

Satellite based drought monitoring and early warning

Examples of EO data and applications

Flemish Institute for Technological Research (VITO)

Roel Van Hoolst, Bart Deronde



VITO - Remote Sensing Unit

SENSOR/MISSION DESIGN
IMAGE PROCESSING

REMOTELY PILOTED AIRCRAFT SYSTEMS

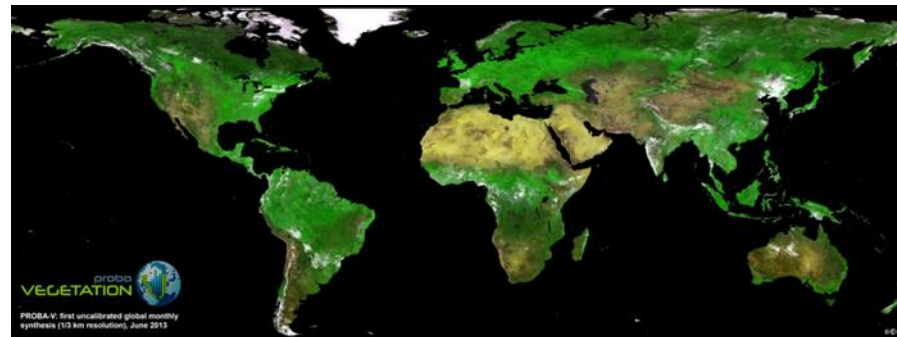
IMAGE QUALITY

TRAINING & CONSULTANCY

GLOBAL & LOCAL APPLICATIONS



WATER
CAL/VAL
AGRICULTURE
BIODIVERSITY



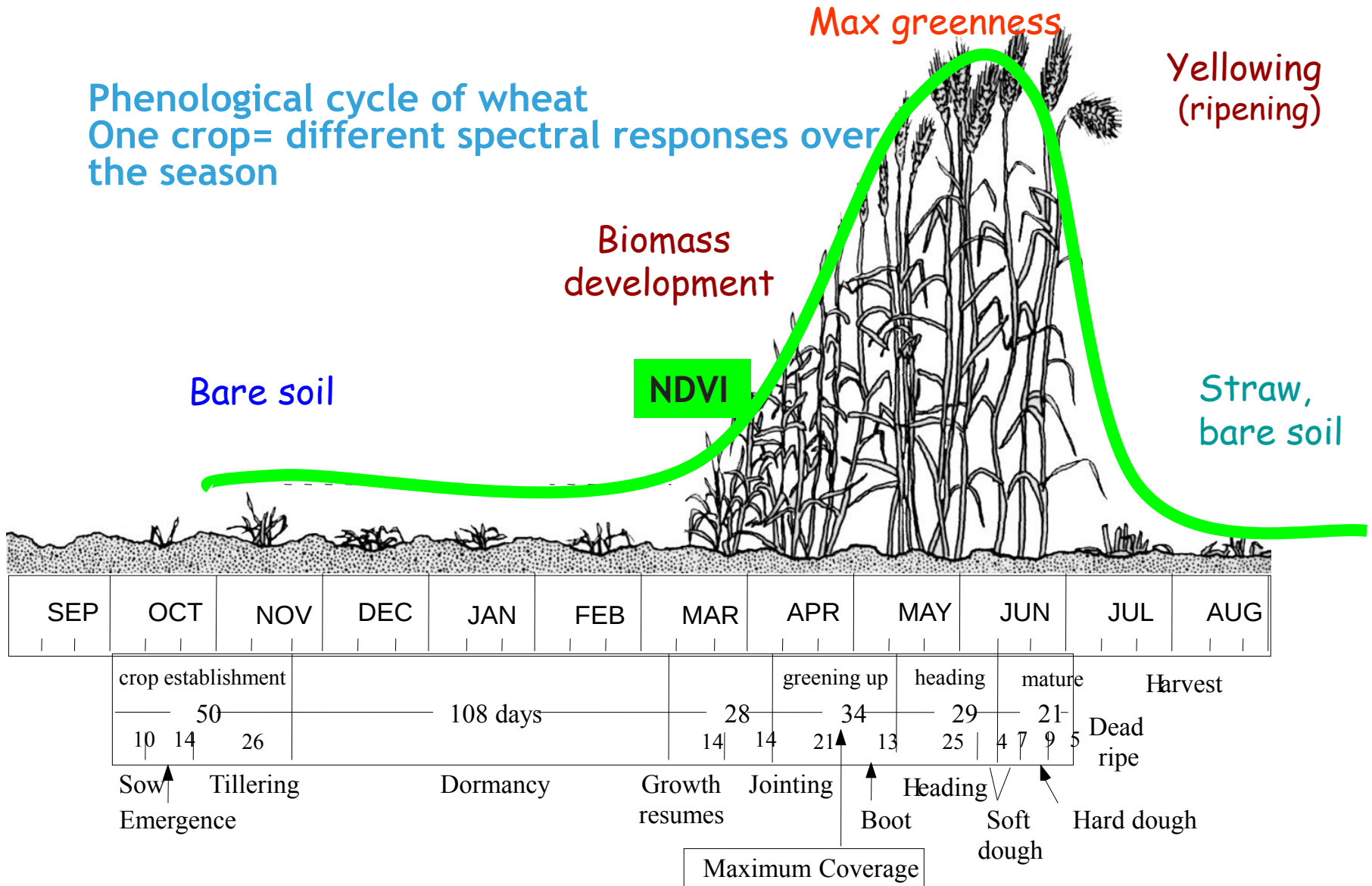
land.copernicus.eu

vito-eodata.be

Free of charge

Vegetation monitoring - Time Series Analysis

Phenological cycle of wheat
One crop= different spectral responses over the season

