ACCWA

Accounting for Climate Change in Water and Agriculture management

H2020-MSCA-RISE-2018, 2019- 2024

Grant agreement no: 823965

2nd Conference on SPACE STAR
18th – 20th October 2023, Sousse, Tunisia

Marie Curie Actions
HORIZON 2020

ACCWA


Baseline Water Stress
Low (<10%)
Low to medium (10-20%)
Medium to high (20-40%)
High (40-80%)
Extremely high (>80%)
Arid & low water use
No data
Definition
Baseline water stress measures the ratio of total annual water withdrawals to total available annual renewable supply, accounting for upstream consumptive use. Higher values indicate more competition among users.
Sources: WRI Aqueduct 2014; FAO AQUASTAT 2008-2012; NASA GLDAS-2 2012; Shiklomanov and Rodda 2004; Flörke et al. 2012; Matsutomi et al. 2009
IRELAND
NETHERLANDS
GERMANY
POLAND
BELARUS
UKRAINE
FRANCE
AUSTRIA
HUNGARY
ROMANIA
CROATIA
SERBIA
BULGARIA
ITALY
SPAIN
PORTUGAL
TURKEY
SYRIA
IRAQ
CYPRUS
LEBANON
ISRAEL
MALTA
TUNISIA
MOROCCO
Celtic Sea
English Channel
Bay of Biscay
Tyrrhenian Sea
Adriatic Sea
Ionian Sea
Aegean Sea
Black Sea
Caspian Sea
Mediterranean Sea

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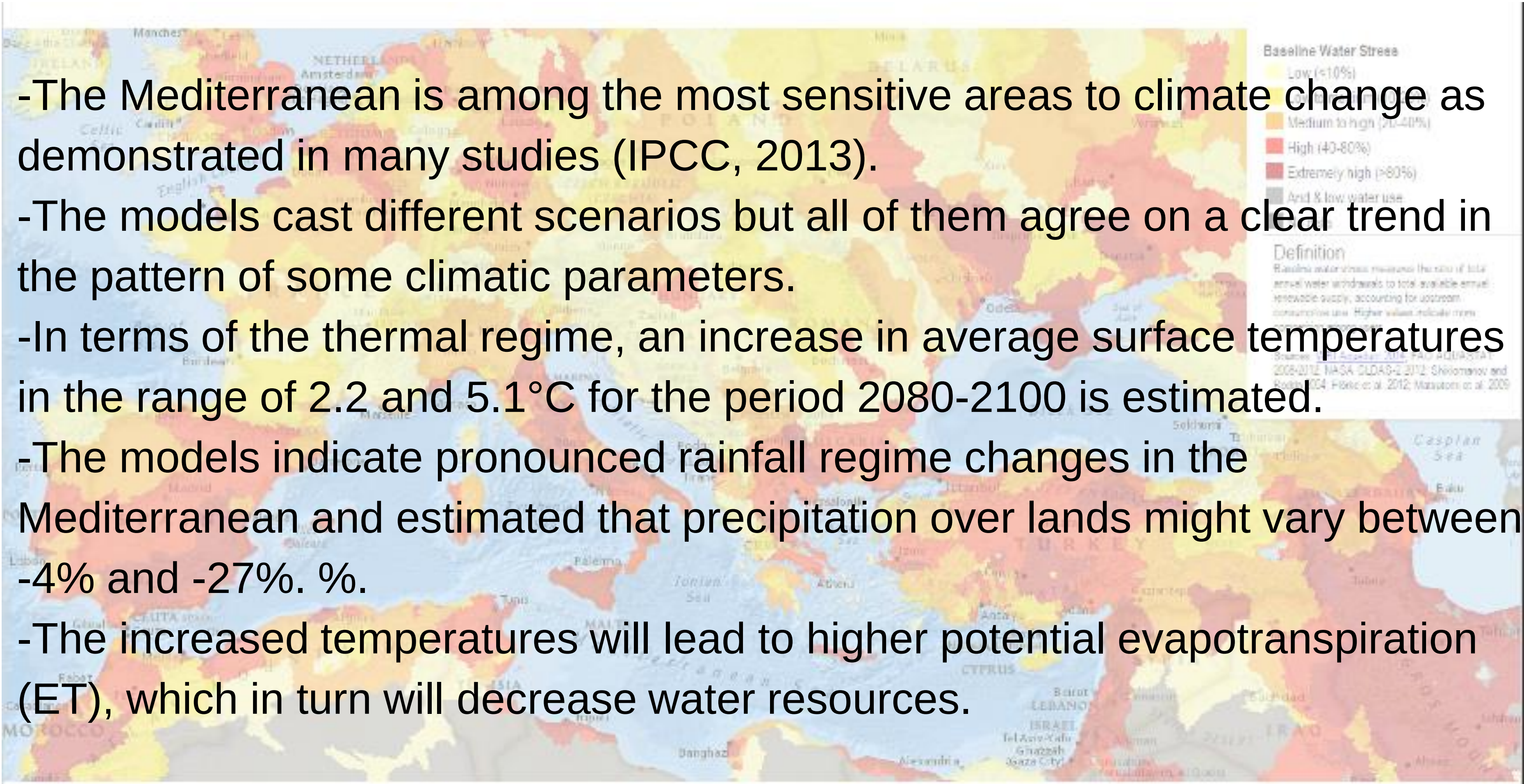

-The Mediterranean is among the most sensitive areas to climate change as demonstrated in many studies (IPCC, 2013).

-The models cast different scenarios but all of them agree on a clear trend in the pattern of some climatic parameters.

-In terms of the thermal regime, an increase in average surface temperatures in the range of 2.2 and 5.1°C for the period 2080-2100 is estimated.

-The models indicate pronounced rainfall regime changes in the Mediterranean and estimated that precipitation over lands might vary between -4% and -27%. %.

-The increased temperatures will lead to higher potential evapotranspiration (ET), which in turn will decrease water resources.

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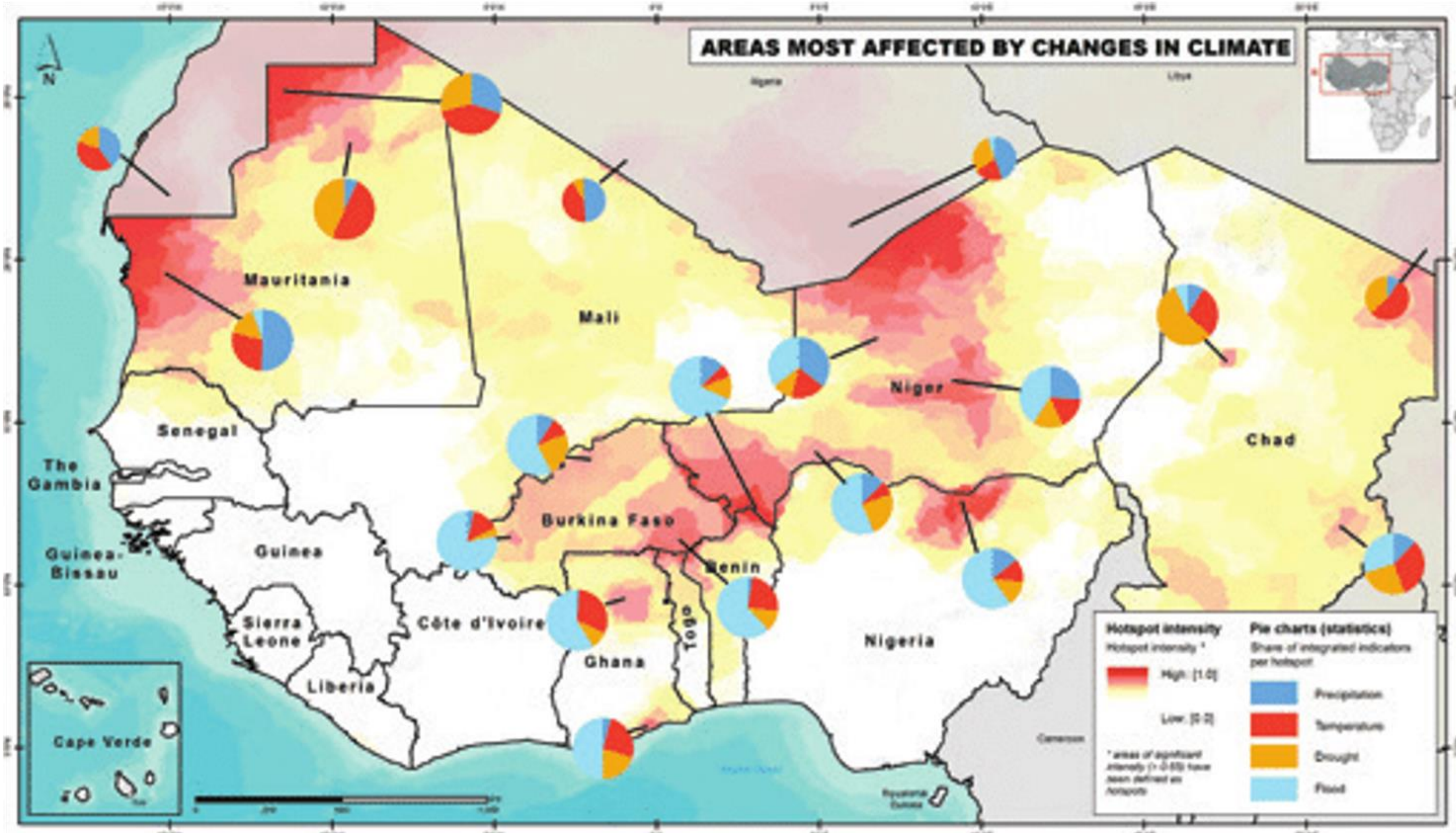
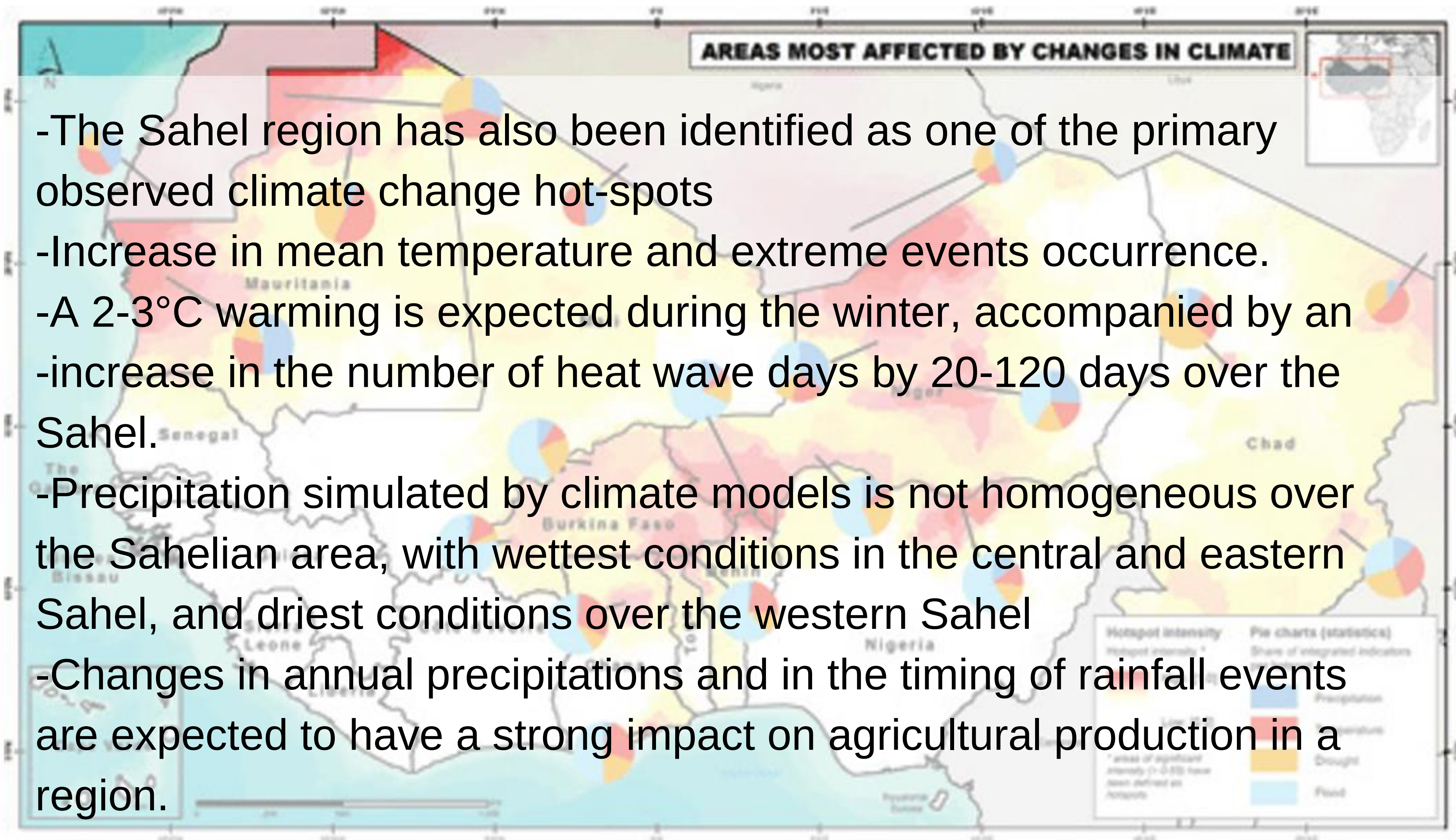

