



*Global Land Service*



Operational 333m  
biophysical products  
of the Copernicus  
Global Land service  
for agriculture  
monitoring

Roselyne Lacaze  
on behalf the consortia

# Outline

- **Context**
- **Service**
  - Portfolio
  - Quality Control
  - Distribution
- **Evolution: 333m biophysical products**
- **Application to agriculture monitoring**
- **Conclusion**

# Global Land Service

## *The Global Component of Copernicus Land service*

Context  
Service  
Evolution  
Applications  
Conclusion

- **Support and consolidate:**

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



- **EU Policy focus**

- Crop Monitoring and Food security in/outside Europe
- Biodiversity, Protected areas and Forest cover monitoring
- Drought Assessment and Desertification
- Carbon modeling, land use and land cover change
- Support to Earth Observation Activities in Africa



# The Global Land Service

- A global systematic monitoring service

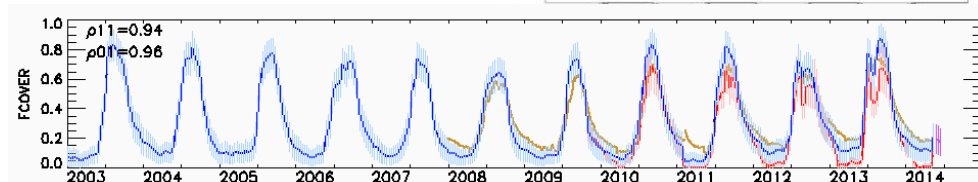
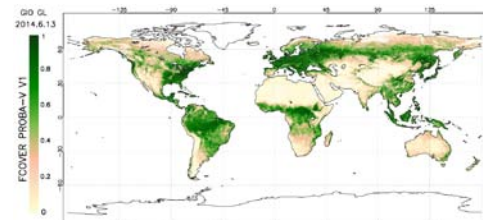
1. Production of 13 bio-geophysical variables

- NRT delivery (hourly -> dekad)
- Global coverage
- Consistent historical time series (15+ years)

2. Quality control

3. Archiving & re-processing

4. Dissemination & user support



# Portfolio - current

Variable	Temporal Coverage	Temporal resolution	Spatial coverage	Spatial resolution	Sensor	Timeliness
LAI/FAPAR/FCover	1999 – present	10 days	Global	1km	PROBA-V & SPOT/VGT	3 days
NDVI/VCI/VPI	1999 – present	10 days	Global	1km	PROBA-V & SPOT/VGT	3 days
Dry Matter Productivity	1999* / 2009 – present	10 days	Global	1km	PROBA-V & SPOT/VGT	3 days
Burnt Area	1999 – present	1 day	Global	1km	PROBA-V & SPOT/VGT	3 days
TOC Reflectance	1999* / 2013 – present	10 days	Global	1km	PROBA-V & SPOT/VGT	3 days
Surface Albedo	1999 – present	10 days	Global	1km	PROBA-V & SPOT/VGT	3 days
Land Surface Temperature	2009 – present	1 hour 10 days*	Global	0.05°	Σ Geo	1 day
Soil Water Index	2007 – present	1 day 10 days*	Global	0.1°	Metop / ASCAT	1 day
Water bodies	1999 – present	10 days	Africa Global*	1km	PROBA-V & SPOT/VGT	3 days

\* Coming soon

- Consistency of time-series and NRT operations, across sensors and across resolutions
- 333m products are expected around summer 2015

More details on <http://land.copernicus.eu/global/products>

# Levels of Quality Control

## • Self-assessment by consortium

### ▪ Technical Quality Control

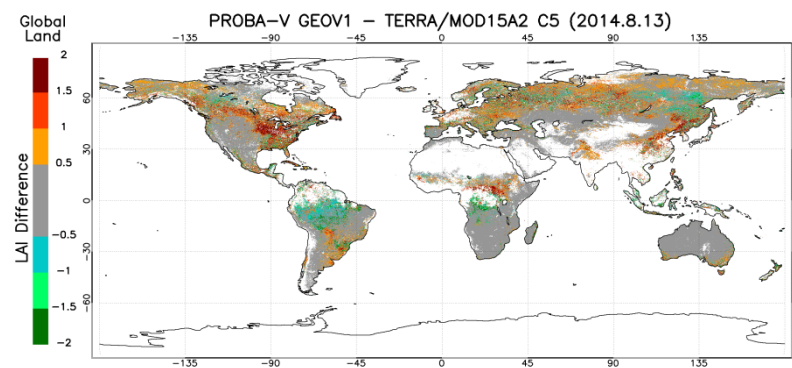
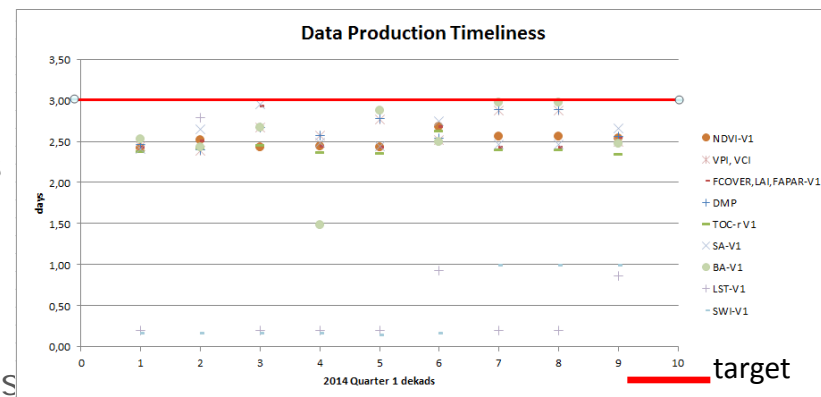
- Semi-automatic checks at operation centers
- Monitor individual processing steps
- Check unreliable values through statistics

