GEOSTORM ON EO IPT POLAND: A PRIVATE INITIATIVE TO PROVIDE EO ADDING VALUE DATA IN A GEOSPATIAL PLATFORM

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CS SI : an IT company of 1800 collaborators

BU Espace at Toulouse : 300 collaborators, prime contractor of CNES and ESA

PDA department Field of activities:
   › Develop Image Ground Segment
   › Develop system to produce, stream, display, enhance spatial, geospatial of cartographic data
   › Develop applications service in Agriculture or Risk Management
   › Develop system to Manage/Archive/Catalog satellite data
   › Maintain Image Ground Segment or Image Quality Center
   › R&D around image processing, image quality of radiative transfer
   › Develop and Maintain ToolBox in the field of Image Processing

Client: CNES, ESA, EUMETSAT, local or national institution, TAS, ADS

People: 120 collaborators
IMAGE PROCESSING & TOOLBOX ACTIVITIES

- Team: 30 collaborators (1/3 of PhD)
- R&D around image processing, image quality of radiative transfer:
  - CNES Atelier 3D
  - CNES Simulation QI
  - Machine learning and Big Data for time series
  - R&D Study around sensor definition, correction for CNES or ESA
  - Various CNES R&T
  - SEOM Studies: Coral Reef monitoring and Costal Atmospheric Correction
- Develop and maintain ToolBoxes in the field of Image Processing
  - Orfeo ToolBox
  - SNAP (S2-ToolBox)
  - CNES Common Tools
  - Kalideos Scientific Processing Chain
  - Sentinel2 For Agriculture
CLOUD AND HPC ACTIVITIES

Team : 30 collaborators

Various projects related to support large EO data processing

› EC/ESA Research User Support : [https://rus-copernicus.eu/portal/](https://rus-copernicus.eu/portal/)
  - on demand virtual desktop with open source tools and EO data
  - Help desk with dedicated support

› CNES CO3D cloud processing demonstrator
  - Integrate CNES Atelier 3D into a cloud environment

› CS SI GeoStorm SDI platform

› CS SI SafeScale ([https://github.com/CS-SI/SafeScale](https://github.com/CS-SI/SafeScale)) : on demand resource multi-cloud creation

› ESA BIDS RAF : new framework to perform generic and multicloud EO data processing and analysis
GEOSTORM
Spatial Data Infrastructure

- Integrate spatio-temporal data
- Produce and Publish on demand map
- On line data analysis
- Disseminate products
- Multi-thematic (Land, Meteo, Inland Water, Oceanography...)

Centralize
Archive
Process
Publish
Seven components:

Main guidelines:
- WEB & SOA
- Interoperable and based on standard
- Extensible and based on open source components

Various deployment possibilities:
- SAAS, Data Center, cluster, Stand alone
- On demand instantiation based on SafeScale
GeoStorm Portal

- **Simple** and ergonomic
  - Adapted to user and data
  - Various toolbox: draw, annotate, publish
  - 2D/3D visualization
- Import external services
- Multi-dimensional
- Dynamic
- Extensible
- Responsive
GeoStorm Data Access Services

- Ingestion and pre-processing of data (EO, GIS, …)
- Dissemination services: standard, optimized and reliable
- Export for off line use
- High security level
- Data storage: object or bloc based
GeoStorm Catalog

- Standard Catalog (Inspire compatible)
- Data & services hub with unified access to data
- Harvesting or Reference to external data
- Scalable
- Plain text and multi-criteria search
GeoStorm Processing

Goal: Allow easy integration of new processors on various infrastructures with scalability and high security

› Use container for execution environment
› Edit and publish complex workflow
› Infrastructure permettant de simplifier la création de services
  ▪ Lambda WPS: GIT push ≡ service publié en WPS
  ▪ Processing and Data APIs
  ▪ Some processors are already available
  ▪ Parallel computing by granule/tile
  ▪ Local Development
  ▪ Automatic catalog ingestion and visualization
› SafeScale Integration
  ▪ Large set of methods: classic processing, Cloud Computing, Machine Learning
  ▪ Large set of infrastructure: private cluster, public clouds, hybrid infrastructure …
  ▪ Safe and automatic deployment, KPI, …
**PUBLISH PROCESSING**

- **WPS Server Workflow Execution engine**
- **Processing Node cluster**

- **Web browser for:**
  - WPS service home page
  - Advertising processes and workflows
  - Processing node monitoring dashboard

