



Copernicus Land Monitoring Service



Copernicus for Agriculture (CLMS Global Component)



Copernicus
Europe's eyes on Earth

Space





Land
Monitoring

CLMS – Copernicus for Agriculture



COPERNICUS: a public good.

- free and open access



Operational Service

- Long term and reliable provision of global products and services
 - Near real time & consistent archive of biophysical parameters of land surface
 - From medium-low resolution EO sensors

Fully validated and quality controlled products

A wide range of applications:

Water management, Land cover & use changes, forestry, desertification, biodiversity, natural resources management, and **Agriculture & Food Security, ...**

- Direct support for EU's Policies, commitments under international treaties & conventions and a key contribution to GEO's global initiatives (e.g. GEOGLAM)



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A Global User Community

An operational service which is:

- Used globally by ...
 - Users in 60+ countries
 - European Commission, through JRC: e.g. MARS Bulletins & Early Warning
 - United Nations: e.g. FAO or World Food program
- Contributing to development and Capacity Building
 - e.g. AMESD/MESA/GMES & Africa programmes with African Union
- Used locally by ...
 - National governments/ institution
 - e.g. CSE/DAPSA (Senegal), INRA Algeria for crop yield forecasts
 - Private companies
 - e.g. agriculture mapping (South Africa), insurance (Brazil, Switzerland),...
 - Civil society, NGOs
 - e.g. Action against Hunger (Spain / W Africa)
- Used by an important Research Community
 - In the framework of European Global projects (SIGMA, e-Agri, AGRICAB, GMFS...)

A key European infrastructure:

majority (50-60%) of users are European



Global Land portfolio 2016: 13 variables / 2019: up to 29 (tentative)

VEGETATION



Leaf Area Index (LAI)
Fraction of Absorbed Photosynthetically Active Radiation (FAPAR)
Fraction of vegetation cover (FCOVER)
Normalized Difference Vegetation Index (NDVI)
Vegetation Condition Index (VCI)
Vegetation Productivity Index (VPI)
Dry Matter Productivity
Burnt Area
Land Cover
Soil Water Index
Greenness Evolution Index

ENERGY



Top-of-Canopy reflectance
Surface Albedo
Land Surface Temperature
Radiation Fluxes
Evapotranspiration
Active Fires
Surface soil moisture
Soil Water Index

- **Near-real time:** hourly, daily, 10-daily,...
- **Consistent time series:** anomalies, trends,...
- **Low to medium spatial resolution:** 1km, 300m

Portfolio: 2018 / +2019

Global Land portfolio 2016: 13 variables / 2019: up to 29 (tentative)

WATER



Water Bodies

Water Level

Coastal Erosion

Lake surface water temperature

Lake and river water level

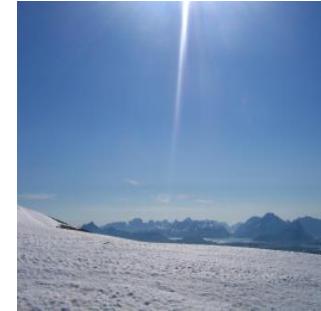
Lake surface reflectance

Lake turbidity

Lake trophic state

Lake ice coverage

CRYOSPHERE



Lake Ice Extent

Snow water extent

Snow water equivalent



- In-situ monitoring
- Hot-spot monitoring
- Sentinel-2 application-ready data

Portfolio: 2018 / +2019

Global Land: current products commonly used in Agriculture

Variable	Temporal coverage	Temporal resolution	Spatial coverage	Spatial resolution	Sensor
LAI/FAPAR/FCover	1999 - present 2014 - present	10 days	Global	1 km 300 m*	SPOT/VGT PROBA-V SENTINEL-3***
NDVI and anomalies (VCI/VPI)	1999 - present 2014 - present	10 days	Global	1 km 300 m	SPOT/VGT PROBA-V
Burnt Areas	1999 - present 2014 – present	1 day	Global	1 km 300 m	SPOT/VGT PROBA-V SENTINEL-3***
Dry Matter Productivity	1999* - present 2014 - present	10 days	Global	1 km 300 m*	SPOT/VGT PROBA-V
Soil Water Index	2007-present 2015-present	1 day 10 days	Global Europe**	0.1° 1km**	Metop/ASCAT ASCAT&Sentinel-1**

