Sustainable agriculture and food/water security

DIRECTIVE 2000/60/EC	establishing a framework for Community action in the field of water policy (Water Framework Directive)
DIRECTIVE 2008/56/EC	establishing a framework for community action in the field of marine environmental policy
REGULATION (EU) No 1380/2013	on the Common Fisheries Policy
REGULATION (EU) 2021/2116	on the financing, management and monitoring of the common agricultural policy
COM(2020) 381 final	A Farm to Fork Strategy - for a fair, healthy and environmentally-friendly food system

*** Darker background indicates policy documents mentioning Copernicus**

Highlights on key policy aspects supported by Copernicus

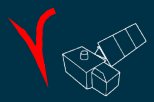
- Supporting CAP implementation
- Crop Monitoring and Forecasting
- Vegetation indices, Soil Moisture, Water Scarcity
- Monitoring of marine food chain, eutrophication and algae blooms

Key Copernicus supporting elements

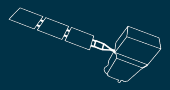
Copernicus Marine Service

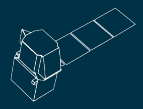
Land Monitoring Service


SENTINEL-1


SENTINEL-2


SENTINEL-3


LSTM

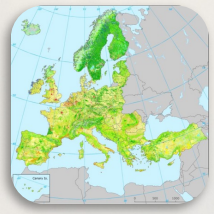

CHIME


CIMR

Copernicus Land Monitoring Service

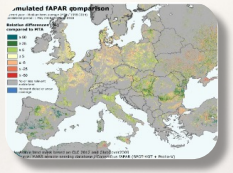
To provide timely information on crop classification, agricultural practices, tree cover density and grasslands, and continuous water monitoring

CORINE Land Cover
1990-2000-2006-12-18-24



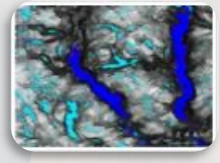
High Resolution Crop & Agricultural patterns mapping
2015-17-18-19-20-21-22…

Ten daily Vegetation Indicators since 2014

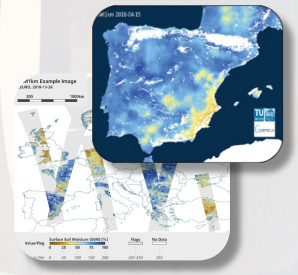


HR-Vegetation Phenology and Productivity
Near Real Time since 2017

HR-Water, Snow and Ice
Near Real Time since 2017



Soil Moisture and Soil Water Index Since 2015



PROGRAMME OF THE EUROPEAN UNION

co-funded with esa

Copernicus4Regions Information Session at European Parliament - *23 October 2023*

Explainer

- **Frequent monitoring of crops at EU scale**

  CLMS offer - *High Resolution Layer – Vegetated Land Cover Characteristics* includes for the yearly crop classification and monitoring of agricultural patterns (such as harvest time and fallow land)

- **Informing about crop condition and production forecast**

  CLMS offer – *Mid resolution vegetation and crop indicators* allow the monitoring of crop condition during the agriculture season and the forecasting of yield end of the season at regional and national scale

- **Dynamic monitoring of vegetation period and productivity**

  CLMS offer - *High Resolution-Vegetation Phenology and Productivity* monitors plant phenology in near real time with a 10m spatial resolution back since 2017.

- **Informing about availability of water resources**

  CLMS offer - *High Resolution Water, Snow and Ice* will monitor water in near real time. It will support drought and water scarcity analysis.

- **Informing about soil moisture**

  CLMS offer - *Soil moisture and soil water index* inform farmers and agro-meteorological modelers about water condition, including drought alerts

- **Long term monitoring of the land use practices, extent and condition of agricultural landscapes**

  CLMS offer - the *CORINE Land Cover* continues to map European landscapes since 1990-s, representing a consistent and coherent time series of land cover, land use and observed changes. Among 44 classes there are many cropland, pasture and agroforestry areas mapped at EU level.

