

LSA SAF Vegetation products

B. Martínez, S. Sánchez-Ruiz, M. Campos-Taberner, F.J. García-Haro, M. A. Gilabert

Environmental Remote Sensing Group of the University of Valencia

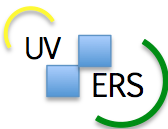
Faculty of Physics, University of Valencia, Spain.

beatriz.martinez@uv.es

www.uv.es/uvers

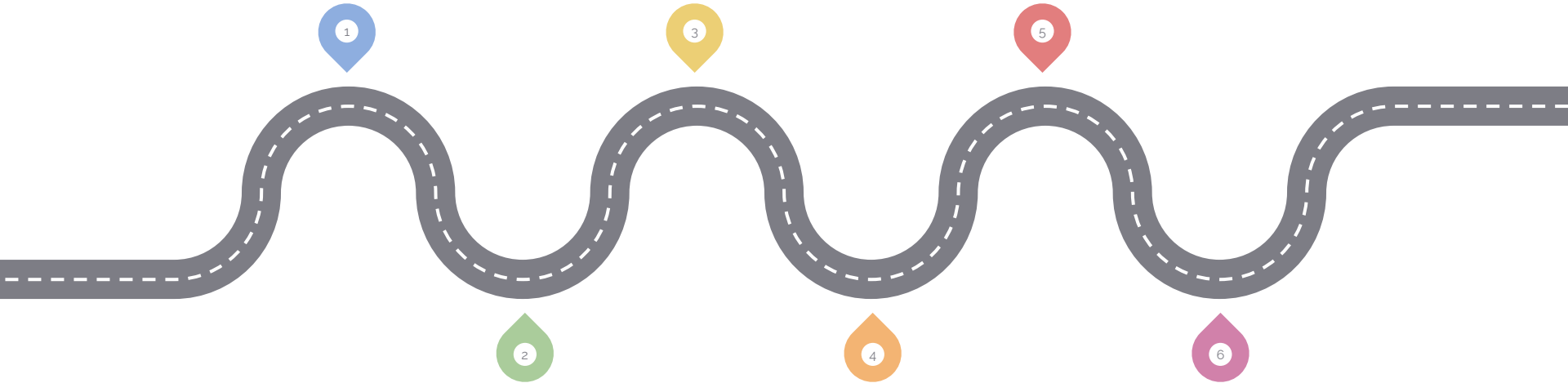


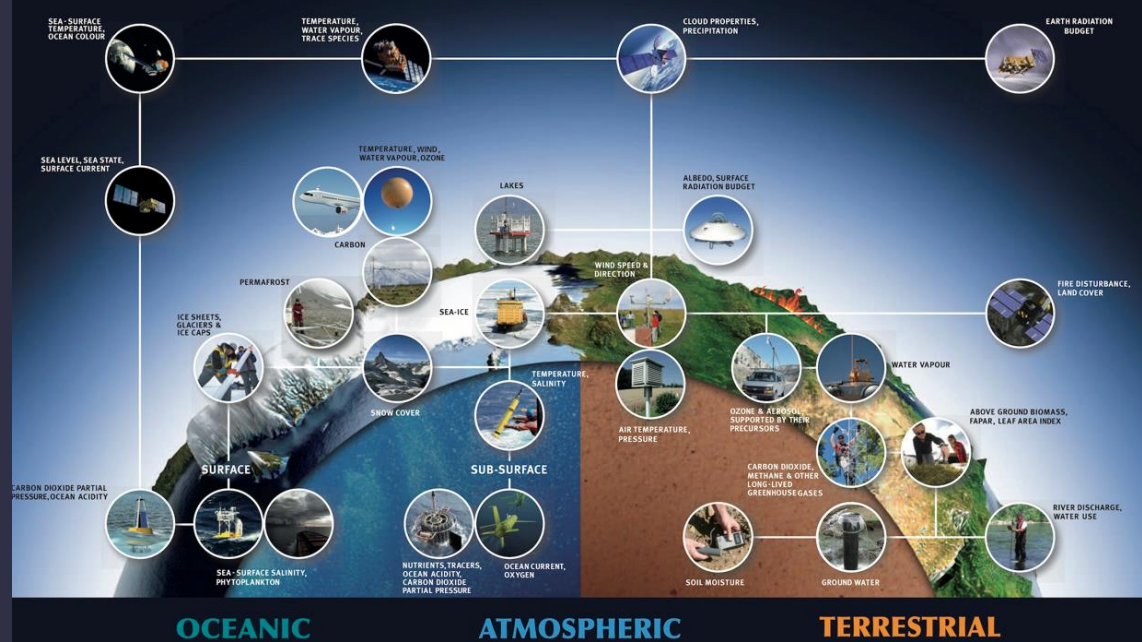
VNIVERSITAT
ID VALÈNCIA



Roadmap

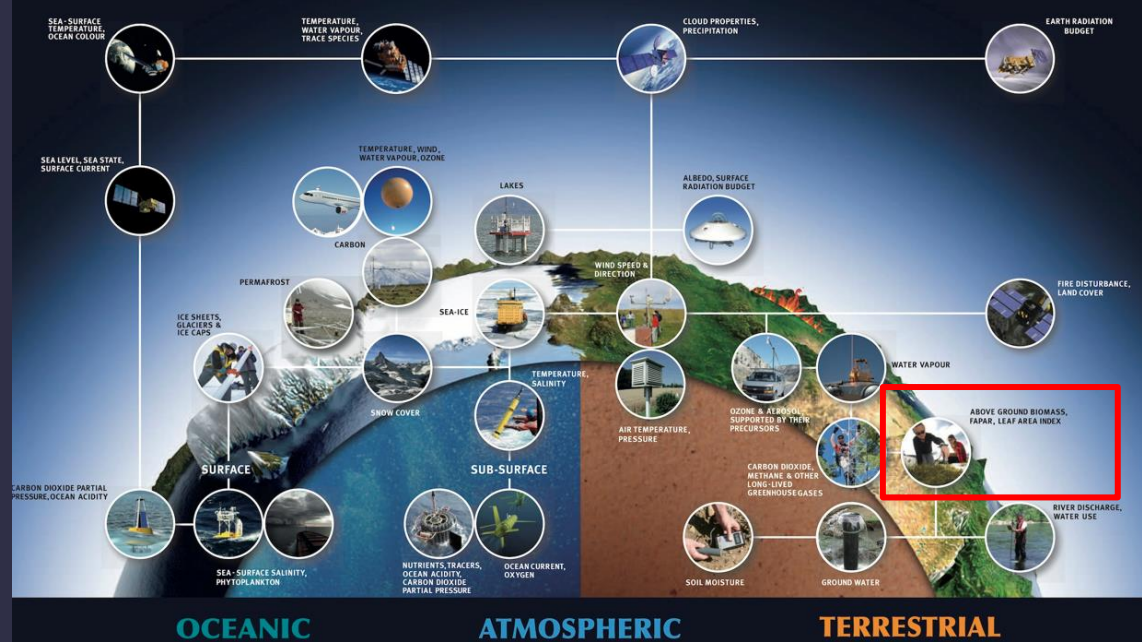
ECV





Essential Climate Variables

Necessity of an improved monitoring of the global climate system → Essential Climate Variables (ECVs) defined formally in 2003.



Essential Climate Variables

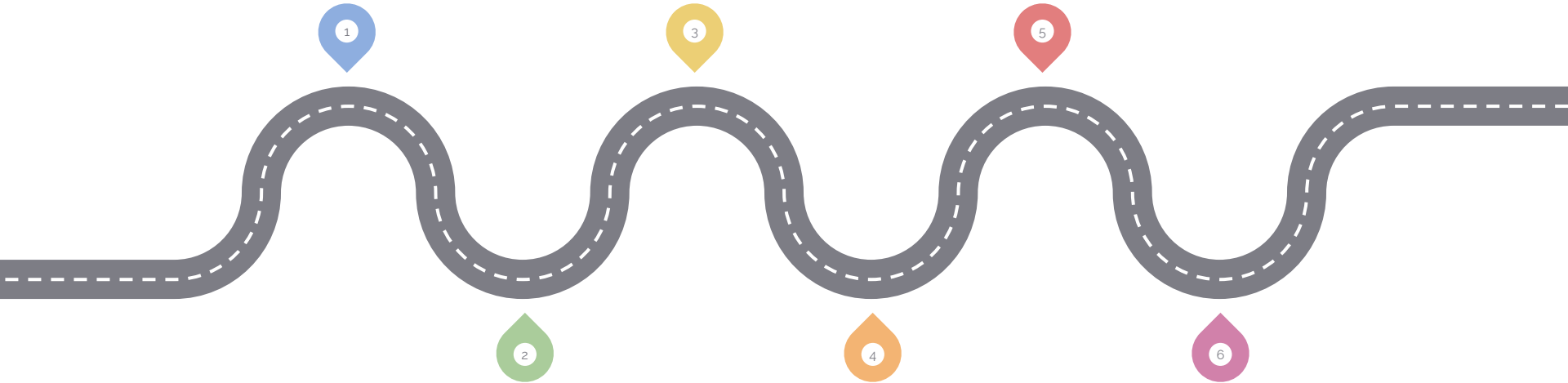
An ECV is a physical, chemical or biological variable or a group of linked variables that critically contributes to the characterization of Earth's climate.

Amount of available sensors → increase the access to a complete portfolio of ECVs from EO data.

Roadmap




ECV

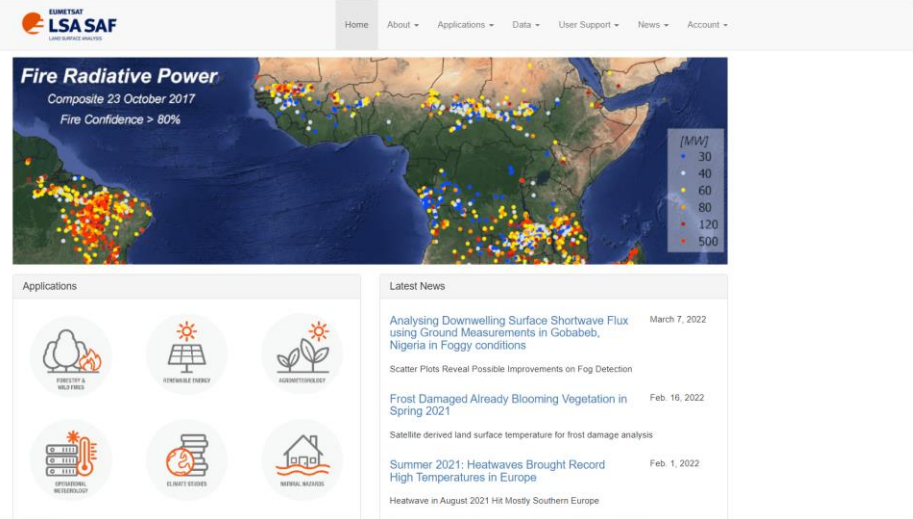


VEGA LSA SAF

LSA SAF VEGA PRODUCTS



- **Estimates** of LAI, FAPAR, FVC, GPP and CWC. 
- **Simulation** of vegetation cover spectral signatures by means of a RTM at global scale.
- **Comparison** between operational EO-based biophysical products.



LSA SAF VEGA PRODUCTS



- Numerical Weather prediction and climate modelling.
- Monitoring terrestrial ecosystem processes.
- Environmental monitoring and assessment.
- Carbon and Energy fluxes modelling.
- Agricultural and forest applications.
- Climate analysis.



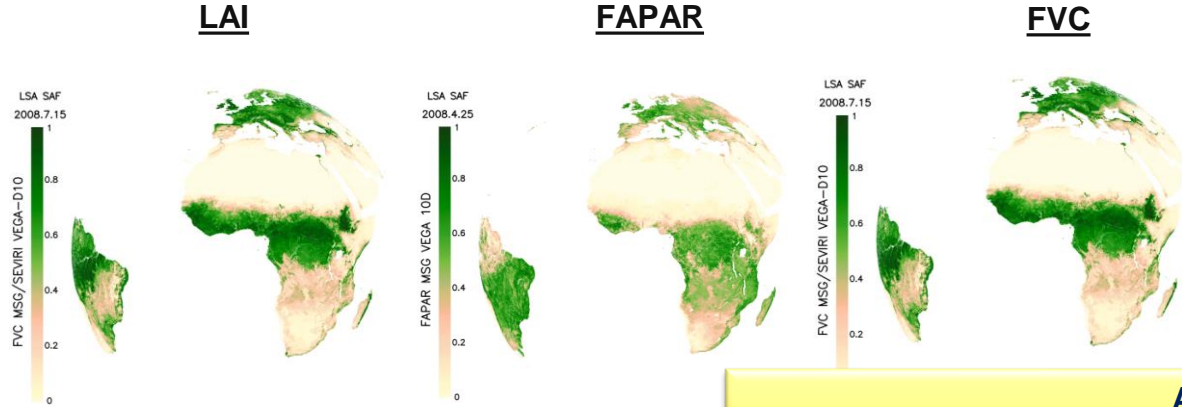
LSA SAF VEGA PRODUCTS



SEVIRI/MSG
Vegetation
products

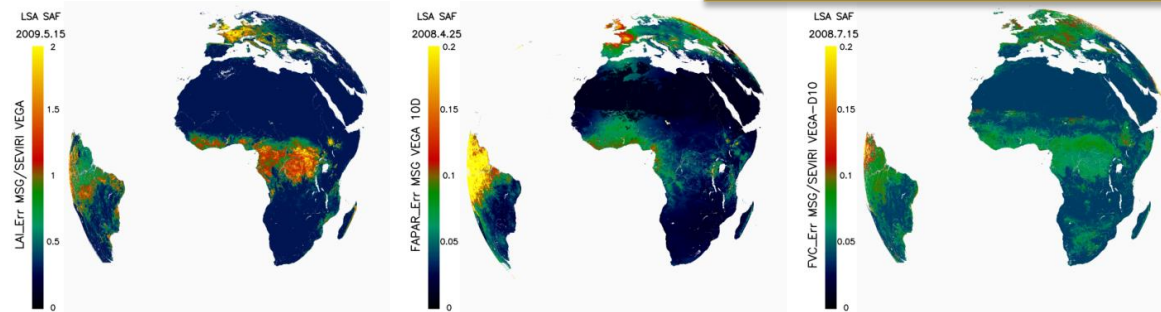
VEGA daily &
10-daily:
Operational since
2008

Product field



AVAILABLE
CLIMATIC DATA RECORDS (2004-2015)