### ▪ Thematic Quality Control

- Per variable, according CEOS (LPV) protocols
- Quality Assessment: exhaustive (multi-year) validation for each product/version
- Quality Monitoring: every six months to check the quality keeps stable along time

### ▪ Cross cutting Quality Control

- Through assimilation in a land surface model
- Consistency across variables (LAI, SWI, Albedo, FAPAR, LST)



## • Assessment through independent entity

- External reviews: recommendations on evolution of service (2 cycles/year)
- Technical User Board: define product specifications according to users' needs



# Distribution - website

<http://land.copernicus.eu/global>

## Copernicus Global Land Service

Providing bio-geophysical products of global land surface



### Home

The Global Land Service is a component of the Copernicus Land service that provides a series of bio-geophysical products on the status and evolution of land surface at global scale at mid and low spatial resolution. Production and delivery of the parameters take place in a timely manner and are complemented by the constitution of long term time series. The products are used to monitor the vegetation, the water cycle and the energy budget.

125 sq kilometres  
burnt in Australia in early  
January 2015

300th  
user registered for online  
access

5.5 TB  
downloaded in last quarter of  
2014

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Providing bio-geophysical products of global land surface



Home Products News Product Access



### Fraction of green Vegetation Cover

The Fraction of Vegetation Cover (FCover) corresponds to the fraction of ground covered by green vegetation. Practically, it quantifies the spatial extent of the vegetation. Because it is independent from the illumination direction and it is sensitive to the vegetation amount, FCOVER is a very good candidate for the replacement of classical vegetation indices for the monitoring of ecosystems.

### FCOVER Alerts

FCOVER v1 temporarily  
unavailable

First FCOVER products from  
PROBA-V  
[Read more or Subscribe](#)