- *Know more* ➔ https://land.copernicus.eu/en

- Contact point : https://land.copernicus.eu/en/contact-service-helpdesk

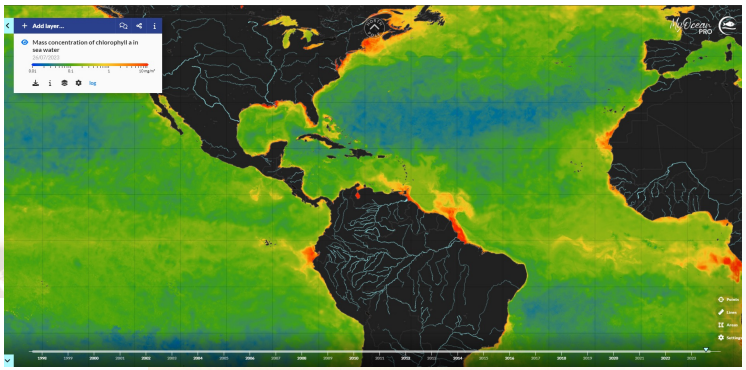
Copernicus Marine Service

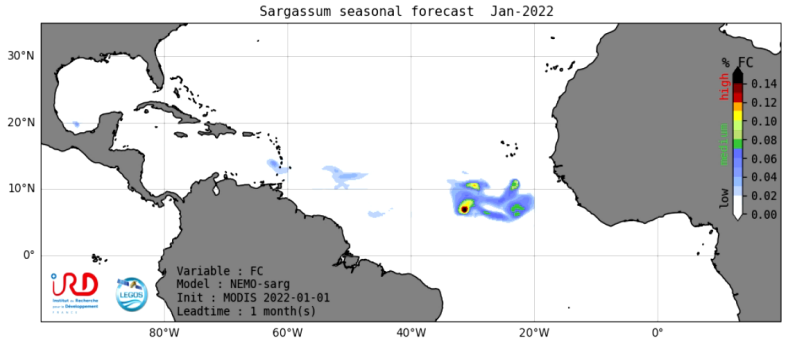
The watchful eye on Sargassum spread, aiding strategies to mitigate negative impacts on fisheries and water

Copernicus Marine Service

MERCATOR OCEAN INTERNATIONAL

✓ Sargassum blooms can have negative impacts on sustainable agriculture and food/water security as it contaminates all its surrounding environment once stranded.





✓ by reducing oxygen levels and releasing toxins in the waters, sargassum can harm fish and other marine life (affecting fisheries and aquaculture but tourism as well)

✓ as Sargassum washes out on beaches and coast areas and are displaced at deposition places, they can release toxins which can reach groundwater and influence drinking water supplies.

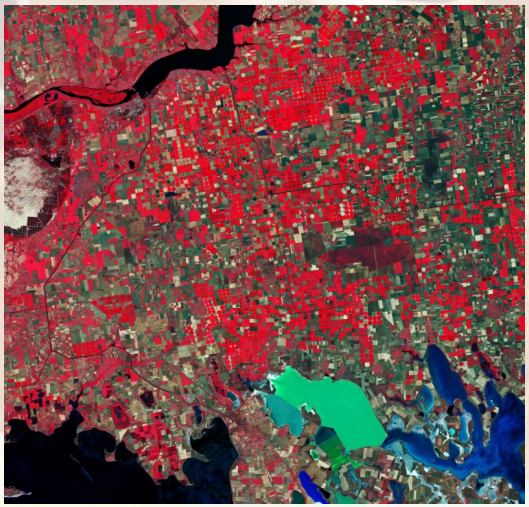
Explainer

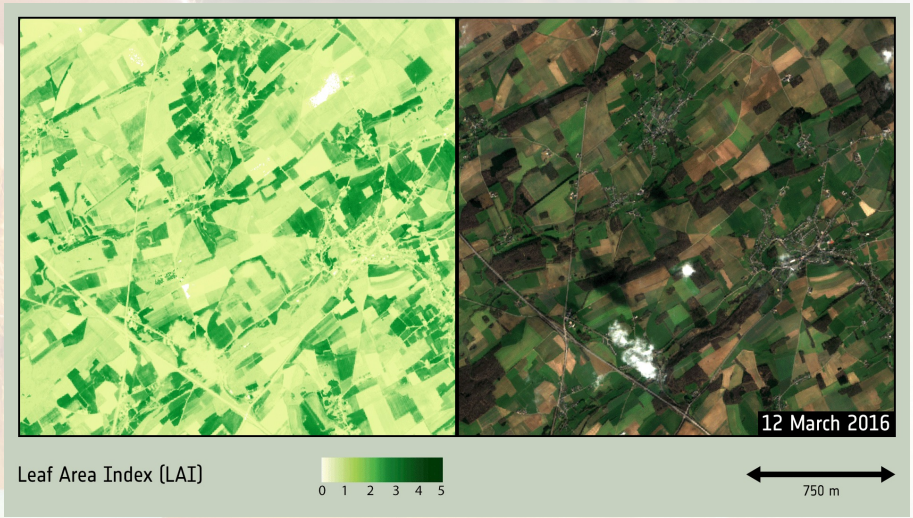
- CMEMS provides sea surface temperature, chlorophyll a, nutrients, ocean current data to detect, track, and predict Sargassum spread, aiding in mitigation strategies.
- **C**ustomized real time maps, trends and predictions aid in understanding the factors that contribute to these outbreaks; additionally, understanding Sargassum's movement patterns, is crucial for forecasting future invasions
- **Main products:** Global Ocean Colour (Copernicus-GlobColour), Bio-Geo-Chemical, L3 (daily) from Satellite Observations (Near Real Time) | ; Global Ocean Physics Analysis and Forecast
- **Main application**: Real time satellite detection and drift forecast of Sargassum algae in the Equatorial Atlantic; SAMtool by CLS
- Known more at THIS LINK

Sentinel-2

The workhorse for agricultural practices, allowing crop monitoring at field scale

- ✓ National and regional Paying Agencies make use of services based on S1/S2 as part of the new CAP Area Monitoring System, to optimize the field inspections and issue payments to farmers.





Development of crop fields in Belgium between March and October 2016. [Source ESA more here].

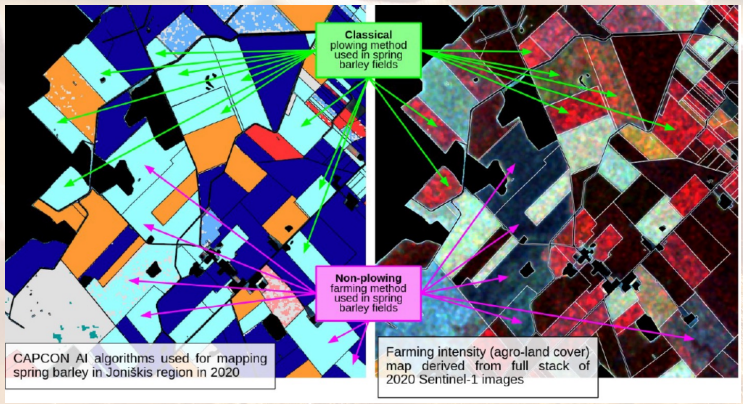
Explainer

- Sentinel-2 channels in the near infrared portion of the e.m. spectrum are specifically designed to measure vegetation health
- Sentinel-2 spatial resolution of 10m is sufficient for typical sizes of European fields
- Sentinel-2 provides frequent coverage (every 3-5 days in Europe and at medium latitudes worldwide) that allows effective monitoring of agricultural fields
- Sentinel-2 observations are only available at daylight and in clear sky conditions, which limits applicability in cloud-prone countries
- Long-term continuity will be ensured through Next Generation Sentinels
- Know more AT THIS LINK

Sentinel-1

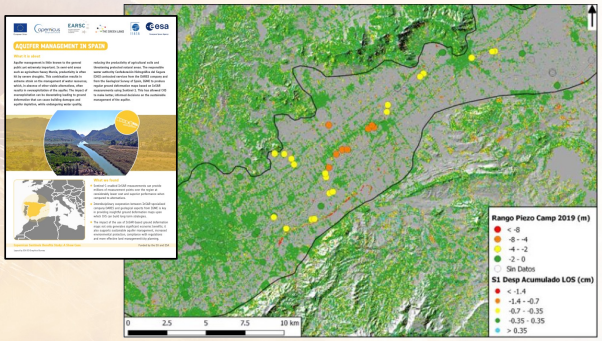
An indispensable complement for monitoring agriculture, especially over cloudy regions

- ✓ National and regional Paying Agencies make use of services based on S1/S2 as part of the newCAP Area Monitoring System to optimize the field inspections and issue payments to farmers.



SAR farming intensity map for detection of spring barley fields in northern Lithuania, 2020. Read full article HERE

- ✓ Sentinel-1 is used to monitor underground aquifers and supports water management especially in dry regions



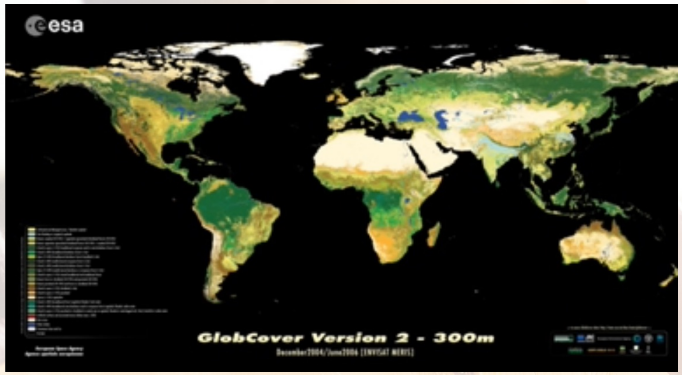
S1-derived deformations around the wells in the Segura river basin. Read full report https://earsc.org/sebs/aquifer-management-in-spain/

Explainer

- Sentinel-1 polarimetric SAR data allows detection of the main crops, farming activities and agricultural management practices at national, European and global level.
- 20m resolution, which is compatible with sizes typical of European fields.
- Sentinel-1 allows to monitor mm-scale deformations such as the ones attributable to underground water overpumping.
- All weather, day and night measurements especially important in cloudy regions.
- Sentinel-1C needs to be launched soon following Sentinel-1B unavailability
- Long-term continuity will be ensured through Next Generation Sentinels
- Know more AT THIS LINK

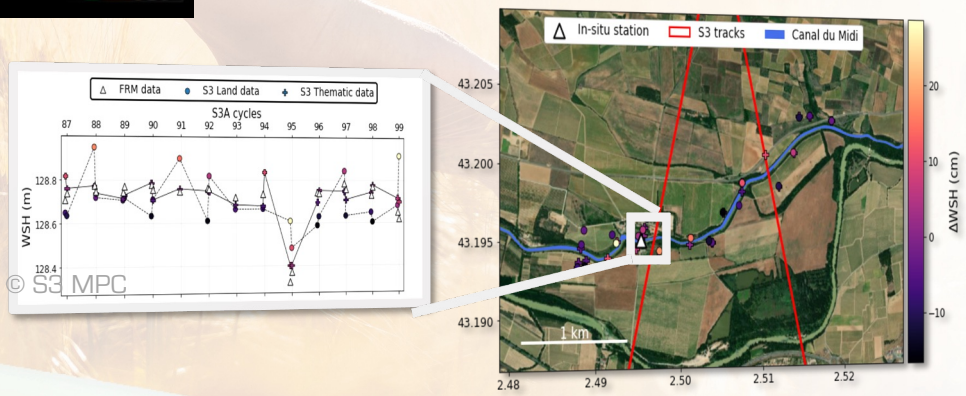
Sentinel-3 (land)

Providing early warning with a more frequent, broad-brush view of changes across the globe



✓ In the context of crop monitoring and food security, the most useful parameter delivered by Sentinel-3 is the NDVI product, which is used for the **early detection of deterioration in vegetation conditions and, as a consequence, of potential risk of drought and famine in any area of the world. [Source]**

✓ Monitoring variation of water surface height over rivers and lakes is key for the **water resource management** and forecasting of **extreme events** such as **floods** and **drought**



Sentinel-3 along-track resolution (300 m) and the on-board microwave radiometer facilitate the measurement of narrow rivers & small lakes. Water height variation from S3A altimetry and in situ over the Canal du Midi River measured during the St3TART campaign [Source]

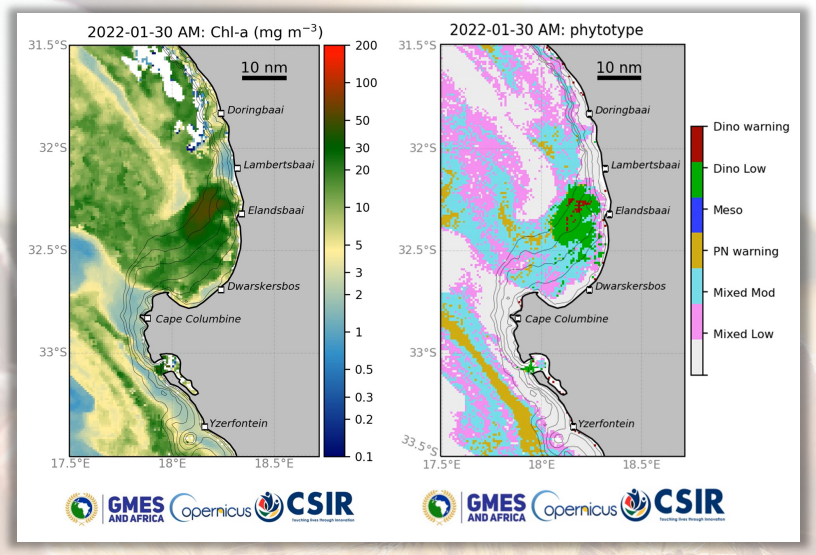
Explainer

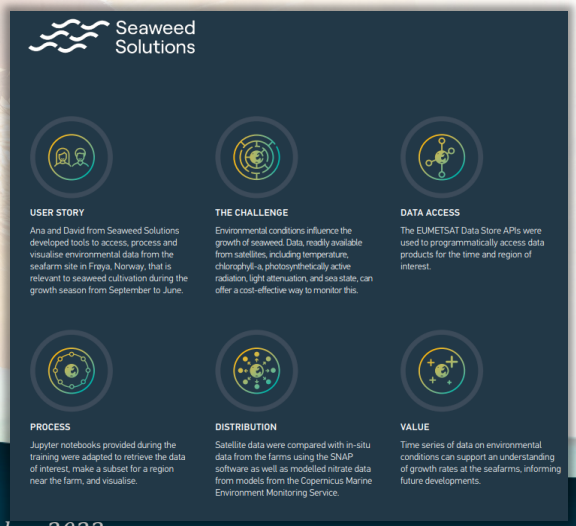
- Sentinel-3 is used widely in information for land and water management. With the daily and near-daily revisit time of the Sea and Land Surface Temperature instrument and the Ocean and Land Colour Instrument, users can generate maps of any area across the globe on a daily to weekly basis, enabling them to locate and track changes in the environment quickly, such as inland water algal blooms and deteriorating vegetation.
- Sentinel-3's altimeter is used to track changes in water height.
- The high revisit time is reached by having the two identical satellites in orbit, S3A and S3B.
- Long-term continuity will be ensured through the S3C and S3D units, and the Next Generation Sentinels.
- Know more AT THIS LINK

Sentinel-3 (marine)

Satellite observations supporting aquaculture and coastal water quality management

EUMETSAT





Explainer

- **Sentinel-3 OLCI's Ocean Colour data offers near daily, high spatial (300m) and spectral resolution data.**
- Can provide information about high biomass/deoxygenation risks, likelihood of toxic species and subsequent impacts on aquaculture.
- Can also be used as a eutrophication indicator
- Combined with other environmental conditions can provide information on risks from other biotoxins, and growth conditions.

Case study examples:

- https://www.eumetsat.int/deoxygenation-impacts-marine-life-benguela
- https://www.eumetsat.int/hydrogen-sulphide-plumes-namibian-coast
- https://www.eumetsat.int/swirls-cyanobacteria-baltic-sea
- Know more AT THIS LINK

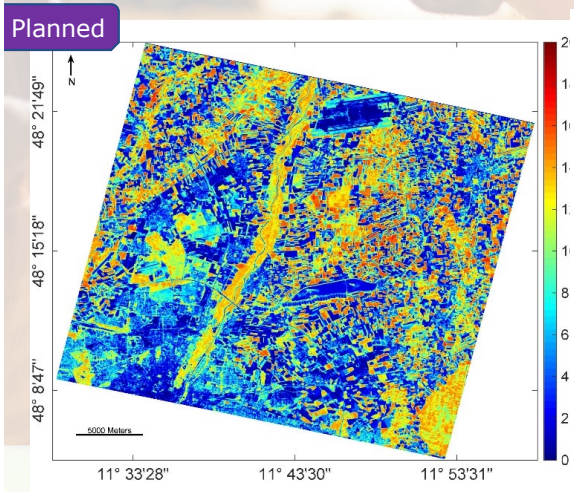
CHIME - Copernicus Hyperspectral Imaging Mission for the Environment

Enhancing precision agriculture practices through advanced monitoring of crops and soil properties

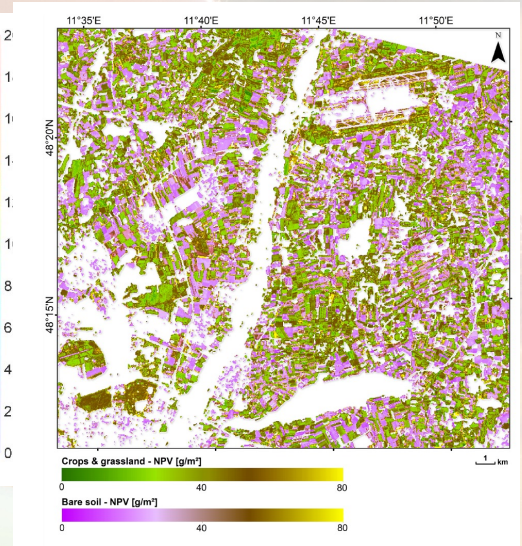
CHIME supports precision agriculture, optimisation of fertilisation practices and carbon farming by monitoring critical crops and soil properties, e.g. nitrogen and water content. Here below: maps of critical crops and soil properties at field scale e.g.:

- ✓ Canopy nitrogen content (CNC)
- ✓ Non-photosynthetic vegetation (NPV)
- ✓ Soil Organic Carbon

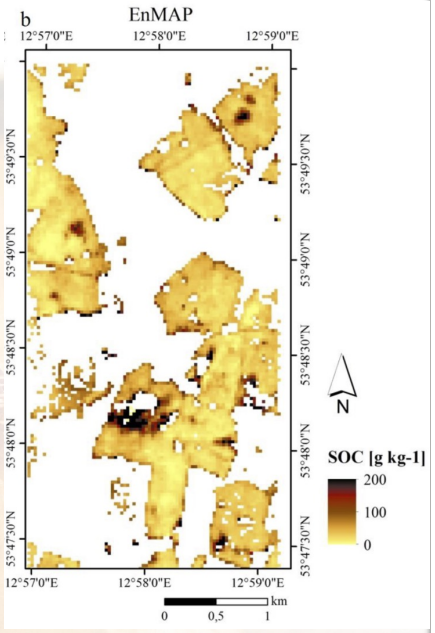
Planned



Verrelst et. al (2021)



Berger et. al (2021)



Ward et. al (2020)

Explainer

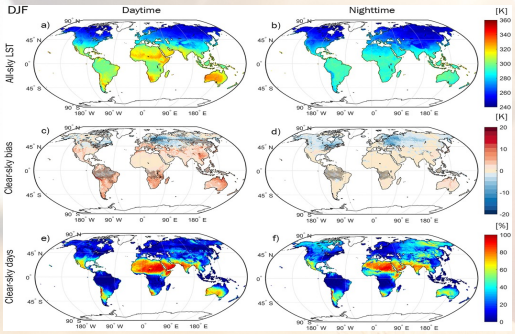
- CHIME will enable monitoring of yield quality (e.g. protein content) in crops and carbon stocks in topsoil at field scale
- Hyperspectral imagers are able to distinguish photo vs. non-photo synthetically active vegetation while also detecting nitrogen and nutrient uptake.
- The unique combination of a continuous spectral sampling in the visible, near infrared and shortwave infrared, 30 m spatial resolution and 11 days revisit (with 2 satellites) will enable effective global monitoring of agricultural practices at field scale
- CHIME a Sentinel Expansion Mission. Two units are currently being developed and will be available for launch as from 2028 subject to budget availability.
- Know more AT THIS LINK

CIMR - Copernicus Imaging Microwave Radiometer

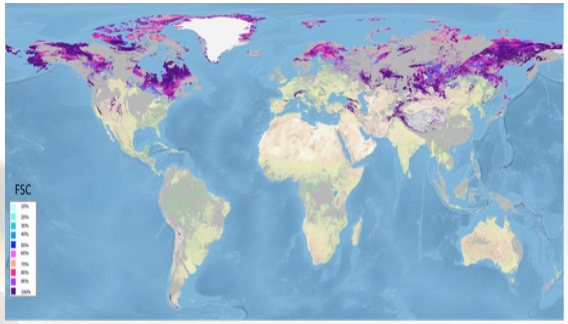
Improved measurements to support sustainable agricultural policies and practices

Planned

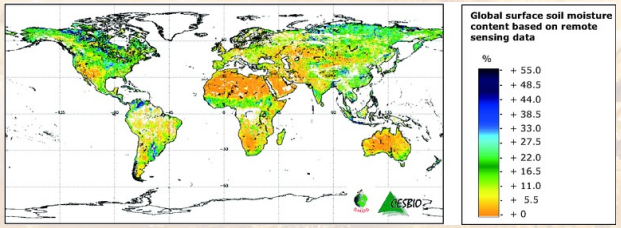
Land Surface Temperature (from AMSR)



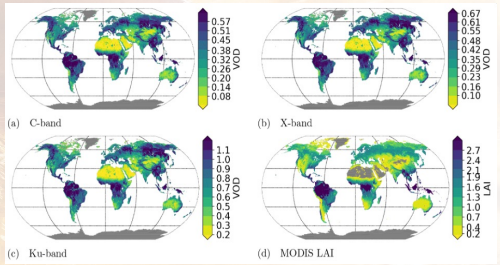
CCI Fractional Snow cover (SSMI/AMSR)



EEA Global Soil Moisture (from SMOS)



Vegetation Indeces (VOD+)



(Moesinger et al., 2020)

Explainer

- CIMR will provide (all weather) measurements of land surface temperature, soil moisture, vegetation state and snow parameters at improved accuracy and/or spatial resolution available from current MW sensors*.
- CIMR will combine spatial resolution of 10km gridded with sub-daily revisit in the Polar regions, allowing improved monitoring globally
- CIMR measurements will be co-located and contemporaneous in near all weather conditions – day and night with global coverage every day.
- CIMR is a Sentinel Expansion Mission. Two units are currently being developed and will be available for launch as from 2028 subject to budget availability.
- Know more AT THIS LINK

*CIMR innovative deployable antenna will allow MW passive measurements at lower frequencies but higher resolutions than what is currently available

LSTM – Land Surface Temperature Monitoring

The watchdog mission for sustainable agriculture and water productivity

Planned

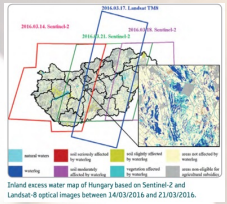
- ✓ **Time series of evapotranspiration (mm/day) at field level and up to daily revisit.** Around 70% freshwater is extracted for irrigation while wide parts of Europe is and will increasingly suffer under droughts and water scarcity.
- ✓ As shown in the video, Sentinel-3 data can be combined with Sentinel-2 data to provide evapotranspiration maps synthetically sharpened to 20m resolution. **LSTM, however, will provide real measurements at 50m, with no need to sharpen from 1km to 20m.** LSTM will provide 400 times higher resolution than Sentinel-3, with a comparable revisit time.

Explainer

- LSTM will **support agriculture management services** and improve sustainable **water productivity at field scale** optimizing irrigation practices.
- LSTM will provide Thermal Infra-Red observations in **5 thermal bands with w**orld-class radiometric accuracy (**1-1.5K LST**) **with 2 days revisit** at the Equator (with 2 satellites).
- LSTM's unprecedented **50 metre** resolution will be much higher than what is currently available and is compatible with typical sizes of European agricultural fields.
- LSTM is a Sentinel Expansion Mission. Two units are currently being developed and will be available for launch as from 2028 subject to budget availability.
- Know more AT THIS LINK

Copernicus4regions User Stories

Selected user testimonials from European public authorities



Damage maps can substitute a large number of on-the-spot checks, leading to substantial cost reductions for authorities and clients likewise."

Hungarian Paying Agency (LINK)

The interpretation of satellite-based vegetation condition information especially with a higher spatial resolution will support the monitoring of the drought stress, and can facilitate decision making."

Tatyana Ademenko,
Ukranian Hydrometeorological Center

Using Sentinels to check damaged fields lets us finish compensation payments in less than two months from the first drop of rain."

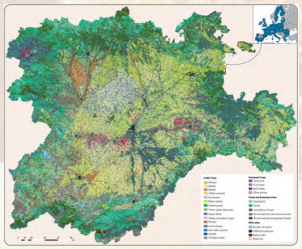
Indulis Abolins, Deputy Director of Rural Support Service (LINK)

Space-based services enable paying agencies to improve transparency, reduce administrative burden and efficiently monitor farmers' compliance to CAP obligations."

Alberto Lafarga,
Institute for Agrifood Technology and Infrastructures of Navarra
INTIA

With Copernicus satellite data, farmers will no longer spend time on declarations, but will receive fair payments for their hard work."

Erikas Bernotoas,
Lithuanian Paying Agency Director (LINK)



This crop map will allow us to monitor agricultural activities as well as improve the effectiveness of the CAP controls and reduce the farmer's paperwork."

Juan Pedro Medina Rebollo D.G. Regional Paying Agency
Castilla Y leon

This application of Copernicus Sentinels will significantly improve the way which farmers are doing online aid applications and, for the Walloon Paying Agency, will help to check the Land Parcel Identification System up-to-date and to move to new checks by monitoring."

Alain Istasse,
General Inspector of Aids Department, General Direction of Agriculture, Natural Resources and Environment, Public Service of Wallonia

User quotes from NEREUS/ESA/EC 2018

Question Time!

BACK TO POLICY AREAS

BACK TO MEETING AGENDA