The Copernicus Global Land Service: status & evolution

Bruno Smets - VITO

on behalf

the GIO - Global Land consortium

Outline

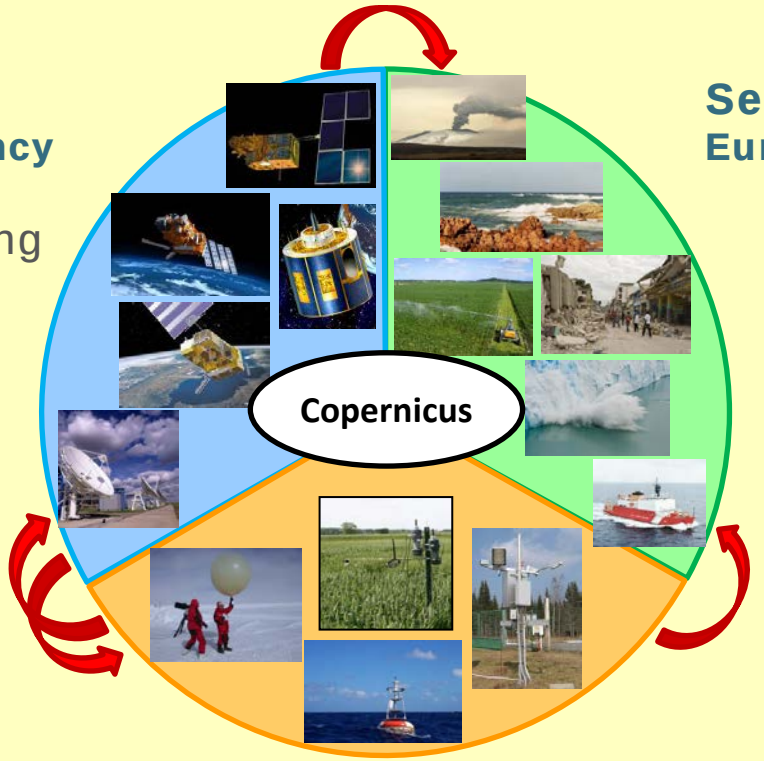
- **Overview and Objectives**
- **Service Description**
  - Infrastructures
  - Portfolio
  - Quality Control
  - Dissemination
- **Continuity and Evolution**
- **Copernicus and LSA SAF ?**

What is Copernicus?

- **The European system for monitoring the Earth**
  - The European response to **global information needs**
  - An **independent Earth Observation system** for Europe
  - The **largest fleet of satellites**, ground and air sensors
  - An **end user-oriented** programme of services
    - Managing the environment
    - Understanding and mitigating the effects of climate change
    - Ensuring the civil security
  - Joined-up **information for policymakers, scientists, businesses and the public**
    - Previously known as the Global Monitoring for Environment and Security (GMES) programme

Overview of Copernicus

Space Component
European Space Agency (ESA)
Sentinel & contributing satellite missions, ground segments