Error estimates

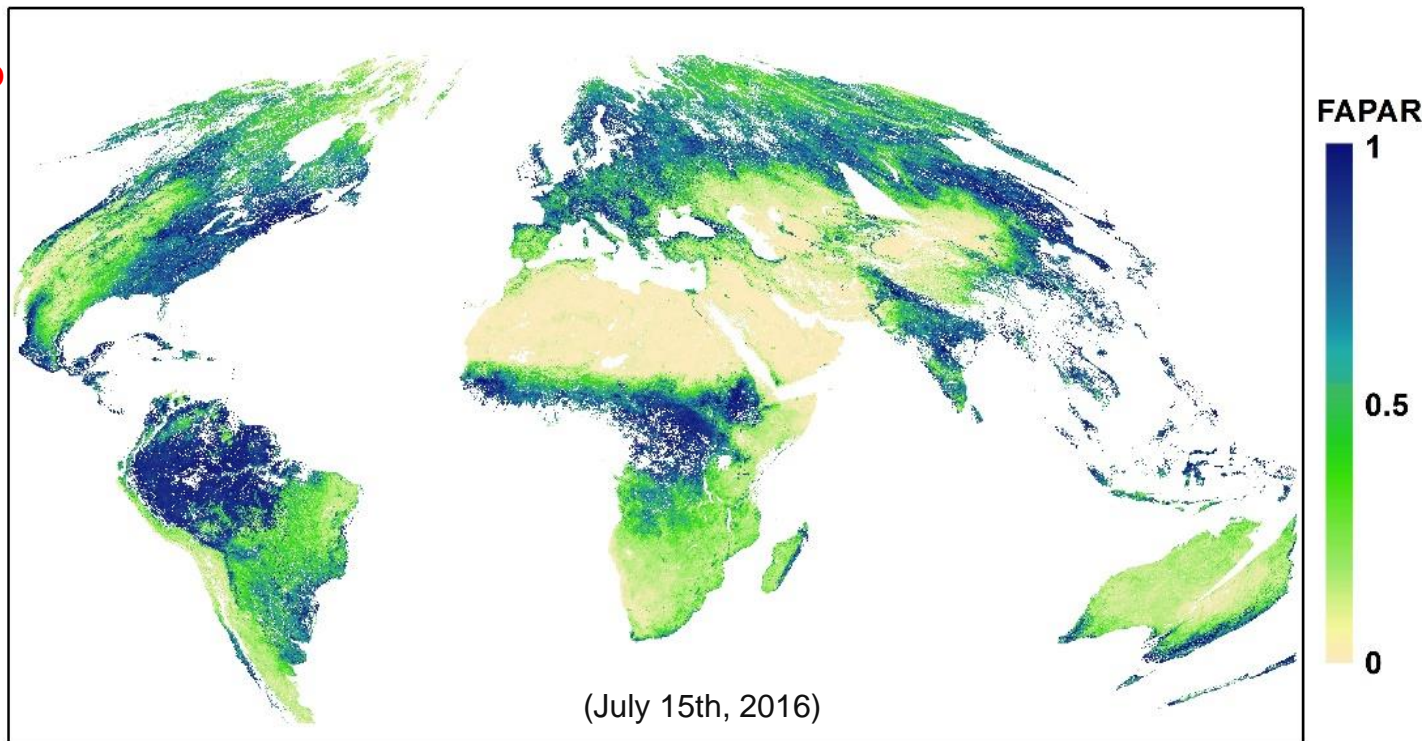


LSA SAF VEGA PRODUCTS



AVHRR/Metop
1 km

0.01° x 0.01°
Since 2015

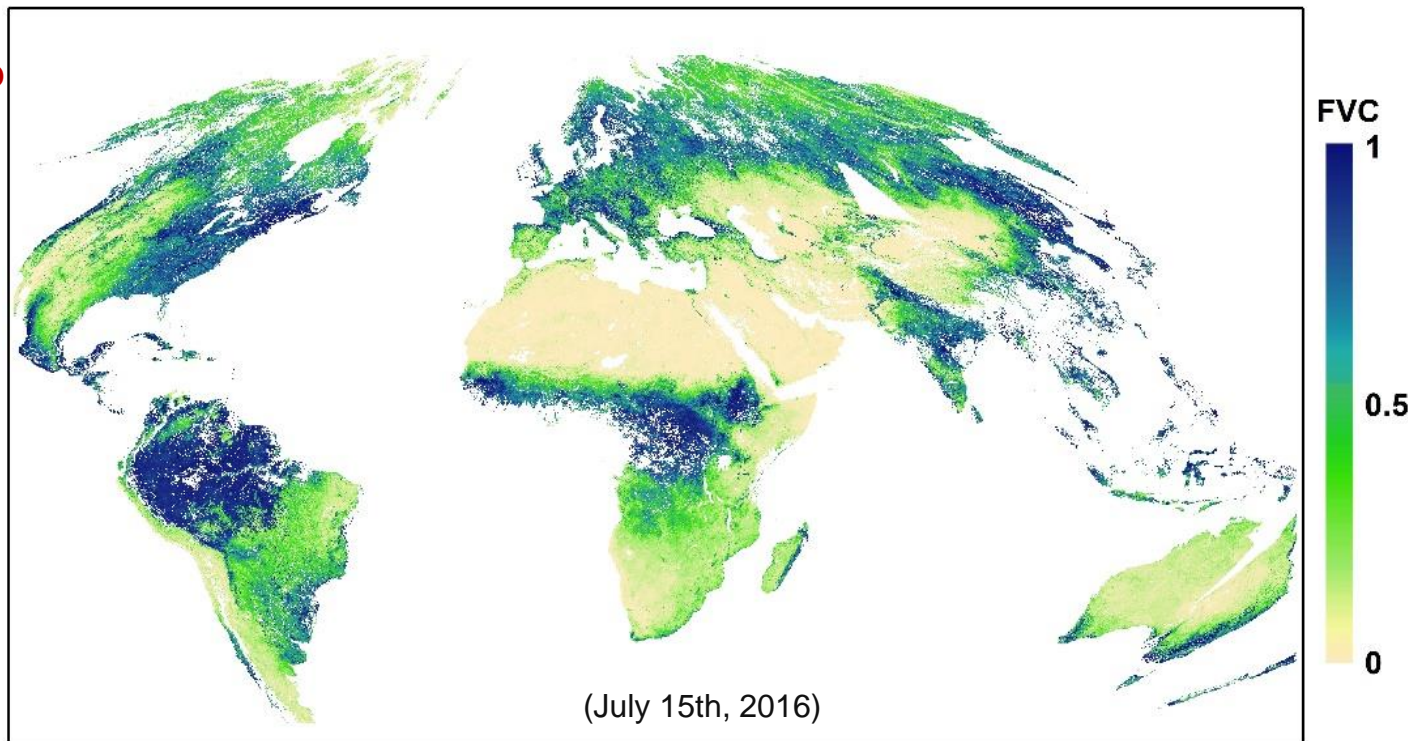


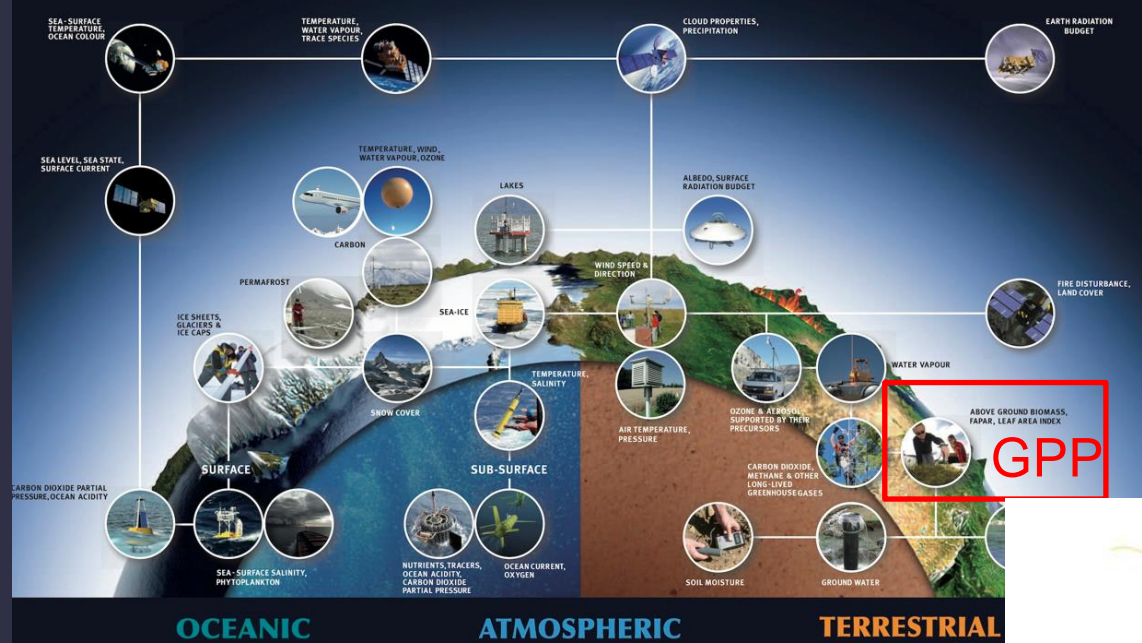
LSA SAF VEGA PRODUCTS



AVHRR/Metop
1 km

0.01° x 0.01°
Since 2015

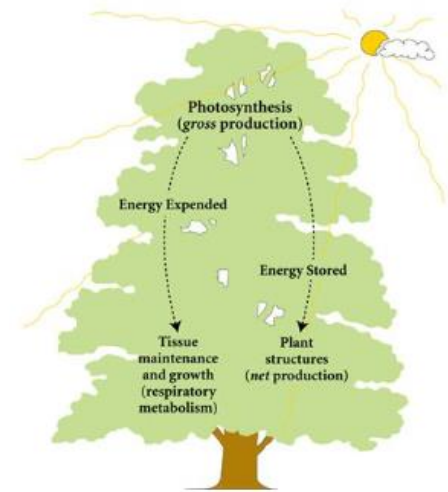




UV-ERS: Research lines

GPP measures the atmospheric carbon uptake per unit photosynthesis.

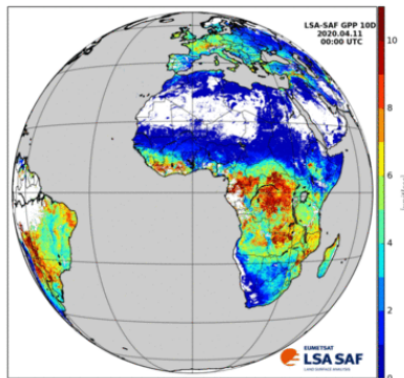
Essential parameter to characterize the ecosystem process





Home About Applications Data User Support News

MSG 10-days Gross Primary Production (MGPP, LSA-411)



Example of Product

NRT Product available since Mar 2018

GET DATA HERE

The **gross primary production (GPP)**, i.e. the rate at which vegetation converts light into chemical energy by photosynthesis, is an essential parameter to characterize the ecosystem processes. The assessment of GPP on wide areas, which is necessary to study the global carbon cycle and for planning and managing resources in response to changing environmental conditions, can be performed using procedures driven by remote sensing data.

Product Documentation

This *operational* product is documented in the following documents:

- [Product User Manual \(PUM\)](#)
- [Product Output Format \(POF\)](#)
- [Validation Report \(VR\)](#)
- [Algorithm Theoretical Basis Document \(ATBD\)](#)
- [Algorithm Changes Record](#)

Please see Product Peer-Review publications in References.

Acknowledgements

More info on this product at <https://landsaf.ipma.pt/en/products/vegetation/mgpp/>

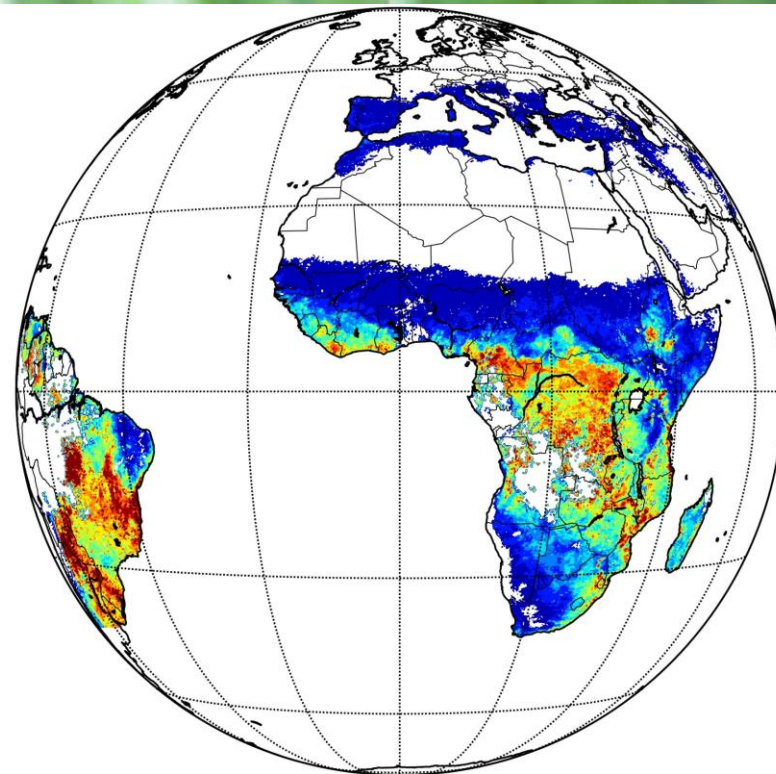
GLOBAL SCALE:

(LSA SAF)

- Near real time production of **10-day GPP**.

□ (MGPP LSA-411)

- Operationally disseminated since March 2018.



GPP (g m⁻² day⁻¹)

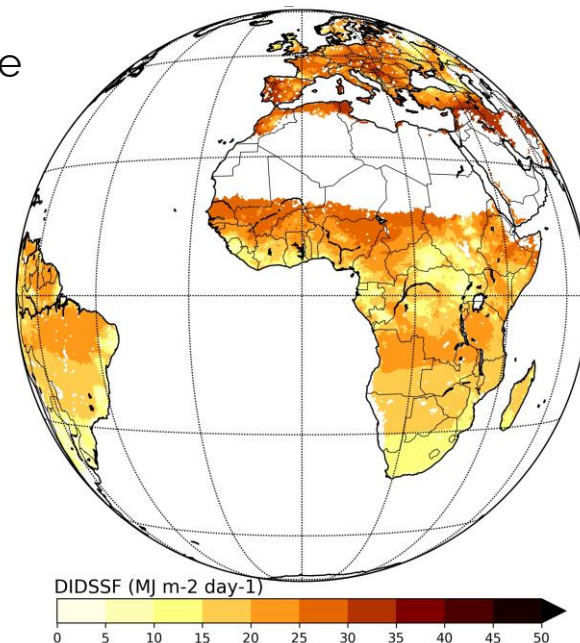




$$\text{GPP} = \epsilon f_{APAR}(\mathbf{0.46 \text{ DIDSSF}})$$

Daily Incoming downwelling Surface
shortwave fluxes

DIDSSF (LSA-203)



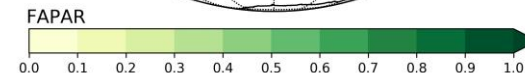
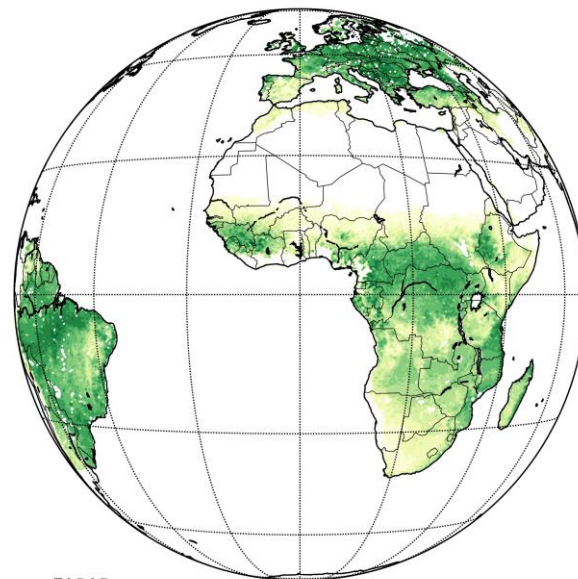
PAR

Incoming photosynthetically active radiation



$$\text{GPP} = \epsilon f_{\text{APAR}} (0.46 \text{ DIDSSF})$$

MDFAPAR (LSA-425)



Operational LSA SAF product.

Renormalized Difference Vegetation Index (**RDVI**).

Clear-sky TOC reflectances in the red R and NIR bands for an **optimal angular geometry** in the solar principal plane (Roujean and Bréon, 1995).

