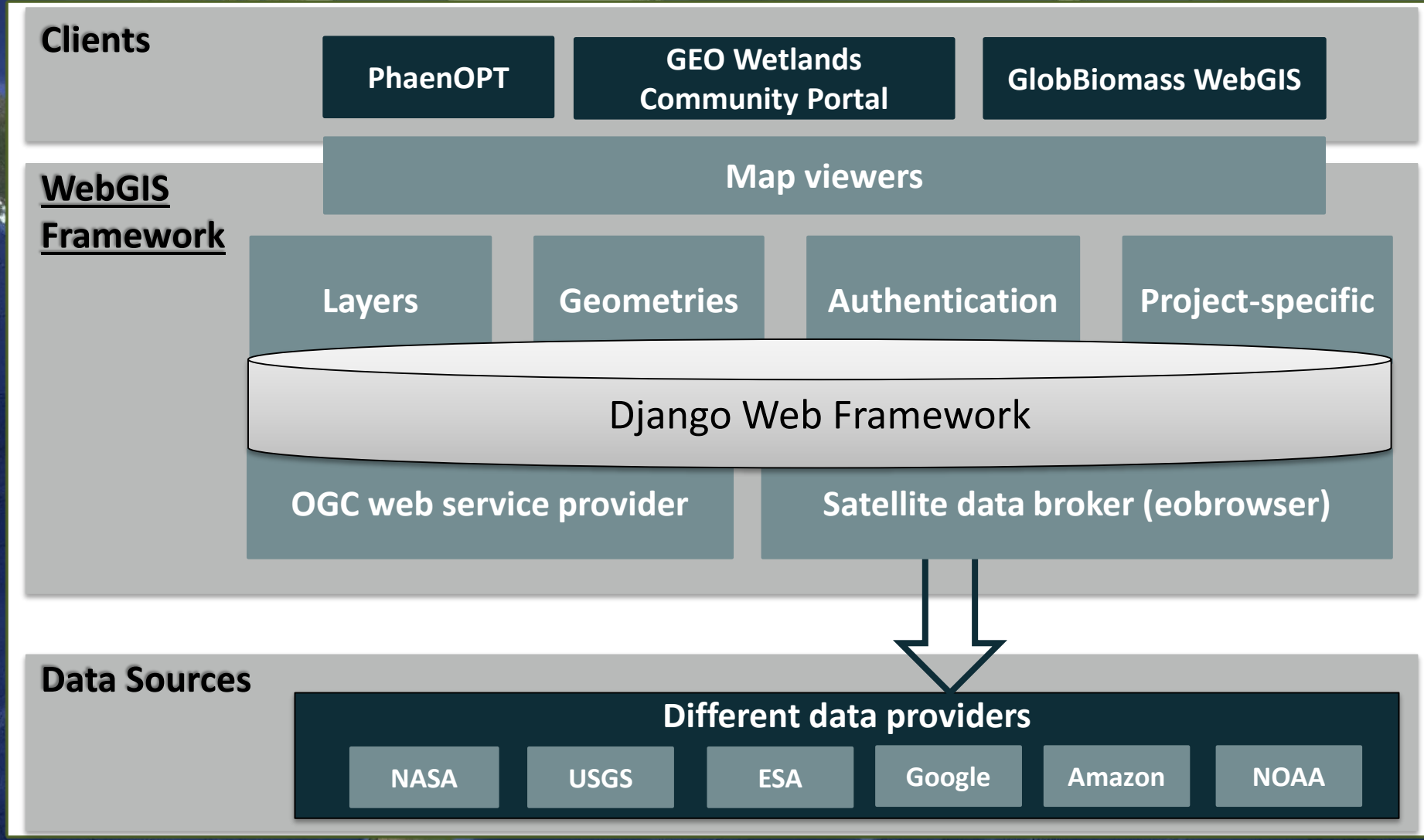
Concept



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Backend: Overview

- **Django Web Framework**
  - High-level Python Web framework
  - www.djangoproject.com
  - License: BSD
- **Django extensions**
  - REST Framework
  - REST-based user authentication
  - GeoDjango
- **Django applications developed**
  - General: Mapviewer, Layers, EOBrowser, Geometries
  - Specific for projects: Wetlands, PhaenOPT

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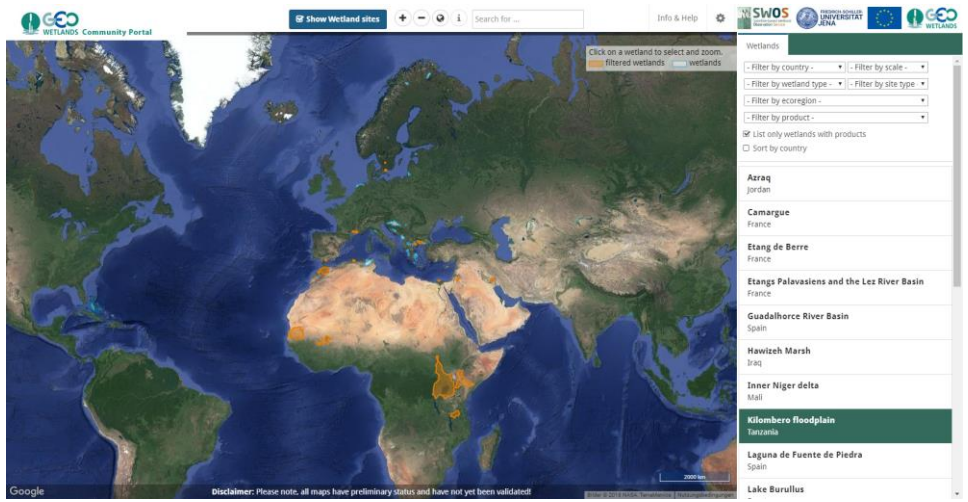
Backend: Mapviewers

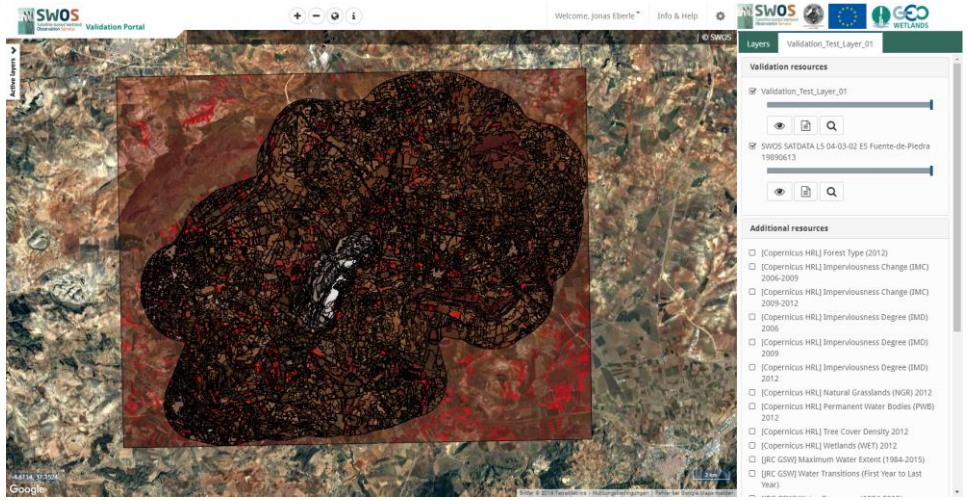
Back

Enables to publish different geoportal applications from the backend within a single instance of the framework.