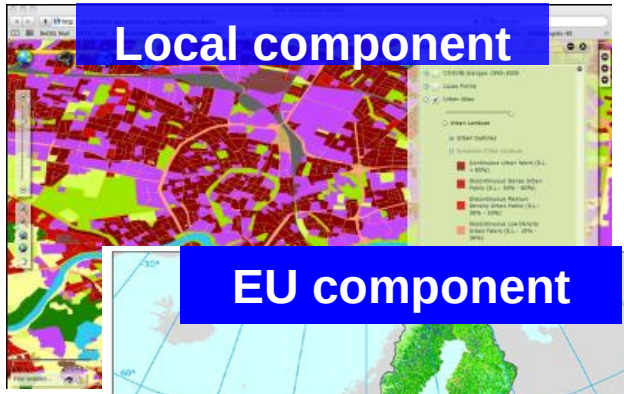


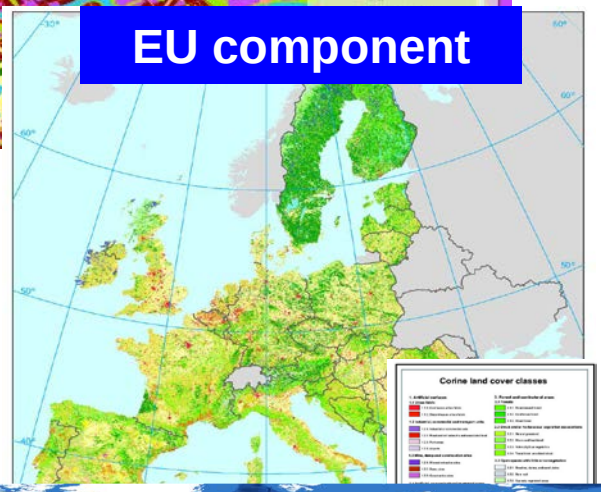
Service Component
European Commission (EC)
Land
Marine
Atmosphere
Emergency
Security
Climate change

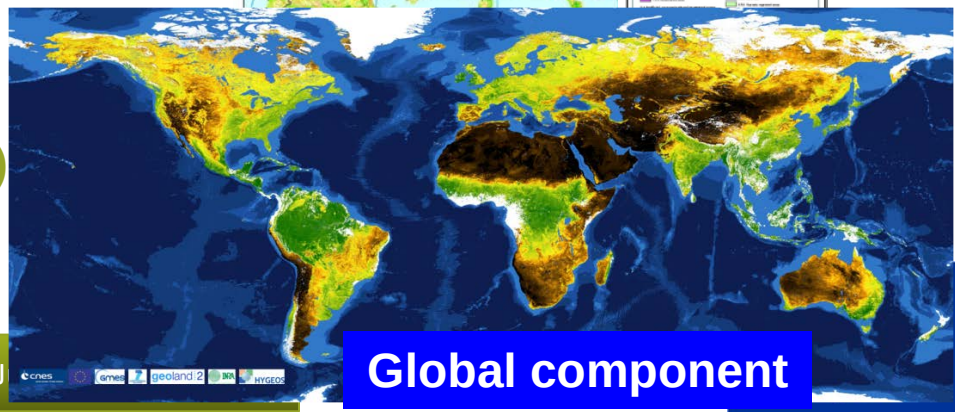
In-situ Component
European Environment Agency (EEA)
land, air and water monitoring sensors

The Land Service components

- **Local → EEA**
  - Zooming on “hot spot” (e.g. urban atlas, protected areas, coastal areas)
- **Continental → EEA**
  - Pan-European products (Corine 2012, 5 High Resolution layers on artificial surfaces, forest, grassland, wetland, water)
- **Global → JRC**
  - **Bio-geophysical variables (Essential Climate Variables) at global scale.**



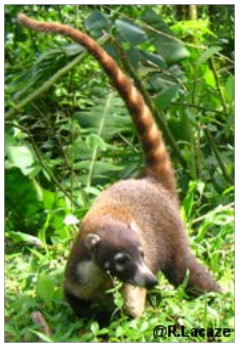


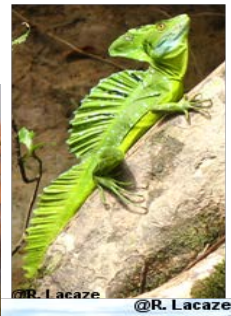


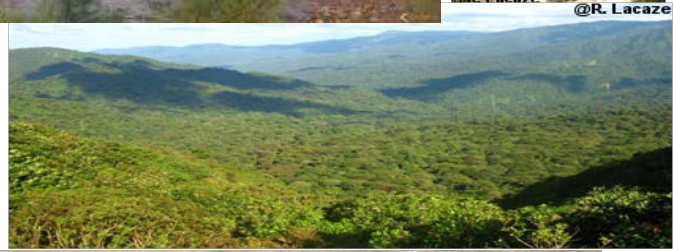
Global Land Service

- **Support and consolidate:**
  - **EU policies** at international level
    - e. g. Climate and Development policies
  - **EU commitments** under international treaties and conventions
    - e. g. UN “Rio” and climate conventions
  - EU contribution to **GEO / GEOSS**

- **Policies focus:**
  - Crop Monitoring and Food security
  - Biodiversity, Protected areas and Forest cover monitoring
  - Drought Assessment and Desertification
  - Carbon modeling, land use and land cover change
  - Support to Earth Observation African Activities