AREAS MOST AFFECTED BY CHANGES IN CLIMATE
Mauritania
Mali
Niger
Chad
Senegal
The Gambia
Guinea-Bissau
Guinea
Burkina Faso
Benin
Sierra Leone
Liberia
Côte d'Ivoire
Ghana
Togo
Nigeria
Cape Verde
Hotspot intensity
Pie charts (statistics)
Precipitation
Temperature
Drought
Flood



-The Sahel region has also been identified as one of the primary observed climate change hot-spots

-Increase in mean temperature and extreme events occurrence.

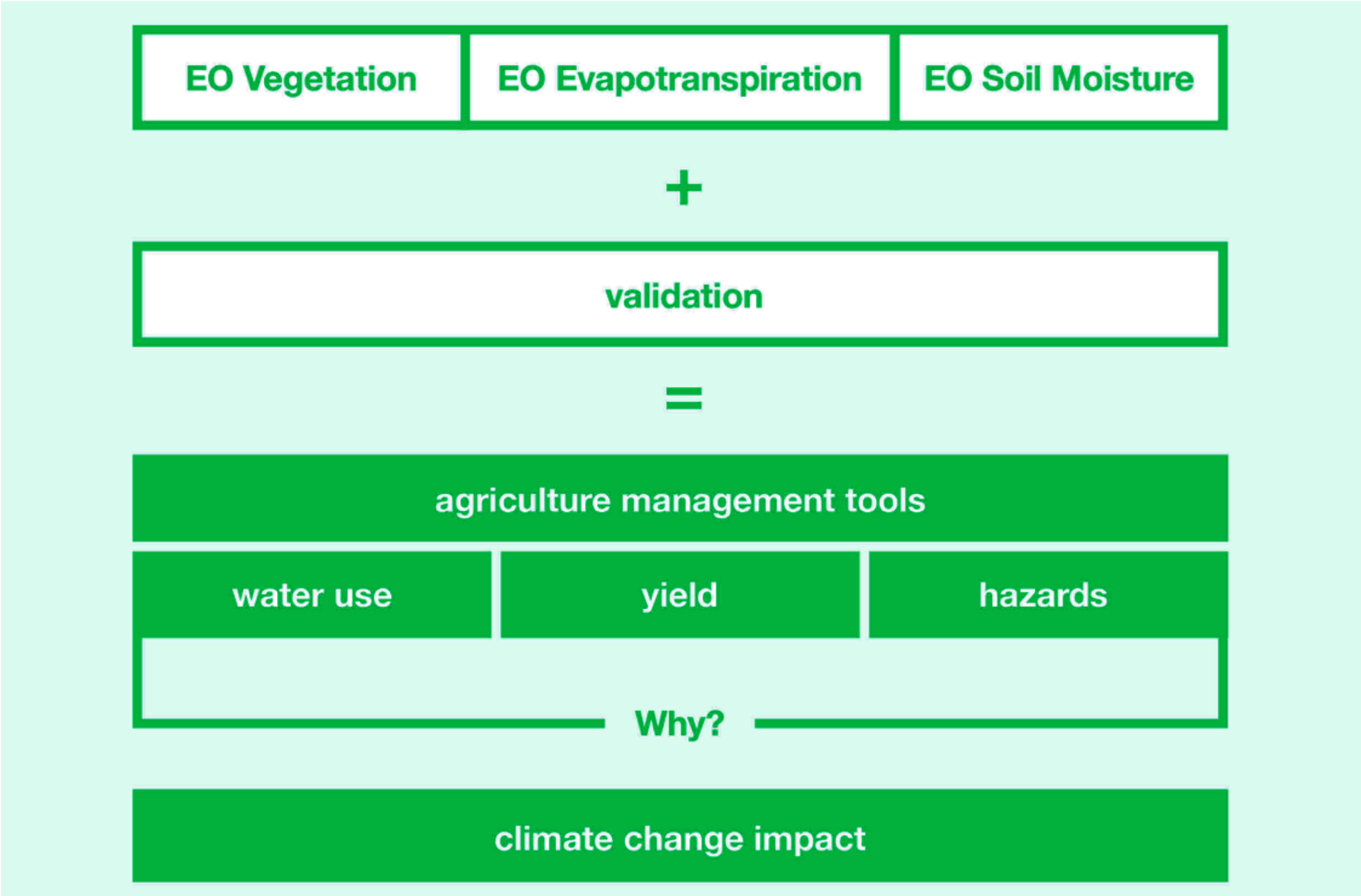
-A 2-3°C warming is expected during the winter, accompanied by an

-increase in the number of heat wave days by 20-120 days over the Sahel.

-Precipitation simulated by climate models is not homogeneous over the Sahelian area, with wettest conditions in the central and eastern Sahel, and driest conditions over the western Sahel

-Changes in annual precipitations and in the timing of rainfall events are expected to have a strong impact on agricultural production in a region.

Objectives

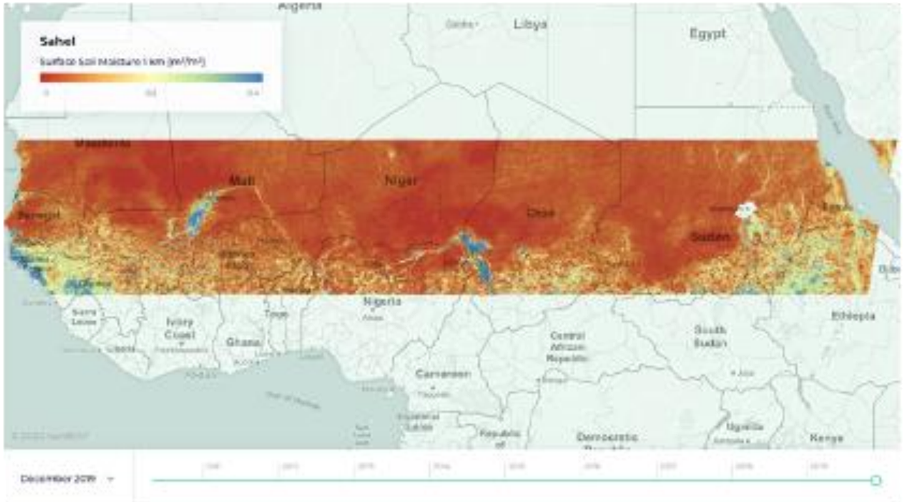


ACCWA aims to develop the remote sensing based management and monitoring tools for food security and water & agricultural risk management that allow improving the reliability of decision making regarding water use, yield and hazards in agriculture.