Configuration fields:

- Template file
- Base layers
- Layer groups
- Center coordinate
- Permissions





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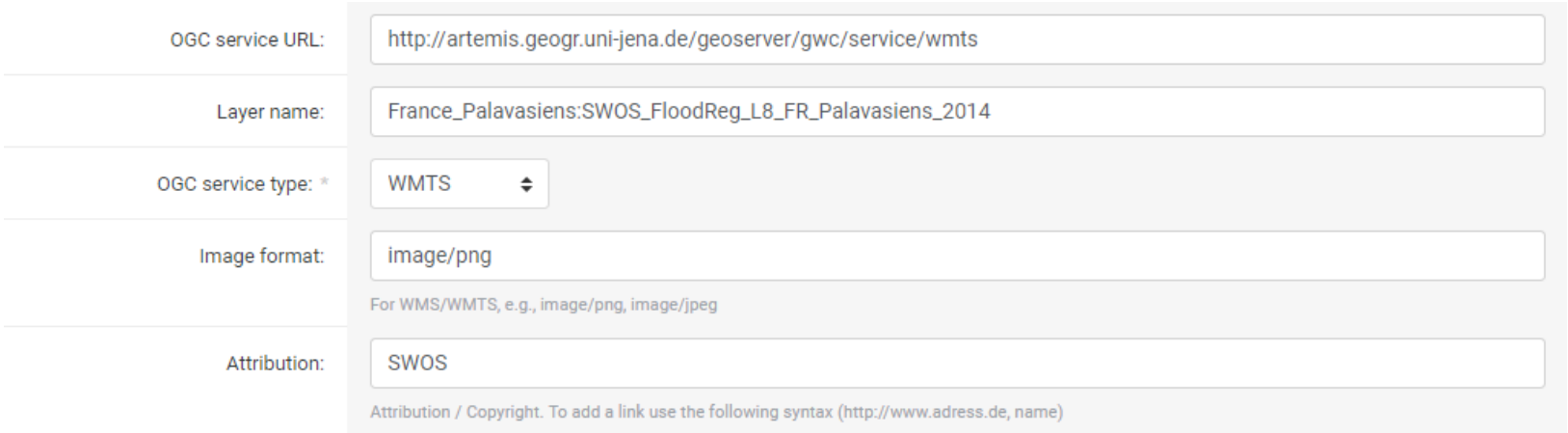
Backend: Layers

Back

- Layers are connected to external services or files
  - OGC services: WMS, WMTS, WFS, TMS, SOS
  - Files: GeoJSON
  - Other services: Bing Maps, Google Maps, OSM



- Each layer need to have further metadata (e.g., title, contact)
  - See slide „Metadata management“

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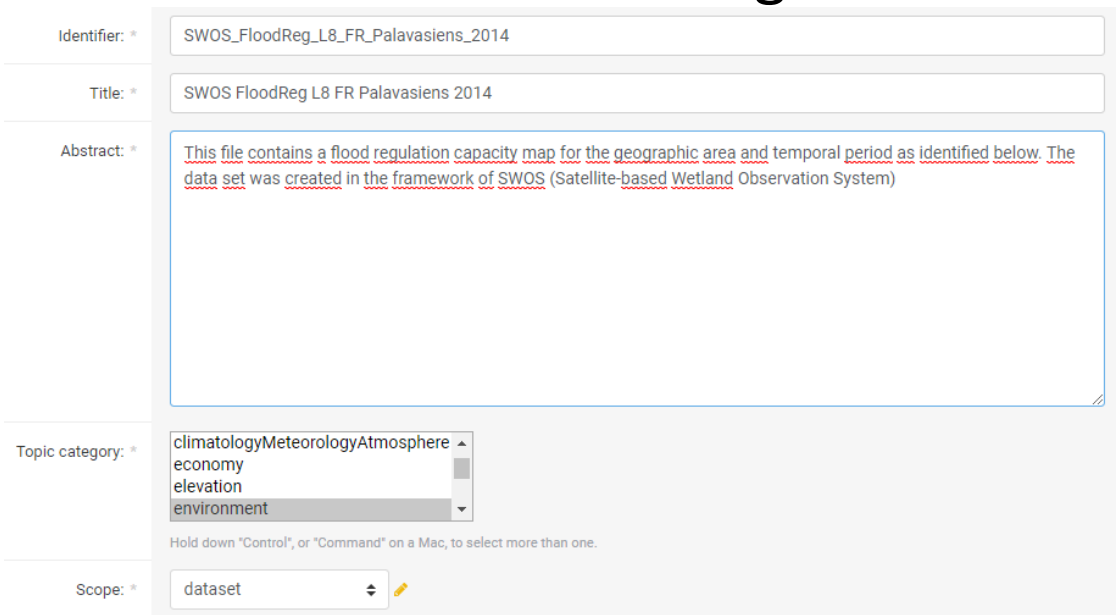
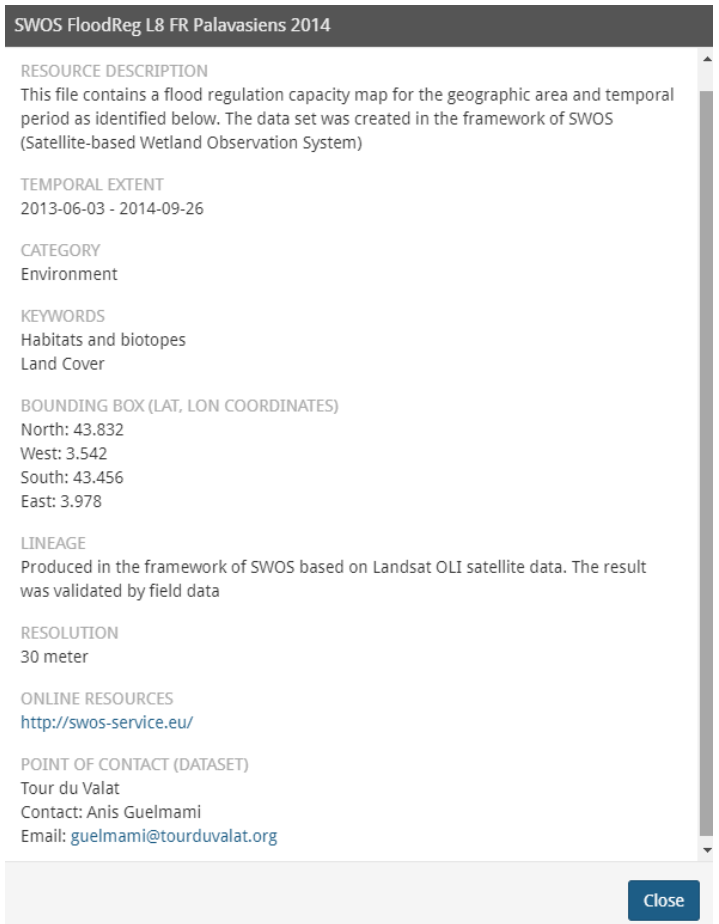
Backend: Metadata management