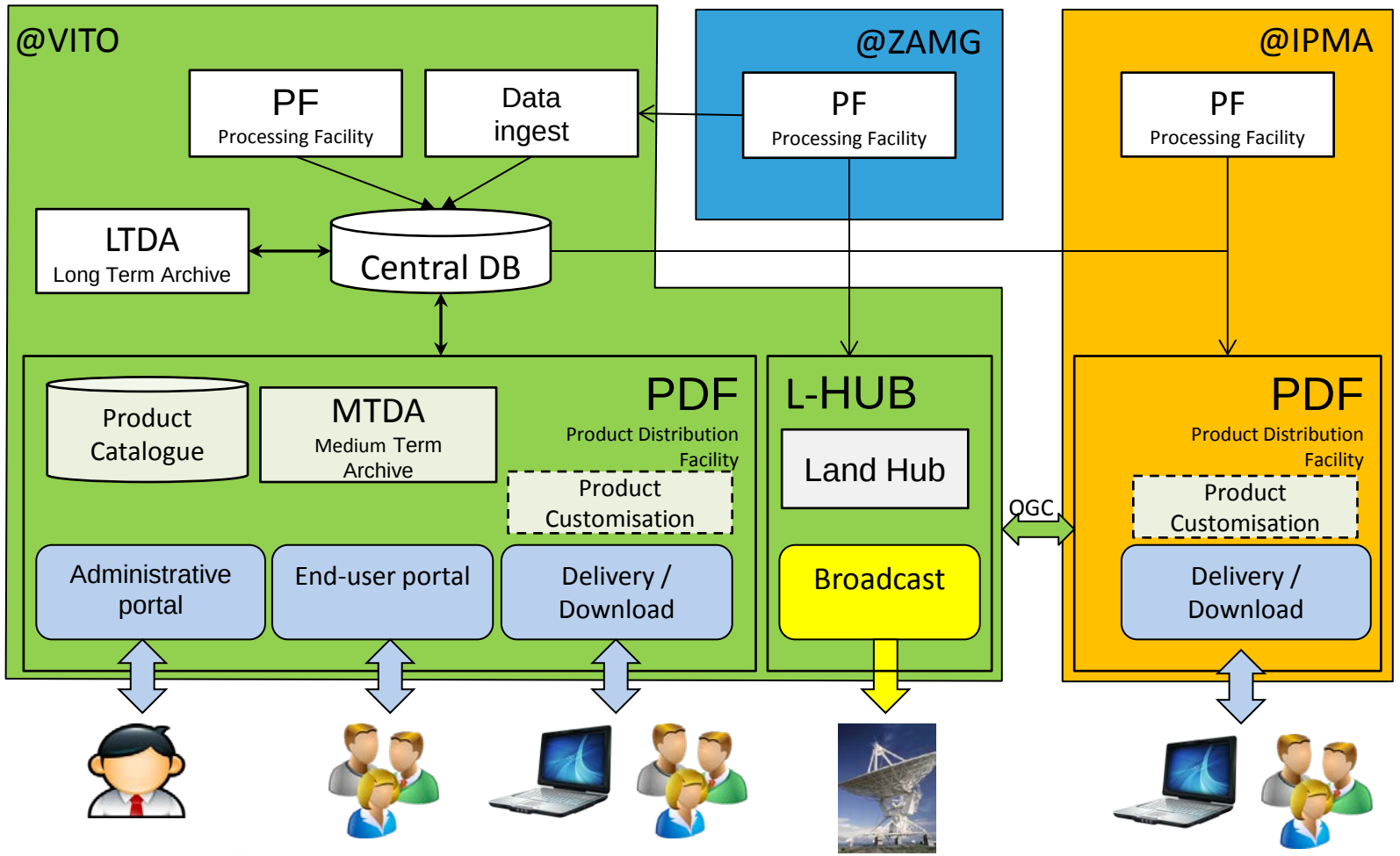

Global Monitoring Service

- **Heritage**
  - 10+ years of EU R&D activities
    - E.g. FP7-Geoland2 & FP7-DevCoCast research projects
  - Accompanied by e.g. EUMETSAT Land Surface Analysis SAF
- **Constraints**
  - Core products for multiple users
  - Mature for operational activities
  - Sustainable & reliable deliveries
  - Validated following standards
  - No duplication but complementary
- **Global systematic monitoring service**
  - Production
    - Bio-geophysical variables
    - NRT & historical time series (up to 15 years)
    - Over the globe
  - Quality control
  - Archiving & re-processing
  - Dissemination & user support