EO SM

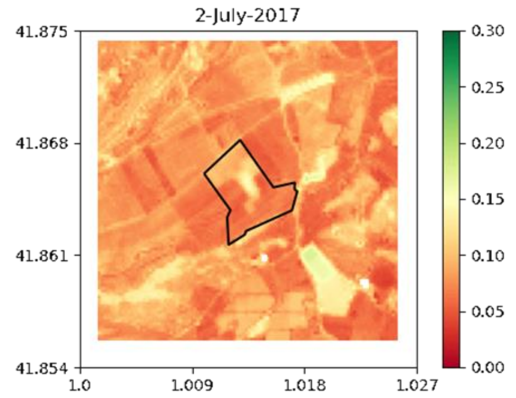
- **Continuous improvement SM 1km product (SMOS/SMAP, MODIS/S3)**
- **RZSM 1km**

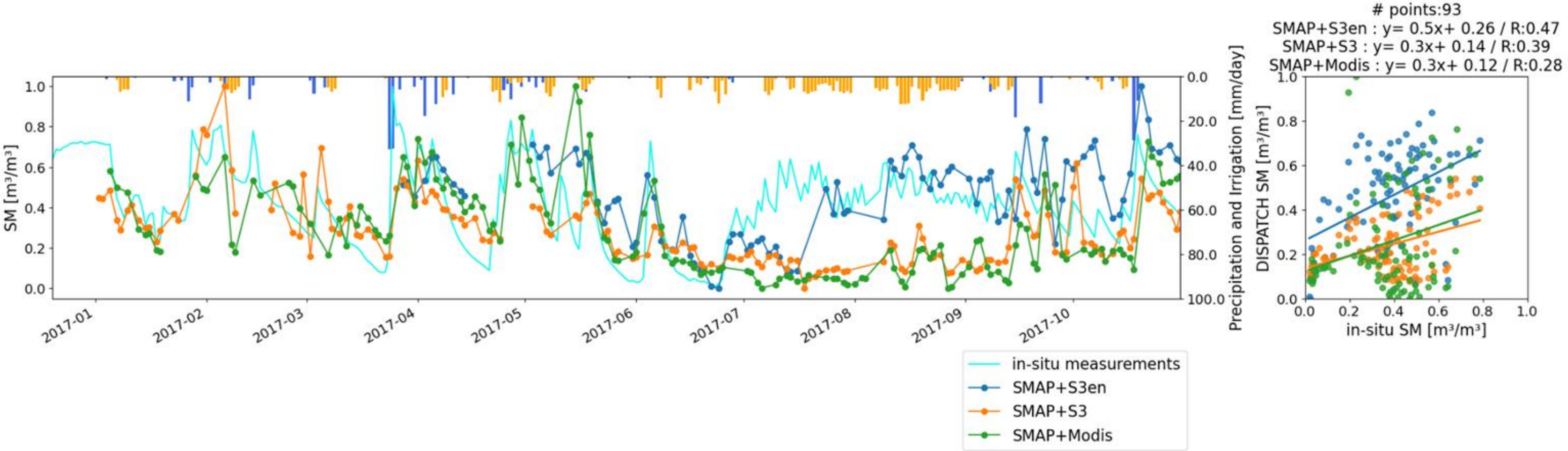
Data	From surface to root-zone soil moisture derived from L-band MW
Temporal coverage	since 2010
Spatial coverage	Global
Temporal resolution	every 1/2 days
Spatial resolution	1 km
Delivery	WMS, FTP, direct download



High resolution soil moisture, disaggregation with SMOS/SMAP in combination with thermal/optical data S3/MODIS (Merlin et al. 2013, Stefan et al. 2021)

- **SM at field scale from SMAP S3/S2**





Paolini et al. "Disaggregation of SMAP soil moisture at 20 m resolution: Validation and sub-field scale analysis." Remote Sensing 14.1 (2021): 167.

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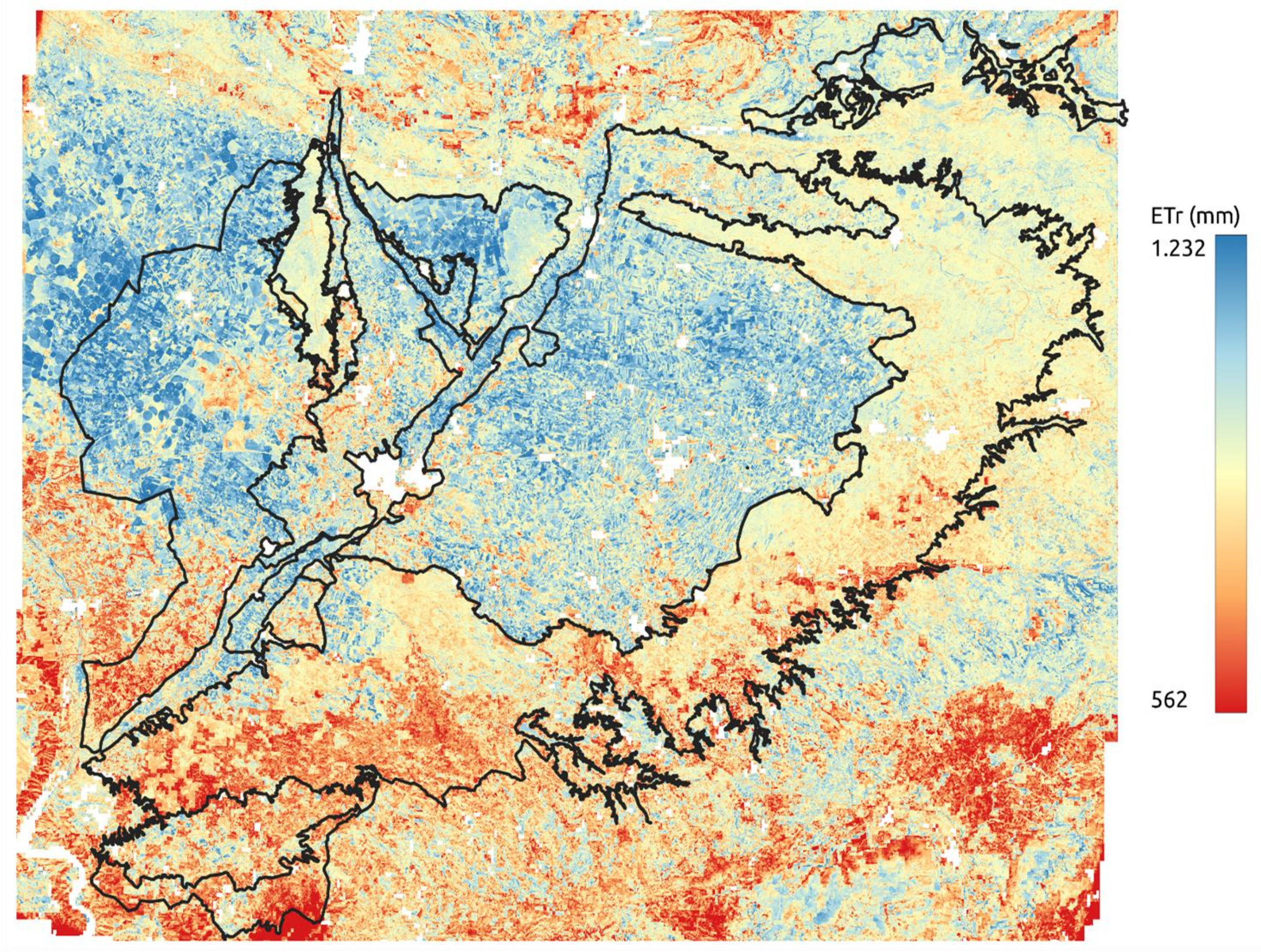
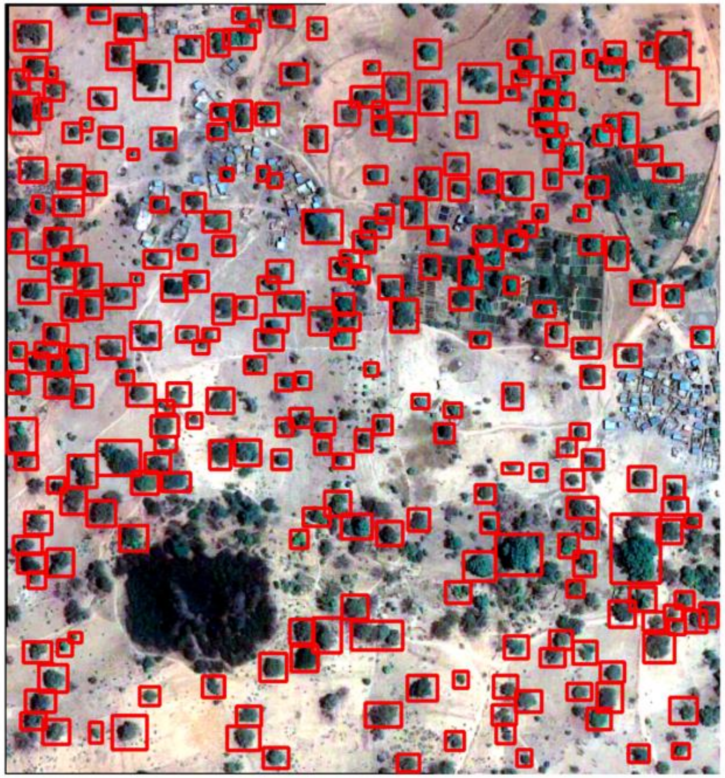
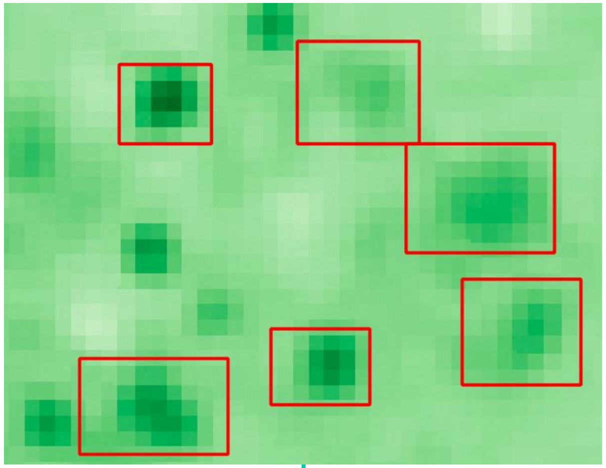
ET based on S3/S2 synergy