Back

- ISO 19115 metadata need to be included for each layer
- Metadata can be directly integrated into OGC CSW-compliant catalogue (e.g., using pyCSW software)
- Also: ElasticSearch integration





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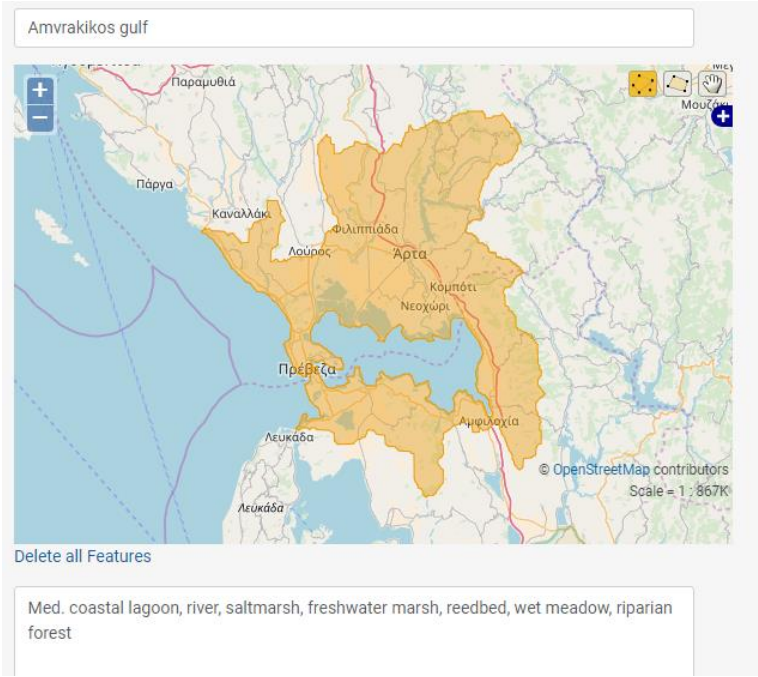
Backend: Geometries / Regions

Back

Regions (as polygon geometries) can be managed to link further tools that are available for individual areas:

- Search for available satellite data
- Search within GEOSS for this area
- List all images from Flickr
- Calculate statistics on geospatial datasets



Also further metadata related to each region can be managed:

- Country, Size, Ecoregion, Type, Processing parameters

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Satellite data broker

How to find and get access to Satellite time-series data without learning how to use all the different tools and services?

Key issues:

- Different web service specifications need to be known by users
- Different data providers need to be requested individually
- Not any data provider provides all necessary metadata (e.g., thumbnails, browse images, sun angles)
- Additional filter capabilities based on the area of interest are needed (e.g., overlap between area and scene)
- Simple overview charts are missing

→ Solution: Satellite time-series data discovery & access broker

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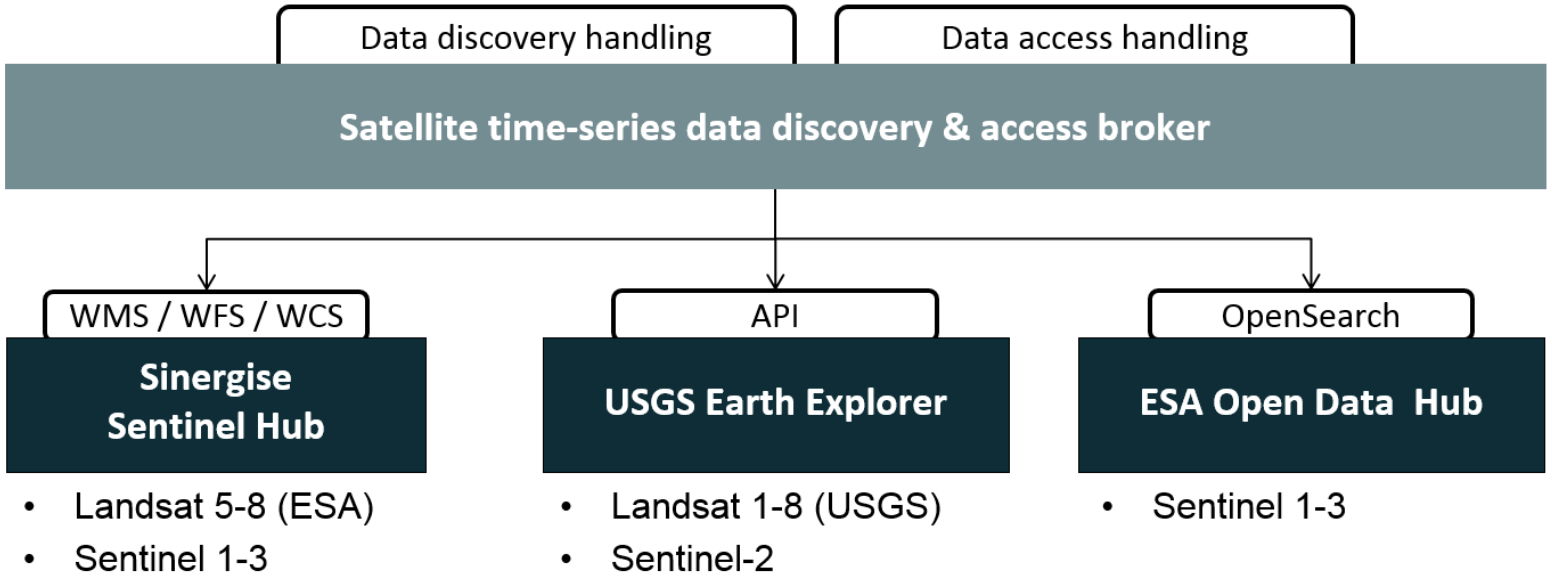
Satellite time-series data discovery & access broker

Concept of the satellite data broker

Back



- Broker (Python code) is connected to different data providers
- Metadata and download links are unified and made available
- Interactive tools to explore data: Charts and Quicklooks

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Satellite time-series data discovery & access broker

Python library (pyEOM v2)