### Latest news

Copernicus Glob.  
new look and feel

First update to p  
portal

First pre-operati  
derived from PRO

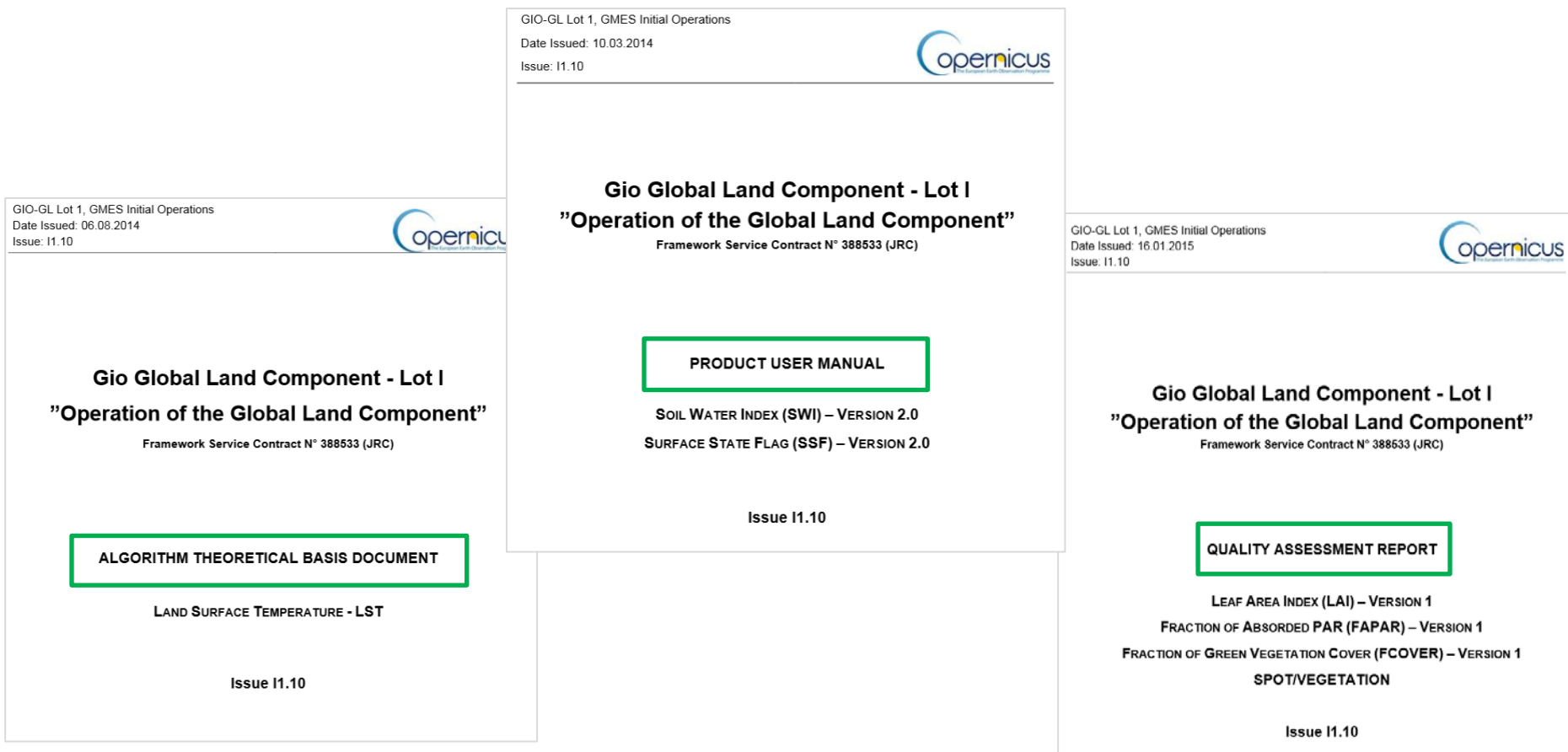
VCI on EUMETCa  
Africa

### User support

### FCOVER characteristics

Access	Algorithm	Quality	Application	Technical	Documents	Gallery
Product version	Access	Status	Sensor	Temporal coverage	Spatial information	Timeliness
3	Expected Q3 2015	In development	PROBA-V	May 2014 - present	Europe, 10°x10° tiles, continental tile, 1/3km	Within 3 days after end of synthesis period
2	Expected Q3 2015	In development	SPOT-VGT, PROBA-V	1999 - present	Global, 10°x10° tiles, continental tiles, 1km	Within 3 days after end of synthesis period
1	Product Portal	Operational	SPOT-VGT	Dec 1998 - May 2014	Global, 10°x10° tiles, continental tiles, 1km	Archive only
1	Expected Q2 2015	In development	PROBA-V	Jun 2014 - present	Global, 10°x10° tiles, continental tiles, 1km	Within 3 days after end of synthesis period

# Distribution - documentation





# Distribution - access

<http://land.copernicus.eu/global>

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[Read more](#)

125 sq kilometres

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### Latest news

Copernicus Global Land Service: a new look and feel

First update to product portal

First pre-operational products derived from PROBA-V

VCI on EUMETCast Africa

### User support

## Copernicus Global Land Service

Providing bio-geophysical products of global land surface

[Home](#) [Products](#) [News](#) [Product Access](#)



### Normalized Difference Vegetation Index

The Normalized Difference Vegetation Index (NDVI) is an indicator of the greenness of the biomes. As such, it is closely linked to the FAPAR.

Even though it is not a physical property of the vegetation cover, its very simple formulation  $NDVI = (REF_{nir} - REF_{red}) / (REF_{nir} + REF_{red})$  where  $REF_{nir}$  and  $REF_{red}$  are the spectral reflectances measured in the near infrared and red wavebands respectively, makes it widely used for ecosystems monitoring.

### NDVI Alerts

NDVI v2 promoted to pre-operational status

Anomalies in PROBA-V NDVI 2.0 products fixed from 20140721

First NDVI products from PROBA-V  
[Read more or Subscribe](#)

### NDVI characteristics

Access	Algorithm	Quality	Application	Technical	Documents	Gallery
Product version	Access	Status	Sensor	Temporal coverage	Spatial information	Timeliness
2	Product Portal	Pre-operational	PROBA-V	June 2014 - present	Global, 10°x10° tiles, continental tiles, 1km	Within 3 days after end of synthesis period
2	Product Portal	Operational	SPOT-VGT	2013 - May 2014	Global, 10°x10° tiles, continental tiles, 1km	Archive only
1	Product Portal	Operational	SPOT-VGT	Dec 1998 - May 2013	Global, 10°x10° tiles, continental tiles, 1km	Archive only

# Distribution – data portal

- Discover -> (custom) Order -> FTP (pull or push)
- Free and open product access
  - Anonymous query
  - Automated Registration
  - Video Tutorials in FAQ
- 2 data download channels
  - Internet: NRT + full archive
  - Broadcast
    - EUMETCast Africa & South-America
    - NRT products only