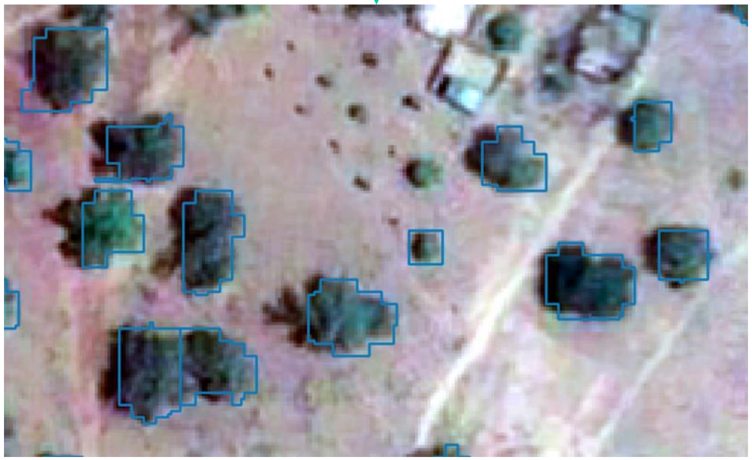


Marti Perpinya PhD : CO_2 capture modelling through satellite imagery and artificial intelligence at different resolutions

Very High Resolution - Individual Tree Level



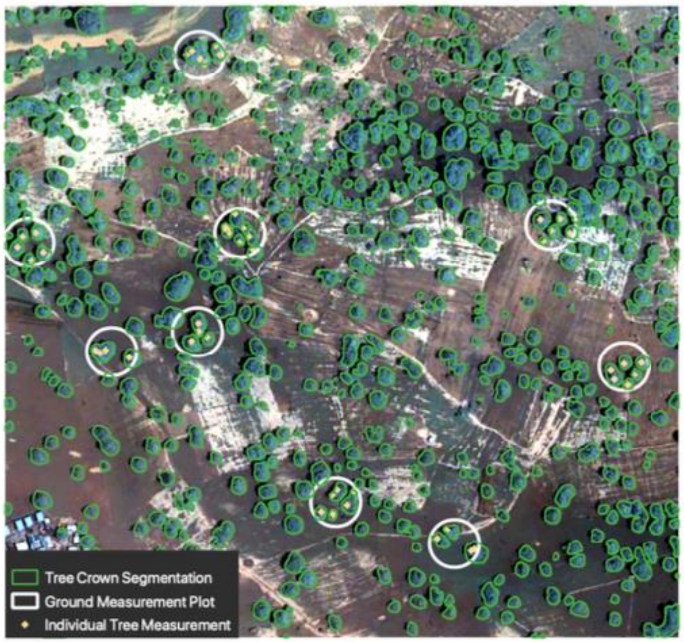


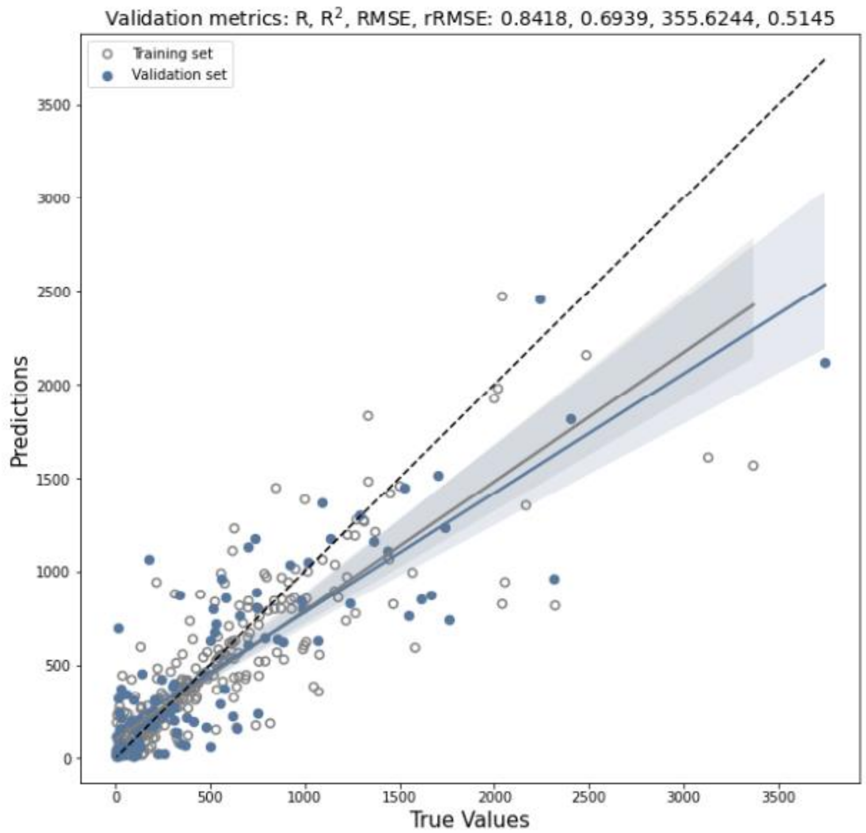


Detection of individual trees and NDVI thresholding for posterior segmentation of tree crown.

Marti Perpinya PhD : CO_2 capture modelling through satellite imagery and artificial intelligence at different resolutions

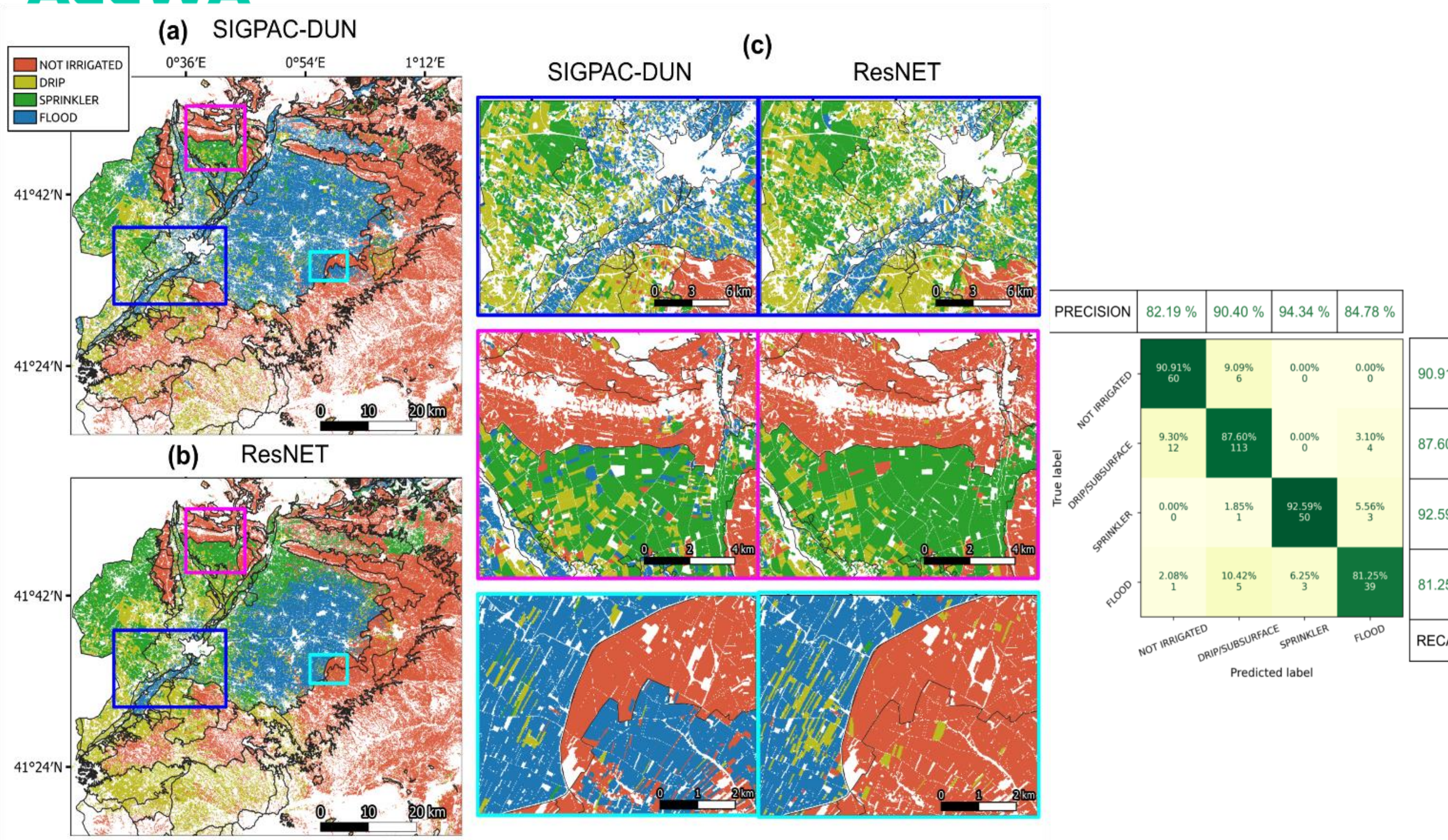
Very High Resolution - Individual Tree Level





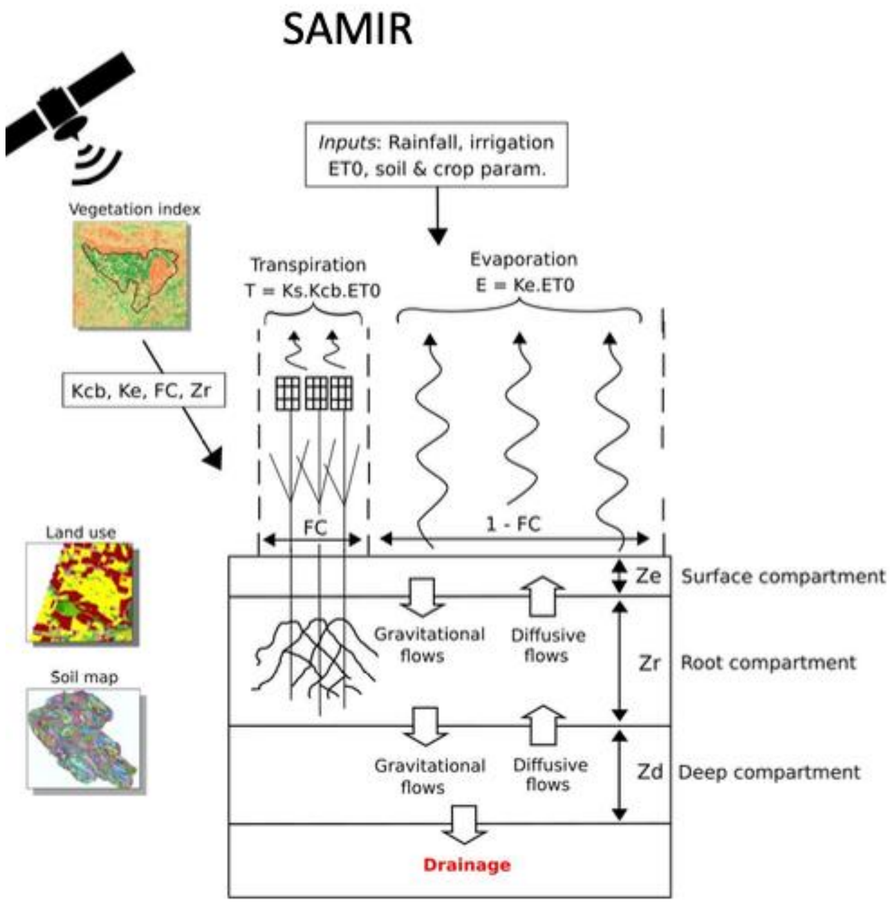
Perpinya et al. Quantification of carbon stocks at the individual tree level in semi-arid regions in Africa, *submitted to RSE*

Water Use

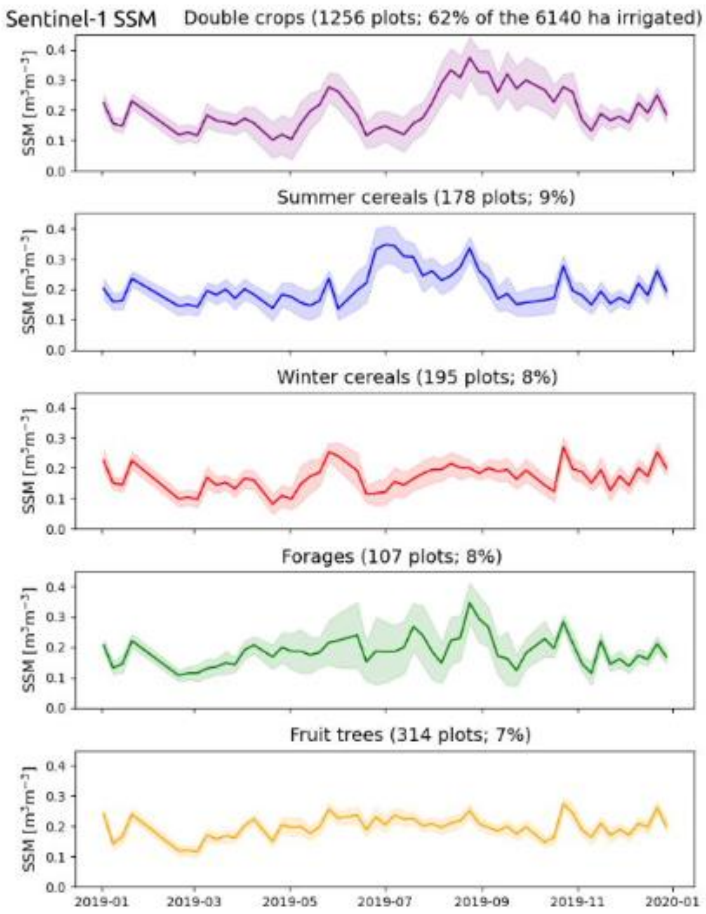


Paolini*, et al. "Classification of Different Irrigation Systems at Field Scale Using Time-Series of Remote Sensing Data." IEEE Journal of Selected Topics in Applied Earth Observations and Remote Sensing 15 (2022): 10055-10072.*

Water Use



SAMIR diagram, adapted from Simonneaux et al. 2008



Laluet, *et al. "Retrieving the irrigation actually applied at district scale: assimilating high-resolution Sentinel-1-derived soil moisture data into a FAO-56-based model" submitted to Agricultural Water Management*

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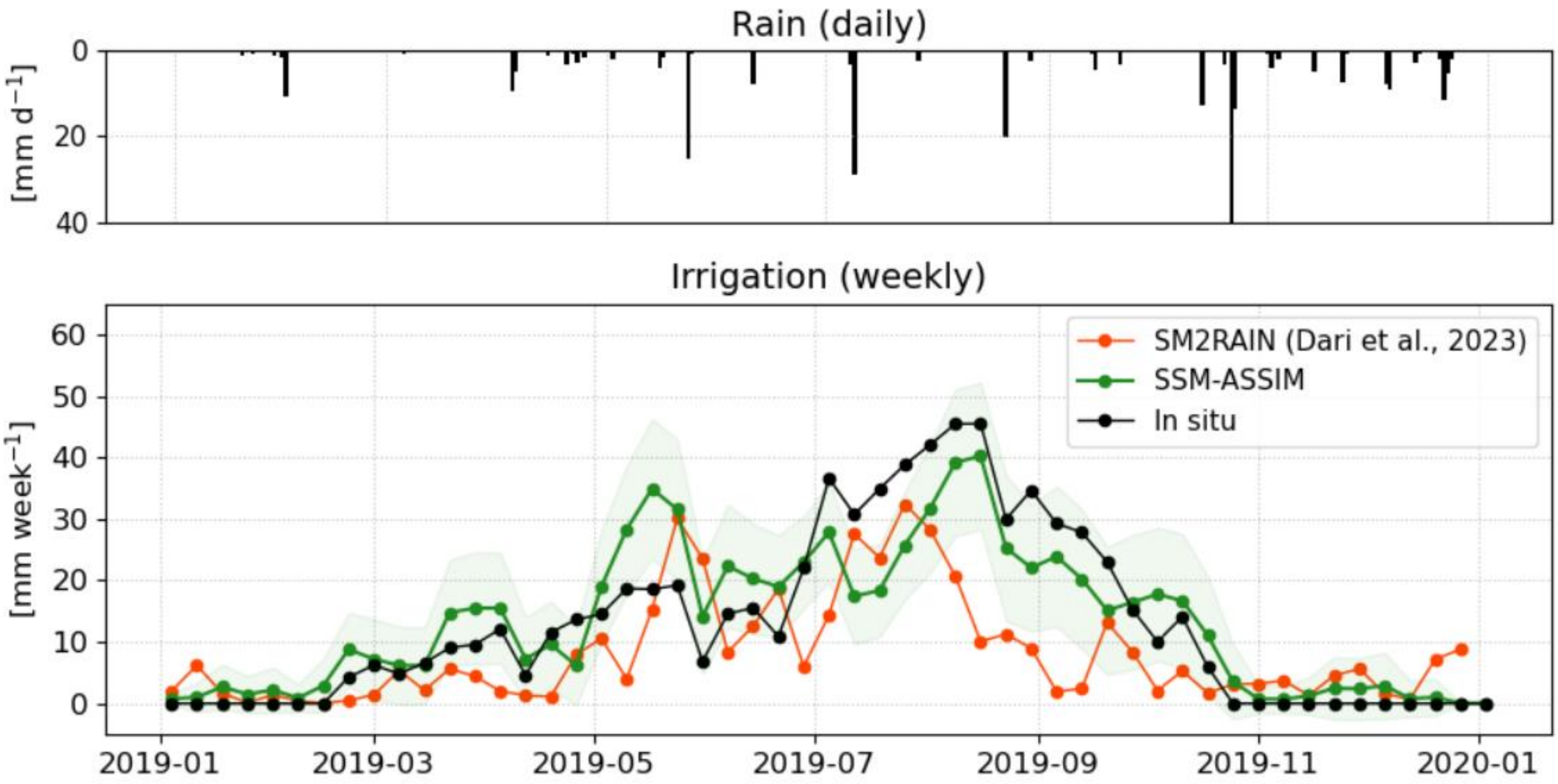
Water Use



Laluet*, et al. "Retrieving the irrigation actually applied at district scale: assimilating high-resolution Sentinel-1-derived soil moisture data into a FAO-56-based model" submitted to Agricultural Water Management*