PAR

f_{APAR}

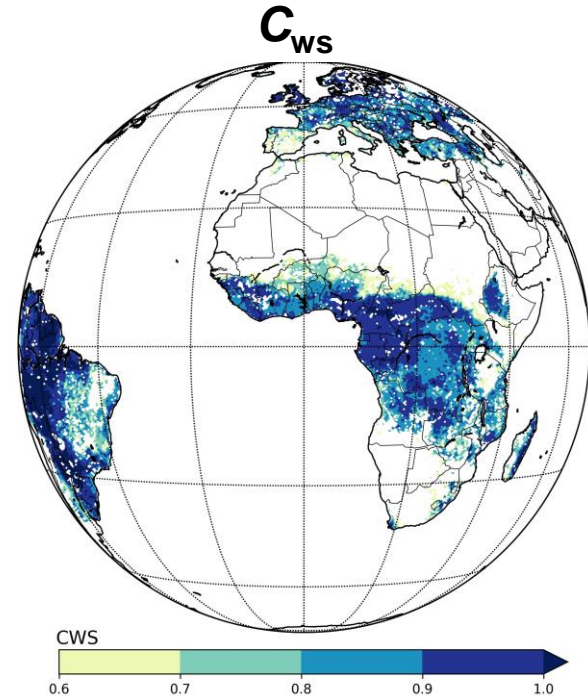
Fraction of absorbed photosynthetically active radiation

GPP



$$\text{GPP} = \varepsilon f_{\text{APAR}} (0.46 \text{ DIDSSF})$$

Light use efficiency



PAR

f_{APAR}

ε

$$\varepsilon = \varepsilon_{\text{max}} C_{ws}$$

$$\varepsilon_{\text{max}} \rightarrow \text{land cover data} \quad C_{ws} = 0.6 + 0.4 \frac{\text{DMET}}{\text{DMETREF}}$$

LSA SAF VEGA PRODUCTS



Article Climate Data Records of Vegetation Variables from Geostationary SEVIRI/MSG Data: Products, Algorithms and Applications

Francisco Javier García-Haro^{1,*,} Fernando Camacho^{2,} Beatriz Martínez^{3,} Manuel Campos-Taberner^{4,5,} Beatriz Fuster^{2,} Jorge Sánchez-Zapero² and María Amparo Gilabert^{1,6}

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² Earth Observation Laboratory (EO-LAB), Parc Científic de la Universitat de València, Catedrático Agustín Escardino, 9, 46080 Paterna, Valencia, Spain
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Received: 26 July 2019; Accepted: 6 September 2019; Published: 9 September 2019



Abstract: The scientific community requires long-term data records with well-characterized uncertainty and suitable for modeling terrestrial ecosystems and energy cycles at regional and global scales. This paper presents the methodology currently developed in EUMETSAT within its Satellite Application Facility for Land Surface Analysis (LSA SAF) to generate biophysical variables from the Spinning Enhanced Visible and InfraRed Imager (SEVIRI) on board MSG-1 (Meteosat-8/11) geostationary satellites. Using this methodology, the LSA SAF generates and disseminates at a time a suite of vegetation products, such as the leaf area index (LAI), the fraction of the photosynthetically active radiation absorbed by vegetation (FAPAR) and the fractional vegetation cover (FVC), for the whole Meteosat disk at two temporal frequencies, daily and 10-days. The FVC algorithm relies on a novel stochastic spectral mixture model which addresses the variability of soils and vegetation types using statistical distributions whereas the LAI and FAPAR algorithms use statistical relationships general enough for global applications. An overview of the LSA SAF/SEVIRI/MSG vegetation products, including expert knowledge and quality assessment of its internal consistency is provided. The climate data record (CDR) is freely available in the LSA SAF, offering more than fifteen years (2004-present) of homogeneous time series required for climate and environmental applications. The high frequency and good temporal continuity of SEVIRI products addresses the needs of near-real-time users and are also suitable for long-term monitoring of land surface variables. The study also evaluates the potential of the SEVIRI/MSG vegetation products for environmental applications, spanning from accurate monitoring of vegetation cycles to resolving long-term changes of vegetation.

García-Haro, et al., 2019. *Climate Data Records of Vegetation Variables from Geostationary SEVIRI/MSG Products: Algorithms and Applications, Remote Sensing*, 11, 2103.

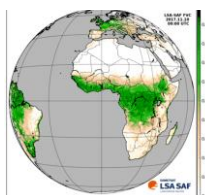
Since the late 1970s, satellite remote sensing has become a key tool for monitoring the Earth's environment significantly in the last decades. Thanks to the Earth observation (EO) satellite systems, a large number of variables related to the atmosphere, oceanic and terrestrial domains are accessible [3].

Remote Sens. 2019, 11, 2103; doi:10.3390/rs11092103

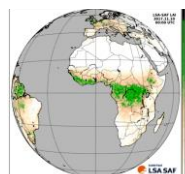
www.mdpi.com/journal/remotesensing

NRT

MSG Daily FVC (MDFVC) SAF-421



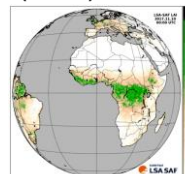
MSG Daily FVC (MTLAI) SAF-423



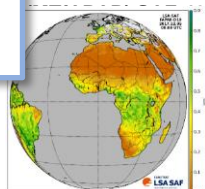
MSG 10-days FVC (MTFVC) SAF-422



MSG 10-days LAI (MTLAI) SAF-424

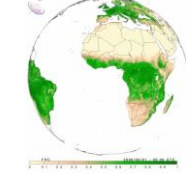


MSG 10-days FAPAR

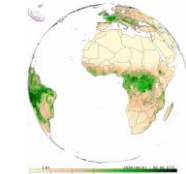


CDRs

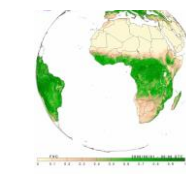
MSG 10-days FVC (MTFVC-R) SAF-50



MSG 10-days LAI (MTLAI-R) SAF-451



MSG 10-days FAPAR (MTfAPAR-R) SAF-452



ISPRS Journal of Photogrammetry and Remote Sensing 159 (2020) 220–236

Contents lists available at ScienceDirect

ISPRS Journal of Photogrammetry and Remote Sensing

journal homepage: www.elsevier.com/locate/isprsjprs

Evaluation of the LSA-SAF gross primary production product derived from SEVIRI/MSG data (MGPP)

B. Martínez^{a,*}, M.A. Gilabert^b, S. Sánchez-Ruiz^c, M. Campos-Taberner^d, F.J. García-Haro^e, C. Brümmer^f, A. Carrara^g, G. Feig^{h,i}, T. Grünwald^j, I. Mammarella^k, T. Tagesson^{l,m}

^a Departamento de Física de la Tierra y Termodinámica, Facultad de Física, Universidad de Valencia, Burjassot, Spain

^b Phosphorus Institute of Climate-Smart Agriculture, Braunschweig, Germany

^c Instituto Centro de Estudios Ambientales del Medioambiente (ICEAM), Paterna, Spain

^d Global Change and Ecosystems Dynamics, Natural Resources and Environment, Council for Scientific and Industrial Research (CSIR), Pretoria, South Africa

^e Department of Geography, Cartography and Meteorology, University of Pretoria, Pretoria, South Africa

^f Technische Universität Dresden, Institute of Hydrology and Meteorology, Tharandt, Germany

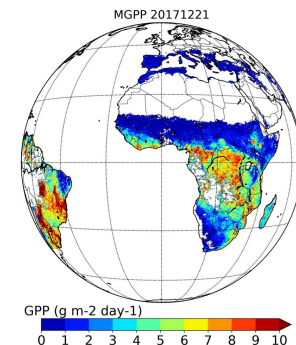
^g Institute for Atmospheric and Earth System Research/Physics, Faculty of Science, University of Helsinki, Helsinki, Finland

^h Department of Physical Geography and Ecosystem Sciences, Lund University, Lund, Sweden

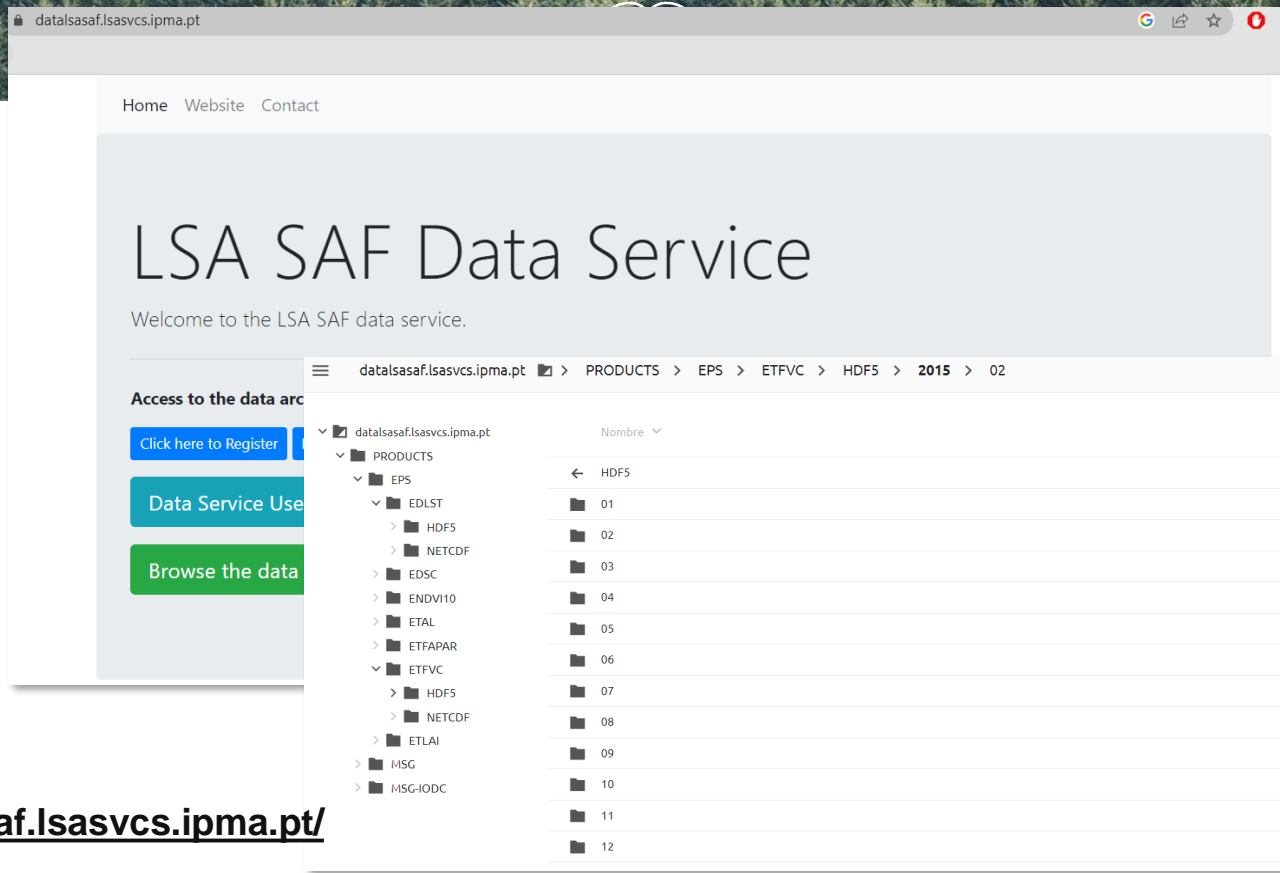
ⁱ Department of Geosciences and Natural Resource Management (IGN), University of Copenhagen, Copenhagen, Denmark

ARTICLE INFO

ABSTRACT



VEGA DATA ACQUISITION



The screenshot displays the LSA SAF Data Service website. The main heading is "LSA SAF Data Service" with a welcome message. A sidebar on the left offers links to "Access to the data archive", "Click here to Register", "Data Service User Guide", and "Browse the data". An overlay window shows a file browser for the URL "datalsasaf.lsasvcs.ipma.pt". The breadcrumb trail is "PRODUCTS > EPS > ETFVC > HDF5 > 2015 > 02". The file list shows a directory structure with folders like "EPS", "EDLST", "HDF5", "NETCDF", "EDSC", "ENDVI10", "ETAL", "ETFAPAR", "ETFVC", "HDF5", "NETCDF", "ETLAI", "MSG", and "MSG-IODC". The "HDF5" folder is expanded, showing a list of files numbered 01 to 12, each with a timestamp from 23/09/2022 09:17 to 23/09/2022 09:29.

Home Website Contact

LSA SAF Data Service

Welcome to the LSA SAF data service.

Access to the data archive

[Click here to Register](#)

[Data Service User Guide](#)

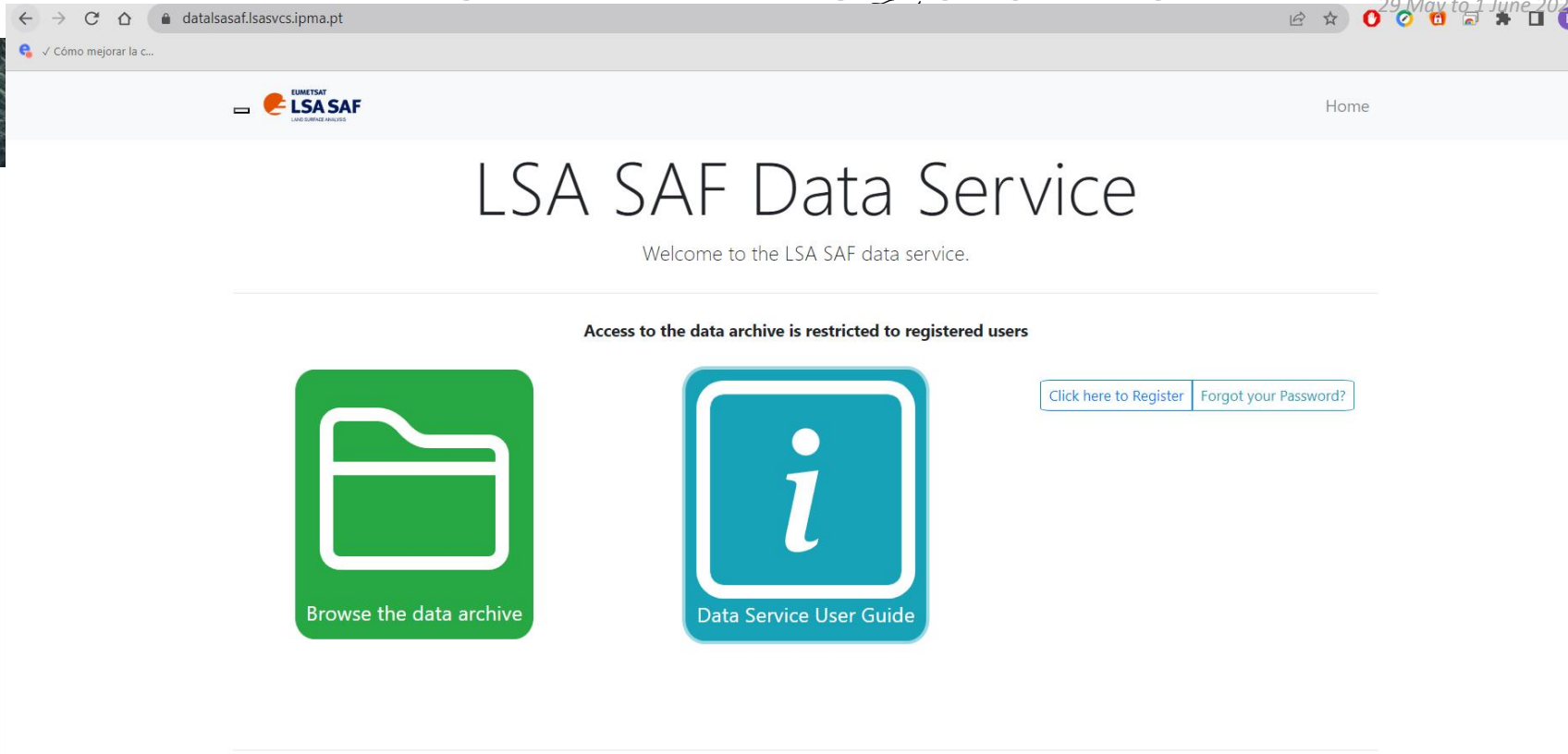
[Browse the data](#)

datalsasaf.lsasvcs.ipma.pt > PRODUCTS > EPS > ETFVC > HDF5 > 2015 > 02

Nombre	Última modificación
← HDF5	
01	23/09/2022 09:17
02	23/09/2022 09:19
03	23/09/2022 09:20
04	23/09/2022 09:21
05	23/09/2022 09:22
06	23/09/2022 09:23
07	23/09/2022 09:24
08	23/09/2022 09:25
09	23/09/2022 09:26
10	23/09/2022 09:27
11	23/09/2022 09:28
12	23/09/2022 09:29

<https://datalsasaf.lsasvcs.ipma.pt/>

VEGA DATA ACQUISITION



The screenshot shows a web browser window with the URL `data.sasaf.lasvcs.ipma.pt`. The page header includes the EUMETSAT LSA SAF logo and a 'Home' link. The main heading is 'LSA SAF Data Service', followed by the text 'Welcome to the LSA SAF data service.' Below this, a message states 'Access to the data archive is restricted to registered users'. Two large icons are displayed: a green folder icon labeled 'Browse the data archive' and a blue information icon labeled 'Data Service User Guide'. To the right of these icons are two buttons: 'Click here to Register' and 'Forgot your Password?'.

data.sasaf.lasvcs.ipma.pt


EUMETSAT LSA SAF


Home

LSA SAF Data Service

Welcome to the LSA SAF data service.