Back

Example: List all Sentinel-1 data from ESA Open Access Hub, Landsat and Sentinel 2A data from USGS and Landsat 5/7 data from Sentinel-Hub (ESA archive) for a given geometry.

```
from pyEOM import SatelliteBroker
# Register brokering services (ESA Science Hub, USGS Earth Explorer, Sinergise Sentinel-Hub)
broker_all = SatelliteBroker(
    esa_scihub=('*username*', '*password*', ['S1*_IW_GRD*']),
    usgs=('*username*', '*password*', ['LANDSAT_MSS', 'LANDSAT_TM_C1', 'LANDSAT_ETM_C1', 'LANDSAT_8_C1', 'SENTINEL_2A']),
    sentinelhub=('http://services.eocloud.sentinel-hub.com/v1/wfs/*APIKEY*', ['L5.TILE', 'L7.TILE'])
)

# Search for all scenes based on given geometry (geom_wkt)
scenes = broker_all.search(geom_wkt)

# Optionally do some automated post processing
scenes_meta = broker_all.post_process_results(scenes, min_overlap=0.7) #filter based on geometry overlap
scenes_meta = broker_all.retrieve_metadata(scenes_meta) #retrieve external metadata
scenes_meta = broker_all.add_sentinelhub_wms_url(scenes_meta) #add sentinel hub wms links

# Export data to GeoJSON file
broker_all.export_results(scenes_meta, 'test_all10.json')
```

Soon available on Github: https://github.com/jonas-eberle

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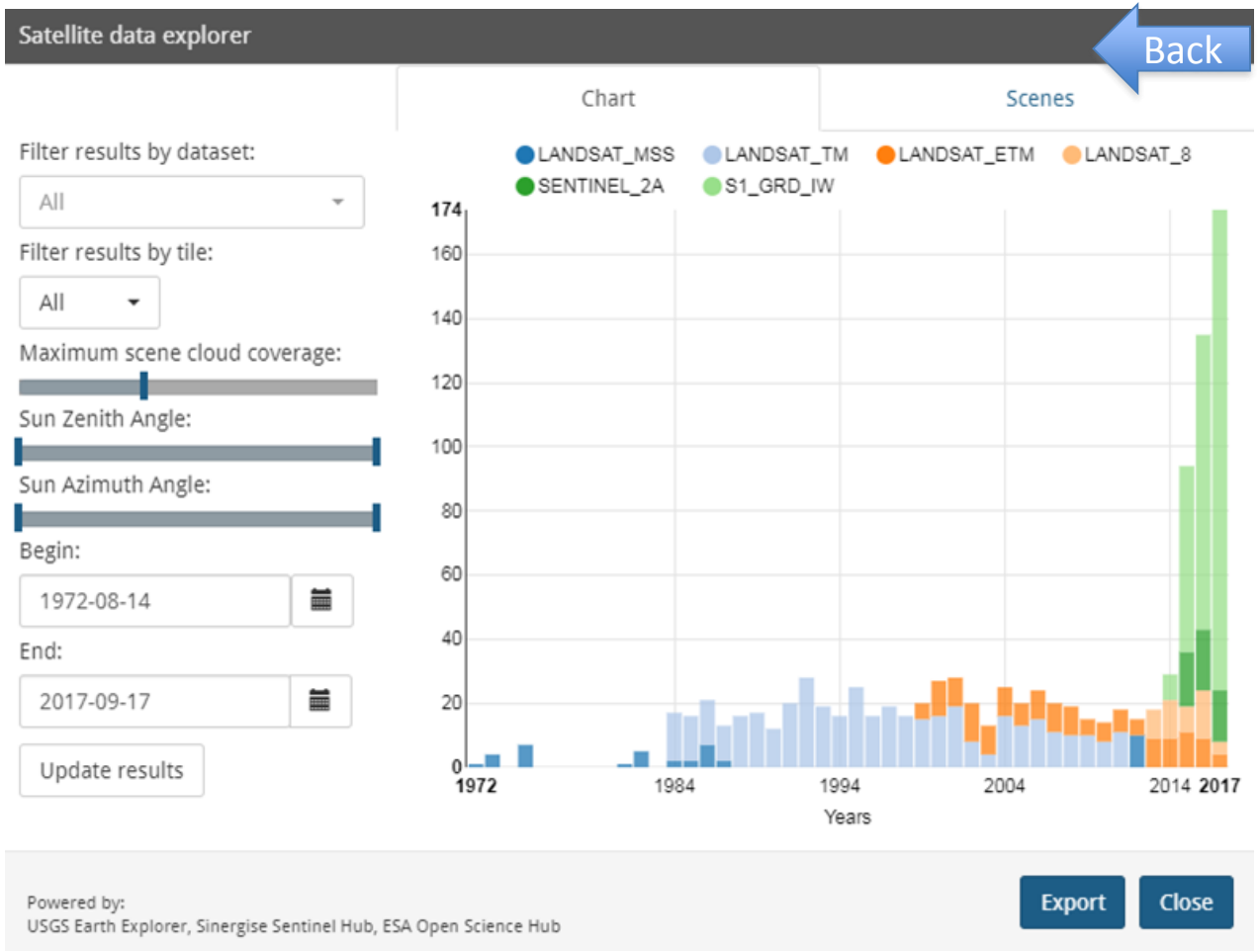
Satellite time-series data discovery & access broker

Interactive charts based on the results from the satellite data broker.

Automatically generated for each of the wetlands in the SWOS portal.



Please look at http://portal.swos-service.eu for live examples.