**Released*
***In development*
****Planned, 2018*

Global Land: upcoming products relevant for Agriculture

Variable	Temporal coverage	Temporal resolution	Spatial coverage	Spatial resolution	Sensor
Dynamic Land Cover**	2015 – present	1 year	Africa Global***	100 m	PROBA-V (Sentinel-2)
Greenness Evolution Index **	2014 – present 2014 - present	10 days	Locust Zone Global***	300m 100m	PROBA-V SENTINEL-3*** (Sentinel-2)
Phenology***	1999 - present	TBD	Global	1km 300m	SPOT/VGT PROBA-V SENTINEL-3
Surface Soil Moisture**	2015-present	1 day	Europe** Global***	1km	Sentinel-1
Evapotranspiration***	TBD -present	1 day	Global	1km 300m	Σ (Geo + Polar)

**Released*
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****Planned, 2018*

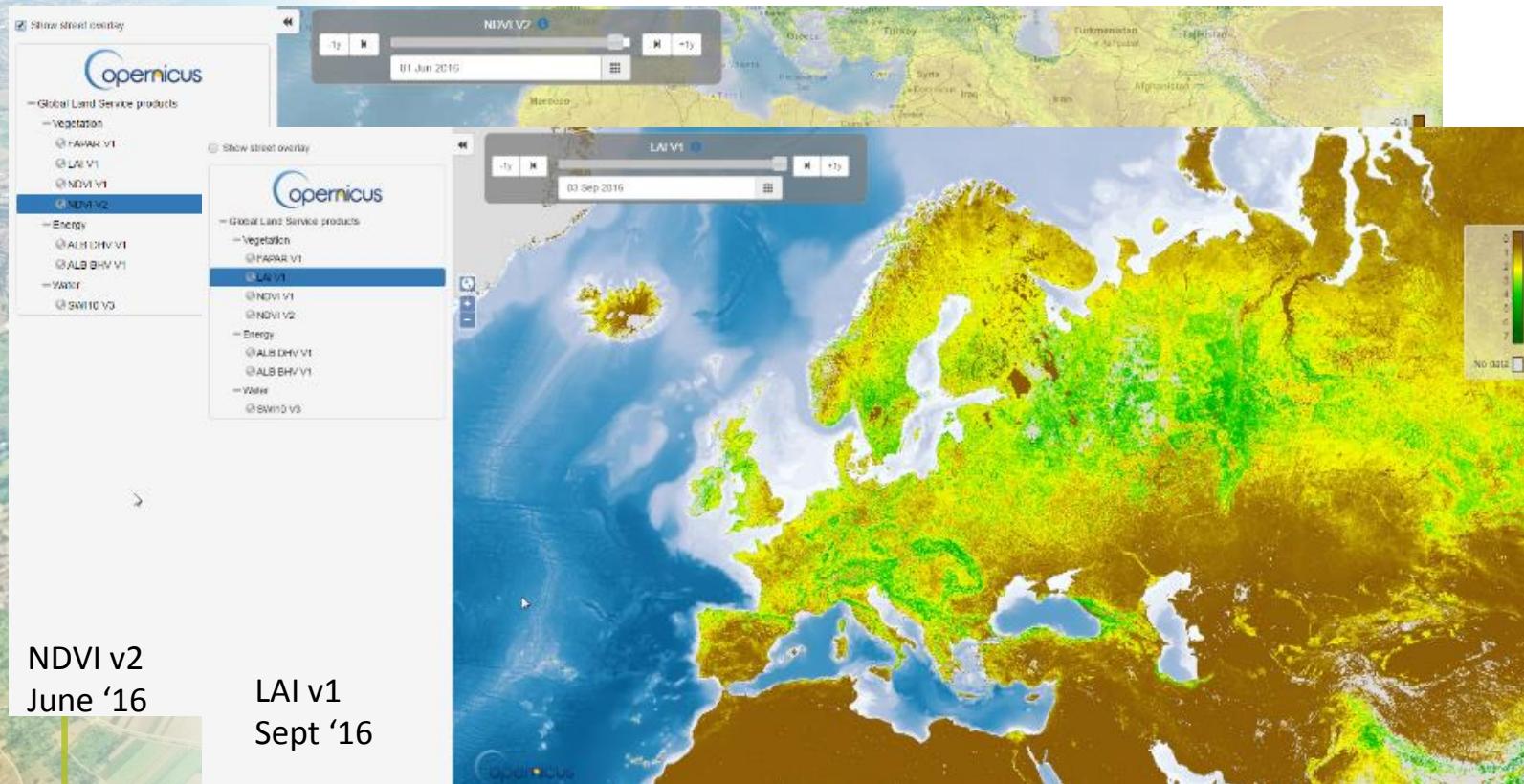


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Example Map Viewer

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



NDVI v2
June '16

LAI v1
Sept '16



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Product Ordering & Download

The screenshot shows the Copernicus Global Land Service interface. At the top, there's a navigation bar with the CLMS logo, the "Copernicus Global Land Service" title, and links for "Login", "Register", "FAQ", and "Contact". Below the navigation is a large world map displaying land cover and albedo data. To the right of the map is a table listing 10-daily SPOT-Vegetation products. The table includes columns for Product ID, Start Date, End Date, Size, Thumbnail, and Quicklink. The products listed are for various dates from March 2014 to November 2014, with file sizes ranging from 1.0B to 871.4 MB. At the bottom of the page, there are links for "Back to search", "Prepare custom order", "Order now", and "Request perm...".