Outline

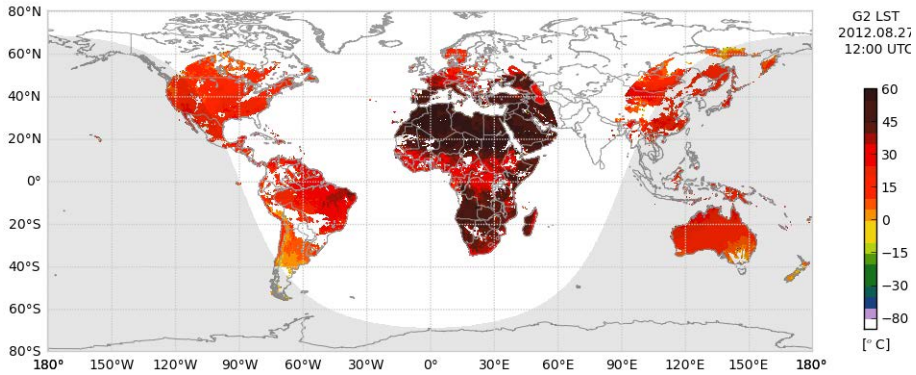
- Overview and Objectives
- **Service Description**
  - Infrastructures
  - Portfolio
  - Quality Control
  - Dissemination
- Continuity and Evolution
- Copernicus and LSA SAF ?