Agenda

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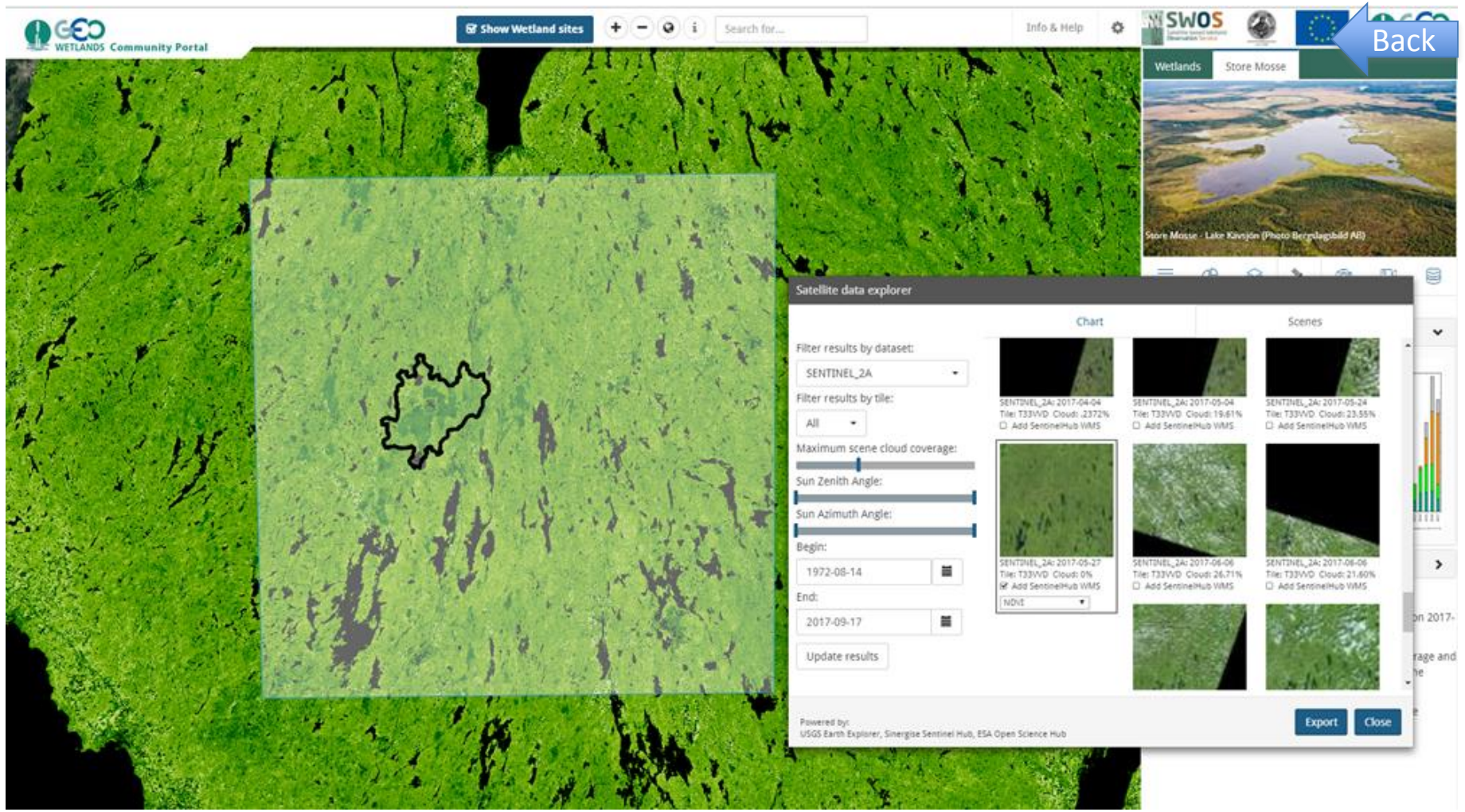
Satellite time-series data discovery & access broker



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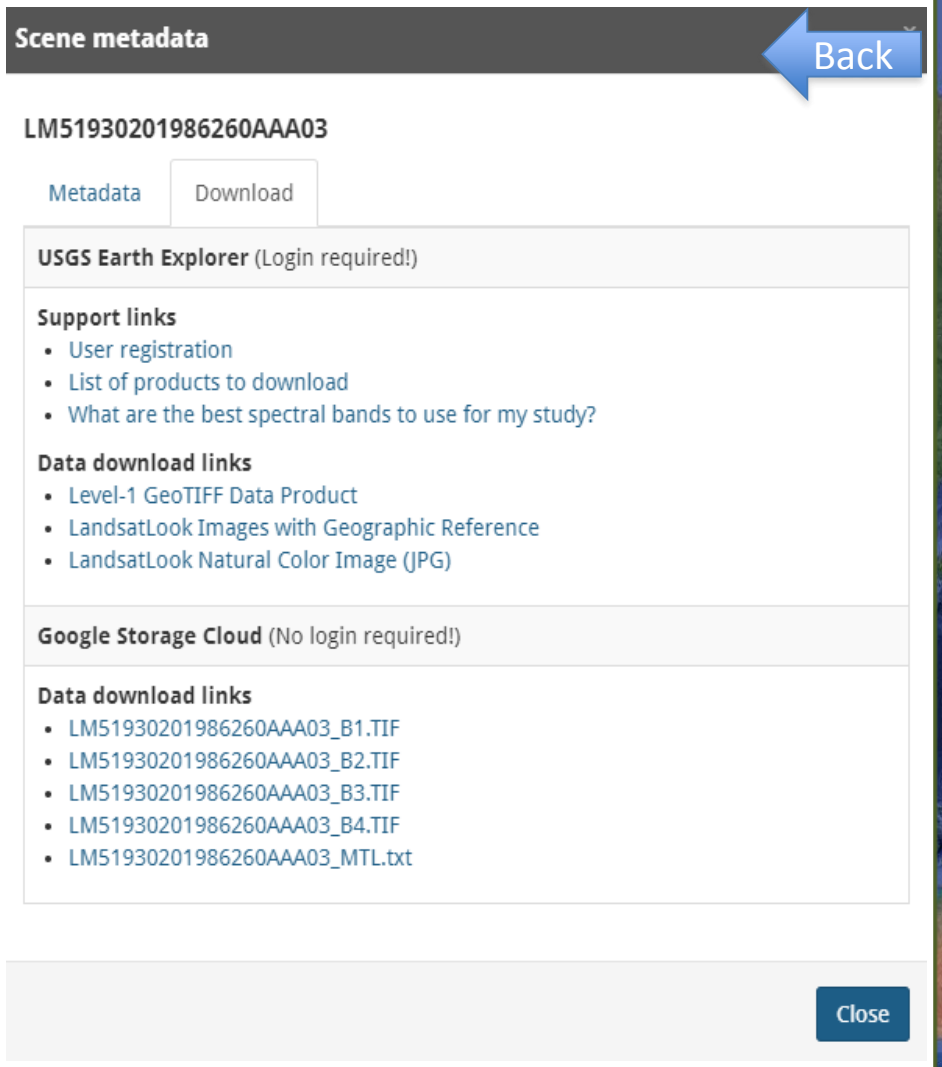
Satellite time-series data discovery & access broker

Metadata and download links are collected from each of the data providers and stored into a unified metadata structure.

Direct download links are provided based on USGS Earth Explorer, Amazon Web Services, Google Cloud Storage as well as CODE-DE.



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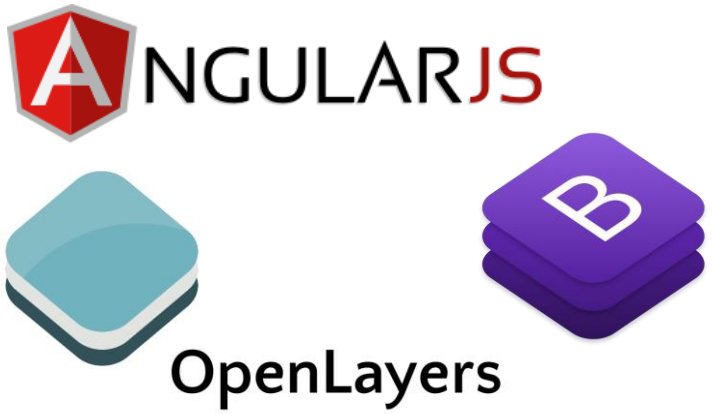
Frontend development

Software

- AngularJS
- Bootstrap CSS
- OpenLayers



Using REST-based services

- Based on Django REST Framework
- Example requests:
  - Get map viewer configuration
  - Get list of layers
  - Get metadata of layer in different formats (HTML, XML, JSON)