Access to the data archive is restricted to registered users

 Browse the data archive

 Data Service User Guide

[Click here to Register](#) [Forgot your Password?](#)

https://gitlab.com/helpdesk.landsaf/lasaf_data_access/-/tree/main/Readme.md












https://gitlab.com/helpdesk.landsaf/lasaf_data_access/-/tree/main/examples/webdav/read_map_hdf5_webdav.ipynb

← → ↻ 🏠 datalsasaf.lsasvcs.ipma.pt/PRODUCTS/           

✓ Cómo mejorar la c...

datalsasaf.lsasvcs.ipma.pt > **PRODUCTS**

Nombre	Última modificación	Tamaño
← datalsasaf.lsasvcs.ipma.pt		
> EPS	11/10/2022 18:56	
> MSG	09/03/2023 15:25	
> MSG-IODC	17/10/2022 18:14	
M+ Readme.md	06/04/2023 16:45	6 KB

← → ↻ 🏠 datalsasaf.lsasvcs.ipma.pt/PRODUCTS/MSG/MDFAPAR/           

✓ Cómo mejorar la c...

datalsasaf.lsasvcs.ipma.pt > **PRODUCTS** > **MSG** > **MDFAPAR**


Nombre	Última modificación	Tamaño
← MSG		
HDF5	02/01/2023 02:29	
NETCDF	02/01/2023 02:19	

VEGA DATA ACQUISITION

← → ↺ 🏠

gitlab.com/helpdesk.landsaf/lsasaf_data_access/-/wikis/data/wget%20examples

🔖 ⭐ 🔒 🌐 📱 ⚙️ 🗖️ 🌐

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☰

Register

Sign in

 **lsasaf_data_access**

📁 Project information

📁 Repository

📁 Issues 0

🔗 Merge requests 0

🔗 CI/CD

🔗 Deployments

📦 Packages and registries


📺 Monitor

📊 Analytics

📖 Wiki

✂️ Snippets

HelpDesk Landsaf IM > 🌐 lsasaf_data_access > Wiki > ⋮ > **wget examples**

Last edited by  **Emanuel Dutra** 3 months ago

wget examples

The recommended way to download several products is with the **wget** tool which is available in most linux distributions. Windows binaries can be found [here](#)

For example to download MSG LST hourly files (skipping minutes 15, 30, 45) for Jan 2006 you can use the following command (**don't forget the last "/" to download only that period**), replacing --user=XXX --password=XXX by your access credentials:

```
wget -c --no-check-certificate -r -np -nH --user=XXX --password=XXX \
-R "*15.nc, *30.nc, *45.nc, *.html, *.tmp" \
https://data.landsaf.landsafcs.ipma.pt/PRODUCTS/MSG/HLST/NETCDF/2006/01/
```

The character \ should be replace by ^ in **windows for line continuation**, or invoke the command in an single line

You can check the details of each option [here](#) . :

► The main options used in the example (click to open)

For example to download EPS 10-daily Leaf Area index for the year 2021 on the native HDF5 format (it's 13Gb of data):

```
wget -c --no-check-certificate -r -np -nH --user=XXX --password=XXX \
-R "*.html, *.tmp" \
https://data.landsaf.landsafcs.ipma.pt/PRODUCTS/EPS/ETLAI/HDF5/2021/
```

Page history

📄 Clone repository

▼ credentials

- forgot password
- register

▼ data

- browse
- webdav
- wget examples

Home

« Collapse sidebar

```
Símbolo del sistema
2023-05-29 12:15:12 (9,39 MB/s) - 'PRODUCTS/MSG/MGPP/NETCDF/2022/02/21/index.html.tmp' saved [2708]

--2023-05-29 12:15:12-- https://datalsasaf.lsasvcs.ipma.pt/PRODUCTS/MSG/MGPP/NETCDF/2022/02/01/NETCDF4_LSASAF_MSG_MGPP_MSG-Disk_202202010000.nc
Reusing existing connection to datalsasaf.lsasvcs.ipma.pt:443.
HTTP request sent, awaiting response... 200 OK
Length: 3832641 (3,7M) [application/octet-stream]
Saving to: 'PRODUCTS/MSG/MGPP/NETCDF/2022/02/01/NETCDF4_LSASAF_MSG_MGPP_MSG-Disk_202202010000.nc'

PRODUCTS/MSG/MGPP/NETCDF/2022/02/01/NETCDF4_L 100%[=====>] 3,65M 4,85MB/s in 0,8s

2023-05-29 12:15:13 (4,85 MB/s) - 'PRODUCTS/MSG/MGPP/NETCDF/2022/02/01/NETCDF4_LSASAF_MSG_MGPP_MSG-Disk_202202010000.nc' saved [3832641/3832641]

--2023-05-29 12:15:13-- https://datalsasaf.lsasvcs.ipma.pt/PRODUCTS/MSG/MGPP/NETCDF/2022/02/11/NETCDF4_LSASAF_MSG_MGPP_MSG-Disk_202202110000.nc
Reusing existing connection to datalsasaf.lsasvcs.ipma.pt:443.
HTTP request sent, awaiting response... 200 OK
Length: 3893820 (3,7M) [application/octet-stream]
Saving to: 'PRODUCTS/MSG/MGPP/NETCDF/2022/02/11/NETCDF4_LSASAF_MSG_MGPP_MSG-Disk_202202110000.nc'

PRODUCTS/MSG/MGPP/NETCDF/2022/02/11/NETCDF4_L 100%[=====>] 3,71M 5,99MB/s in 0,6s

2023-05-29 12:15:14 (5,99 MB/s) - 'PRODUCTS/MSG/MGPP/NETCDF/2022/02/11/NETCDF4_LSASAF_MSG_MGPP_MSG-Disk_202202110000.nc' saved [3893820/3893820]

--2023-05-29 12:15:14-- https://datalsasaf.lsasvcs.ipma.pt/PRODUCTS/MSG/MGPP/NETCDF/2022/02/21/NETCDF4_LSASAF_MSG_MGPP_MSG-Disk_202202210000.nc
Reusing existing connection to datalsasaf.lsasvcs.ipma.pt:443.
HTTP request sent, awaiting response... 200 OK
Length: 3916171 (3,7M) [application/octet-stream]
Saving to: 'PRODUCTS/MSG/MGPP/NETCDF/2022/02/21/NETCDF4_LSASAF_MSG_MGPP_MSG-Disk_202202210000.nc'

PRODUCTS/MSG/MGPP/NETCDF/2022/02/21/NETCDF4_L 100%[=====>] 3,73M 4,95MB/s in 0,8s

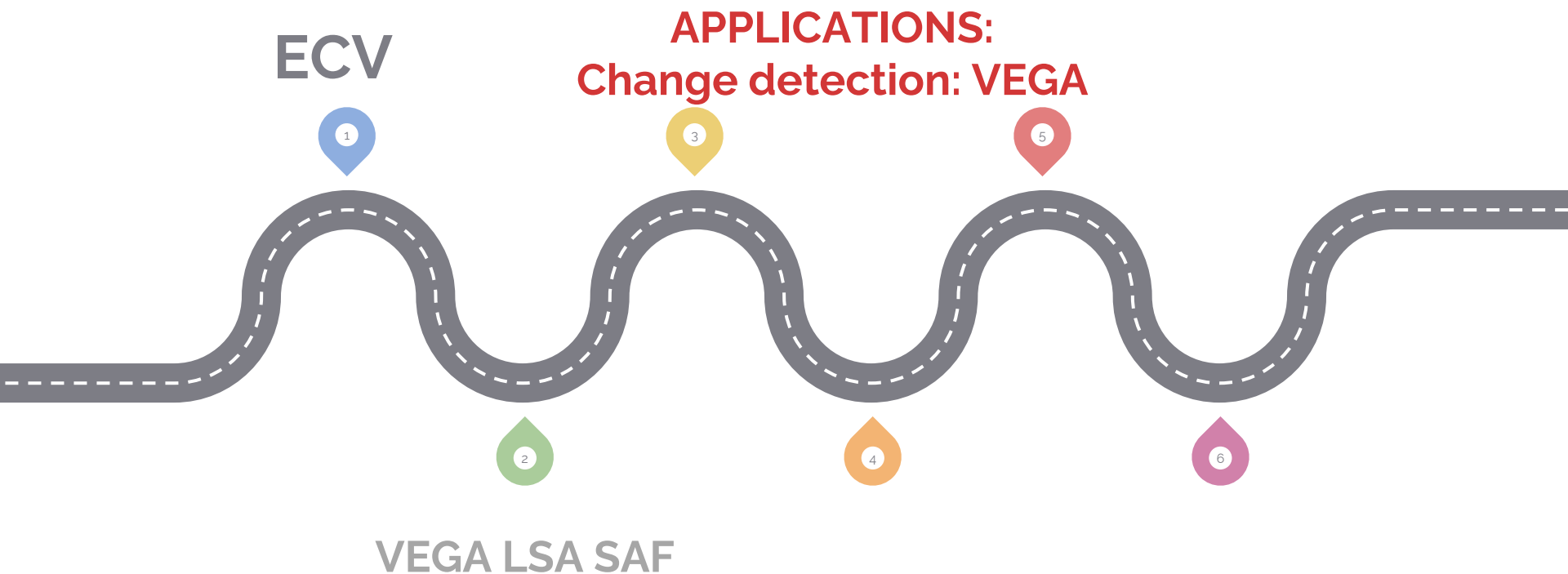
2023-05-29 12:15:15 (4,95 MB/s) - 'PRODUCTS/MSG/MGPP/NETCDF/2022/02/21/NETCDF4_LSASAF_MSG_MGPP_MSG-Disk_202202210000.nc' saved [3916171/3916171]

FINISHED --2023-05-29 12:15:15--
Total wall clock time: 5,4s
Downloaded: 7 files, 11M in 2,1s (5,22 MB/s)

G:\PROGRAMAS\idlprog\MODIS\wget-1.20.3-win32>wget -c --no-check-certificate -r -np -nH \ --user=training01 --password=training01LSASAF \ -R "*.html" \ https://datalsasaf.lsasvcs.ipma.pt/PRODUCTS/MSG/MGPP/NETCDF/2022/02/
```

```
wget -c --no-check-certificate -r -np -nH \ --user=training01 --password=training01LSASAF \ -R
 "*.html" \ https://datalsasaf.lsasvcs.ipma.pt/PRODUCTS/MSG/MGPP/NETCDF/2022/02/
```

Roadmap



VEG. CHANGE DETECTION

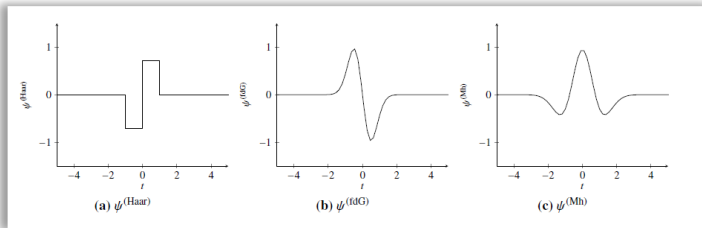
©Matlab

□ MRA-WT

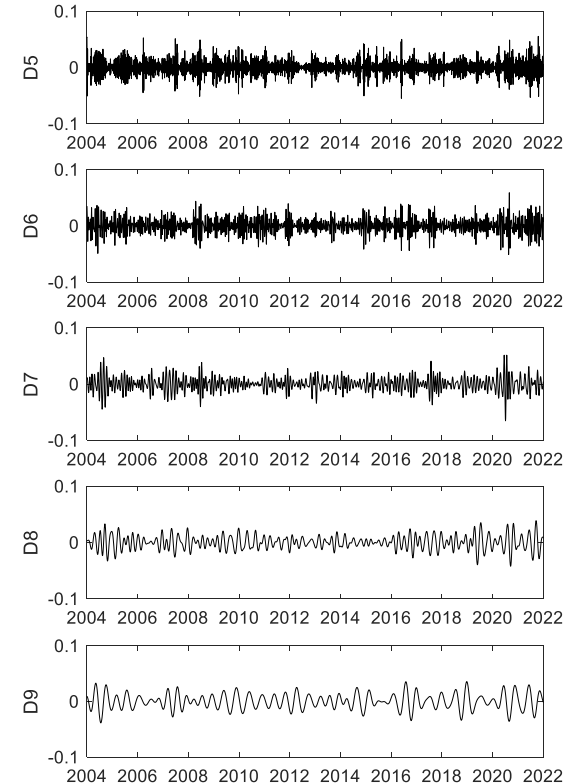
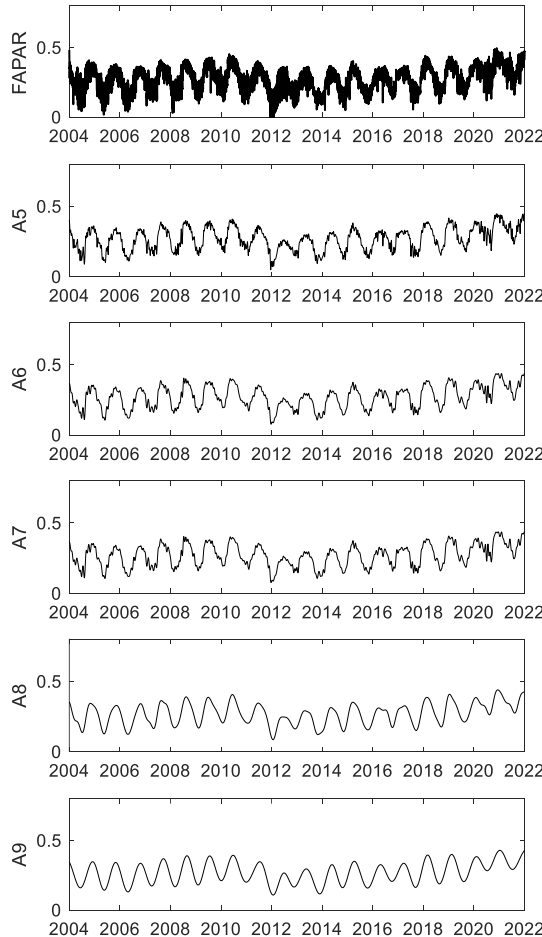
$$f(t) = A_J(t) + \sum_{j=1}^J D_j(t)$$



Low-pass filter (LPF)



1. Translating the Wavelet
2. Scaling the Wavelet at different temporal resolutions (dilatation and contraction)



VEG. CHANGE DETECTION

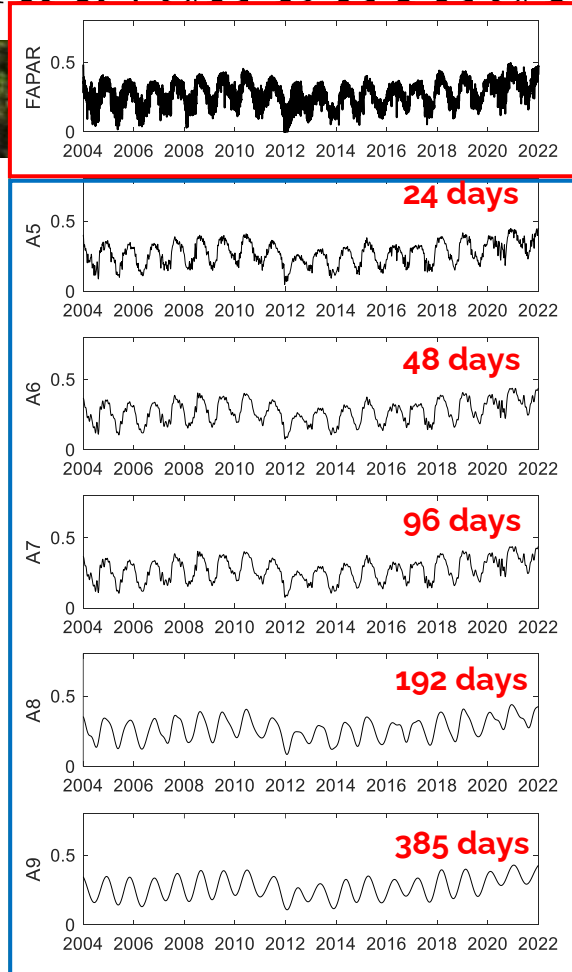
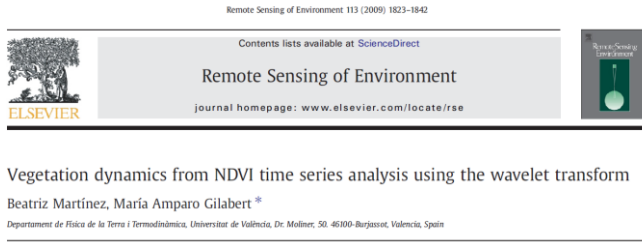