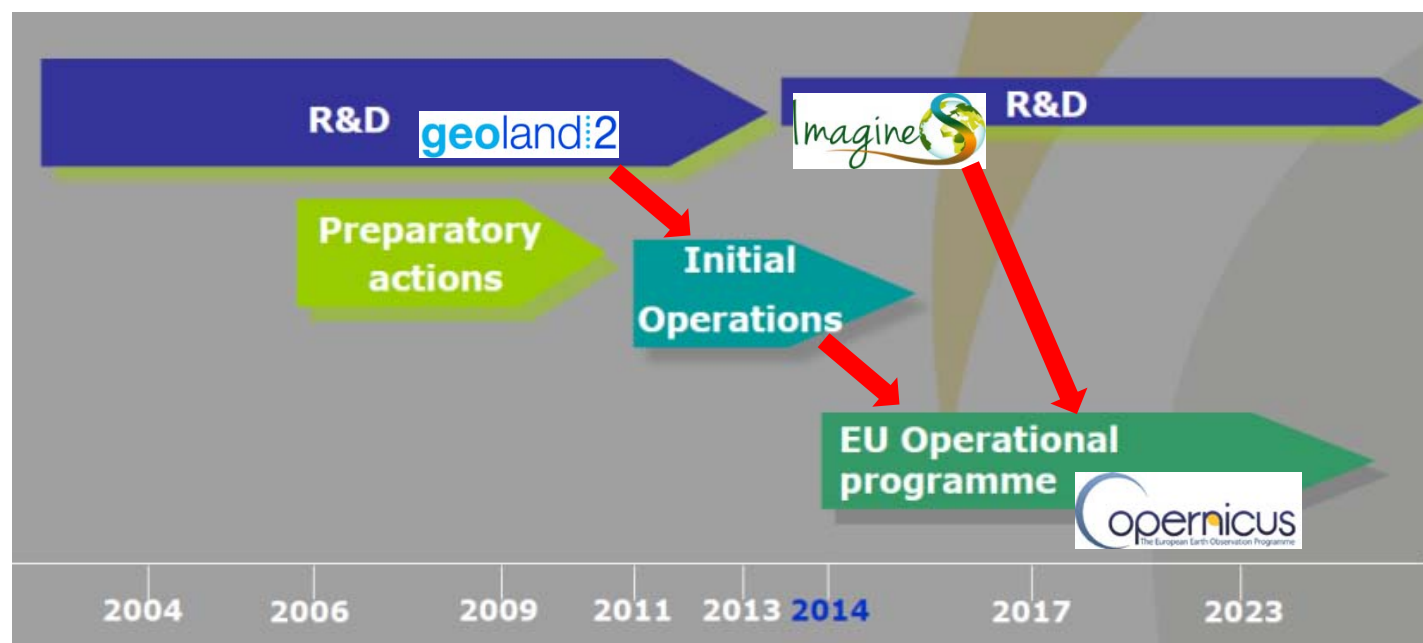
The screenshot displays the Copernicus Global Land Service web portal. The header includes the Copernicus logo and the text 'Global Land Service'. Navigation links for 'Login', 'Register', 'Help', 'FAQ', and 'Contact' are visible. A search bar and a 'Go' button are present. The main content area shows a world map with a legend and a scale bar. On the right, there's a search interface for 'Vegetation Dynamics - LAI V1' with filters for 'Leaf Area Index', 'Fraction of Vegetation Cover', and 'Fraction of APAR'. Below these are input fields for 'Start date' (06/06/2012) and 'End date' (10/07/2012), along with 'Search' and 'Reset' buttons. The bottom of the page shows the 'Number of results per page' set to 50.

# Evolution: 333m products

- **Derived from PROBA-V data**
  - Time series starting November 2013



- **Algorithms and chains developed in FP7/ImagineS**



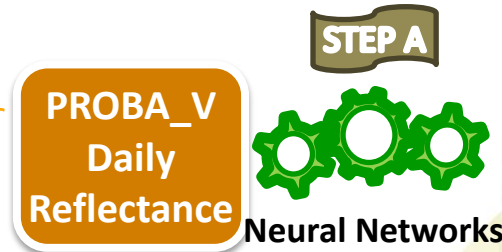


# 333m biophysical variables



- Algorithms:

- LAI, FAPAR, FCover defined by INRA



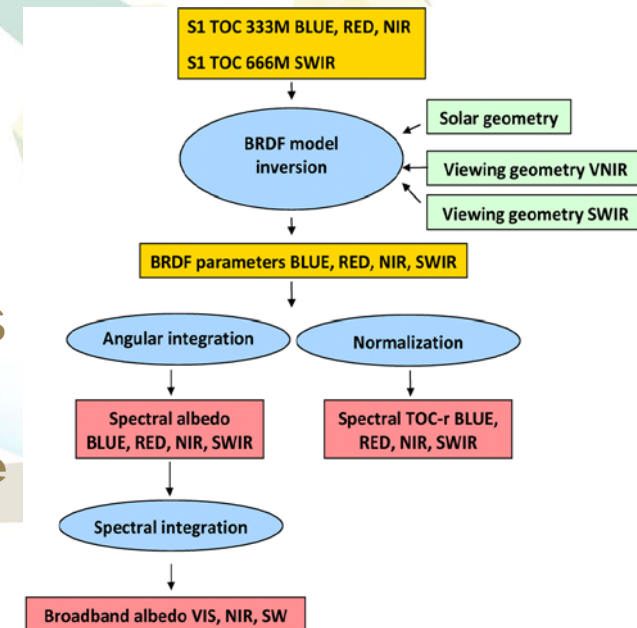
- TOC-r and Albedo defined by Meteo-France