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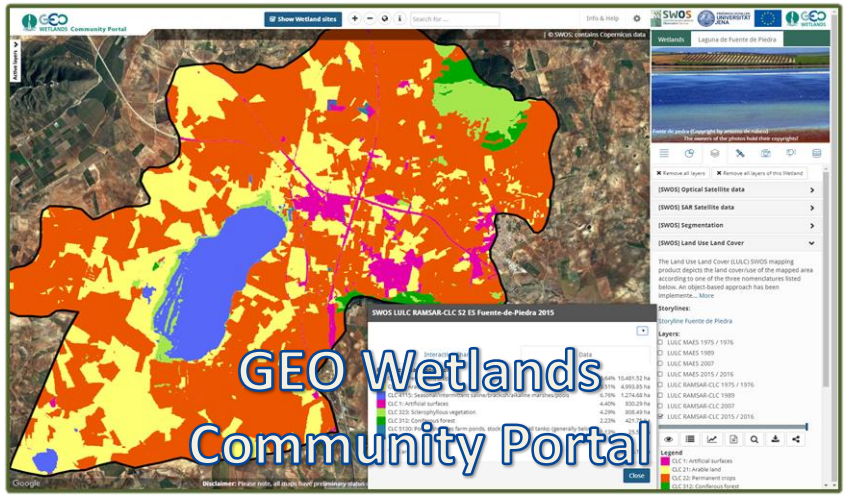
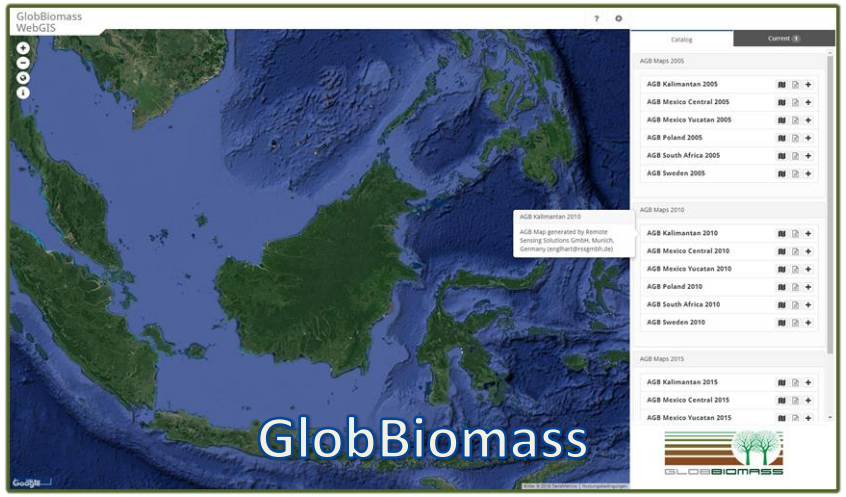
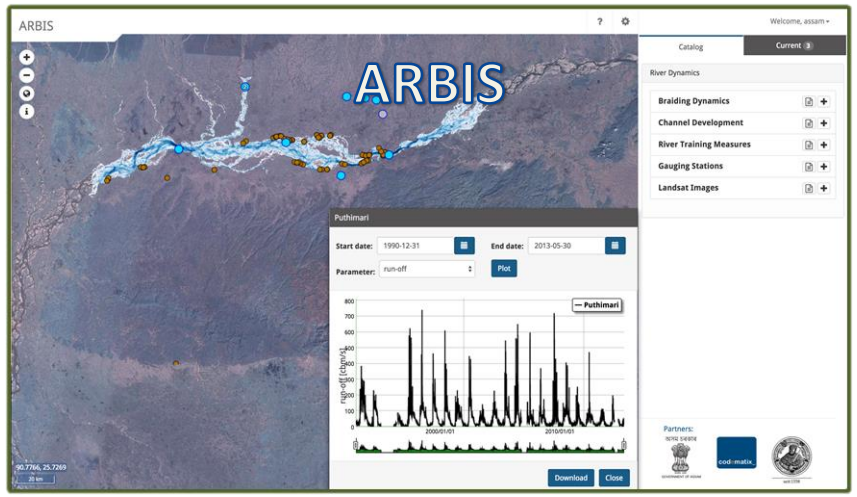
Example usage of this framework



PhaenOPT





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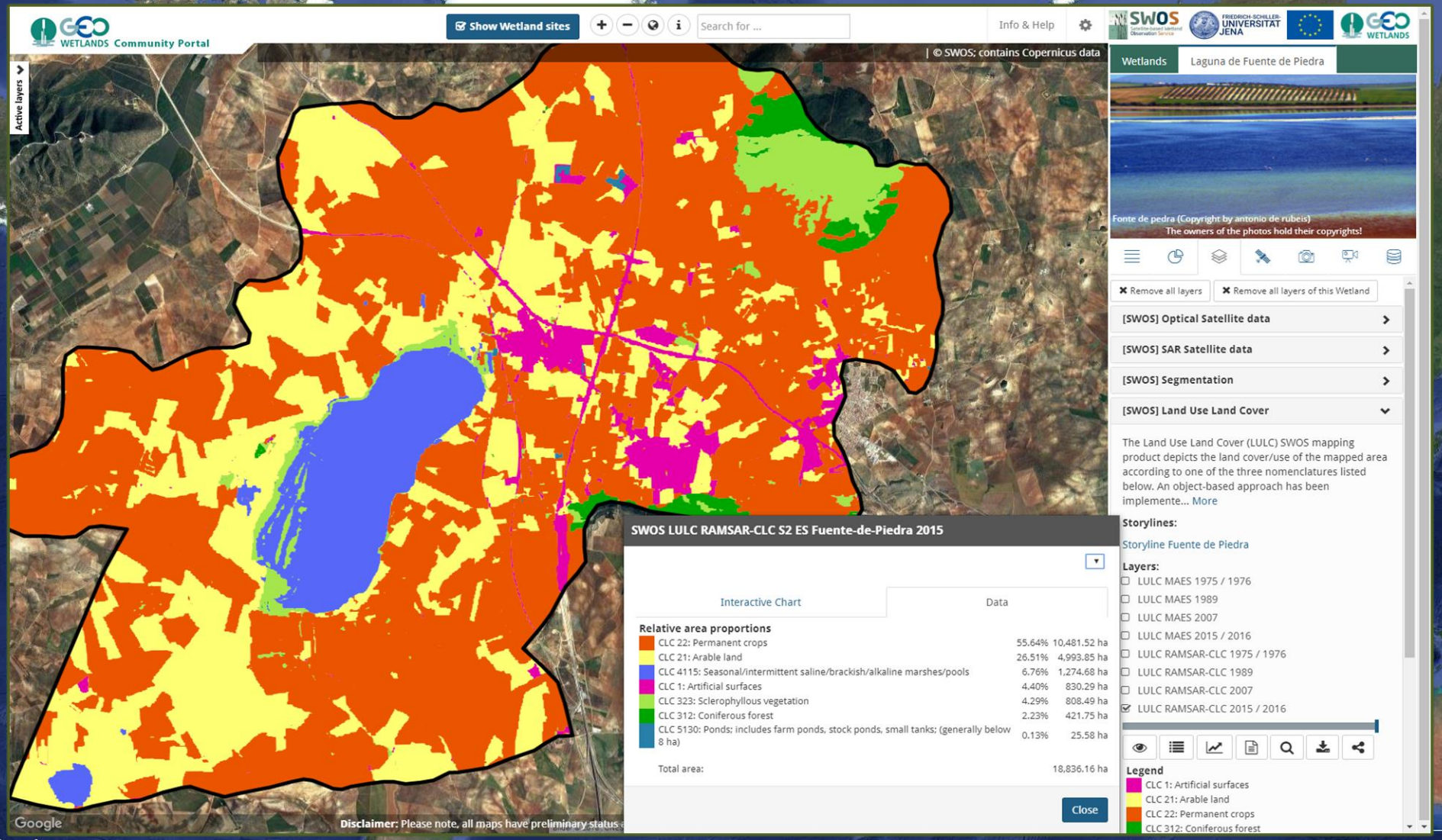
GEO Wetlands Community Portal