Product ID	Start Date	End Date	Size	Thumbnail	Quicklink
global 10-daily SPOT-VEGETATION albedo Directional (4L-CH) - 23/04-05/15	25/04/2014	26/05/2014	1.0B		Link
global 10-daily SPOT-VEGETATION albedo Directional (4L-CH) - 23/04-06/08	10/04/2014	16/06/2014	1.0B		Link
global 10-daily SPOT-VEGETATION albedo Directional (4L-CH) - 23/04-04/23	25/04/2014	09/09/2014	1.1 GB		Link
global 10-daily SPOT-VEGETATION albedo Directional (4L-CH) - 23/04-04/12	26/03/2014	26/04/2014	1.1 GB		Link
global 10-daily SPOT-VEGETATION albedo Directional (4L-CH) - 23/04-04/08	16/03/2014	16/04/2014	1.1 GB		Link
global 10-daily SPOT-VEGETATION albedo Directional (4L-CH) - 23/04-03/24	06/03/2014	09/04/2014	1.0B		Link
global 10-daily SPOT-VEGETATION albedo Directional (4L-CH) - 23/04-01/24	06/02/2014	09/02/2014	871.4 MB		Link
global 10-daily SPOT-VEGETATION albedo Directional (4L-CH) - 23/04-01/15	26/12/2013	26/01/2014	832.3 MB		Link
global 10-daily SPOT-VEGETATION albedo Directional (4L-CH) - 23/04-01/08	16/12/2013	16/01/2014	812.7 MB		Link
global 10-daily SPOT-VEGETATION albedo Directional (4L-CH) - 23/05-12/28	26/12/2013	09/01/2014	827.5 MB		Link
global 10-daily SPOT-VEGETATION albedo Directional (4L-CH) - 23/04-12/12	25/11/2013	25/12/2013	880.3 MB		Link
global 10-daily SPOT-VEGETATION					Link

Ordering:

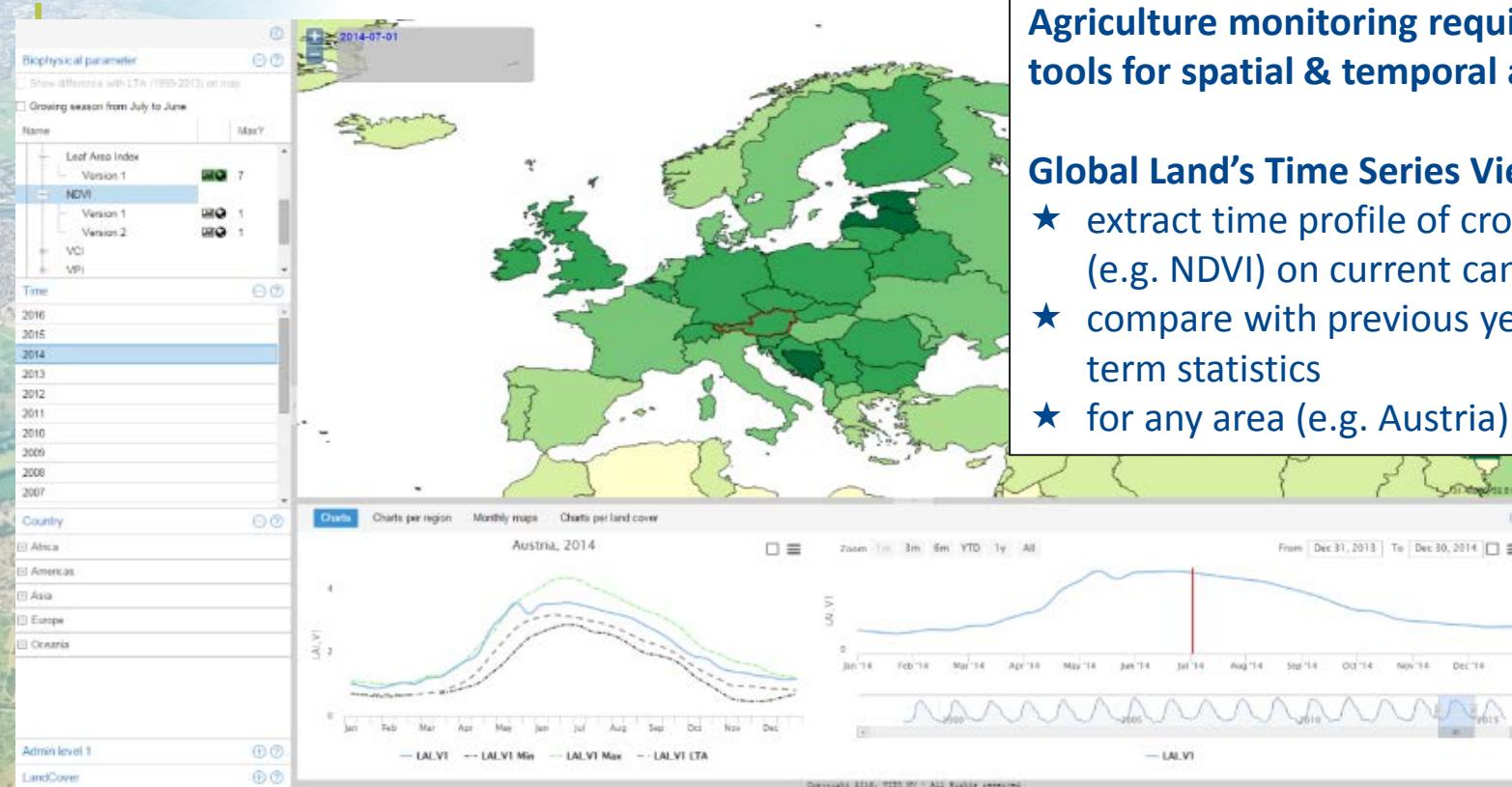
- ★ Email notification when order is ready
- ★ Subscribe to upcoming products
- ★ Customize spatial window, file format, projection, layer selection

Datapool:

automated, direct access in original format

Example Time Series Viewer

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



Agriculture monitoring requires dedicated tools for spatial & temporal analysis.

Global Land's Time Series Viewer allows to

- ★ extract time profile of crop indicators (e.g. NDVI) on current campaign
- ★ compare with previous year or Long-term statistics
- ★ for any area (e.g. Austria)

European Agriculture Monitoring by EC JRC - MARS

Official EC Crop Monitoring and Yield Forecasting System (CMYFS)

- Monthly Bulletins & yield forecasts for 10 crops
- Use Earth Observation & Weather data, crop development models and statistical tools
- Adopted by several EU Member States (e.g. Belgian CGMS) & neighbours (Maghreb, Ukraine)
- Same infrastructure is used to analyse climate change impact, estimate biomass, ...

<http://mars.jrc.ec.europa.eu>

Meteorological infrastructure

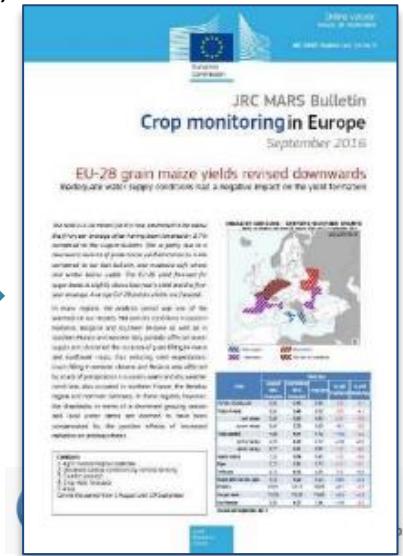
Crop modeling infrastructure

Remote sensing infrastructure

Team of analysts

Statistical infrastructure
Trend, regression, scenarii

MARS Bulletins are published monthly in real time

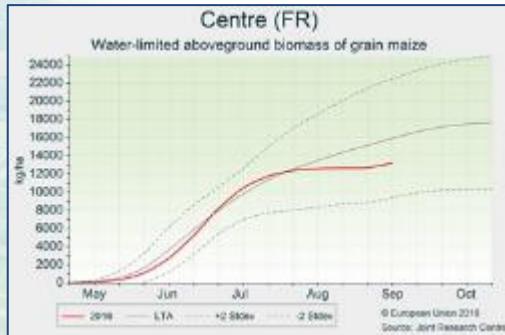




MARS Indicators

<http://mars.jrc.ec.europa.eu>

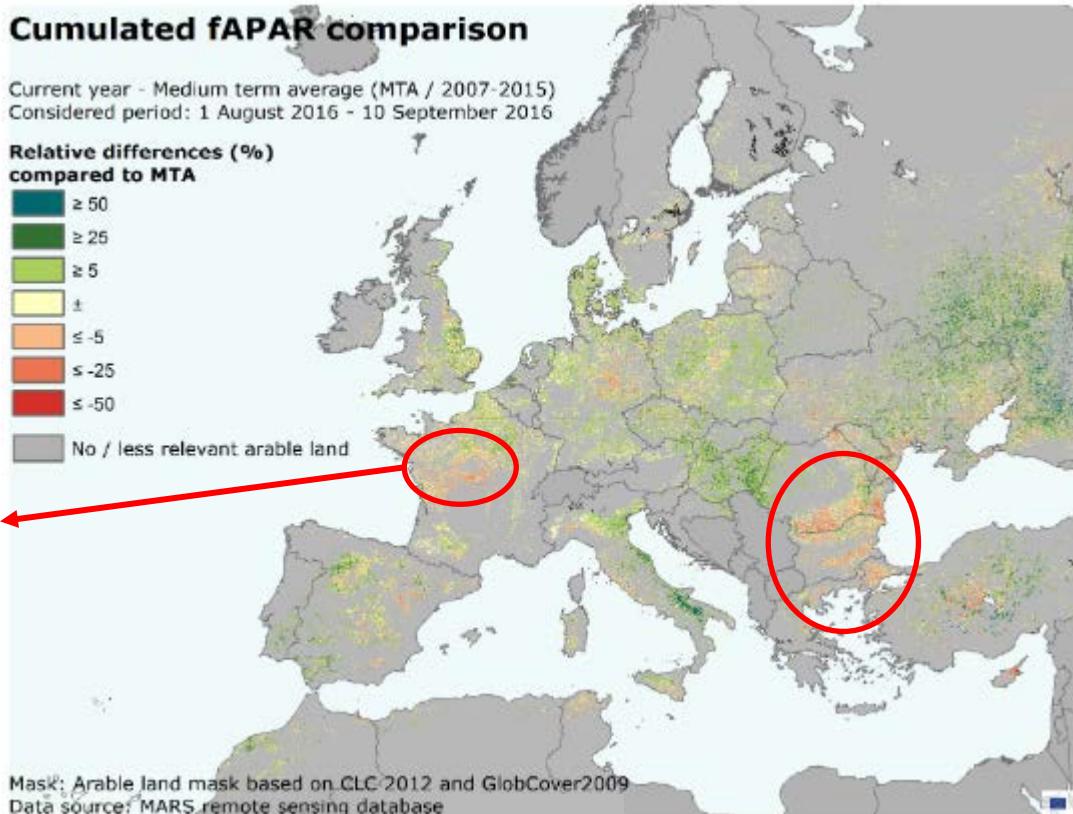
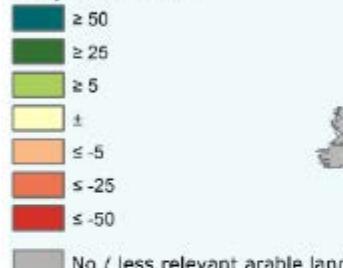
fAPAR indicators detected poor Maize grain filling condition in Romania, Bulgaria and centre France - confirmed by Agromet models (September 2016)



Cumulated fAPAR comparison

Current year - Medium term average (MTA / 2007-2015)
Considered period: 1 August 2016 - 10 September 2016

Relative differences (%)
compared to MTA





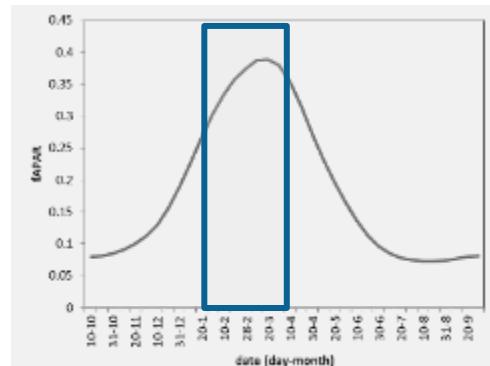
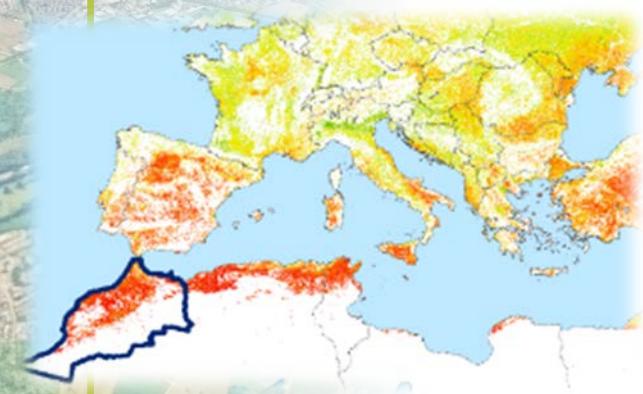
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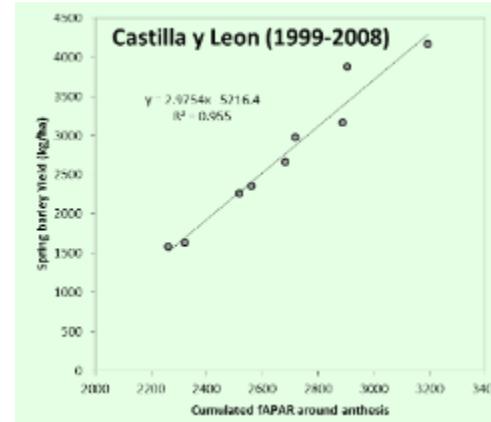
MARS Yield Forecasts

Robust early yield forecasting models

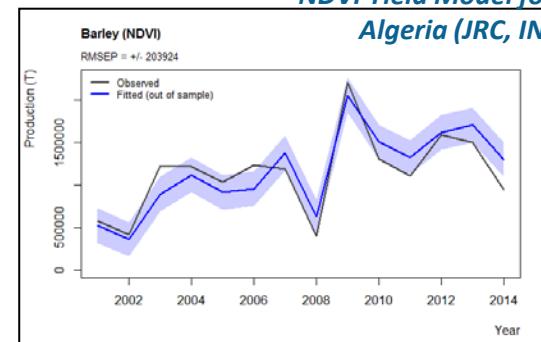
- using NDVI or fAPAR, rainfall, soil water
- in water limited context (Mediterranean)
- used in Algeria, Tunisia, Morocco



Cumulated fAPAR period around
Anthesis

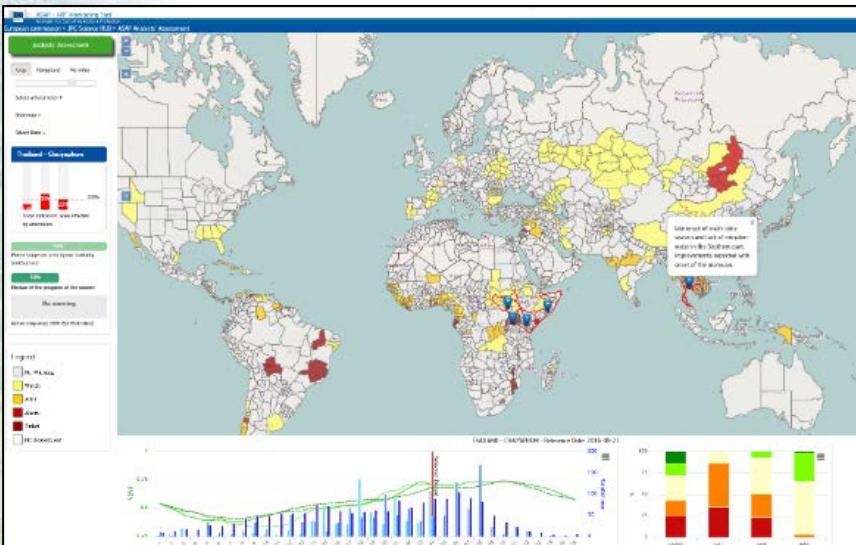


NDVI Yield Model for Barley in
Algeria (JRC, INRAA)

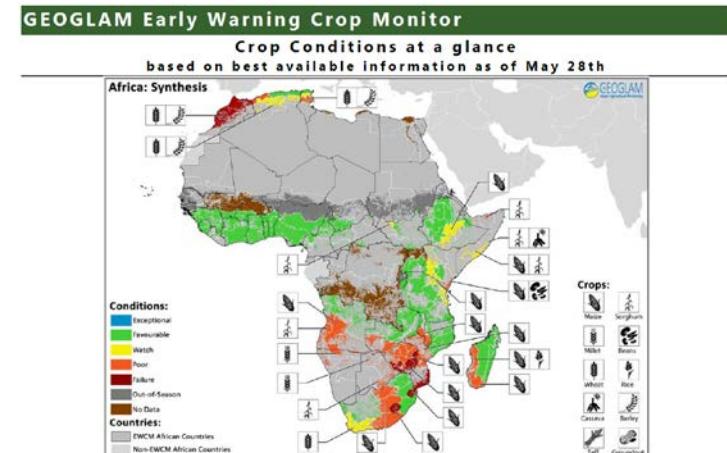


Global Early Warning Using Earth Observation

- **Anomaly Hot Spots of Agricultural Production (ASAP):** a semi-automatic warning classification system
- Timely information to DG DEVCO & contribution to **GEOGLAM Crop Monitor for Early Warning on countries at risks**