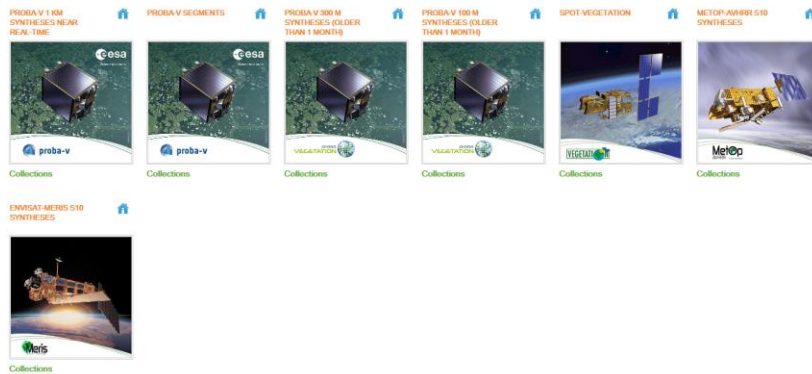


Examples of existing EO datasets

Freely available at VITO and Copernicus Global Land Service(historical & in near real time)

PRODUCT DISTRIBUTION PORTAL

Free Satellite Imagery



Copernicus Global Land Service

Providing bio-geophysical products of global land surface



Home Products News Product Access

Overview of t

The portfolio of the evolution of the co Many products are updated frequently

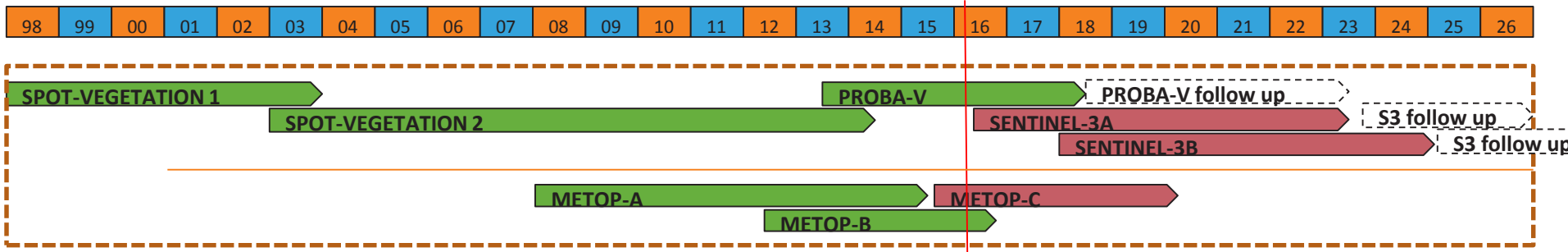
Overview

- > **Vegetation**
 - Burnt Area
 - Dry Matter Productivity
 - Fraction of Absorbed Photosynthetically Active Radiation
 - Fraction of green Vegetation Cover
 - Leaf Area Index
 - Normalized Difference Vegetation Index
 - Vegetation Condition Index
 - Vegetation Productivity Index
- > **Energy**
 - Land Surface Temperature
 - Surface Albedo
 - Top Of Canopy Reflectances
- > **Water**
 - Soil Water Index
 - Water Bodies

User support corner

- Leaflet
- Contact us
- FAQ

Theme	Var	me	Archive status
			In development
			In development



Proba-V (100m)/300m/1km products → NDVI, fAPAR, Dry Matter Productivity,...
METOP-AVHRR 1km → NDVI

Global Vegetation Monitoring Systems

Two examples:

Agricultural Stress Index System (ASIS) based on METOP-AVHRR
Proba-V Mission Exploitation Platform - Time Series Viewer

Example 1

MONITORING AGRICULTURE DROUGHT WITH REMOTE SENSING DATA



Global
Near Real Time
Cropland & grassland
Agricultural Stress Index

Example 1

Earth Observation



Seas

iers

Reference

The country level maps and graphs depict the latest 36-month period of the seasonal, vegetation and precipitation indicators. The data is presented by dekad and month [More](#)

Brazil

Another country:



Seasonal Indicators

[Vegetation Indicators](#)

[Precipitation Indicators](#)

[Graphs \(GAUL level 1\)](#)

ASI-Season 1

[ASI-Season 2](#)

[Mean-VHI-Season 1](#)

[Mean-VHI-Season 2](#)

[ASI-Annual Summary-Season 1](#)

[ASI-Annual Summary-Season 2](#)

Agricultural Stress Index [More](#)

Legend

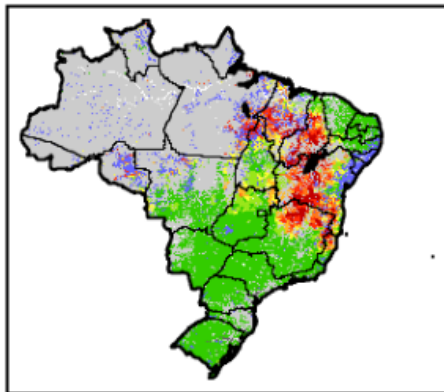


First Dekad

Second Dekad

Third Dekad

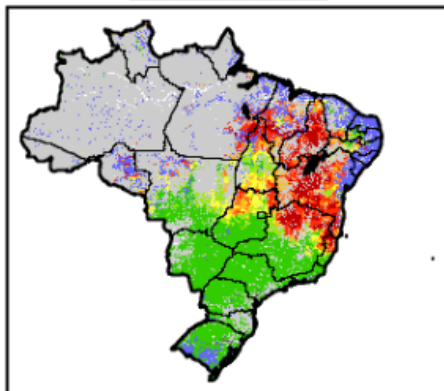
Feb-16



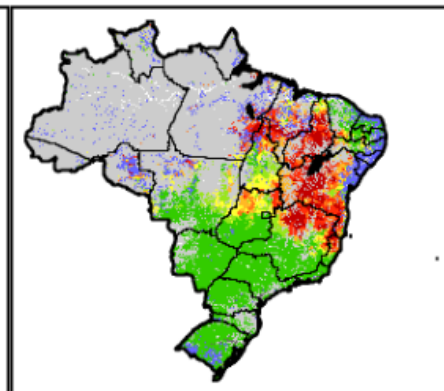
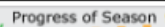
Progress of Season



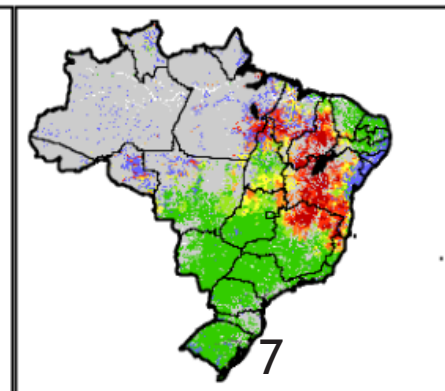
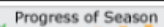
Jan-16



Progress of Season



Progress of Season



Progress of Season

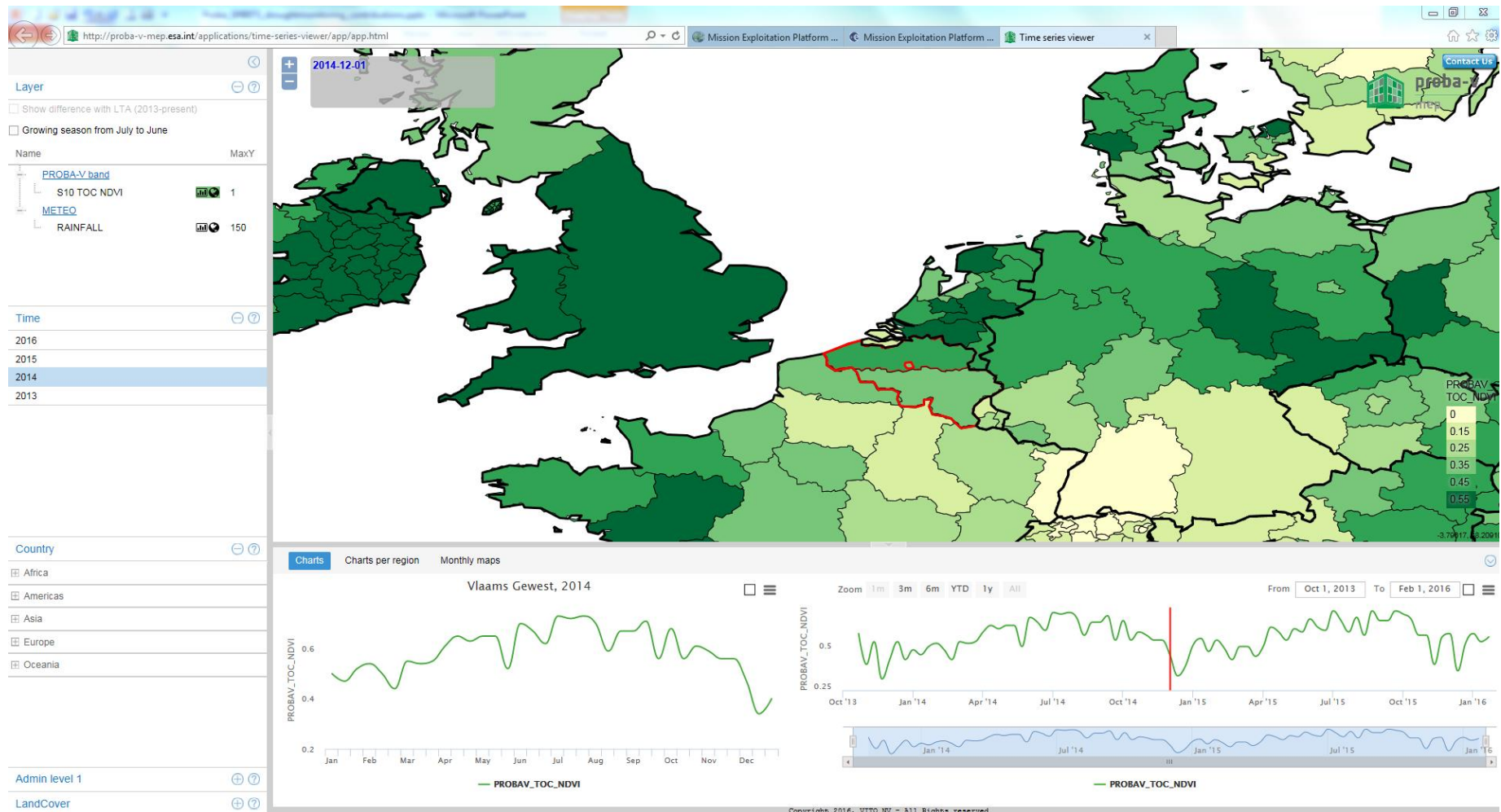


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Example 2

Proba-V Mission Exploitation Platform

<http://proba-v-mep.esa.int/>



Capacity Building & Training on the use of time series for vegetation monitoring

Set-up of low cost receiving stations



Support in generation of bulletins and reports for food-security or drought monitoring

Diffusion de l'information

- Bulletins décennaires du CSE et du GTP
- Bulletins de mi-parcours et fin de campagne du CSE

→ Bulletins décennaires

→ Bulletins mi-parcours et fin de campagne

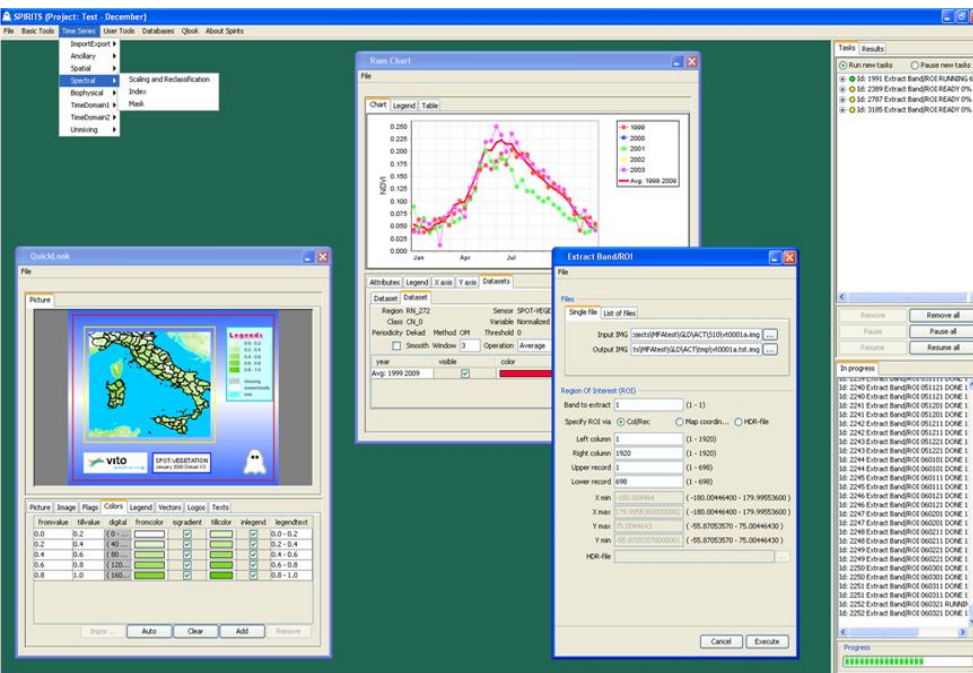


SPIRITS workshop for early warning



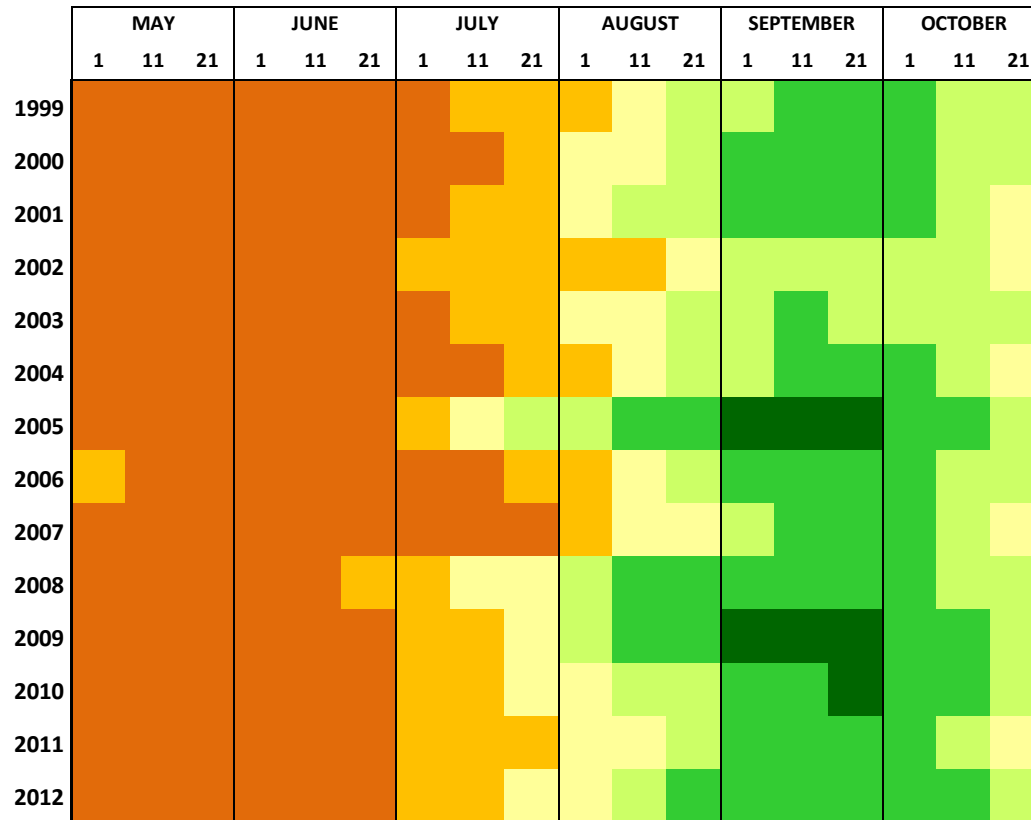
Post-Processing Software: SPIRITS

- JRC-VITO development: Software for the Processing and Interpretation of Remotely Sensed Image Time Series
- Several tools to exploit RS time series & to make agro-meteorological bulletins
- Freely available, incl. Manual & Tutorials
- Users: VITO, JRC, FAO, WFP, Africa
- Training sessions (± 50 so far)



The screenshot shows the SPIRITS website homepage, which is part of the European Commission's Institute for Environment and Sustainability. The page features a navigation menu with links to Home, Overview, Download, Support, Publications, and Links. The main content area includes the SPIRITS logo and a description of the software as an integrated and flexible free software environment for analyzing satellite derived image time series in crop and vegetation monitoring. A map of Africa is displayed, showing the distribution of the software. At the bottom, there are buttons for 'Download it' and 'Get data'.

Comparison of seasons: matrix display



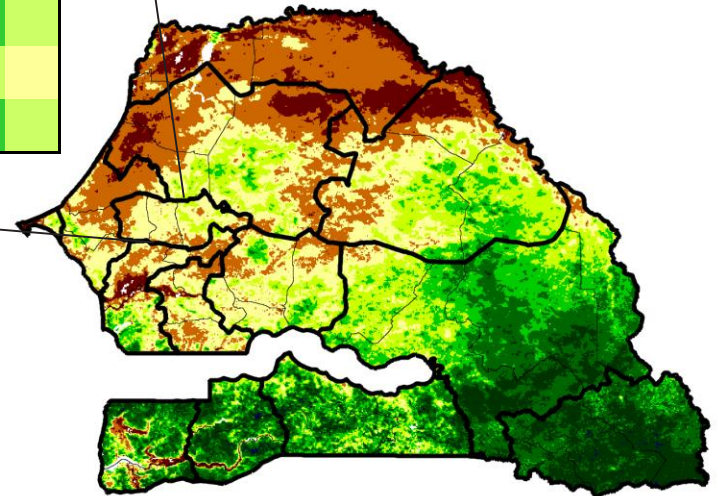
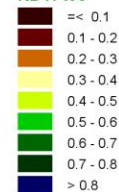
Short season with low NDVI

Important delay in SoS

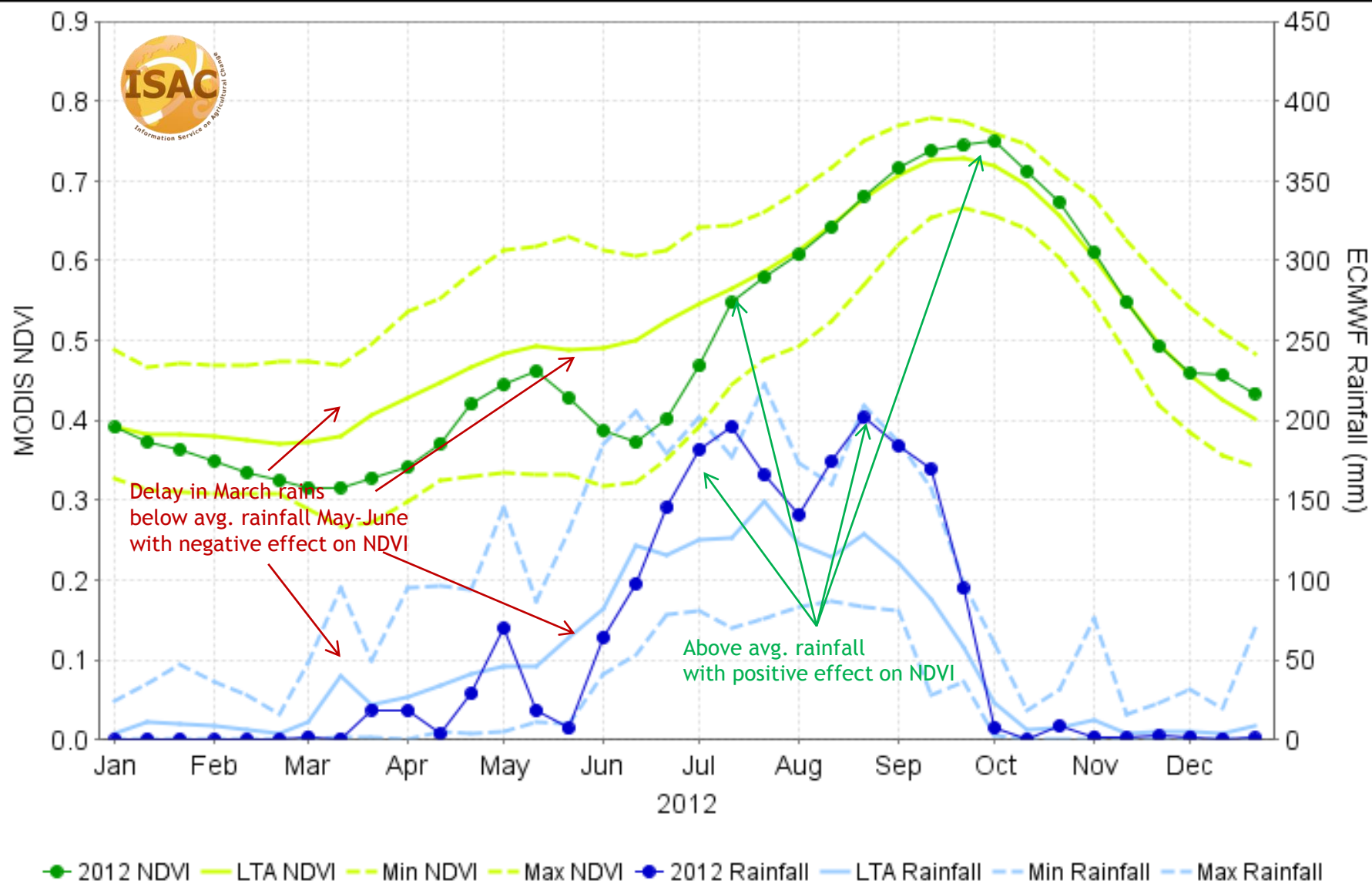
SENEGAL - Elements d'analyse de la campagne agro-pastorale
Indice de végétation de la décade du 21 July 2012

Senegal, province DIOURBEL

NDVI-toc



Example of combining vegetation indices and rainfall data



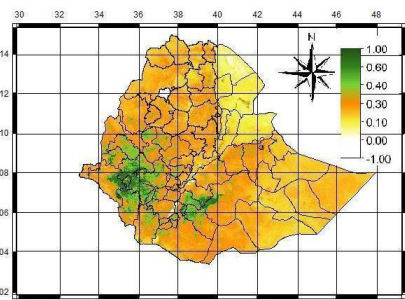
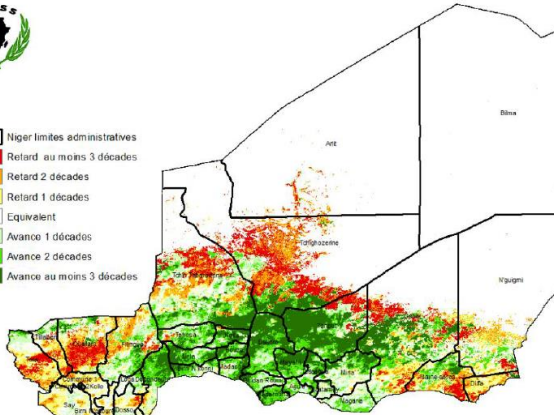
2012 Meher season, West-Shewa, Ethiopia

Vegetation monitoring for food security

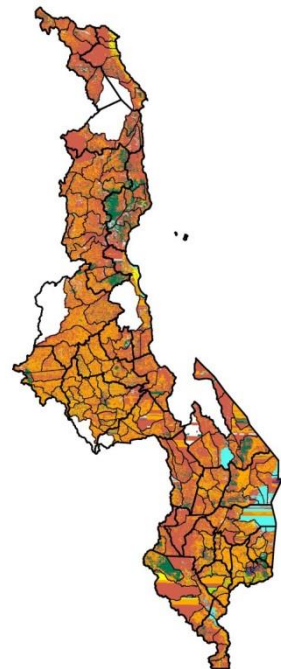
GMFS, AgriCab projects for JRC, FAO, WFP, national and regional authorities



- Niger limites administratives
- Retard au moins 3 décades
- Retard 2 décades
- Retard 1 décades
- Equivalent
- Avance 1 décades
- Avance 2 décades
- Avance au moins 3 décades



NDVI for the 3rd decade of March 2012
Source: GEONETCast real time data
from SPOT_VTG, processed by ILWIS GEONETCast Toolbox



Indicative fAPAR in North Sudan
Growing Season 2010
(until 15/09/2010)

Indicative fAPAR in Sudan
Growing Season 2011
(until 14/09/2011) Sudan State

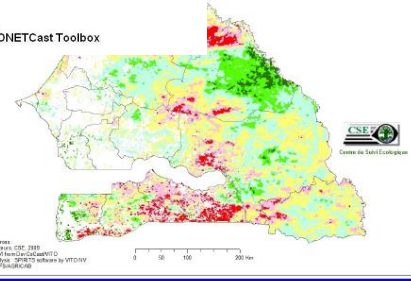
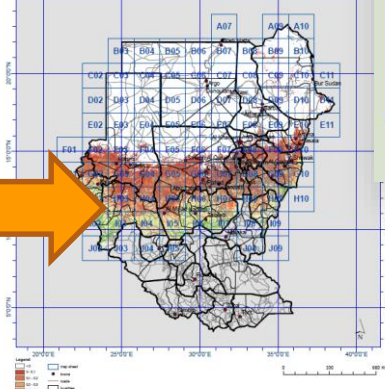
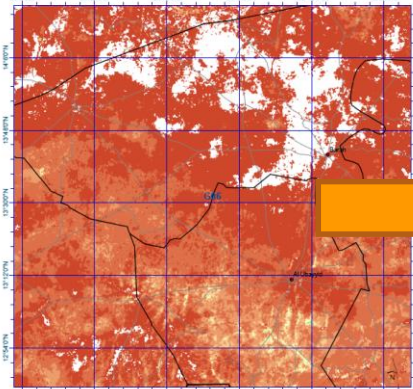
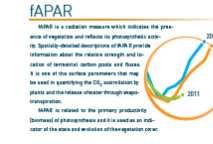
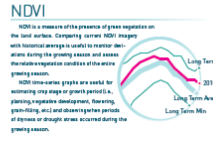
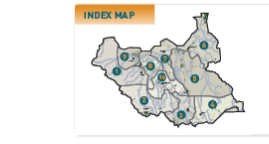
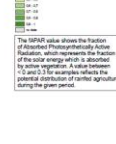
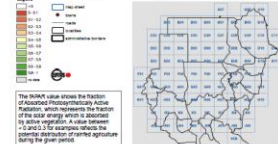
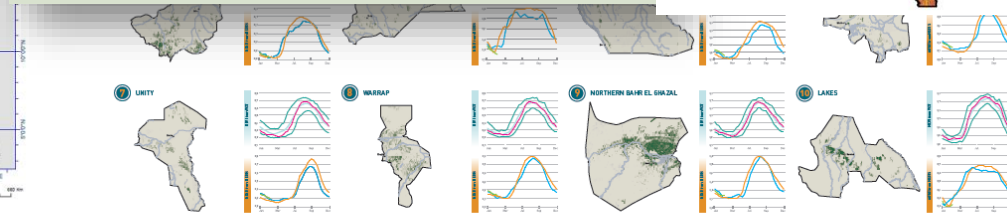


Figure 1 : Anomalies de démarrage de la saison de croissance des pâturages, hivernage 2012

- Légende
- Zones non analysées
 - Décades en avance ou en retard
 - 3 décades en avance
 - 2
 - 1
 - 0 Début de saison normal
 - 1
 - 2
 - 3 décade de retard



Analysis of long term time series of EO data

Vulnerability mapping - drought frequency returning period

Trend analysis

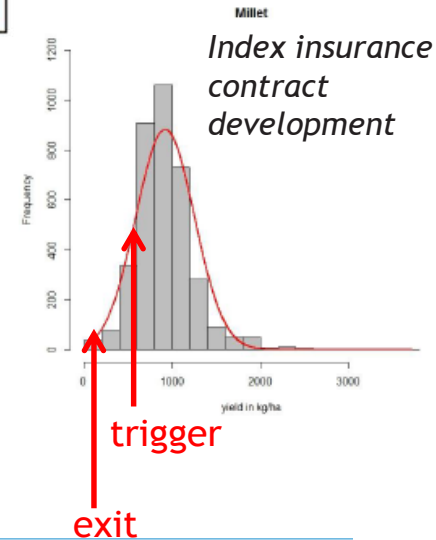
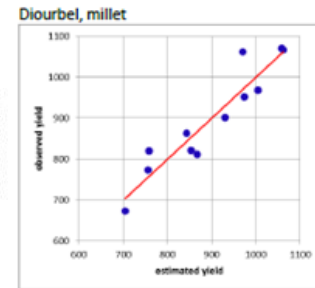
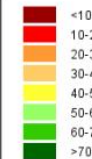
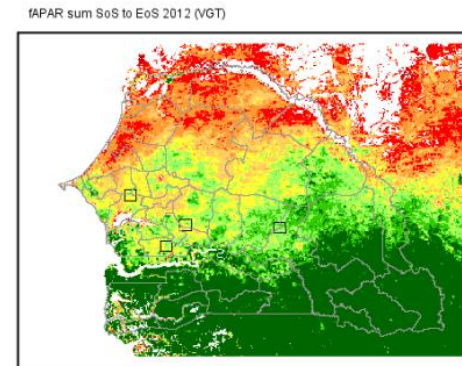
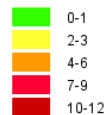
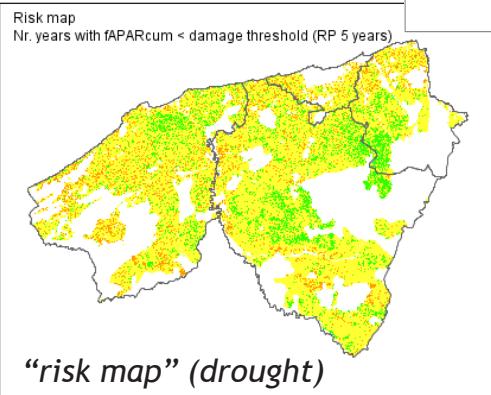
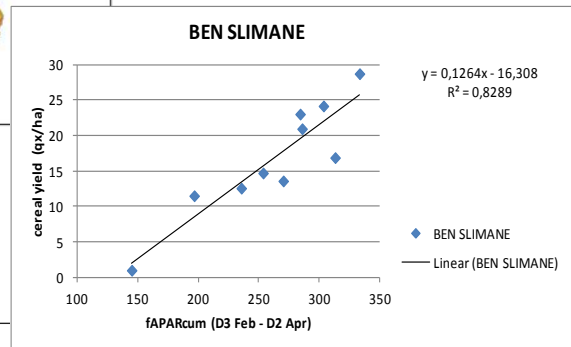
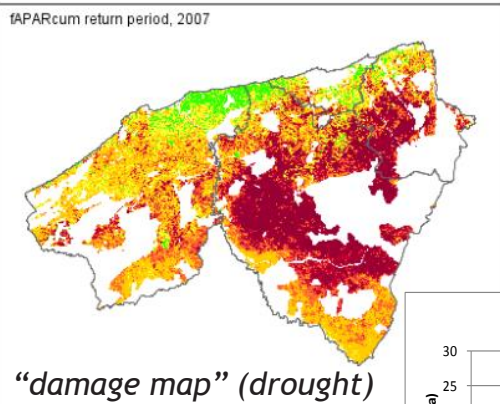
Phenology mapping

Probability of production deficit at end of season

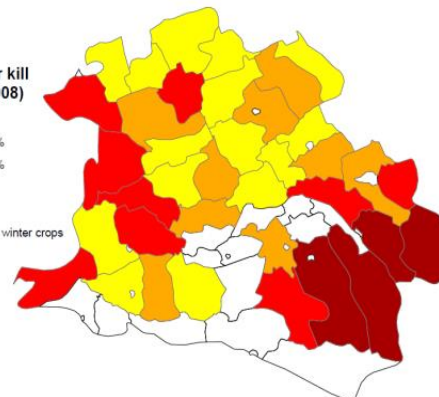
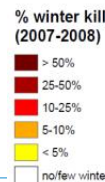
Agricultural index based insurance

Agricultural insurances

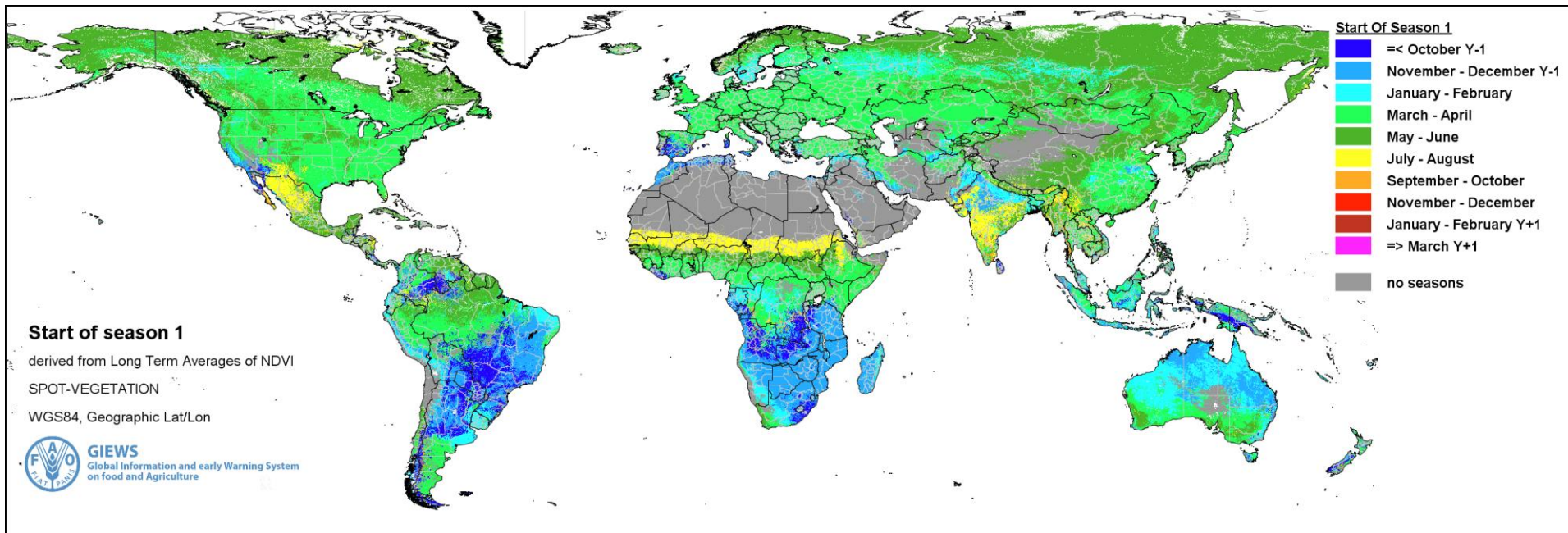
- Use of RS for crop monitoring, damage and risk assessment for the insurance sector: studies for ESA and Swiss Re for parts of Ukraine, Russia, Morocco.
- Development of RS based index insurance products for IFAD-WFP in Senegal