- Processing chains developed by HYGEOS

- Following specifications of Global Land service

- Operated by VITO in Global Land Service

- Conform configuration new version 1km







# 333m biophysical variables



- Algorithms:
  - LAI, FAPAR, FCover defined by INRA



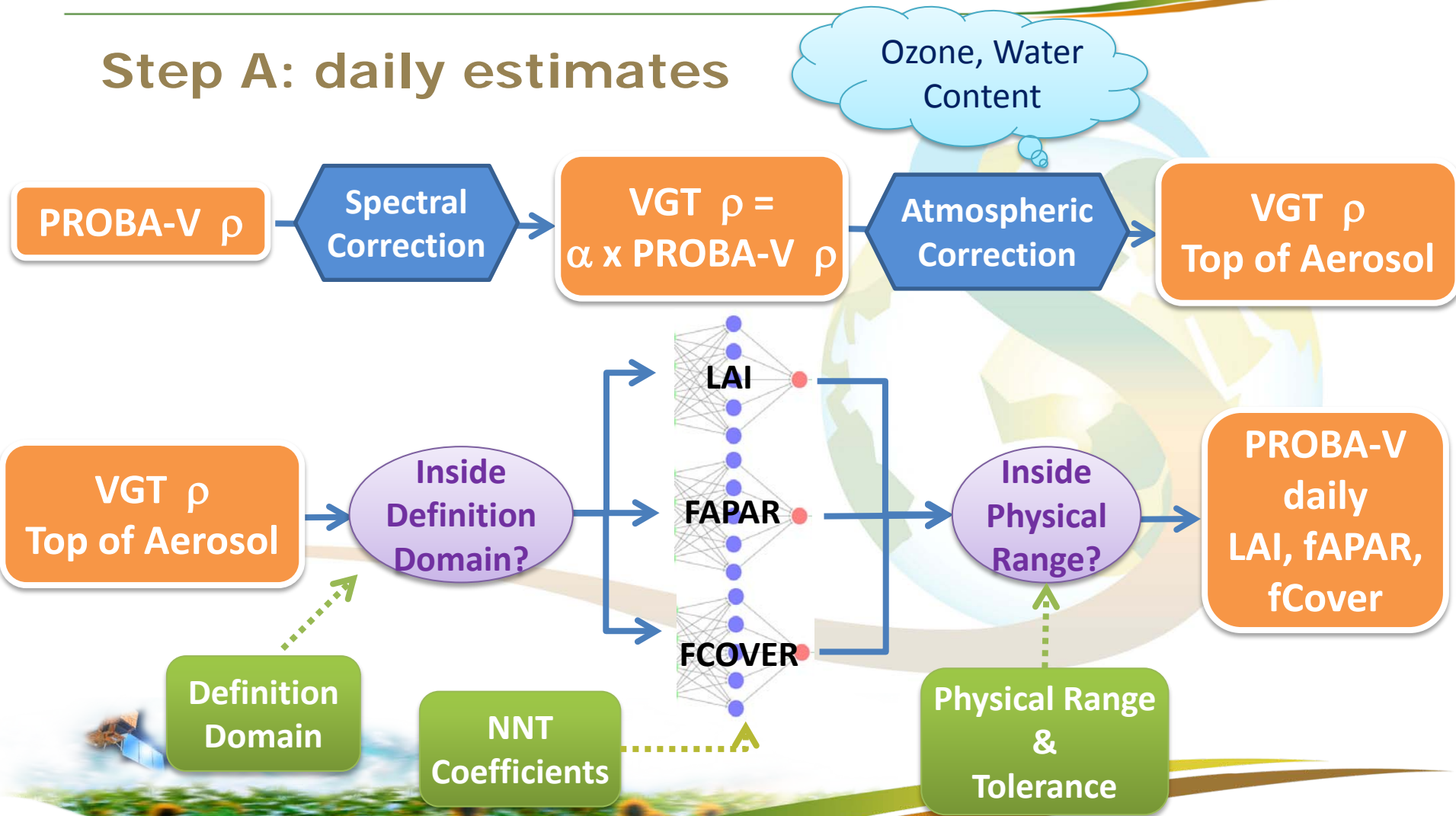




# LAI /FAPAR/FCOVER retrieval



## Step A: daily estimates



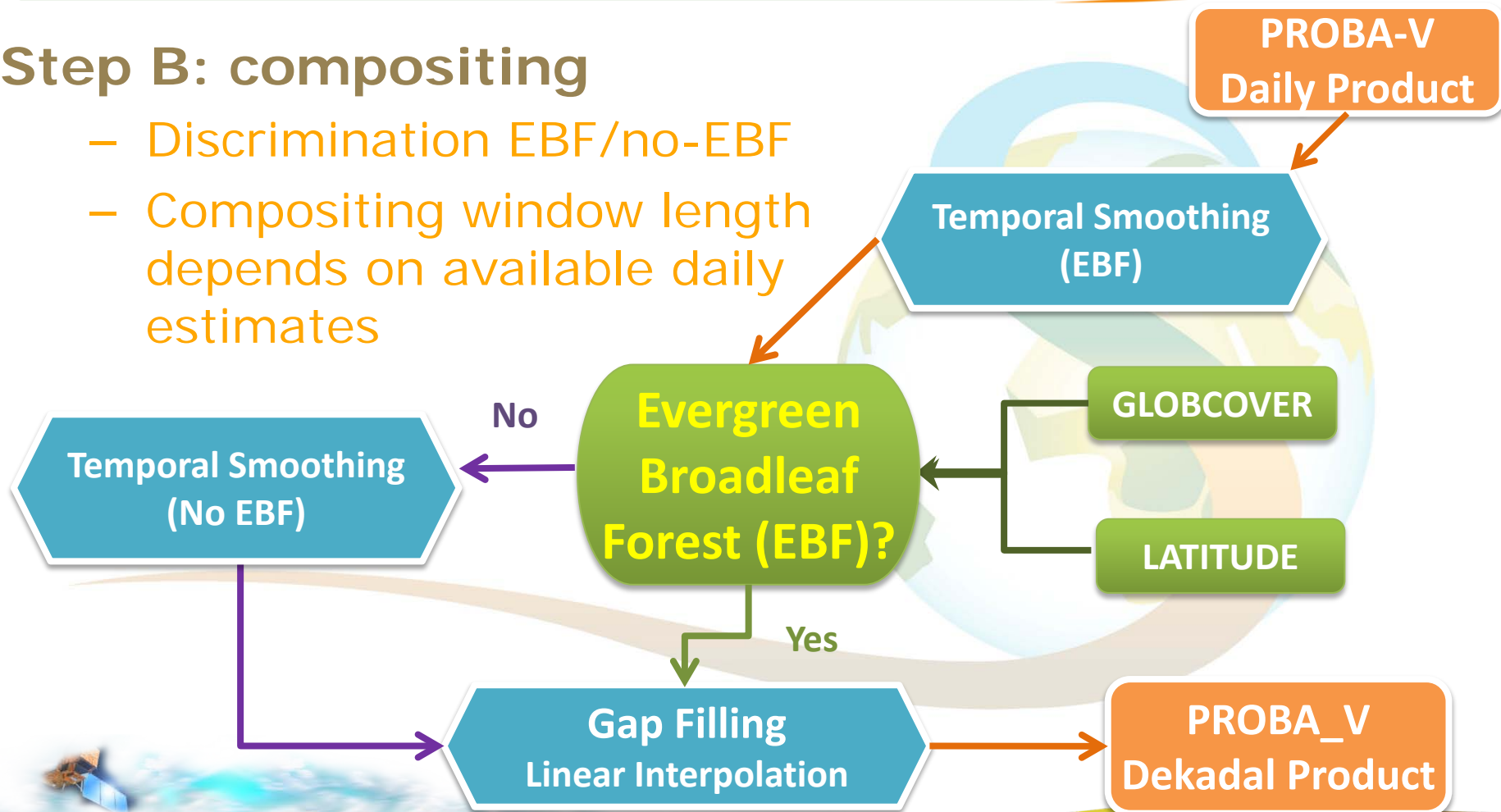


# LAI /FAPAR/FCOVER retrieval



## Step B: compositing

- Discrimination EBF/no-EBF
- Compositing window length depends on available daily estimates