Back



Agenda

1. Home
2. Concept
3. Django backend
4. Satellite data broker
5. Frontend development
6. Examples
7. What is next?

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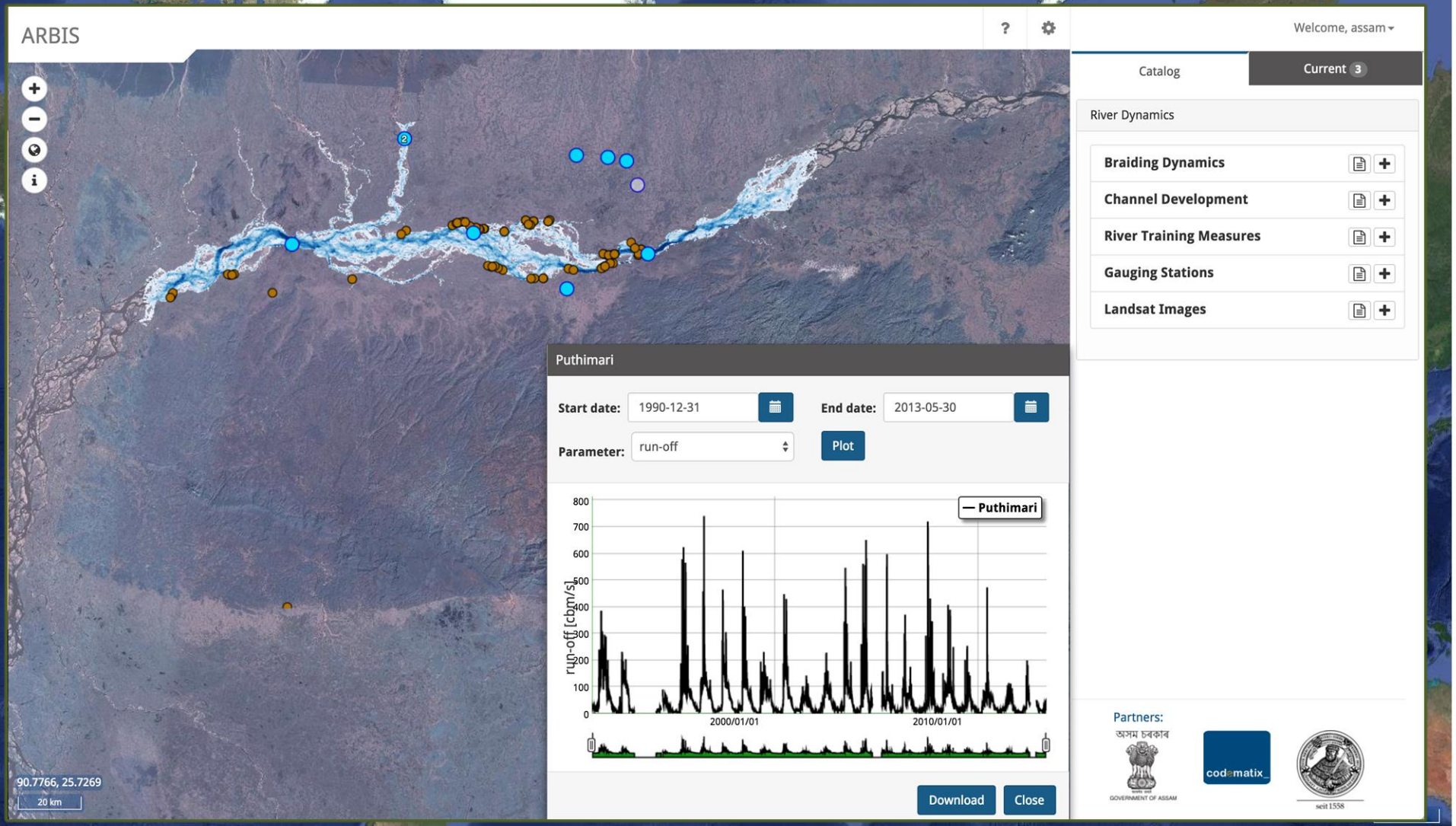
ASSAM River Basin Information System