□ MRA-WT

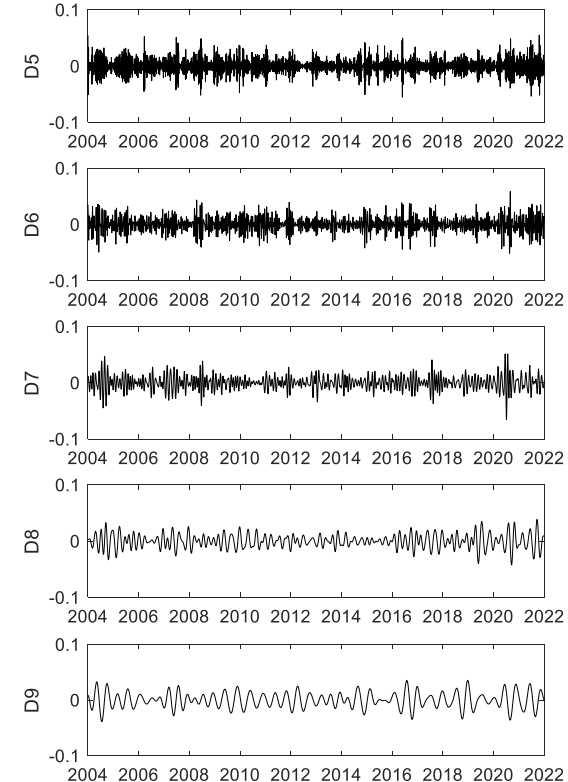
$$f(t) = A_J(t) + \sum_{j=1}^J D_j(t)$$



Low-pass filter (LPF)



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VEG. CHANGE DETECTION



□ MRA-WT

$$f(t) = A_J(t) + \sum_{j=1}^J D_j(t)$$

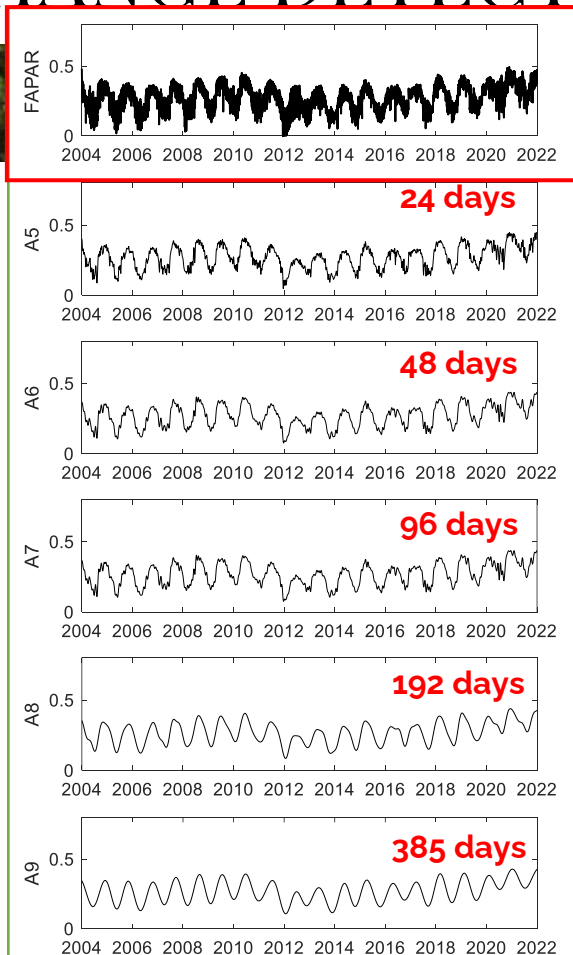


High-pass filter (HPF)

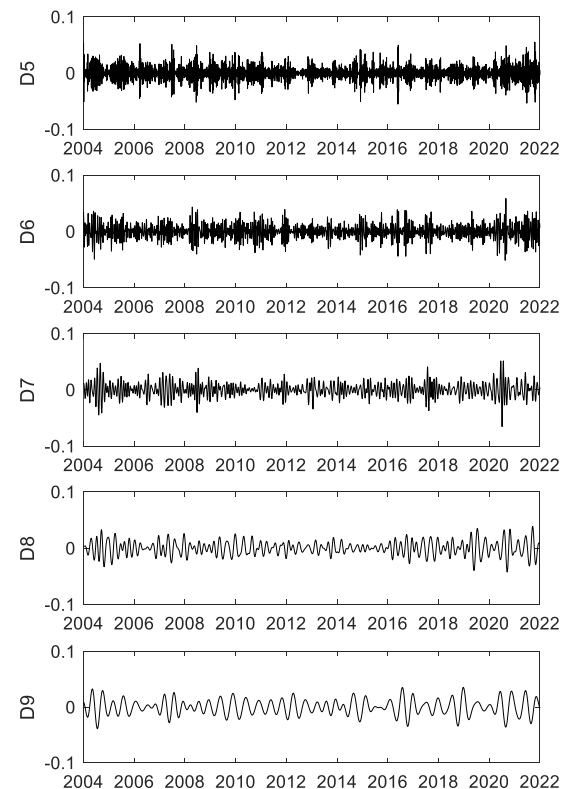
$$f(\text{original}) = A_1 + D_1$$

$$f(\text{original}) = (A_2 + D_2) + D_1$$

$$D_2 = (A_1 - A_2)$$



©Matlab



VEG. CHANGE DETECTION



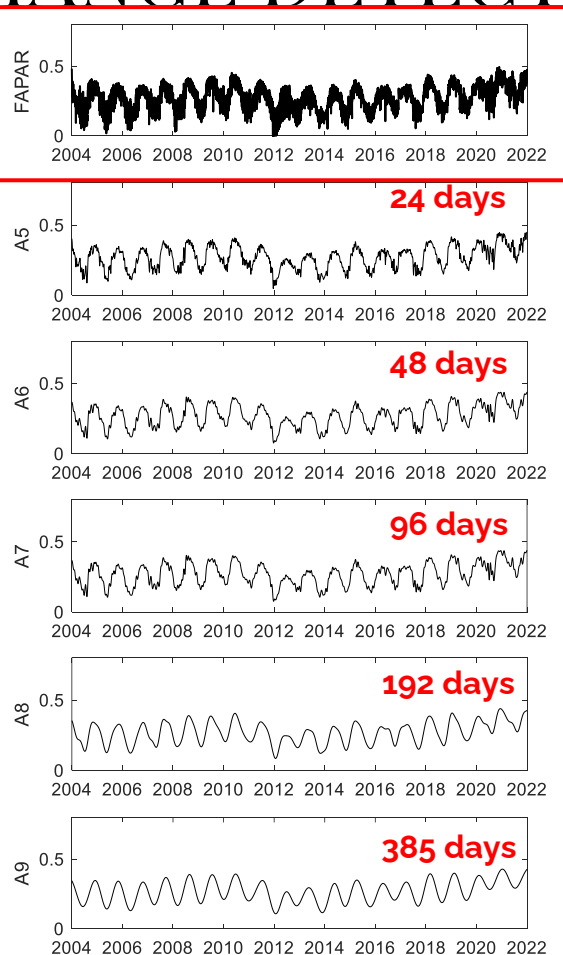
□ MRA-WT

$$f(t) = A_J(t) + \sum_{j=1}^J D_j(t)$$

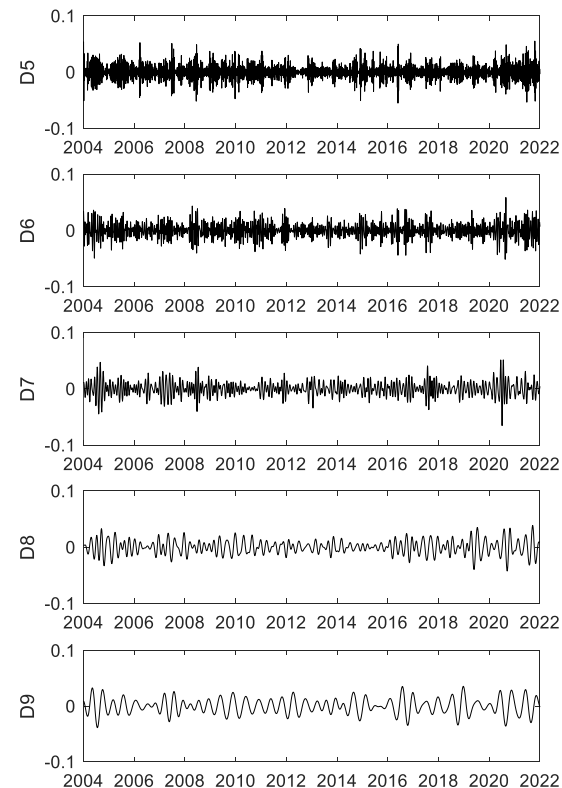


Level 9

$$f(t) = A_9 + \sum D_{1-9}$$



©Matlab



VEG. CHANGE DETECTION



□ MRA-WT

$$f(t) = A_J(t) + \sum_{j=1}^J D_j(t)$$

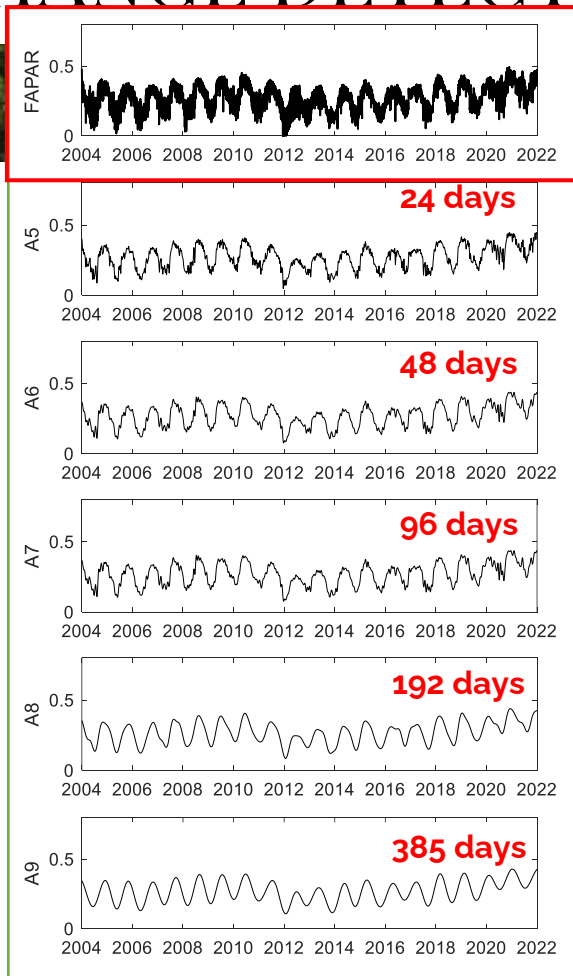
↓
Level 9

$$f(t) = A_9 + \sum D_{1-9}$$

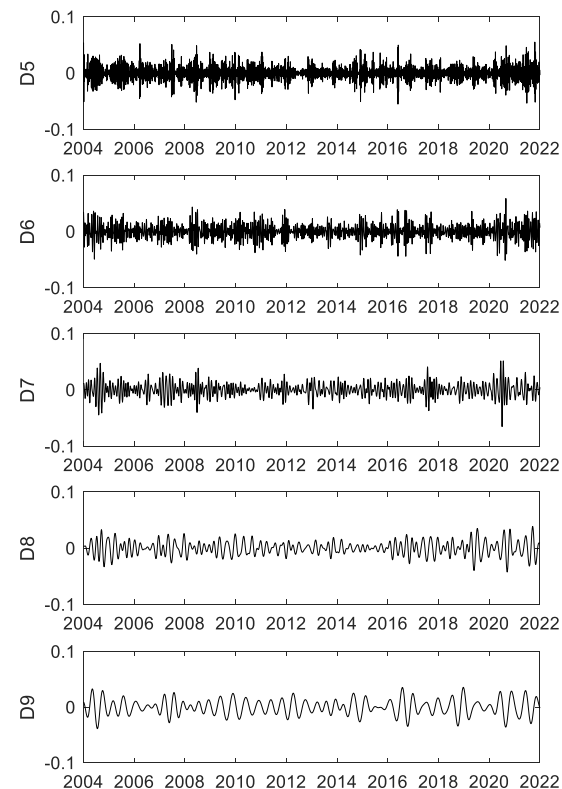
Inter-annual component

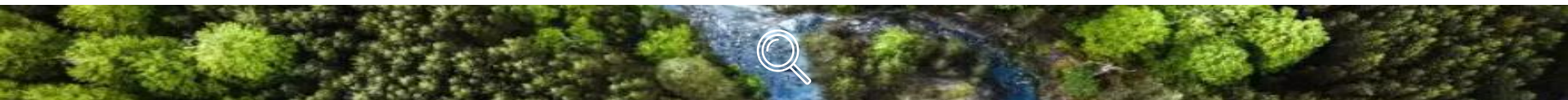


Magnitude and direction of
the slope using Mann-
Kendal and Theil-Sen



©Matlab





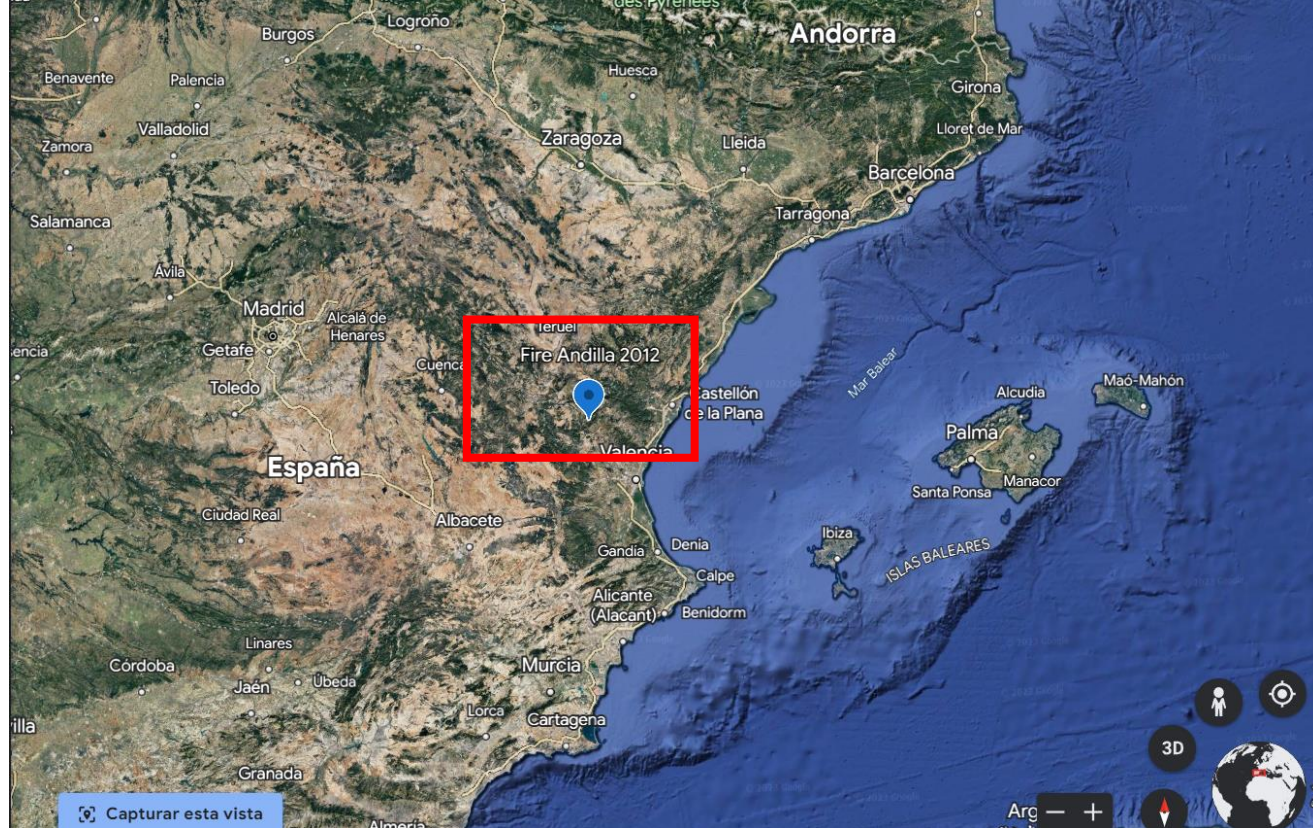
❑ Multiresolution analysis based on wavelet transform (MRA-WT)

VERY IMPORTANT, the MRA does not accomplish change detection on the signal.