ASAP Web GIS (public release early 2017)



GEOGLAM - Early warning on Africa (May 16)



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Where Global & European Land Service components meet: the Sentinels

- **Sentinel 1 & 2: outstanding potential** for crop monitoring: due to high revisit time and unprecedented capacities
- **Crop maps** with high accuracy at **parcel level** in Europe
- In-situ information is critical
- Synergy with the CAP Land Parcel Identification Systems

Example: High accuracy classification for crop production area estimation (NL, July 2015)



Source: JRC-MARS

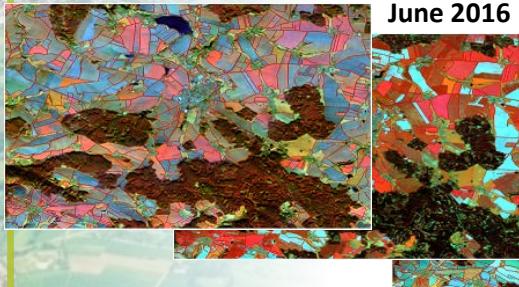


Pilots for Agriculture in Copernicus Land

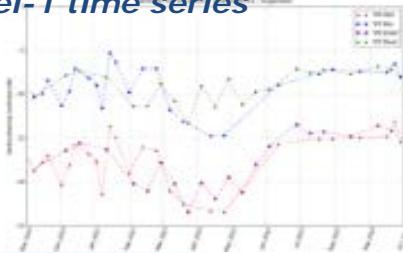
- Large-scale pilot projects in Europe (Czech Agri) & worldwide (Sen2Agri in Ukraine, S-Africa)
- Seasonal Crop maps; Crop-specific biophysical parameters or monitoring farming practices
- Agricultural services under evalution for future Copernicus Land Monitoring

Sentinel-2 time series

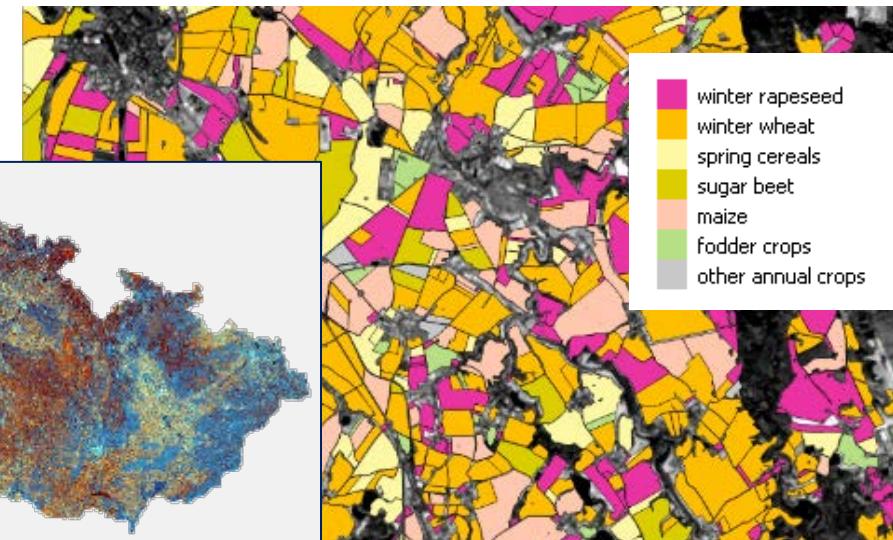
March 2016



Sentinel-1 time series



National CZ crop type map





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Copernicus Land Monitoring Service – Global Component

Implementation coordination

copernicuslandproducts@jrc.ec.europa.eu



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

Helpdesk: helpdeskticket@vgt.vito.be

Institutional Coordination

Michel.MASSART@ec.europa.eu



This material was compiled and kindly provided by:



and JRC ([MARS](#) projects)