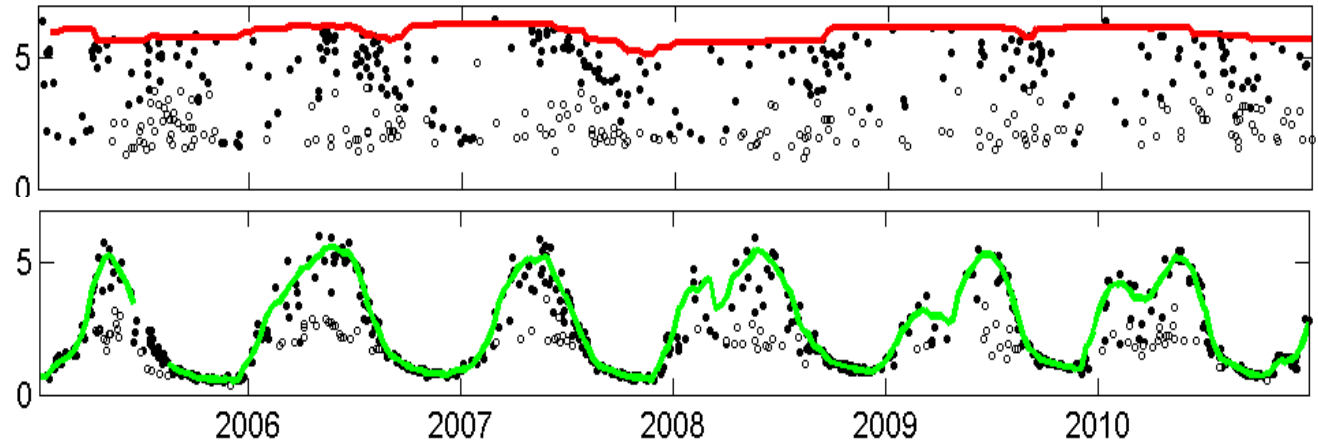
# Examples



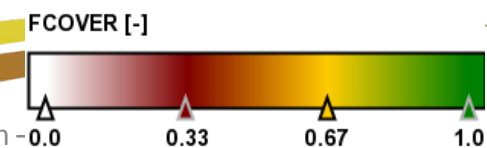
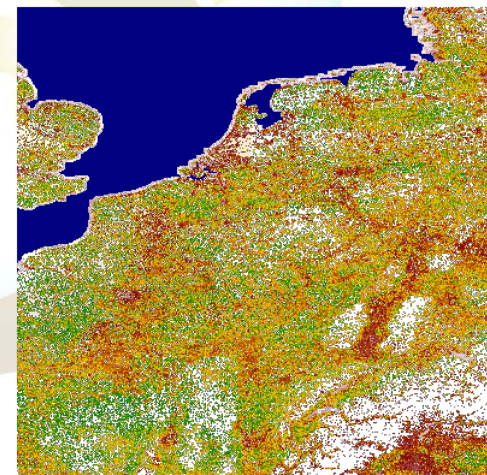
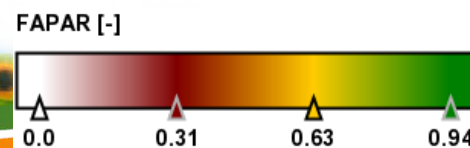
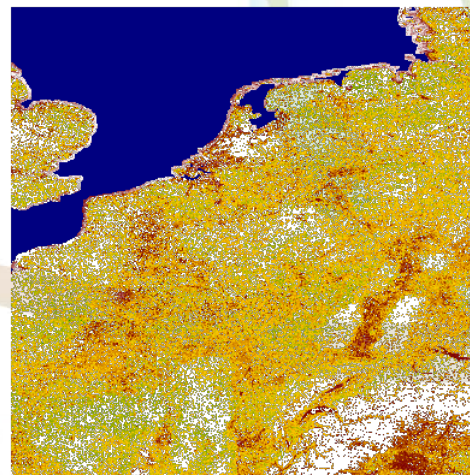
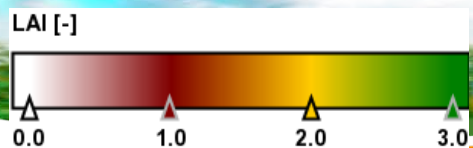
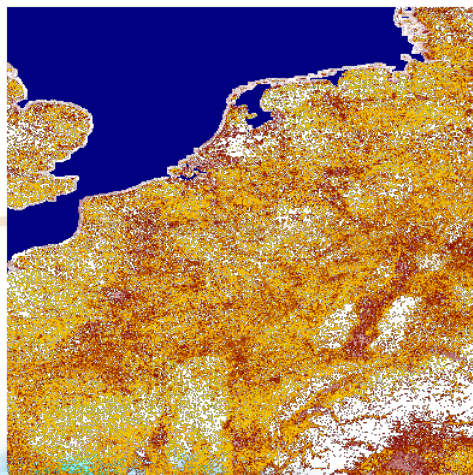
LAI time profiles

EBF case

Non EBF case



March  
2014



Berlin



# Albedo retrieval



	333 m (1/336°)	1 km (1/112°)
Methodology	BRDF model inversion + angular integration + spectral integration	
Time compositing	20 days	30 days
Time frequency	5 days	10 days

- **Finer resolution**
  - Better cloud decontamination
  - Shorter compositing period
- **Finer frequency to discriminate albedo from bare soil and from vegetation**









# Agriculture monitoring



Online version  
Issued: 23 March 2015

## Crop monitoring in Europe

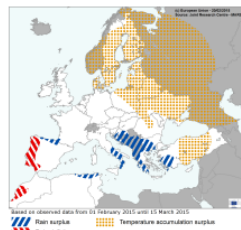
MARS Bulletin Vol. 23 No. 3 (2015)

Current outlook is predominantly positive

Winter crops are generally in good shape and well developed in the EU due to the mild winter conditions. In general, prospects for the new season are promising. At this stage of the season the forecasts are based on the historical trend or average values.

In most of the EU-28, temperature conditions were close to the long-term average during the period of review (1 February-15 March). North-eastern Europe experienced significantly warmer-than-usual conditions, with anomalies w.r.t the long-term average exceeding 4°C. Significantly drier-than-usual conditions (with precipitation less than 50% of the long-term average) occurred over the western Iberian Peninsula, where soil water availability is becoming a concern; as well as in eastern Germany, the Czech Republic and Poland, where soil moisture contents are still satisfying. Significantly wetter-than-usual conditions, in several places associated with water logging, were observed in north-eastern Spain, in the Italian Peninsula, the Balkans and central-western Turkey.