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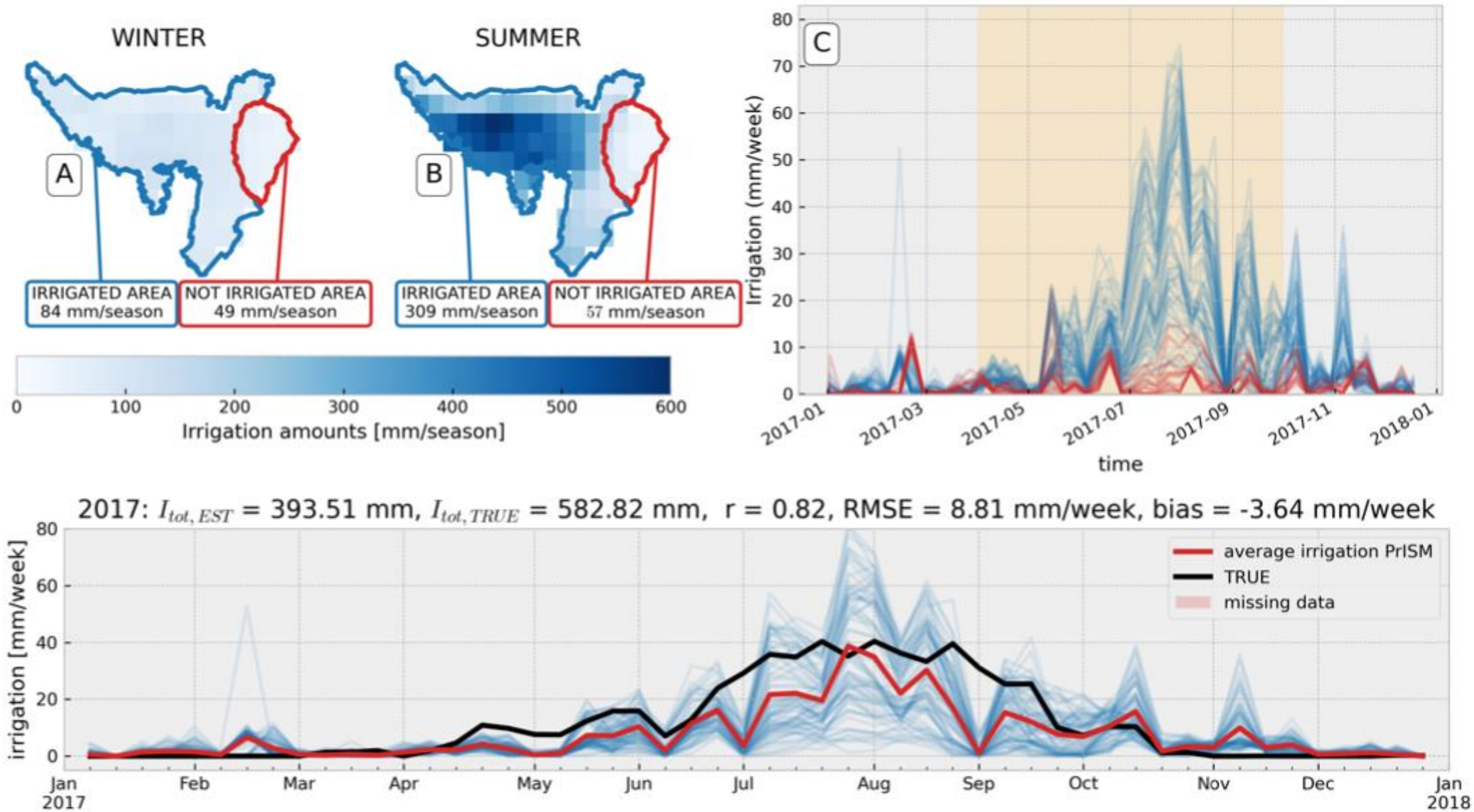
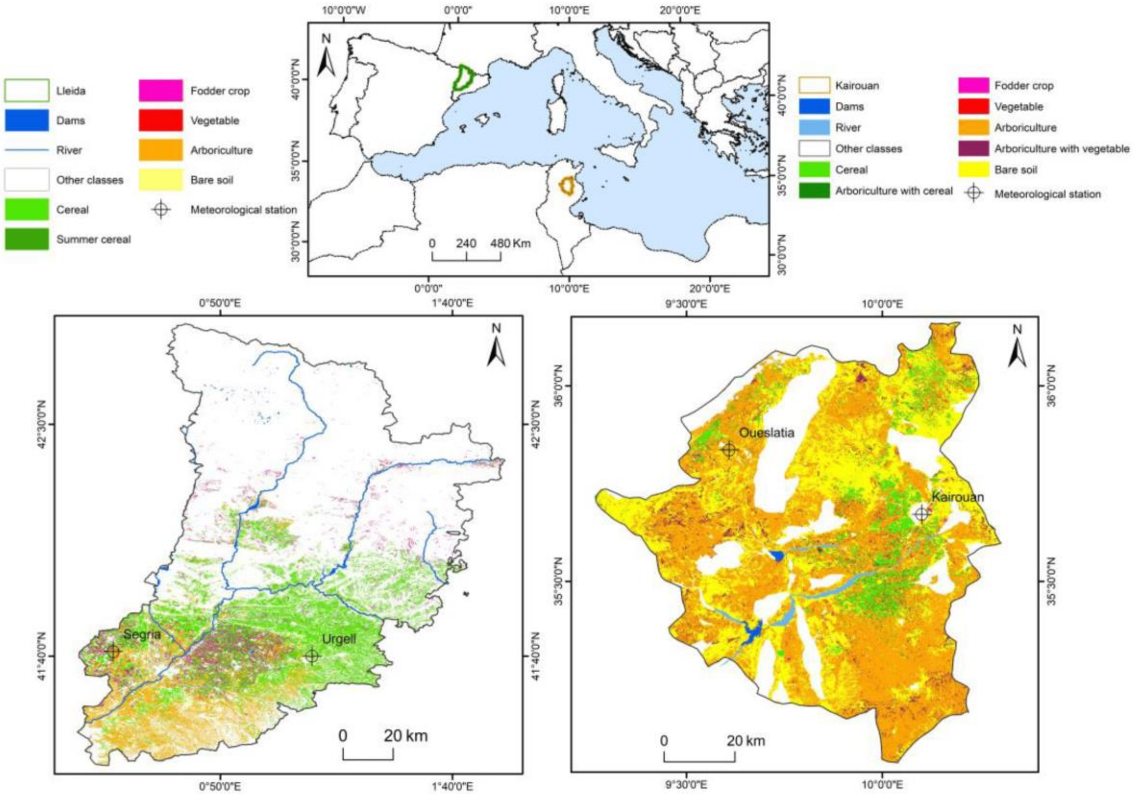


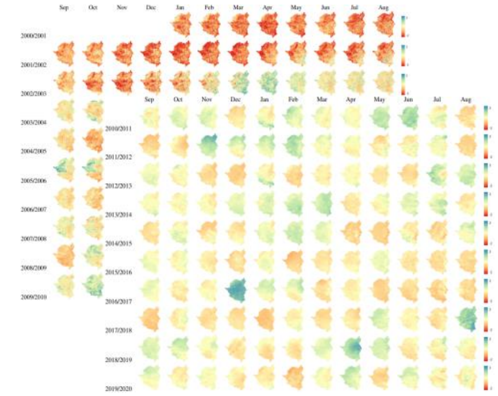
Paolini*, et al. "Estimating Multi-scale Irrigation Amounts Using Multi-resolution Soil Moisture Data: a data- driven Approach using PrISM." submitted to Agricultural Water Management*

Yield

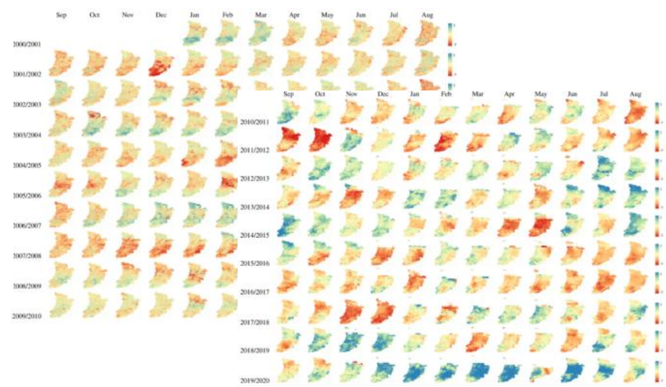


Drought indices

SMAI, VAI, EAI, ITAI

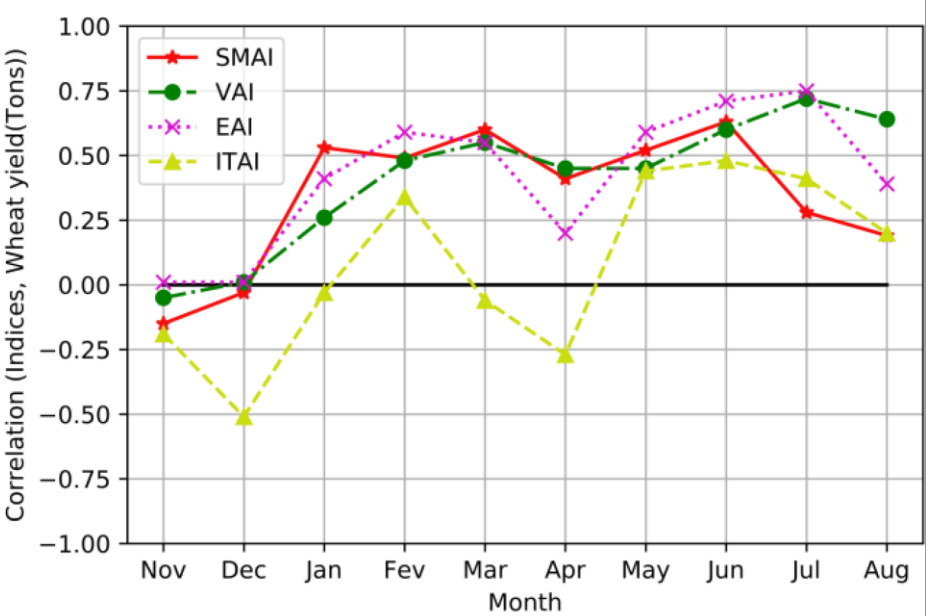


Period: 2010/2022

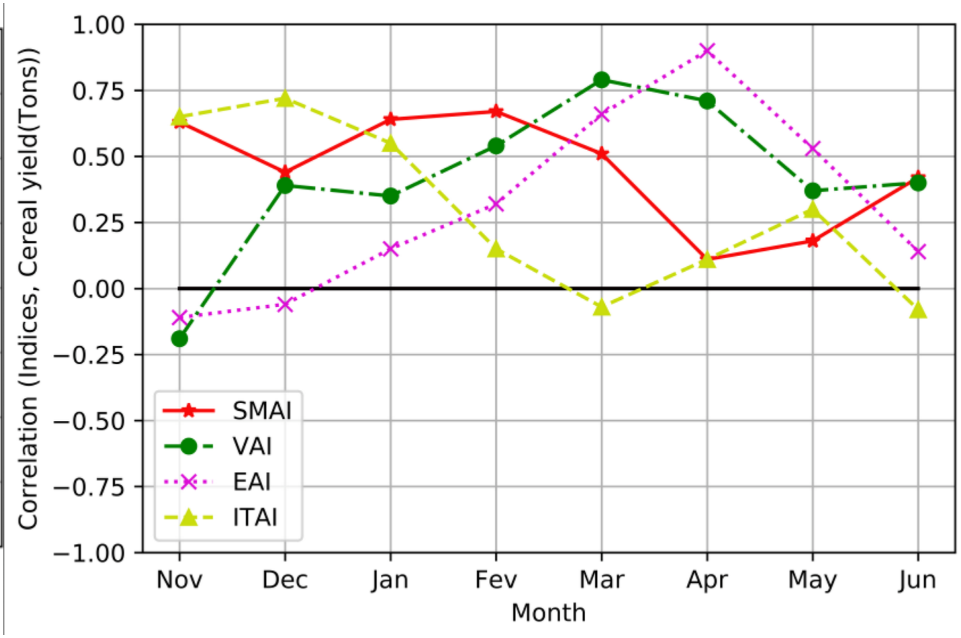


Khlif et al. "Remotely Sensed Agriculture Drought Indices for Assessing the Impact on Cereal Yield." Remote Sensing 15.17 (2023): 4298.