The system of systems

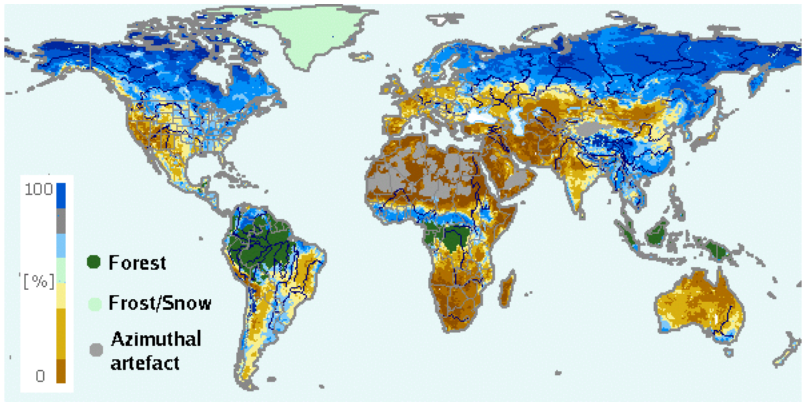


Examples of products

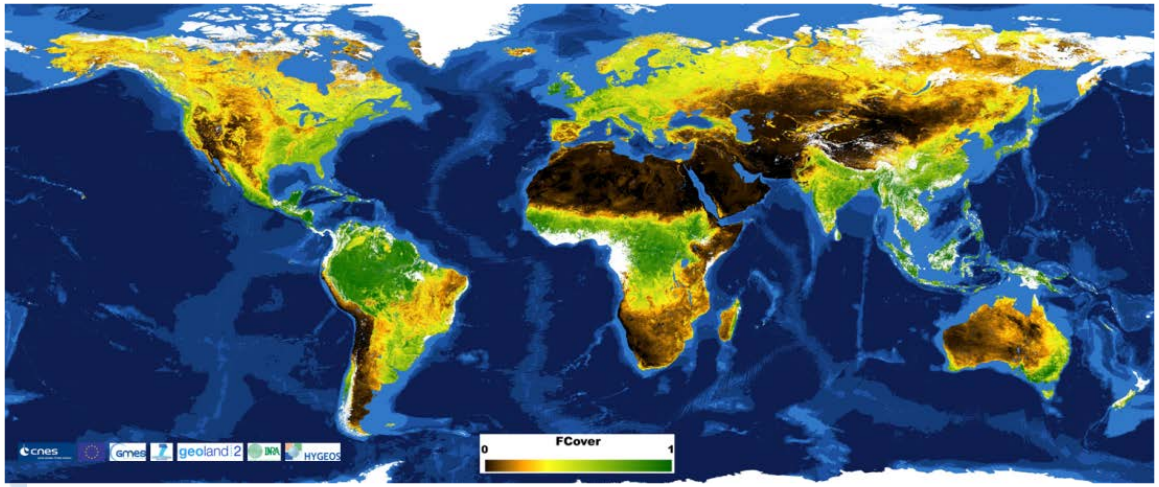
Land Surface Temperature



Soil Water Index



Fraction of green Vegetation Cover



Current Portfolio

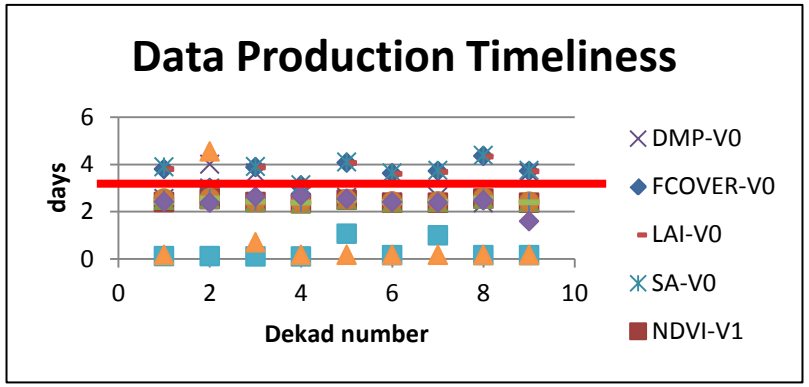
Variable (ECV)	Temporal Coverage	Temporal resolution	Spatial coverage	Spatial resolution	Sensor	Timeliness
LAI/FAPAR/FCover	1999 – present	10 days	Global	1km	SPOT/VGT	3 days
NDVI/VCI/VPI	1999 – present	10 days	Global	1km	SPOT/VGT	3 days
Dry Matter Productivity (related to Biomass)	2009 – present	10 days	Global	1km	SPOT/VGT	3 days
Burnt Area	1998 – present	1 day	Global	1km	SPOT/VGT	3 days
TOC Reflectance	2013 – present	10 days	Global	1km	SPOT/VGT	3 days
Surface Albedo	1999 – present	10 days	Global	1km	SPOT/VGT	3 days
Land Surface Temperature	2009 – present	1 hour	Global	0.05°	Σ Geo	1 day
Soil Water Index (soil moisture)	2007 – present	1 day	Global	0.1°	Metop / ASCAT	1 day
Area of Water bodies	1999 – present	10 days	Africa*	1km	SPOT/VGT	3 days

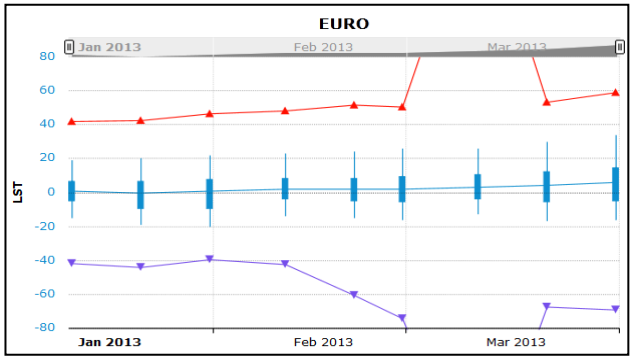
* soon Global

Technical Quality Monitoring

- **Monitoring individual processing steps**
  - Take daily appropriate actions where needed (i.e. input data error, network error, storage error, ..)