Back



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ESA GlobBiomass WebGIS

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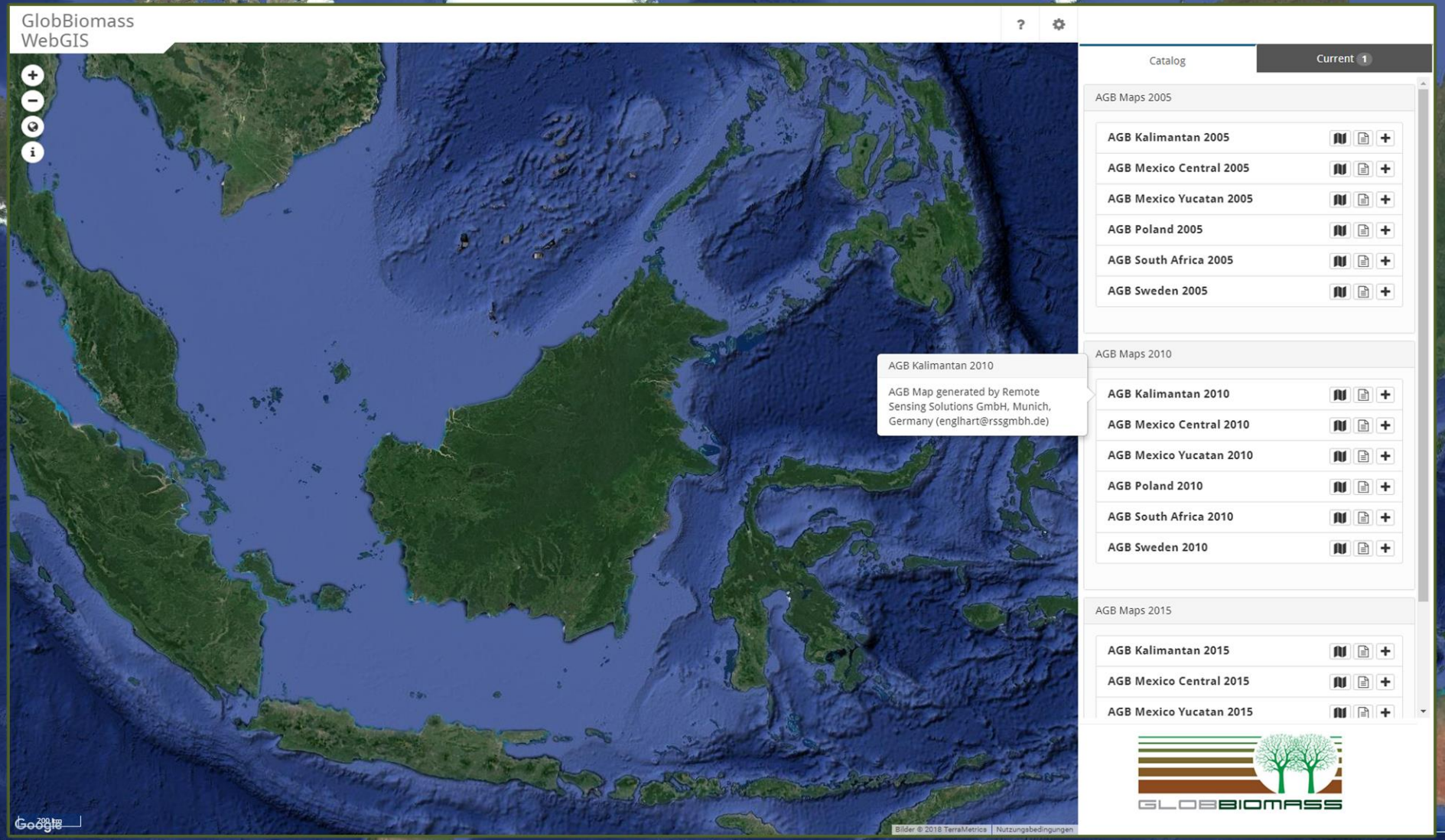

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PhaenOPT – Web services for vegetation data

Back

Objectives

- Provide relevant data (in-situ as well as EO-based) for the analysis of vegetation phenology as annual time-series
- Users can extract time-series for their area of interests and compare Earth Observation data with in-situ observations

Additional tools for web framework

- On-the-fly extraction of data from raster time-series
- Link to Jupyter Notebooks to conduct further analysis

Further information

- See the poster on Friday

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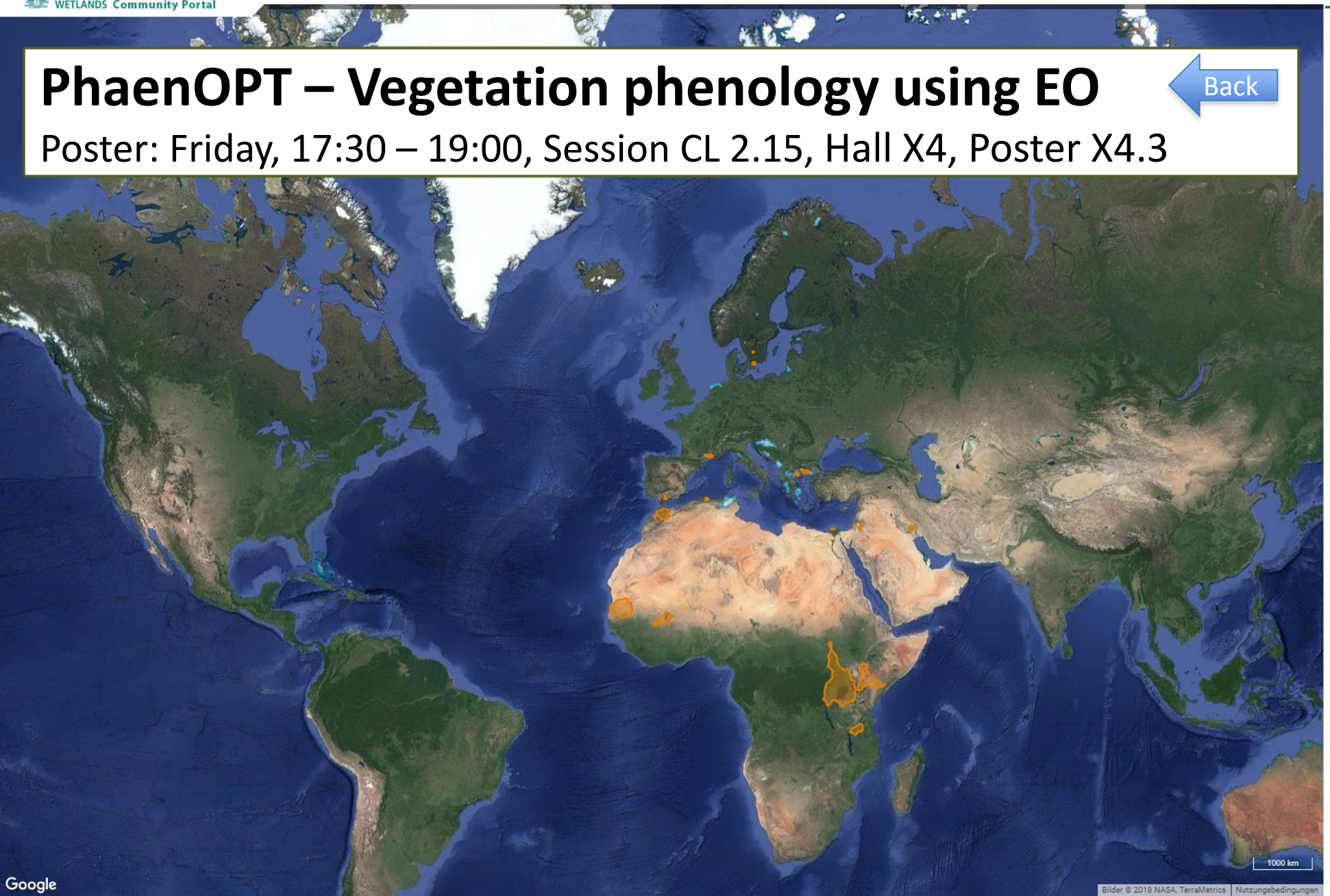
PhaenOPT – Vegetation phenology using EO

Poster: Friday, 17:30 – 19:00, Session CL 2.15, Hall X4, Poster X4.3

Back



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On-going work and future ideas

On-going work

- Linking Django with Jupyter Notebooks
- Source code cleanup and documentation
- Publish web framework and satellite data broker on Github
- Provide Docker container for web framework

Future ideas

- Integrate processing capabilities based on OGC Web Processing Services

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