Correlation between yield and drought indices



Lleida



Kairouan

Khlif et al. "Remotely Sensed Agriculture Drought Indices for Assessing the Impact on Cereal Yield." Remote Sensing 15.17 (2023): 4298.

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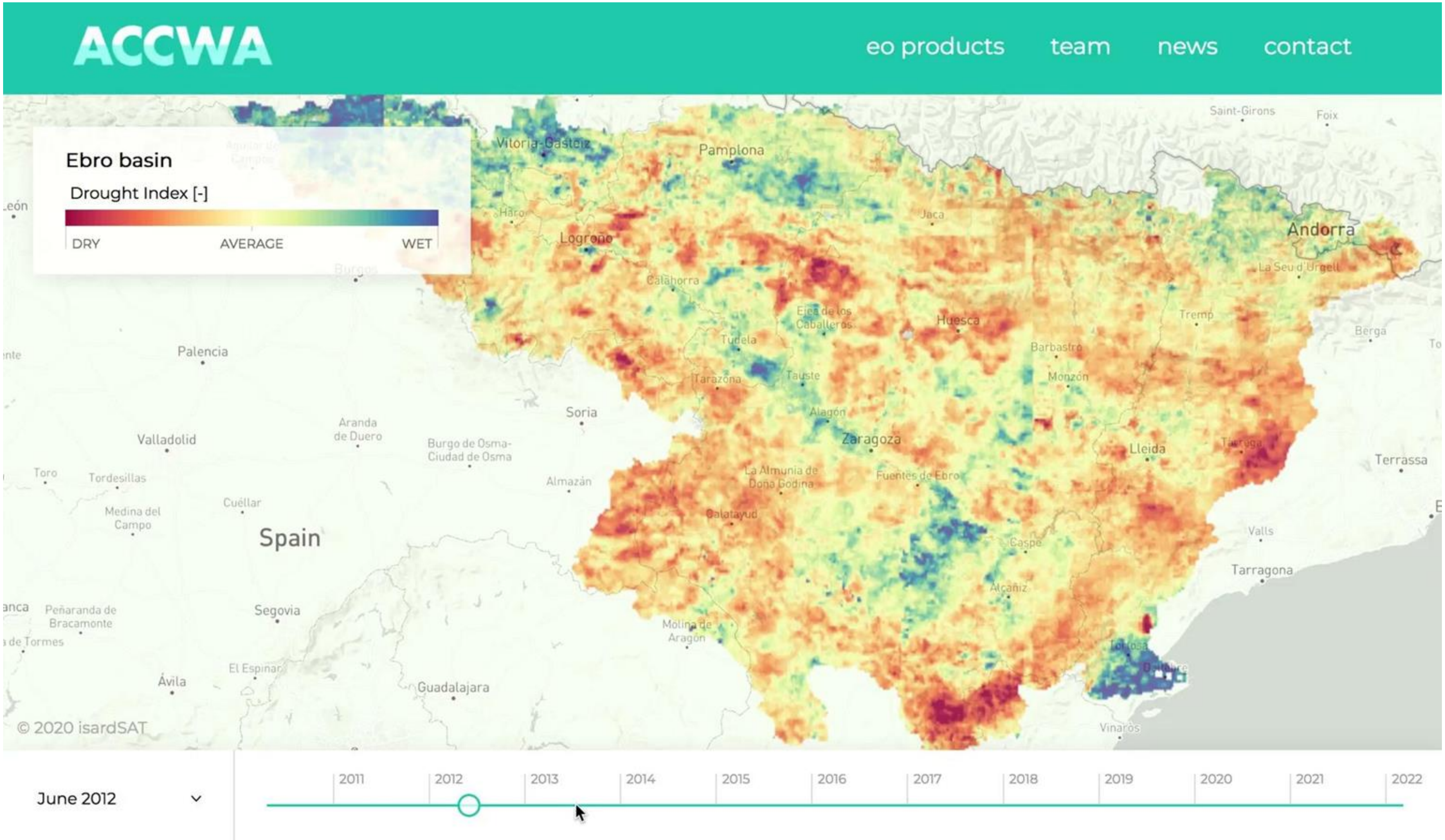
ACCWA
eo products
team
news
contact
Ebro basin
Drought Index [-]
DRY
AVERAGE
WET
Vitoria-Gasteiz
Pamplona
Logroño
Jaca
Andorra
La Seu d'Urgell
Calahorra
Huesca
Tremp
Berga
Palencia
Tudela
Barbastro
Monzón
Tarazona
Tauste
Soria
Zaragoza
Lleida
Valladolid
Aranda de Duero
Burgo de Osma-Ciudad de Osma
Terrassa
Toro
Tordesillas
Almazán
La Almunia de Doña Godina
Fuentes de Ebro
Medina del Campo
Cuéllar
Calatayud
Spain
Caspe
Valls
Tarragona
Alcañiz
Peñaranda de Bracamonte
Segovia
Molina de Aragón
Tortosa
El Espinar
Ávila
Guadalajara
Vinaròs
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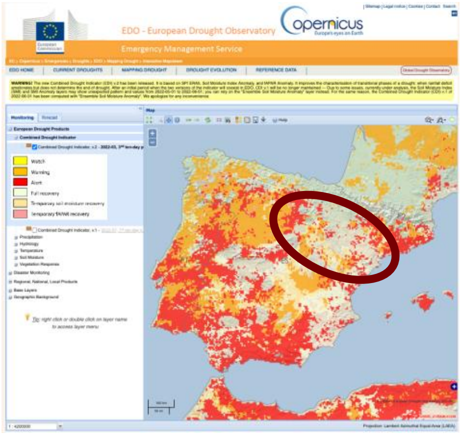
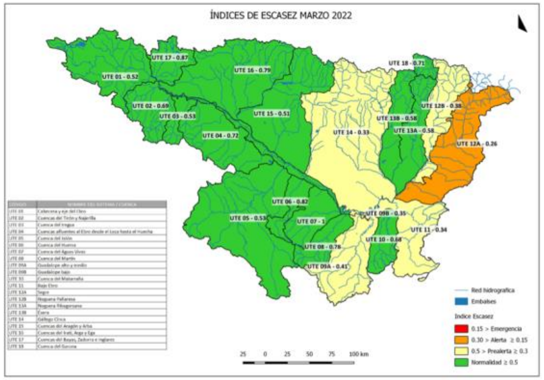
June 2012
2011
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022

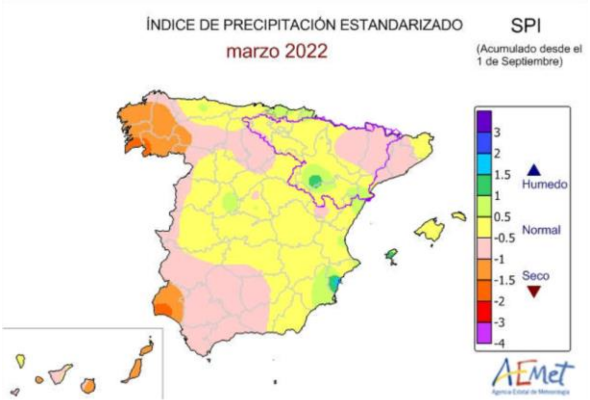
Crop loss due to a previous heavy drought:

How high-resolution Soil Moisture data is key for food security

Nowadays, existing drought monitoring has a coarse resolution and data delivery has a high latency.







As we can see in this case, 1 km resolution data is needed to plan crop loss every year.

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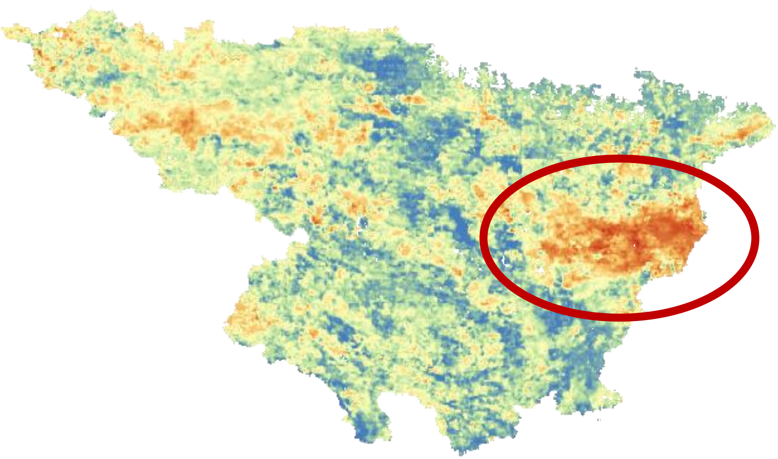
In March 2022, a heavy drought happened over an important agricultural cereal region in Catalonia, in the Ebro river basin.



Drought Monitoring Ebro Basin at 1km based on SMOS SM by isardSAT

Khlif et al. 2022 have shown that March's Soil Moisture Anomaly is the best predictor of yield.
As a consequence of this heavy drought in March, tons of cereals have been lost in this summer's harvest, confirming our forecast.
This information is key to ensure food security.