The MRA is only a filter method that allows you to have different details components (D) or approximated components (A).

To perform the change detection → We chose the **Man kendall and Sen slope** method to evaluate the inter-annual changes.

The levels (j) in which you decompose the signal, will depend on the **mother wavelet** and **on the temporal resolution** of your data (*see eq.10 in 09-RSE paper*).



https://gitlab.com/helpdesk.landsaf/lasaf_data_access/-/blob/main/examples/thredds/thredds_msg_mdfapar_point.ipynb

```
# Change here your user credentials
server_user="training01"
server_passwd="training01LSASAF"
```

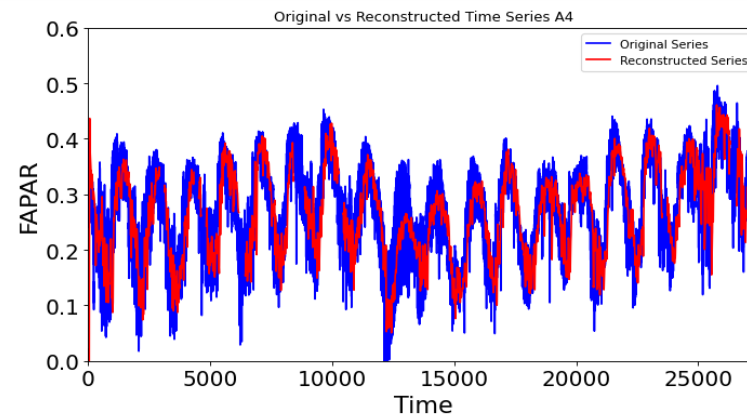
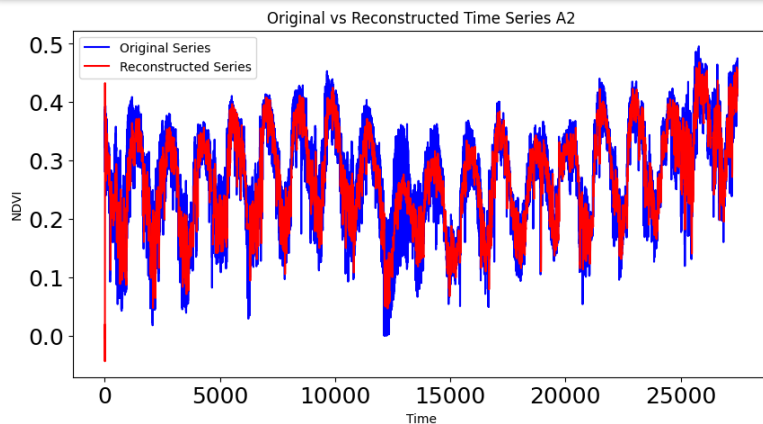
```
LatLonPoint = [39.03, -0.8]
```

VEG. CHANGE DETECTION

```
import pywt
wavelet = 'sym4'
level = 4
# Perform wavelet decomposition to obtain the approximation and detail coefficients at each level
coeffs = pywt.wavedec(data, wavelet, level=level)

# Extract the approximation coefficients at level 4
approx_coeffs_level_4 = coeffs[0]
# Perform wavelet reconstruction using only the approximation coefficients
reconstructed_series = pywt.upcoef('a', approx_coeffs_level_4, wavelet,
level=level)[:len(data)]
```

Python (google colab)

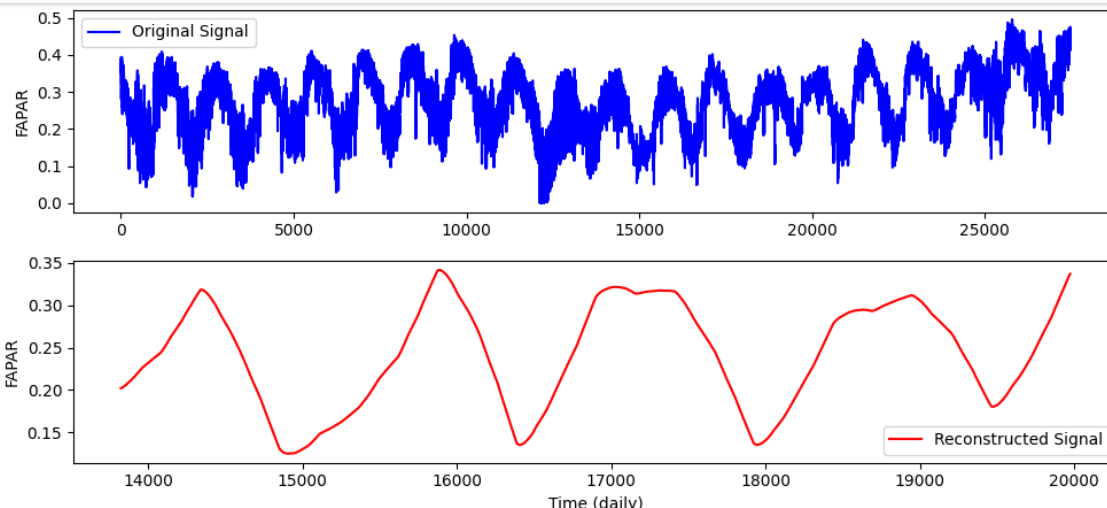


VEG. CHANGE DETECTION

```
wavelet = 'sym4'  
level = 9
```

Python (google colab)

```
# Perform wavelet decomposition to obtain the approximation and detail coefficients at each level  
coeffs = pywt.wavedec(data, wavelet, level=level)  
# Extract the approximation coefficients at level 9  
approximation_coeffs = coeffs[0]  
#WAVEREC  
# Perform wavelet reconstruction using only the approximation coefficients  
reconstructed_signal = pywt.waverec([approximation_coeffs] + [None] * level, wavelet)
```



<https://pywavelets.readthedocs.io/en/latest/ref/2d-decompositions-overview.html>

VEG. CHANGE DETECTION



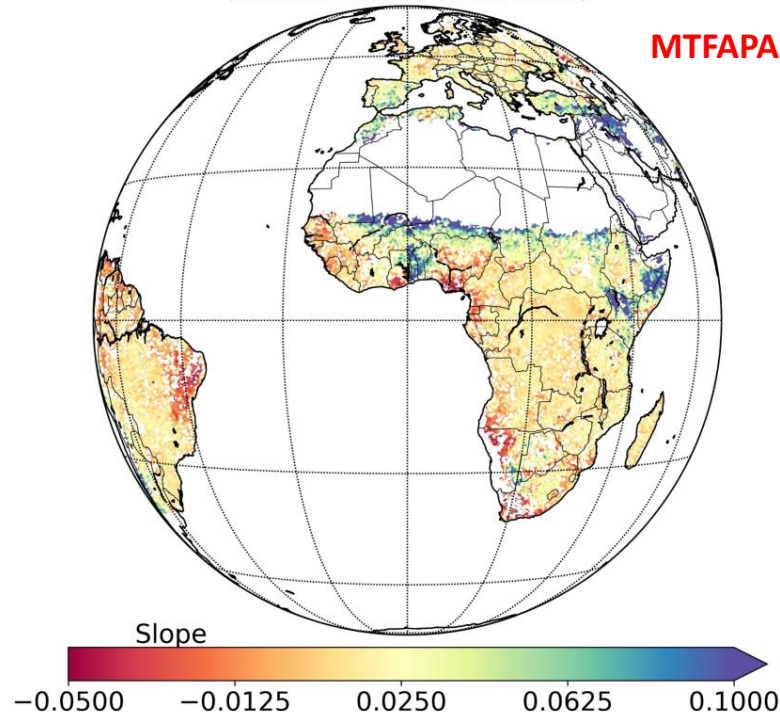
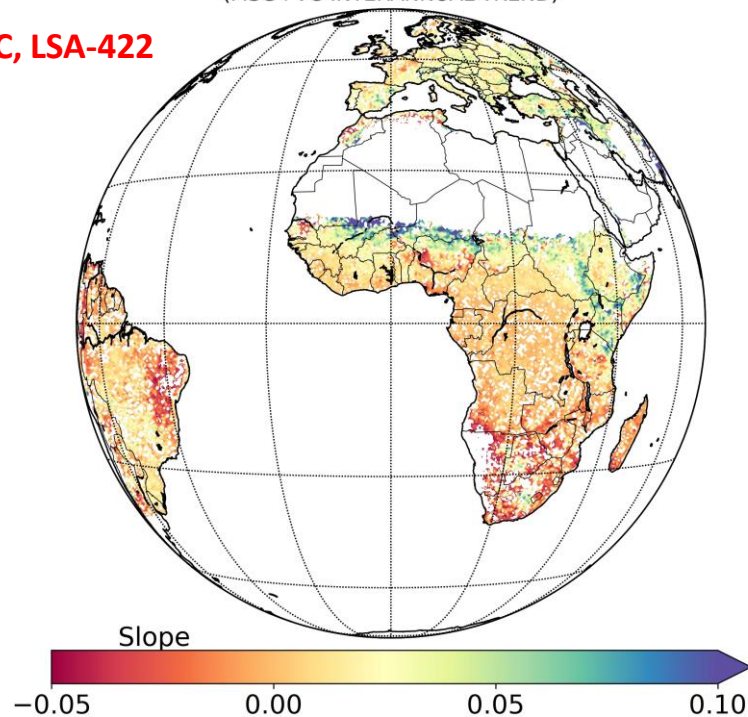
☐ MRA-WT to FAPAR and FVC CDR (2005-2020)

(MSG FVC-INTERANNUAL TREND)

(MSG FAPAR-INTERANNUAL TREND)

MTFVC, LSA-422

MTFAPAR, LSA-426



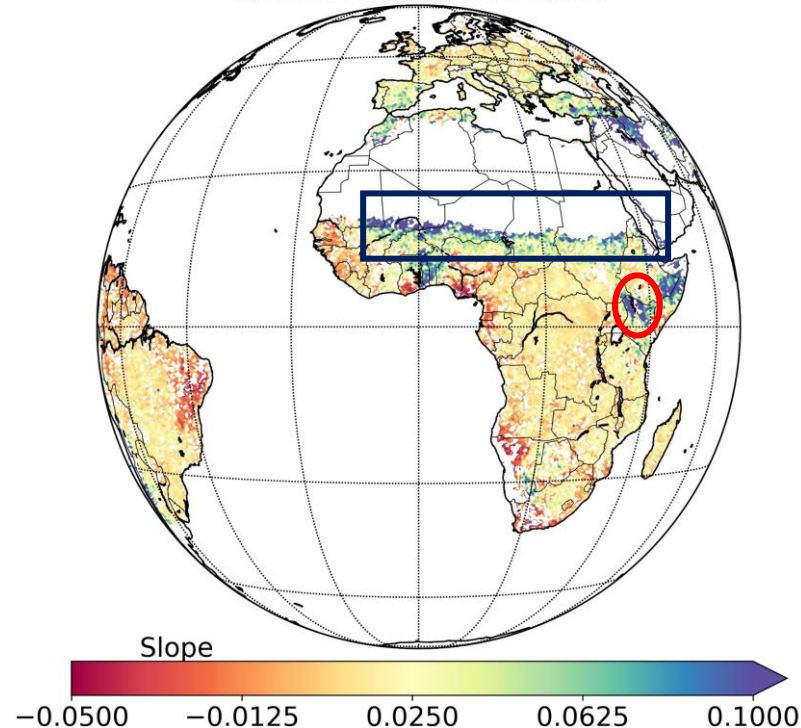
VEG. CHANGE DETECTION

□ MRA-WT to FAPAR and FVC CDR (2005-2020)

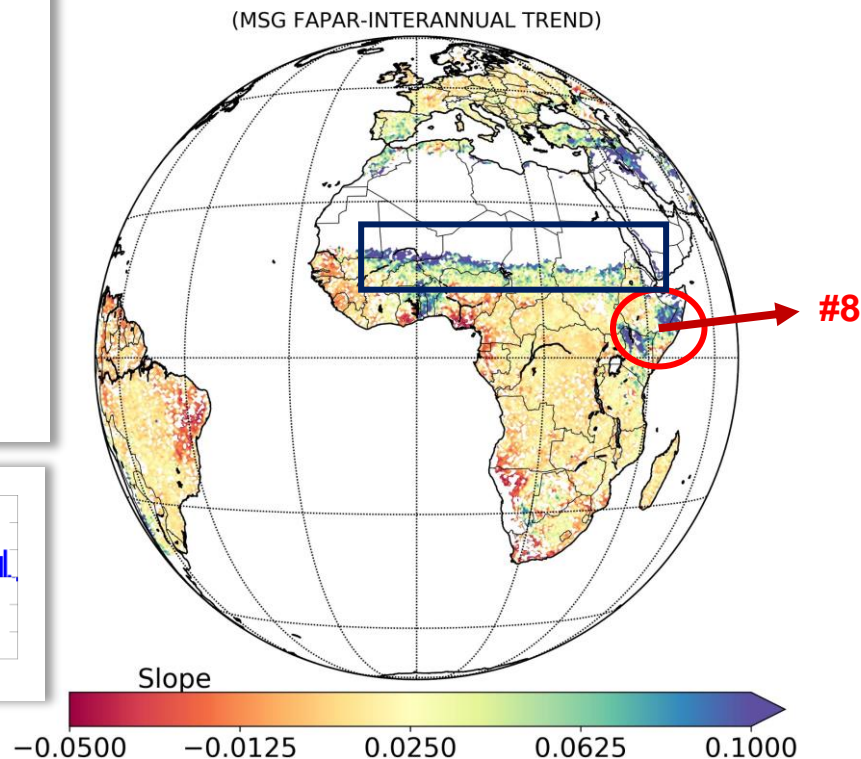
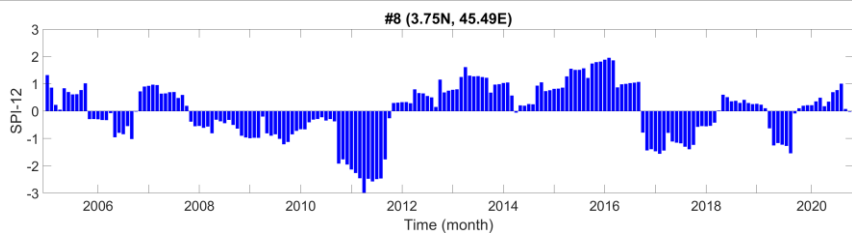
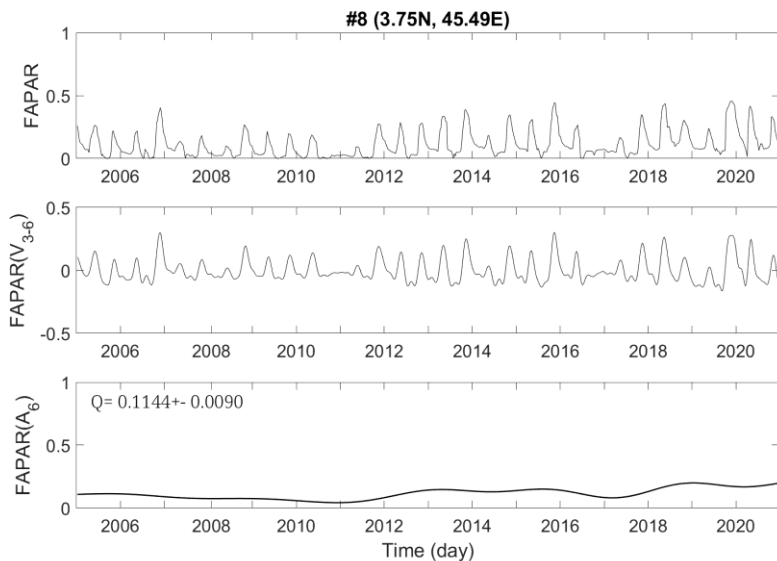
(MSG FAPAR-INTERANNUAL TREND)

Extreme values → Red and blue

A *greening* is observed concentrated on 10° N and 16° N, particularly in the central and eastern Sahel region and east part of Africa (Horn of Africa), which, particularly, was affected by severe drought periods in 2011 and 2016-2017.