**User Graphical tool for workflow design**

**Repository of processing and workflows**

- **Fetch Execute process**
  - **CSW_SEARCH**
  - **APP PARAMETERS**
    - `extend` port
    - `collection` port

**Connections:**

**No Issues**
GEOSTORM ON IPT POLAND
Earth Observation Innovative Platform Testbed Poland

- ESA Initiative
- 5 PB of data: Sentinel-2, Sentinel-3, Envisat, Landsat-2/5/7 and ESA/Landsat-8, Sentinel-1 GRD data and selected data from Sentinel-1 SLC (Europe and surrounds).
- Computing cloud:
  - 1 500 virtual cores,
  - 7 TB RAM,
  - 500 TB of dedicated disk space.

CS SI, co-funded initially by ESA,

- Deploy GeoStorm on EO IPT since September 2017 and use Torque cluster
- Integrate regularly EO processing:
  - OTB processing
  - SNAP processing
  - Sen2Agri processing
  - MAJA
- Integrate regularly EO open data
Layer available:

- Sentinel-2 Cloudless (EOX)
- Copernicus Land Service: Mosaic, CLC, High-resolution layers, Urban Altas, EU-DEM, …
- OSM
- Global Surface Water (JRC, Google)
- Theia OSO
Use EODAG software to retrieve data: https://bitbucket.org/geostorm/eodag

Define a specific visualization scheme for this product.
OTB PROCESSING

- Orfeo Toolbox: https://www.orfeo-toolbox.org/
  - An open source toolbox developed and maintained by CNES
  - Large set of image processing algorithms through OTB Apps
  - Suitable to process Sentinel data

- Design specific web interface for end-users: BandMath, Classification
OTB PROCESSING – BANDMATH NDVI S2 PRESET

eocloud.geostorm.eu/rest/url/p6c56
OTB PROCESSING – RF CLASSIFICATION

eocloud.geostorm.eu/rest/url/45pqf
SNAP PROCESSING

SNAP : http://step.esa.int/main/
  › ESA open source toolboxes (S1/S2/S3)
  › Large set of image processing algorithms for Copernicus data
  › Workflow and graph manager : GPT

Design specific web interface for end-users: Snow monitoring graph, Forest Fire graph

In progress :
  › automatic web interface generation
  › New graph
  › Push custom graph

- ESA initiative to provide a system to local to national agriculture monitoring
- Open Source
- Re-use processors: mainly LAI to generate one shot product

Design specific web interface for end-users: only Date and Bounding box for LAI

Integrate MAJA via `start_maja.py` and `prepare_mnt.py`

Add first analytics based on LAI and GIS data (OSO, RPG, …)
eocloud.geostorm.eu/rest/url/2rqak
Carte 2017 d'occupation des sols opérationnelle:
- Cultures d'été
- Cultures d'hiver
- Prairies
- Verger
- Forêts de feuillus
- Forêts de conifères
- Pelouses
- Landes ligneuses
- Urban diffus
- Zones industrielles et commerciales
- Routes
- Vignes
- Urban dense
- Surfaces minérales
- Plages et dunes
- Eau

Plus d'informations sur undefined
- id: undefined
- label: 11
- layerLabel: Moyenne de la variance de LAI par classe
- mean80: 2.62556e+02643453
- name: undefined
- refProj: 172909
- xref: 4173048945258
**CONCLUSION - FEEDBACK**

- A demonstrator
  - Of image processing capabilities in web interface
  - Of cloud and HPC processing to scale large EO data processing
  - EO data manipulation: search, download, ingest and visualize

- Search users and projects to demonstrate end to end capabilities

- Promote and publish open source code at CS SI:
  - EODAG tool: [https://pypi.org/project/eodag/](https://pypi.org/project/eodag/)
  - 9 Contributions to OTB in 2018: MultiWriter; CLI Monteverdi; Clé nodata; Remote module Sirius; Support ITK5 (Pending); Cost Volume Filter (CVF) (Pending), Optional OTB App parameters, Integration QGIS, Wavelet Denoising (In progress)
  - Sirius - Fast and simple to plug-in C++ resampling library that is taking advantage of the Fourier Transform
    - 37s to zoom a Sentinel-2 (20m-10m)
    - [https://github.com/CS-SI/SIRIUS](https://github.com/CS-SI/SIRIUS)

- Questions: