Michel F. Massart

DG ENTR - European Commission

COPERNICUS Program

COPERNICUS Global Land component

COPERNICUS Program

Copernicus seen from the Regulation (GMES)

"Global Monitoring for Environment and Security (GMES) is an **Earth Monitoring** initiative led by the European Union"

"… carried out in partnership with the **EU Member States** and the **European Space Agency** (ESA)"

"… objective is to provide information services which give access to **accurate data and information** in the field of the environment and security and are tailored to the **needs of users**."

" … GMES should be a key tool to support **biodiversity, ecosystem management, and climate change** mitigation and adaptation…"

Copernicus is in practise …

Copernicus is the **Earth Observation flagship** of the European Union

An **integrated Earth Observation system** which combines space segment and in-situ data with Earth System Services

A source of information for policymakers, scientists, business and the public at large

A **user-driven** programme of services for environment and security

Philosophy

The objective of Copernicus is to develop **operational services**, following the example of meteorology, but for other domains such as:

- Emergency management
- Air quality monitoring
- Land monitoring
- Ocean & sea monitoring …

In addition, science is needed to create and continuously improve operational services

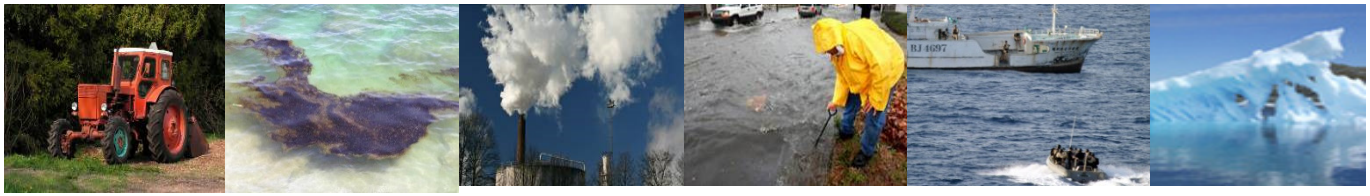
Overview

European Commission

USERS

Policy makers & **Public** & **Private, commercial**

Different Needs



Farming | Oil Spills | Air quality | Flood | Surveillance | Ice levels

Examples

Land | Marine | Atmosphere | Emergency | Security | Climate Change

Information Services

Space Infrastructure & **In-situ Infrastructure**

Sustainable information

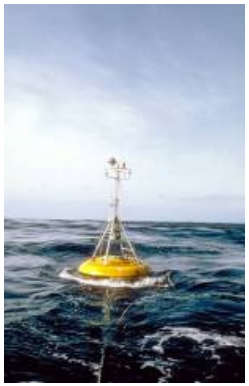
OBSERVATIONS

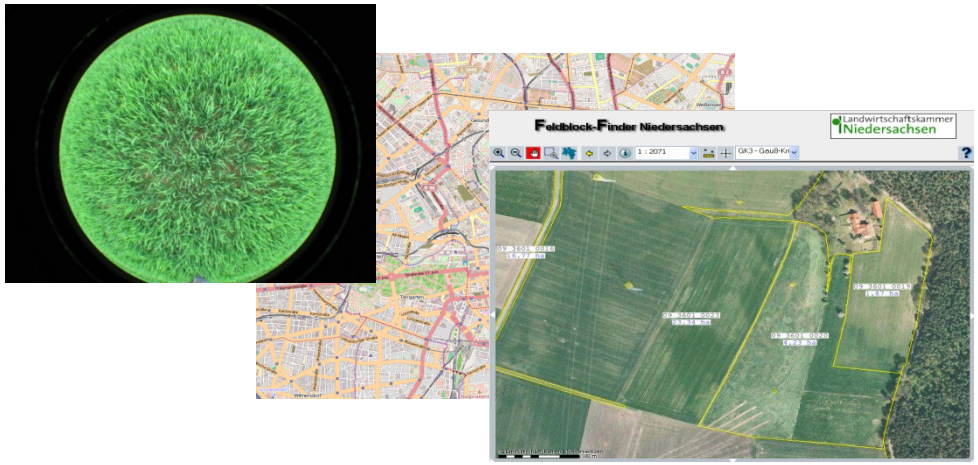
Infrastructure

A specific component is dedicated to In-Situ observations

Coordinated by European Environmental Agency

- Observations mostly under EU Member States responsibility
- Coordination at European level
- Air, Sea and Land-based systems and instruments



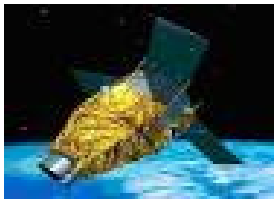


Infrastructure

The Space Infrastructure is a strong element of Copernicus

Led by European Space Agency

- Contributing missions




- Copernicus SENTINEL missions



SENTINEL Missions

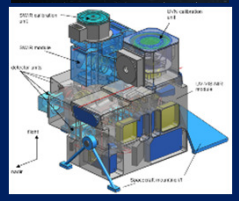
European Commission

Sentinel 1 – SAR imaging
All weather, day/night applications, interferometry
2014

Sentinel 2 – Multispectral imaging
Land applications: urban, forest, agriculture,..
Continuity of LANDSAT, SPOT, …
2014

Sentinel 3 – Ocean and global land monitoring : ocean color, vegetation, sea/land surface temperature, altimetry
2014

Sentinel 4 – Geostationary atmospheric
Atmospheric composition monitoring, trans-boundary pollution
2017



Sentinel 5 – Low-orbit atmospheric
Atmospheric composition monitoring
(S5 Precursor launch in 2014)
2014, 2019+

Services

The Services are covering a wide range of applications

Services monitoring Earth systems

Land

Marine

Atmosphere

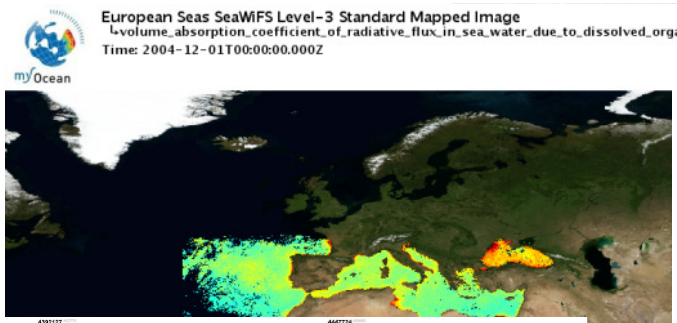
Horizontal services

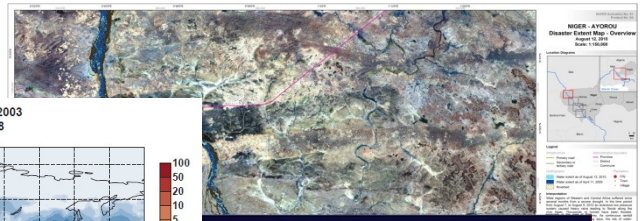
Emergency

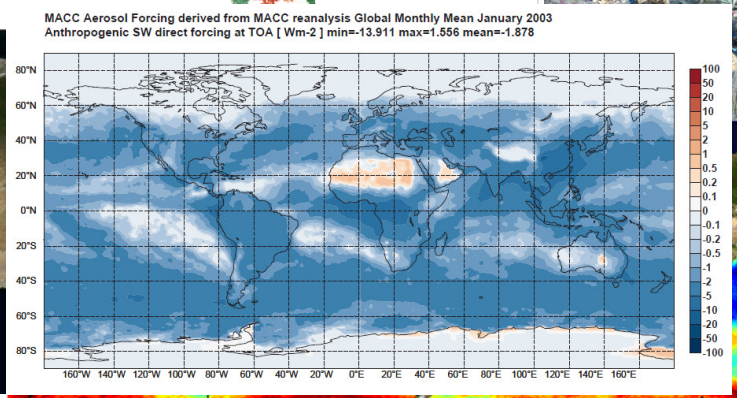
Security

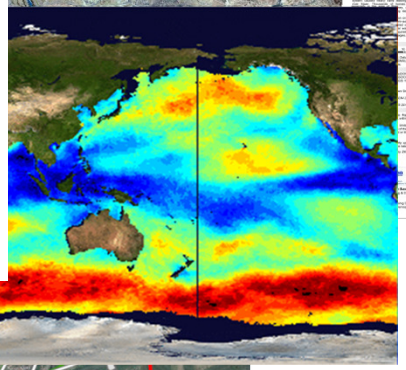
Climate Change

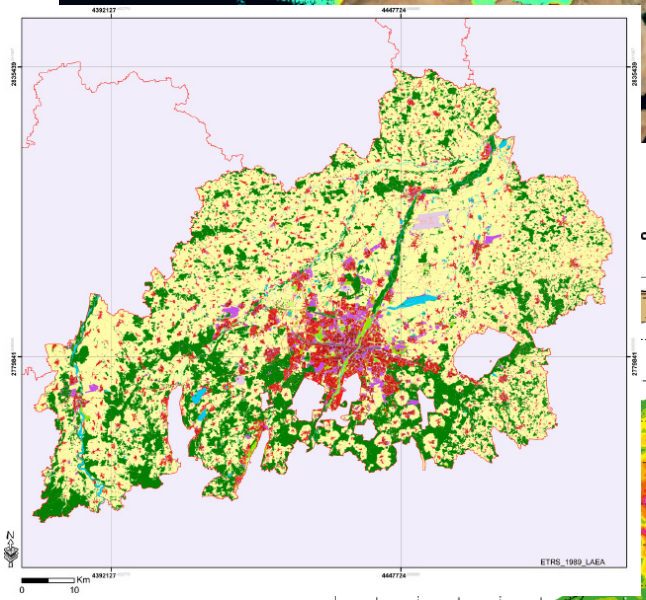
And delivering also a wide range of products

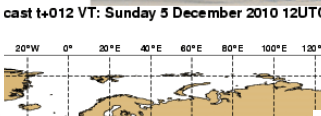


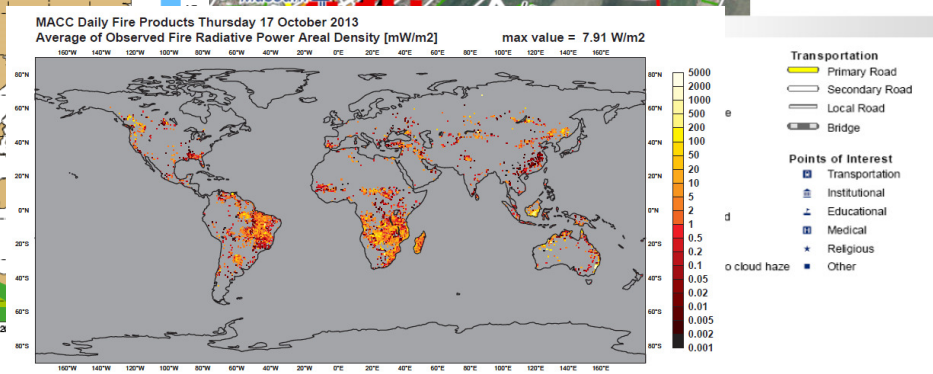












Major milestones

1998	**Initiation of GMES, Baveno Manifesto**
2001	**Gothenburg EU Summit, Heads of State and Government "to establish by 2008 an operational European capacity for GMES"**
2004	**EC Communication to EP and Council "GMES: Establishing a GMES capacity by 2008"** (Action Plan)
2005	**EC Communication "GMES : From concept to Reality"** (Priorities on initial services)
2006	**Establishment of GMES Bureau** (Fast track service delivery, governance, financial sustainability)
2007	**Space Policy Communication - GMES becomes the EO 'flagship' of the European Space Policy – EC-ESA framework agreement signed** (Space segment)
2008	**EC Communication "GMES, we care for a safer planet"** (Financing, infrastructure and management)
2009	**EC proposal for a GMES Programme Regulation** (Start of initial operations)
2010	**Adoption of GMES Initial Operation Regulation** (3 years)
2012	**GMES becomes COPERNICUS**
2014	**Adoption of COPERNICUS Regulation** (7 years) **& Launch of first Sentinels**

Governance

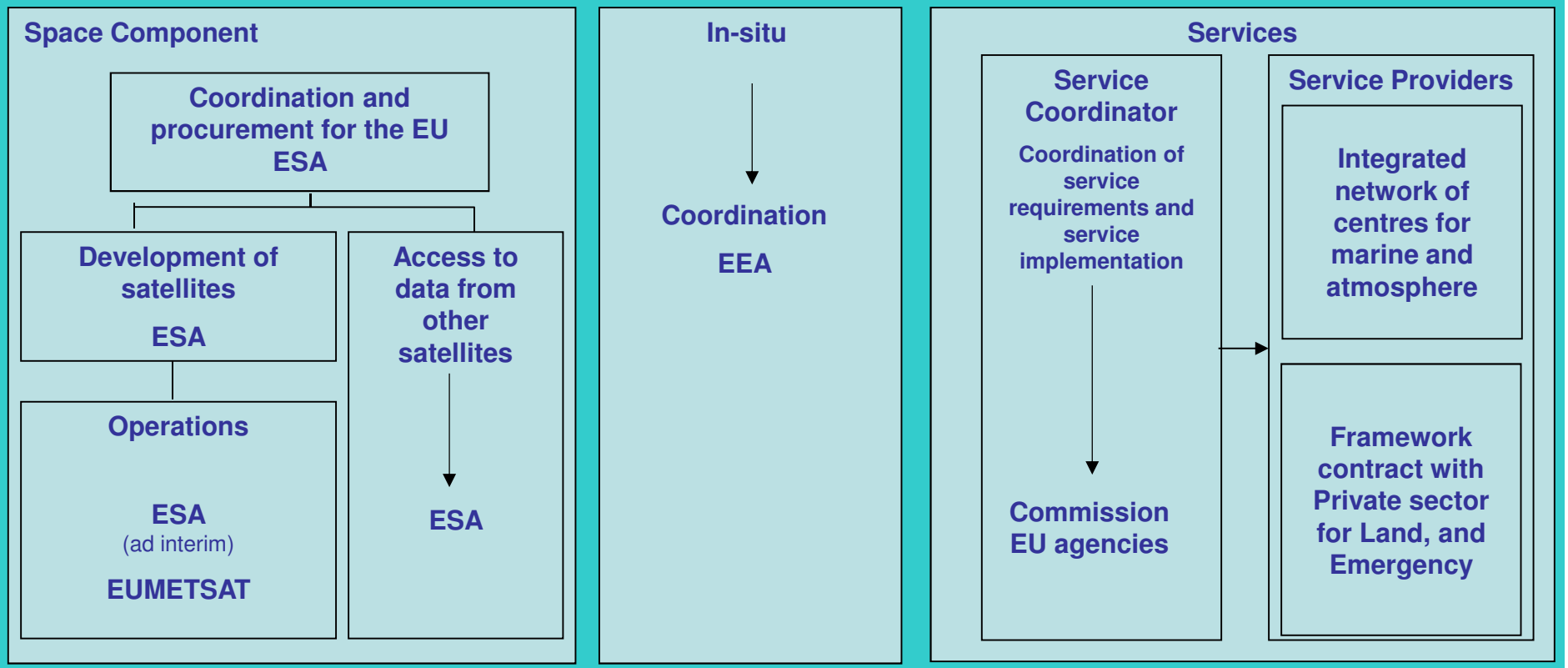
Political Coordination

European Commission

+

Copernicus Committee (MS), Program Committee (DG's)
User Forum (MS)

Technical Implementation



Operational Core Services have a clear value added

Sustainability and reliability of the data and product provision

Delivery of state of the art validated products and services

Centralized service leading to Scale Economies

Copernicus funding is secured for the next seven years

Investment in COPERNICUS up to 2013 : **€ 3.200 million**

Service and In situ components

- **EC - ESA** **€ 770 million**

Space component

- **ESA - EC** **€ 2.430 million**

Annual cost for period 2014-2020 **€ 834 million**

Copernicus is also an Investment for growth

COPERNICUS will have a positive impact on economy, on growth, on jobs and on innovation

COPERNICUS is fully implemented through public funding

A **free and open data policy** is a key element for the success

Inputs from Research Community are essential

Operational Services are based on mature and state-of-the-art research development

Research program and activities of Research FP, DG JRC, ESA, EUMETSAT and EU MS's

Service Evolution is and should be partly triggered by European Union research projects (Horizon 2020)

FP 7 Research support

European Commission

		Land	Marine	Atmosphere	Emergency	Security	Cl. Change
FP7 Projects	*Core*	GEOLAND2	MYOCEAN* MYOCEAN2	MACC* MACCII	SAFER*	GMOSAIC*	
	Service Evolution / R&D	BIO_SOS MS.MONINA ISAC MYWATER SIRIUS GLOWASIS IMAGINES** LOTUS** GLASS** SenSyF**	MYWAVE OPEC OSS2015 SANGOMA	NORS	LAMPRE** IncREO** SENSUM** PREFER**	G-SEXTANT** G-NEXT** SAGRES** LOBOS** NEREIDIS DOLPHIN SIMITYS	EURO4M MONARCH-A CARBONES ReCOVER REDDAF
	Downstream applications	CRYOLAND FRESHMON EUFODOS	FIELD AC AQUAMAR ASIMUT COBIOS SeaU SIDARUS OPERR	PASODOBLE ENDORSE	EVOSS DORIS SubCOAST PANGEO GeoPICTURE*		
	Inter. Coop	WATPLAN MALAREO	EAMNET		GARNET-E *		REDDINESS REDD-Flame
GIO	*Operational Services*	Pan EU Land Global Land Local Land			EMS-Mapping EFAS		

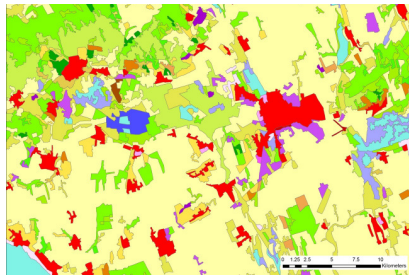
* Finished
** Under negotiation

COPERNICUS Global Land component

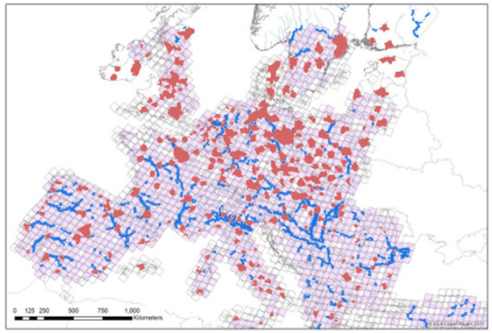
LAND Service

The Land Service is currently divided in three components

Pan EU component : production of HR land cover layers with an EU coverage



Local component : production of VHR land cover information on areas of interest (Urban areas and Riparian zones)



Global component

The background is the 2010 Concept Paper on Copernicus Global Land

Draft prepared by the Global Land Expert Working Group

Expert workshop on the global component of the GMES land monitoring core service (Stresa meeting – May 2009)

Revised draft submitted to GMES Advisory Committee, MS comments received and included

Final Operational Concept Paper on the "GLOB-LAND service" (v 3.0, March 2010): a vision for GIO and beyond

GLOBAL Land

Global Land service aims at

- supporting specific EU policies at international level
- supporting EU commitments under international treaties and conventions
- consolidating EU contribution to GEO/GEOSS

EU Policy areas to be covered

- Climate change, Land Degradation & Desertification, Forest resources, Biodiversity preservation, Water resources, Rural development , Agriculture and Food security

Global Land Service will be a multi-users core service, with two specific components

1. Global systematic monitoring service

Near real time bio geophysical parameters

- global coverage
- on vegetation state and dynamics
- based on low and mid resolution sensors

2. Hot spot ad hoc monitoring service

- limited geographical coverage
- specific regions of interest
- based on high and very high resolution sensors

Customer DG's expressed their priorities and interest in :

- Crop monitoring in and outside Europe (DG AGRI)
- Food security (DG DEVCO)
- Carbon budget, LU and LU change (DG DEVCO, ENV, CLIMA)
- EU – Africa partnership / GMES – Africa initiative (DG DEVCO)
- Water resource management (DG ENV)
- Biodiversity, Protected areas and Forest cover monitoring (DG DEVCO, ENV and CLIMA)
- Drought & Desertification assessment (DG ENV)



Architecture of the Global Systematic Monitoring Service

Production

- **Ten-daily bio geophysical parameters**
- **Near Real Time deliveries**
- **Consistent historical archive (15 years)**
- **Global and Africa specific coverage**
- **Currently mainly SPOT VGT based / Resolution : 1 Km**

Archive maintenance and reprocessing capabilities

Quality control

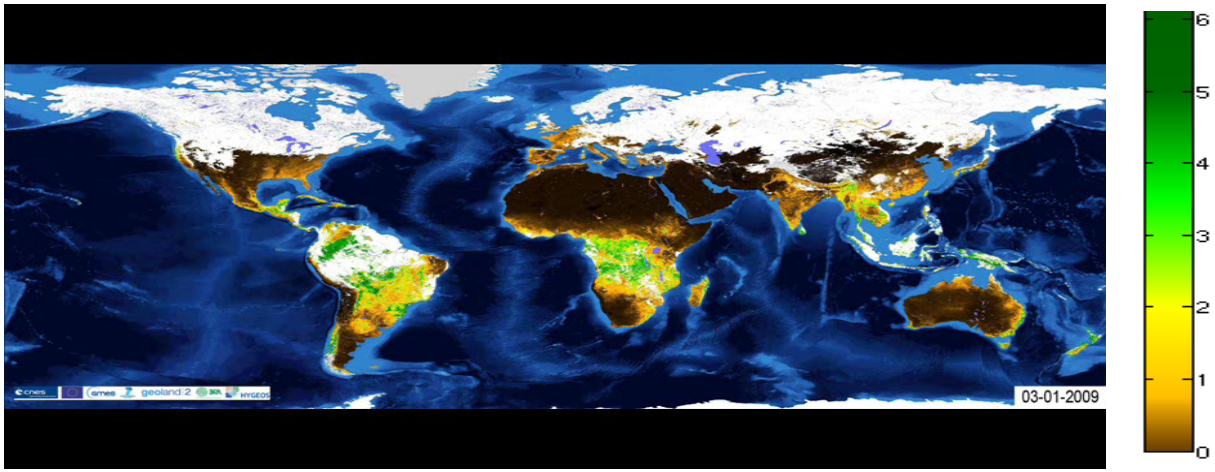
Dissemination and user support

Service started 1st January 2013

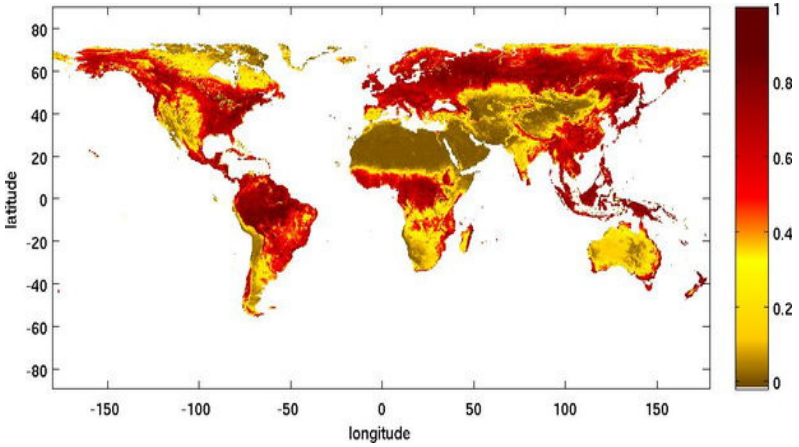
Vegetation Dynamic Products - Examples

European Commission

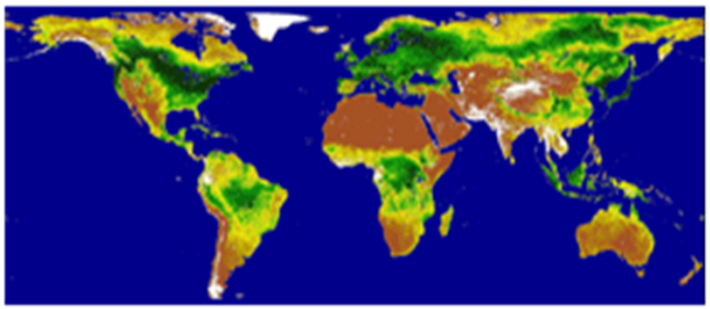
Leaf Area Index



FAPAR



Dry Matter Productivity



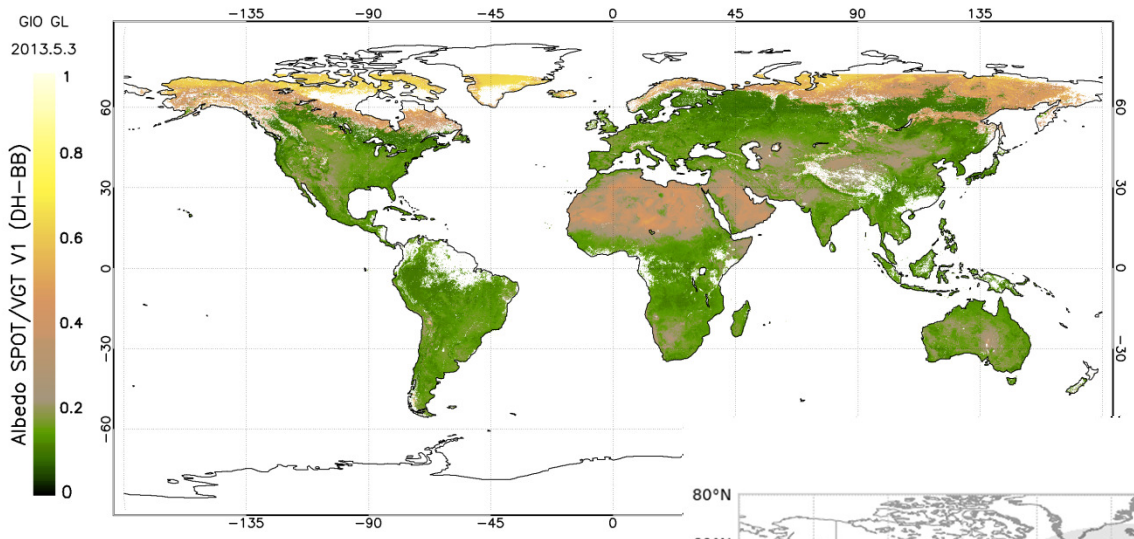
kgDM/ha/day

0 200 water

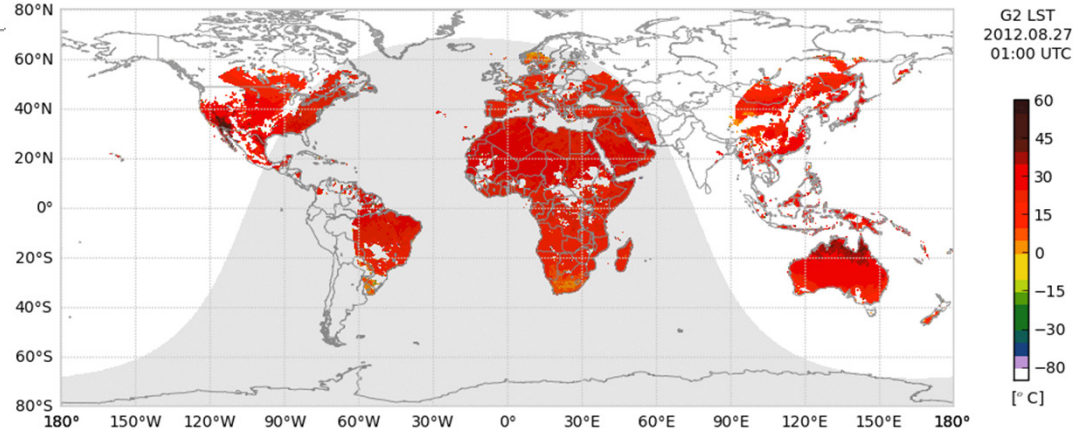
Energy Budget Products - Examples

European Commission

Albedo

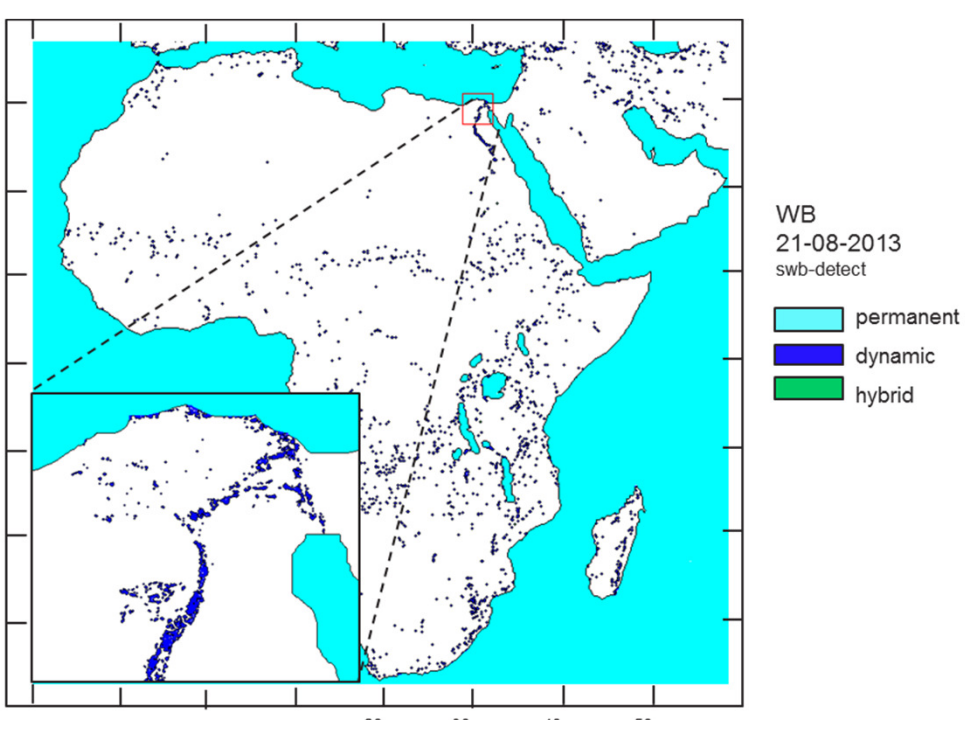


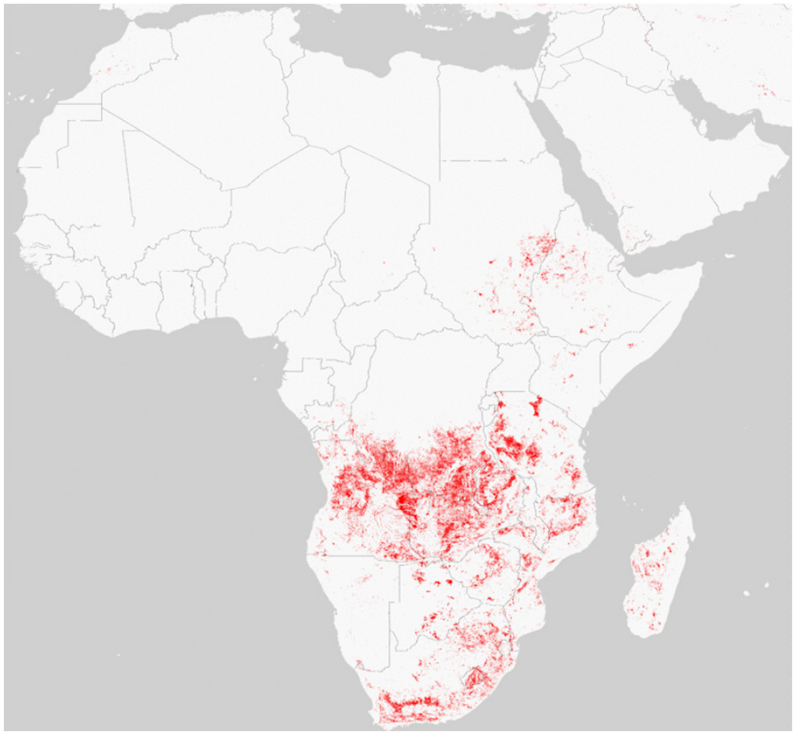
Land Surface Temperature



Detection Products - Examples

Burnt Areas Monitoring (Sept 2010)





Water Bodies Monitoring

Copernicus Global Land

The current portfolio is composed of standard products

Variable	*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	*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°*	*ΣGeo*	*1 day*
Soil Water Index	*2007 – present*	*1 day*	*Global*	*0.1°*	*Metop / ASCAT*	*1 day*
Water bodies	*1999 – present*	*10 days*	*Global**	*1km*	*SPOT/VGT*	*3 days*

GLOBAL Land Products - Applications

European Commission

Weather forecast & Climate change

- Carbon flux forecast

Agriculture:

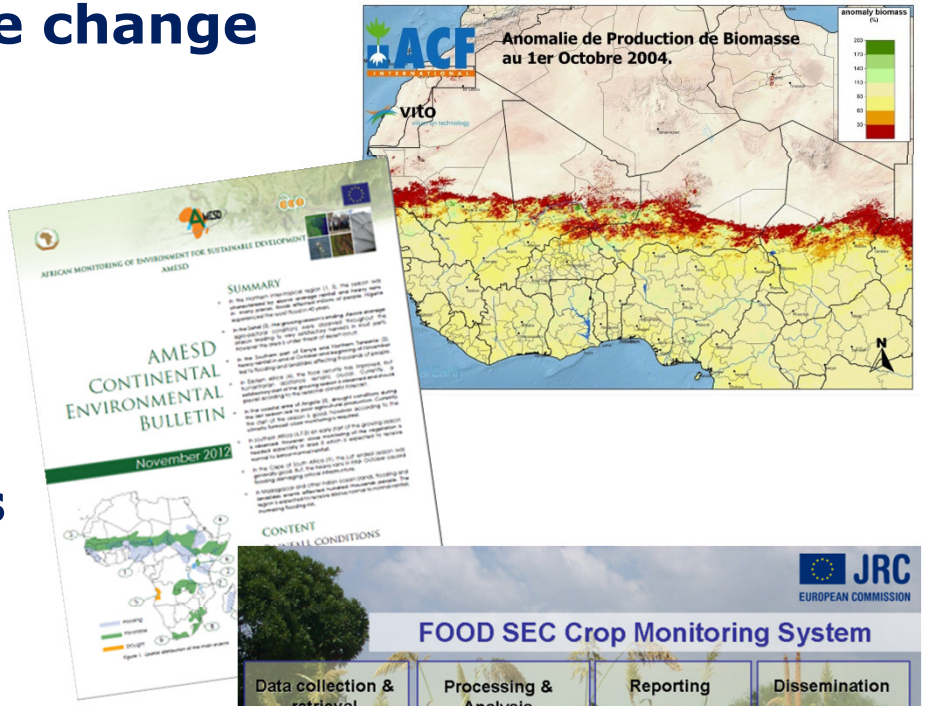
- Crop monitoring
- Yield forecasting
- Heath conditions

Monitoring extreme events

- Flooding and droughts
- Frost conditions
- Heat waves

Hydrology

- Water management
- River discharge



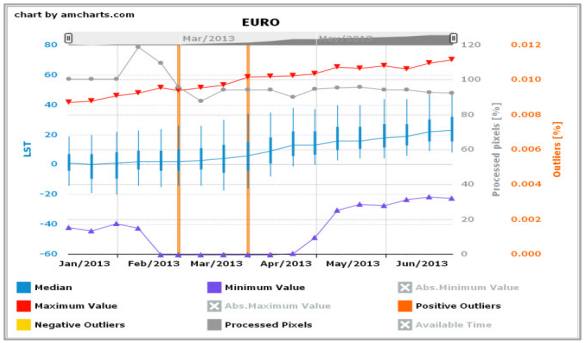
Quality Monitoring

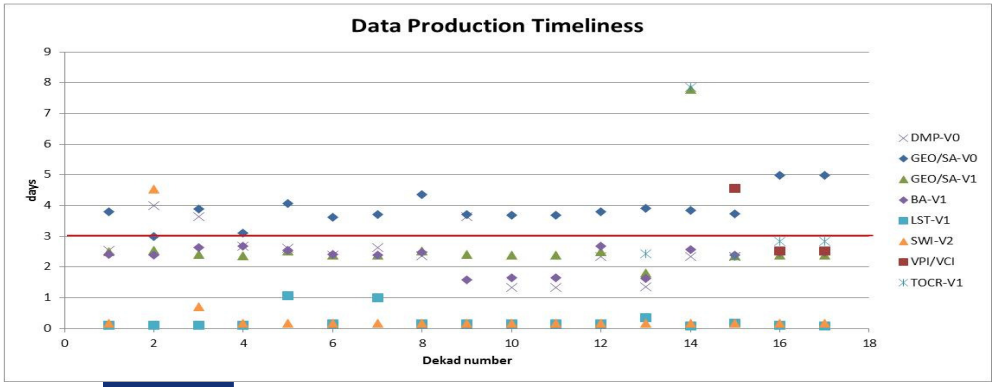
Exhaustive evaluation of products before operational production

- Quality Assessment: Per variable and following guidelines, protocols and metrics defined by the Land Product Validation group of CEOS

Semi-automatic checks

- Monitoring processing steps
- Visual inspection of images
- Automatic checking by displaying statistical parameters
- Monitoring product timeliness





Quality Monitoring

Per variable: following CEOS guidelines and protocols

- Quality Monitoring: continuous and automated check of the stability of the product quality along time

Cross-cutting check: consistency across variables using a Land Data Assimilation System

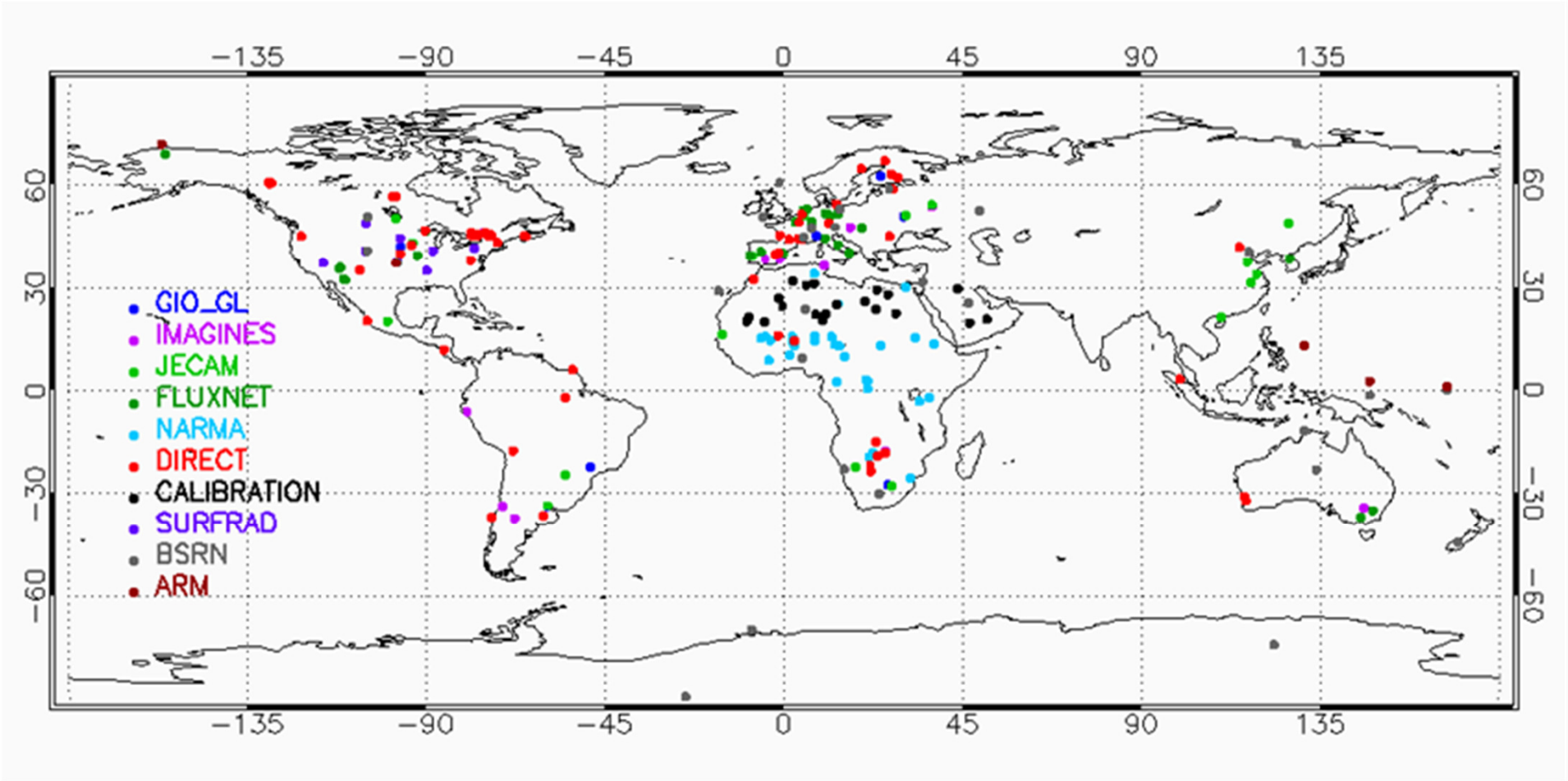
- Assimilation of LAI, SWI, and optionally the surface Albedo

Independent Assessment

- Audit / Reviews
- Technical User Group

European Commission

Validation sites, data sharing and collaboration are essential



To get the products ?

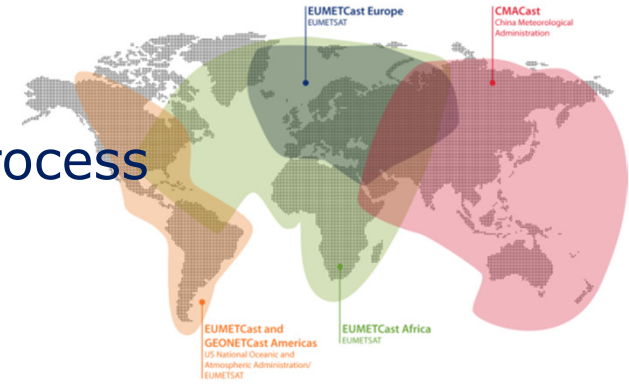
Products are easily accessible

Internet Entry point

- Website: http://land.copernicus.eu/global

Data download channels

- Internet : Access to NRT + full archive
- Broadcast (EUMETCast) : Access to NRT



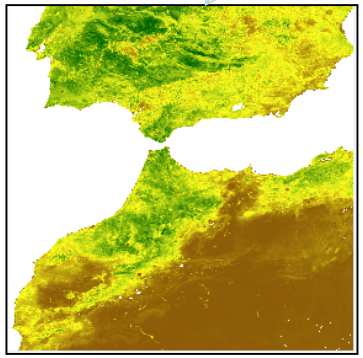
Free and open product access

- Simple and automatic registration process

Product Content

g2_BIOPAR_FCOVER_201304230000_H17V5_VGT_V1.3.zip

Name	Size	Packed	Type	Modified	CRC32
..			File folder		
g2_BIOPAR_FCOVER_201304230000_H17V5_VGT_V1.3.h5	7.544.742	1.465.444	NCSA HDFView	29/05/2013 15:13	89E379A2
g2_BIOPAR_FCOVER_PROD-DESC_201304230000_H17V5_VGT_V1.3.xml	66.358	8.807	XML Document	29/05/2013 15:13	9288882B
g2_BIOPAR_FCOVER_QL_201304230000_H17V5_VGT_V1.3.tiff	80.492	49.126	TIFF image	29/05/2013 15:13	EF909E40
g2_BIOPAR_VITO_ProductSet.xsl	28.987	4.466	XSL Stylesheet	8/05/2013 9:34	82419CD0
g2_BIOPAR_VITO_RIG.txt					



Product Information

Name	**Global 10-daily SPOT-VEGETATION Fraction of Vegetation Cover (FCOVER) : H17V5 2013-04-23**
Version	**V1.3**
Abstract	Fraction of vegetation Cover (FCOVER) corresponds to the gap fraction for nadir direction. It is used to separate vegetation and soil in energy balance processes, including temperature and evapotranspiration. It is computed from the leaf area index and other canopy structural variables and does not depend on variables such as the geometry of illumination as compared to FAPAR. For this reason, it is a very good candidate for the replacement of classical vegetation indices for the monitoring of green vegetation. Because of the linear relationship with radiometric signal, FCOVER will be only marginally scale dependent. Note that similarly to LAI and FAPAR, only the green elements will be considered, either belonging both to the overstorey and understorey.
Algorithm	The input data are the daily Top of the Atmosphere reflectances measured by the SPOT-VGT sensor. They are calibrated, the clouds and their shadows are removed, and they are atmospherically-corrected to get the Top Of the Canopy reflectances. The existing CYCLOPES V3.1 FCOVER product is scaled to correct a significant underestimation. Then, it is used to calibrate a neural network over the BELMANIP2 set of sites to relate the FCOVER to the corresponding atmospherically-corrected and directionally-normalized top of canopy SPOT/VEGETATION reflectances.
Purpose	This product is first designed to fit the requirements of the Core Information Services of the geoland2 project. It can be also useful for all applications related to the environment monitoring.
Keywords	Orthoimagery; geophysical environment; biogeophysical; vegetation cover; H17V5; Dekad; 30-day composite;
Keyword Categories	imageryBaseMapsEarthCover; biota; farming; environment;
Platform	SPOT_5
Sensor	VEGETATION_2
Production Center	Flemish Institute for Technological Research (VITO)
Production Date	2013-05-29
Production ID	62ede7be-4744-4f48-a4f7-70df5bfcaa04
Status	completed

back to top

Spatial Information

Projection	EPSG:32662			
Ellipsoid	WGS84			
Resolution	0.00892857142857	degrees		
Tile	H17V5			
Number of Lines	1121			
Number of Columns	1121			
Bounding Rectangle	**North**	**South**	**West**	**East**
	40	30	-10	0

g2_BIOPAR_FCOVER_2013042

- FCOVER
- FCOVER-ERR
- FCOVER-QFLAG
- LMK
- NMOD

/ (96)
Group size = 5
Number of attributes = 17
ARCHIVE_FACILITY = VITO
CENTRE = VITO
ELLIPSOID_NAME = WGS84
GEODATE_NAME = WGS84
INSTRUMENT_ID = VGT2
LAT = 40
LONG = -10
OVERALL_QUALITY_FLAG = OK
PIXEL_SIZE = 1km
PRODUCT_ALGORITHM_VERSION = 1.3
PRODUCT_TIME = 2013-05-29
PROJECTION_NAME = PlateCarree
REGION_NAME = H17V5
SATELLITE = SPOT5
TEMPORAL_NOMINAL = 2013-04-23
TEMPORAL_START = 2013-04-05
TEMPORAL_STOP = 2013-05-05

Tools:

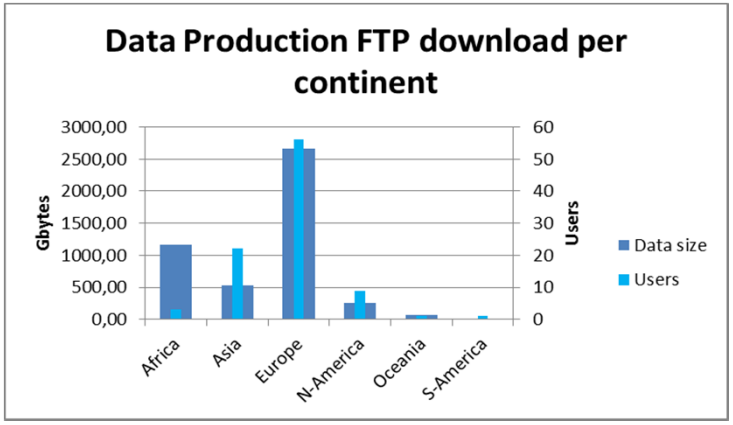
- hdf
- gdal
- vgtExtract

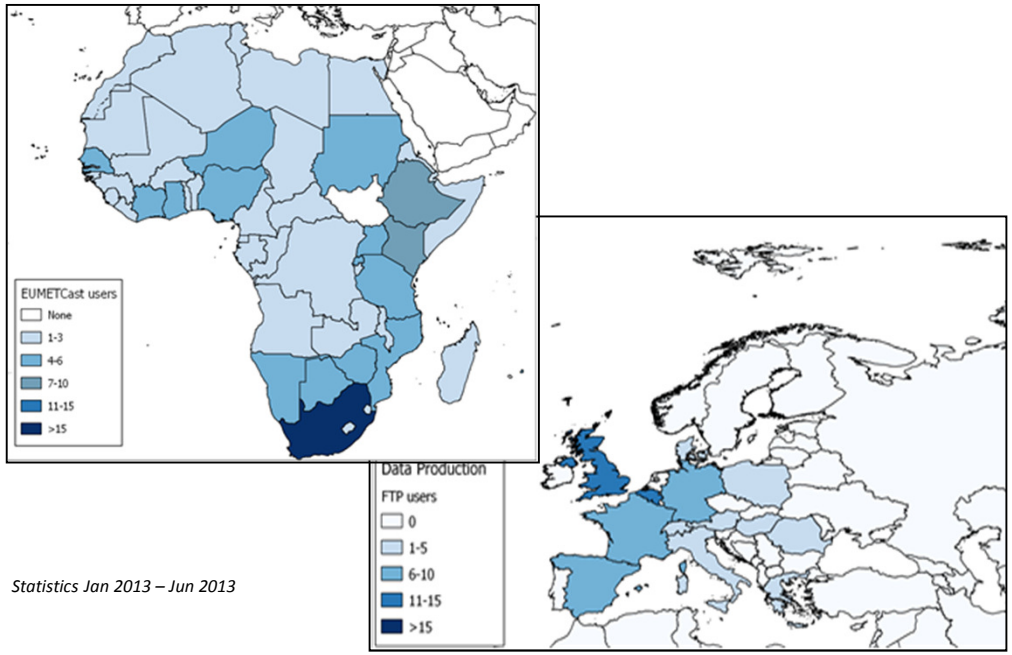
Download Statistics

± 700 ftp users

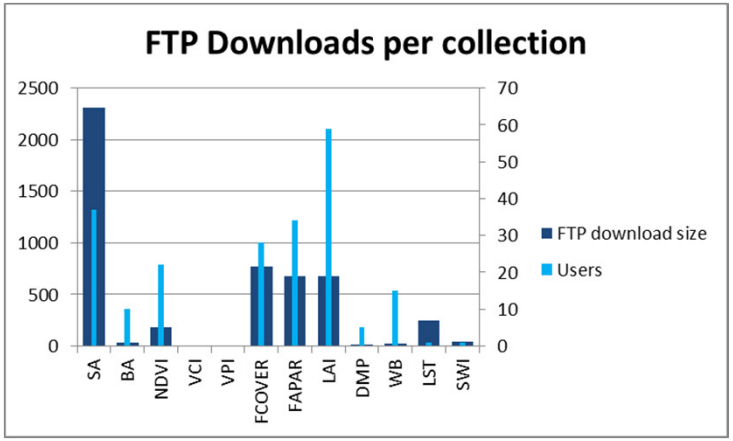
± 6 TB delivered

+ 100 EUMETCAST stations in Africa





Statistics Jan 2013 – Jun 2013



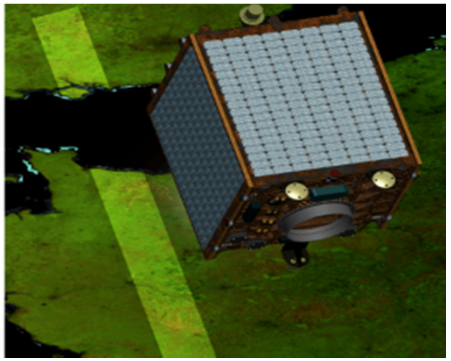
GLOBAL Land Evolution

European Commission

The Global Land service is not static but has to progress …

Global Systematic monitoring

- Continuity of current bio-geophysical variables provision
- Moving from 1 km SPOT-VGT resolution to 300 m PROBA V (ImagineS project support, start of operation in Europe, May 2014)
- Integration of new bio-geophysical variables (water level, phenology, snow cover …)



Implementation of the Hot spot monitoring

- High and Very High resolution for Land cover - land use mapping
- National parks and biodiversity hot spot in Africa

Conclusions

Value of Copernicus = f(HOW THE INFORMATION IS USED)

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Products are : Available, Free, Validated, Documented, Near Real Time and Sustainable

Inputs are needed from Food Security Community

Come back to us with comments and recommendations

Give us your needs and requirements for the evolution of the Service

Global Land site : http://land.copernicus.eu/global

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Pictures BIOPAMA / DG DEVCO – DG JRC