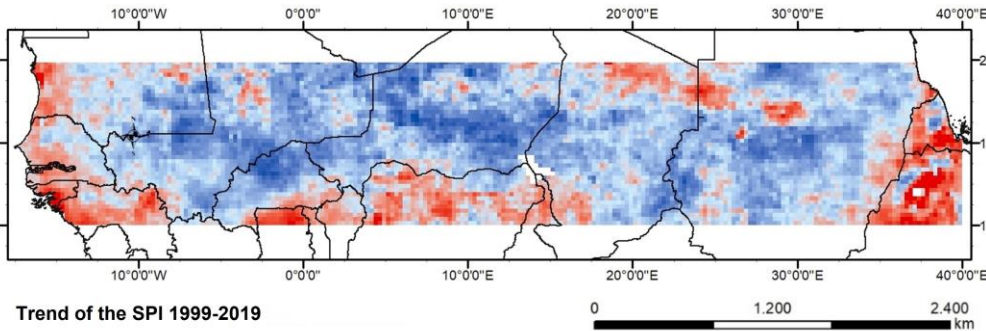
VEG. CHANGE DETECTION



VEG. CHANGE DETECTION

☐ MRA-WT to FAPAR and FVC CDR (2005-2020)

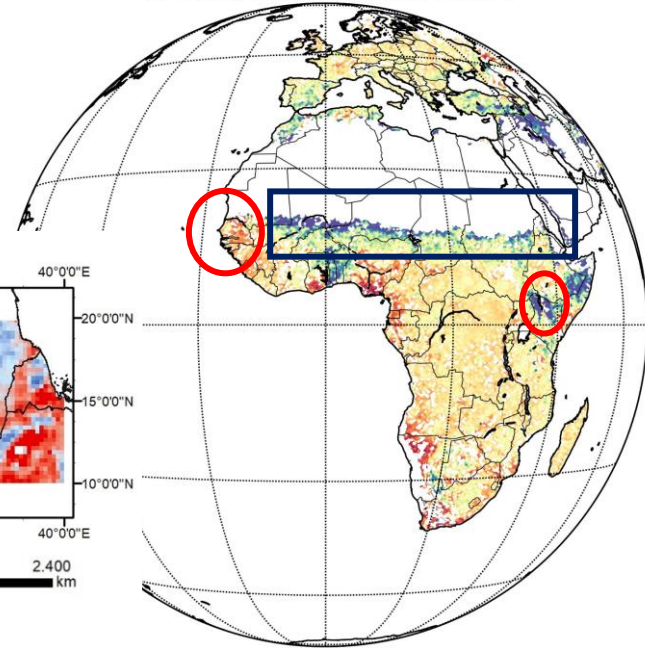
SPI index computed from GPM data (GPM3IMERG, monthly and $0.1^\circ \times 0.1^\circ$ temporal and spatial resolutions).



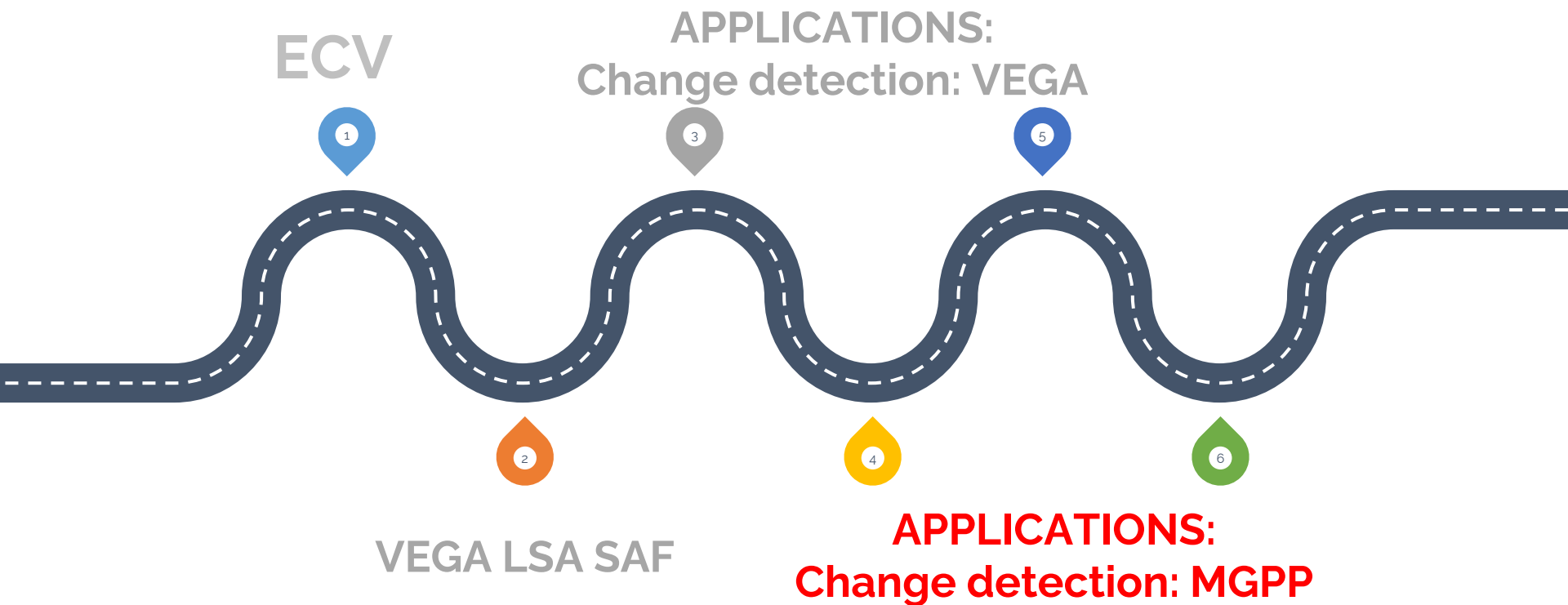
Trend of the SPI 1999-2019



(MSG FAPAR-INTERANNUAL TREND)

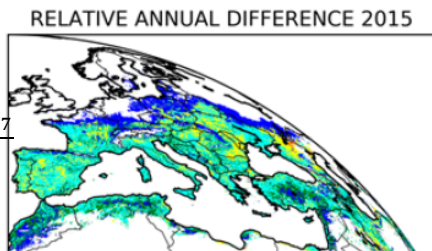


Roadmap

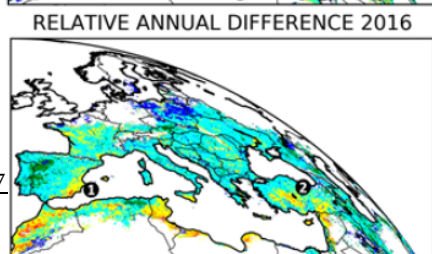


VEG. CHANGE DETECTION

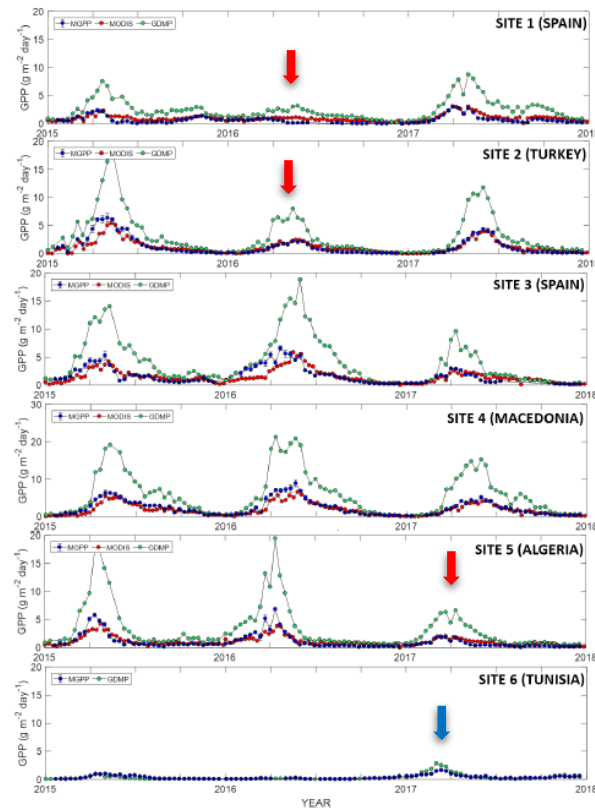
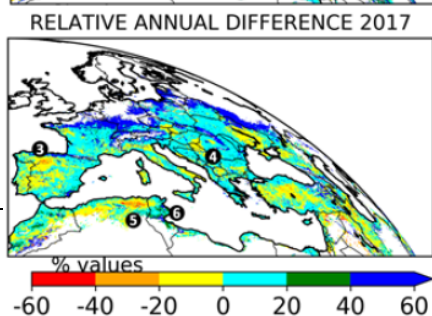
$$\frac{\overline{FAPAR}_{2015} - \overline{FAPAR}_{2015-2017}}{\overline{FAPAR}_{2015-2017}}$$



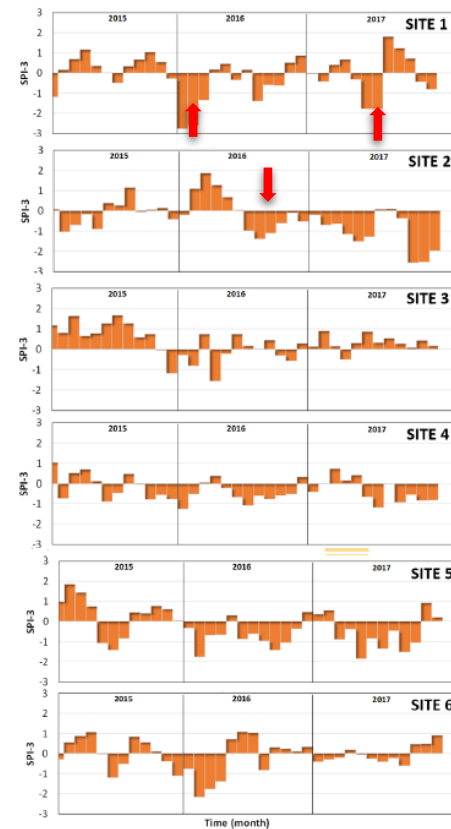
$$\frac{\overline{FAPAR}_{2016} - \overline{FAPAR}_{2015-2017}}{\overline{FAPAR}_{2015-2017}}$$



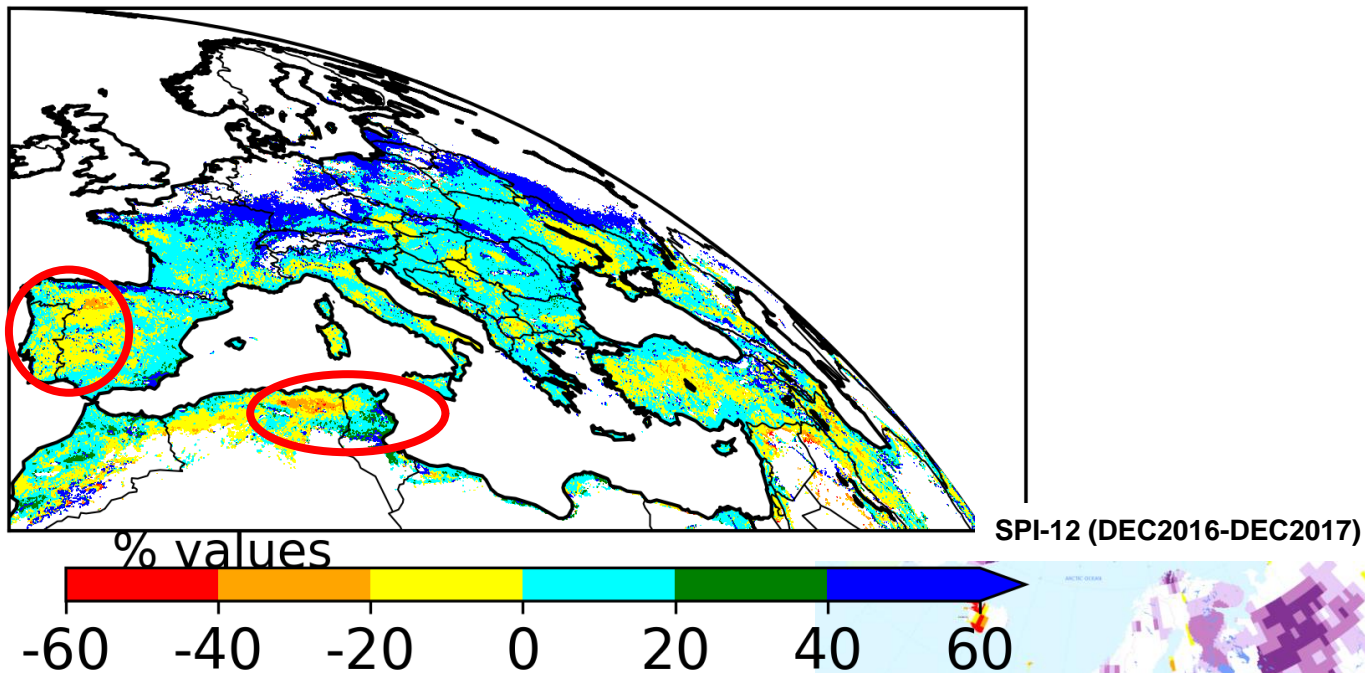
$$\frac{\overline{FAPAR}_{2017} - \overline{FAPAR}_{2015-2017}}{\overline{FAPAR}_{2015-2017}}$$