Comencen a pagar els més de 10 milions d'indemnitzacions als productors de cereal per la sequera d'aquesta campanya

ACN Actualitzada 14/07/2022 a les 15:39

A Catalunya hi ha unes 70.000 hectàrees assegurades que es repartiran els diners

News published describing the consequences of the crop loss

https://accwa.isardsat.space/eo-products/

Escorihuela et al. Drought monitoring in the Ebro basin based on high-resolution Soil Moisture, 2020
Khlif et al. Potential of remote sensing to study the influence of drought on cereals yields in semi-arid regions, ESA LPS22

ACCWA isardSAT

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Water restrictions in irrigation district due to heavy drought

How high-resolution Soil Moisture data is key for food security

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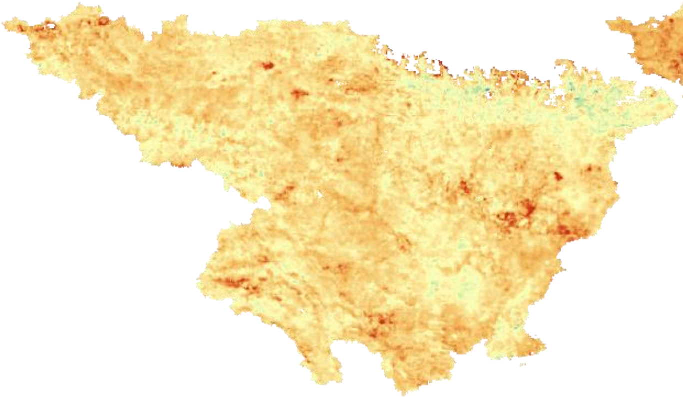
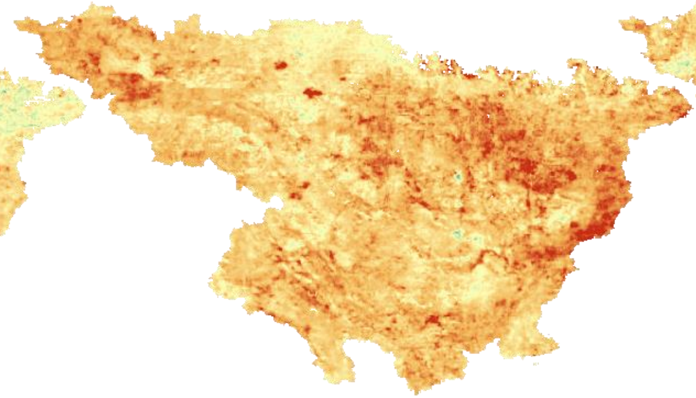
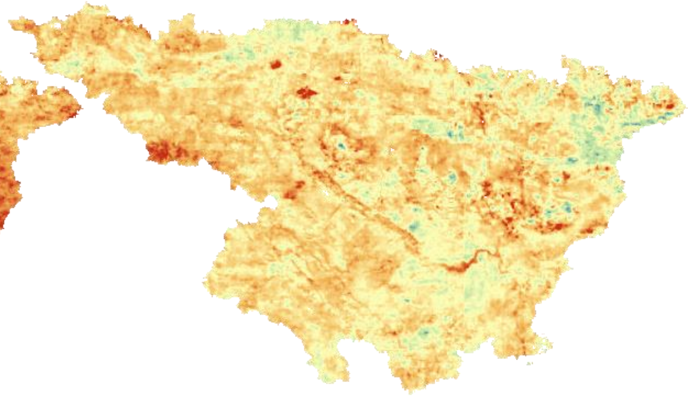
March 2023



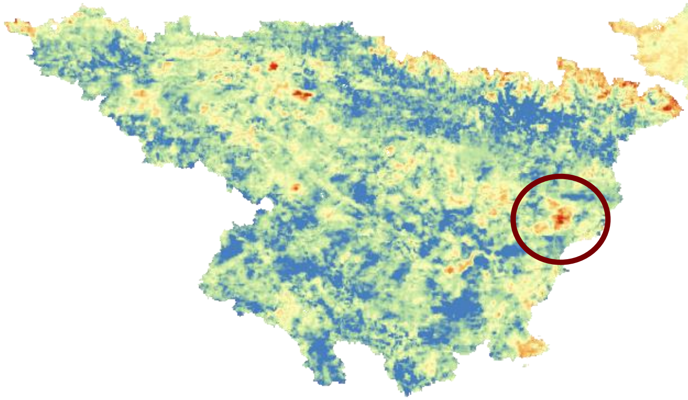
April 2023



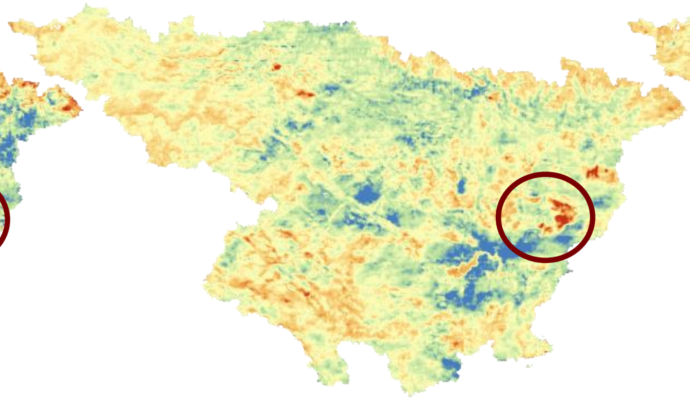
May 2023



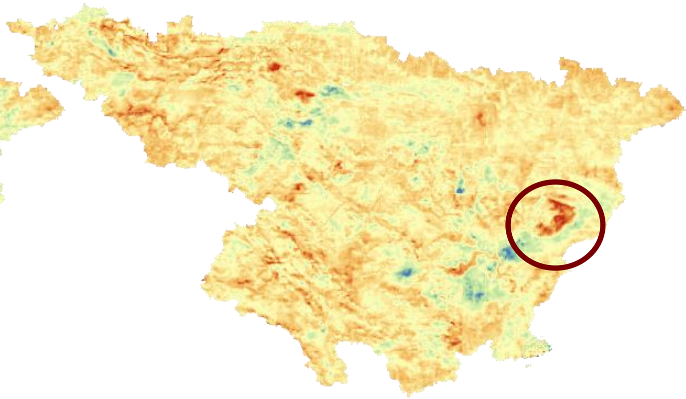
June 2023



July 2023



August 2023



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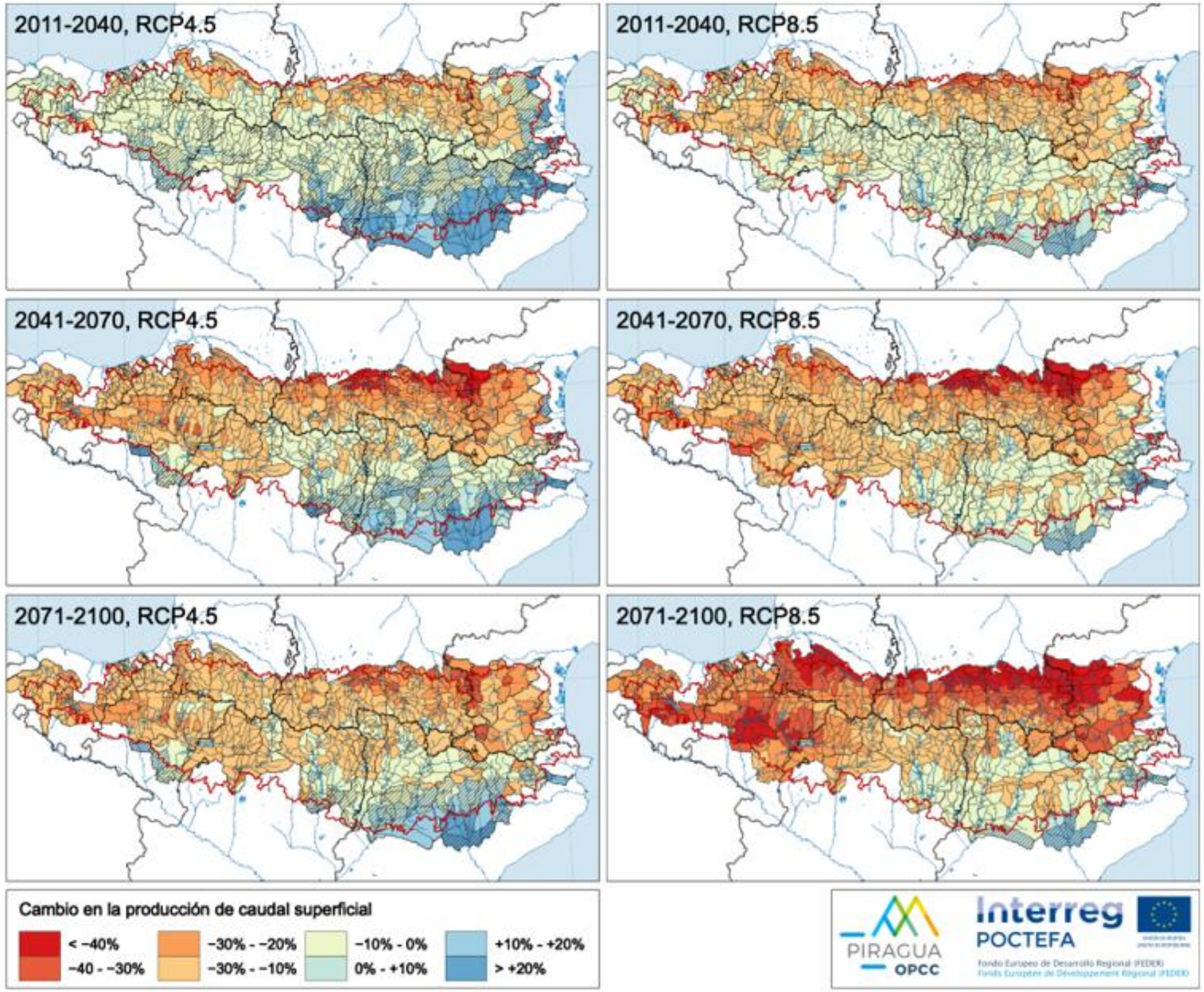
Climate Change Impact



Outreach Activities

ACCWA

- 20 joint PhD
- 41 joint peer review articles
- +200 Conferences
- 14 training activities
- 3 project open days
- 6 Trade Fair
- Link to +20 EU projects
- 11 Brockerage Events
- 6 Workshops

Conclusions

ACCWA is implementing remote sensing management tools for water and agricultural management critically needed in a context of climate change.

Innovative EO datasets (SM, ET, VEG) are being developed with multiple possible applications

The exchange of personnel results in fruitful exchange of know-how between participants

Numerous diffusion and outreach activities result in network knitting and future activities identification

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Thank you!