### AREAS OF CONCERN - EXTREME WEATHER EVENTS



Crop	Yield t/ha				
	2014	MARS 2015 to-revise	Aug. 2014	1/10/14	1/10/15
<b>TOTAL CEREALS</b>	5.08	5.27	5.19	-5.5	+1.7
Total Wheat	6.84	5.55	5.42	-6.0	+2.3
soft wheat	6.86	5.79	5.66	-4.8	+2.3
durum wheat	3.31	3.28	3.25	-1.1	+0.8
<b>Total Barley</b>	4.91	4.63	4.51	-5.5	+2.7
spring barley	4.17	4.08	3.91	-2.1	+4.5
winter barley	5.91	5.44	5.39	-7.9	+0.8
<b>Grain maize</b>	7.51	7.19	6.91	-4.3	+4.1
Rye	4.26	3.79	3.67	-11.6	+0.8
Triticale	4.53	4.26	4.15	-5.8	+2.7
<b>Other cereals</b>	3.09	2.93	2.46	-5.3	+10.3
<b>Rape and turnip rape</b>	3.67	3.24	3.12	-8.4	+3.7
Potato	33.55	32.87	31.18	-2.0	+5.4
Bugler beet	70.08	72.81	70.26	-4.3	+3.8
Sunflower	2.13	2.62	1.91	-5.2	+5.8

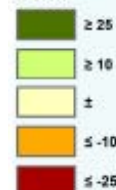
Issued: 20 March 2015

**Content:**  
1. Agro-meteorological overview  
2. Observed canopy conditions by remote sensing  
3. Country headlines  
4. Crop yield forecasts  
5. Atlas

### Relative Difference of fAPAR

Current year - Medium term average (MTA)  
Considered period: 01 March 2015 - 10 March 2015

Relative differences (%) compared to MTA



### Snow coverage since 20 February



Mask: based on CLC 2000

Data source: MARS remote sensing database / METOP-AVHRR, MSG - SEVIRI

Source: EC/JRC-MARS

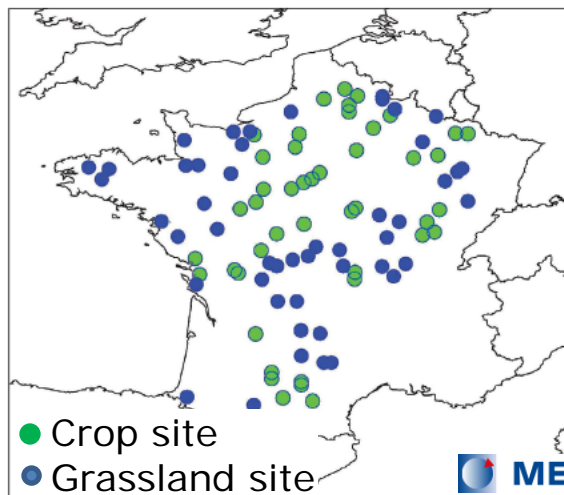
Joint  
Research  
Centre

# Agriculture monitoring

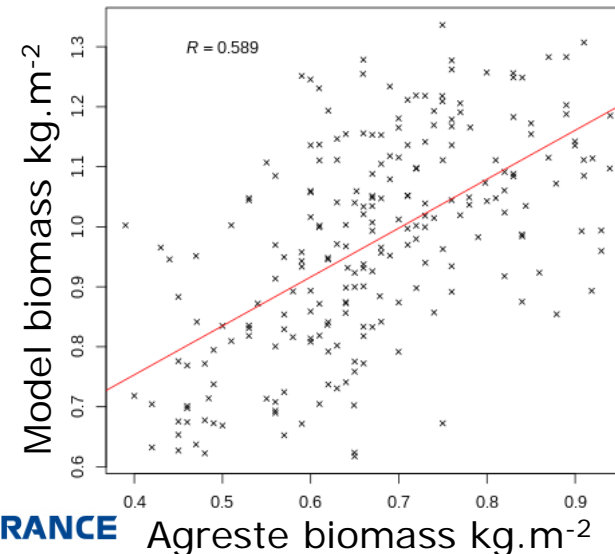
- **Advanced use: seasonal forecast**

- Using a land surface model into the LDAS
- Initial conditions defined by assimilation of LAI and SWI
- Assess variables (root zone water content, heat and water fluxes, biomass, yield) not directly accessible from satellite

Official agricultural statistics  
over France (Agreste)



Soft wheat, 2007-2011, 45 sites



# Conclusion

- **Global Land service is operational**
  - Sustainable delivery of NRT and historic 13 global products
  - Continuous quality monitoring
  - 700+ registered ftp users, 100+ receiving stations
- **Evolution towards 333m production**
  - Consistent with 1km production & archive
  - Products available 2<sup>nd</sup> half 2015
- **Use of Sentinel missions data in preparation**
  - Joint use of Sentinel-1/SAR and Metop/ASCAT data: 1km SWI product
  - Joint use of Sentinel-3 and PROBA-V data: 1km and 333m continuity
  - Joint use of Sentinel-3 and Sentinel-2: 10m biophysical products

## Contacts

# Thank you for your attention!

### Global Land Service

- <http://land.copernicus.eu/global>
- **Coordinator:** Bruno Smets – VITO  
[bruno.smets@vito.be](mailto:bruno.smets@vito.be)
- **S&T contact:** Roselyne Lacaze – HYGEOS  
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- **Consortium**



- <http://fp7-imagines.eu>
- **Coordinator:**  
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- **Consortium**



### Associates



ISRSE – Berlin – 11<sup>th</sup> – 15<sup>th</sup> May 2015