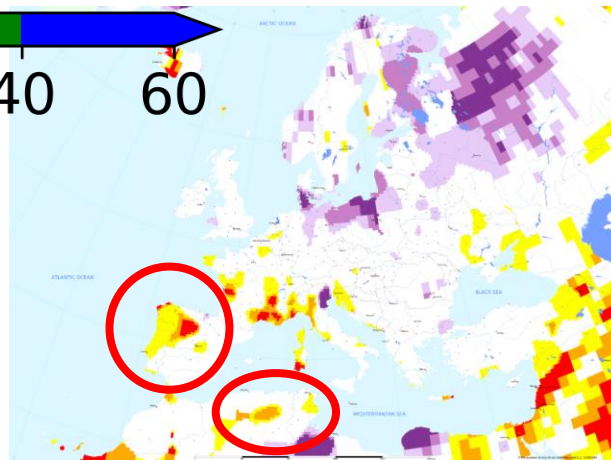
SPI-3 months



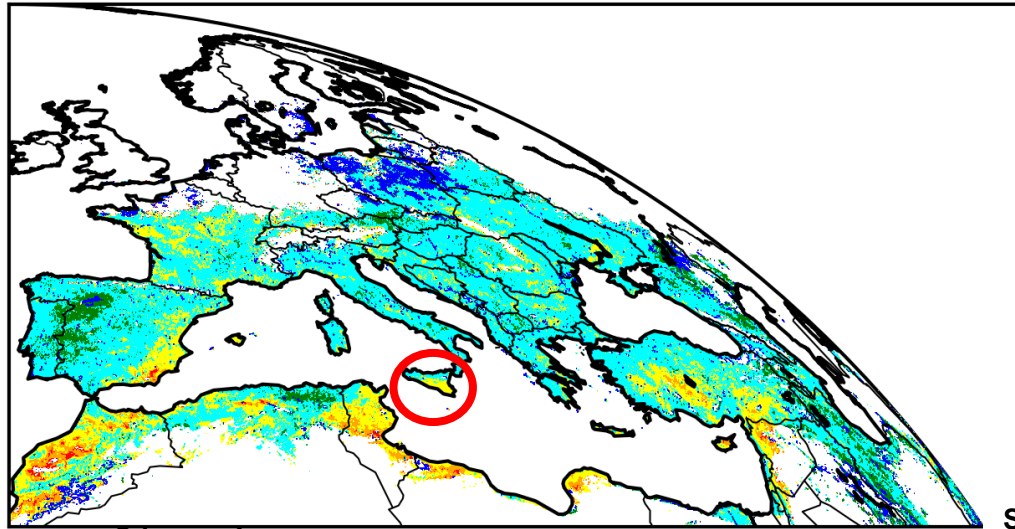
RELATIVE ANNUAL DIFFERENCE 2017



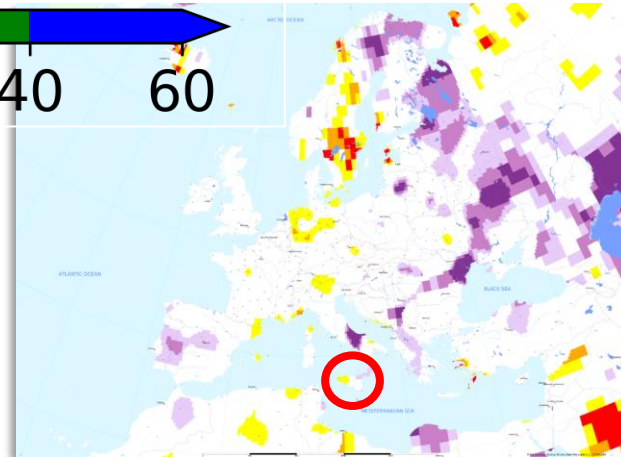
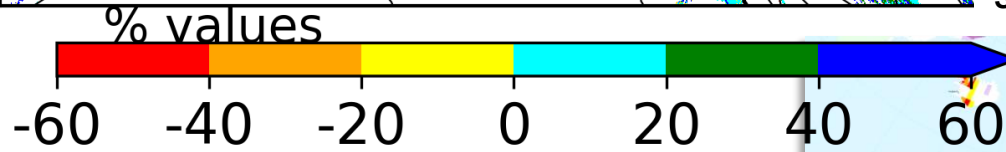
Standardized Precipitation Index (SPI) values provided
by the European Drought Observatory system.
(<https://edo.jrc.ec.europa.eu>)



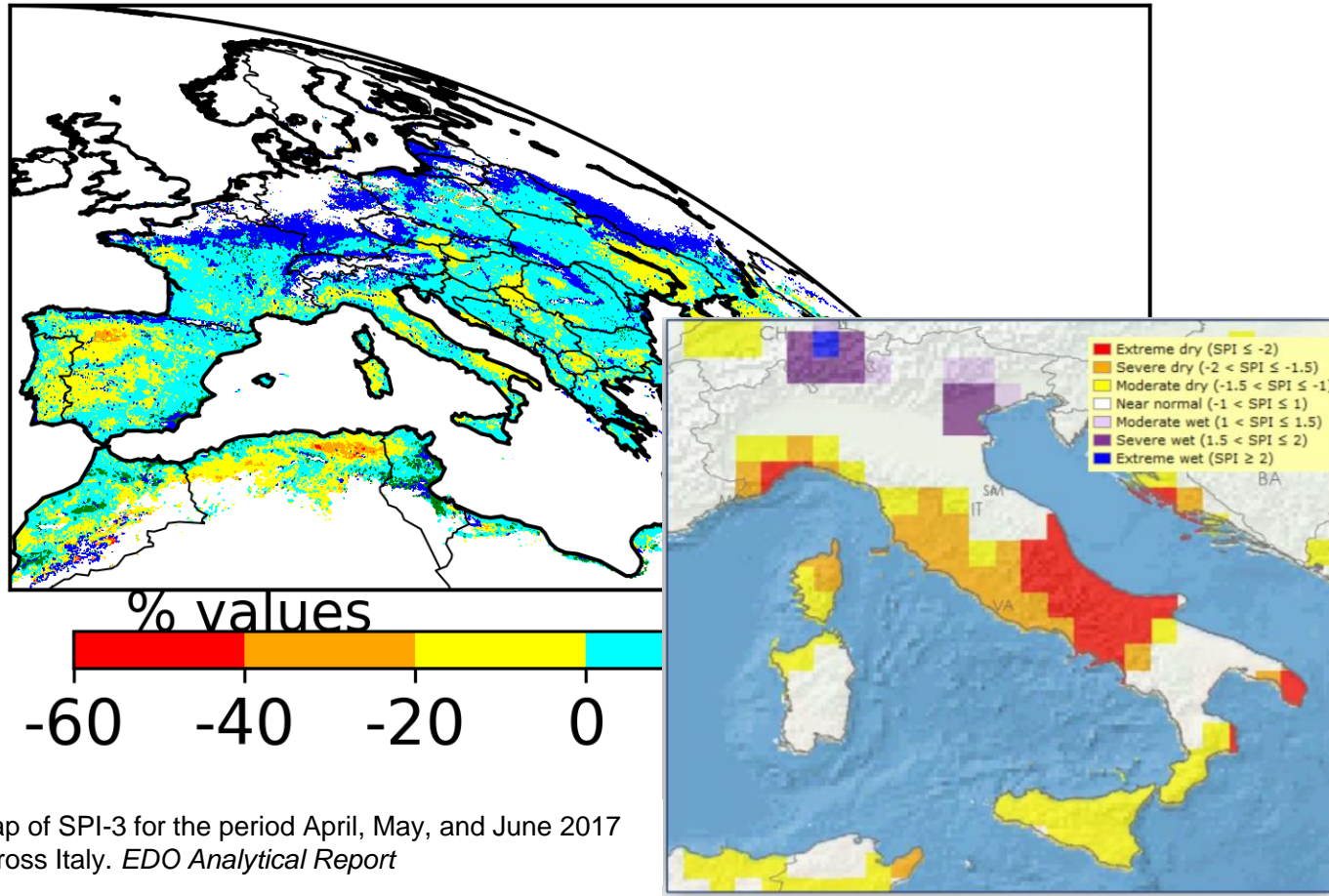
RELATIVE ANNUAL DIFFERENCE 2016



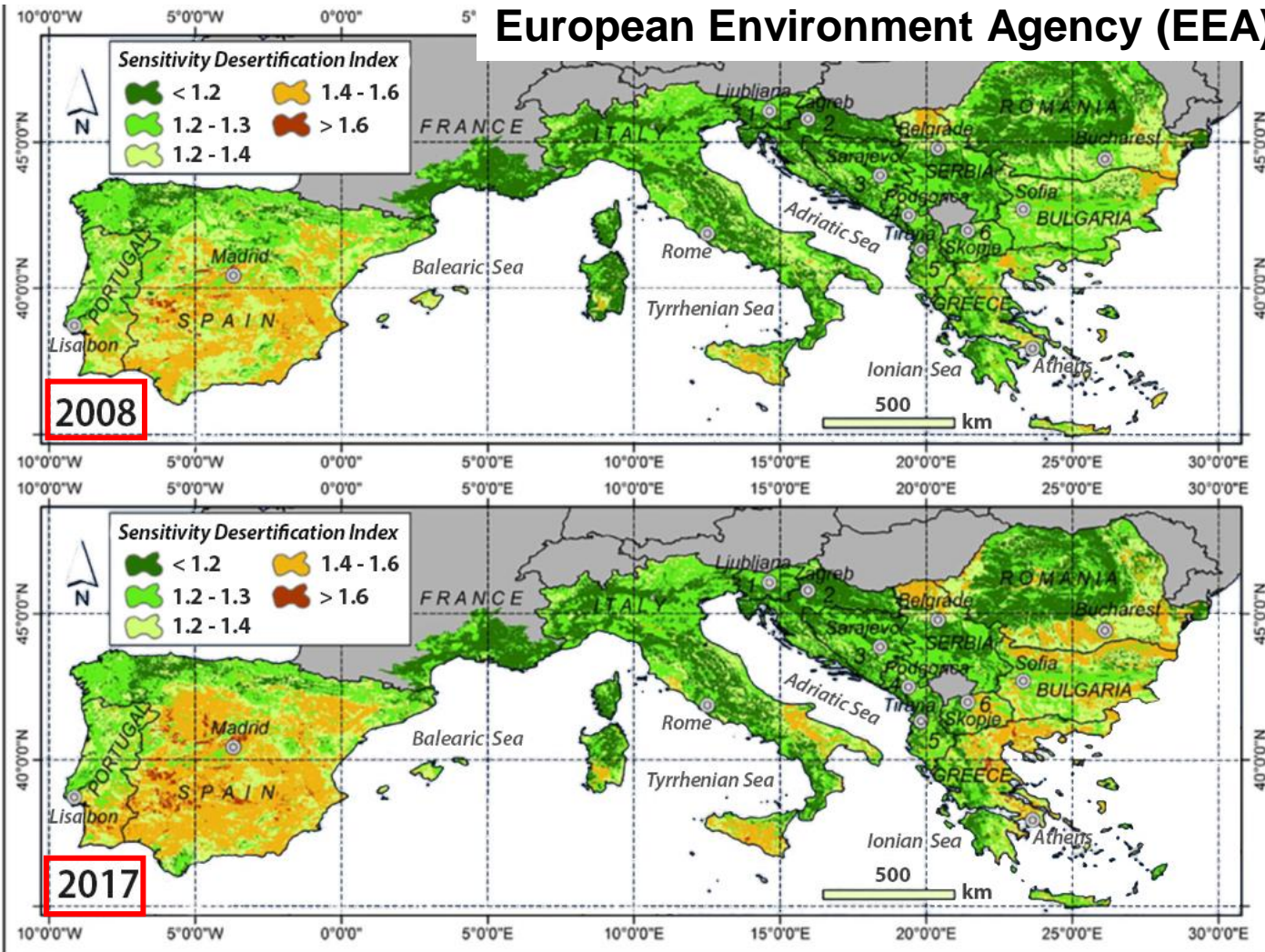
SPI-12 (DEC2015-DEC2016)



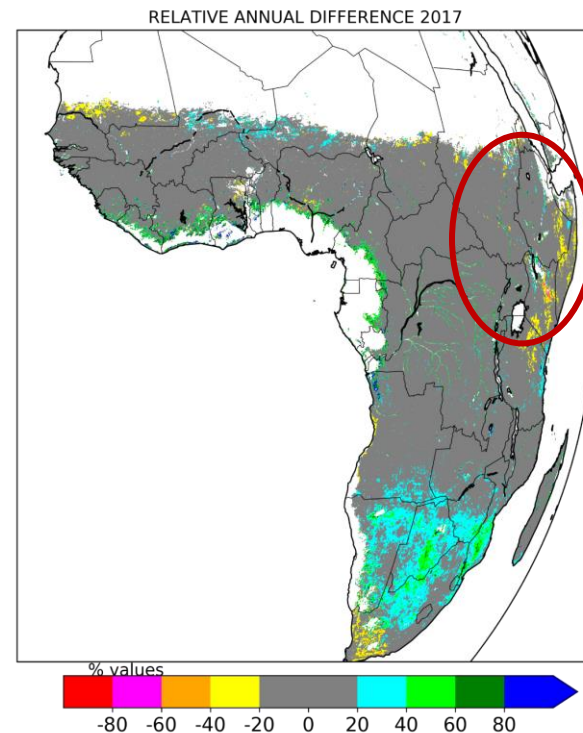
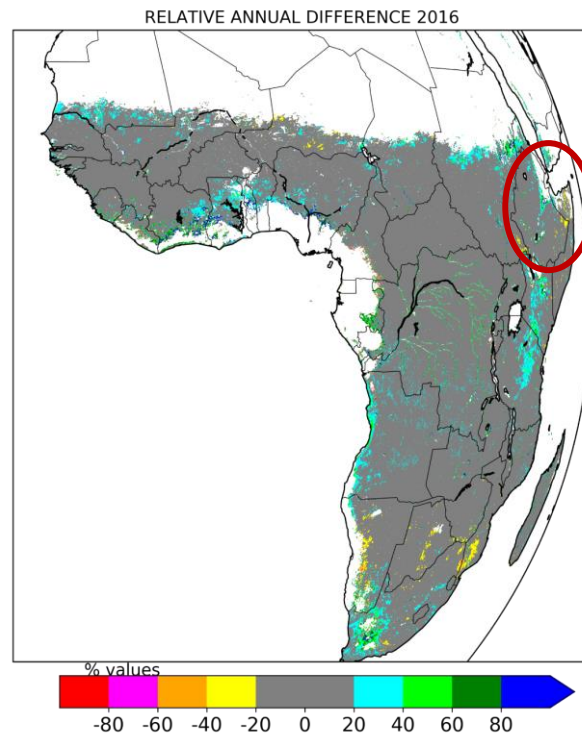
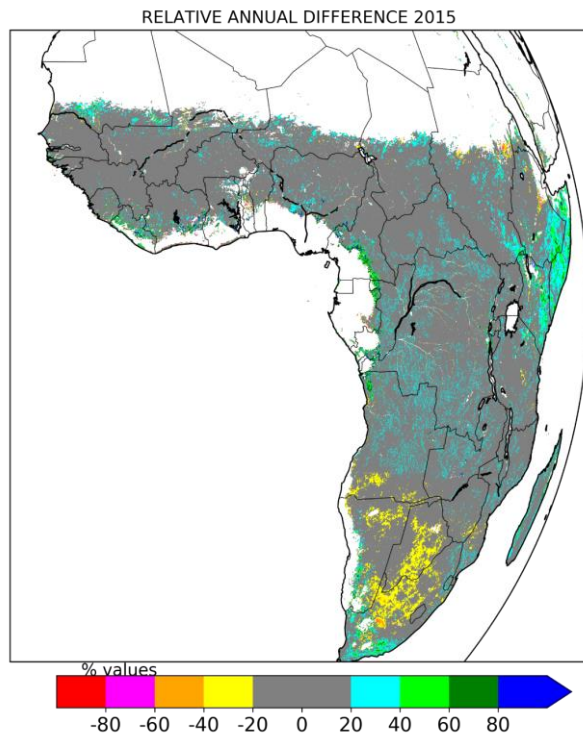
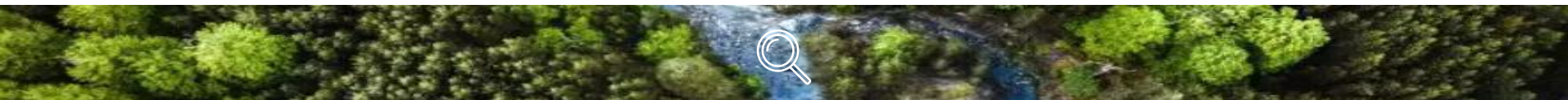
RELATIVE ANNUAL DIFFERENCE 2017



Map of SPI-3 for the period April, May, and June 2017 across Italy. *EDO Analytical Report*



VEG. CHANGE DETECTION



Messages to take home....



- **CLIMATE DATA RECORD of MSG VEGA (LAI, FVC, FAPAR) products** have shown to be a good alternative for vegetation change detection at MSG scale.
- **Ecosystem change detection understanding** can strongly benefit when other CDR are available, such as DMET [LSA-312].
- **The future MGPP** CDR will contribute to the knowledge of how these weather extremes events are affecting our ecosystem and also how it is adapting.
- **Important issues** in vegetation change detection analysis: Considered method, variables used and analyzed time period.

Thanks!

Any questions?

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- Beatriz.martinez@uv.es
- @UVERS2
- <https://www.uv.es/uvers>