**“damage map”
(winter kill)**

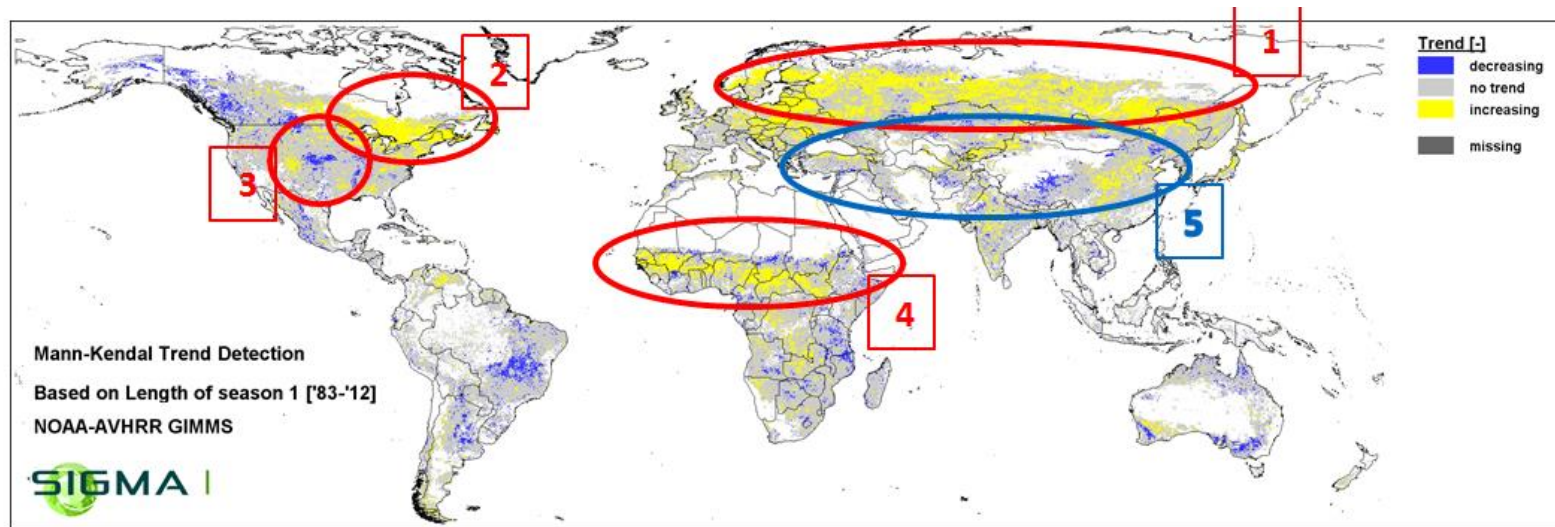


EO based phenology

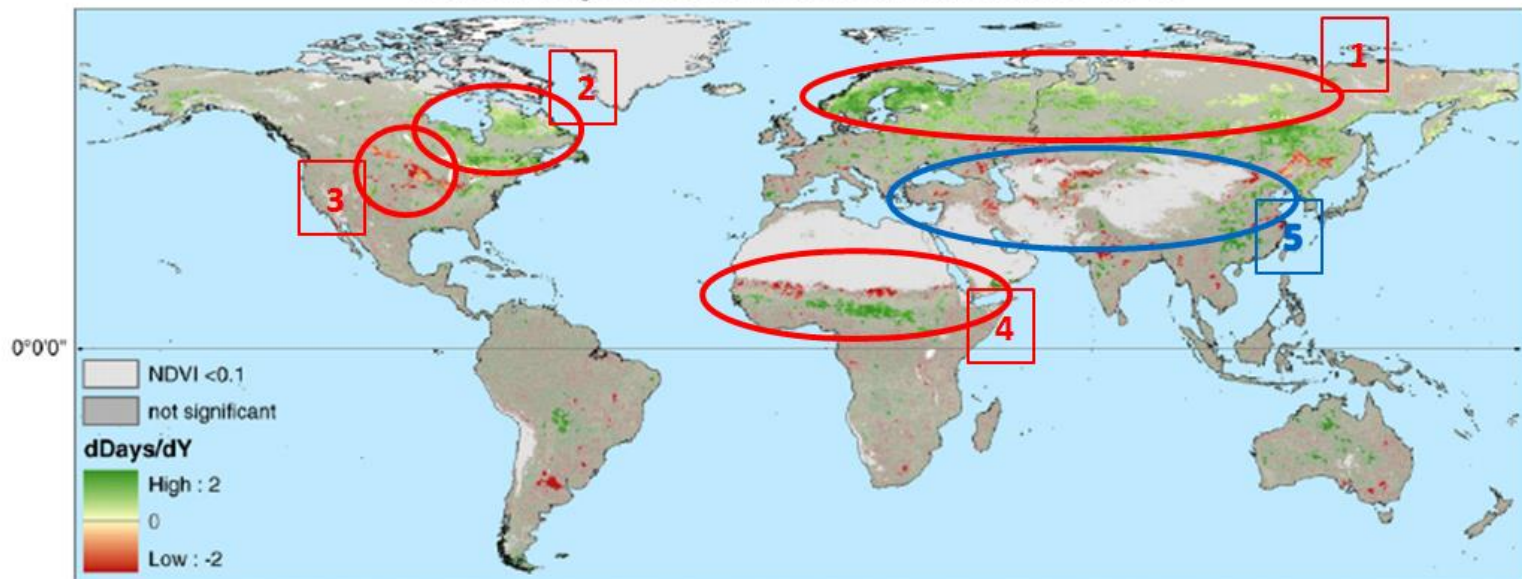


Analysis of global EO based phenology

Global results - GIMMS - '83-'12



Trend in Length of Season, based on GIMMS NDVI '81-'06



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