- **Visual inspection of images**
  - I.e. checking a global image on artefacts as stripes, …





- **Monitoring generated files and timeliness**

- **Checking for unreliable values by displaying statistical variables of each generated product**
  - i.e. for every timeslot and for each geographcial region

Scientific Quality Control

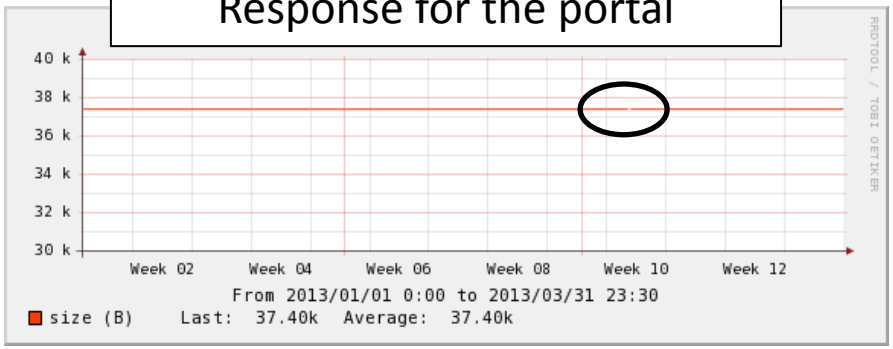
- **Per variable: following the guidelines, protocols and metrics defined by the Land Product Validation group of CEOS.**
  - Quality Assessment: exhaustive evaluation of new products before operational production
  - Quality Monitoring: check continuously operational products quality is stable along time
    - ➢ Lighten procedure
    - ➢ Focus on metrics and criteria that can be easily automated

- **Cross-cutting check: consistency across variables using a Land Data Assimilation System (LDAS)**
  - Assimilation of LAI, SWI and optional the surface Albedo
  - Passive monitoring of FAPAR and LST (simulated FAPAR and LST are compared to satellite products)

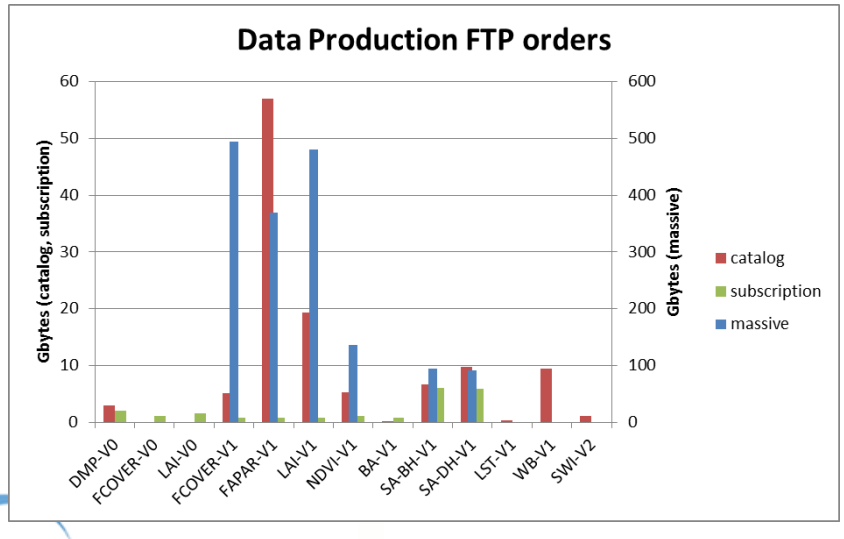
Service Quality Monitoring

- **Continuous check of user-interface**
  - Both portal and product delivery services
  - Through scripting embedded in network monitoring tools

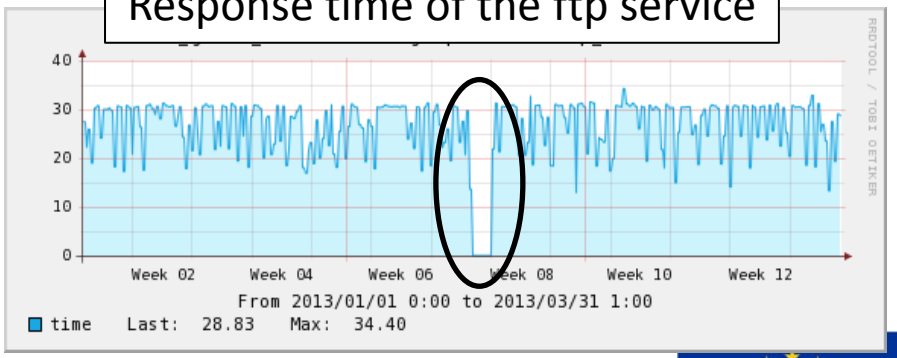
Response for the portal



- **Statistics of order logs**



Response time of the ftp service



Free and open product access

- **Simple registration required**
- **Subscription to receive the near-real time products**

- **Internet access**
  - Website: http://land.copernicus.eu/global
  - Currently:
    - Geoland 2 portal: http://www.geoland2.eu/core-mapping-services/biopar.html
    - DevCoCast web site: http://www.devcocast.eu

- **GEONETCast broadcast access**
  - Via EUMETCast over Africa & the Americas

Upgrade of the FTP portal

TODAY

- **FTP through existing infrastructure**
  - *Pre-defined* Regions:
    - 10° x10° Tiles, Continental Tiles
    - Africa Countries
  - *Single* Format: HDF4 or HDF5
  - *Single* Projection: LatLon

END of 2013

- **FTP through new Portal**
  - *Customize* Regions:
    - Select ROI while ordering
    - Defaults tbd
  - *Customize* Formats: HDF, GeoTiff, NetCDF, …
  - *Customize* Projection: LatLon, Inspire, …

Outline

- **Overview and Objectives**
- **Service Description**
  - Infrastructures
  - Portfolio
  - Quality Control
  - Dissemination
- **Continuity and Evolution**
- **Copernicus and LSA SAF ?**

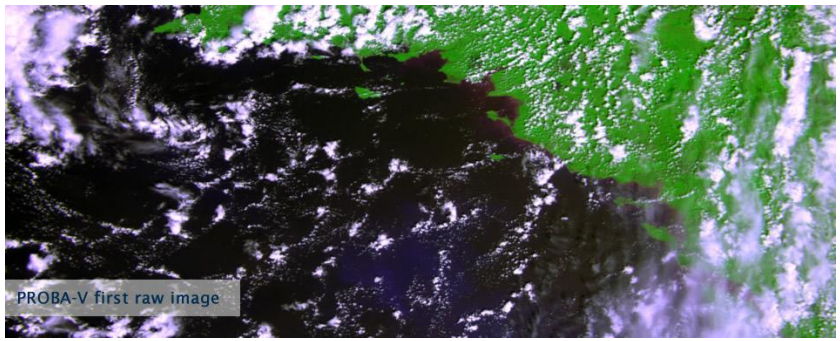
Sensor continuity

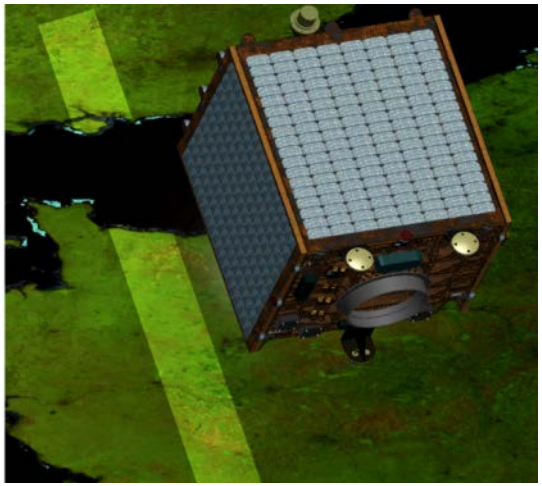
- **Keep 1km products service operational:**
  - Replace nominal sensor by new sensors data:
    - E.g. ASCAT from MetOp-A to MetOp-B & using both sensors,
    - E.g. from SPOT-VEGETATION to Proba-V, Sentinel-3
  - Back-up production in case of failure of the nominal sensor
    - E.g. Metop/AVHRR as back-up to SPOT-VEGETATION

- **Activities:**
  - Adapt the methodologies to new input data
  - Adapt the processing lines according to algorithm evolutions
  - Check consistency between nominal, new and backup products and ensure they reach the quality level compliant with users' requirements

Service Evolution

- **Moving from Low (1km) to Medium (300m resolution) products**
  - PROBA-V ensures continuity between SPOT-VGT & Sentinel3
  - **Successfully launched on 6th May**
  - First image acquired
  - 6 months of commissioning (~ Nov 2013)





- **Objective: pre-operational NRT products starting on May 2014 over Europe (initial focus LAI, FAPAR, Fcover), … then moving to global**
- **Using the achievements of the FP7-ImagineS project**

Product alignment

- **Add 10-daily products on top of high-temporal**
  - LST10
    - Max, Min, Median (per timeslot)
    - Min/max_of_max, Thermal Condition Index (TCI)
  - SWI10
    - 10 or 30 day composite (per T value)
    - Time-series (grid points)
- **Eases the use of (combining) products at users'side, focus on agri-meteo apps**

Outline

- **Overview and Objectives**
- **Service Description**
  - Infrastructures
  - Portfolio
  - Quality Control
  - Dissemination
- **Continuity and Evolution**
- **Copernicus and LSA SAF ?**

Copernicus GLS and LSA SAF ?

Theme	Copernicus GLS (VGT, EPS,ΣGEO)	LSA SAF (MSG)	LSA SAF (EPS)
Vegetation Parameters	• LAI/FAPAR/Fcover • NDVI/VCI/VPI • Dry Matter Productivity	• LAI/FAPAR/FCover	• LAI/FAPAR/Fcover *(planned)* • NDVI
Fires	• Burnt Area	• Fire Radiative Power • Fire Risk Map • Fire Detection and Monitoring	• Burnt Area *(planned)*
Radiation	• TOC Reflectance • Surface Albedo • LST	• Down-welling Fluxes • Surface Albedo • LST	• Down-welling Fluxes • Surface Albedo (planned) • LST
Water / Snow	• Soil Water Index • Area of Water bodies	• Evapotransporation • Snow Cover	
Other		• Bi-drectional Reflectance Function • Land Surface Emissitivity	

Copernicus GLS and LSA SAF ?

Product	Copernicus GLS (VGT, EPS,ΣGEO)	LSA SAF (MSG)	LSA SAF (EPS)
LAI/FAPAR/ Fcover	• Global VGT, 1km->300m, 10days, 1999-NRT • BRDF (Roujean) V1 • Phenology-based V2 • *(proposed EPS backup)*	• MSG disk, 3km, 1&10 days • BRDF (Roujean) • SMA-based	• *(planned) 1km, 10days* • BRDF (Roujean)
NDVI	• Global VGT, 1km, 10-days, 1998-NRT • Consistent (see poster)	• n.a.	• Global METOP-AVHRR, 1km, 10-days, 2008-NRT Consistent (see poster)
Burnt Area	• Global, 1km, daily, 1998-NRT • Spatial windows 112 pixs • Seasonality	• n.a.	• *(planned) 1km* • BRDF (Roujean)
Surface Albedo	• Global, 1km->300m, 10-days, 1999-NRT • BRDF (Roujean) • *(proposed EPS backup)*	• MSG disk, 3km, 1&10 days	• *(planned) 1km, 10days BRDF (Roujean)*
Land Surface Temperature	• Uses LSA SAF, extends region • Upcoming (10-daily with TCI)	• MSG disk, 3km, 15 mins	• Global, 1km, daily

? TBD ?

2 source strategy

? TBD ?.

Copernicus GLS and LSA SAF ?

- **Both services are very complementary**
  - Many different variables
  - Some cross-use
    - LSASAF LST used in GIO GLS LST
    - LSASAF EVO under investigation in GIO GLS DMP
    - GIO GLS WB potential for LSASAF EVO
    - EUMETSAT SSM for GIO GLS SWI
  - Some common with different properties
    - LSA SAF higher temporal frequency (<1hr … 1day / 3-5 km / MSG disk)
    - GLS higher spatial coverage&resolution (1day … 10days / 0,3 - 1km / Globe)

- **Continuous need to align portfolio**
  - Discuss EPS Vegetation and Albedo
  - Potential for users to combine products from both services
  - Option to share, train together

- **Validation strategy, comparisons**
  - Share methods and results
  - Share in-situ

Contact

Coordinator:

Bruno Smets – VITO

Bruno.smets@vito.be

S&T contact:

Roselyne Lacaze – HYGEOS

rl@hygeos.com

Helpdesk:

helpdesk@vgt.vito.be

Global Land consortium

vito vision on technology

HYGEOS

ipma

METEO FRANCE

ZAMG Zentralanstalt für Meteorologie und Geodynamik

Associates

EOLAB

INRA Institut National de la Recherche Agronomique

TU VIENNA

UCL Université catholique de Louvain

University of Leicester